FOR THE RADIO ENTHUSIAST . . .

FEBRUARY 1981

# Practical Wireless

Australia $1.15
New Zealand $1.25
Malaysia $4.00

65p

EXTRA 8 PAGES

## morse tutor


also
ACCENTED METRONOME

&

Beginning new series:

UNDERSTANDING RECEIVER PARAMETERS

Bredhurst electronics

HIGH ST., HANDCROSS, W. SUSSEX 0444 400786

## TRANSCEIVERS

ICOM FOR TWO METRES

### IC 2E £159

inc. VAT & CARRIAGE

- Fully synthesized – covering 144-145.995 in 5KHz steps.
- 1.5W power output with 9V battery as supplied.
- Optional 6V or 12V packs for lower or higher power.
- BNC antenna output socket for helical or external antenna.
- Weight – only 450 grams, with supplied battery pack and helical.
- Send/battery indicator – indicates transmit until time for battery recharge.
- Duplex/Simplex switch – Hi/Low power switch.
- Optional external speaker microphone available now.
- Full 12 months guarantee for all rigs bought from Bredhurst Electronics.

| | |
|---|---|
| **H.F.** | |
| TRIO TS130V (New Model) | £404.00 |
| TRIO TS130S (New Model) | £491.00 |
| TRIO TS520SE (Still a Favourite) | £437.00 |
| YAESU FT707 | £499.00 |
| YAESU FT101Z (New Bands) | £488.00 |
| YAESU FT101ZD (New Bands) | £569.00 |
| TRIO TS830S (The New One) | £639.00 |
| TRIO TS180S (with DFC) | £679.00 |
| YAESU FT107M | £690.00 |
| **2.M. MOBILES** | |
| FDK Multi 700EX | £199.00 |
| STANDARD C8800 | £250.00 |
| ICOM IC255E | £255.00 |
| TRIO TR7800 | £265.00 |
| **HANDHELDS** | |
| FDK PALM II | £99.00 |
| ICOM IC2E | £159.00 |
| FDK PALM IV | £159.00 |
| TRIO TR2300 | £166.00 |
| AOR AR245A | £178.00 |
| TRIO TR2400 | £198.00 |
| YAESU FT207R | £199.00 |
| **2.M. MULTIMODES** | |
| FDK MULTI 750E | £299.00 |
| ICOM IC260E | £339.00 |
| TRIO TR9000 | £345.00 |
| YAESU FT480R | £359.00 |
| ICOM IC251E | £479.00 |

2M FM

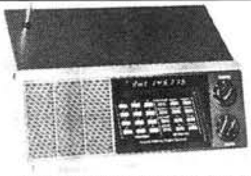
25 Watts

### FDK MULTI 700EX

The 700 EX is a mobile F.M. transceiver with built in speaker and comes complete with microphone, mobile mounting bracket and D.C. lead. Power output is variable between 1-25 watts on the front panel. Tuning is 25 kHz or 12·5 kHz steps from 144-146 MHz. Full repeater shifts are built-in including instant reverse repeater operation and also a scanning facility is included.

**£199,** inc. VAT free Delivery

## RECEIVERS



### THE BEARCAT 220 FB

**For 4M, 2M, 70cm FM Amateur, Low Band Mobile, Aircraft, Public Service, Marine, UHF.**

**£258** inc. VAT, CARRIAGE.

**Suitable antenna for 40-700 MHz Discone DCX, £13.80, carriage £3.00**

| | |
|---|---|
| **H.F.** | |
| LOWE SRX30 | £158.00 |
| YAESU FRG7 | £189.00 |
| TRIO R1000 | £285.00 |
| YAESU FRG7700 | £309.00 |
| **2.M. F.M.** | |
| SEARCH 9 | £45.00 |
| A.O.R. AR22 | £83.00 |
| FDK TM56B | £79.00 |
| BEARCAT 220FB | £258.00 |
| **MARINE V.H.F.** | |
| SEARCH 9 | £45.00 |
| FDK TM56B | £79.00 |
| BEARCAT 220FB | £258.00 |

### FDK TM56B

VHF, FM RECEIVER for Amateur or Marine. Supplied with 10 Xtals for ONLY £79 inc. VAT & Carriage.

Telephone enquiries welcome. Ask for details of our Credit Schemes.

### YAESU FRG 7700 THE NEW RECEIVER

**BASIC UNIT £309**

**FRG 7700M with Memory £389**

**Memory Unit Only £83.95**

These prices include VAT & Carriage

## ACCESSORIES

| | | Carriage |
|---|---|---|
| **MORSE EQUIPMENT** | | |
| HK 707 (Up/Down Key) | £10.50 | (£0.50) |
| MK 704 (Squeeze Paddle) | £10.50 | (£0.50) |
| EK 121 (Elbug) | £29.95 | (£0.50) |
| EK 150 (Electronic Keyer) | £74.00 | (£0.00) |
| **POWER SUPPLIES** | | |
| 13·8V 4 AMP | £22.95 | (£1.00) |
| 13·8V 5/6 AMP | £29.95 | (£1.50) |
| YAESU FP4 4/6 AMP | £40.00 | (£1.50) |
| PH 5000 5/7 AMP | £46.00 | (£1.50) |
| YAESU FP12 12/16 AMP | £78.00 | (£2.00) |
| TRIO PS30 15/20 AMP | £85.00 | (£2.00) |
| YAESU FP707 15/30 AMP | £109.00 | (£2.00) |
| **DUMMY LOADS** | | |
| DL 20 30 WATT | £6.00 | (£0.30) |
| T 100 100 WATT (500 MHz) | £24.00 | (£0.30) |
| T 200 200 WATT (500 MHz) | £35.00 | (£0.30) |
| **PROBLEMS WITH T.V.I.** | | |
| YAESU Low Pass Filter FF501DX (1KW) | £19.95 | (£0.75) |
| TRIO Low Pass Filter LF30A (1KW) | £18.40 | (£0.75) |
| W&S HP3A High Pass Filter (TV down lead) | £3.50 | (£0.25) |
| FERRITE RINGS | £0.45 | (—) |
| **HEADPHONES** | | |
| YAESU YH55 | £10.35 | (£0.50) |
| TRIO HS4 | £10.35 | (£0.50) |
| TRIO HS5 | £21.85 | (£0.50) |
| **WORLD CLOCKS** | | |
| QTR 24 | £18.40 | (£0.60) |
| QTR 24D (QUARTZ) | £24.50 | (£0.60) |

| **MOBILE ANTENNAE** (All with PL259 fitting) | | Carriage |
|---|---|---|
| 14 MHz 1/4 (20SE) | £13.80 | (£1.50) |
| 21 MHz 1/4 (15SE) | £11.50 | (£1.50) |
| 28 MHz 1/4 (10SE) | £11.50 | (£1.50) |
| 144 MHz 1/4 (0dB) | £1.50 | (£0.50) |
| 144 MHz 5/8 (3dB) | £8.50 | (£1.50) |
| 144 MHz 7/8 (4·5dB) | £13.00 | (£1.50) |
| 432 MHz 2×5/8 (5·5dB) | £11.50 | (£1.00) |
| CABLE MOUNT | £3.50 | (£0.50) |
| GUTTER CLIP | £3.15 | (£0.50) |
| MAGNETIC MOUNT | £6.95 | (£0.50) |
| BOOT LIP MOUNT | £3.50 | (£0.50) |
| **MICROWAVE MODULES** | | |
| MMC 144 MHz 5/8 | £24.90 | (—) |
| MMC 432 MHz 2×5/8 | £29.90 | (—) |
| MMC 432/144S 70cm CONVERTER | £29.90 | (—) |
| MMT 144/28 2M TRANSVERTER | £99.00 | (—) |
| MMT 432/285 70cm TRANSVERTER | £136.00 | (—) |
| MMT 432/144R 70cm TRANSVERTER | £173.65 | (—) |
| MML 144/25 2M 25W LINEAR | £48.30 | (—) |
| MML 144/100 2M 100W LINEAR | £142.60 | (—) |
| MML 144/40 2M 40W LINEAR | £69.00 | (—) |
| MML 432/20 70cm 20W LINEAR | £69.00 | (—) |
| MML 432/50 70cm 50W LINEAR | £113.85 | (—) |
| MML 432/100 70cm 100W LINEAR | £228.65 | (—) |
| MMD 50/500 500 MHz COUNTER | £69.00 | (—) |
| MMA 28 10M PREAMP | £14.95 | (—) |
| MMA 144V 2M RF Switched PREAMP | £29.90 | (—) |
| MMF 144 2M FILTER | £6.90 | (—) |
| MMF 432 70cm FILTER | £6.90 | (—) |

| **SWR POWER METERS** | | Carriage |
|---|---|---|
| YW-3 TWIN METER | £11.50 | (£0.50) |
| TOYO T 435 (144-435 MHz) | £34.45 | (£0.75) |
| DAIWA SW110A (1·8-150 MHz) | £35.00 | (£0.75) |
| WELZ SP 200 (1·8-150 MHz) | £49.95 | (£0.75) |
| WELZ SP 400 (130-500 MHz) | £49.95 | (£0.75) |
| DAIWA CN 620A (1·8-150 MHz) | £52.80 | (—) |
| WELZ SP 300 (1·8-500 MHz) | £69.95 | (—) |
| DAIWA CN 630 (140-500 MHz) | £71.00 | (—) |
| **SAFETY MICROPHONES** | | |
| ADONIS MM 202S (CLIP ON) | £20.95 | (£0.50) |
| ADONIS MM 202H (Head Band + Up/Down) | £29.00 | (£0.50) |
| ADONIS MM 202 FU (Swan Neck + Up/Down) | £30.00 | (0.50) |
| DAIWA RM 940 INFRA RED LINK | £45.00 | (£0.50) |
| **DESK MICROPHONES** | | |
| YAESU YD 148 (Dual Imp.) | £20.95 | (£0.75) |
| TRIO MC 50 (Dual Imp.) | £24.15 | (£0.75) |
| SHURE 444 (High Imp.)**** | £25.00 | (£0.75) |
| ADONIS AM 502 Compressor Mic. | £39.00 | (£0.75) |
| ADONIS AM 802 Compressor Mic. (3 outputs) | £59.00 | (£0.75) |
| **A.T.U.'s** | | |
| KX2 (Listeners A.T.U.) | £29.95 | (£0.75) |
| MFJ-901 | £50.95 | (£0.75) |
| TRIO AT 130 | £72.00 | (—) |
| YAESU FC 707 | £74.00 | (—) |
| YAESU FC 707 | £74.00 | (—) |
| TRIO AT 200 | £82.00 | (—) |
| DAIWA CNA 1001A (Automatic A.T.U.) | £129.00 | (—) |
| **TEST EQUIPMENT** | | |
| FX1 Wave Meter | £28.00 | (£0.75) |
| TRIO DM 801 Dip Meter | £51.00 | (£0.75) |

Buy it with Access

**MAIL ORDER – RETAIL CALLERS 9-5.30 PM.**
**HIGH ST., HANDCROSS, W. SUSSEX. 0444 400786**

BARCLAYCARD VISA

TO ORDER ANY OF THE ABOVE ITEMS SIMPLY WRITE, ENCLOSING A CHEQUE OR PHONE YOUR CREDIT CARD NUMBER

EDITORIAL OFFICES
Practical Wireless
Westover House
West Quay Road
Poole, Dorset BH15 1JG
Poole 71191

Geoff Arnold G3GSR
Editor

Dick Ganderton C.Eng., MIERE, G8VFH
Assistant Editor

Peter Metalli
Art Editor

John Fell G8MCP
Technical Editor

Alan Martin G8ZPW
News & Production Editor

Elaine Howard
Technical Sub-Editor

Rob Mackie
Technical Artist

Keith Woodruff
Assistant Art Editor

Sylvia Barrett, Sharron Breeze
Secretarial

ADVERTISEMENT OFFICES
Practical Wireless
King's Reach Tower
Stamford Street
London SE1 9LS
Telex: 915748 MAGDIV-G

Dennis Brough
Advertisement Manager
01-261 6636

Roger Hall G8TNT (Sam)
Ad. Sales Executive
01-261 6807

Claire Gerrish
Secretary
01-261 6636

Colin R. Brown
Classified Advertisements
01-261 5762

Dave Kerindi
Make-up & Copy
01-261 6570



# Practical Wireless

**FEBRUARY 1981 VOL. 57 NO. 2 ISSUE 887**

## contents

# TRANSFORMERS +VAT 15%

Voltages stated are on full load

**Continuous Ratings**

**30 VOLT RANGE (Split Sec)**
Sec Voltages available 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30V or 12V-0-12V or 15V-0-15V.

| Ref. | Amps 30V | Amps 15V | Price | P&P |
|---|---|---|---|---|
| 112 | .5 | 1 | 2.90 | 0.90 |
| 79 | 1 | 2 | 3.93 | 1.10 |
| 3 | 2 | 4 | 6.35 | 1.10 |
| 20 | 3 | 6 | 7.39 | 1.31 |
| 21 | 4 | 8 | 8.79 | 1.31 |
| 51 | 5 | 10 | 10.86 | 1.52 |
| 117 | 6 | 12 | 12.29 | 1.67 |
| 88 | 8 | 16 | 16.45 | 1.89 |
| 89 | 10 | 20 | 18.98 | 1.89 |
| 90 | 12 | 24 | 21.09 | 2.24 |
| 91 | 15 | 30 | 24.18 | 2.39 |
| 92 | 20 | 40 | 32.40 | O.A. |

**50 VOLT RANGE (Split Sec)**
Sec 50V Voltages available 5, 7, 8, 10, 13, 15, 17, 20, 33, 40 or 20V-0-20V or 25V-0-25V

| Ref. | Amps 50V | Amps 25V | Price | P&P |
|---|---|---|---|---|
| 102 | .5 | 1 | 3.75 | 0.90 |
| 103 | 1 | 2 | 4.57 | 1.10 |
| 104 | 2 | 4 | 7.88 | 1.31 |
| 105 | 3 | 6 | 9.42 | 1.52 |
| 106 | 4 | 8 | 12.82 | 1.73 |
| 107 | 6 | 12 | 16.37 | 1.89 |
| 118 | 8 | 16 | 22.29 | 2.39 |
| 119 | 10 | 20 | 27.48 | O.A. |
| 109 | 12 | 24 | 32.88 | O.A. |

**MAINS ISOLATORS (SCREENED)**
Pri 0-120: 0-100-120V (120, 220, 240V) Sec 60-55-0-55-60 twice to give 55, 60, 110, 115, 120, 125, 175, 180, 220, 225, 230, 235, 240.

| Ref | VA | Price | P & P |
|---|---|---|---|
| •07 | 20 | 4·84 | 0·91 |
| 149 | 60 | 7·37 | 1·10 |
| 150 | 100 | 8·38 | 1·31 |
| 151 | 200 | 12·28 | 1·31 |
| 152 | 250 | 14·61 | 1·73 |
| 153 | 350 | 18·07 | 2·12 |
| 154 | 500 | 22·52 | 2·47 |
| 155 | 750 | 32·03 | O.A. |
| 156 | 1000 | 40·92 | O.A. |
| 157 | 1500 | 56·52 | O.A. |
| 158 | 2000 | 67·99 | O.A. |
| 159 | 3000 | 95·33 | O.A. |

•Pri 0-220-240V Sec 115 or 240V. State sec. volts required.

**CASED AUTO TRANSFORMERS**
240V cable in 115V USA flat pin outlet

| VA | Price | P & P | Ref |
|---|---|---|---|
| 20 | 6·55 | 1·03 | 56W |
| 75 | 8·50 | 1·31 | 64W |
| 150 | 11·00 | 1·31 | 4W |
| 250 | 13·39 | 1·67 | 69W |
| 500 | 20·13 | 1·89 | 67W |
| 1K | 30·67 | 2·65 | 84W |
| 1500VA | 42·82 | O.A. | 93W |

**60 VOLT RANGE (Split Sec)**
Pri 220/240V sec 0-24-30-40-48-60V. Voltages available 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60 or 24V-0-24V or 30V-0-30V.

| Ref | Amps 60V | Amps 30V | Price | P&P |
|---|---|---|---|---|
| 124 | .5 | 1 | 4.27 | 1.10 |
| 126 | 1 | 2 | 6.50 | 1.10 |
| 127 | 2 | 4 | 8.36 | 1.31 |
| 125 | 3 | 6 | 12.10 | 1.31 |
| 123 | 4 | 8 | 13.77 | 2.12 |
| 40 | 5 | 10 | 17.42 | 1.89 |
| 120 | 6 | 12 | 19.87 | 2.12 |
| 121 | 8 | 16 | 27.92 | O.A. |
| 122 | 10 | 20 | 32.51 | O.A. |
| 189 | 12 | 24 | | |

**12 OR 24V OR 12-0-12V**
Pri 220-240 volts

| Ref | Amps 12V | Amps 24V | Price | P&P |
|---|---|---|---|---|
| 111 | 0.5 | 0.25 | 2.42 | 0.52 |
| 213 | 1.0 | 0.5 | 2.90 | 0.90 |
| 71 | 2 | 1 | 3.86 | 0.90 |
| 18 | 4 | 2 | 4.46 | 1.10 |
| 85 | 0.5 | 2.5 | 6.16 | 1.10 |
| 70 | 6 | 3 | 6.99 | 1.10 |
| 108 | 8 | 4 | 8.16 | 1.31 |
| 72 | 10 | 5 | 8.93 | 1.31 |
| 116 | 12 | 6 | 9.89 | 1.52 |
| 17 | 16 | 8 | 11.79 | 1.52 |
| 115 | 20 | 10 | 15.37 | 2.39 |
| 187 | 30 | 15 | 19.72 | 2.39 |
| 226 | 60 | 30 | 40.41 | O.A. |

**SPECIAL OFFER**
**Multimeter** 20KΩ B/V – with combined audio/I.F. test oscillator at 1 KHz and 465 KHz AC/DC to 1000 volts DC current to 500mA resistance to 1M. Size 160×97×40mm **£8.50** P & P £1.00 VAT 15%.

**SCREENED MINIATURES**

| Ref | mA | Volts | £ | P&P |
|---|---|---|---|---|
| 238 | 200 | 3-0-3 | 2.83 | 0.63 |
| 212 | 1A, 1A | 0-6, 0-6 | 3.14 | 0.90 |
| 13 | 100 | 9-0-9 | 2.35 | 0.44 |
| 235 | 330, 330 | 0-9, 0-9 | 2.19 | 0.44 |
| 207 | 500, 500 | 0-8-9, 0-8-9 | 3.05 | 0.85 |
| 208 | 1A, 1A | 0-8-9, 0-8-9 | 3.88 | 0.90 |
| 236 | 200, 200 | 0-15, 0-15 | 2.19 | 0.44 |
| 214 | 300, 300 | 0-20, 0-20 | 3.08 | 0.90 |
| 221 | 700 (DC) | 20-12-0-12-20 | 3.75 | 0.90 |
| 206 | 1A, 1A | 0-15-20-0-15-20 | 5.09 | 1.10 |
| 203 | 500, 500 | 0-15-27-0-15-27 | 4.39 | 1.10 |
| 204 | 1A, 1A | 0-15-27-0-15-27 | 6.84 | 1.10 |
| 239 | 50 | 12-0-12 | 2.88 | 0.37 |

**BRIDGE RECTIFIERS**

| | | |
|---|---|---|
| 100V | 25A | £2.86 |
| 200V | 2A | £0.52 |
| 200V | 4A | £0.75 |
| 400V | 4A | £0.98 |
| 400V | 6A | £1.44 |

500V PM7A6 12A £3·75

P&P 17p + VAT

**AUTO TRANSFORMERS**
Voltages available: 105, 115, 190, 200, 210, 220, 230, 240, for step up and step down.

| Ref. | VA (Watts) | £ | P&P |
|---|---|---|---|
| 113* | 15 | 2.73 | 0.81 |
| 64 | 80 | 4.41 | 1.10 |
| 4 | 150 | 5.89 | 1.10 |
| 53 | 350 | 10.08 | 1.31 |
| 67 | 500 | 12.09 | 1.91 |
| 84 | 1000 | 20.64 | 2.39 |
| 93 | 1500 | 25.61 | OA |
| 95 | 2000 | 38.31 | OA |
| 73 | 3000 | 65.13 | OA |
| 80S | 4000 | 84.55 | OA |
| 57S | 5000 | 98.45 | OA |

*0, 115, 220, 240.

**Split Bobbin Type**
0-12-15-20-24-30V
Ref 009 1 Amp **£2·98** P & P £1·10
Ref 010 2 Amp **£4·62** P & P £1·10

**15V RANGE** O-C Tap (7.5-0-7.5V)

| Ref | | | P & P |
|---|---|---|---|
| 171 | 500 mA | 2·30 | 0·52 |
| 172 | 1A | 3·26 | 0·90 |
| 173 | 2A | 3·95 | 0·90 |
| 174 | 3A | 4·13 | 0·99 |
| 175 | 4A | 6·30 | 1·10 |

**AVO TEST METERS**

| | |
|---|---|
| AVO 8 MK5. Latest Model | £106.40 |
| AVO 71 | £43.10 |
| AVO 73 | £58.60 |
| AVO MM5 minor | £36.90 |
| AVO Wee Megger | £87.00 |
| AVO TI169 in circuit transfer tester | £45.00 |
| AVO EM272 316K –Volts | £63.40 |
| AVO DA116 Digital | £108.90 |
| AVO BM7 Megger | £58.60 |
| AVO Clamp Meter to 300A | £59.10 |

All Avos Meggers and accessories available.
**P&P £1.32 VAT 15%**

**Soldering Iron** – 25W to BS spec. **£1·75** P&P 30p +VAT

**Solder Gun** – 100W include bulb for spot on vision and joints **£5.39** P&P 70p + VAT

**De-Solder Pumps** – Spring loaded with quick action button release for one handed working.
Large **£5·10** P&P 35p+VAT Small **£4·75** P&P 30p + VAT
Replacement tips Small **65p** + VAT. Large **86p** + VAT

**20,000 ohm/V Multimeter,** mirror scale Ranges AC DC to 1000V DC current to 250mA Resistance to 3 Mohms
5" × 3½" × 1¼" **£14·36** P&P £1.00 VAT 15%

**U4315 Budget Meter.** 20KΩ/V Ranges to 1000V, 2·5A AC/DC 500KΩ Res. In steel case **£15·85.** PP £1·15 VAT 15%

**ABS Boxes:** inset brass nuts, slots PC flush lid.

| | | |
|---|---|---|
| PB1 | 80mm × 62 × 40 | 80p |
| PB2 | 100mm × 75 × 40 | 90p |
| PB3 | 120mm × 100 × 45 | £1.04 |
| PB4 | 215mm × 130 × 85 | £2.68 |

P&P 33p + VAT.

**MAINS ELIMINATORS**
Plugs into 13A socket 3V × 100ma or 6, 9, 12V × 300ma **£4.60.** P&P 55p + VAT.

**Burglar Alarm:** ultrasonic 20ft range, no installation costs, key operated: built in siren (external can be added). Looks like a speaker. **£98.00** P&P £2.00 + VAT.

**NEW RANGE TRANSFORMERS** 2 windings 0-36V-48V/36V-0-36Vm 48V-0-48V 72V or 96V.

**CONNECTORS:** Thorn, Cannon, Plessey, Bendix, Greenpar now available.

| Amps | Ref. | Price | P&P |
|---|---|---|---|
| ½ | 430 | 4.88 | 0.76 |
| 1.0 | 431 | 8.12 | 0.99 |
| 2.0 | 432 | 13.35 | 1.31 |
| 3.0 | 433 | 16.17 | 1.40 |
| 4.0 | 434 | 20.65 | 2.11 |
| 5.0 | 435 | 29.30 | 2.47 |
| 6.0 | 436 | 36.69 | O.A. |
| 8.0 | 437 | 40.03 | O.A. |

**Metal Oxide Resistors** – ¼W 5% **£1.00** per 100. A bargain.
390Ω/470Ω/510Ω/560Ω/820Ω/1K/1K1/1K2/1K6
1KB/2K/2K4/3K/16K/20K/22K/24K/47K/82K/100K
110K/120/120K/130K/180K/220K/270K/300K
Use instead of Carbon Film (100's only) **30p** P&P+VAT.

**Antex Soldering Irons** 15W & 25W **£4.58** each. Safety Stand **£1.75** P&P 52p each.

**P.W. Purbeck** osciloscope transformer 250-0-250; 6·3V; 12·9V **£8·42** £1·04
(author approved)

**PANEL METERS**

| 43mm × 43mm | | 82mm × 78mm | |
|---|---|---|---|
| 0 50μA | 6·20 | 0 50μA | 6·70 |
| 0 500μA | 5·95 | 0 500μA | 6·70 |
| 0 1mA | 5·95 | 0 1mA | 6·70 |
| 0 30V | 5·95 | 0 30V | 6·70 |

**VU** ind Panel 40mm×40mm 2·60
48mm×45mm 250μF fsd or
**VU** edge SV041 centre zero 250μF **£2·60**
Carriage 76p VAT 15%

Send 20p stamps for Catalogue. Prices correct 1/8/1980.

**EDUCATIONAL METERS (Moving Coil)**
0-10A, 0-15V, 0-30V. Freestanding large scale easily read meters with top screw terminals for quick connections. **£4.50** P&P 66p+VAT. Size 75x78mm scale.

**END OF LINE OFFERS**
**30** – Isolator 240V:240V 200VA **£4.62** £1.10
**M616** – 0-240V: Screen 1) 13-0-13 1A. 2) 12V 150ma **£1.50** 60p
**M489** – 0-24V: 1400V × 150ma, 6.3V × 4A **£5.50** £1.04
**M708** – 6k to 3Ω matching trans. 5 watt **90p** 40p
**M679** – 240V, 36V 1.6A **£3.00** 78p
**M865** – 100V Line to 4 Ω 10 watts **£1.90** 60p
**M1020** – 0-240V 12-0-12V × 50ma **75p** 30p
**M1126** – 120/240V: 9-0-9V × 1A **£1.79** 71p

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

# PCB'S FOR PRACTICAL WIRELESS PROJECTS

| | | | |
|---|---|---|---|
| Jan. 80. | Nimbus Radio Control Encoder | WR061 | Price £2.28 30 pence p&p. |
| Jan. 80. | Nimbus Radio Control Rec. | WR064 | Price £2.92 30 pence p&p. |
| Jan. 80. | A.F. Speech Processor | WR068 | Price £2.28 30 pence p&p. |
| Jan. 80. | Wide Band Pre Amp. | WR067 | Price £0.70 30 pence p&p. |
| Jan. 80. | Nimbus Radio Control T.X. | WR062 | Price £2.26 30 pence p&p. |
| April 80. | Signal Generator | WR070 | Price £2.71 30 pence p&p. |
| April 80. | P.W. Nimbus Relay | WR075 | Price £0.55 30 pence p&p. |
| April 80. | P.W. Nimbus Modulator | WR074 | Price £0.70 30 pence p&p. |
| April 80. | Nimbus Transceiver | WR073 | Price £5.30 30 pence p&p. |
| May 80. | Hundred Second Photo Timer | WR078 | Price £2.48 30 pence p&p. |
| June 80. | Audio Limiter Main Board | WK076 | Price £2.00 30 pence p&p. |
| June 80. | Audio Limiter | WK077 | Price £1.15 30 pence p&p. |
| June 80. | Audio Limiter RF Input Board | WR079 | Price £1.30 30 pence p&p. |
| June 80. | VHF/UHF Repeater Timer Main | WR080 | Price £1.90 30 pence p&p. |
| June 80. | P.W. Nimbus Base Station Adpt. | WR083 | Price £2.60 30 pence p&p. |
| June 80. | Acoustic Flash Trigger | WRK84 | Price £1.25 30 pence p&p. |
| Aug. 80. | Model Railway Controller | WR085 | Price £2.17 30 pence p&p. |
| Sept. 80. | Transceiver Power Unit | WR095 | Price £0.62 30 pence p&p. |
| Sept. 80. | P.W. Nimbus Tonedurst/ Timer Module | WR096 | Price £1.85 30 pence p&p. |
| Sept. 80. | Beginners 2m Converter | WAD634 | Price £1.08 30 pence p&p. |
| Sept. 80. | P.W. Tamar Board 1 | WR086 | Price £0.80 30 pence p&p. |
| Sept. 80. | P.W. Tamar Board 2 | WR087 | Price £1.50 30 pence p&p. |
| Sept. 80. | P.W. Tamar Board 3 | WR088 | Price £1.71 30 pence p&p. |
| Sept. 80. | P.W. Tamar Board 4 | WR089 | Price £1.71 30 pence p&p. |
| Oct. 80. | P.W. Tamar Board 5 | WR090 | Price £3.70 30 pence p&p. |
| Oct. 80. | P.W. Tamar Board 6 | WR091 | Price £3.70 30 pence p&p. |
| Oct. 80. | P.W. Nimbus 7 Mains PSU/Charger | WR097 | Price £0.80 30 pence p&p. |
| Oct. 80. | Direct Conversion Receiver | WR082 | Price £1.40 30 pence p&p. |
| Nov. 80. | Linear Scale Resistance Meter | WAD641 | Price 90p 30 pence p&p. |
| Nov. 80. | Model Radio Control Field Test Unit | WK100 | Price 90p 30 pence p&p. |
| Nov. 80. | M.R.C.F. T.V. | WK101 | Price 90p 30 pence p&p. |
| Nov. 80. | P.W. Helford | C4CLF | Price £2.24 30 pence p&p. |
| Nov. 80. | P.W. Sherborne Synth Boards | 1-2 | £8.95 per set 30 pence p&p. |
| Dec. 80. | P.W. Helford | WR0104 | 50p per set 30 pence p&p. |
| Dec. 80. | Bird Scarer | WR0101 | 94p per set 30 pence p&p. |
| Dec. 80. | Bird Scarer | WR0102 | £1.05 per set 30 pence p&p. |
| Dec. 80. | Buffer Amp | WR0103 | 90p per set 30 pence p&p. |

**FULL RANGE OF RS COMPONENTS AVAILABLE**

## C. BOWES ELECTRONICS
**252A Stockport Road, Cheadle Heath, Stockport, Cheshire SK3 0LX.**
**Tel: 061-428 4497**
Please enclose cheque or postal order with order.

# TV SPARE PARTS & COMPONENTS

The Practical Wireless TV Sound Tuner. Still unsurpassed! Parts still available. Price List, copy of original article supplied on request. (cost of set of parts £28.40 incl. p/p & VAT)

**Callers still welcome at shop premises.**

## MANOR SUPPLIES
**(Tel. 01-794 8751)**
**172 WEST END LANE, LONDON NW6.**
***(near W. Hampstead Jubilee and British Rail Stations).***

# L.B. ELECTRONICS

**SPECIAL OFFER:** ·5" LED displays. FND500 Full spec. **50p** each, larger quantities P.O.A. P/P 25p.
FULL SPEC
**JUST ARRIVED:** Battery eliminator 6V 200mA, brand new **95p** each. P/P 35p. 5K Multi turn trim pots, PCB Mounting, pack of 14 **£2.50.** P/P 25p.
**CAPACITOR SCOOP:** 1600uf at 10V, 160uf at 25V axial lead 24 at **£1.00** (mixed). P/P 25p.
**GIVE AWAY:** 22 pin low profile Dil socket, gold plated **12p** each. 10 at **£1.00.** P/P 25p.
**PEWEC:** Mini fans 80mm × 80mm approx. 115V **£4.50.** P/P £1.00.
**TANTULUM CAPACITORS:** 4.7uf at 25V. 14 for **£1.00.** P/P 25p.
LEDS: 2" Red **12p,** TIL209 **10p,** OCP70 **25p,** 2114 (45ONS) **£1.85** each P/P 25p. 2708 (45ONS) **£3.00,** 2526 (Character Generator) **£2.95.** **2716** Eprom (single rail full spec.) **£6.95** P/P 25p.

**★ALL I.C's POSTAGE AND PACKING 25p★**
**★ALL PRICES INCLUSIVE OF V.A.T.★**
**★MANY SURPLUS COMPUTER BARGAINS★**
*ACCESS AND BARCLAYCARD ACCEPTED*

## L.B. ELECTRONICS
**11 Hercies Road, Hillingdon, Middlesex UB10 9LS.**
**Telephone: (89) 55399.**

OFF THE SHELF DELIVERY ON THESE ®

**FLUKE**

## BRAND NEW FROM FLUKE . . . NOW AVAILABLE THE 8024A HAND HELD DMM

This model incorporates all the features of the 8020A but in addition has:

A peak hold switch which can be used in AC or DC for volts and current functions.

Audible continuity testing and level detection for sensing logic levels.

A temperature (°C) range for use with a thermocouple.

**£135**

Carriage and Insurance £3

**The following accessories are in stock now**

| | |
|---|---|
| Y8008 Touch and Hold Probe............ | **£18.00** |
| 80K-40 High Voltage Probe.................. | **£45.00** |
| 81RF RF Probe to 100 MHZ................. | **£32.00** |
| 80T-150C Temperature Probe (C)...... | **£55.00** |
| 801-600 Clamp-on AC Current Probe | **£55.00** |

## HERE IT IS . . . THE EVER POPULAR 8022A HAND-HELD DMM

Consider the following features:
6 resistance ranges from 200 ohm-20 ohms.
8 current ranges from 2mA-2A AC/DC.
10 voltage ranges from 200 mv-1000v DC-200 mc-750V AC.
Pocket size – weighing only 370 gms.
Full overload protection – will withstand 6kv spikes.
Rugged construction – virtually indestructable.
Meets tough military specs. – drop proof
In line, pushbutton operation for single-handed useage.
Incorporates low power cmos chip for low power consumption.
All this plus a 2-year full guarantee.

**NOW only £75**

Carriage and Insurance £3

**Soft carrying case £7 extra**

**Even more sophisticated the Fluke 8020A.**
Identical in most respects to the 8022A but in addition incorporates a conductance range from 2mS-200nS.

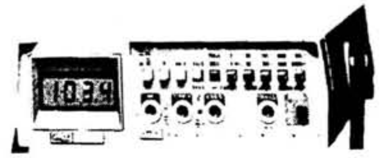
**Price £112**

Carriage and Insurance £3.00

A handsome soft carrying case is included (this model only)

OFF THE SHELF DELIVERY ON THESE ®

**FLUKE**



## 8010A AND 8012A BENCH MODEL D.M.M.s

The 8010A is a general purpose, bench/portable digital multimeter with more functions and features than ever offered for such a low price. Its companion, the 8012A, has identical characteristics except that it has two additional low resistance ranges, 2Ω and 20Ω to replace the 8010A's 10 ampere current range.

The 8010A and 8012A feature:
10 voltage ranges from 200mv-1000v dc, 200mv-75v ac.
3 conductance ranges from 2mS-200nS.
6 resistance ranges from 200Ω-20mΩ – the 8012A has two additional resistance ranges 2Ω and 20Ω.
10 current ranges from 200μA-2A AC/DC – the 8010A has two additional current ranges 10A AC and 10A DC.

8010A **£159** 8012A **£199**

Carriage and Insurance £3.

The 8010A is also available with two rechargeable Nicad size C batteries installed in option –01 a+ **£179.00.**

**PLEASE ADD 15% VAT TO ALL ORDERS except where items marked "VAT Included". CALLERS WELCOME.**

We are open 9 a.m.-6 p.m. Monday-Saturdays. We carry a very large selection of electronic components and electro-mechanical items. Special quotations on quantities.

# ELECTRO-TECH COMPONENTS LTD.

**364 EDGWARE ROAD, LONDON, W.2. TEL: 01-723 5667**

# PM COMPONENTS LTD

VALVE & COMPONENT SPECIALISTS

**CONINGSBY HOUSE, WROTHAM RD., MEOPHAM, KENT.**

| VALVES | |
|---|---|
| DY86 | 0.55 |
| DY802 | 0.60 |
| E180F | 5.65 |
| EABC80 | 0.56 |
| EBF89 | 0.70 |
| ECC81 | 0.55 |
| ECC82 | 0.55 |
| ECC83 | 0.60 |
| ECC85 | 0.60 |
| ECC88 | 0.65 |
| ECC807 | 1.30 |
| ECF80 | 0.65 |
| ECF82 | 0.60 |
| ECH81 | 0.58 |
| ECL82 | 0.58 |
| ECL83 | 1.13 |
| ECL86 | 0.74 |
| EF80 | 0.48 |
| EF86 | 0.70 |
| EF89 | 0.65 |
| EF91 | 1.22 |
| EF93 | 0.65 |
| EF94 | 0.65 |
| EF95 | 0.78 |
| EF183 | 0.56 |
| EF184 | 0.56 |
| EL34 | 1.54 |
| EL84 | 0.60 |
| EM84 | 0.65 |
| EZ80 | 0.48 |
| EZ81 | 0.56 |
| GZ32 | 0.76 |
| GZ33 | 1.85 |
| GZ34 | 2.00 |
| KT61 | 3.50 |
| KT66 | 4.00 |
| KT77 | 5.00 |
| KT88 | 6.00 |
| N78 | 8.90 |
| OA2 | 0.78 |
| PCF80 | 0.72 |
| PCF802 | 0.66 |
| PCF808 | 1.48 |
| PCL82 | 0.68 |
| PCL84 | 0.72 |
| PCL86 | 0.75 |
| PCL805 | 0.80 |
| PFL200 | 1.13 |
| PL504 | 1.13 |
| PL508 | 1.48 |

| | |
|---|---|
| PL509 | 2.30 |
| PL802 | 2.50 |
| PY88 | 0.72 |
| PY500A | 1.35 |
| PY801 | 0.60 |
| QQV02-6 | 8.25 |
| QQV03-20A | 12.25 |
| QQV06-40A | 13.95 |
| QV03-12 | 3.25 |
| TB2.5/300 | 42.00 |
| TY2-125A | 30.00 |
| U19 | 11.95 |
| UCH81 | 0.70 |
| UCL82 | 0.70 |
| UL84 | 0.78 |
| UY85 | 0.70 |
| Z759 | 9.00 |
| 2D21 | 1.60 |
| 4CX250B | 21.75 |
| 5R4GY | 1.25 |
| 5U4G | 0.90 |
| 6GK6 | 2.50 |
| 6J6 | 0.65 |
| 6JS6C | 5.00 |
| 6KD6 | 4.50 |
| 6L6GC | 1.75 |
| 6LD20 | 0.60 |
| 6LQ6 | 6.50 |
| 6SN7GT | 0.90 |
| 6V6GT | 1.05 |
| 7S7 | 2.00 |
| 12AT7 | 0.60 |
| 12AU7 | 0.60 |
| 12AX7 | 0.65 |
| 12BA6 | 0.80 |
| 12BE6 | 1.05 |
| 12BH7 | 0.95 |
| 12HG7 | 3.50 |
| 85A2 | 1.20 |
| 90C1 | 1.69 |
| 807 | 1.09 |
| 811A | 9.00 |
| 813 | 11.30 |
| 833A | 47.85 |
| 866A | 2.50 |
| 2050A | 3.90 |
| 5763 | 3.20 |
| 5814A | 2.75 |

| | |
|---|---|
| 6080 | 4.20 |
| 6146A | 4.45 |
| 6146B | 4.85 |
| 7025 | 1.50 |
| 7360 | 7.50 |
| 7591 | 2.35 |
| **SEMI-CONDUCTORS** | |
| AC126 | 0.22 |
| AC127 | 0.22 |
| AC128 | 0.28 |
| AC141K | 0.34 |
| AC176 | 0.22 |
| AC176K | 0.31 |
| AC187 | 0.26 |
| AC187K | 0.28 |
| AC188 | 0.22 |
| AD149 | 0.70 |
| AD161 | 0.39 |
| AD161/2 | 1.04 |
| AD162 | 0.39 |
| AF127 | 0.32 |
| AF139 | 0.42 |
| AF239 | 0.42 |
| BC107 | 0.10 |
| BC107B | 0.10 |
| BC108 | 0.10 |
| BC108C | 0.10 |
| BC109B | 0.10 |
| BC140 | 0.31 |
| BC141 | 0.25 |
| BC142 | 0.21 |
| BC143 | 0.24 |
| BC147 | 0.09 |
| BC148 | 0.09 |
| BC149 | 0.09 |
| BC157 | 0.10 |
| BC158 | 0.09 |
| BC159 | 0.09 |
| BC160 | 0.28 |
| BC170B | 0.10 |
| BC171 | 0.08 |
| BC172 | 0.09 |
| BC173B | 0.10 |
| BC182 | 0.09 |
| BC183 | 0.09 |
| BC184LA | 0.09 |
| BC212 | 0.09 |
| BC212L | 0.09 |
| BC213 | 0.09 |

| | |
|---|---|
| BC213L | 0.09 |
| BC214 | 0.09 |
| BC214L | 0.09 |
| BC237 | 0.09 |
| BC238 | 0.08 |
| BC307 | 0.09 |
| BC327 | 0.10 |
| BC337 | 0.10 |
| BC461 | 0.30 |
| BC478 | 0.20 |
| BC547 | 0.10 |
| BC548 | 0.10 |
| BC549A | 0.08 |
| BC557 | 0.07 |
| BC558 | 0.07 |
| BD131 | 0.32 |
| BD132 | 0.35 |
| BD133 | 0.40 |
| BD135 | 0.30 |
| BD136 | 0.30 |
| BD137 | 0.28 |
| BD138 | 0.30 |
| BD139 | 0.32 |
| BD140 | 0.30 |
| BD144 | 1.20 |
| BF115 | 0.35 |
| BF167 | 0.24 |
| BF179 | 0.34 |
| BF180 | 0.29 |
| BF183 | 0.29 |
| BF194 | 0.11 |
| BF195 | 0.11 |
| BF196 | 0.11 |
| BF197 | 0.11 |
| BF198 | 0.10 |
| BF199 | 0.14 |
| BF200 | 0.30 |
| BF257 | 0.28 |
| BF258 | 0.25 |
| BF259 | 0.26 |
| BF336 | 0.34 |
| BFX29 | 0.30 |
| BFX84 | 0.26 |
| BFX85 | 0.28 |
| BFX86 | 0.30 |
| BFX88 | 0.25 |
| BFY50 | 0.21 |
| BFY51 | 0.21 |
| BFY52 | 0.25 |
| BFY90 | 0.73 |
| BU105 | 1.22 |

| | |
|---|---|
| BU108 | 1.69 |
| BU205 | 1.30 |
| BU208 | 1.39 |
| BU208A | 1.52 |
| MJE340 | 0.40 |
| OC71 | 0.22 |
| R2008B | 1.70 |
| R2010B | 1.70 |
| R2540 | 2.48 |
| TIP29 | 0.40 |
| TIP29C | 0.42 |
| TIP30C | 0.43 |
| TIP31C | 0.42 |
| TIP32C | 0.42 |
| TIP41C | 0.45 |
| TIP42C | 0.47 |
| TIP47 | 0.65 |
| TIP2955 | 0.84 |
| TIP3055 | 0.60 |
| TIS91 | 0.20 |
| 2N3054 | 0.59 |
| 2N3055 | 0.59 |
| 2N3702 | 0.12 |
| 2N3703 | 0.12 |
| 2N3704 | 0.12 |
| 2N3705 | 0.12 |
| 2N3706 | 0.12 |
| 2N3708 | 0.12 |
| 2N5294 | 0.38 |
| 2N5296 | 0.48 |
| 2N5298 | 0.38 |
| **I.C.'s** | |
| MC1307 | 1.00 |
| MC1350 | 1.00 |
| MC1495 | 3.00 |
| SN76003N | 1.65 |
| SN76013N | 1.15 |
| SN76013ND | 1.15 |
| SN76023N | 1.35 |
| SN76033N | 1.35 |
| SN76131N | 1.30 |
| SN76227N | 1.05 |
| SN76660N | 0.60 |
| TAA661B | 1.20 |
| TBA120S | 0.70 |
| TBA540 | 1.25 |
| TBA550Q | 1.55 |
| TBA641-B11 | 1.90 |

**Prices exclude VAT**
**Please add 15%**
**P&P 50p per order**

Many other types available including vintage valves.

**PHONE 0474 813225**

BARCLAYCARD VISA

# NICKEL CADMIUM BATTERIES

| | AA (HP7) 0.5AHr | SUB 'C' 1.2AHr | 'C' (HP11) 1.65AHr | 'C' (HP11) 2.0AHr | 'D' (HP2) 4.0AHr | PP3 0.1AHr |
|---|---|---|---|---|---|---|
| 1–24 | £0.85 | £1.38 | £1.69 | £2.25 | £2.97 | £3.79 |
| 25–49 | £0.82 | £1.28 | £1.58 | £2.10 | £2.77 | |
| 50–99 | £0.80 | £1.24 | £1.52 | £2.02 | £2.67 | |
| 100 up | £0.70 | £1.15 | £1.41 | £1.87 | £2.47 | |

All cells are brand new full spec devices from reputable mnfrs. All Nickel Cadmium cells (except PP3) are supplied complete with solder tags and are **'VENTED' devices** suitable for fast charge.

**CHARGERS** – single or dual O/P to charge PP3, AA or SUB 'C' cells in 12-14 hrs (chargers will charge 'C' and 'D' cells but with longer charging time). Units supplied complete in plug top case with flying leads. Number of cells (10 max) in series and type **must** be specified for each required O/P when ordering.

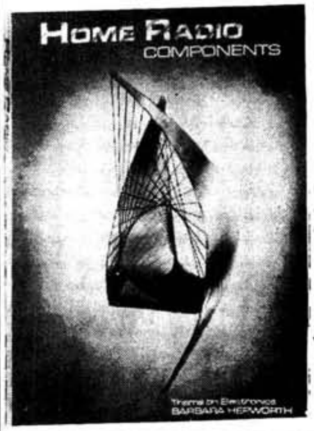
SINGLE O/P CHARGER **£5.04**
DUAL O/P CHARGER **£5.72**

**TRANSFORMERS** – as used in chargers, 2 × 12 volt 0.25 amp secondarys 240v primary, tag connections **£1.57** each.

Data and charging circuits free with orders over £10 otherwise 30p post. P&P 10% if order less than £10, 5% if order over £10. Prices *DO NOT INCLUDE VAT* and this should be added to the total order.

**Cheques, P.O.'s Mail Order to:–**

**SOLID STATE SECURITY,**
Dept. (PW), Bradshaw Lane,
Parbold, Wigan, Lancs.
Telephone 02576-3018.




## START THE NEW YEAR WELL with a HOME RADIO CATALOGUE

- About 2,000 items clearly listed.
- Profusely illustrated throughout.
- Large A-4 size pages.
- Bargain list, order form and 2 coupons each worth 25p if used as directed, all supplied free.

Price £1, plus 50p for post, packing and insurance.

*Send cheque or P.O. for £1.50*

**HOME RADIO Components LTD**
**Dept. PW, P.O. Box 92, 215 London Road, Mitcham, Surrey. 01-543 5659**

# AND THERE'S MORE WHERE THIS CAME FROM

**It's a long time since one of our adverts was presented in 'list' form - but simply because we do not try to squeeze this lot in every time doesn't mean that it's not available. Our new style price list (now some 40 pages long) includes all this and more, including quantity prices and a brief description. The kits, modules and specialized RF components - such as TOKO coils, filters etc. are covered in the general price list - so send now for a free copy (with an SAE please). Part 4 of the catalogue is due out now (incorporating a revised version of pt.1).**

## LINEAR ICs - NUMERIC LISTINGS

| | |
|---|---|
| TBA120S | 1.00 |
| L200 | 1.95 |
| U237B | 1.28 |
| U247B | 1.28 |
| U257B | 1.28 |
| U267B | 1.28 |
| LM301H | 0.67 |
| LM301N | 0.30 |
| LM308H | 0.96 |
| LM308N | 0.65 |
| LM339N | 0.66 |
| LM348N | 1.86 |
| LF351N | 0.38 |
| LF353N | 0.76 |
| LM374N | 3.75 |
| LM380N-14 | 1.00 |
| LM380N-8 | 1.00 |
| LM381N | 1.81 |
| ZN419CE | 1.95 |
| NE544N | 1.80 |
| NE555N | 0.30 |
| NE556N | 0.50 |
| NE560N | 3.50 |
| NE562N | 4.05 |
| NE564N | 4.29 |
| NE565N | 1.00 |
| NE566N | 1.60 |
| NE570N | 3.85 |
| SL624 | 3.28 |
| TBA651 | 1.81 |
| uA709HC | 0.64 |
| uA709PC | 0.36 |
| uA710HC | 0.65 |
| uA710PC | 0.59 |
| uA741CH | 0.66 |
| uA741CN | 0.27 |
| uA747CN | 0.70 |
| uA748CN | 0.36 |
| uA753 | 2.44 |
| uA758 | 2.35 |
| TBA810AS | 1.09 |
| TBA820M | 0.75 |
| TCA940E | 1.80 |
| TDA1028 | 2.11 |
| TDA1029 | 2.11 |
| TDA1054 | 1.45 |
| TDA1062 | 1.95 |
| TDA1072 | 2.69 |
| TDA1074A | 5.04 |
| TDA1083 | 1.95 |
| TDA1090 | 3.05 |
| HA1137 | 1.20 |
| HA1196 | 2.00 |
| HA1197 | 1.00 |
| TDA1220 | 1.40 |
| LM1303 | 0.99 |
| LM1307 | 1.55 |
| MC1310P | 1.90 |
| MC1330 | 1.20 |
| MC1350 | 1.20 |
| HA1370 | 1.90 |
| HA1388 | 2.75 |
| TDA1490 | 1.86 |
| MC1496P | 1.25 |
| SL1610P | 1.60 |
| SL1611P | 1.60 |
| SL1612P | 1.60 |
| SL1613P | 1.89 |
| SL1620P | 2.17 |
| SL1621P | 2.17 |
| SL1623P | 2.24 |
| SL624C | 3.28 |
| SL1625P | 2.17 |
| SL1626P | 2.44 |
| SL1630P | 1.62 |
| SL1640P | 1.89 |
| SL1641P | 1.89 |
| TDA2002 | 1.25 |
| TDA2020 | 3.00 |
| ULN2242A | 3.05 |
| ULN2283B | 1.00 |
| CA3080E | 0.70 |
| CA3089E | 1.84 |
| CA3090AQ | 3.35 |
| CA3123E | 1.40 |
| CA3130E | 0.80 |
| CA3130T | 0.90 |
| CA3140E | 0.46 |
| CA3189E | 2.20 |
| MC3357P | 2.35 |
| LM3900N | 0.60 |
| LM3909N | 0.68 |
| LM3914N | 2.80 |
| LM3915N | 2.80 |
| KB4400 | 0.80 |
| KB4406 | 0.60 |
| KB4412 | 1.95 |
| KB4413 | 1.95 |
| KB4417 | 1.80 |
| TDA4420 | 2.25 |
| KB4420B | 1.09 |
| KB4423 | 2.30 |
| KB4424 | 1.65 |
| KB4431 | 1.95 |
| KB4432 | 1.95 |
| KB4433 | 1.52 |
| KB4436 | 2.53 |
| KB4437 | 1.75 |
| KB4438 | 2.22 |
| KB4441 | 1.35 |
| KB4445 | 1.29 |
| KB4446 | 2.75 |
| KB4448 | 1.65 |
| NE5044N | 2.26 |
| NE5532N | 1.85 |
| SD6000 | 3.75 |
| SL6270 | 2.03 |
| SL6310 | 2.03 |
| SL6600 | 3.75 |
| SL6640 | 2.75 |
| SL6690 | 3.20 |
| SL6700 | 2.35 |
| ICL8038CC | 4.50 |
| MSL9362 | 1.75 |
| MSL9363 | 1.75 |
| HA11211 | 1.95 |
| HA11223 | 2.15 |
| HA11225 | 1.45 |
| HA12002 | 1.45 |
| HA12017 | 0.80 |
| HA12402 | 1.95 |
| HA12411 | 1.20 |
| HA12412 | 1.55 |
| LF13741 | 0.33 |
| SN76660N | 0.80 |

## FREQUENCY DISPLAY & SYNTHESISER ICs

| | |
|---|---|
| SAA1056 | 3.75 |
| SAA1058 | 3.35 |
| SAA1059 | 3.35 |
| 11C90DC | 14.00 |
| LN1232 | 19.00 |
| LN1242 | 19.00 |
| MSL2318 | 3.84 |
| MSM5523 | 11.30 |
| MSM5524 | 11.30 |
| MSM5525 | 7.85 |
| MSM5526 | 7.85 |
| MSM5527 | 9.75 |
| MSM55271 | 9.75 |
| ICM7106CP | 9.55 |
| ICM7107CP | 9.55 |
| ICM7216B | 19.25 |
| ICM7217A | 9.50 |
| SP8629 | 3.85 |
| SP8647 | 6.00 |
| 95H90PC | 6.00 |
| HD10551 | 2.45 |
| HD44015 | 4.45 |
| HD12009 | 6.00 |
| HD44752 | 8.00 |

## CMOS 4000 SERIES

| | |
|---|---|
| 4001 | 0.17 |
| 4000 | 0.17 |
| 4002 | 0.23 |
| 4008 | 0.80 |
| 4009 | 0.58 |
| 4010B | 0.58 |
| 4011AE | 0.20 |
| 4011B | 0.20 |
| 4012 | 0.55 |
| 4013 | 0.55 |
| 4015 | 0.95 |
| 4016 | 0.52 |
| 4017 | 0.80 |
| 4019 | 0.60 |
| 4020B | 0.93 |
| 4021 | 0.82 |
| 4022 | 0.90 |
| 4023 | 0.17 |
| 4024 | 0.76 |
| 4025 | 0.17 |
| 4026 | 1.80 |
| 4028 | 0.72 |
| 4029 | 1.00 |
| 4030 | 0.58 |
| 4035 | 1.20 |
| 4040 | 0.83 |
| 4042 | 0.85 |
| 4043 | 0.85 |
| 4044 | 0.80 |
| 4046 | 1.30 |
| 4047 | 0.99 |
| 4049 | 0.52 |
| 4050 | 0.55 |
| 4051 | 0.65 |
| 4052 | 0.65 |
| 4053 | 0.65 |
| 4063 | 1.09 |
| 4066 | 0.56 |
| 4068 | 0.25 |
| 4069 | 0.20 |
| 4070 | 0.20 |
| 4071 | 0.20 |
| 4072 | 0.20 |
| 4073 | 0.20 |
| 4075 | 0.20 |
| 4076 | 0.90 |
| 4077 | 0.20 |
| 4078 | 0.20 |
| 4082 | 0.20 |
| 4093 | 0.78 |
| 4175 | 0.95 |
| 4503 | 0.69 |
| 4506 | 0.51 |
| 4510 | 0.99 |
| 4511 | 1.49 |
| 4512 | 0.98 |
| 4514 | 2.55 |
| 4518 | 1.03 |
| 4520 | 1.09 |
| 4521 | 2.36 |
| 4522 | 1.49 |
| 4529 | 1.41 |
| 4539 | 1.10 |
| 4549 | 3.50 |
| 4554 | 1.53 |
| 4560 | 2.18 |
| 4566 | 1.59 |
| 4568 | 2.18 |
| 4569 | 3.03 |
| 4572 | 0.30 |
| 4585 | 1.10 |

## TTL N and LSN

| | |
|---|---|
| 7400N | 0.13 |
| 74LS00 | 0.20 |
| 7401N | 0.13 |
| 74LS01 | 0.20 |
| 7402N | 0.14 |
| 74LS02 | 0.20 |
| 7403N | 0.14 |
| 74LS03 | 0.20 |
| 7404N | 0.14 |
| 74LS04 | 0.24 |
| 7405N | 0.18 |
| 74LS05 | 0.26 |
| 7406N | 0.28 |
| 7407N | 0.38 |
| 7408N | 0.17 |
| 74LS08 | 0.24 |
| 7409N | 0.17 |
| 74LS09 | 0.24 |
| 7410N | 0.15 |
| 74LS10 | 0.24 |
| 7411N | 0.20 |
| 74LS11 | 0.24 |
| 7412N | 0.17 |
| 7413N | 0.30 |
| 7414N | 0.51 |
| 74LS15 | 0.24 |
| 7416N | 0.30 |
| 7417N | 0.30 |
| 7420N | 0.16 |
| 74LS20 | 0.24 |
| 7421N | 0.29 |
| 74LS21 | 0.24 |
| 7423N | 0.27 |
| 7425N | 0.27 |
| 7427N | 0.27 |
| 74LS27 | 0.44 |
| 7428N | 0.35 |
| 74LS28 | 0.32 |
| 7430N | 0.17 |
| 74LS30 | 0.24 |
| 7432N | 0.25 |
| 74LS32 | 0.24 |
| 7437N | 0.40 |
| 7438N | 0.33 |
| 74LS38 | 0.24 |
| 7440N | 0.17 |
| 74LS40 | 0.24 |
| 7441N | 0.74 |
| 7442N | 0.70 |
| 74LS42 | 0.99 |
| 7443N | 1.15 |
| 7444N | 1.12 |
| 7445N | 0.94 |
| 7446N | 0.94 |
| 74LS47 | 0.89 |
| 7448N | 0.56 |
| 74LS48 | 0.99 |
| 74LS49 | 0.99 |
| 7451N | 0.17 |
| 74LS51 | 0.24 |
| 7453N | 0.17 |
| 7454N | 0.17 |
| 74LS54 | 0.24 |
| 74LS55 | 0.24 |
| 7460N | 0.17 |
| 74LS63 | 1.24 |
| 7470N | 0.28 |
| 7472N | 0.28 |
| 7473N | 0.32 |
| 74LS73 | 0.38 |
| 7474N | 0.27 |
| 74LS74 | 0.28 |
| 7475N | 0.38 |
| 7476N | 0.37 |
| 74LS76 | 0.38 |
| 74LS78 | 0.38 |
| 7480N | 0.48 |
| 7481N | 0.86 |
| 7482N | 0.69 |
| 7485N | 1.04 |
| 74LS85 | 0.99 |
| 74LS86 | 0.40 |
| 7489N | 2.05 |
| 7490N | 0.33 |
| 74LS90 | 0.90 |
| 7491N | 0.76 |
| 74LS91 | 1.10 |
| 7492N | 0.38 |
| 74LS92 | 0.78 |
| 7493N | 0.32 |
| 74LS93 | 0.99 |
| 7494N | 0.78 |
| 7495N | 0.65 |
| 74LS95 | 1.14 |
| 7496N | 0.58 |
| 74LS96 | 1.20 |
| 7497N | 1.85 |
| 74LS107 | 0.38 |
| 74109N | 0.63 |
| 74LS109 | 0.70 |
| 74110N | 0.54 |
| 74111N | 0.68 |
| 74LS112 | 0.38 |
| 74LS113 | 0.38 |
| 74LS114 | 0.38 |
| 74118N | 0.83 |
| 74120N | 1.15 |
| 74121N | 0.42 |
| 74122N | 0.46 |
| 74123N | 0.73 |
| 74LS124 | 1.75 |
| 74125N | 0.38 |
| 74LS125 | 0.44 |
| 74126N | 0.57 |
| 74LS126 | 0.44 |
| 74128N | 0.74 |
| 74132N | 0.73 |
| 74LS132 | 0.78 |
| 74LS136 | 0.40 |
| 74LS138 | 0.60 |
| 74141N | 0.56 |
| 74142N | 2.65 |
| 74143N | 3.12 |
| 74144N | 3.12 |
| 74LS145 | 0.97 |
| 74147N | 1.75 |
| 74148N | 1.09 |
| 74LS148 | 1.19 |
| 74150N | 0.99 |
| 74151N | 0.55 |
| 74LS151 | 0.84 |
| 74153N | 0.64 |
| 74LS153 | 0.54 |
| 74154N | 0.96 |
| 74155N | 0.54 |
| 74LS155 | 1.10 |
| 74156N | 0.80 |
| 74157N | 0.67 |
| 74LS157 | 0.55 |
| 74LS158 | 0.60 |
| 74159N | 2.10 |
| 74160N | 0.82 |
| 74LS160 | 1.30 |
| 74161N | 0.92 |
| 74LS161 | 0.78 |
| 74LS162 | 1.30 |
| 74163N | 0.92 |
| 74LS163 | 0.78 |
| 74164N | 1.04 |
| 74LS164 | 1.30 |
| 74165N | 1.05 |
| 74LS165 | 1.04 |
| 74167N | 2.50 |
| 74LS169 | 2.00 |
| 74170N | 2.30 |
| 74LS170 | 2.00 |
| 74LS174 | 1.20 |
| 74175N | 0.87 |
| 74LS175 | 1.10 |
| 74176N | 0.75 |
| 74177N | 0.78 |
| 74181N | 1.65 |
| 74LS181 | 3.50 |
| 74LS183 | 2.10 |
| 74184N | 1.35 |
| 74185N | 1.34 |
| 74LS190 | 0.92 |
| 74192N | 1.05 |
| 74LS192 | 1.80 |
| 74193N | 1.05 |
| 74LS193 | 1.80 |
| 74194N | 1.05 |
| 74196N | 0.99 |
| 74LS196 | 1.10 |
| 74LS197 | 1.10 |
| 74198N | 1.50 |
| 74199N | 1.60 |
| 74LS247 | 0.93 |
| 74LS257 | 1.08 |
| 74LS260 | 1.53 |
| 74LS279 | 0.52 |
| 74LS283 | 1.20 |
| 74LS293 | 0.95 |
| 74LS365 | 0.49 |
| 74LS366 | 0.49 |
| 74LS367 | 0.43 |
| 74LS368 | 0.49 |
| 74LS374 | 1.80 |
| 74LS377 | 1.95 |
| 74LS379 | 1.30 |
| 74LS393 | 1.40 |

## VARICAP TUNING DIODES

| | |
|---|---|
| BA102 | 0.30 |
| BA121 | 0.30 |
| ITT210 | 0.30 |
| BB204B | 0.36 |
| BB105B | 0.36 |
| BB109 | 0.27 |
| MVM125 | 1.05 |
| BB212 | 1.95 |
| KV1210 | 2.45 |
| KV1211 | 1.75 |
| KV1226 | 1.95 |
| KV1225 | 2.75 |
| KV1215 | 2.55 |
| KV1225 | 2.75 |

## SWITCHING AND PIN DIODES

### SHOTTKY DIODES

| | |
|---|---|
| 1N6263 | 0.62 |
| BA182 | 0.19 |
| BA244 | 0.17 |
| BA379 | 0.35 |
| TDA1061 | 0.95 |

## SIGNAL DIODES & RECTIFIERS

| | |
|---|---|
| 1N4148 | 0.06 |
| 1N4001 | 0.06 |
| 1N4002 | 0.07 |
| 1N5402 | 0.15 |
| OA91 | 0.07 |
| AA112 | 0.25 |
| BRIDGES: | |
| 1A/50V | 0.35 |
| 6A/200V | 0.75 |

## TRANSISTORS

### AUDIO DEVICES

| | |
|---|---|
| BC237 | 0.08 |
| BC238 | 0.08 |
| BC239 | 0.08 |
| BC307 | 0.08 |
| BC308 | 0.08 |
| BC309 | 0.08 |
| BC413 | 0.10 |
| BC414 | 0.11 |
| BC415 | 0.07 |
| BC416 | 0.08 |
| BC546 | 0.12 |
| BC556 | 0.12 |
| BC550 | 0.12 |
| BC560 | 0.12 |
| BC639 | 0.22 |
| BC640 | 0.23 |
| 2SC1775 | 0.18 |
| 2SA872A | 0.14 |
| 2SD666A | 0.30 |
| 2SB646A | 0.30 |
| 2SD668A | 0.40 |
| 2SB648A | 0.40 |
| 2SD760 | 0.45 |
| 2SB720 | 0.45 |
| 2SC2546 | 0.19 |
| 2SA1084 | 0.20 |
| 2SC2547 | 0.19 |
| 2SA1085 | 0.20 |

### AUDIO POWER DEVICES

| | |
|---|---|
| 2SB753 | 2.34 |
| 2SB723 | 2.34 |
| 2SK133 | 3.00 |
| 2SJ 48 | 3.00 |
| 2SK134 | 3.10 |
| 2SK135 | 3.75 |
| 2SJ 50 | 3.75 |
| BD535 | 0.52 |
| BD536 | 0.52 |
| BD377 | 0.33 |
| BD378 | 0.33 |
| BD165 | 0.30 |
| BD166 | 0.31 |

### SMALL SIGNAL RF DEVICES

| | |
|---|---|
| BF194 | 0.18 |
| BF195 | 0.18 |
| BF224 | 0.22 |
| BF241 | 0.18 |
| BF274 | 0.18 |
| BF440 | 0.21 |
| BF441 | 0.21 |
| BF362 | 0.49 |
| BF395 | 0.18 |
| BF479 | 0.66 |
| BF679S | 0.55 |
| BFR91 | 1.33 |
| BFW92 | 0.60 |
| BFT95 | 0.99 |
| BFY90 | 0.90 |
| 40238 | 0.85 |

### RF POWER DEVICES

| | |
|---|---|
| VN66AF | 0.95 |
| 2N3866 | 0.85 |

### SMALL SIGNAL RF FET/MOSFET

| | |
|---|---|
| BF256 | 0.38 |
| 2SK55 | 0.28 |
| 2SK168 | 0.35 |
| J310 | 0.69 |
| J176 | 0.65 |
| 40823 | 0.65 |
| 40673 | 3SK51 |
| 3SK45 | 0.49 |
| 3SK51 | 0.54 |
| 3SK60 | 0.58 |
| MEM680 | 0.75 |
| BF961 | 0.70 |
| BF960 | 1.24 |
| 3SK48 | 1.64 |

## CAPACITORS

**All 5mm or less spacing**

CERAMIC 50v
2P2,3P3,4P7,6P8
8P2,10P,15P,18P..0.04
22P,27P,33P,47P
56P,68P,82P,100P.0.05
150P,220P,270P
330P,390P,470P...0.055
1N0,2N2,3N3,4N7..0.06
10N (0.01uF)....0.05
22N,47N..........0.06
100N,220N........0.09
MONOLITHIC CERAMIC
10N,100N.........0.16

FEEDTHRU
1N0 SOLDER IN....0.09

POLYESTER (SIEMENS)
10mm LEAD SPACING
10N,22N,33N......0.17
47N,68N,100N.....0.19
220N,470N........0.22
1uF..............0.29

POLYESTER (GENERAL)
10mm LEAD SPACING
10N,15N,22N,33N..0.06
47N,68N,100N.....0.08
220N.............0.11
20mm LEAD SPACING
220N,330N,470N...0.18

MYLAR
5mm LEAD SPACING
1N0,10N,22N,33N..0.08
100N.............0.09
20mm LEAD SPACING
220N,470N....... 0.17

POLYSTYRENE
10P,15P,18P,22P,
27P,47P,56P,68P..0.08
100P,180P,220P,
270P,330P,390P...0.09
470P,680P,820P...0.10
1N0,1N2,1N5,1N8..0.11
2N2,2N7,3N3,3N9..0.12
4N7,5N6,6N8,10N..0.13

TANTALUM BEAD CAPS
16v: 0.22,0.33,
0.68,1.0.........0.18
16v: 2.2,4.7,10..0.19
6v3: 22,47.......0.30
10v: 22,100......0.35

**ALUMIN ELECTROLYTICS RADIAL (VERT. MOUNT)**
(uF/voltage)
1/63,2.2/50,4.7/35
10/16,15/16,22/10
33/6.3...........0.08
22/16,33/10,
47/10............0.09
10/63,22/50,33/50,
47/16,100/16.....0.10
47/63,100/25,220/16
470/6.3..........0.12
100/63,470/16,
1000/10..........0.18
1000/16,470/63...0.23
1000/63,2200/16..0.30
3300/25..........0.69
1000/100.........0.88
10000/70.........3.00

AXIAL (HORIZ. MOUNT)
1/25,4.7/16,6.4/25
10/16............0.08
4.7/63,22/10,22/16
33/16............0.09
47/25,100/16.....0.10
100/25...........0.11
1000/16..........0.25
2200/16,1000/25..0.36
1000/35,4700/16..0.45
1000/50..........0.58

## RESISTORS

0.25W, 5% E12 CARBON
1ohm-10M.........0.02
0.25W 1% E12 METAL FILM
1.1ohm-1M........0.05

HORIZ CARBON PRESETS
10mm TYPE
100ohms-2M5......0.12
HORIZ CERMET PRESETS
1k, 10k..........0.27

## TOKO COILS AND FILTERS SEE THE EXTENSIVE SECTION IN OUR NEW PRICE LISTS AND CATALOGUE

### LF/HF FIXED INDUCTORS —FULL E12 RANGE

| | |
|---|---|
| 7BA series 1uH-1mH | 0.16 |
| 8RB series 100uH-33mH | 0.19 |
| 10RB series 33mH-120mH | 0.33 |
| 10RBH series 120mH-1.5H | 0.55 |
| PIEZO SOUNDER PB2720 | 0.44 |

## VOLTAGE REGULATORS

| | |
|---|---|
| 78series | 0.95 |
| 79series | 1.00 |
| 78Mseries | 0.65 |
| 78Lseries | 0.35 |
| 79L05 | 0.85 |
| 78MGT2C | 1.75 |
| 79MGT2C | 1.75 |
| 723CN | 0.65 |
| L200 | 1.95 |
| TDA1412 | 0.75 |
| NE5553N | 1.25 |
| LM317MP | 1.48 |
| LM337MP | 1.48 |

## MICROMARKET

| | |
|---|---|
| 8080A/2 | 7.50 |
| 8212 | 2.30 |
| 8214 | 3.50 |
| 8216 | 1.95 |
| 8224 | 3.50 |
| 8251 | 6.25 |
| 8255 | 5.40 |
| 6800P | 7.50 |
| 6810 | 5.95 |
| 6820 | 7.45 |
| 6850 | 4.90 |
| 6852 | 4.85 |
| MC2708 | 7.50 |
| 2114 | 6.50 |
| 4027 | 5.78 |
| 2102 | 1.70 |
| 2112 | 3.40 |
| 2513 | 7.54 |
| HM4716 | 4.50 |
| 81LS97 | 1.25 |

## CRYSTAL FILTER PRODUCTS

| | |
|---|---|
| 10.7MHZ 2 POLE TYPES: | |
| 10M15A 15KHZ BW | 2.49 |
| 10.7MHZ 8 POLE TYPES: | |
| 10M4B1 15kHz BW | 14.50 |
| H4402 7.5KHZ BW | 15.50 |
| 10M22D 2.4KHZ SSB | 17.20 |
| HF FIRST FILTER: | |
| B34F8A 34.5MHz HF | 32.00 |

## RADIO CONTROL CRYSTALS

(No splits available)

| | |
|---|---|
| AM TX:- | |
| 3rd OT 30pF HC25U | 1.65 |
| AM/FM RX:- | |
| 3rd OT 30pF HC25U | 1.65 |
| FM TX :- | |
| Fund 20pF HC25U | 1.85 |
| Pairs FM | 3.25 |
| Pairs AM | 3.10 |

## CRYSTALS

| | |
|---|---|
| 32.768 kHz | 2.70 |
| 100kHZ | 3.85 |
| 455kHZ | 5.00 |
| 1.0MHz | 3.00 |
| 3.2768MHz | 2.70 |
| 4.000MHz | 2.00 |
| 4.19439MHz | 2.30 |
| 6.5536MHz | 2.10 |
| 10.0MHz | 2.50 |
| 10.6985MHz | 2.50 |
| 10.7015MHz | 2.50 |
| 10.245MHz | 2.50 |
| 10.7MHz | 3.00 |
| 11.52MHz | 2.50 |
| 100MHz | 3.00 |

## LEDs

| | |
|---|---|
| 5MM RED | 0.12 |
| 3MM RED CLEAR | 0.15 |
| 3MM RED | 0.15 |
| 2.5 X 5MM RED | 0.17 |
| 5MM GREEN | 0.15 |
| 3MM GN CLEAR | 0.16 |
| 3MM GREEN | 0.16 |
| 2.5 X 5MM GN | 0.20 |
| 5MM YELLOW | 0.15 |
| 3MM YELLOW CL | 0.16 |
| 3MM YELLOW | 0.18 |
| 2.5 X 5MM YE | 0.20 |
| 5MM ORANGERED | 0.20 |
| 5MM ORA CL | 0.29 |
| 3MM ORANGERED | 0.19 |
| 2.5 X 5MM ORA | 0.24 |
| 5MM INFRA RED | 0.56 |
| BPW41 IR DET | 1.51 |
| IR OPT CPLR | 1.44 |
| 5MM CLIP | 0.04 |

## LCDs

| | |
|---|---|
| 3.5 digit | 9.45 |
| 4 digit | 8.95 |
| 5 digit | 8.95 |

## SCHOTTKY DIODE BAL MIXERS (SBL1=MD108)

| | |
|---|---|
| SBL1 1-500MHz | 4.25 |
| SBL1-8 .1-200MHz | 4.55 |
| SBL1-X 10-1000MHZ | 5.75 |
| SRA1 .5-500MHz | 8.45 |
| SRA1-1 .1-500MHz | 9.25 |
| SRA1H .5-500MHz | 13.35 |
| SRA3 .025-200MHz | 10.25 |

## LCD Module

CM161.
Miniature clock, 12/24 hr., alarm, day, date, backlight.
All for......9.95

**PRICES EXCLUDE VAT - PLEASE ADD 15%***
**Postage 35p per order. CWO please. (*UK only)**

# ambit
INTERNATIONAL

CWO PLEASE : Commercial MA terms on application. Goods are offered subject to availability, prices subject to change - so please phone and check if in doubt.

**Please send an SAE with all enquiries. Access/Barclaycd (min £5 please) Callers welcome**

# 200 North Service Road, Brentwood, Essex

TELEPHONE (STD 0277) 230909 TELEX 995194 AMBIT G POSTCODE CM14 4SG

**CATALOGUES**
**2 & 3....60p ea**
**4............75p**
**(4 inc. rev. of part 1)**
**ALL PARTS : .......£1.75......**

## POPULAR KITS AND PARTS

**TRANSMITTER SURVEILLANCE**
Tiny, easily hidden but which will enable conversation to be picked up with FM radio. Can be made in a matchbox—all electronic parts and circuit. **£2·30.**

**RADIO MIKE**
Ideal for discos and garden parties, allows complete freedom of movement. Play through FM radio or tuner amp. **£6·90.**

**SAFE BLOCK**
Mains quick connector will save you valuable time. Features include quick spring connectors, heavy plastic case and auto on and off switch. Complete kit **£1.95.**

**LIGHT CHASER**
Gives a brilliant display—a psychedelic light show for discos, parties and pop groups. These have three modes of flashing, two chase-patterns and a strobe effect. Total output power 750 watts per channel. Complete kit. **Price £16.** Ready made up **£4 extra.**

**FISH BITE INDICATOR** enables anglers to set up several lines then sit down and read a book. As soon as one has a bite the loudspeakers emits a shrill note. Kit. **Price £4·90.**

**6 WAVEBAND SHORTWAVE RADIO KIT**
Bandspread covering 13·5 to 32 metres. Based on circuit which appeared in a recent issue of Radio Constructor. Complete kit, includes case materials, six transistors, and diodes, condensers, resistors, inductors, switches, etc. Nothing else to buy, if you have an amplifier to connect it to on a pair of high resistance headphones. Price **£11·95.**

**SHORT WAVE CRYSTAL RADIO**
All the parts to make up the beginner's model. Price **£2·30.** Crystal earpiece **65p.** High resistance headphones (give best results) **£3·75.** Kit includes chassis and front but not case.

**RADIO STETHOSCOPE**
Easy to fault find—start at the aerial and work towards the speaker — when signal stops you have found the fault. **Complete kit £4·95.**

**INTERRUPTED BEAM KIT**
This kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components—relay. photo transistor, resistors and caps etc. Circuit diagram but no case, Price **£2·30.**

**OUR CAR STARTER AND CHARGER KIT** has no doubt saved many motorists from embarrassment in an emergency you can start car off mains or bring your battery up to full charge in a couple of hours. The kit comprises: 250w mains transformer, two 10 amp bridge rectifiers, start/charge switch and full instructions. You can assemble this in the evening, box it up or leave it on the shelf in the garage, whichever suits you best. **Price £11·50** + £2·50 post.

**G.P.O. HIGH GAIN AMP/SIGNAL TRACER.** In case measuring only 5¼in × 3½in × 1½in is an extremely high gain (70DB) solid state amplifier designed for use as a signal tracer on GPO cables etc. With a radio it functions very well as a signal tracer. By connecting a simple coil to the input socket a useful mains cable tracer can be made. Runs on standard 4½v battery and has input, output sockets and on-off volume control, mounted flush on the top. Many other uses include general purpose amp. cueing amp, etc. **An absolute bargain at only £1·85.** Suitable 80 ohm earpiece **69p.**

**VU METER**
Edgewise mounting, through hole size 1¾" × ½" approx. These are 100 micro amp f.s.d. and fitted with internal 6 volt bulb for scale illumination, also have zero reset. The scale is not calibrated but has very modern appearance. Price **£2·88p.**

**BALANCE METER**
Edgewise mounting 100 UA centre zero. Price **£2·30p.**

**1¾" SQUARE PANEL METER**
Eagle full vision plastic front, 50 UA. Price **£4·60p** 1 mA Price **£4·03p.**

**WATERPROOF HEATING WIRE**
60 ohms per yard. This is a heating element wound on a fibre glass coil and then covered with p.v.c. Dozens of uses—around water pipes, under grow boxes in gloves and socks. **23p** metre.

**DIAL INDICATOR**
As used in tool making and other precision measuring operations, the famous John Bull accurately shows differences of 0·1mm. A beautifully made precision instrument, price in most tool shops would be £12-£15. We have a fair quantity. Price **£9·20p.**

**COMPONENT BOARD Ref. W0998.**
This is a modern fibre glass board which contains a multitude of very useful parts, most important of which are: 35 assorted diodes and rectifiers including four 3 amo 400v types (made up in a bridge) 8 transistors type BC 107 and 2 type BFY 51 electrolytic condensers, SCR ref. 2N 5062 25 Ouf 100v DC and 100uf 25v DC and over 100 other parts including variable, fixed and wire wound resistors, electrolytic and other condensers. A real snip at **£1·15.**

**FRUIT MACHINE HEART.** 4 wheels with all fruits, motorised and with solenoids for stopping the wheels with a little ingenuity you can defy your friends getting the "jackpot." **£9·95 + £4** carriage.

**DESOLDERING PUMP**
Ideal for removing components from computer boards as well as for service work generally. Price **£6·35.**

**4-CORE FLEX CABLE**
White pvc for telephone extensions, disco lights, etc. 10 metres **£2,** 100 metres **£15.** Other multicore cable in stock.

**MUGGER DETERRENT**
A high-note bleeper, push latching switch, plastic case and battery connector. Will scare away any villain and bring help. **£2·50** complete kit.

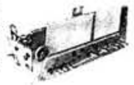
**HUMIDITY SWITCH**
American made by Honeywell. The action of this device depends upon the dampness causing a membrane to stretch and trigger a sensitive microswitch. Very sensitive breathing on it for instance will switch it on. Micro 3 amp at 250V a.c. Only **£1·15.**

**MINI-MULTI TESTER**
Deluxe pocket size precision moving coil instrument, jewelled bearings—2000 o.p.v. mirrored scale.
11 instant range measure:
DC volts 10, 50, 250, 1000.
AC volts 10, 50, 250, 1000.
DC amps 0-100 mA.
Continuity and resistance 0-1 meg ohms in two ranges. Complete with Test Prods and instruction book showing how to measure capacity and inductance as well.
Unbelievable value only **£6·75 + 50p** post and insurance.

**FREE** Amps ranges kit to enable you to read DC current from 0-10 amps, directly on the 0-10 scale. It's free if you purchase quickly but if you already own a mini-tester and would like one, send **£2·50.**

**SUPER HI-FI SPEAKER CABINETS.** Made for an expensive Hi-fi outfit—will suit any decor. Resonance free cut-outs for 8" woofer and 4" tweeter. The front material is carved Dacron, which is thick and does not need to be stuck in and the completed unit is most pleasing. Colour black. Supplied in pairs, price **£6·90** per pair (this is probably less than the original cost of one cabinet) carriage £3 the pair.

3 wave band radio with stereo amplifier. Made for incorporation in a high-class radiogram, this has a quality of output which can only be described as superb. It is truly hi-fi. The chassis size is approximately 14". Push buttons select long, medium, short and gram. Control are balance, volume, treble and bass. Mains power supply. The output is 6 + 6 watts. Brand new and in perfect working order, offered at less than value of stereo amp alone, namely **£6·90.** Post £2·00.

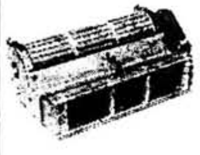


## MULLARD UNILEX

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 anyone. In easy-to-assemble modular form 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 **£16** including V.A.T. and postage.
FREE GIFT—Buy this month and you will receive a pair of **Goodman's** elliptical 8" × 5" speakers to match this amplifier.

**THIS MONTH'S SNIP** We all know how especially in the cold weather p.v.c. leads lose a lot of their flexibility, in fact some poor grade p.v.c. can be quite stiff and awkward and will not stay put. We recently purchased a quantity of an extra flexible twin cable. This is highly suitable for lead lamps, vacuum cleaners, in fact any portable device which does not need an earth. The regular price of this very flexible cable which is suitable for up to 7·5 amps is 30p per metre, and that is buying 1,000 metres at a time. However, this month you can buy 50 metres for **£6·35** or 250 metres for **£28·00.**

**WALL MOUNTING THERMOSTAT,** Danfoss, a handsome 2 tone this is intended for living rooms but is just as efficient in a greenhouse or store. It is suitable for normal air temperature range 32F-80F—price **£4·60.**



3 KW Mode
£6·95
+ £1.50 P & P

## TANGENTIAL HEATER UNIT

A most efficient and quiet running blower-heater by Solatron—standard replacement in many famous name heaters—comprises mains induction motor—long turbo fan—split heating element and thermostatic safety trip—simply connect to the mains for immediate heat—mount in a simple wooden or metal case or mount direct into base of say kitchen unit. Price **£5·95,** post £1·50. Control switch to give 2kw, 1kw, cold blow or off available 60p extra. 3kw model **£6·95.** Control Switch **95p.**

## 3-CHANNEL SOUND TO LIGHT KIT

Complete kit of parts for a three-channel sound to light unit controlling over 2,000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for Disco work.
The unit is housed in an attractive two-tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four-pin plug and socket facilitate ease of connecting lamps. Special snip price is **£13·50** in kit form or **£16·50** assembled and tested.

**TERMS:** Cash with order—but orders under **£10** must add **50p** to offset packing, etc.

BULK ENQUIRIES INVITED. PHONE: 0444-54563.

ACCESS & BARCLAYCARD WELCOMED.

# J. Bull [ELECTRICAL] Ltd.

**(DEPT. EE1)**

**34-36 AMERICA LANE,**

**HAYWARDS HEATH SUSSEX.**

**RH16 3QU**

## IT'S FREE

**Our monthly Advance Advertising Bargains List gives details of bargains arriving or just arrived—often bargains which sell out before our advertisement can appear—it's an interesting list and it's free—just send S.A.E. Below are a few of the Bargains still available from previous lines.**

**DUE TO THE HIGH & RISING PRICES OF FUEL** many companies and probably many householders are looking around for ways of saving some of this cost. One Company bought a number of fans from us and fitted these on the ceiling of their workshops where the hot air tends to collect and they blow this hot air downwards. Another Company has bought fans from us to suck the exhaust from their oil fired central heaters through a zig zag of asbestos pipes, the asbestos pipes being in a separate chamber which becomes a hot air chamber, the hot air from this is blown through ducting to where ever it is needed. Basically, they have cut out the normal chimney and replaced this with one of our high power extractor fans. If you have any other good ideas on heat cost saving, let us know and we will pass it on to other readers.

**PING PONG BALL BLOWER-UPPERS** Have you got to organise a Christmas Party or Charity Fund-Raising Event? Then one always popular way is to have ping pong balls going up and down and being caught. We have some powerful blowers and these should be ideal for this, and of course for more serious purposes. They are 4 stage blowers, coupled to synchronised AC mains motors of approximately ¼ h.p. They have a terrific suction as well as a high velocity blow. Ex computers, price **£26·00.**

**TWO MORE BLOWERS** Both 'snail' type, one very small and compact and suitable for cooling projectors or other equipment. Impeller size 2" × 1", coupled to mains voltage induction motor, outlet size approximately 1½" × 1¼". Price **£5·50** + 68p. The other is a larger **FLANGED BLOWER** for direct coupling to ducting, outlet size 3½" × 2½" + 1" flange, holed for easy fixing to trunking. Impeller size 5½" × 1¾". Powered by 1/12 h.p. mains motor. **£11·75.**

**RECHARGEABLE SOLID GEL BATTERY** 12v 5 AH new and unused made by or for Elpower Corporation of California. Dimensions, 6" long, 3¾" high and 2½" wide. Regular price of similar batteries, R.S. Components is **£26·00.** Limited quantity available at **£15·80.**

**DUAL DIGITAL TIMER** Short delay, left timer adjustable 0-2 secs, right timer 0-9·9 secs. Made by Techno Instruments Ltd., catalogue no. 010 18/1. We have very little information on these, but they are battery operated, to use you simply set the digital switches in the desired position, turning the rotary indicator to the chosen time. The lamp will light up when the right timer is in operation. Periodic or single action possible. This is a precision instrument 4¾" wide, 1½" high and 5¾" deep. We understand that these cost over £60·00 from the Makers, limited quantity only at **£23·00.**

**SOLID STATE VARIACS** By Lewis and Holtzman Ltd—their "Elvar", 230-240v AC in and out. 10 amp model is cylindrical approximately 3½" diameter 4½" deep. Price **£13·80.** 5 amp model, again cylindrical, 2¼" diameter, 4½" deep. Price **£9·20.**

**E.H.T. UNITS** One of our specialities has always been E.H.T. transformers, and we probably have bigger stocks than most of our contemporaries. It is surprising what uses these high voltages can be put to—killing flies and weeds, lighting central heating boilers, lifting paper, extracting dust, etc. etc. A new one this month is 14·5 KV. (dc) 0·5mA—made by ADVANCE ELECTRONICS—this unit is completely enclosed and has input and output sockets—size of the unit is approximately 6" × 3" × 3¾", price **£15·38** post £1.
To remind you of the E.H.T. Transformers we stock, here is a list:

| | | | |
|---|---|---|---|
| 3-4 KV | 3 mA | ex equipment | £2·90 |
| 5 KV | 5 mA | ex new equipment | £7·15 |
| 5 KV | 5 mA | with outer casing and E.H.T. outlets | £9·45 |
| 8·5 KV | 10 mA | totally enclosed with E.H.T. outlets | £13·50 |

**LEDS** are used increasingly and are now being recommended for nearly all indicators and for games and novelties. Due to a fortunate purchase, this month we are able to offer 10 red led's for **£1.** These are the small ones equivalent to the TIL 209. Bulk price **£60·00** per 1,000 + V.A.T.

**FIG. 8. FLEX** is always in demand, especially when doing the Christmas decorations. We are able to offer white Fig. 8 5 amp type on 50 metre roll for **£2·80,** ditto but dark grey with tracer lead, suitable for speaker extensions, 50 metres **£3·38.**

**500 WATT MERCURY VAPOUR LAMP** Mazda, ref. 90-5104 MAT/V blended. These give a really powerful light but, of course, have to be used with the correct control gear. We are expecting to get this control gear early in the New Year. Price of the lamp is **£3·38** + 38p. Post 50p.

**ANTI FROST THERMOSTAT** The normal refrigerator type thermostat, switches off as the temperature falls and so is not suitable for anti-frost devices. However, we have the *ice stat*—this switches on as the temperature falls and is set to switch on just above freezing point. It is a skeleton stat so would require boxing, but the price is modest at **£1·10.**

**THIN CONNECTING WIRE** 500 metre drums, 7 stranded copper core p.v.c. covered available in 10 different colours. Price **£7·15.**

**OCTOBER/NOVEMBER CONSTRUCTOR'S SNIP.** Here's a super bargain for you. 100 twist drills, regular tool shop price over £50, yours for only **£11·50.** With these you will be able to drill metal, wood, plastic etc from the tiniest holes in P.C.B. right up to about ½". Don't miss this snip—send your order today.

**SUPER BREAKDOWN PARCEL** with free gift of a desoldering pump, perhaps the most useful break-down parcel we have ever offered. Consists of 50 nearly all different computer panels on which you will find: over 300 ICs, over 300 diodes, over 200 transistors and many hundred other parts, resistors, condensors, multi turn pots, rectifiers, SCR etc. etc. for only £8·50, which when you deduct the value of the desoldering pump, works out to just a little over 4p per panel, + **£1·27** VAT + £2 post (it's a big parcel).

**TIME SWITCH BARGAIN** Large clear mains frequency controlled clock, which will always show you the correct time + start and stop switches with dials. Complete with knobs **£2·50.**

# Why the Sinclair ZX80 is Britain's best-selling

# Built: £99.95

Including VAT, post and packing, free course in computing, free mains adaptor.

# Kit: £79.95

Including VAT, post and packing, free course in computing.


This is the ZX80. A really powerful, full-facility computer, matching or surpassing other personal computers at several times the price. 'Personal Computer World' gave it 5 stars for 'excellent value'. Benchmark tests say it's faster than all previous personal computers.

Programmed in BASIC – the world's most popular language – the ZX80 is suitable for beginners and experts alike. And response from enthusiasts has been tremendous – over 20,000 ZX80s have been sold so far!

**Powerful ROM and BASIC interpreter**

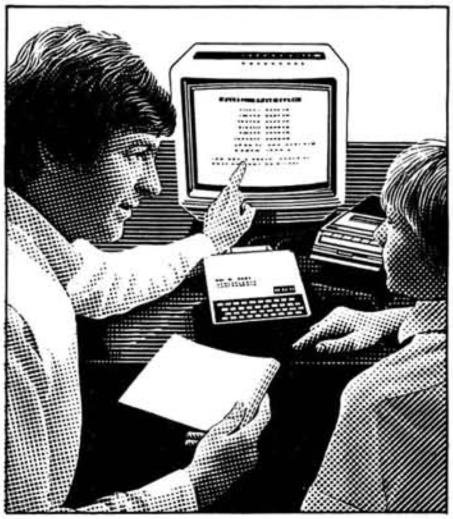
The 4K BASIC ROM offers remarkable programming advantages:

* Unique 'one-touch' key word entry: the ZX80 eliminates a great deal of tiresome typing. Key words (RUN, PRINT, LIST, etc.) have their own single-key entry.
* Unique syntax check. A cursor identifies errors immediately.
* Excellent string-handling capability – takes up to 26 string variables of any length. All strings can undergo all relational tests (e.g. comparison).
* Up to 26 single dimension arrays.
* FOR/NEXT loops nested up to 26.
* Variable names of any length.
* BASIC language also handles full Boolean arithmetic, condition expressions, etc.
* Randomise function, useful for games and secret codes, as well as more serious applications.
* Timer under program control.
* PEEK and POKE enable entry of machine code instructions.
* High-resolution graphics.
* Lines of unlimited length.

**Unique RAM**

The ZX80's 1K-BYTE RAM is the equivalent of up to 4K BYTES in a conventional computer – typically storing 100 lines of BASIC.

No other personal computer offers this unique combination of high capability and low price.



*The ZX80 as a family learning aid. Children of 10 years and upwards are quick to understand the principles of computing – and enjoy their personal computer.*

**The Sinclair teach-yourself BASIC manual**

If the specifications of the Sinclair ZX80 mean little to you – don't worry. They're all explained in the specially-written 128-page book (free with every ZX80). The book makes learning easy, exciting and enjoyable, and represents a complete course in BASIC programming – from first principles to complex programs.

**Kit or built – it's up to you**

In kit form, the ZX80 is pleasantly easy to assemble, using a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9V DC nominal unregulated. If not, see the coupon.

Both kit and built versions come complete with all necessary leads to connect to your TV (colour or black and white) and cassette recorder. Plug in and you're ready to go. (Built versions come with mains adaptor.)

# comment...

# When All Else Fails...

... READ THE INSTRUCTIONS! So goes a well-known saying, which is apparently not borne in mind by some of our readers. We often get letters and telephone calls posing questions about a project which are answered in the article itself, or else in an advertisement in the same issue of the magazine. When I am reading a book or magazine article, I always feel it a matter of pride to make every effort to find the answer to a query myself, without asking anyone else, but some constructors will put pen to paper quite unnecessarily.

One reader, not many months ago, was puzzled over something in a circuit diagram. When it was pointed out to him that the accompanying caption specifically referred to his problem, he admitted that he hadn't read the caption. Just last week, another reader telephoned to point out an error in the *PW* "Twynham" multimeter project, for which we were very grateful. But he then went on to complain that we hadn't given enough information in our December issue to enable him to build it, not realising that it was only the first part of the article, although this had been mentioned in no less than four places in that issue.

I would be the first to admit that we sometimes don't give all the information about a project that we should or might do, and in any case we always try to answer any queries which we receive. But, it may save you the cost of a letter plus return postage, **and** waiting for the answer to come back, if you read the *whole of the relevant* article carefully, just to make sure that the solution to your problem wasn't there all the time.

Having said all the above, we do like getting your letters nevertheless. We simply can't cope with technical queries by telephone, though, they just take up too much time that we should be devoting to preparing future issues of *PW*. And when writing, don't forget to include a stamped, self-addressed envelope, or for overseas readers, an International Reply Coupon.

Incidentally, though I quite understand how frustrating it can be, waiting for the remaining parts of an article to appear before a project can be completed, we can **not** give out information in advance of publication, no matter how pressing the need.

Geoff Arnold

# services

### QUERIES
While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the **Editor, "Practical Wireless", Westover House, West Quay Road, Poole, Dorset BH15 1JG,** giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the "Buying Guide" box included in each constructional article.

### PROJECT COST
The approximate cost quoted in each constructional article includes the box or case used for the prototype. For some projects the type of case may be critical; if so this will be mentioned in the Buying Guide.

### CONSTRUCTION RATING
Each constructional project will in future be given a rating, to guide readers as to its complexity:

**Beginner**
A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

**Intermediate**
A project likely to appeal to a wide range of constructors, and requiring only basic test equipment to complete any tests and adjustments. A fair degree of experience in building electronic or radio projects is assumed.

**Advanced**
A project likely to appeal to an experienced constructor, and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

### SUBSCRIPTIONS
Subscriptions are available to both home and overseas addresses at £11.80 per annum, from **"Practical Wireless" Subscription Department, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

### BACK NUMBERS AND BINDERS
Limited stocks of some recent issues of *PW* are available at 95p each, including post and packing to addresses at home and overseas.

Binders are available (Price £4.30 to UK addresses and overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

Send your orders to **Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.** All prices include VAT where appropriate.

Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

# NEWS NEWS NEWS

## Club News

A new amateur radio club has been formed, the Rolls-Royce R. A. C., Barnoldswick Division, with the callsign G3RR.

The club meets at the Rolls-Royce Sports and Social Club, Barnoldswick, on the first Wednesday of the month at 2000hrs, and a c.w. class is held every Monday evening, starting at 1915.

Visitors are very welcome and further details can be obtained from: *The Secretary, L. Logan, 19 Fenton Avenue, Barnoldswick, Colne, Lancs. BB8 6HB.*


**The RRRAC QSL card**

## State of the Art

In a design Centre exhibition, open from Wednesday, 7 January 1981 until Saturday, 7 March, the public will be able to see and try out microelectronic products for the home, and have a glimpse of things to come.

In the form of central heating programmers, electronic chess sets and other products, microelectronics are gradually moving into the home. They are to be found in modern versions of familiar household items such as alarm clocks, toys or burglar alarms, but it is the opportunities microelectronics offer in previously undeveloped product areas that will arouse the most interest. Some designers are already taking advantage of the way in which microelectronics has enabled the shape of the product to be related to the needs of the user rather than its mechanical function. Their imaginative ideas will be a main feature of the exhibition.

*The Design Council, 28 Haymarket, London SW1Y 4SU. Tel: 01-839 8000.*

## Technical Literature

Mullard Ltd. have produced two new publications which give details of practical hi-fi power amplifiers using Darlingtons.

The first publication, Ref. M80-0058, describes a 10/20W amplifier incorporating Darlingtons Type BDT80 and BDT61.

The second, Ref. M80-0057, deals with a 25/30W amplifier using BDT62 (p-n-p) and BDT63 (n-p-n) Darlingtons.

In addition to describing the circuits, both publications give advice on the preparation of suitable p.c.b.s.

Copies are available from: *Technical Publications Department, Mitcham New Road, Mitcham, Surrey CR4 4XY. Tel: 01-648 3471.*

## New Research Fellowship

Racal Electronics Ltd. has established a new Research Fellowship in Radio Communications at the University of Surrey, to promote the imaginative study of some aspects of radio communications systems. The Racal Fellowship is to be held in the University's Department of Electronic and Electrical Engineering, initially for a period of four years.

The first holder of the Fellowship is Mr A. K. Brown, a physics graduate of the University of East Anglia (1974), who joined Marconi Research Laboratories, Great Baddow, Essex, where he was particularly concerned in the design of the Post Office Goonhilly IV Earth Station. He then joined Standard Telecommunication Laboratories, Harlow, where he was involved in research and development on a variety of antenna systems.

During his tenure of the Fellowship, Mr Brown will continue to work on antennas. His personal interests lie in microstrip antenna arrays and adaptive systems and it is likely that his efforts will be concentrated in these areas.

His programme of work will be undertaken in association with related work on antennas, both at Racal Research Ltd. and at Racal-Decca Ltd. Mr Brown will also contribute his knowledge to the design of the microwave antennas for UOSAT, the small satellite for schools and radio amateurs which is now being built at the University and is scheduled for launch in September 1981.

*University of Surrey, Guildford, Surrey GU2 5XH. Tel: (0483) 71281.*

## BBC's 1000th Colour TV Transmitter

On Friday, 7 November 1980, the BBC's 1000th colour TV transmitter came into operation at Hedleyhope, in County Durham.

The Hedleyhope relay station has been built to provide television services for about 1000 residents of Waterhouses, Esh Winning and East Hedleyhope in the Deerness Valley.

In order to take advantage of the station, viewers will need to install suitable aerials. Group B aerials should be used, they should be mounted outside where there is a clear view of the relay station and should be fitted with their elements horizontal.

The channels used at Hedleyhope are: BBC1 (North-East) Ch. 40; BBC2 Ch. 46; ITV (Tyne Tees) Ch. 50. The BBC channels carry the Ceefax information service for viewers with teletext receivers.

*BBC Engineering Information Department, Broadcasting House, London W1A 1AA.*

**Inside the Hedleyhope relay station**

# NEWS NEWS NEWS

## Free Catalogues

Babani Books, the technical book publishers, inform me their latest catalogue is now available.

The 24-page catalogue lists nearly 90 separate titles which cover virtually every aspect of electronics.

To obtain your free copy of the catalogue apply to: *Bernard Babani (Publishing) Ltd., The Grampians, Shepherds Bush Road, London W6 7NF. Tel: 01-603 2581/7296.*

Visitors to the PETSHOW held at the Cafe Royal in June 1980 will have witnessed a large selection of British software and hardware developments for Commodore's PET microcomputer systems. All products exhibited were featuring as Commodore approved products and as part of Commodore's Endorsement Scheme. Complemented by several new additions, details on these Commodore Approved products are available from the 200 regional PET dealers. The new Approved Products Catalogue now contains over 50 such products from business software, business peripherals, educational programs, medical construction and building services, engineering software, mains power control, hardware and interfacing programmer's aids/utilities to literature, furniture and field maintenance service.

Copies are available, free, on application to: *Commodore Business Machines, Commodore Information Centre, 360 Euston Road, London N1. Tel: 01-388 5702.*

Verospeed, the Hampshire based electronic component distributors, have announced a massive increase in the number of stocked product lines in the new Autumn '80 edition of their catalogue.

Over 400 new product lines have been added to the existing range, including Resistors, Capacitors, Fuses and Fuse Holders, Batteries and Chargers, Voltage Selectors, High Quality DIP Sockets, Audio XLR Connectors, PC Rotary Switches, Test Leads, Multimeters, Electronic DPM's and Counters, Engineers' and Technicians' Tool Kits, Component Storage Cabinets, Modular Bezels, Panel Mounting DIN Enclosures, Extruded Aluminium Boxes, Battery Wire-Wrapping Tools, Power Supplies and many more.

The catalogue is free, and as always, is fully priced, with many of the existing product lines showing significant reductions.

*Verospeed Limited, Stansted Road, Boyatt Wood Industrial Estate, Eastleigh, Hampshire SO5 4ZY. Tel: (0703) 618525.*

## On The Move

Electronics Brokers have recently moved to new premises. The move became necessary following the company's rapid growth in the second-user market for test equipment, mini computers and peripherals, and the need to provide improved facilities for refurbishing and calibration.

The larger premises and special equipment installed, allow Electronic Brokers to carry greater and much more varied stocks. Also, specialised facilities in the new premises enable the company to offer thorough demonstration of all the equipment it sells. The new premises are at: *61/65 King's Cross Road, London WC1X 9LN. Tel: 01-278 3461.*

## New Catalogue

Marshall's latest 1980/81 catalogue is now available. The 60-page catalogue covers a number of important new product areas which include NiCad batteries and chargers and test equipment from the Leader company.

Priced at 60p, the catalogue is available free to bona fide companies ordering on their headed paper, or by mail order for 75p which includes p&p, from: *A. Marshall (London) Ltd., Kingsgate House, Kingsgate Place, London NW6 4TA. Tel: 01-624 8582.*

## Silver Jubilee for GB2SM

The Science Museum Radio Station, GB2SM, has been demonstrating the practice of radio communication to visitors for the past 25 years and during this time tens of thousands of contacts have been made throughout the world.

It has progressed from a simple table-top layout into a large purpose-built console which enables the visitor to see all that is happening. This was manufactured to the Museum's design by Imhof-Bedco Ltd. and allows flexibility in the use of equipment and its accessibility to the operator. During times of maximum activity it provides for three separate operating positions to be worked simultaneously, thus enabling more than one mode to be demonstrated.

The main position utilises a Collins KWM-2 and a 30L-1 with a 75S3-B and Racal 1772 receivers also available. An alternative position uses a KW 2000E integrated with an Eddystone EA12. VHF operation is covered by a Trio TS-700 and linear amplifier. Eight aerials, located on the roof of the Museum, provide for both local and long distance communication to be demonstrated.

Geoff Voller G3JUL, has been the staff operator of the station since it started in 1955 but assistance has been given by a number of volunteers, all experienced operators, and many being members of F.O.C. These people started as a contest team and were world leaders during the station's early days. Their operation is now mainly at weekends and their expertise is much appreciated, when besides providing a high standard of operating they are ambassadors of Amateur Radio, helping the visitor to understand the world of radio communication and encouraging people to enter the field of electronics.

The station can be viewed during normal Museum opening hours and demonstrations are at 1130 and 1600 Monday to Friday and 1500–1730 on Saturdays. Special demonstrations can be arranged for parties visiting the Museum if advance notice is given.

*Science Museum, South Kensington, London SW7 2DD. Tel: 01-589 3456.*

# The BASICS of TV DXing

Part 1 Roger BUNNEY

Last month we looked at the types of propagation which make long-distance reception of TV programmes at v.h.f. and u.h.f. possible. We complete this short series by talking about aerials and accessories and give information on aerial supplies and further reading.

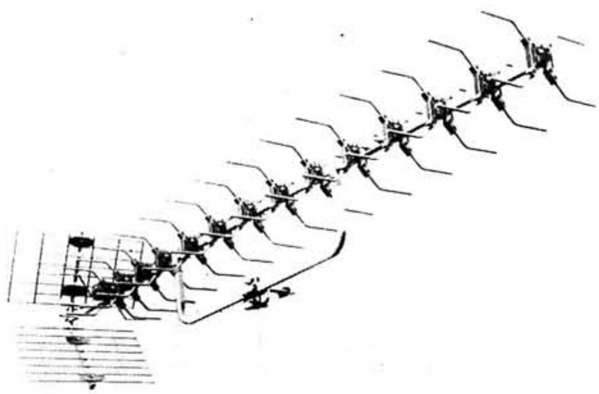
## Aerials

We have covered signal reception by both Tropospheric and Ionospheric modes, and general practice dictates a different philosophy for each type of reception. The Tropospheric signal at Band III and u.h.f. is weak, and a high-gain system will be required. Certainly the size of the array will relate to its gain, i.e., the bigger the power gain, the bigger the structure. I feel that the beginner in the hobby should confine "Tropo" reception to the u.h.f. spectrum, where a wealth of equipment is available. Since reception will be required over the whole u.h.f. band, a cost-effective system for the beginner will suggest wideband coverage with a single aerial array.

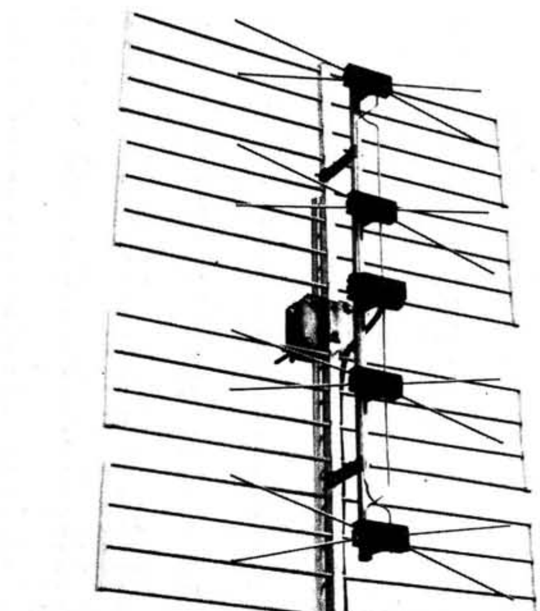
There are many wideband types, including the multiple-director format (the "X" type director) but inevitably such a Yagi system will have a rising gain throughout the spectrum, which in part compensates for increasing losses in cable and tuner performances with increase in frequency. Unfortunately such arrays can be expensive, but given a favourable location the array may provide an alternative ITV programme for domestic viewing. Another type of system that has a wideband characteristic is the stacked bowtie (much favoured in North America) which has a flat response throughout the band (at least within about 3dB). Whereas the Yagi is very directional, the bowtie tends to have a much broader forward acceptance lobe at −3dB points, which has both advantages and disadvantages. The bowtie system tends to be much cheaper.

Typical beamwidths at −3dB points for a multiple element Yagi would be 30°, whereas a stacked bowtie could be 50° or more (at the low frequency end in both cases). Power gain with a multiple wideband Yagi typically is around 11dB to 17dB (a rising gain response throughout the band peaking at around Ch. E60), whereas a bowtie will hover around the 12–14dB mark throughout the band. Cost for these systems again varies according to manufacturer and source. The Yagi can range from £29 to just under £50, whereas the bowtie tends to be lower, between £14 and £16.

Head amplifiers are invaluable at u.h.f. when long coaxial cable runs are encountered, although with the contin-



**A grouped u.h.f. multiple-director long Yagi, the JBX14 by Jaybeam. Wideband multiple-director arrays are produced by several UK manufacturers**



**An example of a wideband u.h.f. stacked bowtie array, the "Colour King" by Wolsey. The overall height is around 760mm**

# H. LEXTON LIMITED

**HARVEY G4JDT** *RADIO AND ELECTRONIC ENGINEERS* **DAVE G8SYG**

We are proud to announce that we are now stockists of **CUSHCRAFT** for the London area – also Sommerkamp/Yaesu, Standard, Swan/Cubic, Sony.
We are the main UK Service Contractors to Hitachi Sales UK Ltd and we have fully trained engineers on the premises.
We have been in the service industry for 15 years and we know what we are doing.
Here are some of the products available at the **EAST LONDON HAM STORE**:–

# THE STANDARD TWINS

## C7800 C8800
## £270 £250

**THIS MONTHS SPECIAL OFFER**
**TS802**
**ONLY £129**

## SOMMERKAMP

| | |
|---|---|
| FT767Dx HF | £525.00 |
| TS280FM 50W | £199.00 |
| TS280LP 10W | £169.00 |
| FRG7 | £189.00 |
| FT277ZD | £589.00 |
| FT480RE | £359.00 |

## YAESU

| | |
|---|---|
| FT227RB | £258.75 |
| FT207 | £196.00 |
| YM24 | £16.27 |
| N9C | £7.50 |
| FT101Z | £488.75 |
| FT101ZD | £569.00 |

## FULL RANGE OF FDK EQUIPMENT AVAILABLE

## SWAN

FDK750E

| | |
|---|---|
| 100MX (Including Mounting Bracket) | £418.00 |
| Astro 150 (Including Mounting Bracket) | £613.00 |
| 120BX | £798.00 |
| 103BX (Due in soon) | |
| PSU-5 (100MX) 13.8VDC 20 Amp. Reg | £135.00 |
| PSU-6 (102BX) | £142.00 |
| 1500Z | £406.00 |

FRG7

## CUSHCRAFT AMATEUR ANTENNAS

### H.F.

| | | |
|---|---|---|
| A3 | 20/15/10 3ele Beam 8dB gain | £147.00 |
| ATV5 | 80-10 Trapped Vertical | £74.40 |
| ATV3 | 20/15/10 Trapped Vertical | £34.00 |
| ATV4 | 40/20/15/10 Trapped Vertical | £68.00 |

### VHF (144 MHz)

| | | |
|---|---|---|
| A3219 | 19ele Long 'Boomer' Yagi 16.2dB gain | £62.00 |
| 214B | 14ele Jnr 'Boomer' Yagi 15.2dB gain | £49.50 |
| ARX2 | Ringo Ranger 6dB gain vertical | £24.75 |
| A144-4 | 4ele Yagi 9.0dB gain | £16.25 |

| | | |
|---|---|---|
| A144-7 | 7ele Yagi 10.0dB gain | £20.31 |
| A144-11 | 11ele Yagi 11.3dB gain | £25.72 |
| DX120 | 20ele Array 13.2dB gain | £47.20 |
| ARX2B | Ringo Ranger II | £28.75 |
| ARB2K | Conversion Kit for Ringo to Mk II version | £12.75 |
| CS100 | Communication Speakers | £11.50 |
| TAP3009 | 5/8 Side Mount and snap in 2MTR.- 144-174 MHz | T.B.A. |
| TAP677 | | £18.50 |
| K220 | Mag Mounts Base 17' Cable & PL259 | £8.67 |
| TAP/432 MHz | Snap in for K220 | TBA |

Full range of accessories, plugs, sockets etc. available. We also supply and fit in-car entertainment – Hitachi – Pioneer – Sharp – National Panasonic

Also available:– Video – Hi-Fi – T.V. – Music Centres, e.g. Hitachi SDT 300 auto-reverse music centre with pre-set FM, Dolby, strobe turntable, 25 + 25W per channel, including speakers only **£269.95** – These are either Sample or Demonstration units. Many other Hitachi Demonstration models available, Hi-Fi, Portable Stereo Radio Cassettes etc.

**Telephone 01-558 0854** **191 FRANCIS ROAD, LEYTON, LONDON E10** **Telex 8953609**

**Opening Times: 9-5.30 Mon.-Fri.**
**10.00–1.00 pm Sat.**
**or any time by appointment.**

BARCLAYCARD VISA

Buy it with Access

uing improvement of u.h.f. tuner front ends, unless a head amplifier with very low noise is used, it may be found that the noise figure of the tuner is better (i.e., lower) than the amplifier, and little improvement is noted. In a wideband aerial amplifier for u.h.f., one could expect a gain in excess of 20dB and a noise figure of under 4dB. In fact, the writer has recently noted advertisements in the technical press for a head amplifier for u.h.f. Group operation with a gain of 20dB and a noise figure of just 1·2dB. That is just about as low as one will get with the current state of the art—unfortunately the price of the latter unit is rather high!

In the event of the operator living within 15 miles of a high-powered local transmitter (u.h.f.), it may be found that a wideband amplifier will tend to overload the front end of the tuner, causing cross-modulation and "spread" of the local channels onto other channels that would normally be empty. In such cases the DXer is advised to make use of notch filtering prior to external amplification, and it may be found more practical to use ultra-low-loss coaxial cable feeder, site the amplifier indoors and insert filtering as and when necessary to reduce the impact of the "local" on immediately adjacent channels. One would obviously select an amplifier that can handle high-level signals since this type is less likely to increase the problem. Typical prices for low-noise, high-signal handling head amplifiers range from about £21 (also needing a power supply for "up the cable powering", which would be typically from about £11). Notch filters vary according to notch depth but simple types for in-line use cost around £6.

Band I DX will generally appear between 48–64MHz (video carriers) and as with u.h.f., a single wideband array will be efficient, cost-effective and avoid the drama of aerial changing when changing channel. Wideband Band I aerials can be purchased in a variety of types, ranging from a single dipole to a higher gain 4/5 element beam, or for the practical enthusiast they can be constructed. A single dipole for Band I using 12mm diameter elements will have a bandwidth of perhaps 4–5MHz, certainly insufficient to cover all of Band I. Wide-banding a Band I system is at best a compromise, but losses encountered with mismatch will be much lower than would occur at u.h.f. A wideband aerial therefore contains more than one element, the elements resonating at various parts of the design bandwidth and coupled into the main dipole to effect (hopefully!) a reasonable performance over Band I. In practice, however, results over many years confirm that acceptable wideband performances can be obtained on simple home-constructed arrays. An outline design for a simple array for wideband coverage of Band I is given in Fig. 4. It is suitable for use with 75Ω coaxial cable. I will not pursue use of head amplifiers on Band I since cable losses are minimal and inevitably some sort of filtering will be needed to reduce local interference sources.

Prices for commercial wideband Band I arrays range upwards from around £21 for a 3-element. Antiference manufacture a wideband u.h.f. system (for use in Band I and Band III) and intended for export. This has been used by enthusiasts with some success. The Band I section comprises 3 elements and the Band III section either 8 or 11 elements depending on the type purchased. The approximate cost for the smaller version (at the time of writing) is £41.25 including VAT and subject to production runs.

One aerial that has proved extremely popular for Band I work is the omni-directional system comprising two wideband dipoles (half-wave dipoles actually) mounted at right angles, the two dipoles combining with equal lengths of coaxial cable in a ferrite-cored wideband coupler such as the Labgear CM6011/OS. Such an array can give reception over 360° when mounted horizontally. Indeed,

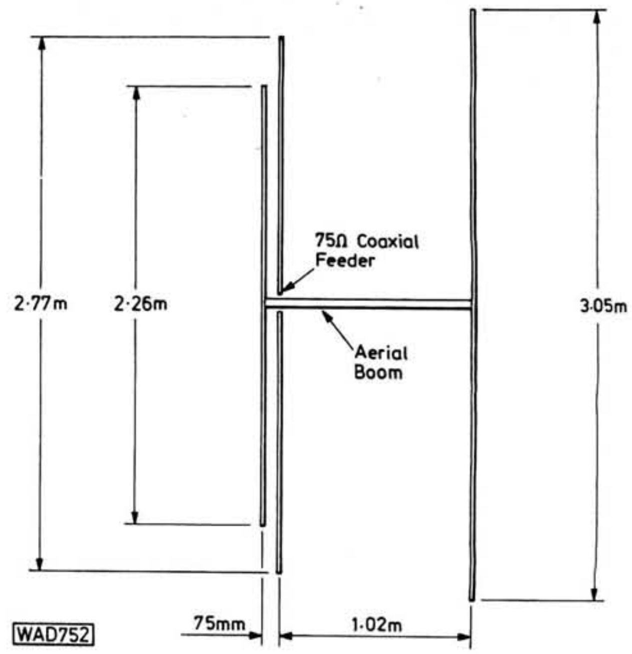
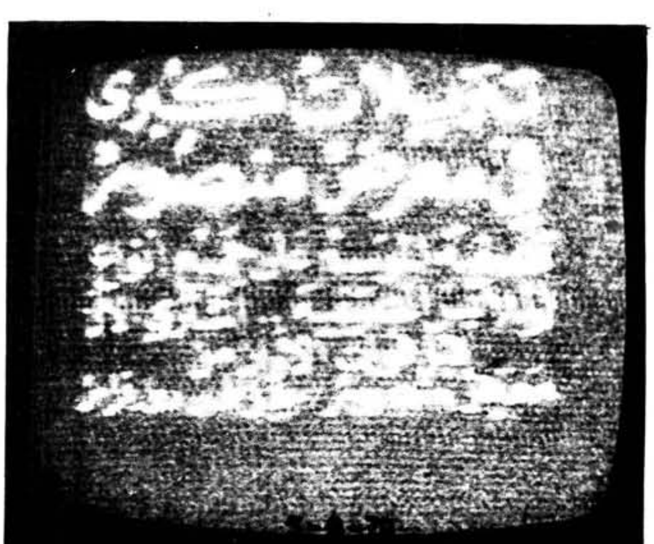


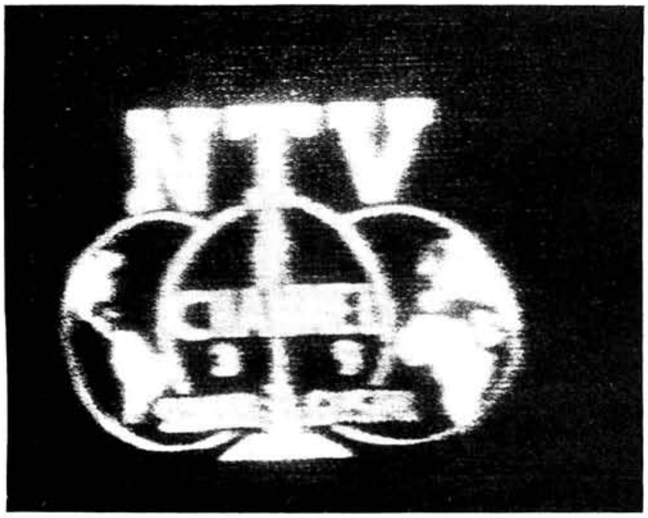

**Fig. 4: Directional wideband Band I array (48–64MHz) based on the patented Antiference "Trumatch" system. All elements 12mm o.d. and the boom 25mm o.d. hard-drawn seamless alloy tube**

all Band I and u.h.f. arrays should be mounted in the horizontal plane since most European countries use this polarisation, and with our vertical polarisation from BBC 405-line main stations a useful reduction in local Band I interference is obtained.

Depending upon the type of array in use (and certainly with the u.h.f. arrays) it will need to be rotated, either by a home-brew system or the more costly rotor system (usually from around £42). Since each house/flat is different, I will not detail any aerial supporting masts/structures, but perhaps give a few ideas. A cheap and sturdy mast is constructed from scaffold (alloy preferred), mounted on a 1·2m putlock hammered into the ground. A scaffold swivel clamp is used to hold the scaffold pole and lift it to the vertical, and then to secure it against the house,



**Double-hop Sporadic E from Amman, Jordan, Ch. E3 (55·25MHz) received by Ryn Muntjewerff. A department store bargain sale advertisement**



**A classic station identification. The Ch. E3 Nigerian TV transmitter at Jaradi/Sokoto, received by David Martin in north Dorset at over 3000 miles via multi-hop Sporadic E**

**Reception via F2 layer at 6000 miles by Ryn Muntjewerff in Holland. An eastern USSR station on Ch. R1**

etc. The eaves of a typical house can be nearly 9m high and with quite simple TV bracketry one can put aerials to over 11m with ease. Many enthusiasts use their Band I arrays inside the roof space with success, and this can give the added bonus of all-weather access for experiments and changes. The u.h.f. array should, when possible, be mounted outside to avoid the much higher losses encountered when inside the roof space.

## Amplifiers

The wideband aerial amplifier can give a useful increase in received signal in all bands. There are many types commercially available that fulfil the function of medium gain and low noise. Designs appear from time to time in our sister magazine *Television,* and indeed several appear in my own book. For use with an up-converter I would suggest that a low- to medium-gain v.h.f. amplifier is used, to avoid taking the up-converter stages into cross-modulation. In the July 1978 issue of *Television* was featured an interesting hybrid i.c. amplifier covering 30–900MHz with a flat gain of around 18dB and noise figure of 5dB maximum. The SGS amplifier Type SH221 can be recommended for DXTV use (I have two in service), and being ready assembled on a small chip one need only supply 24V d.c. to pin 4. Care must be taken with construction, and lead lengths minimised with the earth pins directly grounded. The data sheet can be obtained from SGS-ATES UK Ltd., Planar House, Walton Street, Aylesbury, Bucks—enclose an s.a.e. The SH221 can be obtained directly from Hawnt Electronics Ltd., Firswood Road, Birmingham B33 0TQ at £8.35 plus 25p handling and 15% VAT, a total of £9.89.

## Conclusion

It is hoped that his article has given the reader an insight into the setting up of a DXTV installation, and of the problems likely to be encountered and how to resolve them. No two installations are the same, and difficulties found in one will usually differ from another even when in the same town. It is obviously impossible to be truly detailed when writing an article aimed at a readership that can range from young schoolboys to doctors of science, since the subject is so technically complicated. Hopefully this article has succeeded in giving some enlightenment, that more DXTV enthusiasts will take up the banner and that those already established will look to technical improvements in their existing installation.

Several of the illustrations used in this series have previously appeared in *Television.* Our thanks to the Editor of that magazine for permission to reproduce them here. ●

**Further information can be obtained from:**

*Practical Aerial Manual, 2nd edition,* by Gordon King (Newnes-Butterworth).

*Long Distance Television Reception (DXTV) for the Enthusiast,* by Roger Bunney (Babani Publishing Ltd., Book No: BP52).

*Television* Magazine (IPC Magazines Ltd.), a monthly DXTV column.

**Suppliers of equipment:**

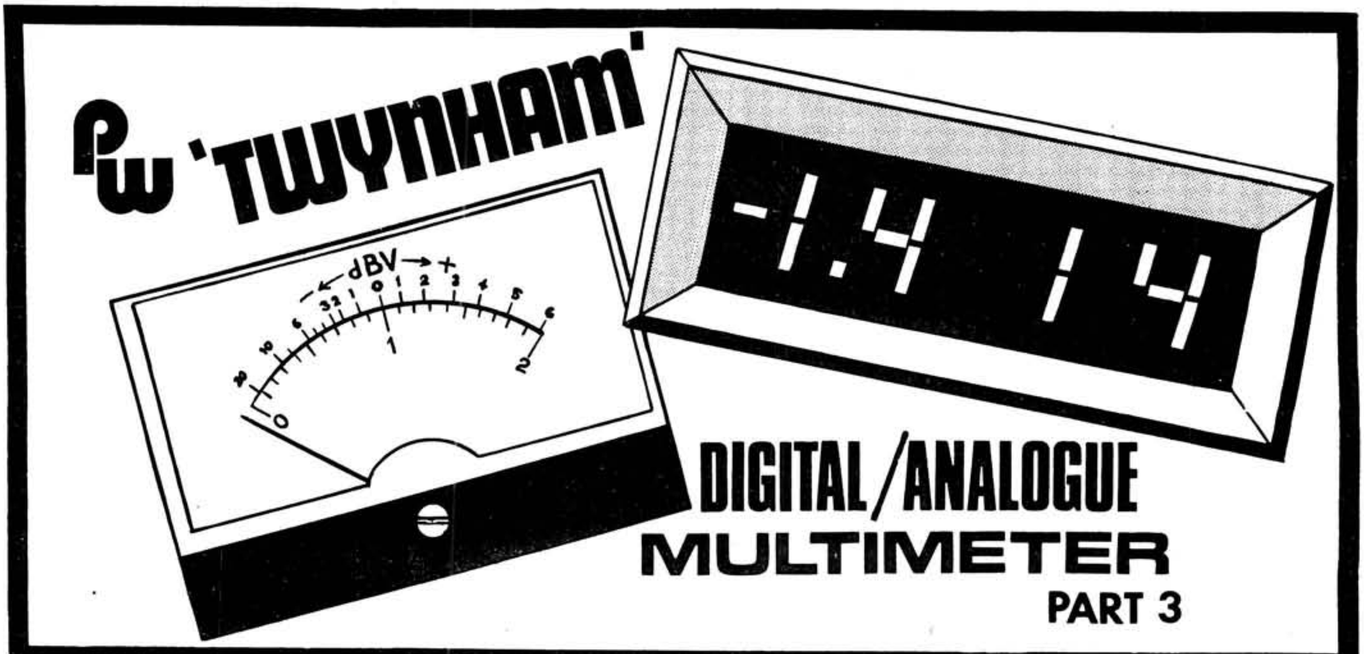
High Cocks Television Services, Bre Cottage, Cripps Corner, Staplecross, Robertsbridge, East Sussex TN32 5RY, can supply modified TV receivers, varicap tuner units, miscellaneous components and "one-off" DX accessories. S.a.e. with all enquiries.

South West Aerial Systems, 10 Old Boundary Road, Shaftesbury, North Dorset. Tel: 0747 4370. Suppliers of TV and f.m. receiving aerial equipment for local, fringe and DXing installations. Customer advisory service. Catalogue 25p or s.a.e. with enquiries.


"You are S9 + 30 here. Could I have your name and QTH as I didn't get them."

*... heard by G4BYV*

**Have you heard any (printable) comments, funny peculiar or funny ha-ha? If so, why not send them in to our Editorial offices at Poole. We will pay for every one published.**



# PW 'TWYNHAM' DIGITAL/ANALOGUE MULTIMETER PART 3

**Michael TOOLEY B A & David WHITFIELD M A M Sc**

The ultimate accuracy of the digital multimeter depends largely on the care taken during the calibration process. It is therefore important that the following steps are taken before relying upon any indications given by the instrument!

**1. Initial Calibration of the 7107 Reference Voltage:**
This is carried out by connecting an external meter (preferably another digital meter) between pin 36 of the 7107 and the 0V rail. R33 is then adjusted for a reading of exactly 1V d.c. at this point.

**2. DC Voltage Ranges:**
The 2V d.c. range should not need any calibration and no further adjustment is necessary on this range. The arrangement for calibrating the d.c. voltage ranges is shown in Fig. 22 and Table 1. R5 and R6 are adjusted in conjunction with an external meter, as shown.

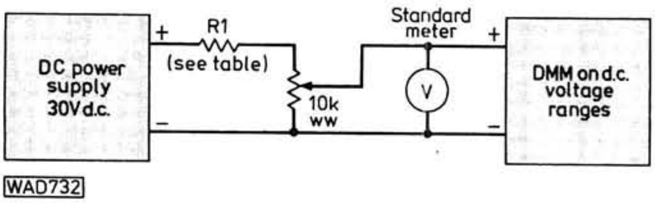



**Fig. 22: DC voltage range calibration**

**Table 1. Adjustments for calibration of d.c. voltages**

| DMM Range | 2V d.c. | 20V d.c. | 200V d.c. |
|---|---|---|---|
| $V_{cal}$ | 1V d.c. | 10V d.c. | 20V d.c. |
| R1 | 100kΩ | 10kΩ | Zero |
| Adjust | none | R5 | R6 |
| Desired Indication | *1.000* | *10.00* | *20.0* |

**3. AC Voltage Ranges:**
Provided that the precision rectifier is functioning correctly no calibration of the a.c. voltage ranges should be required. The arrangement shown in Fig. 23 and Table 2 will, however, provide a means of checking the instrument on the a.c. ranges. Note that any changes made to the settings of R5 and R6 will affect both the a.c. and d.c. range calibrations.

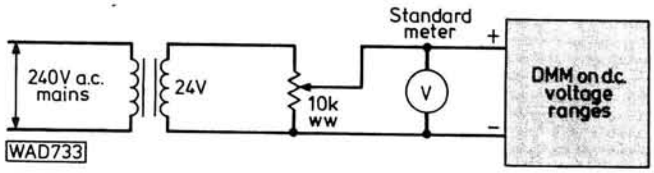



**Fig. 23: AC voltage range checks and calibration**

**Table 2. Adjustments for calibration of a.c. voltages**

| DMM Range | 2V a.c. | 20V a.c. | 200V a.c. |
|---|---|---|---|
| $V_{cal}$ | 1V a.c. | 10V a.c. | 20V a.c. |
| Adjust | none | R5 but see text | R6 but see text |
| Desired Indication | *1.000* | *10.00* | *20.0* |

**4. DC Current Ranges:**
Calibration of the direct current ranges may be carried out using the arrangement of Fig. 24 and Table 3. Before starting to calibrate the current ranges it is first necessary to short-circuit the input terminals of the multimeter and adjust R20 for zero indication on the most sensitive (20mA full-scale) range. This adjustment compensates for the offset current associated with IC1c.

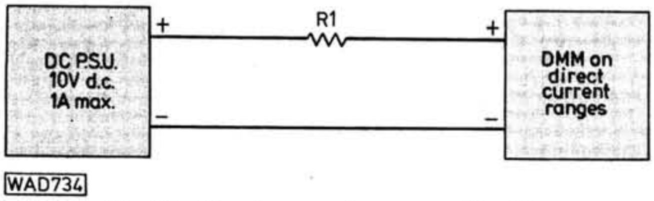


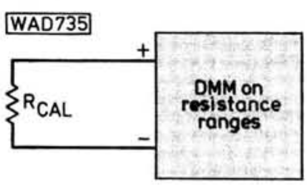

**Fig. 24: Direct current range calibration**

**Table 3. Adjustments for calibration of direct current ranges**

| DMM Range | 2A | 200mA | 20mA |
|---|---|---|---|
| $I_{cal}$ | 100mA | 100mA | 10mA |
| $R_1$ | 100Ω 5% 1W carbon | 100Ω 5% 1W carbon | 1kΩ 2% metal oxide |
| Adjust | none | R24 | R25 |
| Desired Indication | .100 | 100.0 | 10.00 |

**5. Resistance Ranges:**

The arrangement shown in Fig. 25 and Table 4 should be used. Before attempting to calibrate the instrument on the ohms ranges it is wise to set R9, R10 and R11 to mid-position, this avoids excessive currents in Tr2 which would occur if the variable resistors were left at the extreme short-circuit setting.




(No standard meter is required)

**Fig. 25: Resistance range calibration**

**Table 4. Adjustments for calibration of resistance ranges**

| DMM Range | 2kΩ | 20kΩ | 200kΩ |
|---|---|---|---|
| $R_{cal}$ ($\frac{1}{2}$W 2%) | 1kΩ | 10kΩ | 100kΩ |
| Adjust | R9 | R10 | R11 |
| Desired Indication | 1.000 | 10.00 | 100.0 |

**6. Junction Test Facility**

This can be checked by connecting known silicon and germanium diodes to the meter in the manner shown in Fig. 26. Typical indications of forward voltage ( in volts) will be given on the 2kΩ resistance range. On this range the junction is tested at a current of 0·1mA. When the 20kΩ and 200kΩ ranges are selected the test currents are 100µA and 10µA respectively. The forward voltage will then appear in mV but the position of the decimal point should be ignored.

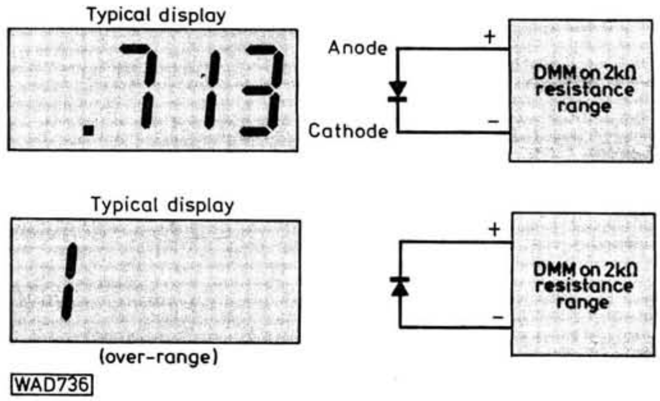
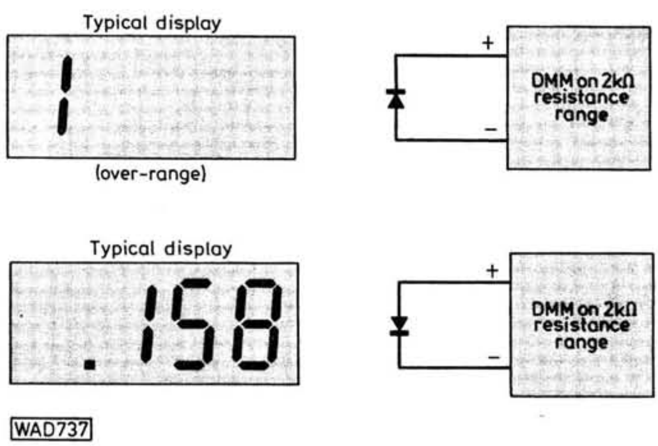



**Fig. 26(a): Checks for junction test facility using a silicon diode ▲**

**Fig. 26(b): Checks for junction test facility using a germanium diode ▼**




# Operational Notes

As with any piece of test gear the digital multimeter will need plenty of familiarisation before the user can extract the maximum benefit from it. One particular pitfall for the newcomer is that of relying on the last digit or two rather than using the full 3½ digits to obtain maximum accuracy and resolution. The range switching should always be used where possible to provide a display of at least three digits.

With the exceptionally high values of input impedance associated with the 7107 and j.f.e.t. operational amplifiers of the LF347 care must be taken not to operate the digital multimeter in stray fields created by other mains-operated equipment in the vicinity.

For maximum hum and noise reduction it is recommended that the metal body of the shafting assembly be connected to the 0V rail. In some cases it may also be necessary to earth the core of the mains transformer.

Where the meter is used extensively to measure quantities which are referenced to earth it is recommended that the 0V rail be linked to the mains supply earth (Fig. 13). This again reduces hum and noise pick-up. If, however, the meter is required to be fully "floating", this link should not be connected.

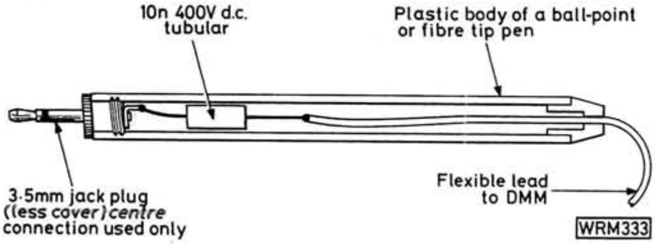
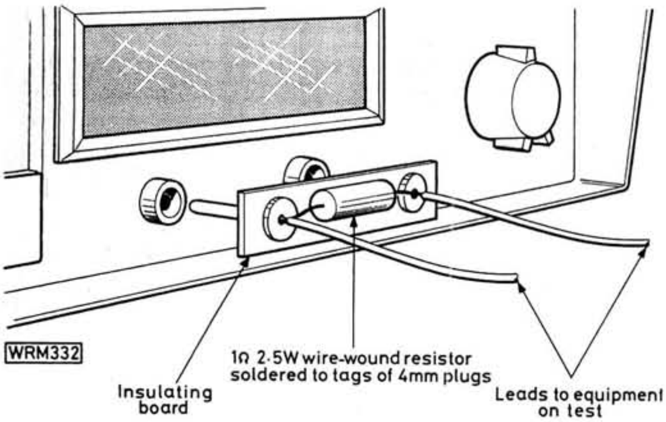



**Fig. 27: Construction of the a.c. voltage probe ▲**

**Fig. 28: Construction of the plug-in a.c. current shunt ▼**




Where the instrument is used to measure alternating voltages in the presence of a d.c. level, a capacitor of 10nF 400V d.c. working should be connected in the live "+" signal lead. Details of a suitable a.c. probe are given in Fig. 27. This may readily be constructed using the body of a discarded pen and a 3·5mm jack plug. For measurements of alternating currents the instrument should be used on the 2V a.c. range in conjunction with a suitable shunt as shown in Fig. 28. If a 1Ω 2·5W resistor is used the 2V a.c. range will read 2A full-scale. If, alternatively, a 10Ω 1W resistor is used the indication will be 200mA full-scale.

Transistor junctions may be tested as shown in Figs. 29(a) and 29(b). In both cases the meter should be switched to the 2kΩ resistance range and the input leads are alternately reversed to forward and reverse bias each junction. Unmarked transistors may thus be checked and identified as "good" germanium or silicon types. Note that this does not provide any measure of the current gain!

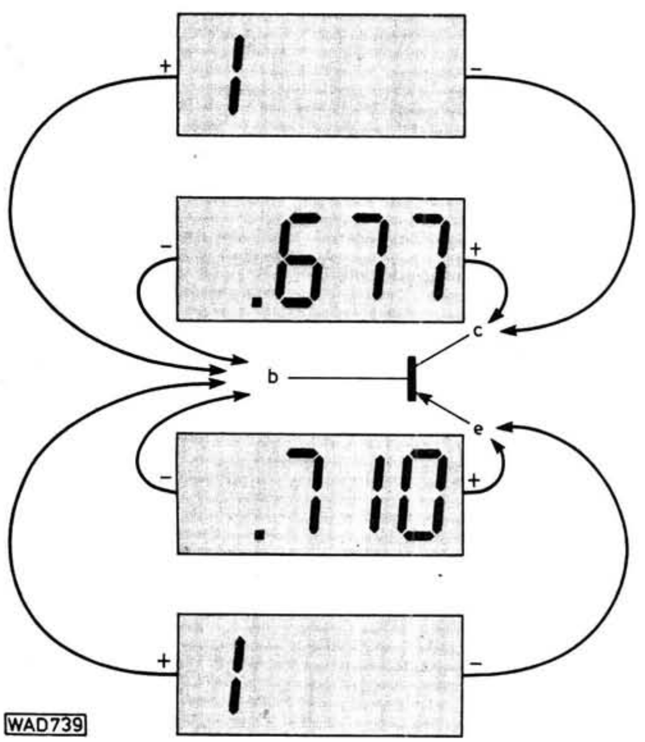



**Fig. 29(a): Testing *npn* transistors**

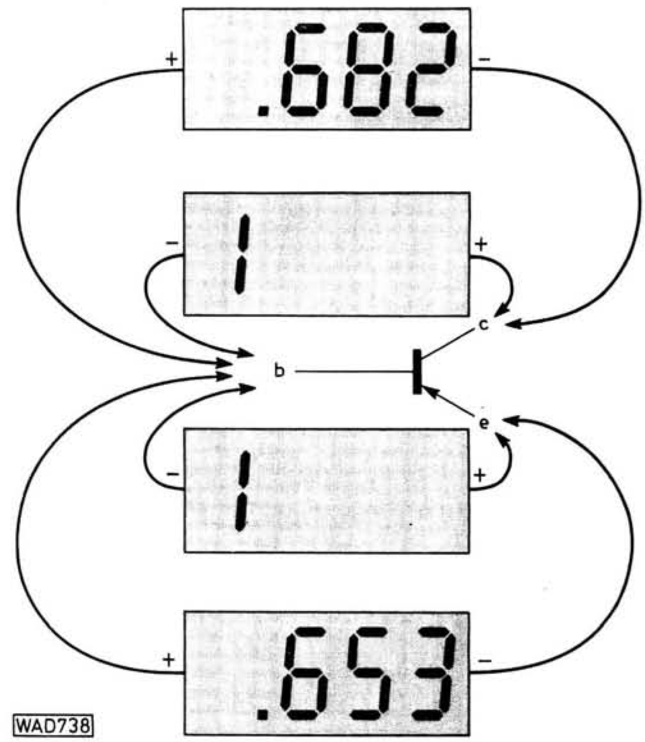



**Fig. 29(b): Testing *pnp* transistors**

The brilliance of the l.e.d. display may, if desired, be varied using the circuit of Fig. 30. This gives a range of control from "dim" to "very bright" and can be useful where the instrument is used under a wide range of lighting conditions. In either case the use of a display bezel and filter (RS Components 586–790) is highly recommended.

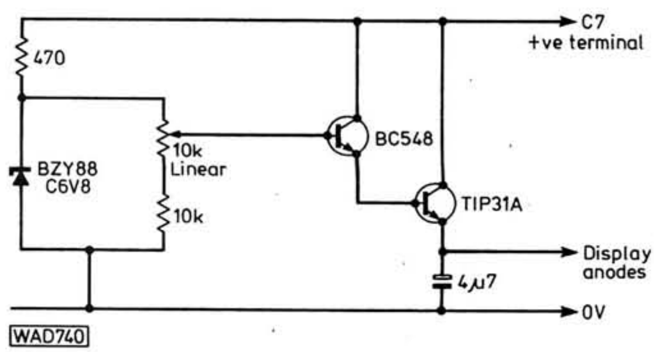



**Fig. 30: Circuit for varying the display brightness**

This completes the *PW* Twynham digital multimeter with analogue readout. You should find this a very useful instrument to have around the shack or workshop. ●

# IC of the month

Brian DANCE M Sc

## The Fairchild μA714 Precision Op. Amp.

The Fairchild μA714 has been designed for precise, low-level signal applications. It offers low-noise, low-drift and accurate closed-loop gain which make it particularly suited for certain of the more exacting instrumentation applications, such as bio-medical instruments, precision measuring and data conversion applications.

## Package

The device is housed in a T099 circular, 8 lead, metal package with the connections as shown in Fig. 1. The absolute maximum permissible operating voltage is ±18V for the L version, and ±22V for the μA714, μA714E and μA714C, but it is wise to set an upper limit of a few volts less than these maximum values to allow for tolerances, and drift in supply voltages.

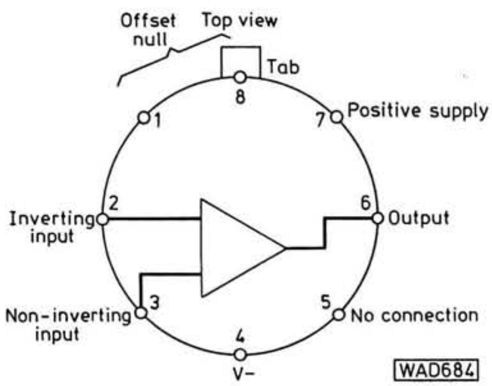



**Fig. 1: Connections to the μA714 circular metal package**

A particular feature of the μA714 is its low input offset voltage which has a maximum value of 250μV in the case of the μA714L and 75μV in the case of the μA714 with typical values of 30μV. These compare with a maximum input offset voltage of up to 6mV in a 741 op. amp.

A variable resistor is used in many operational amplifier circuits to null the input offset voltage; the potentiometer being adjusted so that the output voltage of the operational amplifier is zero when the same voltage is present at the non-inverting (+) and inverting (−) inputs. Unfortunately this external nulling technique has a number of disadvantages, including extra component cost and space for the variable resistor, the resulting degradation of the offset characteristics with temperature changes and the requirements for setting up time and setting up equipment. Other nulling techniques such as signal chopping and an internally heated input stage also have their own disadvantages.

In the μA714 the input offset voltage is greatly reduced by a technique known as "Zener zapping" so that a nulling circuit is often not required, but when external nulling is used, only a very small adjustment is needed. Zener zapping is used only during the manufacture of the operational amplifier. The device offset voltage is measured by the production equipment which is programmed to send a large current through certain internal Zener diodes so that their electrodes are melted together; the device then has a much lower input offset voltage. Only selected Zeners are fused in each particular μA714 to achieve optimum performance in that particular device.

## Low Input Current

Another special feature of the μA714 is its low input bias current (maximum ±30nA for the μA714L, typically 1nA for the μA714). This input current is roughly thirty times lower than the 741 (maximum 500nA). The μA714 does not have such a small input current as the types with f.e.t. input devices, such as the μAF771 series with a maximum of 100pA input current, but f.e.t. input devices do not have such small input voltage offset values and the bias current doubles for each 10°C rise.

Various other parameters such as the large signal voltage gain, the input resistance and the common mode rejection ratio are well up on the same parameters of the 741 device, as is the noise performance which is not even specified for the 741. The μA714 is not a fast device and its slew rate is even less than that of the 741.

A number of applications for the μA714 have been described by Jeff Thompson in Fairchild application note 348 dated 1979. Most of these applications are of the instrumentation type where the features of the μA714 are put to good use.

## Thermocouple Amplifier

The circuit of Fig. 2 shows the use of the μA714 to compare the potentials from the two thermocouple junctions V1 (which is at the temperature to be measured) and V2 (which is at a reference temperature). This type of application is a very demanding one for an operational amplifier, since the small differential voltage between the two junctions has to be measured in the presence of large common mode voltages present at both inputs. It is therefore important that the amplifier used should have excellent common mode rejection of such signals. In addition, the change of input offset voltage with temperature must be very small and the offset must be stable over a long time period.

In order to obtain optimum common mode rejection in the Fig. 2 circuit, the ratio of R1/R2 should be matched to that of R3/R4, preferably to 0·01 per cent. If the value of R1 and R3 is of the order of 1kΩ, this will decrease the voltage drops due to input bias currents.

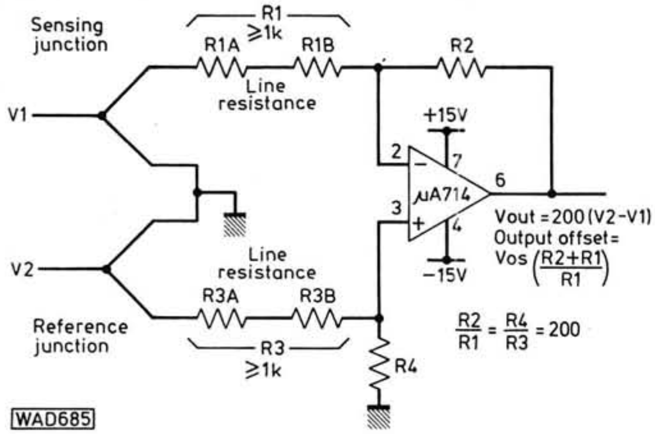



**Fig. 2: A high stability thermocouple amplifier**

## Two Stage Amplifier

The circuit of Fig. 3 employs a μA714 in the input stage for a very small input offset voltage together with a μAF771 output stage. The use of this output device enables a slew rate of 13V/μs to be obtained as opposed to the 0·17V/μs of the μA714 device alone. This means that the output voltage can change more rapidly and hence larger output voltage swings can be handled at higher frequencies than with a μA714 alone. This two-stage approach is less expensive than the use of an amplifier device which has both a good input voltage offset performance and a high slew rate.

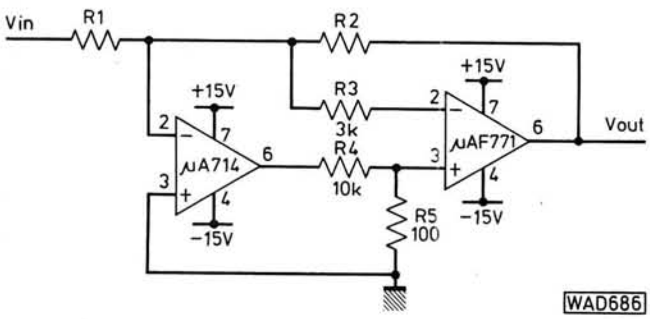



**Fig. 3: A two-stage amplifier with high slew rate and low input offset voltage**

The low input bias current of the μAF771 allows the value of R2 to be as high as 5kΩ, but the use of higher values of R2 will start to produce appreciable errors in the output voltage. The junction of R2 and R3 is forced to a potential equal to the offset of the μAF771. The gain is set by the ratio R2/R1.

## DC Power Amplifier

The use of a μA714 in the input circuit of Fig. 4 and a μA759 power operational amplifier in the output circuit enables the low input offset voltage of the μA714 to be combined with the high output current of the μA759 which is at least 352mA. The input signal is connected to the non-inverting input of the μA714 and the output of the latter is connected to the non-inverting input of the μA759 so that a positive going input voltage produces a positive going output voltage.

The resistor R4 provides negative feedback over the second stage and the resistor R5 over the whole of the two stages. The gain of the whole circuit is set by the ratio of R5/R2. Thus the values shown produce a gain of 100kΩ ÷ 1kΩ = 100, but R5 could, for example, be doubled to double the gain.

The output voltage of this circuit can swing to ±10V d.c. into a 100Ω load for an output current of 100mA. A suitable heatsink should be fitted to the μA759 power operational amplifier. The offset referred to the input is less than 100μV, so with an overall gain of 100, the output d.c. shift is less than 10mV.

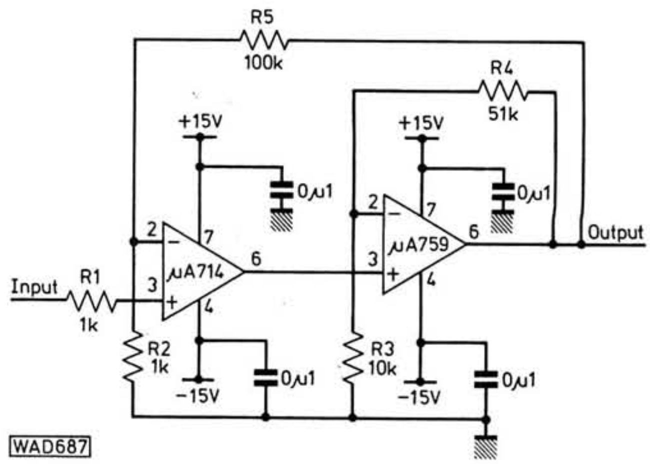



**Fig. 4: A d.c. power amplifier using two stages**

## Voltage Follower

The circuit of Fig. 5 is a buffer stage for large signals with a gain of unity which can be used as an interface between two stages which could be connected directly together because of impedance matching problems.

The low offset voltage of the μA714 combined with its high common mode rejection ratio ensures that the output voltage is kept accurately at the same value as the input voltage—hence the name "voltage follower" for this type of circuit, since the output voltage "follows" that of the input.

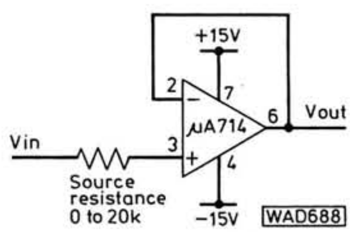



**Fig. 5: A large-signal voltage follower**

## Conclusion

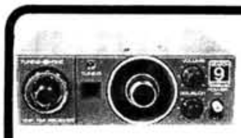
The μA714 device is suitable for many of those applications where one requires a device with a performance that is significantly better than that offered by products such as the 741. The μA714 is one of the quietest of the current range of operational amplifiers. ●

# WATERS & STANTON ELECTRONICS

18/20 MAIN ROAD, HOCKLEY, ESSEX. TEL (0702) 206835

**4,000 SQ FT DEVOTED TO RADIO COMMUNICATION**

"SUCH NICE PEOPLE"

**SR9 VHF RECEIVER AMATEUR/ MARINE**

**£46 inc. VAT**

The SR9 must be one of the most popular monitors for 2 metre amateur radio enthusiasts. (Also available as a marine version at the same price). It is fully tuneable across the band with the option of also installing up to 11 xtal controlled channels. Power requirements are 12v DC negative earth at 200ma approx. The unit comes complete with mobile mounting kit and built-in speaker.

**PROFESSIONAL AIRCRAFT MONITOR**

**R517 £49.50**

(as supplied to pilots, ground crew etc.)

The R517 is a professional aircraft monitor receiver, having superb sensitivity and capable of tuning across the entire aircraft band 118-143mHz. For easy tuning there is both a coarse and fine tuning control. In addition there is a 3 position switch for selecting xtal controlled channels (xtals £3.00 extra) for your local airport. The unit is completely portable running off self-contained batteries.

**AR22 VHF FM MONITOR**

**OUR PRICE £83 inc. VAT**

Truly amazing! The AR22 tunes across the 2 metre FM band 142-148mHz (also includes Police and Fire Brigade) in 5kHz steps. So small it will fit into a shirt pocket and yet nothing is sacrificed in terms of performance. Price includes rechargeable batteries, mains charger, fly serial etc. You won't find a smaller monitor anywhere.

**TRIO R1000**

**COMMUNICATIONS RECEIVER**

**OUR PRICE £285 (Free Securicor Delivery)**

The R1000 has really caused a stir in the receiver market! Its performance matches professional receivers costing many times more and with our new competitive price of £285 it must be the best value on the market today. Full digital readout from 200kHz (actually it operates right down to 20kHz but with reduced sensitivity) means accurate tuning and the 30 position band selector switch means really good bandspread for easy operation. Other features include noise blanker (a really good one!) built-in speaker, digital clock/timer and both 230v AC/12v DC operation. (Yes we include the 12v DC kit free!) Each model is fully checked and delivered anywhere in the U.K. within 24 hours of receipt of payment!

**YAESU COMMUNICATIONS RECEIVER**

**FRG7700 £309**

**FRG7700MEM £380**

**PLUS FREE GLOBAL 3-30mHz Aerial**

**Free Securicor Delivery**

The FR7700 is a new model from Yaesu that replaces the FRG7000. Full coverage is provided between 200kHz and 30mHz with bright digital readout that also doubles as a clock. Features include noise blanker, FM detector, internal speaker, 230 volt AC operation and built-in timer. As an optional extra there is also a memory unit which enables up to 12 selected frequencies to be stored and selected.

**PS134 4 AMP 13·8v POWER SUPPLY. STABILISED & SHORT CIRCUIT PROOF**

**£23 plus £1.50 p&p**

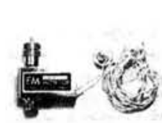
This is the power supply that we've been advertising and selling for several months. It really is a robust little unit with a transformer 50% larger than its competitors. Some cheap power supplies get hot, hum and even go bang! This one stays silent and keeps on working. It is fully protectd against short circuit and overload and is capable of delivering 4 amps continually at 13.8v DC. Ideal for transceivers.

**SWR/POWER/FIELD STRENGTH MEASURING METER SPECIAL OFFER**

**£11.50 +50p p&p**

As used by CB and Amateur radio operators.

The YW3 is used by amateur radio and CB operators around the World. It's offered to you at a really low price because we import them direct from Japan. It tells you the VSWR, power output and field strength and covers 3.5 to 150mHz. If you want the strongest signal in town – you'll find the YW3 the sure answer.



**FM TX MONITOR**

**NOW YOU CAN MONITOR YOUR OWN TRANSMISSIONS**

(15 watts max.)

**£12.95**

Now at last you can actually hear your own FM transmissions in 2 metres. Simply plug this unit into your transmitter aerial lead in order to hear your own transmitted audio. At this price there really is no excuse for not having one.

**M161 FM SCANNER AMATEUR OR MARINE MODEL**

**£59 inc. VAT**

This highly compact monitor can be supplied either for the 2 metre amateur band or the marine band. It has the capability of scanning up to 16 channels and hunting out and locking on to any signal that appears. Ideal for mobile or base operation an external 12v DC supply is required but unit has built-in speaker, mobile mounting brackets, etc. The receiver comes with the national calling channel. Additional crystals for channels are £3 each.

**GLOBAL SHORT WAVE AERIALS**

The new Global short wave aerials mean better reception for short wave listeners. These fully comprehensive kits provide all the materials you need to erect a really efficient, long lasting aerial. All wire is special light weight alloy and all fittings are non-corrosive.

INVERTED 'L' This covers 3-30mHz and requires a garden length of 30ft.

**£9.95**

BROAD BAND DIPOLE This covers a 3-30mHz and requires a garden length of 65ft. Also included in 50ft. of special low loss coax cable.

**£29.00**

For further details send S.A.E.

**SX2000 MONITOR 26-500MHz**

**£240 inc. VAT**

Here's a really wide coverage receiver going all the way from 26mHz to 500mHz (with just a few gaps). Mains or battery operation, FM or AM, means it can be used just about anywhere for anything. Channel memory, scanning and built-in clock are just a few of its features. If you're interested in amateur radio, aircraft, Police, taxis, etc., then this receiver covers them all.

**STOP PRESS:– SEND 14p STAMP FOR NEW 1981 CATALOGUE ON RADIO COMMUNICATIONS**

**MAIL ORDER SLIP** to: Waters & Stanton Electronics, Warren House, Main Road, Hockley, Essex.

Name .................................................. Good required ..................................................

Address ..................................................  ..................................................

..................................................  ..................................................

..................................................  ..................................................

Please rush me the above. Cheque enclosed for £............/Please charge to credit card No ..............................

# ACCENTED METRONOME

R.A.PENFOLD


The majority of metronome projects that appear in the amateur electronics magazines are designed to simulate an ordinary mechanical metronome (or Maelzel's metronome as it is sometimes called after its originator). There is a type of mechanical metronome that can be set to ring a bell on every second, third or fourth beat, and this design is really just an electronic equivalent of such an instrument. Apart from the normal characteristic regular clicking sound, the accentuation takes the form of a distinct lowering in the pitch of the output signal. A beat of about 40 to 270 beats per minute is covered in a single continuously variable range.

## Operation

Before going on to consider the operation in detail it may be helpful to consider the basic way in which the device functions.

A NE555V astable is adjusted to oscillate at the desired beat rate, and this functions as a clock oscillator. The output of the clock generator is used to trigger a monostable multivibrator, which is formed from one of the two monostables contained in a c.m.o.s. 4098 device. This circuit will produce a short output pulse each time it receives a positive going input signal, and this pulse is used to drive a loudspeaker via a simple single-transistor output stage. In this way the basic metronome sound is generated.

The output from the clock oscillator is also used to drive a c.m.o.s. digital divider circuit. When the function switch S1 is in position 1, the clock enable terminal of the divider is taken to the positive supply rail voltage by resistor R9. This terminal must be taken low (logic 0 or the 0V rail) in order to connect the clock signal through to the divider circuitry. The metronome therefore acts as an ordinary non-accented type with switch S1b in position 1.

In the other three positions of S1b, the clock enable terminal is connected to the 0V supply rail and the divider circuit is able to operate. The divider used is a 4022 divide-by-eight device, but this is also a one-of-eight decoder, and it is this mode that is used in the device.

For those who are unfamiliar with one-of-eight decoders, these are devices which have eight outputs, usually designated 0 to 7. Before the circuit starts to count, or when it is reset, the 0 output is high and the other seven outputs are low. On the rising edge of the first clock input cycle the 0 output goes low and the 1 output goes high. On the next clock cycle the 1 output goes low and the 2 output goes high. On subsequent clock cycles outputs 3 to 7 go high in sequence, and then the circuit resets itself and starts once again from the beginning.

In this case the 1 output is connected to the input of a second positive-edge monostable circuit which is formed by the other section of the 4098 device. This produces an output pulse which is about five times longer than that generated by the first monostable, and it is used to drive the output stage and loudspeaker.

If the 4022 was left to function normally, on every eighth clock cycle the 1 output would go high and trigger the second monostable. This would result in a longer output pulse from the speaker.

The extended output pulse would contain lower frequency components than the normal pulse produced, and this would give a noticeably lower pitch. Its longer length would also tend to make its sound somewhat louder than the normal output pulses. This would give the required accentuation, but only on one pulse in eight. In order to obtain the accentuation on every second, third and fourth beat it is necessary to make the 4022 reset itself at the required time. This is accomplished by connecting the reset terminal to outputs 2, 3 and 4 respectively, using S1 to select the appropriate output for the desired division rate.

**CONSTRUCTION RATING** **Beginner**

**BUYING GUIDE**

Constructors should have little difficulty obtaining the components for the Accented Metronome. The box used in the prototype was the Verocase Type 75-141 1D 205 × 140 × 75mm.

**APPROXIMATE COST** **£16**

Fig. 1: Full size p.c.b. copper track pattern of the Accented Metronome

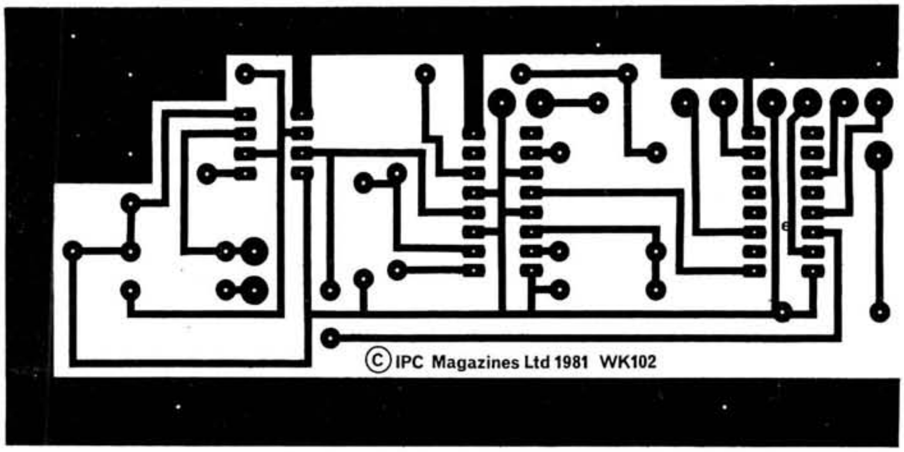



Fig. 2: Component placement layout

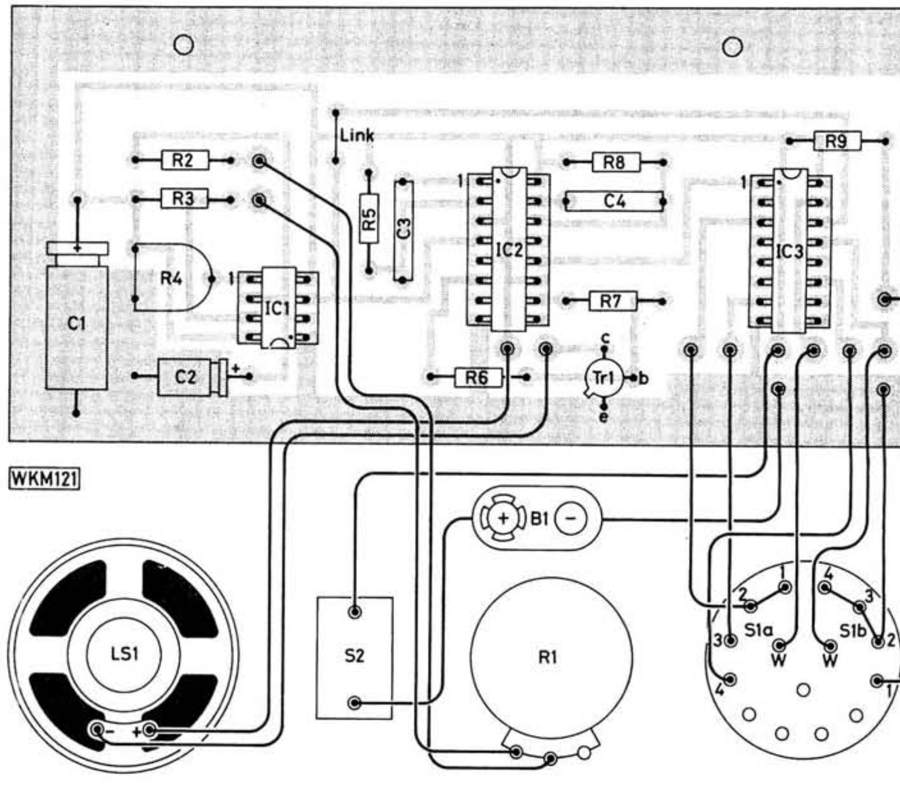
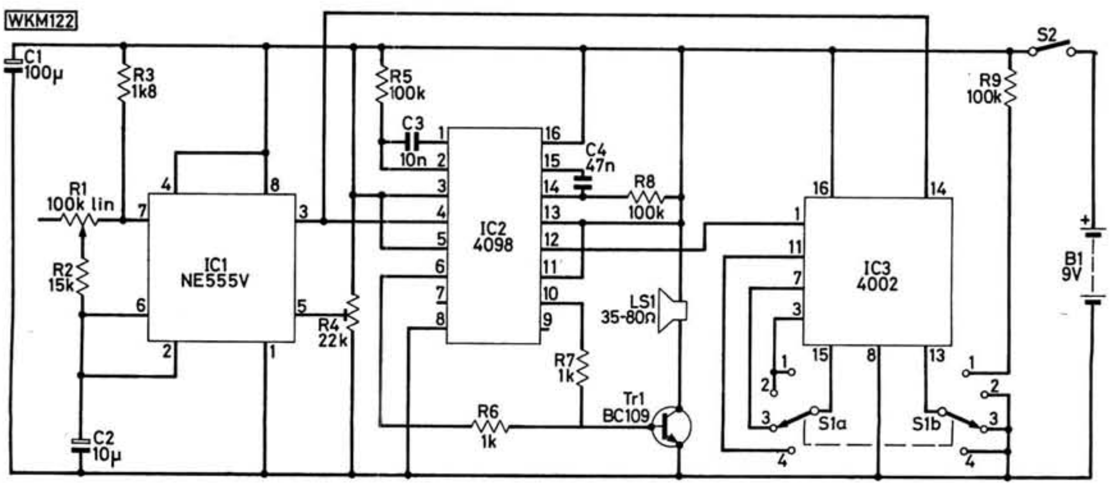



Fig. 3: Complete circuit diagram of the metronome ▼



Thus in position 3, for example, outputs 0, 1 and 2 will each go high for one clock cycle, then at the beginning of the next clock cycle output 3 goes high and resets the counter back to zero. The circuit continuously cycles in this manner with output 1 going high on every third clock cycle, and with every third beat emphasised in consequence. The beat rate of the clock generator, IC1, can be varied by adjusting R1. One problem with this type of circuit is that it is necessary to use an electrolytic capacitor (C2) in the timing network due to the fairly low frequencies involved. With the wide tolerance range of electrolytics (even before allowances are made for other timing components) there is a strong likelihood of more than the required frequency range being covered. This is overcome by including R4 in the circuit. It shunts an internal potential divider circuit of IC1 which determines the threshold voltage at which C2 begins to be discharged. By raising this voltage, the range of output frequencies are all reduced, and reducing this voltage has the opposite effect. This enables the circuit to compensate for any inaccuracy in the timing component values, provided there is not an unreasonably large discrepancy.

The output signal at pin 3 of IC1 is compatible with the c.m.o.s. devices it is used to drive. A timing network for the first monostable is provided by R5 and C3, and they set the output pulse length at about 0·5ms. The second timing network is set by R8 and C4, producing an output pulse of a little under 2·5ms in duration.

Transistor Tr1 is used as a simple common-emitter output stage having the loudspeaker as its load. Its base is driven from the Q outputs of the monostables via current-limiting resistors R6 and R7, and so Tr1 is normally cut off and will only be driven into conduction for periods when one or both of the outputs are in the high state.

The divider circuit of IC3 is almost identical to the arrangement outlined previously. The only and very minor difference is that the reset terminal is connected to the 2 output in position 1 of S1. This is merely done as IC3 is a c.m.o.s. device and should not have any input left floating. It is tied to the 2 output merely because it is the most convenient point. S2 provides on/off switching, and C1 is the only supply decoupling component that is needed.

## ★ components

**Resistors**
*¼W 5%*

| | | |
|---|---|---|
| 1kΩ | 2 | R6,7 |
| 1·8kΩ | 1 | R3 |
| 15kΩ | 1 | R2 |
| 100kΩ | 3 | R5,8,9 |

**Potentiometers**

| | | |
|---|---|---|
| 22kΩ | 1 | R4 *(horizontal preset)* |
| 100kΩ lin | 1 | R1 |

**Capacitors**
*Electrolytic*

| | | |
|---|---|---|
| 100μF 25V | 1 | C1 |
| 10μF 10V | 1 | C2 |

*Polyester*

| | | |
|---|---|---|
| 10nF | 1 | C3 |
| 47nF | 1 | C4 |

**Semiconductors**
*Transistors*

| | | |
|---|---|---|
| BC109 | 1 | Tr1 |

*Integrated Circuits*

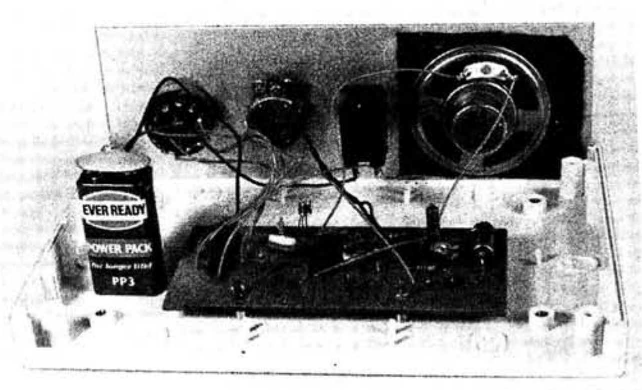
| | | |
|---|---|---|
| 555 | 1 | IC1 |
| 4022 | 1 | IC3 |
| 4098 | 1 | IC2 |

**Miscellaneous**
4w3p rotary switch (1); Toggle switch s.p.s.t. (1); Loudspeaker 35–80Ω; Verocase (Type 75-1411D) 205 × 140 × 75mm; Control knobs (2); PP3 battery and connectors.

## Construction

The prototype was housed in a Verocase with the loudspeaker and controls mounted on the front panel. Apart from the battery, the remaining components are all mounted on a printed circuit board. Although the cabinet is made of plastics, it is advisable to space the panel slightly off the case for mechanical rather than electrical reasons; the panel might otherwise distort and possibly crack when it is bolted into position.

All c.m.o.s. devices have an inherently high input impedance and are very susceptible to damage by static discharge. Under no circumstances must you remove the device from its protective conductive foil packaging until ready to insert into circuit. This operation should be done on a metallic surface that is at earth potential. A metal draining board would usually suffice. Note one hand must be kept in contact with the metallic surface at all times to prevent the build up of body static. When soldering components to the board ensure the iron tip is earthed and if this is not so, allow it to reach working temperature and remove mains plug.

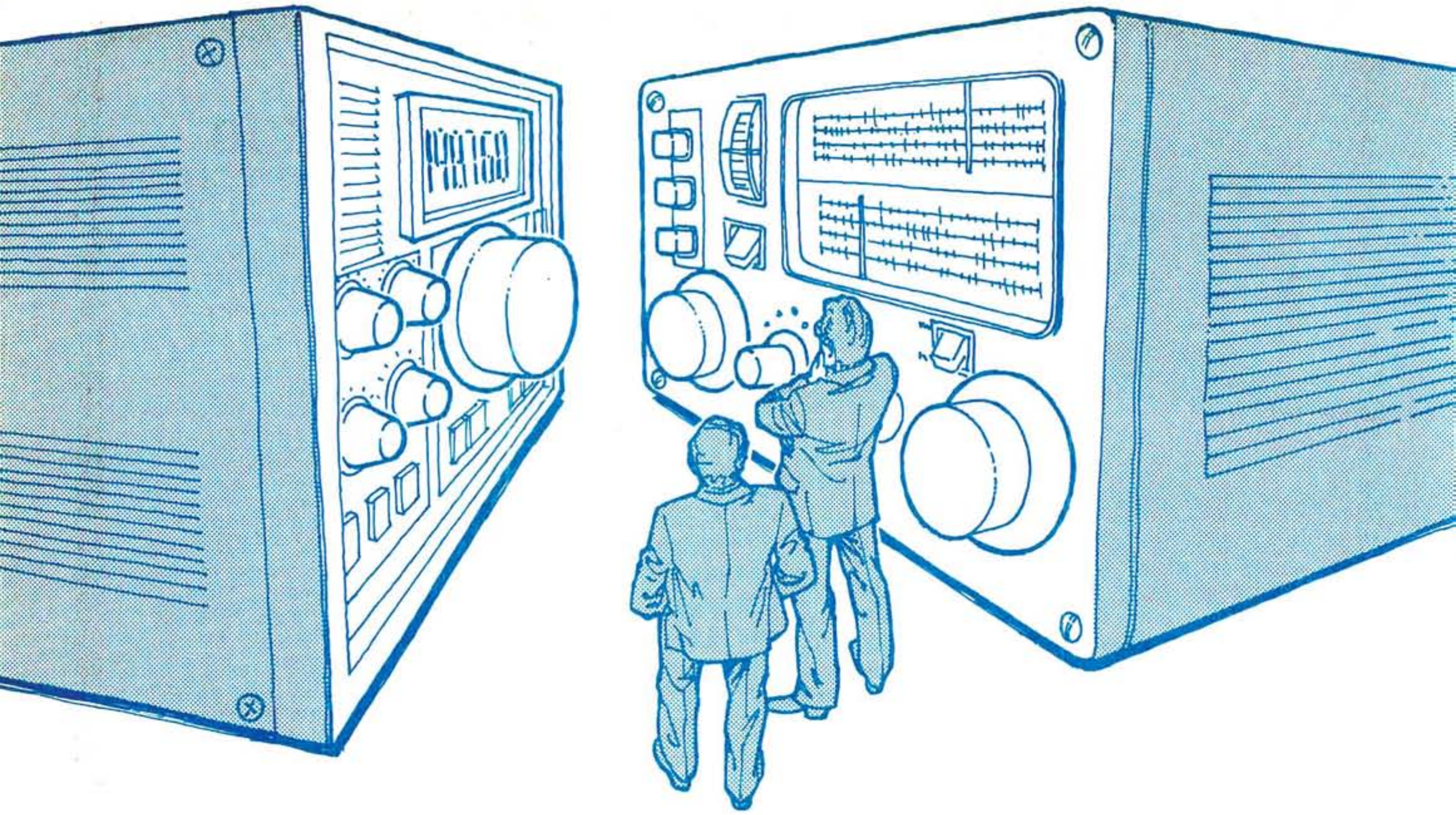


**Internal view of the prototype**

## Adjustment

Initially R2 should be set with the slider at about the centre of its track. If the range covered by the unit errs on the low frequency side, then by adjusting R4 in a clockwise direction it should be possible to correct this. It should be adjusted in an anti-clockwise direction if a reduction in the frequencies covered is necessary.

Finally, a scale calibrated in beats per minute should be marked around the control knob of R1. The output frequency is easily determined simply by counting the number of beats produced in a one minute period. ●




**PART 1**

**Peter CHADWICK G3RZP**

# UNDERSTANDING RECEIVER PARAMETERS

Radio receivers are fairly complex pieces of apparatus, with price tags capable of varying over a range of 500 to 1. Defining performance and achieving the best price compromise is therefore fairly important, and usually only by comparing the performance figures can any real choice be made. The number of figures required can be somewhat daunting, in so far as manufacturers describe parameter specifications emphasising the good points, whilst advertisers frequently make seemingly meaningless statements to blind the purchaser, not with science, but with pseudo engineering jargon. Furthermore, some of these parameters are not understood by many amateurs and, as a listen to 80 metres will show, in many cases a little knowledge can turn out to be a dangerous thing!

This article will attempt to shed some light on the various measurements that are required to evaluate the parameters of a receiver. Although biased towards h.f. communications, the principles involved are equally applicable to l.f. or v.h.f. receivers and, in some cases, to conventional broadcast receivers as well.

## Sensitivity

The basic requirement of any radio receiver is good sensitivity. Sensitivity is a measure of the ability of the receiver to detect a signal, and provide a suitable output from it. The requirements in terms of absolute sensitivity are very variable, and as with most other parameters, are in the nature of a compromise. The sensitivity required for any particular receiver is dependent upon the job it has to do—anyone who watched the TV series *The Secret War,* or read Dr R. V. Jones' book will probably remember that one of the clues that established the existence of the Knickebein Beams was the discovery of the unnecessarily high sensitivity of the Lorenz Beam Approach receiver fitted to captured pathfinder aircraft.

Receivers for the h.f. bands normally have a sensitivity of around 1μV for a quoted signal-to-noise ratio. The absolute figure is somewhat variable, and it is necessary to define terms before we get hopelessly lost.

The first consideration is noise. Conduction of electricity is by means of moving electrons in a conductor, but this movement also occurs when current is not flowing. In any conductor that is above absolute zero temperature there is a random movement of electrons. Because this movement is non-polarised, there is no net movement—if there was, a voltage could appear across the ends of a piece of copper wire! In a resistance also, random movement of electrons causes voltages to appear, and although there is a net cancellation, a small fluctuating noise voltage appears across the resistance. The greater the random movement of electrons, the greater this noise voltage becomes. Similarly, for any given random current, the voltage is proportional to the resistance and also the bandwidth of the system. As already stated the random movement of the electrons is affected by the absolute temperature, and thus a relationship can be derived for the value of the noise voltage in terms of resistance, bandwidth and temperature. This relationship, derived from basic physics, gives an absolute limit on the sensitivity of any radio receiver. How much worse the receiver sensitivity is depends upon the design and the system requirements.

# MICROWAVE MODULES

EX-STOCK FROM

# Bredhurst electronics

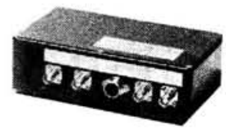
HIGH ST., HANDCROSS, W. SUSSEX 0444 400786

## 2M & 70CM LINEARS

| | |
|---|---|
| *MML 144/25* | *£48.30* |
| *MML 144/100* | *£142.60* |
| *MML 144/40* | *£69.00* |
| *MML 432/20* | *£69.00* |
| *MML 432/50* | *£113.85* |
| *MML 432/100* | *£228.65* |

## TRANSVERTERS

| | |
|---|---|
| *MMT 28/144* | *£90.85* |
| *MMT 144/28* | *£99.00* |
| *MMT 432/144R* | *£173.00* |
| *MMT 70/144* | *£155.00* |



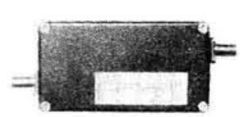
## 2M PRE-AMPLIFIER

*MMA 144V*
*ULTRA LOW NOISE*
*RF SWITCHED GAIN 15dB*
*NOISE FIGURE 1.3dB*

ONLY £29.90

## CONVERTERS

| | |
|---|---|
| *MMC 50/28* | *£24.90* |
| *MMC 70/28* | *£24.90* |
| *MMC 144/28* | *£24.90* |
| *MMC 432/285* | *£29.90* |
| *MMC 432/1445* | *£29.90* |



*MMD 50/500 FREQUENCY METERS £69.00*

*For further information on any of the above items, or any other MICROWAVE MODULES products please contact:*

## *BREDHURST ELECTRONICS,*

*The High Street, Handcross, Sussex. Tel. 0444 400786*

*MAIL ORDER* — *ALL PRICES INCLUDE VAT, CARRIAGE AND A FULL 12 MONTH GUARANTEE* — *RETAIL CALLERS*

TO ORDER ANY OF THE ABOVE ITEMS SIMPLY WRITE, ENCLOSING A CHEQUE OR PHONE YOUR CREDIT CARD NUMBER

---

### *COMPARE THESE FEATURES*

- ★ MICROPROCESSOR CONTROLLED 32,000 CHANNELS
- ★ AM & FM ALL BANDS
- ★ WIDER COVERAGE: 26-58, 58-88, 108-180, 380-514MHz; includes 10m, 4m, 2m, & 70cm Amateur bands.
- ★ 5kHz & 12½kHz FREQUENCY INCREMENTS
- ★ 16 MEMORY CHANNELS WITH DIRECT ACCESS
- ★ SELECTIVE PRIORITY CHANNELS WITH LOCKOUT
- ★ 2 SPEED SCAN SCAN DELAY CONTROL
- ★ 2 SPEED SEARCH UP AND DOWN
- ★ SEARCH BETWEEN PRESET LIMITS UP AND DOWN
- ★ 3 SQUELCH MODES inc. CARRIER & AUDIO
- ★ Dx & LOCAL CONTROL
- ★ RELAY OUTPUT FOR Aux. CONTROL
- ★ INTERNAL SPEAKER
- ★ EXTERNAL SPEAKER & TAPE OUTPUTS
- ★ LARGE GREEN DIGITRON DISPLAY BRIGHT/DIM
- ★ AM-PM CLOCK DISPLAY
- ★ 12v DC, 230V AC OPERATION

# SX200

## THE ULTIMATE SCANNER

**"SCAN-X" VHF/UHF BROADBAND FIXED STATION AERIAL £19.90.**
Ideal for SX-200 and other VHF/UHF receivers.

**£241.50 INC. VAT Delivered**

**U.K. IMPORTERS & DISTRIBUTORS:**
**REVCO ELECTRONICS LTD.**
**POUNDWELL STREET**
**MODBURY, DEVON, PL21 0RQ**
**Tel: Modbury (0548) 830665**
**Dealer enquiries invited**

**MAIN SERVICE & SALES AGENTS:**
**GAREX ELECTRONICS**
**7 NORVIC ROAD**
**MARSWORTH, TRING**
**HERTS HP23 4LS**
**Tel: Cheddington (0296) 668684**

How much sensitivity can be used? This will depend upon the frequency of operation. Below about 2MHz, noise levels are such that a minimum detectable signal of 20μV is, in many cases, much better than is needed, whilst at 144MHz, 20 or 30nV is nearer the mark. For h.f. work, it is usual to talk in terms of a 10 or 20dB signal-to-noise ratio at between 0·3μV and 1μV input. Nevertheless, a complication occurs when defining what this 1μV input is, and Fig. 1 illustrates this point. A battery with a 1Ω internal resistance, with no load connected across it, has a terminal voltage for example, of 1·5V. With a 1Ω load applied the terminal voltage will fall to 0·75V, the difference between the e.m.f. or open-circuit value, and the p.d. (potential difference). In a matched impedance system, this variation is 2 to 1, or 6dB, which gives a marked indicated difference in sensitivity. The American and Japanese manufacturers probably tend to use p.d., because it makes the figure look 6dB better! Some argument exists over which is correct—to assume that there is a 6dB difference under all circumstances pre-supposes that the receiver input impedance is accurately known, which is rarely the case. When the receiver does not look like 50 or 75Ω, then tests can be very indeterminate. In these circumstances the actual input voltage depends upon the input impedance and the standing wave ratio on the cable from the signal generator to the receiver—a veritable Tom Tiddlers ground for results failing to agree.

A given receiver can therefore be seen to have a limit on its sensitivity governed by physics, a required sensitivity dependent upon application and a measured sensitivity dependent on the definition of what a 1μV input is! No wonder confusion reigns!

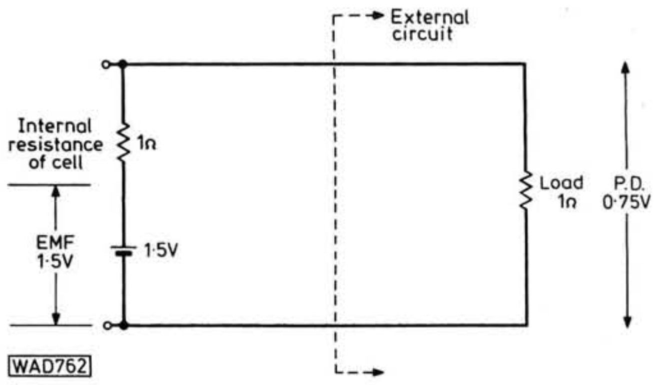



**Fig. 1: The difference between e.m.f. and p.d.**

## Sensitivity Measurements

Basically, a receiver is a very high gain amplifier. Such amplifiers have active and passive components in them and the resulting random flow of electrons produces noise within these components that is amplified along with the wanted signal. If the noise produced by the amplifier is greater than the signal, quite obviously the signal will be drowned out. The measurement of sensitivity in terms of signal-to-noise ratio measures how much degradation there is in the receiver, and this degradation may be expressed in several ways. The simplest method, shown diagramatically in Fig. 2, is that of signal-plus-noise-to-noise ratio, where the output power is measured with the signal present, and then again without the signal and the resulting ratio expressed in decibels. For a.m. and f.m. this measurement is the ratio of output with modulation to output without modulation, as the presence of the carrier makes an appreciable difference to the noise output. This is a straightforward, simple measurement, and has been used for many years. However, the ratio is also dependent upon the bandwidth of the system—the greater the bandwidth, the greater the noise. A variation of this specification that is becoming more popular is the SINAD measurement—signal-plus-noise-plus-distortion to noise-plus-distortion. This is measured using a distortion factor meter, which measures the degradation of the signal, and treats the noise introduced as distortion. However, at low input signal levels, the noise is much greater than the distortion and so for SINAD ratios of 20dB or less, it is therefore a close approximation to the signal-to-noise ratio method. The SINAD method does have the advantage that it correlates the signal-to-noise ratio and the distortion at high levels of input.

Finally, there is noise figure. Noise figure is the ratio by which input signal-to-noise ratio is degraded by the receiver, and because it is the ratio of two ratios, it can be shown to be independent of bandwidth. This is a great advantage when making comparisons, but measurement of noise figure is not easy, especially in f.m. systems. However, some correlation can be obtained from the signal-plus-noise-to-noise measurement as follows.

For a given input impedance, bandwidth and temperature, the signal-noise ratio is $X$dB. (This is derived from physical constants described previously.) If the measured signal-plus-noise-to-noise ratio is $Y$dB, then the degradation in signal-noise ratio is $(Y-X)$dB. For a 50Ω input impedance with a 3kHz bandwidth at room temperature, the value of $X$ is −26dB relative to 1μV—so a receiver with a 10dB noise figure will give a signal-plus-noise-to-noise ratio of 16dB for an input of 1μV e.m.f. For h.f. work, a noise figure of 10dB is adequate for most purposes, although lower values can be useful where small aerials with very little pick up are used, and below 15MHz, a noise figure of 15dB is generally accepted as adequate. For OSCAR reception on 28MHz, a lower noise figure still, may be useful in some conditions but as will be seen later, the use of such a low noise figure may not effectively improve the receiving system.

When the signal-plus-noise-to-noise ratio is measured on a.m., it will often be found that it is appreciably worse than on s.s.b. There are two reasons for this, these being:

(a) The bandwidth used on a.m. is greater than on s.s.b., so the noise is greater.

(b) The a.m. measurement is usually made with 30 per cent modulation, whilst the single tone used on s.s.b. represents a signal with 100 per cent modulation. This produces figures for a.m. that are 10dB worse.

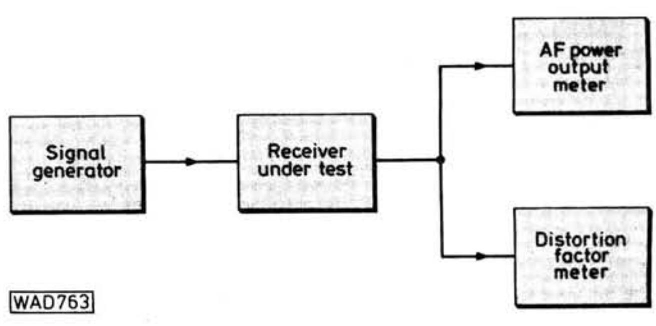



**Fig. 2: Single signal measurement set-up**

A further aspect of sensitivity measurement relates to the output power available from the receiver. Marine specifications require 50mW for loudspeakers and 1mW for headphones, for the input at which a 20dB signal-plus-noise-to-noise ratio is obtained, but this is not very loud in applications with high ambient noise levels such as found in mobile use. Very few receiver specifications mention the output power developed at low values of input signal, such as 1μV.

Even more rarely specified is signal-to-noise improvement ratio—probably because of the fact that few receivers show up very well! Signal-to-noise improvement ratio is fairly important. Consider a receiver with a 1μV input, and a 15dB signal-to-noise ratio. (Note that signal-to-noise ratio, and signal-plus-noise-to-noise ratio are not quite the same thing, but the difference is not important for this particular discussion.)

If the input signal is increased by 20dB, it is reasonable to expect that the signal-to-noise ratio will improve by 20dB, and the amount of improvement is an excellent measure of the distribution of gain control.

Suppose for example that the gain control is by means of an attenuator at the input terminals of the receiver. Because of the decrease in signal level to produce the original input to the receiver, the improvement in signal-to-noise ratio will be zero. The signal-to-noise improvement ratio also governs the ultimate signal-to-noise ratio—the signal-to-noise ratio provided by a big input signal. Incidentally, any hum or supersonic oscillation in the a.f. stages shows up here as a degradation and of course, if the ultimate signal-to-noise ratio is about 30dB, there is generally little point in going for very low a.f. distortion. Practically speaking, it is fair to assume that for a 20dB increase in input signal from the 20dB signal-noise level, the improvement should be to at least a 35dB signal-to-noise ratio.

Measurement of noise figure is an area in which conflicting results are readily available, especially when talking in terms of 3dB or better noise figures.

Summing up then, sensitivity is one of the parameters governing the output level of the receiver, and its capability for receiving weak signals. Other parameters governing this ability will be discussed later.

## Selectivity

A radio receiver very rarely has to receive the wanted signal on its own. Especially in the bands up to 30MHz, the number of signals adjacent in frequency to the wanted signal can be very large and the ability of the receiver to pick the wanted signal is called selectivity.

Selectivity is a function dependent upon the bandwidth of the signal to be received. Bandwidths vary from between approximately 200Hz to 400Hz for c.w. and RTTY and 150kHz for broadcast f.m. An s.s.b. receiver requires a bandwidth of between 2kHz and 3kHz if the information transmitted is not to be lost. This bandwidth is that which hopefully can be passed without any attenuation of the signal at all but in practice is usually the frequency at which the signal is −6dB relative to the strength at the peak of the response, which is generally at the centre frequency. However, the wanted signal may be very weak in comparison to the unwanted signal—perhaps by a ratio of as much as 70dB or 80dB. The ability of the receiver to reject the unwanted signal on an adjacent frequency is determined by its selectivity. If the rejection of a signal 10kHz away from the wanted signal is 40dB in one receiver and 60dB in another, then all else being equal, the 60dB receiver is better able to cope with interfering signals. So not only is the bandwidth at the 6dB points important, but so is that at which the i.f. filters reject unwanted signals by 60dB. For a good s.s.b. receiver, the ratio of the 6dB to 60dB bandwidths, called the Shape Factor, is about 1·7:1, while figures of up to about 2·4:1 are quite acceptable. For a.m. and c.w. worse shape factors are common, frequently for economic reasons connected with filter design. Receivers of the HRO, AR88, CR100 vintages have crystal filters with very poor shape factors by today's standards, although especially on c.w., the best selectivity is generally provided between the operators ears!

Measurement of selectivity is not at all easy. The best way is to attach an r.f. voltmeter just prior to the detector stage and to plot a graph of voltage against frequency. However, in modern receivers using integrated circuit i.f. strips, this can prove impossible. By varying the signal frequency with the receiver in the s.s.b. or c.w. mode, it is possible to measure the a.f. output level and to plot the result on a graph against frequency, but the response of the a.f. stages will then affect the measurements. The s.s.b. transceiver is possibly the easiest to measure as the common filter section response can be plotted on transmit. Becoming popular, however, is the Two-Signal Method of measuring selectivity, which will be dealt with later.

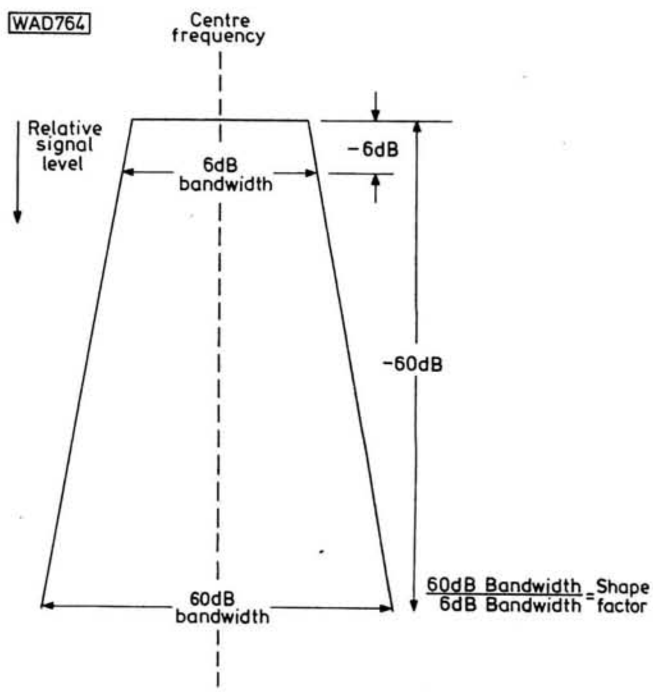


**Fig. 3: Selectivity and filter bandwidth**

Related to selectivity, but rarely mentioned is Electric Fidelity. This is a measure of the a.f. frequency response that the receiver is capable of and is easily measured by varying the modulation frequency over a wide range. It is of course, fairly important for broadcast receivers, especially for f.m.

Selectivity is a very important receiver parameter and is fairly easy to specify. As a result, it is generally properly specified, although the occasional "howler" is perpetrated.

## Spurious Responses

Related in some ways to selectivity is the topic of spurious responses, i.e., outputs from the receiver caused by inputs at frequencies other than the tuned frequency (external spurious) and whistles generated at particular frequencies (internal spurious). One of the most important external spurious responses in a superhet receiver is the Image or Second Channel frequency. This is produced as follows: Within a superheterodyne receiver the incoming radio frequency (the signal frequency) is fed into a mixer together with the local oscillator signal. The output of this mixer is the intermediate frequency and is either the sum or the difference of the signal and local oscillator frequencies. For example, a receiver is tuned to 14 100kHz and has a fixed i.f. of 455kHz. The local oscillator is on 14 555kHz and the resulting difference (local oscillator 14 555kHz–14 100kHz signal) is thus the i.f. of 455kHz. However, a signal on 15 010kHz would also produce an i.f. of 455kHz and this unwanted signal is the image, or second channel signal. The local oscillator is occasionally on half or even a third of the required frequency, but this is not common. A signal on a frequency such that it can mix with the harmonics of the local oscillator to produce the i.f. will also give a spurious response and all these responses can be defined. It is rare for external spurious responses other than the image to be specified on receiver data sheets. Such responses should be at least 60dB down on a well-designed modern receiver, but unfortunately are often nowhere near this. A further frequency that can cause trouble is the actual i.f and rejection at this frequency needs to be quite high, the actual figure depending upon its frequency. For example, early TV receivers with a 14MHz i.f. suffered very badly from local amateur transmission breakthrough.

At the time of writing, the Band I TV transmitter at Crystal Palace, in South-East London, has sufficient radiated field on 41·5MHz to interfere with TV sets using an i.f of 34–38MHz. Indeed, the strength of signal is such that some manufactured sets are unusable close to the station, whilst others have to be modified for use in this area.

Internal spurii (spurious whistles) are generated in the receiver. A favourite one occurs in most amateur equipments with a v.f.o. covering 5·0–5·5MHz, where the fourth harmonic of the v.f.o. causes a whistle at 21·200MHz. Other frequencies can appear, and the mechanism of production is very varied. One professional receiver of some 15 years ago had an earth lead in a peculiar point on the chassis and moving this earth around made some of the whistles disappear. Probably the position of the earth lead was found on the prototype, and then just copied! These internal spurious are worst in the case of multiple-conversion receivers, and frequently are caused by earth loops. In receivers using a high first i.f. (above 30MHz) the mechanism of spurious generation is frequently due to harmonics of the first local oscillator getting into the second mixer and mixing with harmonics of the second local oscillator. These harmonics can be in the hundreds of megahertz region and curing them can be very difficult, necessitating complex filters and castings. Incidentally, it can sometimes be achieved by perseverance with the p.c.b. layout, which is considerably cheaper!

The level of spurious whistles should be as low as possible and the ideal is not to have any there at all; or at least for them to be so low that the specified signal-to-noise ratio can be met in the presence of the whistle.

The final internal spurious problem can be harmonics produced by the b.f.o. or c.i.o. (carrier insertion oscillator) but these are restricted to spot frequencies. Those whistles caused by digital frequency counters are much harder to cure; generally, isolation between digital and analogue circuitry and careful screening is required.

All in all, the definition of a superhet given by Cathode Ray in *Wireless World,* pre-war, is nearer the truth than was imagined at that time. Superhet, short for supersonic heterodyne—a very powerful type of radio receiver. Receives all stations at least once, and most of them more than twice. To which the cynic can add, with occasionally some justification—simultaneously!!

## Automatic Gain Control

Automatic Gain Control, a.g.c., is almost universally fitted to receivers these days, even if its main purpose is to drive an "S" meter. The idea of a.g.c. is to maintain the a.f. output from the receiver constant over a wide range of input signals, but a completely flat a.g.c. characteristic, i.e., one that allows no change in output, is not desirable. This is because the noise in the absence of signal is brought up by action of the a.g.c. circuit to the same level as the signal was. For this reason, a rise of 6dB in output for a 90dB change in input is usual, although some sets boast of a 3dB change. One of the problems that can arise is that if the a.g.c. starts acting with very little input signal, the signal-to-noise improvement ratio may suffer and for this reason, carefully designed delayed a.g.c. is required but rarely provided, except in very high priced, high performance professional receivers.

The a.g.c. line is universally used to drive the "S" meter, which leads to all sorts of problems. What is S9? The choice of some arbitrary value for S9 on 3·5MHz is all very well, but the "S" meter is then accused of being "Scotch" on the upper h.f. bands. Calibration of the "S" meter in "S" points of given numbers of dB, e.g., 6dB per "S" point, is common, although it is extremely rare for the calibration to be correct over the full range of the meter. Unfortunately, "S" meters seem to be given a greater degree of uncritical belief and blind faith in their correctness than pocket calculators! Generally, some value between 20µV to 50µV is used for S9, but without very careful design of the i.f. strip, and indeed all the a.g.c. controlled stages, to obtain reproducible gain control characteristics and carefully defined gain, the reliance put on "S" meters is misplaced. From the manufacturers' viewpoint the cost of doing so is uneconomic.

## Two-Signal Tests

So far in this article, we have only considered those measurements that can be made on a receiver using a single signal source. As has been mentioned earlier, the real world in which a radio receiver operates is such that a considerable number of signals are always present at the input terminals and the receiver must be able to sort out the desired one. Selectivity has been mentioned as one of the parameters involved, as have spurious responses, but there are other mechanisms which cause interference to the wanted signal. These are evaluated for performance comparisons under the heading of Two-Signal Tests and comprise Intermodulation, Cross Modulation, Blocking or Desensitisation, and Reciprocal Mixing. Many of these terms have been frequently misapplied, or even ignored, not only by amateurs, but by the manufacturers of quite advanced equipment.

NEXT MONTH

**In Part 2 of this series we will deal with parameters related to two-signal test procedures**

# PRODUCTION LINES

## ALAN MARTIN G8ZPW

### Low-Cost Tape Eraser

With the increasing use of video recorders in this country, the new Bib Video Tape Eraser will be a most useful accessory for erasing both the video and audio signals from either VHS or Betamax video cassette tapes. Although this model has been specially developed for erasing video tapes, obviously it is suitable for $\frac{1}{4}$in tape and audio cassette tapes.

It is often evident that poor image quality and unwanted background noise result from insufficient erasure of previously recorded material. Using the eraser ensures that tapes are signal free and are ready to accept new recordings. The powerful 1420 gauss magnetic field far exceeds the erasure capability of the standard domestic video recorder's erase head.

An on/off switch is located on the front of the unit and there is a red l.e.d. to indicate when the unit is operating. The eraser is mains powered and BSI approved.

The Bib Tape Eraser should be available from most leading video shops, price £20.70 including VAT.

*Bib Hi-Fi Accessories Ltd., Kelsey House, Wood Lane End, Hemel Hempstead, Herts HP2 4RQ. Tel: (0442) 61291.*


### Mini Travel Alarm


About the size of a bank card, the Systema S-283 travel alarm clock provides quartz accuracy timekeeping in two time zones. The large liquid crystal display shows hours, minutes, flashing seconds signal, am/pm indicator and alarm set symbol.

The high-pitched alarm can be expected to wake the weariest traveller, or may also be carried in a pocket to bleep reminders throughout the day. A large button on the face of the unit operates a five minute snooze feature and illuminates the display for viewing in the dark. Three small buttons on the side of the S-283 enable easy setting of alarm time and both time zones.

Finished in black and silver with an integral hinged stand, the mini travel alarm is fitted with long-life batteries and supplied in a soft carrying pouch. Overall measurements are 65 × 50 × 11mm.

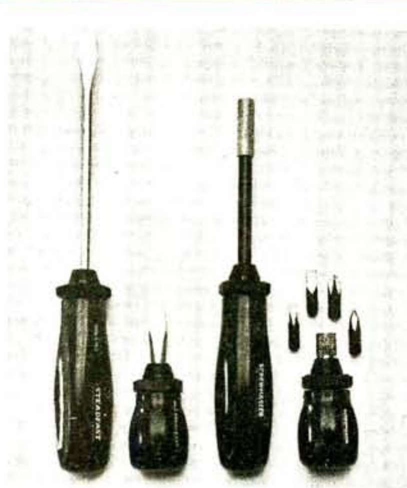
On sale at Selfridges and Harrods, the S-283 is also available from Systema, at an inclusive price of £12.95.

*Systema Watch Co. (England) Ltd., 371 Station Road, Harrow, Middlesex HA1 2AW. Tel: 01-427 2352.*

### Four in One

"Four screwdrivers in one" is the latest addition to the Steadfast Screwmaster family of screwdrivers.

The new screwdriver adaptors incorporate the patented roller ratchet Screwmaster mechanism which was successfully launched earlier this year. There is a sleeve at the end of the driver shaft to hold all types of standard $\frac{1}{4}$in A/F screwdriver bits.



The bit holder is available in two sizes. The Chubby model is only 76mm in length and the larger model is 210mm in length. Both sizes come with either a magnet or retaining clip at the base of the sleeve to hold the bit in place.

The magnet will also attract a screw—a particular feature if working in tight or awkward conditions. However, in situations where a magnetised blade is not suitable the retaining clip is the alternative.

The adaptor and bits are available separately or in kit form comprising an adaptor, together with No. 1 Pozidriv, No. 2 Pozidriv, 5mm and 6mm flat bits.

Retail prices range from £3.35 to £4.90, plus VAT, for the bit holders and £5.95 to £7.50, plus VAT, for the kit form. All are available through normal retail outlets.

*J. Stead & Co. Ltd., Greenland Road, Sheffield S9 5BW. Tel: (0742) 445472.*

### New Multimeter

Lascar Electronics has recently introduced a new multimeter, the LMM-400, which possesses two extra functions for automotive applications.

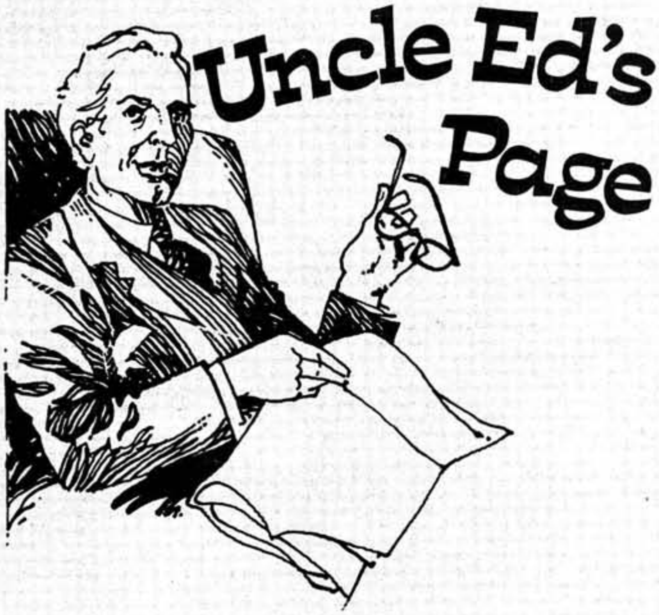
The instrument features a.c./d.c. voltage measurements from 0·1mV to 1kV and a.c./d.c. current range up to 20 amps. The resistance range measures from 0·1Ω to 20MΩ.

The "engine" functions are implemented simply by placing the probe connectors between the vehicle earth and the l.t. side of the ignition coil. The instrument will measure r.p.m. (up to 20,000) and will also indicate the ignition dwell angle in degrees.

The LMM-400 is designed for use on vehicles with 4, 6 or 8 cylinders, either positive or negative earth and with either conventional or electronic ignition systems. Measurements are indicated via an l.c.d. display with 12·7mm high characters and inputs are fully protected.

Priced at £69.80, which includes VAT and p&p, the LMM-400 is available from: *Lascar Electronics Ltd., Unit 1, Thomasin Road, Burnt Mills, Basildon, Essex SS13 1LH. Tel: (0268) 727383.*

# Uncle Ed's Page



**A monthly look at some aspect of the radio/electronics hobby that seems to bug the beginner, or occasionally a more advanced topic seen from an unusual angle.**

## *MORE DIODES*

Last month, in Fig. 3, I showed a simple rectifier circuit with the supply of alternating voltage indicated by the general symbol of a circle with a "squiggle" in it. I suggested using a mains transformer as the source of that voltage, and Fig. 5 shows such an arrangement. At (a) and (b) are the voltage waveforms before and after the diode. You would see something like these waveforms on an oscilloscope connected to the points arrowed. As I said last month, the diode only passes current in one direction, so only **half** the **wave**form gets through it. Hence the name **half-wave** rectifier.

The big gaps between the voltage pulses in (b) are often a bit of a problem, and it would be nice to be able to fill them in. If we add a second transformer T2 and diode D2 as in Fig. 6, we could do just that, providing the alternating voltages at the anodes of D1 and D2 were always of opposite polarity at any given moment. We speak of such voltages as being in anti-phase. In Fig. 6 the little black blobs indicate the ends of the windings that are **in** phase—another convention which you should know about.

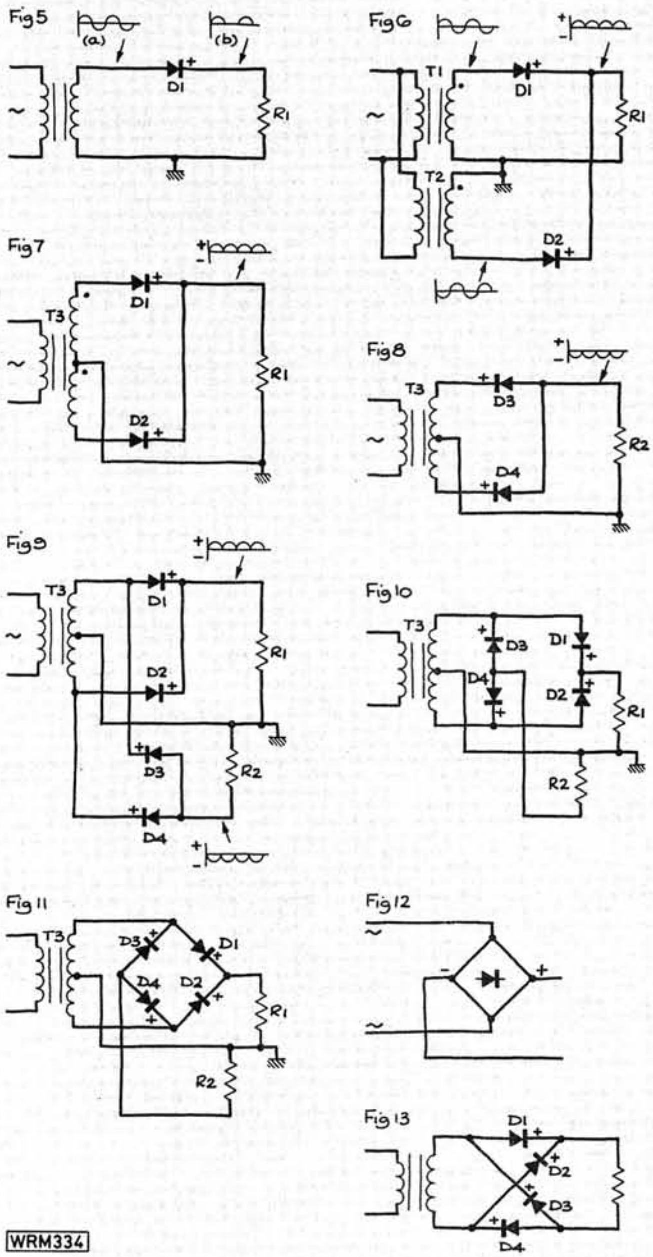
Now, there is no reason why we shouldn't combine the two transformers of Fig. 6 into a single one (T3) as in Fig. 7. The secondary winding might be a single one with a centre-tap, in which case it might be labelled, for example "6-0-6V" or "6V-0-6V", or even described as "12V, centre-tapped", or it might be two separate windings as shown (each labelled, for example "6V" or "0-6V") connected in series with the appropriate phase. The effect is the same.

Because the two diodes, between them, pass the **full wave**form to the load R1, this arrangement is known as a **full-wave** rectifier.

The output of Fig. 7 is a pulsating positive waveform, but we can get a negative waveform simply by turning the diodes round the opposite way, like D3 and D4 in Fig. 8. If we want both positive and negative outputs, we can do another crafty bit of economising by combining Figs. 7 and 8 to produce Fig. 9. You'll find that this is just like the arrangement used in the power supply of the *PW* "Twynham", as shown last December on page 22.

Now, Fig. 9 can be redrawn like Fig. 10, or even Fig. 11. They're all electrically identical. I'm sure you recognise the arrangement of the four diodes in Fig. 11—that's right, it's a bridge. In fact, if you ignore the transformer centre-tap and earth connection in these circuits and merge R1 and R2 in each case, you have three ways of drawing a bridge rectifier circuit. This is another type of full-wave rectifier, using twice as many diodes but only half the amount of transformer secondary winding that was necessary for the arrangement of Fig. 7.

As I said, Figs. 9–11 show three ways of drawing a bridge rectifier, depending largely upon the whim of the draughtsman. Fig. 12 shows a common "shorthand" version of the bridge. Yet another variant occasionally encountered is shown in Fig. 13.

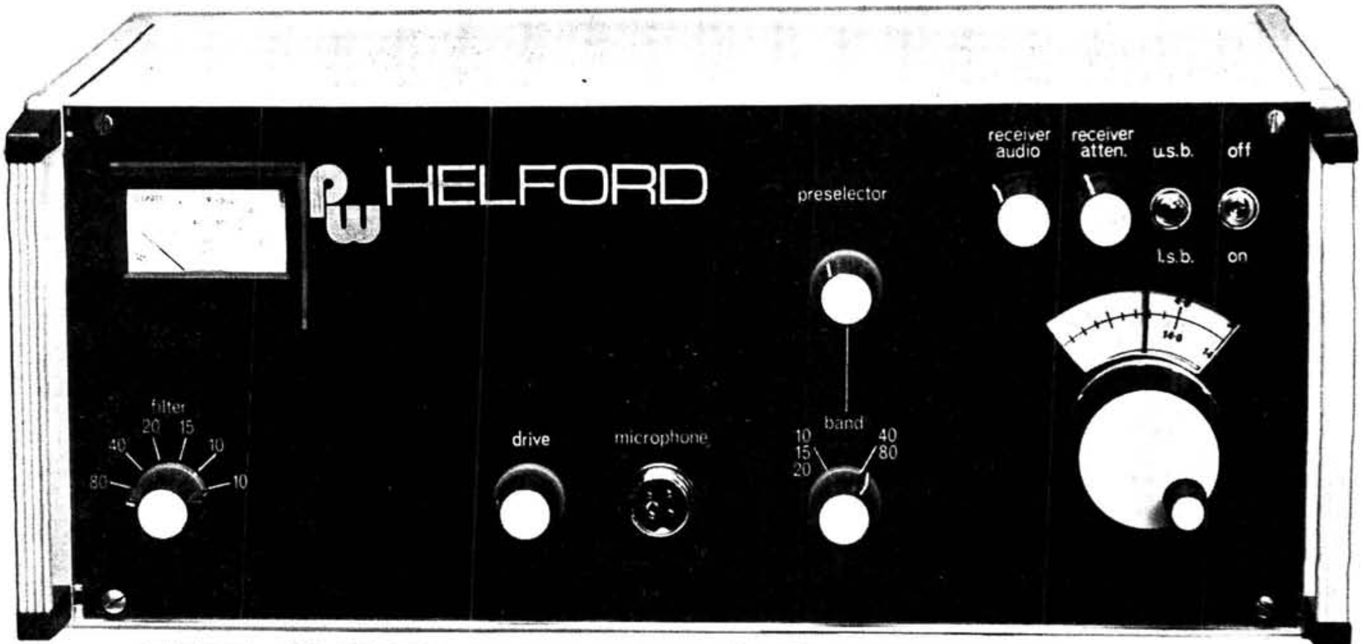



Incidentally, if you come across what looks like a bridge but with the diodes connected anode/cathode, anode/cathode, anode/cathode, anode/cathode, so that all the "arrow-heads" point in the same direction, it's not a bridge at all, but a diode ring. These are commonly used in modulators and demodulators for s.s.b., and sometimes in frequency multipliers, and are most often drawn in the pattern of Fig. 13 but with diodes D2 and D4 with polarity reversed.

**Next month: What is s.s.b?**

# PW HELFORD

Part 4




# HF SSB TRANSCEIVER

Vic Goom G4AMW

Having completed the basic transceiver in the previous three parts we can now make a start on the transmitter power amplifier stages.

To get the full 100W r.f. output it is necessary to use two stages of r.f. amplification. In this part we will be dealing with the r.f. driver amplifier which takes the low power output from the Tx First Amplifier and produces an output of 5W to drive the final p.a. stage.

The driver amplifier is based on a TRW Application Note for a 1·5MHz to 30MHz linear power amplifier intended for s.s.b. transmitter applications. The design is capable of providing 5W in a Class A mode with better than −40dB intermodulation distortion. By simply changing the bias supply voltage the design is capable of giving a full 25W, as a Class AB amplifier, with better than −30dB intermodulation distortion.

The complete amplifier has a capability of withstanding an infinite v.s.w.r. at full output power and it would be quite feasible to use the driver amplifier as the final p.a. stage with an output of 25W instead of the 100W of the full design.

The circuit diagram of the driver amplifier is shown in Fig. 13. The two TRW PT9795 transistors (Tr401,402) are operated as a single-stage push-pull amplifier. The required 50Ω input and output impedances are maintained by the use of matching transformers T401 and T403.

The driver amplifier is mounted onto a suitable heatsink which for the *PW* Helford can be a 51mm length of Redpoint MA Type with the height of the fins reduced to about 13mm. The thermal rating of this heatsink is given by Redpoint as 2·8°C/W and if a different make of heatsink is used then this is the figure to aim for.

## Construction

The driver amplifier is built onto a single p.c.b. as shown in Fig. 14. This is a double-sided board with the underside being plain copper to act as a ground plane. The components are mounted onto the copper pads as shown in Fig. 15. The r.f. transistors should be handled with care and the board must be cut out to allow the metal body of the device to drop through and sit squarely on the heat-

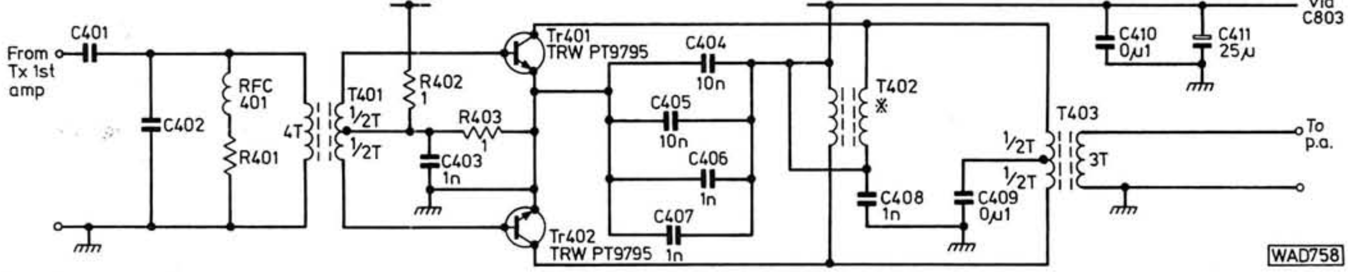



**Fig. 13: Circuit diagram of the driver amplifier. The values of the input circuit components are given in the components list**

## From the World-Record Joystick People!

# A REVOLUTIONARY ANTENNA THEY CALLED "IMPOSSIBLE"

## THE JOYFRAME (Patent Applied for)

Amateur Bands 3.5-30 Mhz.

The ultimate in small package, poor QTH, versatile antennas. Comes in easily assembled package which makes up to a 21 · 21 · 21 (inches) triangle. The unit JUST STANDS ON TOP OF TX/RX! Two knob control – and is rotated by hand for directivity on 80m. Is omni-directional on higher freq.'s and for many SW BC stations. Incredible low angle radiation. Tested at 2 watts (only) CW at our works – world wide contacts! "Soak test" with G2VF using only 30 watts has satisfyingly filled his log with world wide QSO's. Loop TRANSMISSION performance with such a small unit has, we believe, never been seriously contemplated before, but rather written off as "impossible". Years of research from the firm that produced the JOYSTICK VFA and related systems now offers the JOYFRAME to the amateur fraternity and is the answer to the "maidens prayer" to everyone with a space problem. All the benefits of JOYSTICK products: substantially harmonic-free, low angle, efficiency, compact.

**COMPLETE JOYFRAME (incl. ATU) £60.00**
(or write – 14p – or phone for literature)

## ANTENNAS (our regular lines)

### THE JOYSTICK VFA (Variable Freq. Antenna)

- Only 230cm long, easily assembled and installed.
- Continuous tuning 0.5-30Mhz ● Omni-directional
- Substantially harmonic-FREE

**SYSTEM "A"** For the SWL or 160m. Tx. **£48.55**

### THE JOYMASTER SUPERMATCH SYSTEM

● Newer development for higher power, improved performance and even greater capability in the awkward QTH! ● Includes matching ATU ● Amateur Bands (Incl. 'new' bands) 3.5-30MHz. ● 500 w.p.e.p.

### NEW SUPERMATCH SYSTEM

with ,13' Joyradial 5 band radial **£82.00**

### SUPERMATCH ATU

available to improve performance of existing antennas. Impressive, versatile, try it! **£50.00**

### JOYRADIAL (3.5-30Mhz) £6.90

## RECEIVERS

Get on the air in seconds!
● FRG7700 £309 (£380 with Memory) ● FRG7 + free wire aerial ONLY £187 ● Package "R.1" FRG7 + ATU + World Record VFA and FREE HEADPHONES £218 ● Package "R.3" FRG7700 (without Memory), VFA, ATU, Headphones £345.50 ● Package "R.4" FRG7700 (with Memory), VFA, ATU, Headphones £425.50.

## TRANSCEIVERS ETC.

We reckon we're offering the

## LOWEST YAESU PRICES

Try phoning us for your PERSONALISED quote with or without Partridge antennas. For example: ● FT101ZD – only £559 ● FT901DM – only £795 ● FT7B – only £395.

BARCLAYCARD VISA

**JUST TELEPHONE YOUR CARD NUMBER**
0843 62535 (ext 5) (62839 after office hours) or send 14p stamp for FREE literature. Prices correct as at press. NOTE our prices are always INCLUSIVE OF VAT, carriage. Prompt service too, goods usually despatched WITHIN 48 HOURS!

5 Partridge House,
Prospect Road, Broadstairs, Kent CT10 1LD
(Callers by appointment).

G3CED
G3VFA

PARTRIDGE ELECTRONICS LTD
BROADSTAIRS KENT ENGLAND

---

## CB AND AMATEUR RADIO ●

ANTENNAS ● ACCESSORIES
● MAIL ORDER
NEW ● NEW ● NEW

**SUPER SLIM JIM** – 2 metre omni (LJ2). An even slimmer version of the famous SLIM JIM. An entirely new design by F. C. Judd G2BCX, even more efficient than the original. Only 44 inches long, can be used for BASE STATION or MOBILE OPERATION. Imp: 50 ohms. Completely enclosed and waterproof. Gain 3dB (EIA). Fittings for mast mounting, mobile magnetic or gutter mounting available extra. LJ2 price **£17.25** including VAT, postage and packing.

**THE BIG JIM** – 27MHz omni – BJ27. An entirely new design – base station antenna for CB radio. Only 9 feet long – no radials. Gain 3dB (EIA). Low angle radiation for local or DX. Two-way 27MHz contacts between the UK and USA have produced S9 plus signals and 10-4 copy. Mast or wall mounting fittings extra. Also tunable for 10M Amateur band. BJ27 price **£67.00** including vat, postage and packing.

**THE RED ALERT** – VHF antenna checker and RF sensor (ZLS1). Will check any antenna for radiation, correct voltage and current distribution. Repeating audible bleep and visual indication in presence of radiation. Operates any frequency 20-1000MHz. Supplied complete with probe antenna. ZLS1 price **£12.00** including VAT, postage and packing.

**THE PERSUADER** – Speech Processor (SP15). Increase your talk power by up to 32 times. Average effective speech power gain 15dB. Fully automatic in operation. Red and green indicators show correct operational setting. Operates for SSB, AM or FM. Tailored response for greater readability and harmonic filtering. Suitable all standard mics and rigs. SP15 price **£38.18** including VAT, postage and packing.

**DUMMY LOAD** – Self indicating (ZL50). Check TX power without radiating. Check co-axial cable runs and antenna match by comparison. Useable with all VSWR meters. Built in LED power indicator. Automatic sensing insures impedance of 50 ohms to within better than 0.5 ohm. Useable power up to 20 watts continuous or 100 watts intermittent. Self VSWR 1 to 1. Frequency limit 200MHz. ZL50 price **£9.00** including VAT, postage and packing.

SAE for further details of above.

**CASH WITH ORDERS ONLY**. Cheques, Postal Orders etc., payable to ZL COMMUNICATIONS.**

Wide selection of books on CB Radio, Electronics, Amateur Radio etc. Also CB T-Shirts, badges, car stickers and unique LEARN ALL ABOUT CB cassette tape etc. Send 30p stamps (not SAE) with name and address for full catalogue and accessories list.

## ZL COMMUNICATIONS

**CANTLEY, NR. NORWICH, NORFOLK, NR13 3RT.**
**Tel: 049 370 821 (9-5.30 Monday to Friday only).**
**Callers by appointment only.**

**IMPORTANT NOTICE**
Notice is hereby given that antennas for 2 metre operation called the ZL SPECIAL (series) and the SLIM JIM, which are currently being advertised in various journals as manufactured products, are NOT repeat NOT produced by ZL COMMUNICATIONS. Neither are these antennas approved in any way whatsoever by F. C. Judd (G2BCX), Director of ZL Communications, and who was responsible for their design in the first instance as published in various issues of Practical Wireless and the book "Two Metre Antenna Handbook".

---

# Western

THE COMMUNICATIONS SPECIALISTS
EVERYTHING FOR THE RADIO AMATEUR

## ANTENNAS . . .
### FOR THE HF BANDS

### BRITISH MADE BY Western

| | | |
|---|---|---|
| **TRAP DIPOLES (3 types)** | | |
| TD1/10-80 | 10, 40 and 80m | £34.44 |
| TD1/15-80 | 15, 20, 40 and 80m | £34.44 |
| TD-P | Portable type with winding spools | £30.48 |
| (TD1 are of 14 gauge copper; TD-P is copper/terylene braid) | | |
| **VERTICAL** | | |
| DX-5V | 10-80 metres; approx 26ft high; slimline | £89.00 |
| **BEAM ANTENNAS (and Rotary Dipole)** | | |
| DX-31 | Rotary dipole for 10, 15, 20m | £46.00 |
| DX-32 | 2-element beam for 10, 15, 20m | £80.50 |
| DX-33 | 3- " " " " " " | £121.90 |
| DX-34 | 4- " " " " " " | £161.00 |
| DX-103 | 3-element monoband beam for 10m | £74.75 |
| DX-105 | 5- " " " " " | £97.75 |

★ Other Antenna Accessories available – see our Price List ★

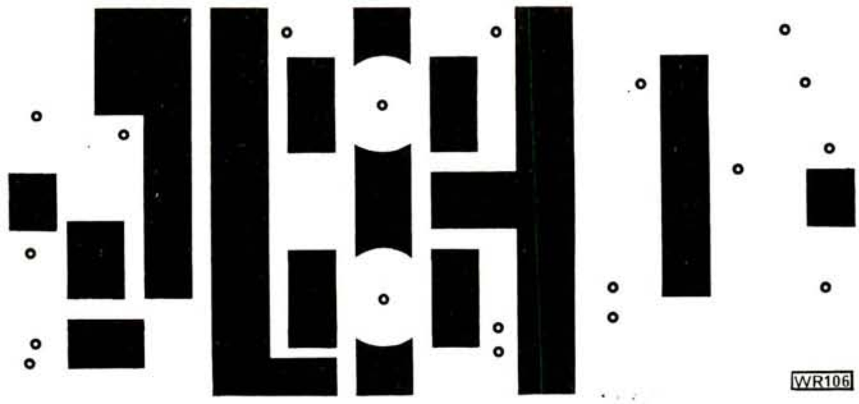
ALL PRICES INCLUDE VAT (15%) AND FREE DELIVERY UK.

**Send large SAE for further details of this and other equipment – or use our Answerphone after hours.**

## Western Electronics (UK) Ltd

**HEAD OFFICE (All Mail/Enquiries)**
**FAIRFIELD ESTATE**
**LOUTH, LINCS, LN11 0JH**
**Tel: Louth (0507) 604955/6/7**

ACCESS
VISA
H.P.



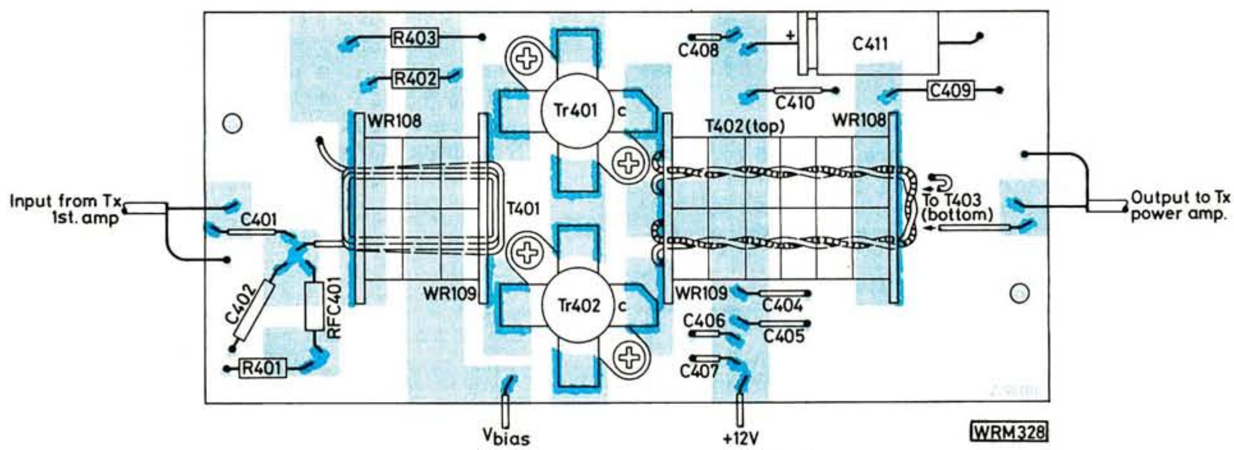



**Fig. 14 (top): Full-size p.c.b. copper track pattern for the driver amplifier. Fig. 15 (above): Shows the component layout of the driver amplifier. Note the components are on the copper track side of the board and that the other side is a copper ground plane**

## ★ components

**DRIVER AMPLIFIER**

| | | |
|---|---|---|
| **Resistors** | | |
| *½W, 5% Carbon* | | |
| 1Ω | 2 | R402,403 |
| 56Ω | 1 | R401 |
| **Capacitors** | | |
| *Disc Ceramic* | | |
| 1nF | 4 | C403,406,407,408 |
| 10nF | 3 | C401,404,405 |
| 0·1μF | 2 | C409,410 |
| *Silvered Mica* | | |
| 56pF | 1 | C402 |
| *Electrolytic, Axial* | | |
| 25μF 25V | 1 | C411 |
| **Inductors** | | |
| 2·2μH | 1 | RFC401 |
| **Semiconductors** | | |
| *Transistors* | | |
| PT9795 (TRW) | 2 | Tr401,402 |

**Miscellaneous**
Transformer end cheeks (2 sets); Brass tube 4·8mm dia. × 200mm long; CN-20 Type C-1-2 ferrites 4·8mm i.d. × 9·7mm o.d. × 4·8mm long (30); p.c.b.; Heatsink (see text).

sink. The orientation of the two transistors must be noted and the four tabs carefully soldered to the appropriate pads on the p.c.b. ensuring that no strain is placed on the transistors (Fig. 16). The transistors themselves can now be used to mark out the positions of the fixing holes to be drilled in the heatsink for mounting the transistor bodies.

Care should be taken to follow closely the layout of components shown in Fig. 15 and all component leads should be as short as is practical. The reader is recommended to study this month's *Constructors' Sketchbook* on page 56 where he will find more details on this form of construction.

## Transformers

The transformers are constructed around two small p.c.b.s which form the end cheeks and are connected together by two lengths of brass tube which are loaded with the appropriate number of ferrite cores and then soldered to the copper pads on the end cheeks. The wire is then wound through the brass tubes and soldered to the appropriate pad or ground plane as shown in Fig. 15. T401 is shorter than T402 and T403, and has only two brass tubes. T402 and T403 are constructed on one pair of end cheeks with T402 being wound on the upper set of brass tubes. When the transformers have been wound the end cheeks can be soldered directly to the p.c.b. pads as shown in Fig. 15.

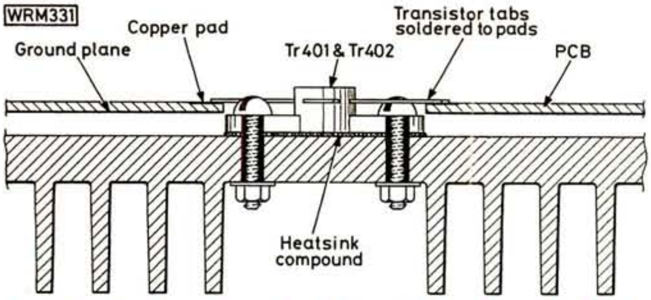



**Fig. 16: Section through the heatsink and p.c.b. of the driver amplifier showing the mounting details of the transistors Tr401,402. Extra support for the p.c.b. should be added using 6BA screws and washers**


**Fig. 17: The end cheeks of the transformers. One of each of the p.c.b.s shown here are required for each transformer. The brass tubes must be soldered to the copper pads which are on the outer ends of the transformers. The material is 3mm copper-clad board**

**Transformer winding details**

| | |
|---|---|
| T401 | Secondary is one turn centre tapped consisting of two lengths of brass tube 4·8mm o.d. × 20·3mm long. Primary is 4T 20 s.w.g. enamelled copper wire. |
| T402 | Twisted pair of pvc covered 7/0·2mm stranded wires twisted at about one twist per mm passed through the top pair of brass tubes. |
| T403 | As T401 but brass tubes are 35mm long. Secondary 3T 20 s.w.g. enamelled copper wire. |

# ★ components

**BIAS SUPPLY REGULATORS**

| | | |
|---|---|---|
| **Resistors** | | |
| *¼W, 5% Carbon* | | |
| 220Ω | 1 | R802 |
| *Cermet trimmer side adjusting* | | |
| 100Ω | 1 | R801 |
| **Capacitors** | | |
| *Disc Ceramic* | | |
| 0·1µF | 1 | C801 |
| *Feed-through* | | |
| 1nF | 1 | C803 |
| *Tantalum bead* | | |
| 1µF 35V | 1 | C802 |
| **Semiconductors** | | |
| *Integrated Circuit* | | |
| 317K | 1 | IC801 |

**Miscellaneous**
Aluminium sheet (16 s.w.g.) for heatsink; Insulating kit for IC801; p.c.b.; 6BA screws, nuts and washers.

## Bias Supply

The driver amplifier and the final p.a. both require a fully stabilised bias supply to set the working conditions of each amplifier. Both bias supplies use basically the same circuit and mechanical design, only component values change as required to set the different bias voltages needed.

The circuit design chosen is very simple and uses a standard 317K variable voltage i.c. regulator capable of operating between 1·25V and 37V at up to 1·5A. The circuit is shown in Fig. 18 and it can be seen that R801 sets the output voltage. The i.c. is fully short-circuit protected.

The output voltage is set by varying R801 and is governed by the formula $V_{out} = 1{\cdot}25(1 + R801/R802)$. With R801 adjustable between 0Ω and 100Ω the output voltage can be varied from 1·25V to about 1·8V.

Each regulator is built on a simple p.c.b. with the copper track pattern on the component side as shown in Fig. 19. The i.c. is mounted on the heatsink, using an insulating kit and heatsink compound to ensure good thermal contact. The heatsink is a plain sheet of aluminium alloy about 16 s.w.g. and folded into a "U" shape. All the other components are mounted onto the p.c.b. pads as shown in Fig. 19 ensuring that all leads are kept as short as possible.

*continued on page 66* ▶▶▶

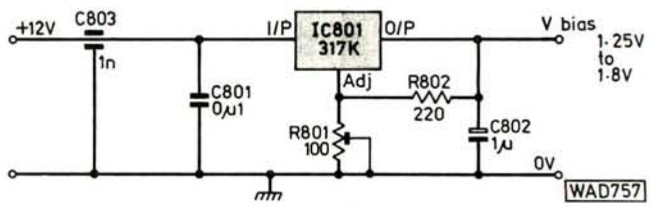
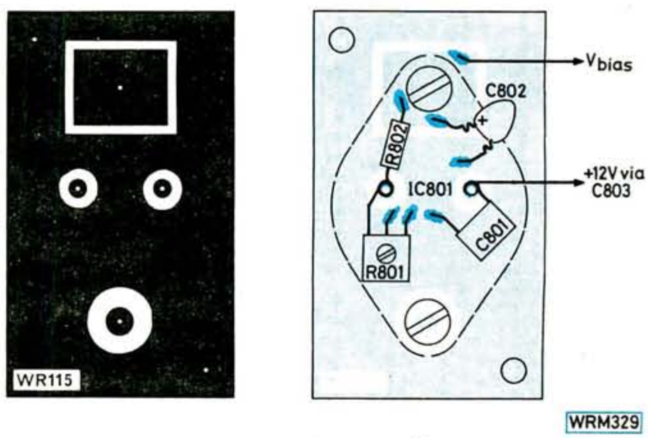



**Fig. 18: The circuit diagram of the two bias regulators**



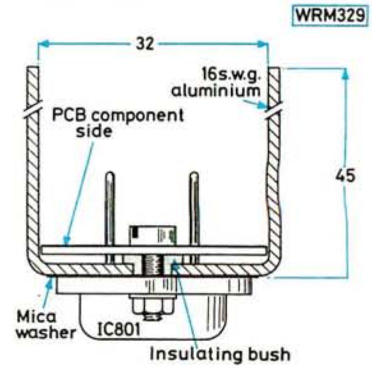




**Fig. 19: Details of the construction of the two bias regulators. The p.c.b. is shown full size**

# Next month in PW

**FREE**

## FREQUENCY ALLOCATION CHART

**NEW BANDS FROM WARC '79**

# antenna special

featuring:~

## Active Receiving Antenna

## Delta Beams for 10 & 15m

## Q Multiplier and Spiral Loop Antenna

**ON SALE 6 FEB**

# PW morse tutor


Ian HICKMAN

The Commodore PET personal computer is a versatile beast and can be programmed to do all sorts of things, from abstruse mathematical or financial calculations to playing "RHINO" and a host of other computer games. Playing "RHINO" in particular (or one of its derivatives) is known to be habit-forming and as part of an effort to break the addiction Geoff Howells decided to write a program for a "computer game" which was not only fun to play but useful to boot. The result was "MORSE TEST", a "BASIC" program which runs on a PET and resides on cassette. The PET was slightly modified to include a bleeper, controlled by one bit of the INPUT/OUTPUT port but apart from this it is an entirely standard instrument.

In use, having loaded the program, the v.d.u. "visual display unit" displays the program title: "MORSE TEST" and on the next line "SPEED WORDS PER MINUTE?" It then waits for you to key in whatever rate you want to try your hand at, e.g., "12" if you wish to see if you stand any chance in the amateur licence Morse Test, displays your selected speed and on the next line "NUMBER OF CHARACTERS?" Again it waits for you to key in your requirement, for example "5", as the Morse Test consists of groups of five characters at 12 w.p.m. The machine then causes the bleeper to emit the chosen number of characters (randomly chosen) at the selected speed and waits for you to key in what you thought they were. Suppose you key in "SETLY", but got one wrong; having received the correct number of key entries the machine would then, for example, display "MESSAGE WAS SETPY YOUR SCORE WAS 80%".

This program caused a good deal of interest and one of our colleagues demonstrated his skill by reading 10 characters on the trot at 25 w.p.m. four times over with 100 per cent success each time. This is more testing than a real Morse message, as the characters are truly random, whereas in real test there is redun-ancy to -elp yo- guess any letter-s you mis-ed. At this point our colleague retired gracefully (beads of perspiration on his forehead) on the grounds that discretion is the better part of valour—always give up while you are still winning!

As a Morse tutor, the program was a great success, but not everyone owns, or has access to, a PET; particularly one with a special built-in bleeper! So it was that one lunchtime the authors found themselves discussing a special purpose Morse tutor, designed to do nothing else and costing only a tiny fraction of the price of a PET. Both the design of the electronics and the ergonomics were discussed; an important feature was to be some sort of feed-

**CONSTRUCTION RATING** **INTERMEDIATE**

**BUYING GUIDE**

Most of the components required are available from regular supply sources. A full kit of parts will be available from A. Marshall (London) Limited, including the ready programmed PROM. The case featured in this article is a Type NK 103 manufactured by Newrad. The data listing for the PROM is available from our editorial offices, price 50p.

**APPROXIMATE COST** **£39**

back to enable the user to check his accuracy. Cost ruled out a decoding system and alpha-numeric display, and displaying the dots and dashes which had been sent on a string of l.e.d.s seemed crude and cumbersome. In the end it was decided that the machine would provide a "NEW CHARACTER" push-button, which on being depressed and released would send a randomly chosen character at a rate set by a "DOT RATE" knob on the front panel. The user would then decide what the letter was and verify his decision with reference to a "Morse to English" dictionary, shown below.

The feedback is provided in the form of a "REPEAT" button, which will cause the last new character to be repeated as often as is necessary; if need be the dot rate can be reduced as well. For more advanced learners, another pushbutton causes a group of five random characters to be sent. The novel feature here is that another front panel knob, "BETWEEN-CHARACTER PAUSE", can be set to provide any between letter gap from the correct spacing of one dash, up to a second or so, although the characters themselves are still sent at the speed selected by the "DOT RATE" knob. The characters are sounded by a small loudspeaker behind the front panel, or alternatively this can be cut out by inserting the jack of a standard pair of low impedance stereo headphones, enabling the user to learn Morse in the comfort of the lounge whilst the rest of the family watch television.

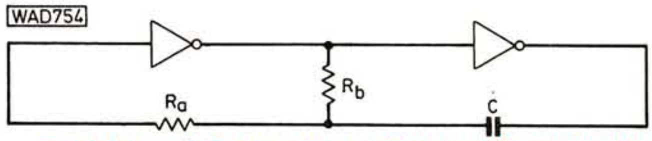
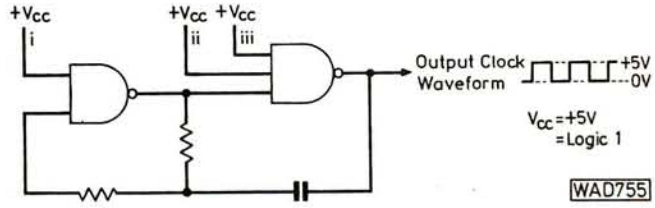



**Fig. 1 (above): Basic c.m.o.s. squarewave generator**

**Fig. 2: Gated c.m.o.s. clock generator using NAND gates**




## Circuit Description

Fig. 3 shows the full circuit diagram of the *PW* Morse Tutor, and in fact it is not as fearsomely complicated as may appear at first glance. The heart of the system is IC6, a 246 × 4 bit "PROM" (programmable read-only memory). Refer to buying guide block for details. The PROM, has eight "address lines", pins 1 to 7 and pin 15. These are connected to the outputs of an 8-bit binary counter consisting of IC7 and IC8. When these are at a count of zero, i.e., 0000 0000, the four outputs on pins 9, 10, 11 and 12 of the PROM are 0,1,0,1, reading from m.s.b. (most significant bit) to l.s.b. (least significant bit). When the 8-bit binary counter addresses location 1, i.e., its outputs are 0000 0001, the four PROM outputs are 1,0,1,0, and so on up to address 255, i.e., 1111 1111, when the outputs are again as it happens 1,0,1,0. If the counter continually cycled sequentially through the addresses, the letters of the alphabet would all appear in sequence at pin 9 of the PROM as can be seen by reading down from m.s.b. column of Fig. 3, where a 1 indicates presence of tone for one dot period and a 0 represents silence. Each character would be separated from the next by one dot period, this period being marked by a 1 on pin 10. Thus between the first two 1s in the pin 10 column we have in the m.s.b. column (pin 9) 010111 read out on the first six consecutive clock pulses. These are fed via S5b to IC9b, which gates the tone produced by free-running oscillator IC9a to the loudspeaker only when a 1 is present at pin 10. Thus in the above instance the loudspeaker would sound a dot followed by a dash, i.e., "A" in Morse.

The gap between dots and dashes of an individual character should equal one dot period and a dash should equal 3 dot periods. The method just described of producing Morse characters from a clocked PROM ensures these

## THE MORSE CODE AND SOUND EQUIVALENTS

**Alphabet**

| | | | | | |
|---|---|---|---|---|---|
| A | ·– | di-dah | N | –· | dah-dit |
| B | –··· | dah-di-di-dit | O | ––– | dah-dah-dah |
| C | –·–· | dah-di-dah-dit | P | ·––· | di-dah-dah-dit |
| D | –·· | dah-di-dit | Q | ––·– | dah-dah-di-dah |
| E | · | dit | R | ·–· | di-dah-dit |
| F | ··–· | di-di-dah-dit | S | ··· | di-di-dit |
| G | ––· | dah-dah-dit | T | – | dah |
| H | ···· | di-di-di-dit | U | ··– | di-di-dah |
| I | ·· | di-dit | V | ···– | di-di-di-dah |
| J | ·––– | di-dah-dah-dah | W | ·–– | di-dah-dah |
| K | –·– | dah-di-dah | X | –··– | dah-di-di-dah |
| L | ·–·· | di-dah-di-dit | Y | –·–– | dah-di-dah-dah |
| M | –– | dah-dah | Z | ––·· | dah-dah-di-dit |

**Numerals**

| | | | | | |
|---|---|---|---|---|---|
| 1 | ·–––– | di-dah-dah-dah-dah | 6 | –···· | dah-di-di-di-dit |
| 2 | ··––– | di-di-dah-dah-dah | 7 | ––··· | dah-dah-di-di-dit |
| 3 | ···–– | di-di-di-dah-dah | 8 | –––·· | dah-dah-dah-di-dit |
| 4 | ····– | di-di-di-di-dah | 9 | ––––· | dah-dah-dah-dah-dit |
| 5 | ····· | di-di-di-di-dit | 0 | ––––– | dah-dah-dah-dah-dah |

**Punctuation**

| | | |
|---|---|---|
| Full stop (.) | ·–·–·– | di-dah-di-dah-di-dah |
| Comma (,) | ––··–– | dah-dah-di-di-dah-dah |
| Question mark (?) | ··––·· | di-di-dah-dah-di-dit |
| Fraction bar or solidus | –··–· | dah-di-di-dah-dit |
| Double hyphen (=) | –···– | dah-di-di-di-dah |
| End of transmission | ·–·–· | di-dah-di-dah-dit |
| Error | ········ | di-di-di-di-di-di-di-dit |

**Spacing and Length of Signals**

1. A dash is equal to three dots.
2. The space between the signals which form a letter is equal to one dot.
3. The space between two letters is equal to three dots.
4. The space between two words is equal to five dots.

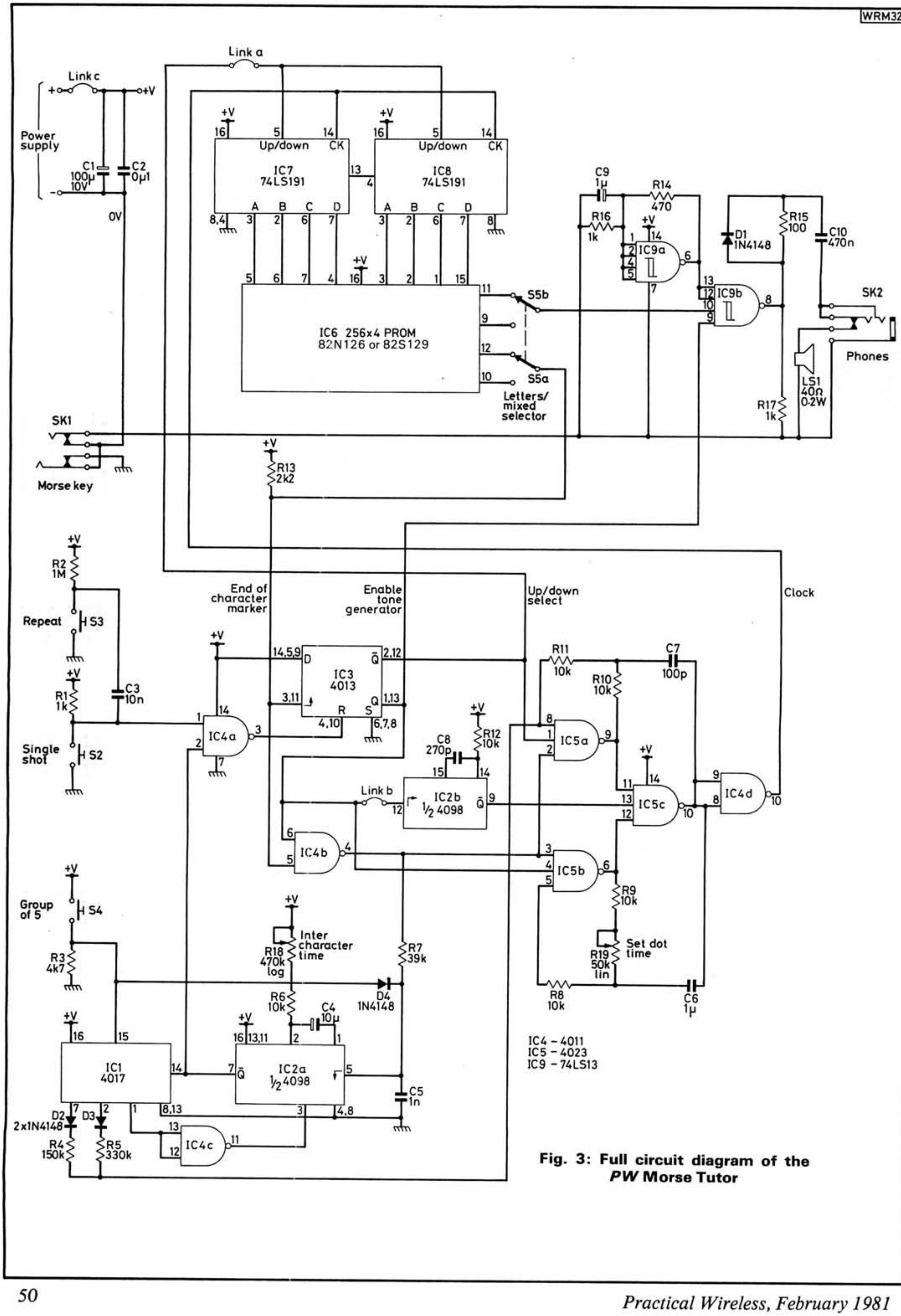



**Fig. 3: Full circuit diagram of the *PW* Morse Tutor**

criteria are met exactly. The gap between successive characters in a real Morse message should equal one dash (i.e., three dot) periods, but in the *PW* Morse Tutor this gap is adjustable, as will be seen later.

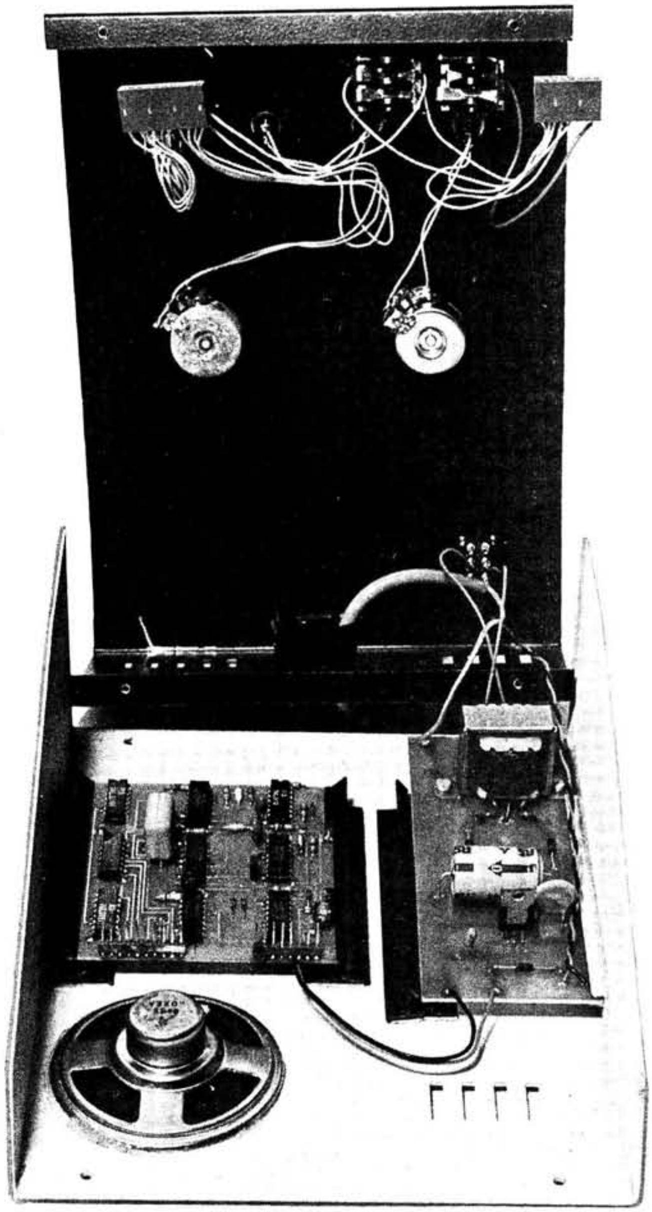
The clock waveform to drive the 8-bit binary counter IC7 and IC8 is derived from a free-running c.m.o.s. squarewave generator basically identical to the well-known circuit of Fig. 2a. This consists of two inverters with local negative feedback via Ra and Rb round one, and a positive feedback loop via C and Ra round the pair. By using a NAND gate(s) for either (or both) inverter(s) as in Fig. 2b, the oscillator will only run when all the various enable inputs are "high", i.e., at logic 1.

There are two such oscillators in the full circuit of Fig. 3, namely IC5a and IC5c, and IC5b again with IC5c. The first, when enabled, runs at about 80kHz (IC5a plus IC5c) whilst the second—the dot rate generator—when enabled runs at 3Hz to 18Hz, the exact frequency being adjustable by means of R19. This corresponds to a Morse transmission rate of about 6 to 32 words per minute.

When the instrument is switched on but not sending a character, neither clock oscillator is running, and the counters IC7 and IC8 are at a count such as 0000 1001, i.e., 6 in decimal notation, such that there is a 1 at pin 10 of the PROM.

The D type flip-flop IC3a and b (the two halves of the circuit are connected in parallel to provide extra drive capability) is normally in the SET condition, so the Q output is high. Thus with both inputs to two-input NAND gate IC4b high, its output is low, disabling both the fast- and slow- (dot rate) clock generators at pins 2 and 3 of IC5a and b respectively. Note that as the Q output of IC3 goes to pin 4 of IC5b whilst the $\overline{Q}$ output goes to pin 1 of IC5a, under no circumstances can both fast and slow clock oscillators be enabled simultaneously.

Monostable IC2a is only used when sending groups of five characters, its $\overline{Q}$ output is therefore normally at logic 1 and so IC4a output sits at logic 0 as both its input pins are at logic 1. When the "SINGLE" button S2 is pressed, pin 1 of IC4a is grounded, so its output resets IC3, setting the latter's Q output to 0 and its $\overline{Q}$ output to 1. This causes IC4b's output to enable pin 2 of IC5a and also pin 3 of IC5b, but the slow clock generator cannot run because the zero Q output has disabled pin 4. However pin 1 of IC5a is also enabled by the $\overline{Q}$ output, so the fast clock generator runs for as long as S2 is depressed, clocking counters IC7 and IC8. These count down due to the 1 on their up/down inputs from $\overline{Q}$ of IC3. Thus if the counter had been sitting at binary address 0000 0110 (6 in decimal) it will count through addresses 5,4,3,2,1,255,254—etc., as long as S2 is pressed. Even if S2 is given a quick jab, this is unlikely to be less than a tenth of a second—about 8000 clock pulses or 30 times round the whole PROM. The reset input at pins 4, 10 of IC3 is an over-riding input, so that although a stream of 1s from IC6 pin 10 (the "letters end of character" bit of each 4-bit nibble output from the PROM) will appear at the clock input of IC3, they will have no effect. However, as soon as S2 is released, the next 1 from pin 10 of the PROM appearing at the clock inputs of IC3 will set it, as a 1 is permanently applied at the D inputs (pins 5 and 9). Thus with a 1 at the Q output of IC3 and also at pin 5 of IC4b, the latter's output will be a 0 disabling both clock generators. In addition, the 0 which has appeared at the $\overline{Q}$ output of IC3 will disable pin 1 of IC5a and set the counters IC7 and 8 to up counting. So the whole system is now locked up, since even though the Q output of IC3 has enabled pin 4 of IC5b, IC4b output is low—but, the rising edge of IC3's Q output triggered monostable IC2b. This puts a temporary 0 on pin 13 of IC5c, whose other two inputs are both high. At the end of this short period pin 13 of IC5c is again at 1, giving a 0 at its output and a 1 at IC4d



output. This clocks the counter address on by one count (now of course counting UP), thus stepping off the address which gave a 1 on the letters end of character output pin 10 of the PROM. IC4b pin 5 therefore falls to 0 enabling pin 3 of IC5b and the dot rate generator runs. It does so at the speed selected by R19, causing IC7 and 8 to count up until the next end of character 1 appears at pin 10 of the PROM, setting IC4b pin 5 high and stopping the dot rate clock generator. This time of course, IC3 being already set, there was no Q output rising edge to trigger monostable IC2b so the system is now back in its quiescent condition with both clock generators disabled, having read a Morse character out of pin 9 of the PROM.

Pressing the repeat button S3 causes exactly the same sequence of events to be followed, but with one important difference. The differentiating action of C3,R1 is equivalent to pressing S2 for a couple of microseconds—rather difficult to do manually—so that although IC3 is reset (setting the counters to count down), the fast clock generator is only enabled for one or two clock periods before the reset at pins 4, 10 of IC3 is removed. The counter will therefore count back to the immediately previous 1 at pin 10 of the PROM, when the normal sequence of events already described will continue, resulting in the last new character selected being repeated.

The "GROUPS" button, S4, works as follows: IC1 is a decimal counter with ten decoded outputs. Its quiescent condition is at the count of 5, i.e., a 1 output at pin 1. This is inverted by IC4c, the resultant 0 at pin 3 of the between character pause monostable IC2a preventing it from triggering. In the quiescent condition, IC4b output is low and therefore so is the negative edge trigger input pin of IC2a. On pressing S4, IC1 is reset to zero, so the decoded output "5" at pin 1 falls to 0, enabling IC2a, whilst the diode D4 rapidly charges C5, putting a 1 on pin 5. On releasing S4, C5 discharges via R7 (remember IC4b output is at 0) and the resultant negative edge is fast enough to trigger IC2a. The $\overline{Q}$ output of IC2a therefore falls to 0 for a period controlled by C4 and the setting of between

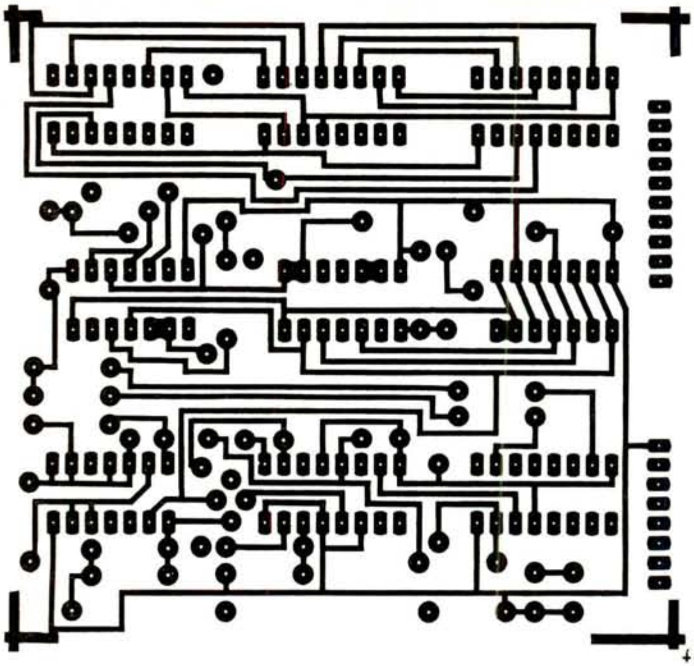


**Fig. 4 (above): Track pattern of the underside of the main p.c.b. shown full size. Note that holes are *not* plated through**

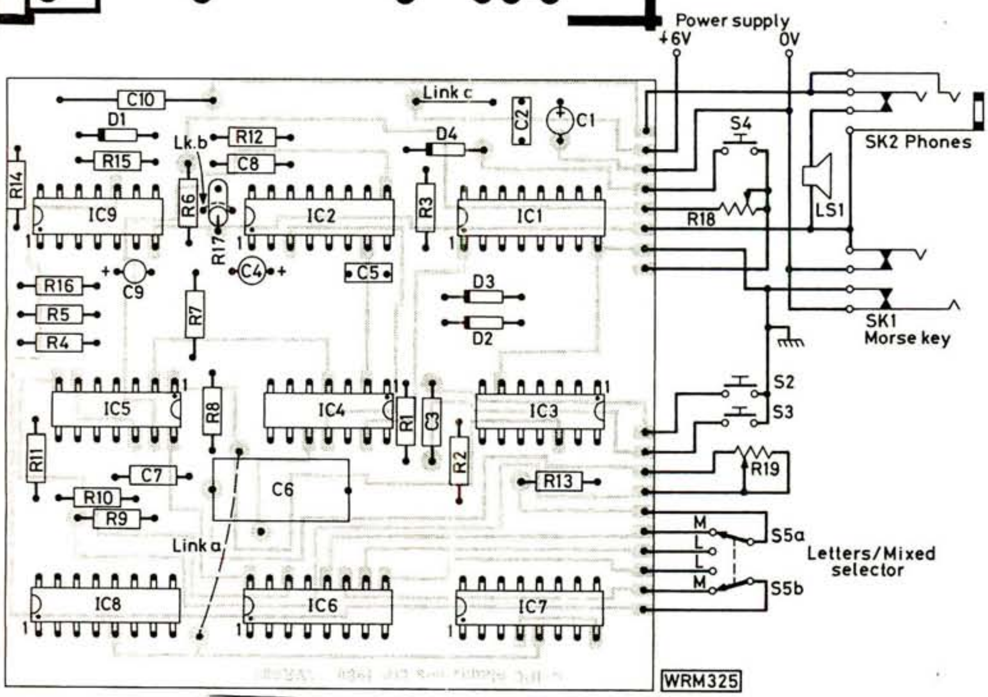



**Fig. 5: Component locations and connections to controls**

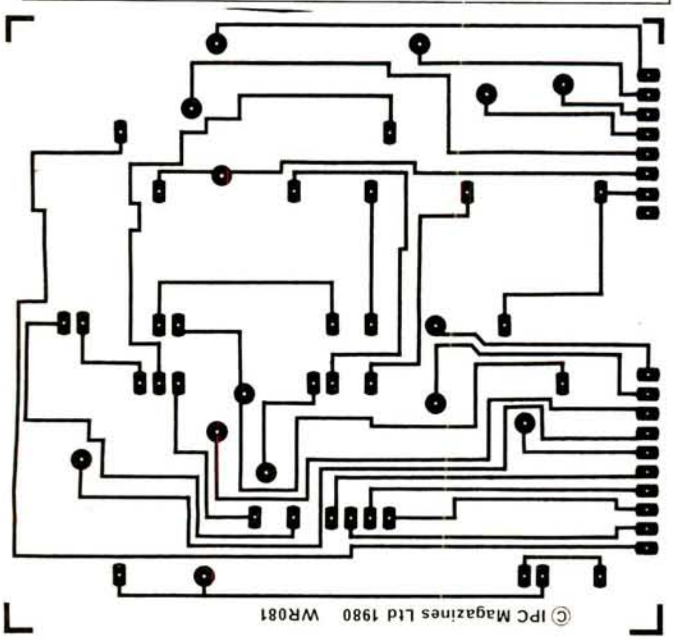


**Fig. 6 (below): Track pattern of the component side of the p.c.b.**

character pause (b.c.p.) control R18, and this has exactly the same effect as pressing the "SINGLE" button S2, generating a Morse character as previously described.

During the period when the fast clock generator is running, IC3 Q output will be at 0 and therefore IC4b output at 1. C5 will therefore charge up via R7. During the change from fast to slow clock generator operation, IC4b will momentarily (i.e., for the duration of IC2b's negative going output pulse) return to zero, but so briefly that C5 will not discharge to a level at which IC2a retriggers. However at the end of transmission of the first character of the group of five, IC4b's output will fall to 0 and stay there. This will retrigger IC2a, causing a re-run of the above sequence, and this will occur five times in all. On each occasion, IC1 will advance one count, until a 1 appears at the decoded 5 output (pin 1) which inhibits IC2a, terminating the sequence.

When set to minimum b.c.p., as for example when sending groups of five at a fast rate, there would be a tendency to repeat long characters. This is because the fast clock generator speed is quite stable, and the same goes for the period of IC2a. Therefore, depending on the particular setting of b.c.p. control R18, we could have the situation where each time the number of fast clock pulses generated equals an equal multiple of 256 (or nearly so), finishing up with the same character being repeated. This is clearly more likely with a long character like Q than a short one like E. It is impossible to prevent repeats entirely, but unless something were done, the same letter could be sent five times over! So the decoded 1 and 3 outputs of IC1 at pins 2 and 7 respectively are used to change the speed of the fast clock generator on alternate characters of a group of five, by shunting R4 or R5 across one of the timing resistors at pin 8 of IC5a. There will still be occasional repeated characters.

Setting S5 to the other position selects the other two bits of each PROM output nibble, giving instead of letters, all the numerals, punctuation marks and other assorted characters such as "error", "end of message", etc.

Socket SK1 accepts a $\frac{1}{4}$ inch breakjack plug connection from a Morse key thus permitting the *PW* Morse Tutor to be used for practice in sending Morse. The 0V supply to IC9 pin 7 is separate from all the other i.c.s, which are isolated by the breakjack action of SK1. Thus for sending practice only IC9 is energised, and that only when the key is down.

## Construction

The construction of the *PW* Morse Tutor should present no problems as all components except for the front panel controls, power supply, speaker and sockets SK1 and SK2, are mounted on a single printed circuit board. The speaker is fixed to the bottom of the case with a quick-setting epoxy resin adhesive, and is positioned over the slots already cut in the case.

Before loading components onto any p.c.b. it is good practice to examine it carefully for any possible defects such as cracked track or solder bridge. This is particularly true with a double sided p.c.b. as used in the *PW* Morse Tutor. Take great care when loading the i.c.s to get them in the right way round—note that IC3, 4 and 5 are the other way round from the rest. The same precaution applies to the polarised components, namely the electrolytic capacitors and the diodes.

To keep the cost of building the *PW* Morse Tutor to a minimum, the p.c.b. does **not** use plated through holes. It should therefore be noted which i.c. pins need soldering to pads on the component side of the board instead of (or in some cases as well as) on the reverse of the board. As soldered connections to i.c. pins are required on the component side of the board, conventional i.c. sockets cannot be used.

Some of the i.c.s are c.m.o.s. devices, and most constructors will be aware of the precautions against static electricity which should be observed when handling these devices. It is a good idea to fit them to the board last as the other components will then provide shunt paths on the c.m.o.s. inputs, and of course a soldering iron with an earthed tip is a must. Check that its earth lead is in good order and makes good contact at the mains socket. Constructors are also referred to the hints on handling c.m.o.s. devices given on page 33 of this issue.

## Power Supply

A conventional stabilised power supply capable of giving 5V at 100mA is used for this project and is built on a separate board. If it is thought desirable to be able to use the *PW* Morse Tutor in a car then 12V can be fed into the stabiliser input at the point indicated in Fig. 7.

For those readers who want complete freedom from the mains supply the unit may be powered by four U2 cells in series. Note that in this case Link C must be replaced with a suitable diode (1N4001) to drop the 6V provided by the batteries to nearer the 5V needed for the logic i.c.s the bar of the diode should be away from the battery (i.e., connected to C1 and C2 positive).

## ★ components

| | | |
|---|---|---|
| **Resistors** | | |
| *$\frac{1}{4}$W, 5%* | | |
| 470Ω | 1 | R14 |
| 1kΩ | 2 | R1,16 |
| 2·2kΩ | 1 | R13 |
| 4·7kΩ | 1 | R3 |
| 10kΩ | 6 | R6,8,9,10,11,12 |
| 39kΩ | 1 | R7 |
| 150kΩ | 1 | R4 |
| 330kΩ | 1 | R5 |
| 1MΩ | 1 | R2 |
| **Potentiometers** | | |
| *$\frac{1}{4}$ inch spindle, linear law* | | |
| 50kΩ | 1 | R19 |
| 500kΩ | 1 | R18 |
| **Capacitors** | | |
| *Polystyrene* | | |
| 100pF | 1 | C7 |
| 270pF | 1 | C8 |
| *Ceramic* | | |
| 1nF | 1 | C5 |
| 10nF | 1 | C3 |
| 0·1μF | 1 | C2 |
| 0·47μF | 1 | C10 |
| *Polyester* | | |
| 1μF | 1 | C6 |
| *Tantalum bead* | | |
| 1μF 35V | 1 | C9 |
| 10μF 16V | 1 | C4 |
| 100μF 10V | 1 | C1 |
| **Semiconductors** | | |
| *Integrated circuits* | | |
| 4011 | 1 | IC4 |
| 4013 | 1 | IC3 |
| 4017 | 1 | IC1 |
| 4023 | 1 | IC5 |
| 4098 | 1 | IC2 |
| 74LS13 | 1 | IC9 |
| 74LS191 | 2 | IC7,8 |
| 82N126 or 82S129 | 1 | IC6 |

**Miscellaneous**

Miniature toggle switch d.p.d.t. (2); Miniature push-button switches (3); Speaker 40Ω to 80Ω; $\frac{1}{4}$ inch stereo jack switched; $\frac{1}{4}$ inch mono jack switched; Knobs (2); Case 170 × 220 × 75mm with sloping front (refer to Buying Guide); p.c.b.

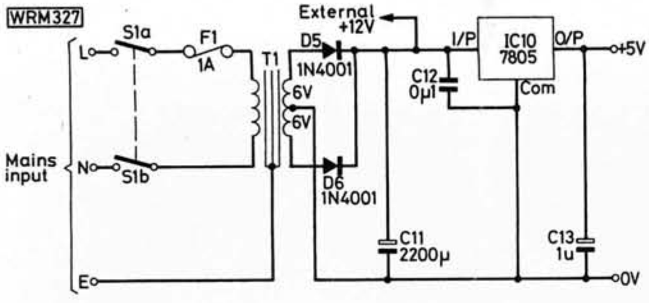



**Fig. 7 (above): Circuit diagram of the optional mains power supply. Dx and Rx are in series across C13**

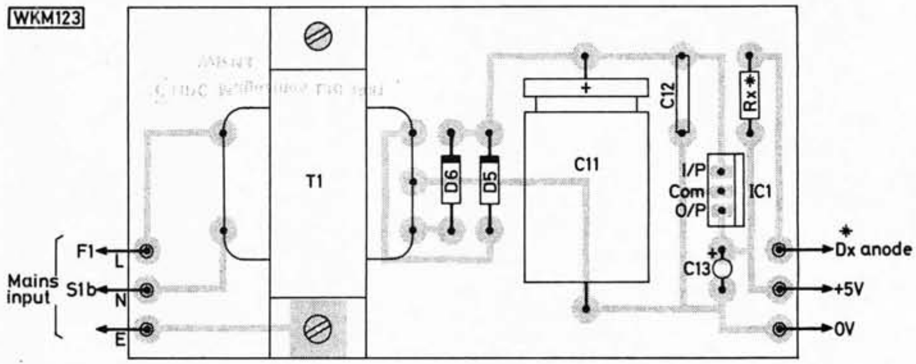



**Fig. 8: Component locations on the p.s.u. board**

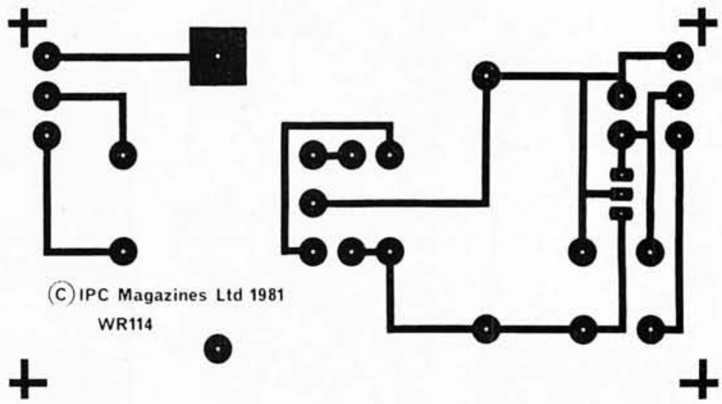



**Fig. 9: Track pattern of the power supply p.c.b. shown full size**

## Testing and Calibration

On completion of construction switch on and measure the current drawn by the circuit. This should be in the region of 100mA. Check that pressing the SINGLE button S2 causes a single character to be sounded and that the REPEAT button S3 works. Check that the DOT RATE control R19 adjusts the dot rate from slow to fast clockwise. Set the CHARACTER SPACE control R18 fully anticlockwise and press the GROUPS button S4. This should result in a group of five characters being sent, with a fair gap between each. Rotating R18 clockwise should reduce this gap but note that if rotated too far, the characters will run on with no gap; in this case R19 must be rotated further clockwise in sympathy.

Finally check that plugging a pair of stereo headphones into SK2 cuts out the internal loudspeaker and sounds via the 'phones instead, and that plugging a Morse key into SK1 enables the instrument to be used as a Morse practice oscillator.

The equipment is now complete and operating and may be used as it is without further ado. However, a nice refinement is to calibrate the controls in terms of words per minute (w.p.m.). To do this, send groups of five characters and adjust the two controls to send Morse at the lowest speed possible subject to the b.c.p. being equal (as best you can estimate) to the correct gap of one dash. Now send groups of five with the gap between groups being approximately two dashes, and time how many groups occupy one minute. This is the w.p.m. rating for that setting of the controls and should be marked on the front panel for *both* controls. Similarly, mark higher w.p.m. settings up to the maximum obtainable. These calibrations will be useful to you as you work up your Morse speed.

## Using the *PW* Morse Tutor

The Tutor will prove of considerable use in learning Morse but to obtain the maximum benefit from it a few important points must be observed.

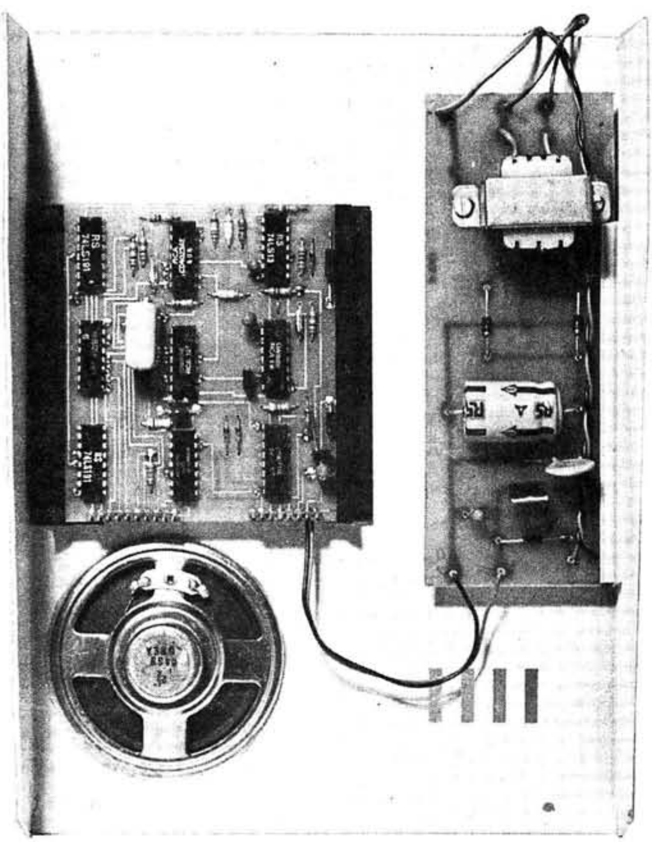
The first stage in learning Morse is to become thoroughly familiar with all the characters and many people will want to start with the letters, moving on to numerals, punctuation marks, etc., afterwards. So select letters with S5, press the SINGLE button and try to identify the random character sounded by the tutor.

Most people know a few Morse letters such as E, S, O, and older readers will of course remember V (for Victory!). If you don't know the letter it can very quickly be located in the "Morse to English" dictionary. It is important to use a fast dot rate from the start, at least corresponding to 12 w.p.m. and in fact it is really no more difficult to learn the individual Morse characters at a 15 w.p.m. dot rate **from the outset.**

If in the early stages you are not quite sure of the pattern of dots and dashes sounded, you can repeat it with the S3 REPEAT button, but on no account get into the habit of

## ★ components

| POWER SUPPLY | | |
|---|---|---|
| **Resistors** | | |
| *¼W, 5%* | | |
| 1·5kΩ | 1 | Rx (to suit l.e.d.) |
| **Capacitors** | | |
| *Disc ceramic* | | |
| 0·1μF | 1 | C12 |
| *Tantalum bead* | | |
| 1μF 35V | 1 | C13 |
| *Electrolytic, axial* | | |
| 2200μF 16V | 1 | C11 |
| **Semiconductors** | | |
| *Diodes* | | |
| 1N4001 | 2 | D5,6 |
| Red l.e.d. | 1 | Dx |
| *Integrated circuits* | | |
| 7805 | 1 | IC10 |
| **Miscellaneous** | | |
| Miniature mains transformer 6–0–6V 1·2VA; p.c.b; Fuseholder and 1A fuse. | | |



**The main control board and p.s.u. located on the cabinet base**

using this regularly; if need be slacken off the dot rate temporarily. The ear very soon adapts to perceiving the dot/dash pattern sounded at a quite surprising speed and only a few hours practice are needed before you know all the characters. It is important however to try and avoid repeating the sound in your mind as an intermediary step to calling up the corresponding letter, as there will not be time to do this when receiving groups of five. (A group of five characters counts as a word as far as w.p.m. ratings go).

## Groups

When you are thoroughly familiar with all the individual characters you can try groups of five. You should already be used to hearing and recognising the individual characters at a dot rate well in excess of that corresponding to 12 w.p.m., but at first you will need the b.c.p considerably longer than it should be. Do not set it so slow that you can get all five characters, better to work under pressure so that you get say two out of five—or three if you're lucky. And you **must** from the outset write the group of five down as you receive it, in cursive, not capitals, with dashes for missed letters.

You will find that the difficulty is not that you don't know the letter corresponding to each sound pattern, but that you cannot dredge it up quickly enough, viz before the next one is upon you. Nevertheless, by this time you really should not need repeats, though the REPEAT button S3 will repeat the last character of a group of five if need be.

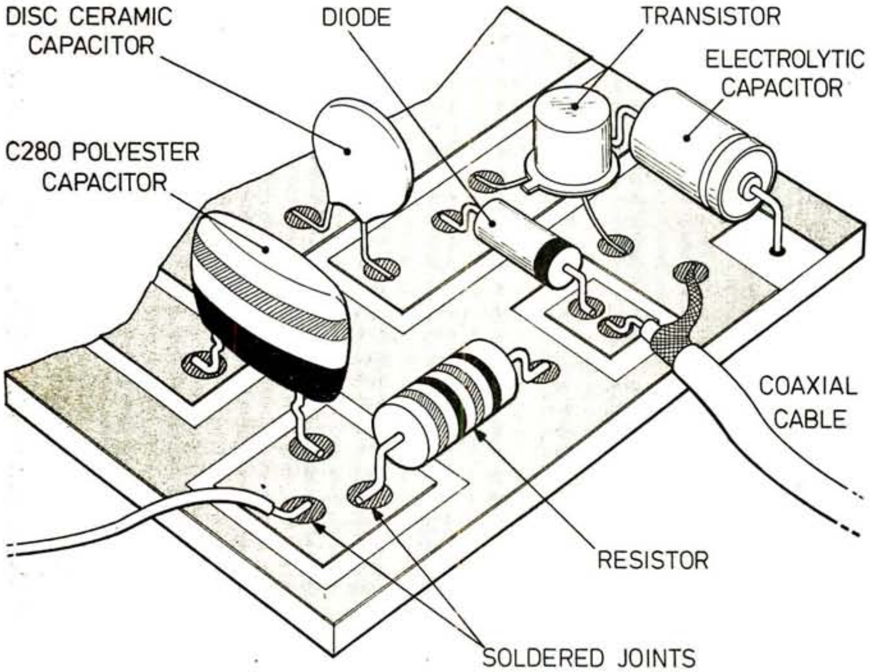
Long sessions on the tutor prove very tiring due to the intense mental activity in trying rapidly to match sound patterns with characters; it is much better to have short sessions often and regularly.

## Perseverence

A few minutes morning and evening and lunchtime as well if possible is the best way. Perseverence is necessary as learning Morse to 12 or 15 w.p.m is not easy, and don't let anyone tell you it is. When you can regularly get three or four characters out of each five it is time to listen in on the amateur bands to "real Morse", as this contains (despite all the abbreviations and contractions) a fair amount of redundancy, whereas the *PW* Morse Tutor's output is entirely random, giving no help at all in this respect. In fact, the *PW* Morse Tutor calibrated as described in w.p.m. ratings, gives rather a pessimistic indication of your Morse reading speed. The reason for this is as follows. The letter E plus its stop bit occupies two adjacent locations in the PROM whereas a longer letter occupies many more, in the case of P for example, 13. Thus the *PW* Morse Tutor sends the more difficult to learn longer characters much more frequently than the short simple ones, a P being $6\frac{1}{2}$ times more probable than an E. This is a handy feature for learning the characters, but of course the Morse alphabet is designed on entirely the opposite principle; in a real message the short characters are in the majority. It is difficult to quantify the difference but it is probably true to say that your real w.p.m. rate will be at least thirty per cent faster that that indicated by the *PW* Morse Tutor calibrated as described.

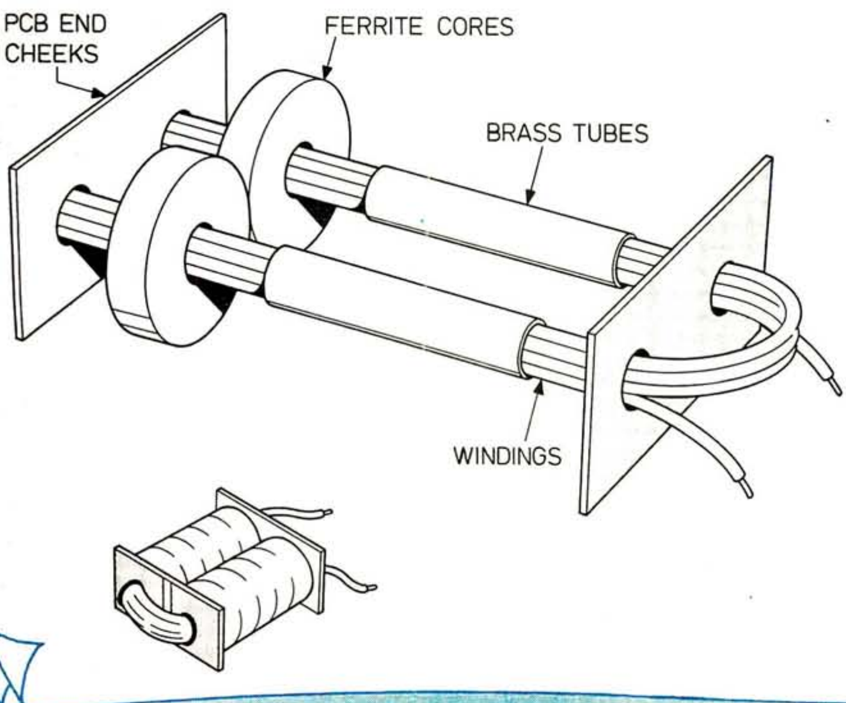
Don't forget also that your *PW* Morse Tutor doubles as a Morse practice oscillator, enabling you to practice sending as well as receiving. ●

# CONSTRUCTOR'S SKETCHBOOK




LAND CONSTRUCTION TECHNIQUES

THE COMPONENTS ARE MOUNTED ON THE COPPER SIDE OF THE PCB. THE LEADS MUST BE AS SHORT AS POSSIBLE AND ARE BENT SO THAT THE COMPONENT SITS NEATLY AS CLOSE TO THE BOARD AS IS PRACTICAL. IN THE *PW HELFORD* A MODIFIED FORM OF THIS CONSTRUCTION IS USED WHERE THE COMPONENTS ARE MOUNTED AS SHOWN BUT A GROUND PLANE COVERS THE UNDERSIDE OF THE BOARD AND THERE IS NO COPPER BETWEEN THE LANDS ON THE COMPONENT SIDE. GROUNDED LEADS PASS THROUGH HOLES IN THE PCB AND ARE SOLDERED TO THE GROUND PLANE ON THE UNDERSIDE.




FERRITE CORE TRANSFORMERS

THESE TRANSFORMERS ARE USED IN THE *PW HELFORD* DRIVER AND P.A. STAGES. THE BRASS TUBES FORM A SINGLE TURN WINDING WHICH IS CENTRE–TAPPED BY SOLDERING THE BRASS TUBES TO THE COPPER CLADDING ON THE UNCUT END CHEEK, AND TERMINATED BY SOLDERING TO THE SEPARATE COPPER PADS ON THE OTHER END CHEEK. THE OTHER WINDINGS ARE WOUND THROUGH THE BRASS TUBES.

WAM029

# NIMBUS

## Modular 2m Transceiver System

## 16-Channel Scanner (Part 9)

Michael TOOLEY BA G8CKT
&
David WHITFIELD BA MSc G8FTB

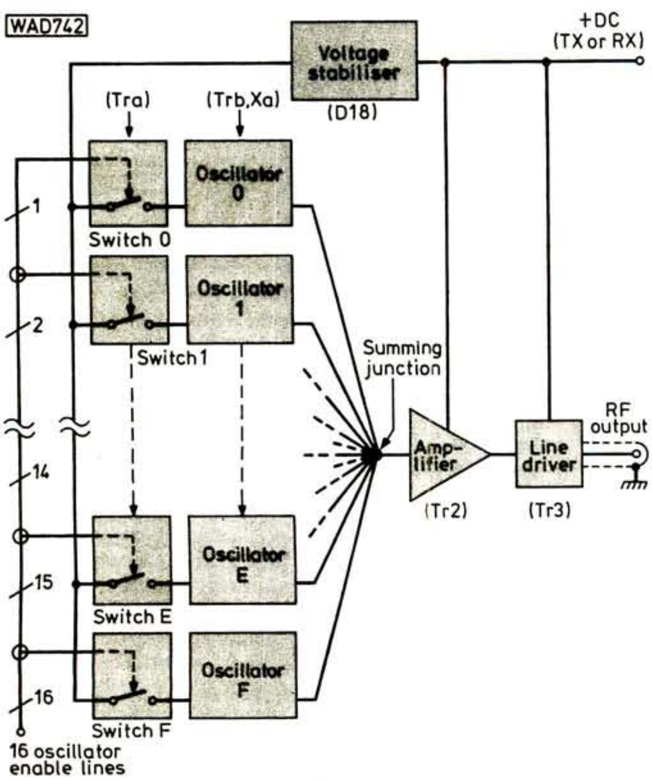
Following the detailed description of the autoscanner control logic we continue this month with the remaining sections and complete constructional information.

### Channel Oscillators

The channel oscillator banks for the transmitter and receiver are both of identical design. A block diagram is shown in Fig. 9. There are 16 electronically switched crystal oscillators whose outputs are summed to give a signal at the frequency of the currently selected channel. This signal is then amplified to compensate for the summing losses and used to drive the coaxial link to the transceiver. The selection of which of the two oscillator banks is active is performed by using the transceiver's receiver and transmitter d.c. supply rails to power the appropriate bank.

The circuit for the summer/amplifier stages, and for one of the channel oscillators is shown in Fig. 10. The d.c. supply to the 16 oscillators is stabilised by R53/D18, and decoupled by C18, C19, C21 and C22. In each oscillator Tra operates as an electronic switch. The open-collector output from the channel selector board is used to drive the ENABLE input, with Ra acting as the collector load for IC17. With the input HIGH, Tra is held "off" and the oscillator is disabled. When the input goes LOW, Tra turns "on". The supply to the oscillator transistor rises to almost the level of the stabilised rail voltage, and oscillation occurs.

The frequency of oscillation is set by Xa, with fine frequency adjustment provided by Ce. The range of adjustment provided by Ca has been found to be adequate for most receiver oscillators and crystals. With some transmitter channels, however, it may be necessary to add a parallel fixed capacitor of around 22pF to adjust the oscillator frequency onto channel.



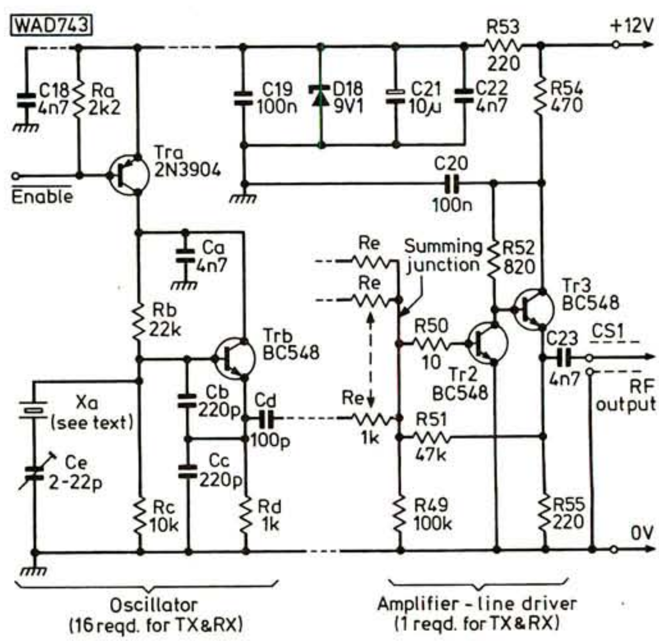




**Fig. 9: Left. Block diagram of the channel oscillators**

**Fig. 10: Above. Channel oscillator circuit diagram**

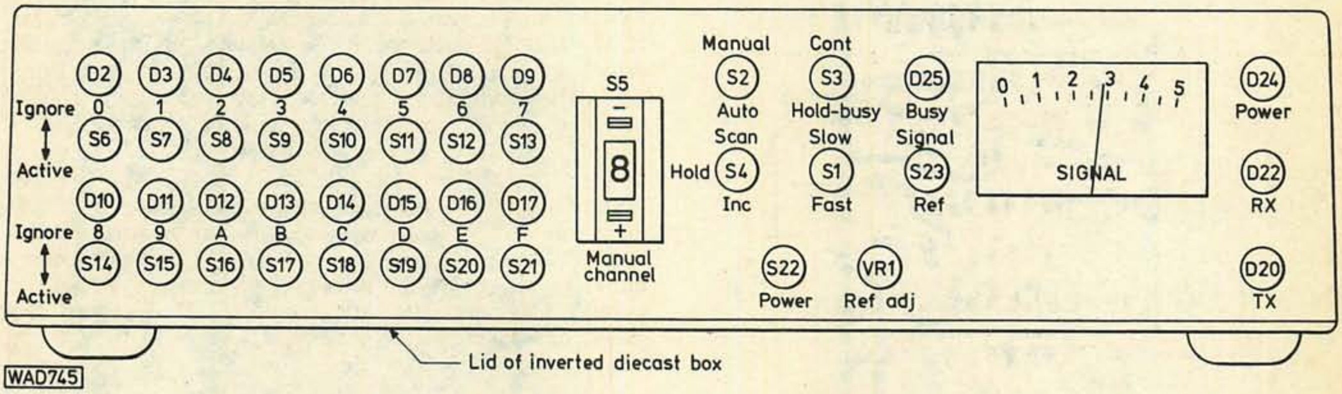
The output from each oscillator, measured at the emitter of Trb, is approximately 500mV r.m.s. This is coupled to the summing junction by Cd/Re. The summing losses are compensated by the gain from the amplifier stage, Tr2. The signal is then buffered by an emitter follower stage, Tr3, and used to drive the coaxial link to the transceiver. The output to the link is typically 500mV r.m.s., at 18MHz, and the output impedance is approximately 33Ω. Current consumption for the oscillator bank is typically 20-30mA at +12·5V.

**Readers who intend to operate the *PW* Nimbus should be in possession of the appropriate licence issued by the Home Office to those who have passed the City and Guilds Radio Amateurs' Examination. Details may be obtained from: The Home Office, Radio Regulatory Department, Amateur Licensing Section, Waterloo Bridge House, Waterloo Road, London SE1 8UA.**

## Power Supplies

The autoscanner requires three d.c. power inputs from the associated transceiver in order to operate. These inputs are from the transmitter, the receiver, and from the main power supply of the transceiver, and are used to power the transmitter oscillator bank, the receiver oscillator bank, and the control logic respectively. If preferred, the supply to the control logic may be provided from an independent source. Typical current consumption figures are 50mA each for the oscillator banks and 500mA for the control logic. It is an inherent design feature of the control system that, if no power is supplied to the control logic, none of the oscillators in either of the two banks can be activated; power supply switch-on sequencing is thus rendered unnecessary.

**Fig. 11: Suggested front panel layout**



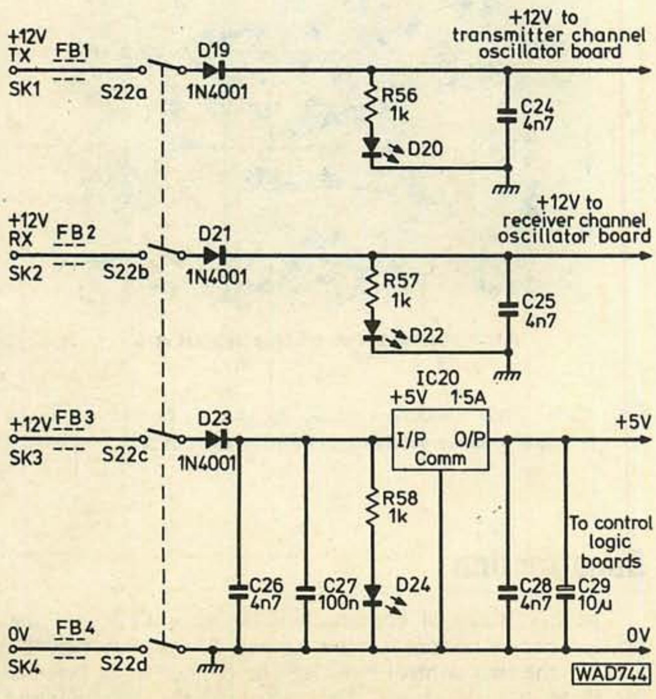




**Fig. 12: Circuit diagram of the autoscanner power supply**

A power supply circuit diagram is shown in Fig. 12 for the Tx/Rx and control logic boards. Power connections are made to 4mm insulated sockets on the rear of the diecast box. Each line is switched by the 4-pole main power switch, S22, and decoupled to r.f. by the ferrite beads and C24/5/6. The diodes D19/21/23 are included for protection against incorrect supply polarity. Each line is monitored by l.e.d. indicators D20/2/4 and the two oscillator banks are then supplied directly. The control logic, however, requires a +5V supply, and this is provided by means of the integrated regulator, IC20. The regulator uses the diecast box as a heatsink. Capacitors C27 and C28 are essential to the operation of IC20. The +5V supply is decoupled by C29, and by the various capacitors distributed along the power rails on the two logic boards.

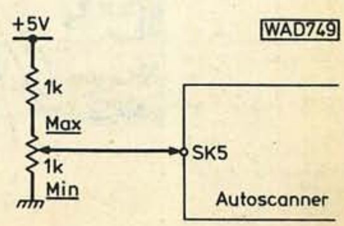
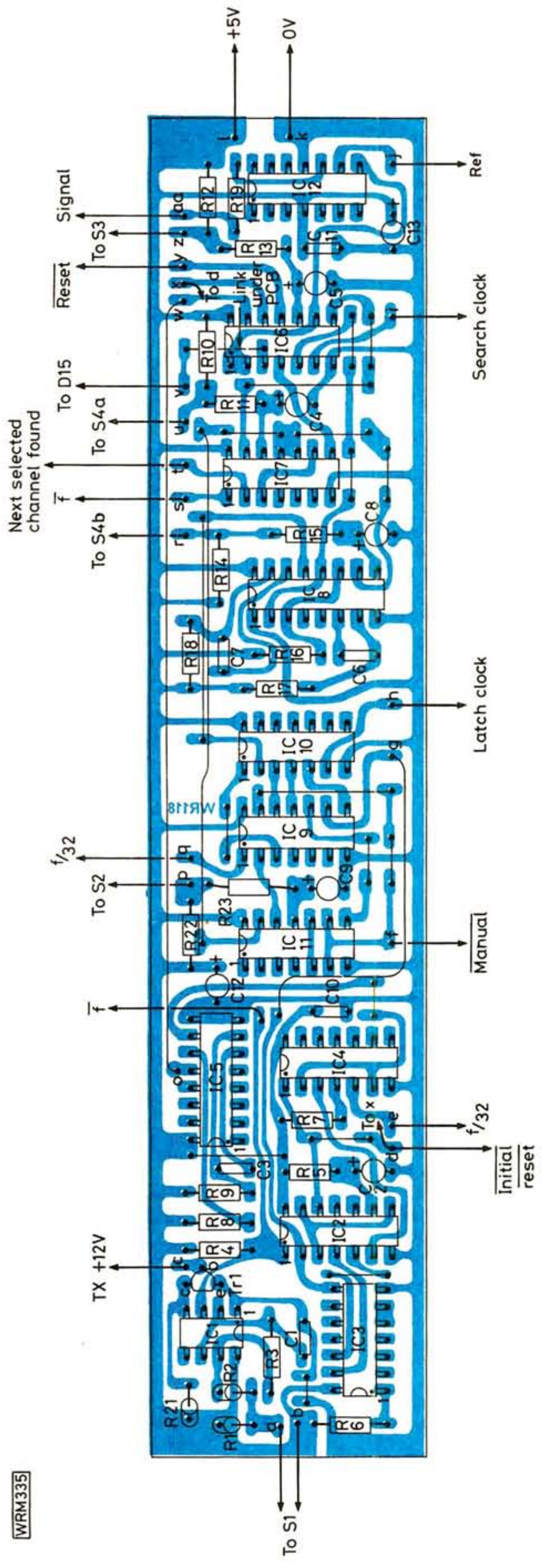
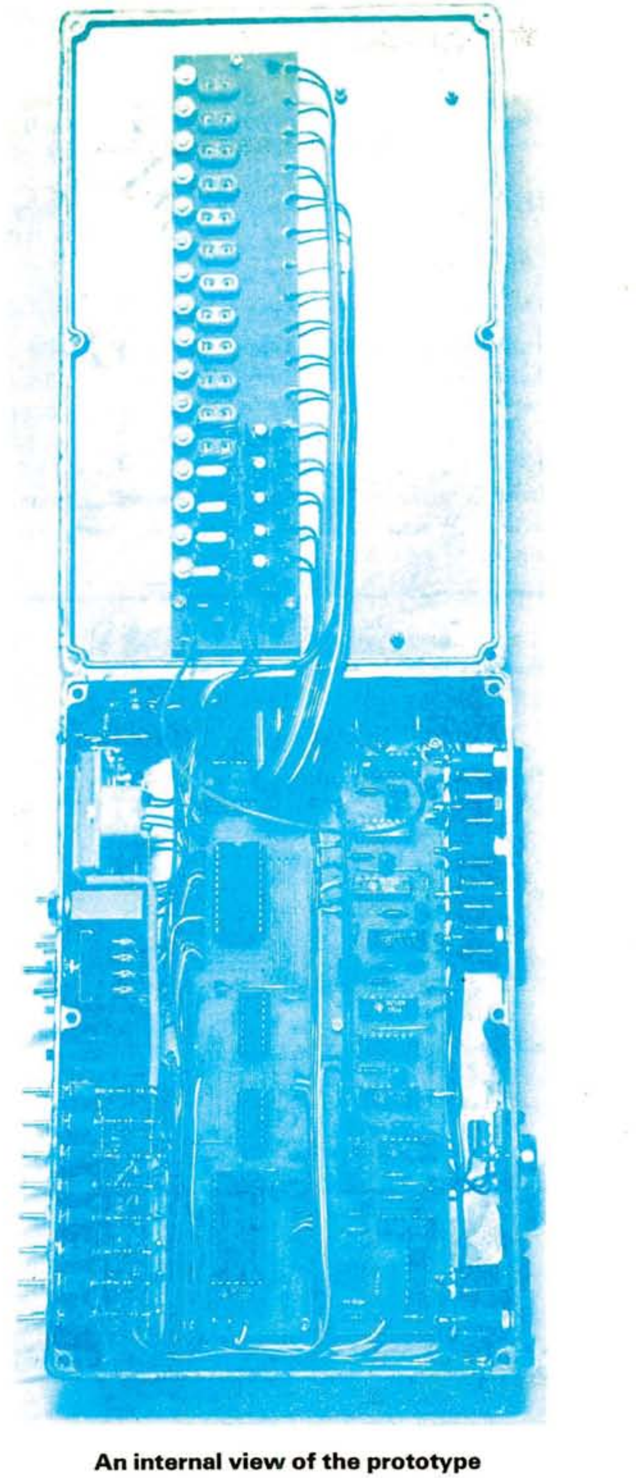



**Fig. 13: Test circuit for the signal strength meter**



**An internal view of the prototype**

**Fig. 14: Left. Component layout of the timing generator and sequencing logic p.c.b.**

## Construction

The first stage of construction is the assembly of the printed circuit boards for the Tx and Rx oscillator banks and for the two control boards. The copper track layouts for these boards should be related to the accompanying component layouts Figs. 14, 15 and 16. Note that the Tx and Rx boards are of identical layout and construction.

### CHANNEL OSCILLATORS

1 set of the following required for each Tx and Rx channel fitted

**Resistors**

*¼W 5% miniature carbon*

| | | |
|---|---|---|
| 1kΩ | 2 | Rd,Re |
| 2·2kΩ | 1 | Ra |
| 10kΩ | 1 | Rc |
| 22kΩ | 1 | Rb |

**Semiconductors**

*Transistors*

| | | |
|---|---|---|
| 2N 3904 | 1 | Tra |
| BC108 | 1 | Trb |

**Capacitors**

*Sub-miniature plate ceramic*

| | | |
|---|---|---|
| 100pF | 1 | Cd |
| 220pF | 2 | Cb,Cc |
| 4·7nF | 1 | Ca |

*Miniature ceramic trimmer (Ambit)*

| | | |
|---|---|---|
| 2pF to 22pF | 1 | Ce |

**Miscellaneous**

HC 25/U crystal (see text); HC 25/U crystal socket p.c.b. mounting.

### LINE DRIVER

1 set of the following required for Tx and Rx boards

**Resistors**

*¼W 5% miniature carbon*

| | | |
|---|---|---|
| 10Ω | 1 | R50 |
| 220Ω | 2 | R53,R55 |
| 470Ω | 1 | R54 |
| 820Ω | 1 | R52 |
| 47kΩ | 1 | R51 |
| 100kΩ | 1 | R49 |

**Semiconductors**

*Transistors*

| | | |
|---|---|---|
| BC548 | 2 | Tr2,Tr3 |

*Diodes*

| | | |
|---|---|---|
| BZY 88C9V1 | 1 | D18 |

**Capacitors**

*Ceramic*

| | | |
|---|---|---|
| 4·7nF | 3 | C18,C22,C23 |

*Polyester*

| | | |
|---|---|---|
| 100nF | 2 | C19,C20 |

*Tantalum bead*

| | | |
|---|---|---|
| 10μF 15V | 1 | C21 |

**Miscellaneous**

Printed Circuit Boards (2); 0·040 Veropins; Coaxial socket (1).

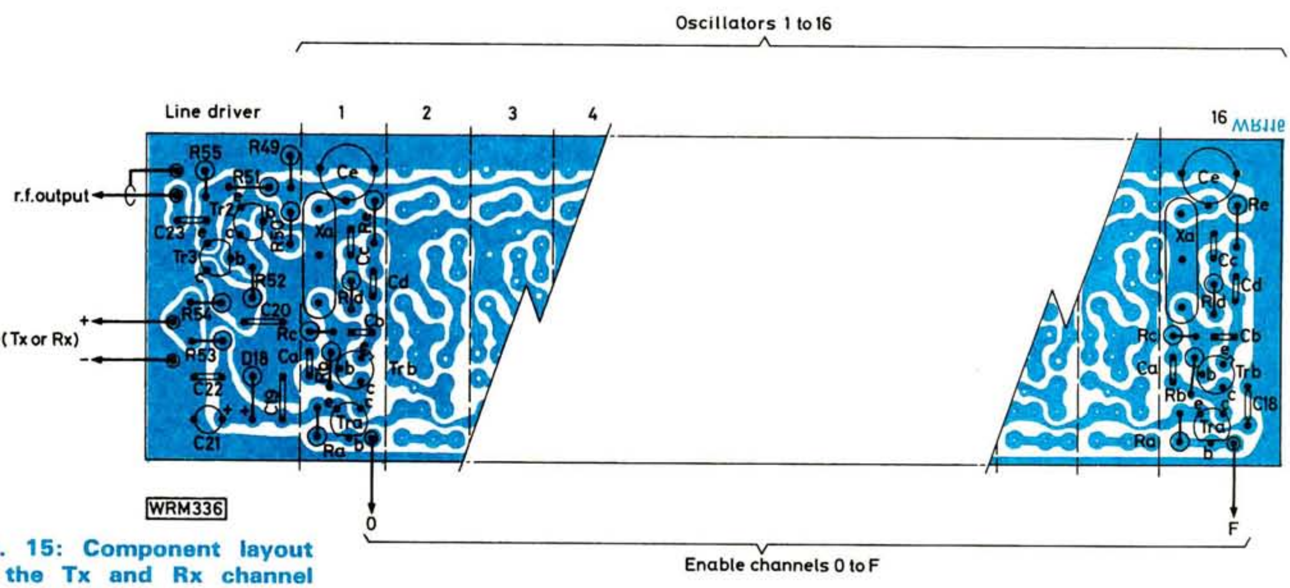
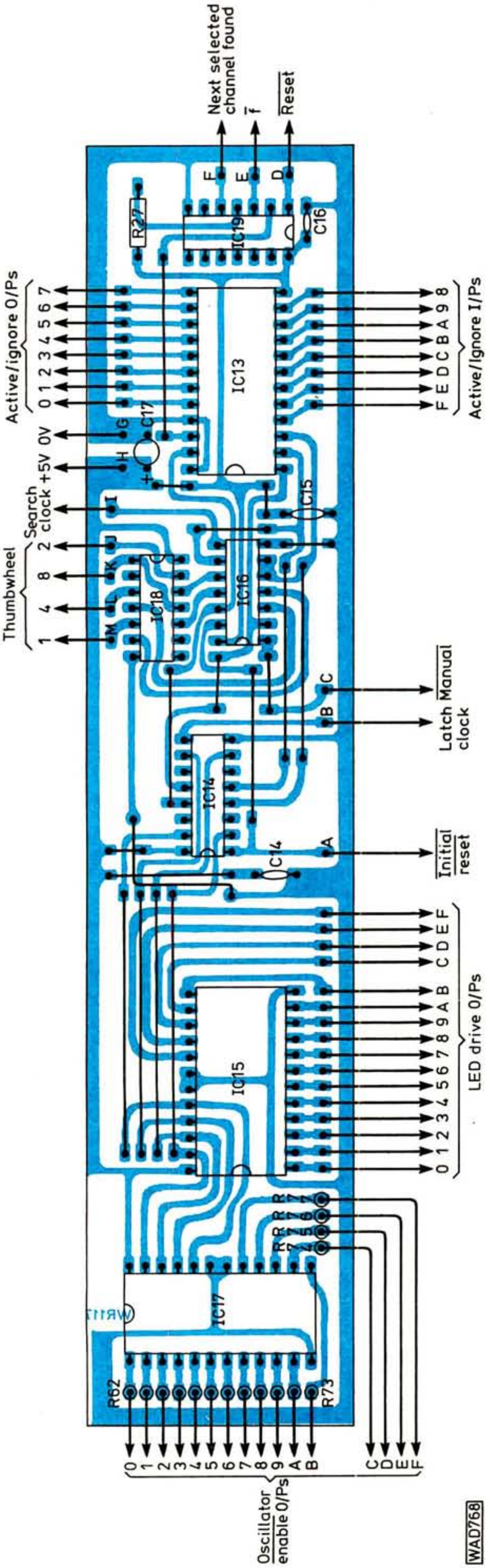



**Fig. 15: Component layout of the Tx and Rx channel oscillator boards**

There are no special handling considerations to be borne in mind when mounting the components on the boards, but care must be taken to ensure correct orientation of the integrated circuits before soldering in place. If preferred dual-in-line sockets may be used. Short board links are made from tinned copper wire with longer connections in insulated connecting wire.

Interconnections to the control logic boards are located around the edges and it is recommended that 0·040in Veropins are used. This technique will allow inter-board wiring after the boards have been installed in the diecast box.

On the channel selector board, connections to the oscillator boards for the $\overline{\text{ENABLE}}$ lines are made by means of




a 16-way ribbon cable whose conductors are soldered to the upper ends of R62–R77. These resistors stand vertically on the board, the lower end of each resistor being soldered to the p.c.b., and the top end (cut off to approximately 4mm) acting as the terminal pin.

The component layout given in Fig. 15 shows the arrangement of components for the line driver/first oscillator, and for the 16th oscillator/decoupling components. The layout of the intervening oscillators follows the pattern of the first.

Successful assembly of the channel oscillator boards requires the use of suitable components as space is at a premium. The use of plastic transistors will help to reduce the probability of inadvertent short circuits, but the use of sleeving on the component leads should not be necessary. The use of a fine-tipped soldering iron will be of considerable assistance during assembly.

It is worthwhile to experiment with the assembly of two adjacent oscillators (without necessarily soldering the components) to ensure the suitability of the components to be used. The line driver and the required number of oscillators may then safely be assembled. The use of Veropins for off-board wiring is again recommended as a means of simplifying the final assembly wiring.

After assembly, the track side of each board should be thoroughly cleaned with suitable solvent cleaner, and then carefully inspected for solder bridges or other inadvertent short circuits. Next measure the power consumption of each board in isolation (i.e., with no inputs/outputs connected). Each oscillator bank should consume approximately 20mA at +12V, with the logic boards consuming approximately 250mA (timing/sequencing) and 200mA (channel selector) at +5V. Significant deviations from these figures should be investigated before the boards are installed in the box.

The autoscanner is built into an inverted standard diecast box, with the lid of the box acting as the base of the unit. All of the necessary fixing holes and cut-outs should be drilled before any of the components are fitted. A suggested front panel layout is shown in Fig. 11. Drilling instructions are not given as they will depend on the exact dimensions of the switches, etc., that are employed.

After the diecast box has been drilled, the switches, sockets and other components, with the exception of the two control logic p.c.b.s, are installed. The "S" meter should be attached to an aluminium bracket, using a suitable adhesive such as Araldite and mounted in the box so that the face of the meter is flush with the surface of the front panel.

When locating the printed circuit boards, a clear space of at least 3·5cm should be left behind the front panel, and at least 2cm behind the rear panel, to allow for wiring and ancillary components. The oscillator boards should be mounted on the removable lid of the box, directly above and in line with the control logic boards mounted on the bottom of the box. The channel selector board should be the board immediately behind the front panel.

The wiring of the "ACTIVE/IGNORE" switches (S6–S21 and R32–R47) and the "ACTIVE CHANNEL" l.e.d.s (D2–D17 and R48) is shown in Fig. 18. This wiring is best installed at the front panel end before the channel selector p.c.b. is fitted. The connections between the front panel and the p.c.b. are conveniently made with lengths of 8-way ribbon cable. The pull-up resistors R32–R47 are mounted, as shown in the inset on Fig. 18, on the rear of switches S6–S21, respectively.

**Fig. 16: Component layout for the channel selector board**

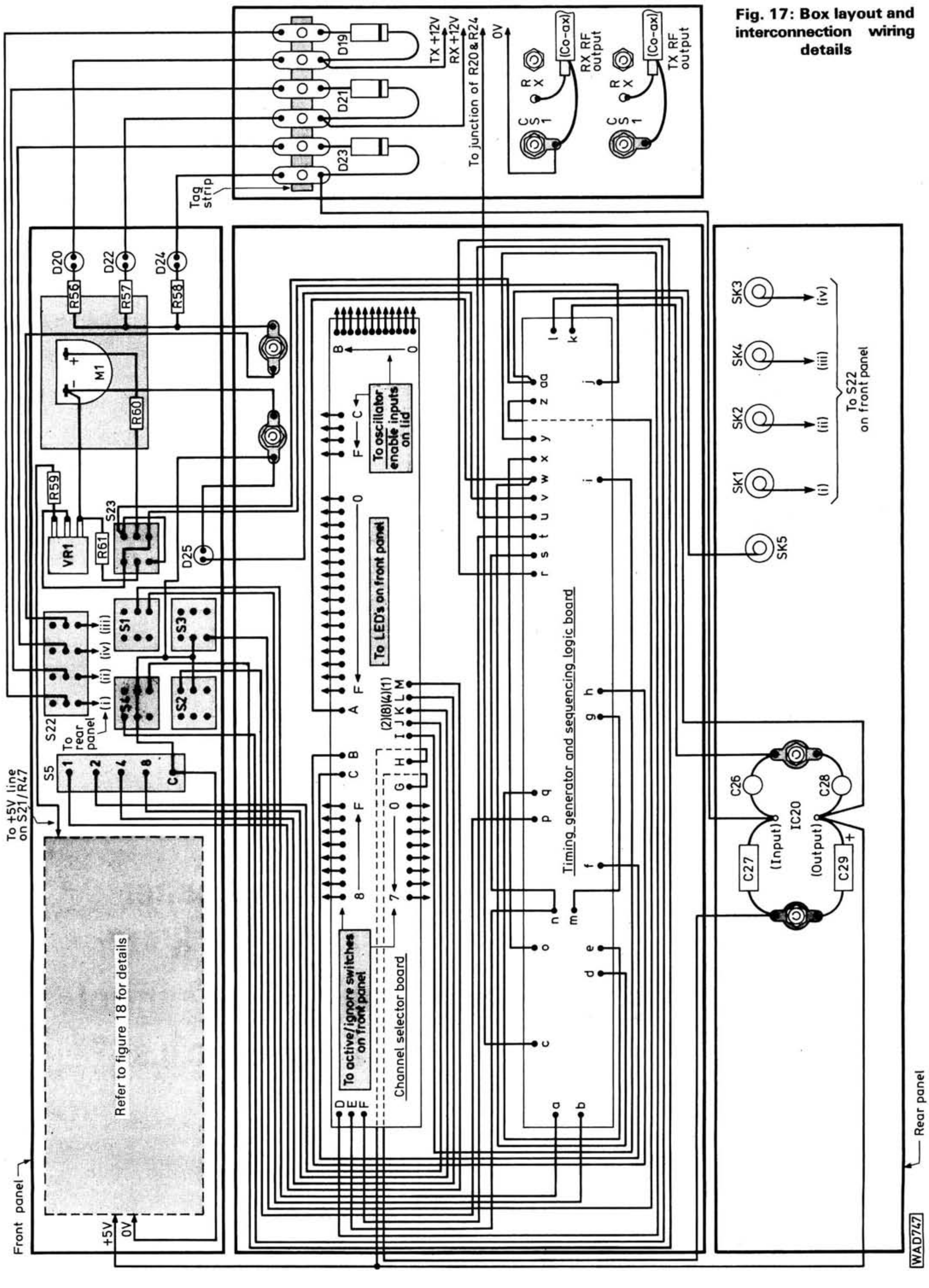



**Fig. 17: Box layout and interconnection wiring details**

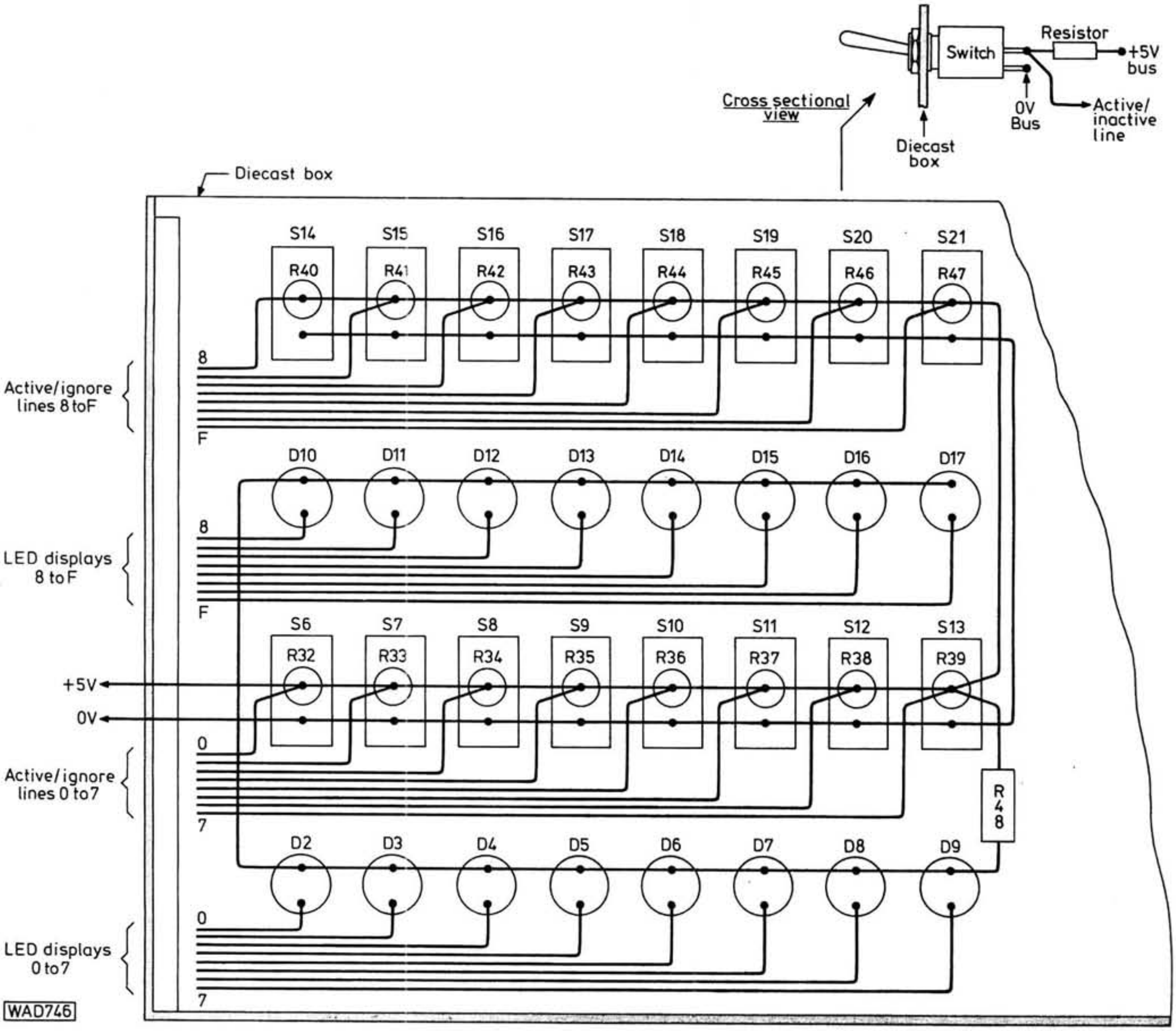



**Fig. 18: Connections for the Active/Ignore switches and Active Channel l.e.d.s behind front panel**

When the wiring behind the front panel has been completed, the two logic boards can be installed, taking care not to short either signal or d.c. lines to the case with the mounting hardware. The free ends of the ribbon cables are then connected to the appropriate pins on the channel selector board. The remainder of the interconnecting wiring follows the layout shown in Fig. 17. Again, the use of ribbon cable will produce a neat result and greatly assist in construction.

Finally the power and control lines, to the two lid mounted oscillator boards, are connected as shown in Fig. 19, output links are routed through suitable lengths of coaxial cable. The construction of the Autoscanner is now complete. Fig. 19 appears next month.

## Next Issue

In the concluding part of this article comprehensive notes on setting up the scanner will be given along with modifications to allow for 8-channel operation.

# air test

## USER REPORTS ON SETS AND SUNDRIES

## MIZUHO LA-2X 2 metre Linear Amplifier


The 2 metre hand-held transceiver has been shrinking in size and price as well as increasing in output power and channel capabilities. A lot of amateurs who possess one of these useful rigs would like to be able to use it either as a mobile unit or as a fixed station. This, of course, usually means that more output is desired as the one or two watts provided by the hand-held is obviously not enough.

For either mobile or fixed station operation the output power is not limited by the need to achieve a reasonably economic battery life since the rig can be externally powered.

Most of the current designs of hand-held rigs have a receiver sensitivity that would be compatible with an r.f. output several times greater than that provided. For these all that is required to improve the performance is a suitable r.f. amplifier to boost the output from the one watt or so of the rig to around ten watts.

There are several linear amplifiers on the market which could be used for this purpose. However, the Mizuho LA-2X amplifier is probably the lowest priced commercially available unit on the market. It provides ten watts of r.f. power for one watt input and is described as being linear. No receive pre-amplifier is fitted so there are no problems of degradation of the receiver side of the rig.

The LA-2X is designed to be used primarily with Mizuho's own SB-2XM one watt portable rig and so has no r.f. VOX circuit to switch from receive to transmit mode. Instead the two relays used to effect the changeover are driven directly from the p.t.t. switch of the transceiver.

To use the LA-2X with any other rig requires access to the p.t.t. switch or alternatively the addition of a simple r.f. VOX circuit to the amplifier to operate the two relays. There is enough room inside the metal case to accommodate such a circuit.

The amplifier runs from a nominal 12V d.c. supply and takes almost 2A when delivering the full 10W output. On test 10W was produced for 1W input and grossly overloading the amplifier gave rise to no noticeable nasty effects.

The unit is well made and housed in a robust metal case 36 × 56 × 128mm and weighing 430g. A flying coaxial lead terminated with a PL259 UHF plug connects the amplifier to the transceiver while an SO239 UHF socket is used for the antenna connector. A pair of colour coded wires provide the means to supply the amplifier and a separate flying lead with a small plug on the end is used to operate the changeover relays, connecting it to the supply puts the amplifier into the transmit mode.

The opposite end of the case to the inputs and outputs has a slide switch fitted to switch the power on and off and two l.e.d.s one green and one red, to indicate POWER ON and TRANSMIT.

At a few pence under £40 including VAT the LA-2X linear amplifier is available from **Lowe Electronics, Chesterfield Road, Matlock, Derbys. Tel: 0629 2817** to whom we offer our thanks for the loan of the review unit.

## JIL SX-200 Scanning Monitor

The JIL SX-200 Scanning Monitor Receiver is a recent arrival in the UK, and offers one of the widest frequency ranges of all the currently available scanners.

When we reviewed the Bearcat 220 in our August 1980 issue, we remarked on the limitations imposed on radio listening in the UK by the Wireless Telegraphy Act. It is interesting to note that since then, legislation has been proposed in the USA which, if it is passed, will bring the regulations in the two countries closer together. Should this happen, it may well have an effect on the market for scanning monitor receivers in the US, and therefore their availability.

The SX-200 covers 26–88MHz, 108–180MHz and 380–514MHz, with a.m. and f.m. modes available throughout. Frequency entry is by means of the keyboard. Sixteen memory channels are provided, which can be selected by individual push-buttons, or can be scanned at a rate of 4 or 8 channels per second. Two scanning modes are provided: SCAN A, in which all the memory channels are covered, and SCAN B in which any number of these channels can be selected.

A 4-second scan delay can be switched in if desired.

Any selected band of frequencies can be searched at a rate of 5 or 10 channels per second, the channel spacing being 5kHz below 58MHz and between 108–180MHz, and 12·5kHz over the rest of the coverage. Three squelch modes are provided: SQ1, ordinary squelch operation; SQ2, audio-operated squelch, scan stops on carrier; SQ3, audio-operated squelch, scan stops on audio.

A 590mm telescopic antenna screws into the top of the receiver, and a car-type socket is provided for connecting an external 50–75Ω antenna.

The power supply requirement is a nominal 10W at 13·8V d.c., negative ground, and a 240V a.c. mains adaptor comes as standard. Other facilities are a LOCAL/DISTANCE switch which controls a 20dB attenuator, connections for extension loudspeaker (2W into 4–8Ω) and tape-recorder, and on/off control of auxiliary equipment (such as a tape-recorder) in time with squelch operation.

A 12-hour digital clock is incorporated in the SX–200, the bright blue fluorescent frequency display reverts to time automatically after five seconds, except when in the scan or search modes. A two-position dimmer switch is provided.

## *Results*

Learning to "drive" the SX-200 so as to make full use of its facilities is not easy, due to an inadequate Operation Manual written in very poor English. The Squelch control instructions are perhaps the most incomprehensible, for example:

> "SQ2. Audio Squelch Noise Stop. In case that the modulation (Voice) **within a certain degree** is not received, the voice will not come out of the speaker, even though a wave is received. Noisy sound during intermittent of conversation can be eliminated. That is, **for only receiving carrier,** scanning will stop."

Receive sensitivity is specified as 0·4μV below 180MHz and 1μV above for 12dB S/N on f.m., and 1μV below 180MHz and 2μV above for 10dB S/N on a.m. Measurements on the review model returned 12dB SINAD for less than these inputs except for slight divergences at one or two points. Measured audio output was 1W at onset of clipping and 1·5W at 10% distortion.

Tests at a QTH some three-quarters of a mile from GB3SC (R1) revealed a lack of adjacent channel selectivity, since 'SC wiped out GB3WR on R0 every time it came on the air, even though the latter station puts in a very respectable signal. The specification quotes adjacent channel selectivity on f.m. as better than 60dB (method of measurement unspecified), but our tests showed that a +35dB signal 25kHz off frequency would degrade a 12dB SINAD wanted signal by 6dB, which would seem to support the poor on-air results on 2m.

One facility which was felt to be lacking was the ability to step just one channel up or down. Pressing the UP or DOWN buttons sets the machine off scanning at a rate of knots, so the only way is to punch in the new frequency, even if it's only one channel away.

The SX-200 measures approximately 75 × 210 × 235mm overall and weighs around 2·8kg. It is well-constructed, but would probably be rather difficult for the owner to service himself. The microprocessor control circuitry is housed in a soldered-up box.

The JIL SX-200, complete with mobile mounting kit, costs £241.50 including carriage and VAT from **Garex Electronics, 7 Norvic Road, Marsworth, Tring, Herts HP23 4LS, telephone Cheddington (0296) 668684,** to whom we offer our thanks for the loan of the review kit.

## *PW* HELFORD—4

▶▶▶ *continued from page 46*

## Setting Up

The driver amplifier can be set up by adjusting the bias voltage to give the collector current applicable to the output required. For an output of 5W, which is the requirement to drive the main p.a. to its maximum 100W of r.f. power out, the collector current should be set to 2A. For an output of around 25W the quiescent collector current is set to about 150mA. The current may be monitored via the supply line to the amplifier.

Testing should be carried out with a suitable dummy load on the output and a signal source on the input adjusted to give the required output.

During the initial setting up care should be taken not to over-run the transistors. Also keep an eye on the temperature of the driver amplifier heatsink and the bias supply heatsink.

## Part 5

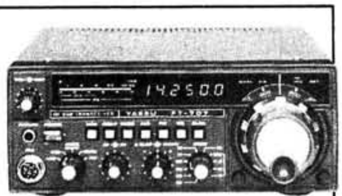
The next part will cover the main r.f. power amplifier. With this the basic electronic and radio side of the *PW* Helford will be complete, leaving the mechanical and metalwork side to finish off what should prove to be a very professional looking project.

# AMATEUR RADIO EXCHANGE

**Brenda (G8SXY) and Bernie (G4AOG) invite you to visit the only shop in London where you can see and try ALL the leading makes of Amateur Radio equipment under one roof . . . YAESU, ICOM, TRIO/KENWOOD . . . compare them all, and choose the rig that's right for you. The only make you can't choose is the coffee . . . that's "instant Brenda"!!**

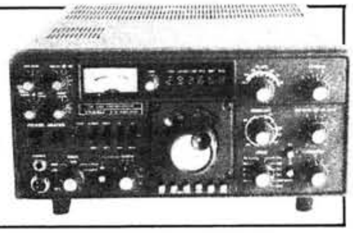
## FT-707

The ultimate in HF mobile transceivers from YAESU.
All the new bands, and all the latest technology.
**£499** Inc. VAT



## FT-101

Yaesu's '101' series HF base stations have earned an outstanding reputation for reliability over the years, and our 101s come complete with cooling fan and mic.
FT-101Z **£488** Inc. VAT
FT-101ZD **£569** Inc. VAT

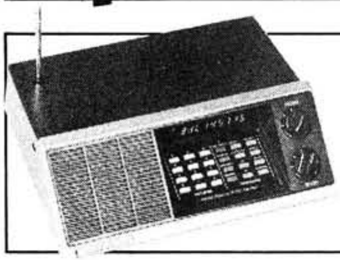


## FRG-7

Still the finest value-for-money communications receiver on the market at only
**£185** Inc. VAT
and free Heliscan aerial worth **£15**

## R-1000

Trio/Kenwood's successful new receiver with the PLL system that has proved so popular.
**£285** Inc. VAT
and free Heliscan aerial worth **£15**

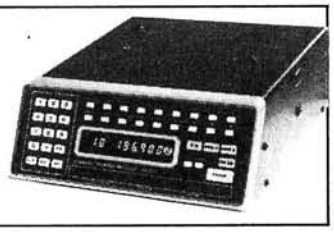


## BEARCAT 220FB

The super scanner which brings you all the excitement of the VHF and UHF frequencies . . . aircraft, marine, amateur, plus so much more.
**£258.75** Inc. VAT

## SX-200

Another of our sophisticated scanning receivers. Similar functions to the BEARCAT, but even wider frequency coverage, and with AM and FM right across its range.
**£240** Inc. VAT



## IC-720

Icom's superb new HF rig with general coverage receive 100kc-30MHz plus transmit facility across its entire range for commercial purposes.
**£699** Inc. VAT

## FRG-7700

Yaesu's latest receiver with FM right across the band and optional memory facility plus excellent filtering.
**£309** Inc. VAT
and free Heliscan aerial worth **£15** (Memory extra)

## FT-480R

Yaesu's new 2m all-mode mobile, already acclaimed as the pace-setter in its class.
**£359** Inc. VAT

## TR-9000

Trio/Kenwood's long-awaited entry into the 2m all-mode mobile field with 5-channel memory, twin VFOs etc.
**£342** Inc. VAT

**Closed Wednesday, but use our 24-hour Ansaphone service, or ring Martin (G4HKS) on 01-575 5291 for evening sales enquiries**

LICENSED CREDIT BROKERS
*Ask for written quotation

INSTANT HP FOR LICENSED AMATEURS AND 6 MONTHS NO INTEREST HP TERMS AVAILABLE

Buy it with Access — BARCLAYCARD VISA

Credit Card Sales by telephone

**2 NORTHFIELD ROAD, EALING, LONDON, W13 9SY. TEL: 01-579 5311**

*So easy for Overseas visitors – Northfields is just seven stops from Heathrow on the Piccadilly Line.*

# YAESU MUSEN – FRG-7700

## A NEW BREAKTHROUGH IN RECEIVER TECHNOLOGY

YAESU

Yes indeed, the exciting new FRG-7700 GENERAL COVERAGE RECEIVER from YAESU MUSEN, the world's largest manufacturer of Amateur Radio equipment, will satisfy the demands of the most critical Short Wave Listener or Licensed Operator with it's superb performance and incredible specification -- just consider the following condensed details:


Frequence coverage 150 KHz–29.999 MHz.

Modes AM (fitted Narrow, Medium and Wide Filters).
USB, LSB, CW **and** FM.
Memory option with twelve channels and automatic band selection.
CPU Digital Clock and Timer.
State-of-the-Art Noise Blanker.
FM Squelch Control.
Mains or Battery operation.
Digital and Analogue read-out.

Send today for full details of the new FRG-7700 or if you would like the full Yaesu catalogue as well 36 pence in stamps will bring you this together with our credit voucher for £3.60 – a 10 to 1 winning offer!

FRG-7700 **£309.** Memory unit **£83.95.** FRG-7700M (with fitted memory) **£389**

**FULL DETAILS AND THE NEW LOW FACTORY PRICE LIST FROM**

**BRITAIN'S NO. 1 IMPORTER**

**EX-STOCK – INSTANT CREDIT – FREE SECURICOR DELIVERY**

G3FIK

**AMATEUR ELECTRONICS UK**

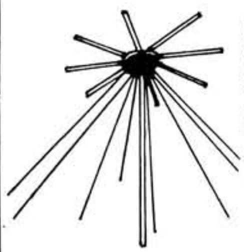
Buy it with Access

**508-516 ALUM ROCK ROAD** 021-327 1497 6313

**BIRMINGHAM 8** Telex 337045

# NORTHERN COMMUNICATIONS

AMATEUR • COMMERCIAL • MARINE



## NORCONE 512 (66-512 MHz)

It's here! A no compromise, precision made, full 16 element discone antenna, made in Britain. Standard S0239 connector, with cover. Supplied with 1" diameter, 30" mounting support mast and complete instructions.

An ideal partner for the SX200A, "Bearcat" and other scanning receivers. It may also be used for transmission and in particular where antenna space is limited.

Full coverage of 70.144.432MHz Amateur bands plus Aircraft, Marine and Commercial bands.

**£24.95** p.p. £1.50

NCMK-1. In line vertical mounting kit for 1" to 2" mast. **£2.45** p.p. £0.50

## SX200A SCANNER

HF-VHF-UHF Receiver, as reviewed in this issue. **£241.50**

Special Offer SX 200A + Norcone 512. Complete, inc. VAT-delivery. **£260.00**

## ZL-12 COMPACT YAGI

13db gain, compact 2 metre Yagi. 10'6" boom, lightweight rugged design. Hundreds of this award winning antenna already in use. Send for details.

**£28.75** p.p. £1.50

## ZL-8 SUPER COMPACT YAGI

9db gain, super compact 2 metre Yagi. 6'0" boom, lightweight rugged design. Ideal for limited spaces and portable operation. Send for details. **£17.25** p.p. £1.50

## YAESU FT480R. FDK 750E MULTIMODES

Both of these new 2 metre multimodes transceivers are amongst our full range of Amateur Radio equipment and accessories. Ring or call for complete information:

## NEW YAESU FRG7700 RECEIVER £309.00

Superb new addition to our range. Come in and try it for yourself.

299–303, Claremount Road, Halifax HX3 6AW,
West Yorkshire. G3UGF.
Tues-Sat. 9.45am–5.30pm.
Telephone (0422) 40792.
24 hour Ansafone Service.

Buy it with Access

BARCLAYCARD VISA

# AJH ELECTRONICS

**20 BARBY LANE, HILLMORTON,**
**RUGBY, WARWICKSHIRE CV22 5QJ.**
**TEL: 76473 EVE 71066.**

*Mail Order Only or callers by appointment.*
*All prices include VAT but add 50p post & packing.*

**VHF RF. POWER TRANSISTORS:–**

| Type | Gain (db) | Output (watts) | Volts | Freq. | Price |
|---|---|---|---|---|---|
| 2N6083 | 5.7 | 30w. | 12 | 175MHz | **£6.50** |
| BLY87A | 9 | 8 | 12 | 175 | **£4.00** |
| SD1212-6 | 8.2 | 3 | 12 | 175 | **£2.50** |
| BLW16A | 10 | ¾ | 12 | 175 | **£0.75** |
| PT4236A | 10 | 1 min. | 12 | 175 | **£0.75** |
| PT4555 | 8 | 25 | 12 | 80 | **£3.50** |
| PT4556C | 7 | 40 | 12 | 80 | **£4.50** |
| 2N5070 | 13 | 25(pep) | 24 | 30 | **£5.00** |

**MDA800** 8 amp 50 volt bridge rectifier OK for 12v PSU etc. **65p. 2** for **£1.15.**
**DUAL-GATE MOSFETS** 3N204 **£1.25,** 3SK51 (40673) **80p,** BFR84 **75p.**
**FETs** E5565 (2N3819) **30p,** TIS88A **40p,** BF256C **40p,** 2N4381 **40p.**
**BIPOLARS:–** BF576, pnp VHF RF amp. FT1200 MHz **20p,** 2N4957 pnp VHF/UHF RF amp nf only 3½db @ 1GHz **30p,** BF180 **30p,** BF166 VHF RF amp **25p,** BFY90 UHF RF amp **95p,** BF152 VHF mix/osc. **15p.**
**RF SWITCHING DIODES** for switching oscillators etc. BA143 (VHF) **20p,** BA144 (UHF) **25p.**
**AUDIO AMP IC.** TBA1010 6 watt output adjustable to 9 watt, @ 14 volt single-in-line type & ideal for transceivers, receivers, record players, cassette players etc. BARGAIN OFFER ONLY **£1.35** two for **£2.40.** Supplied with data sheet showing construction of stereo amp. full data sheet (19 pages) **20p.**
**27-30 MHz RECEIVER PRE-AMP.** Have you a tired or old receiver with poor performance above 25MHz then one of our super pre-amps is what you want:– 50 ohm imp. in & out 25db gain with better than 1db nf. ready built on PCB 60mmx-40mm, adjustable gain control, only **£8.00** or built into grey hammer finish die cast box with BNC sockets **£12.50.**
**10.7 MHz CRYSTAL FILTER** for AM/FM 12½ KHz channel spacing ±3½ KHz @ only new & unused small size 38mmx18mmx15mm 200 ohm imp. give away PRICE ONLY **£4.00** each two for **£7.00.**
**10.7 MHz CRYSTAL FILTER** for AM/FM 12½ KHz channel spacing +3½ KHz @ 3db ITT type 024DE/923L. **£7.00 ea.**
**MOTOROLA CAR RADIO PCBs** complete less vol. cont. tuner etc. with circuit **80p ea.** four for **£3.00.**
**CAR RADIO** 470 KHz IF AMPS with stereo pre-amp IC. with circuit **65p.**
**CAR RADIO/CASSETTE PLAYER** stereo amps 5 watt/chan. with multigang pot. matching amp to above IF amp board. Contains 2 TA7205P ICs, with circuit **£2.75.**
**BAG MIXED ELECTROLYTIC CAPACITORS** 2.2mf – 1000MFd 100 **£1.60.**
**BAG OF MIXED RESISTORS** ¼ watt carbon film pre-formed type all with long leads plus some ⅛ watt std types 250 for **£1.60.**
**FEEDTHROUGH CAPACITORS** 1000pf 500v solder in type ⅛" dia. 10 for **28p.**
**FERRITE RINGS** 12mm dia **10p ea. FERRITE BEADS** FX1115 10 for **20p.**

*PRICE LIST 15p STAMP – FREE WITH ORDER.*

# tape/slide controller

**PART 2**

**Fred JUDD**

A full explanation of the circuitry together with the components list was given in Part 1. This part deals with the circuit boards, assembly and setting up the controller for operation with any stereo cassette or reel-to-reel recorder. Mono only recorders may also be used.

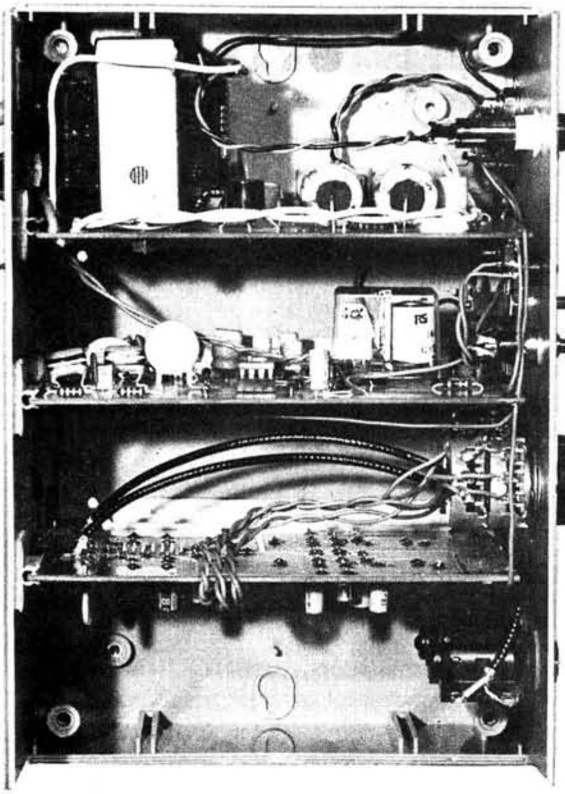
## The Circuit Boards

There are three p.c.b.s mounted as shown in the photographs. The power supply and 50Hz pulse circuit (Board 3) is shown in Figs. 13 and 14. Observe carefully the polarity of the electrolytic capacitors. The transformer T1 must have a 12V 1A (12VA) secondary winding.

Board 2 contains the components and i.c.s for the 50Hz and music pass filters with the printed tracks being shown in Fig. 11 and the component positions in Fig. 12. The relay is an RS Type 349–658 or Maplin YX98G and this should be used as the circuitry is designed around it. One pair of contacts, normally open, are used for the projector slide control mechanism and another pair, also normally open, are for the l.e.d. indicator which lights up whenever the relay is actuated.

The remaining p.c.b. (Board 1) carries the whole of the audio mixing circuitry. Printed tracks are shown in Fig. 9 and component positions in Fig. 10.

Point-to-point conventional wiring with components mounted on plain matrix board could be used, with component layout following as close as possible to that shown.



Internal view of the completed controller showing the layout of the p.c.b.s

## Initial Checking Out

Various adjustments must be carried out before fitting the unit into the box. The first check is to see that the requisite rail voltages are correct as indicated on the circuit diagrams. Some adjustment to the value of RX (nominally 270Ω) (Board 3) may be necessary to obtain the 15V supply rail to the amplifier and filter circuits. Total current drawn on this rail should be in the region of 10mA. Current drawn by the relay circuit (20V rail) is approximately 85mA with the relay actuated.

Check with an audio voltmeter or a.c. reading meter, that approximately 300mV r.m.s. of 50Hz signal is present at the junction of R51 and C29 on Board 3, and that about 1V r.m.s. at 50Hz is present at C34 and R54 on this board with the push-button depressed.

## Filter Response Adjustment

The following deals with the adjustment of the filter circuit presets R18 and R37 so that each filter responds correctly to 50Hz and music signals respectively. The adjustments can be made with only an a.c. reading voltmeter. However, if an audio signal generator and audio voltmeter are available, the procedure is as follows:

Connect the audio generator output to the socket marked "FROM TAPE OUT LH". Connect the audio voltmeter to the output socket marked "EXT AMPLIFIER LH". Now set the generator to 1kHz and adjust the level from it until about 200mV of signal is present at the output socket. Next, set the generator to 50Hz and adjust R18 to obtain the lowest level possible of 50Hz signal at the output which should be in the region of 40dB below the level obtained with the 1kHz signal, i.e., 2mV for 200mV of

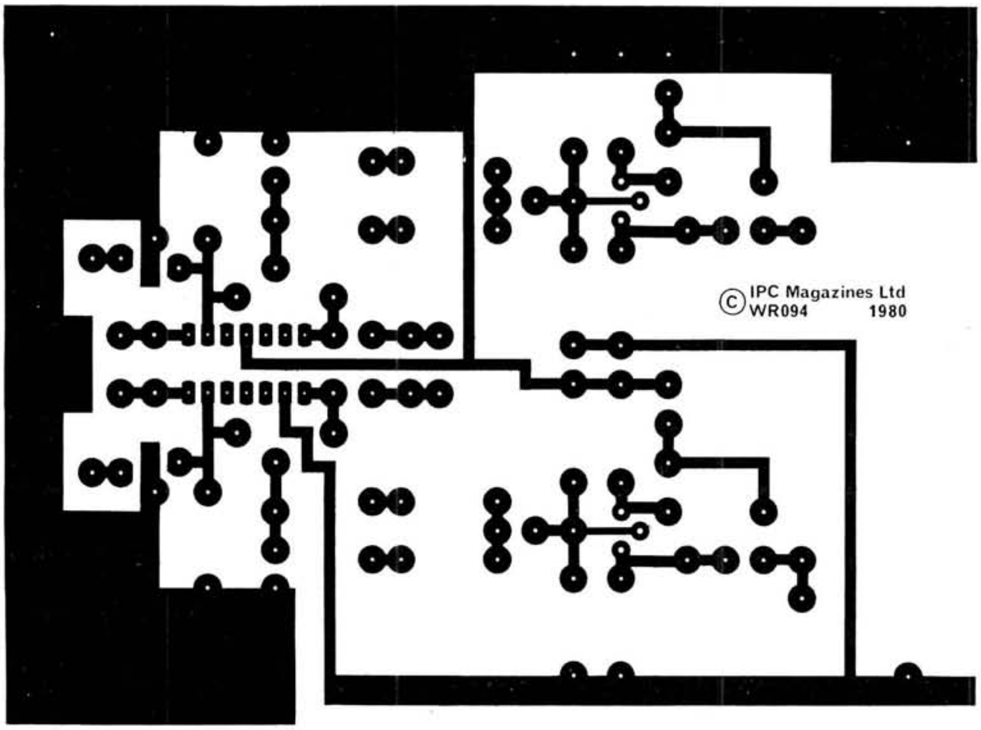



**Fig. 9: Full-size copper track pattern for Board 1**

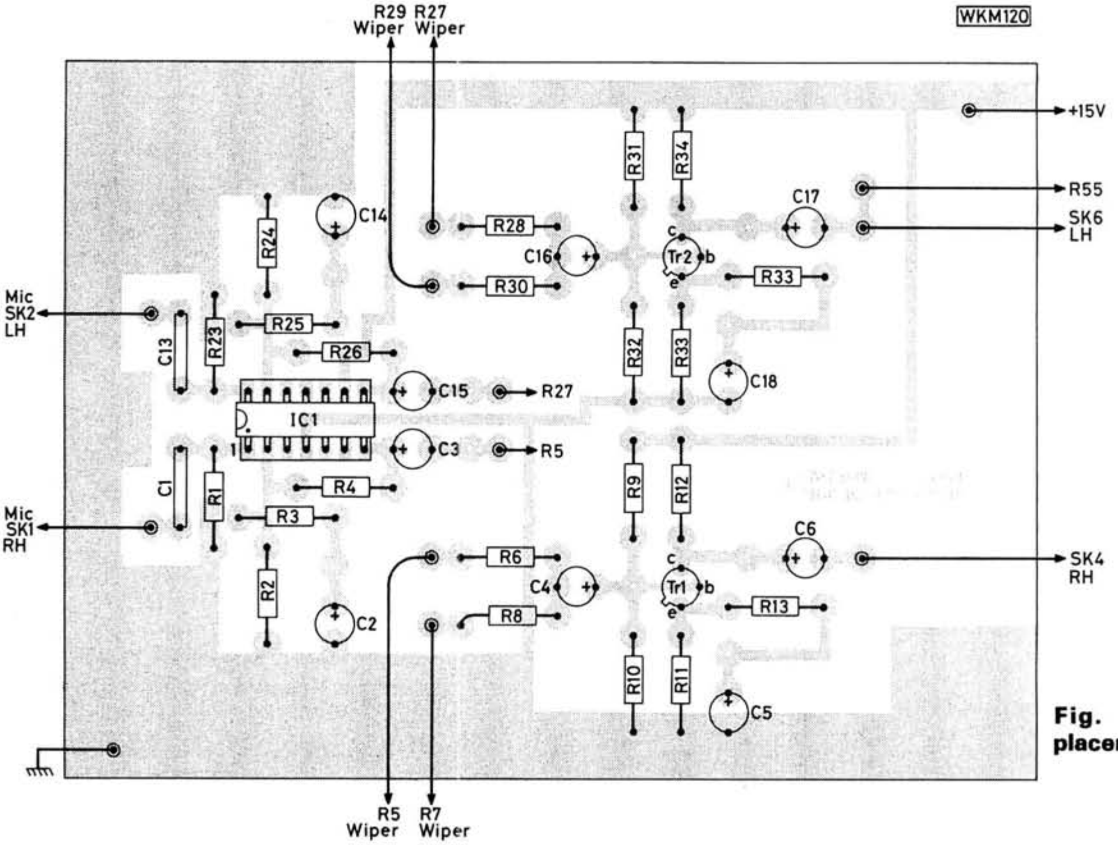



**Fig. 10: Component placement drawing for Board 1**

1kHz. The overall response obtained should then be close to that shown in the frequency response curves.

Leave the generator connected to the same socket, "FROM TAPE OUT" and connect the meter to the junction of C25 and D1. Set the generator to 1kHz and its output level to 100mV. Now switch the generator to 50Hz and adjust R37 until between 1V and 1·5V is present at C25 and D1 junction. At this point the relay should be actuated and the l.e.d. indicator lit up.

## Critical Components

Component values in twin-T filters are fairly critical. If the above adjustments do not produce the requisite responses, i.e., the filters do not tune very close to 50Hz, it may be necessary to increase the capacity slightly of C7 and C8 and/or C19 and C20, or both. The additional capacitors, if required, are marked on the circuit diagram as CX. Allowance for the connection of these has been

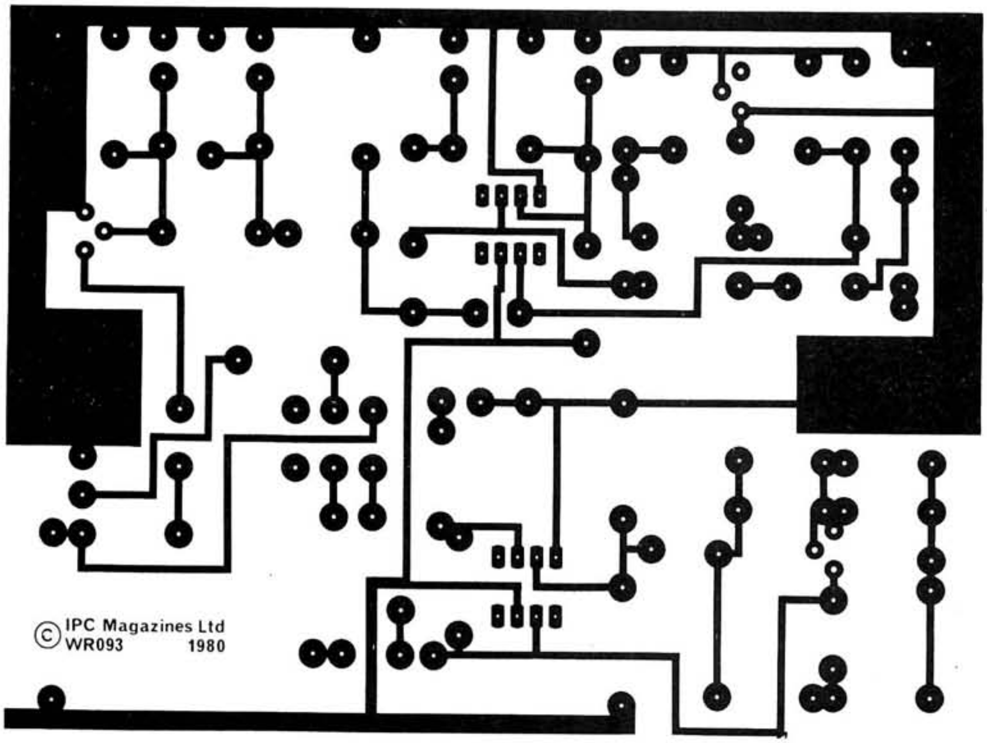



**Fig. 11: Full-size copper track pattern for Board 2**

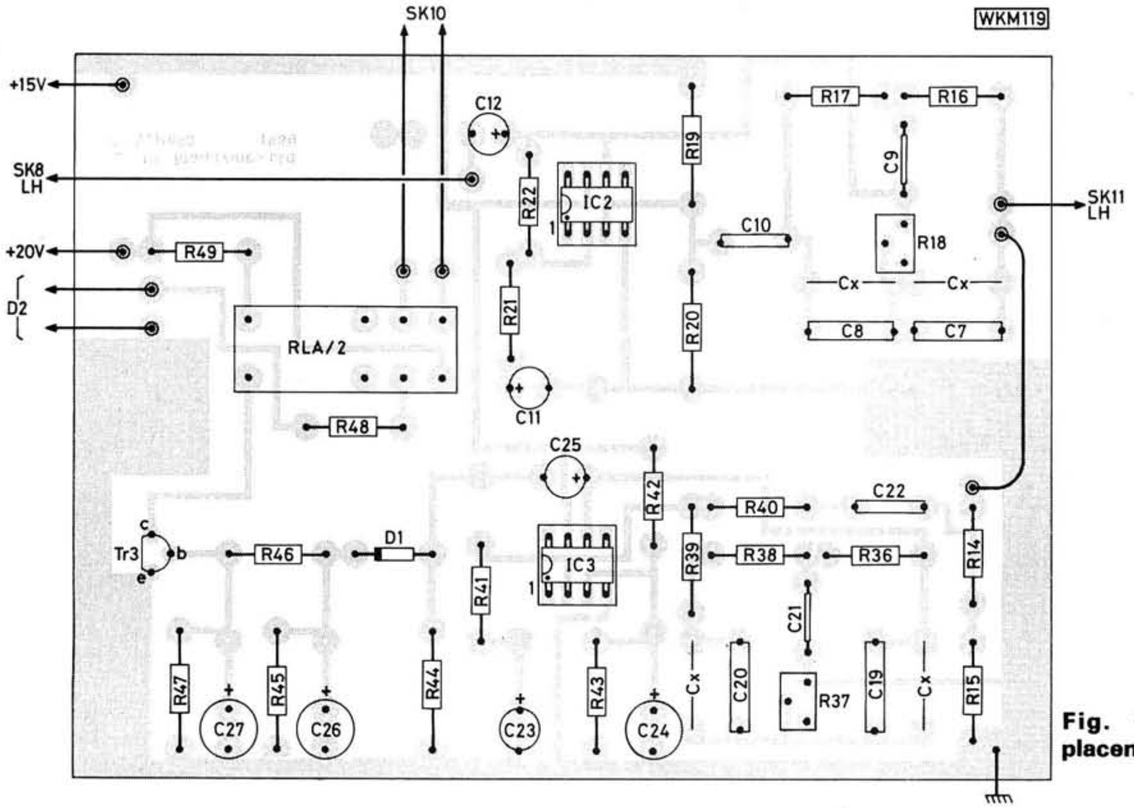



**Fig. 12: Component placement drawing for Board 2**

made on Board 2. The amount of capacitance required may be between 1000pF and 2000pF so it would be as well to have capacitors of 1000pF, 1500pF and 2000pF to hand.

When the foregoing adjustments have been made disconnect the generator and meter. Set the "override" switch S1 to ON (down) and press the push-button a few times. The relay should close and the l.e.d. light up each time.

Adjustment of the filters can be carried out with only an a.c. reading voltmeter and the use of the external amplifier that will normally be used with the tape-recorder. Procedure for the 50Hz pass filter IC3 is as follows: connect the meter between the junction of C5 and D1 and 0V and use a range suitable to read 1·5V, which should be obtained when the push-button is depressed. This voltage is obtained by adjustment of R37 and is a.c. at 50Hz. By this time the relay will have actuated and the l.e.d. lit up. Each time the button is pressed the relay should operate.

The music pass filter IC2 is adjusted as follows: connect the amplifier LH channel output to the external amplifier. Either channel on the amplifier can be used for this. Press the pulse button and hold and adjust R18 until the

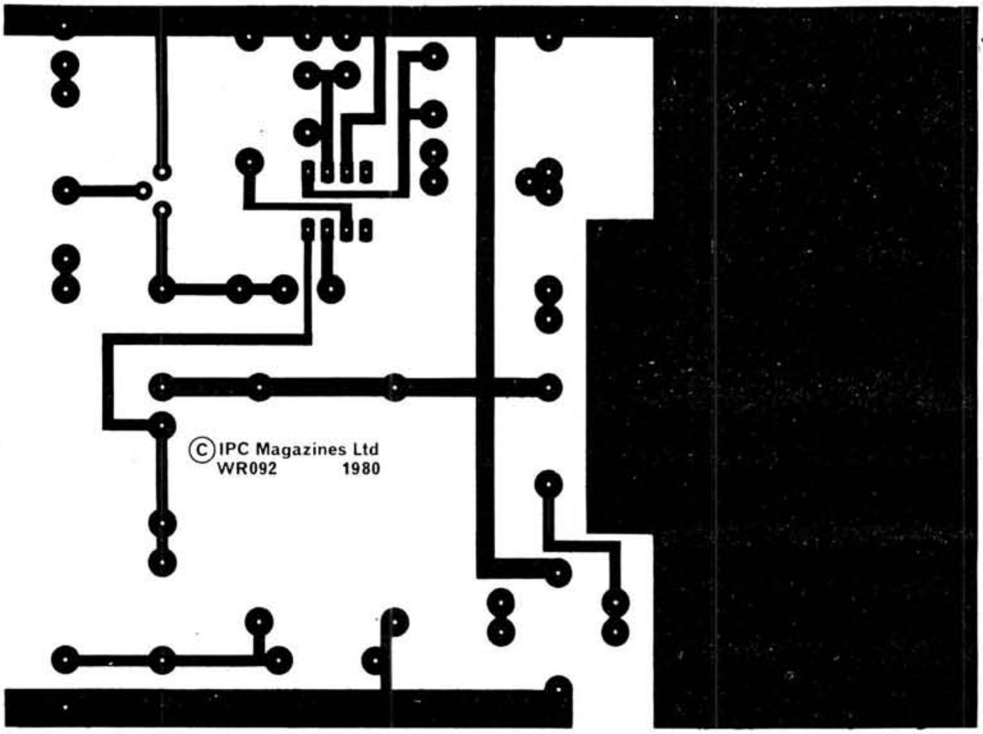



**Fig. 13: Full-size copper track pattern for Board 3**

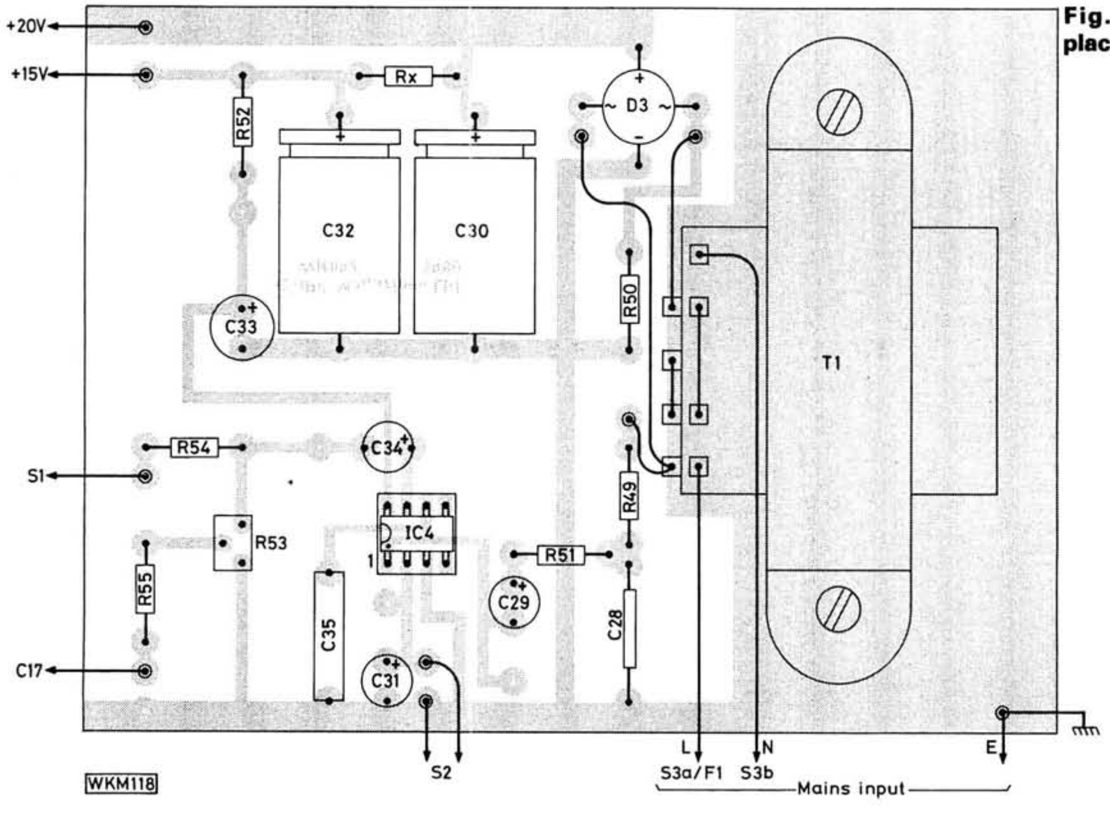



**Fig. 14: Component placement drawing for Board 3**

50Hz pulse signal is audibly low as adjustment will allow.

If either of the filters do not respond as outlined above it may be necessary to add the small extra capacitance CX to the filter circuits as already explained.

If suitable instruments are available it would be worth checking the mixer circuits for frequency response as in Fig. 4 and for the requisite mic and line inputs sensitivity versus output level at the sockets marked "TO TAPE IN RH and LH" and which the actual audio outputs from the mixer section.

## Setting up for Recording

There is only one final adjustment to make and this is to the preset R53 on Board 3. This controls the level of the 50Hz pulse to the tape-recorder. Connect the controller to the tape-recorder as shown in Fig. 15. Set the recorder for recording and hold the tape with the pause control. *Set the record level controls on the recorder to maximum and note they will always be used at maximum when recording with the slide controller.* Press and hold the pulse push-button whereupon the left-hand record level meter will be reading the level of the 50Hz signal. Adjust R53 until the meter

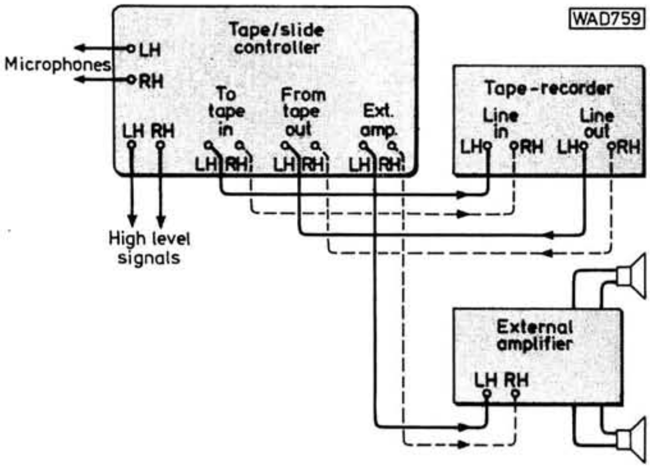



**Fig. 15: Connecting the controller to a tape-recorder and audio amplifiers**

reads between 6dB and 10dB below 0dB record level. If the deck has through monitoring the controller relay will now be actuated. Release the button and press again to check that the relay operates positively. Set the recorder running and record pulses of about one second duration along the tape at intervals. With the tape re-run on replay the relay should now click in at each point where a pulse was recorded.

A suitable socket or other connector can be fitted to the rear panel of the controller for connection to the slide projector remote control socket or remote control push-button contacts.

A final test can now be carried out with the slide projector and with recorded speech or music on the tape. *Always use the tape-recorder recording level controls at maximum and adjust speech and music recording level only with the gain controls R18 and R37 on the controller*. The 50Hz control pulse will now always be recorded at the preset level of between 6dB and 10dB below 0dB record level. Make a 5 or 10 minute test recording of music with pulses at intervals which should actuate the projector slide change mechanism as they are recorded. If the recorder does not have through monitoring, then use the "override" switch. This will still allow slide changes to take place whilst recording.

When the test recording is completed restore the projector slide carrier and re-run the test tape. The slides should change only when a pulse occurs. To obviate accidental change do not let any music or speech recording exceed normal level with no more than the occasional peak above 0dB.

## Programming a Slide Show

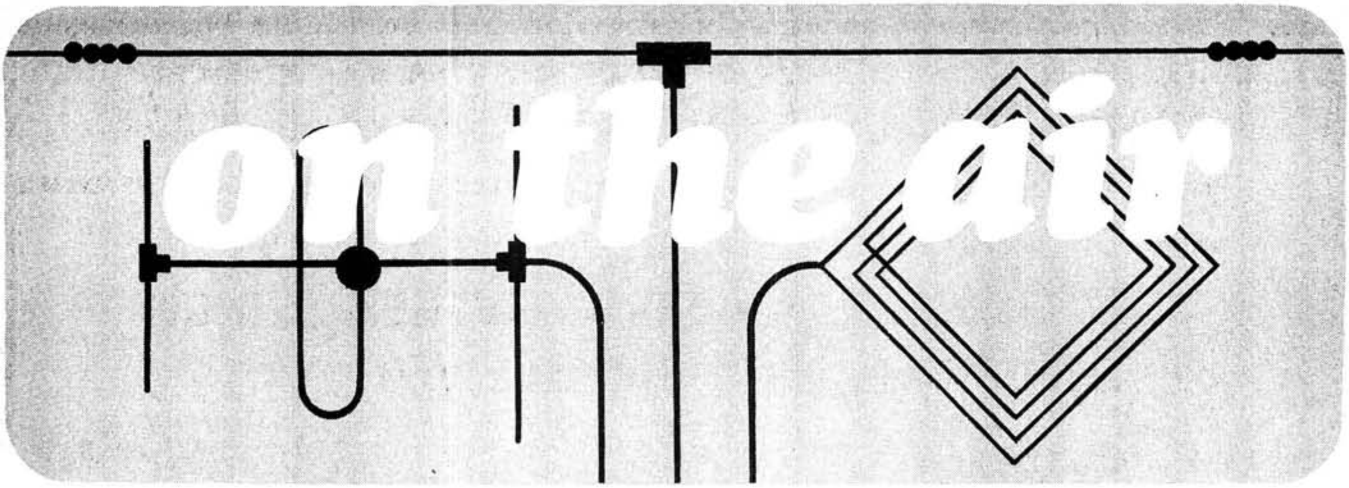
A slide show can be greatly enhanced by good commentary, background music to suit the mood of the programme, and even background sounds and sound effects. Although the pictures are still, some illusion can be created by sound effects. For example, a cruising holiday may commence with a picture of the cruise liner at the dockside followed by various shots taken on board during the cruise. Some background, not overdone, of sea sounds and the odd seagull cry will impart realism and if a portable recorder is available, specific sounds, related to pictures, taken on the voyage, could be recorded and later dubbed for the slide programme.

A script for the commentary, music and sounds are worth preparing beforehand. A dummy run can be made and the slides actually run through on cue with the facility provided by the controller. If one has to stop anywhere during the final take, perhaps to change a record of music, etc., then the tape pause control can be used to advantage. If an error is made somewhere during the programme it is only necessary to return to that point (including the slides) and recommence from there.

As a final point of interest the prototype controller was tested with two different makes of typical domestic stereo cassette decks and a stereo reel-to-reel recorder. A test programme was made with music and commentary, etc., and replayed through a top grade hi-fi system. The 50Hz control pulse is completely inaudible with average level of speech or music, since it is at least 40dB below this.

The controller can be used with a single track (mono) recorder by using the left-hand channel only. Procedure is otherwise as already outlined.

One final note. Always use about a one second long pulse for slide changing. The pulse rectifier will not respond to very short pulses. ●




# Amateur Bands

by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR
Silver Firs, Leatherhead Road,
Ashtead, Surrey KT21 2TW.
Logs by bands in alphabetical order.

As with any hobby there is a continual inflow of new blood into amateur radio, seeking advice and information, and eager to learn all about the subject as soon as possible. At first all is confusion especially over the jargon we use, much of which cannot be explained in a rational manner.

Regular writers on amateur radio must therefore repeat their words of wisdom and guidance from time to time for the benefit of the newcomer. Those of us already in the business accept and understand the strange symbols but to the outsider callsigns and Q-groups and the like are very much a mystery.

The one symbol that arouses most curiosity, and, at the same time, is most difficult of explanation, is "DX", and its derivatives like DXing and DXpedition. The point has been covered many times but I'd like to offer my own understanding of its meaning as I think that there is much more to "DX" than meets the eye.

"DX" is frequently written off as meaning a long distance (contact) between two amateur stations or a listener logging a station a long way away. Stemming from the early days of radio communication the origins of DX are quite vague but I like to think that it means Distance Xtra" or a bit further than is normal, for we have to relate distance, whether it be a few miles or a thousand miles, to the frequencies involved.

On, say, a v.h.f. band such as 2m, normal contacts may be restricted to a few tens of miles depending upon antennas and antenna heights and suchlike, but if a tropospheric opening, or lift, occurs then suddenly DX is achieved by working or hearing stations hundreds of miles off. On the other hand the h.f. amateur bands can provide worldwide contacts, especially on the very popular 20m band, on virtually any day of the year, with the modern commercial equipment in general use on these bands coupled to rotary beam antennas.

Thus although Australia (VK) is almost our antipodes it is hardly worth calling DX because it can be heard and worked comparatively easily, but let a VK appear from one of the rarely worked islands such as Lord Howe or Macquarrie and all hell is let loose with thousands of amateurs all round the world queuing to get a contact. That's real DX! Thus the term DX involves an element of rarity as well as distance. So when a station appears in a country or zone that is rarely worked, because of the lack of activity there by amateurs, it is going to be regarded as a highly desirable piece of DX by the fraternity chasing new awards and achievement certificates.

It might even apply to a station as near to the UK as one on Jan Mayen Island or the tiny state of San Marino because of the lack of any permanent amateurs in those places. It should not be overlooked that countries as understood by the amateur includes many islands and similar spots that the rest of humanity would consider belonged to some motherland nearby. For that reason amateur listings take in well over 375 countries.

So what is wanted every month in the logs for our DX corner? Well, half a dozen entries of choice DX would be ample, certainly not the routine loggings of Japanese, American or European stations unless, as mentioned before it is an unusual prefix or country. Actual frequencies are of no consequence with just about every station today able to move to any frequency in a band at will, mainly to avoid interference. A final note, do not just stick to the popular 20m band because it seems to be open 24 hours a day, but try the other h.f. bands from time to time as some very interesting DX will be heard there. This applies particularly to the 80 and 160m bands now that wintertime conditions are upon us.

## In the Mail

Interesting letter from RTTY enthusiast **Godfrey Manning** G4GLM of 63 The Drive, Edgware, Middx. who has a *PW* project going spare, the "Student" Oscilloscope, which can be easily converted for use as a tuning oscilloscope as per December *PW*, page 27. Anyone interested contact Godfrey or ring him on 01-958 5113. Some info on Friden Flexowriters is also available and Godfrey would be very happy to hear from other users of this machine.

Doing things the hard way is exemplified by young **Jonathan Kempster** BRS45205 of Northchurch, near Berkhampstead, Herts, who uses a Vega VEF206 for reception of s.s.b. on the amateur bands. As there is no

# LOWE ELECTRONICS LTD

## THE SHIMIZU SS105S 80-10 METRES SSB/CW TRANSCEIVER

This super new transceiver covers 80-10 metres, gives 10W out and is smaller than anything else we have seen so far. Ideal for transverter driving, the SS105S has FM transmit and receive options as well as excellent performance on SSB/CW for HF band use.

The SS105S is supplied in semi kit form so as to keep down the price, but all the RF and mixer boards are ready built and aligned so no test equipment is required. All the cabinet work has been carried out so all you have to do is assemble the IF strip, xtal oscillator, and fit them to the completed chassis. Great idea and it brings back the flavour of home brew with added advantage that the rig will work when you've finished it.

For more info, just ask us or come along and see it. It's a great little rig.

| | | Net | Inc. VAT | Carr. |
|---|---|---|---|---|
| SS105S | 80-10m solid state SSB/CW/FM transceiver. Semi kit form | 225.00 | 258.75 | 4.50 |
| SE-NB | Noise blanker kit | 6.75 | 7.76 | .50 |
| SE-FMrx | RX FM discriminator kit | 15.00 | 17.25 | 1.00 |
| SE-FMtx | TX FM generator kit | 11.00 | 12.65 | 1.00 |
| SE-MK | RX marker kit | 9.60 | 11.04 | .50 |
| 0.5 CWF | 500 Hz CW filter | 19.50 | 22.43 | .50 |
| Optional band crystals | | 3.00 | 3.45 | .25 |

## AR 245 2 metre HAND HELD FM SYNTHESIZED 144·148MHz TRANSCEIVER 5 WATTS or 1 WATT OUTPUT

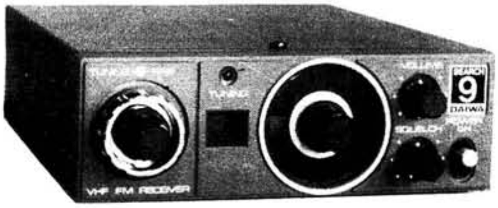
"A staggering technical achievement"; "How can they get it into such a small size"; "Outperforms any rig I've ever had"; these are typical of the comments made by amateur radio operators after seeing and using the remarkable AR245 2 metre FM handheld transceiver. What does it mean to you? Well, at last you can really take your amateur radio with you, anywhere you want to go, because in this handheld unit, you have a complete synthesized 2 metre FM transceiver covering 144·000 to 147·995kHz in 5kHz steps. Also included are + and – 600kHz repeater shifts and a crystal controlled tone burst unit.

ONE OF THE FINER THINGS IN LIFE FROM AOR.

## ALSO AVAILABLE, THE ORIGINAL AR 240A SAME OUTSTANDING FEATURES BUT 1½ WATTS

AOR 245 5 watts high 1 watt low output **£178** inc. VAT
AOR 240A 1½ watts output **£158** inc. VAT
Carriage on above £1.50.

**AOR AR22** 2 metre FM Synthesised Receiver **£83.00** inc. VAT carriage £1.50



## SR9 DAIWA

2 metre FM Tuneable/Xtal Receiver
**£46.00** inc. VAT carriage £1.50

CRYSTALS FOR SR9 & SL1600A **£2.50 each**

## SL 1600A

16 channel 2 metre Scanning Receiver
**£39.50** inc. VAT carriage £1.50

**HEAD OFFICE AND SERVICE CENTRE**
**CHESTERFIELD ROAD, MATLOCK, DERBYS. TEL: 0629-2817 or 2430 OPEN TUES-FRIDAY 9-5.30**
**SAT 9-5.00 CLOSED FOR LUNCH 12.30-1.30**
**FOR ALL THAT'S BEST IN HAM RADIO CONTACT US AT MATLOCK**
**FOR FULL CATALOGUES SEND 48p IN STAMPS WITH YOUR ADDRESS. MARK ENQUIRY PW.**

b.f.o. he "beats one station against the other"! The aerials are two dipoles with a common feeder. Main operation has been on the 80m band until recently when Jonathan "found the 15m band" after having been round to local G3VRY for a chat. His log has some quite good DX so one wonders what he would do with a proper receiver!

We have all complained at one time or another of the interference caused by BC stations operating on frequencies to which they are not entitled on the 7MHz band, and despite continual protests nothing ever happens to mitigate the problem. The main QRM is to amateur services in the 7100 to 7300kHz band in Region 2. The ITU has recently sent a notice to all administrations bringing this point to their attention. But you can bet your bottom dollar that precisely nothing will come of this, as usual, because the ITU is completely powerless to act effectively in this matter.

## DX Notes

Good and bad news from **P. C. Hawkes** of Stourbridge, long-time contributor to this column. After being made redundant recently he has been able to get a job in Zimbabwe and expects to be there in the New Year. His faithful AR88 goes with him, but not, I understand, as part of his personal baggage! Although plans to take the RAE here have been shelved I have suggested he does take the December RAE if at all possible so as to smooth the way for a licence out there when that becomes possible. Good luck OM and hope to work you from darkest Africa some day. DX logged lately on 10m included HMØU (QSL JA6HNK) and 5N2ØATW with cards to POB 3197 Lagos. 3B8DB and J3AH were found in the Round Table net on 20m, and a quick look around 0630 on 160m revealed VE1BNN and VE1DXA, all on s.s.b.

**Edward Baker** of Gramlington, Northumberland, took time off from his duties as Editor of the ISWL magazine *Monitor* to tell of the DX he has logged on 160m s.s.b., like OH2BNP, YU4FRS, UC2ACA, SP3BLG and W2HCW and a VE1 that got away. On 40m Ed roped in 4S7KK, 8Q7AZ and A7XD with WA1YIG/3B8 on 15m, ending with VQ9TT on 10m, all s.s.b. Gear used is an SX100 or GR78 plus 100ft wire and audio filters.

**Bill Rendell** of Feoch, near Truro, was pestered by oscillator instability on his HRO, eventually tracing it to a dry joint on the valveholder. Now he says the old faithful is a super performer even on the 10m band where the HRO has never been particularly brilliant. So Bill's s.s.b. log starts with ZL4AO on 3·5MHz, then J73PP on Dominica, VK3XI and VK7LZ plus YS9RVE on 7MHz; CE9AF, HKØEKM, J3AH, J6LOU, M1D and VP8PP for 14MHz, while 21MHz came up with FPØGAP, VP2SAB, VP5B and ZD8TC. New signals heard on 28MHz included A7XD, CO2OM (Box 3011 Havana), HK1CC1, K8YWG on Gibraltar Is. in Lake Erie, so a new island for Bill, VP8PP, VP8SB on Adelaide Is., and ZP5GLS who said QSL through W3HNK. Bill also noted EI7EB on 80m operating from a hospital bed because he had "been such a good boy"! Get well soon OM!

**Dave Coggins** is still playing around with his phased verticals in Knutsford, Cheshire, which although designed for 20m are doing quite well on other h.f. bands, he says, with less TV timebase QRM than he gets on his old 66ft wire. Dave has been looking around Top Band too, sometimes with his frame antenna which netted KP4ES and 4U1ITU plus YU3LF. On the other bands the FRG-7 found FO8FO, HKØEHM, PJ2CC, TG9AL. VK7AE, YC1BMI, ZS1MZ and ZL4LZ all on the 40m segment, with 10m coming up with FGØDYM/FS7, VK9XW (Christmas Is.), VS6CT and ZD8KM. Nice finds on 15m included YC6MF/Ø, VK9NC on Norfolk Is. not to mention VK9ZG located on Willis Is., a pair of fine rarities there OM!

In Birmingham, **Dennis Court** has been getting hot under the collar over some military stations operating in the 80m band, interfering with the amateurs. Well Dennis I'm afraid that this band is a shared band meaning that all kinds of other radio services like shipping, aircraft, fixed and mobile services and point-to-point have just as much right there as us amateurs, or even more right if the truth were known, so afraid we just have to use our operating experience to get through all the QRM.

From Hull, **Colin Frankland** BRS45342, tells of excellent conditions on the bands generally in recent times. Biggest catch for him with his Trio 9R59DS and two indoor dipoles was VQ9AA on Diego Garcia, rapidly becoming a popular spot for reasons we'll not mention here, but likely to remain a rarity all the same. The nice, clear log starts with 15m listing C5ACA in the Gambia, CO1FL, KH6WU, SVØBL on Rhodes, TU4AT, VP9BDA, VP2MPB on Montserrat, the VQ9AA, ZB2GK and YC1GJ. Only catch worthy of mention on 10m was VP5WW and QSL to WB4EYX. Useful one on 20m was S83W in the Transkei while VP5TCI on the Turks and Caicos Is. wants cards to POB 78 Grand Turk.

## Clubland

New clubs being formed thick and fast all round the country can only be a good thing for our hobby. Hope the PROs concerned will see that everyone in their area is fully informed on club activities. Make the most of the free advertising available in local newspapers who are always looking for information on hobby interests.

**Smiths Industries Radio Society.** Just formed as a section of the Sports and Social Club, Cheltenham, SIRS is open to any with amateur or electronics interests. Meetings third Wednesday of the month at the Club House, Newlands, Bishop's Cleeve with emphasis on the practical and social aspects of the hobby. Morse classes courtesy of G3CXI with RAE courses at North Gloucestershire Technical College where lecturer is Terry Adams G4CHD. Much more info from Secretary Roger Hawkins G8UJJ on Bishop's Cleeve (0242 67) 3333 ext 2489 during office hours or B's Cleeve 2175 otherwise, not to forget channels S20 or R3 if you are on v.h.f.!

**Leighton Linslade RC.** But two months old! Meeting second and fourth Thursdays at 7.30pm at the Pavilion, Mentmore Road, Leighton Buzzard. Naturally anyone interested will be made most welcome, says C. R. Wood G8UGN of 2 Stivers Way, Harlington, Dunstable, Beds, who will be glad to fill in with the details.

**Verulam ARC.** Fourth Tuesday at 7.30pm, Charles Morris Memorial Hall, Tyttenhanger Green, near St. Albans, Herts. January meeting welcomes G3LHZ for a chat on antenna systems. Advance notice that well-known character Pat Hawker G3VA will be lecturing on direct conversion receivers at the March meeting. Informal meetings of the club are held on the second Tuesday at RAFA HQ, Victoria Street, St. Albans, if that is more convenient. Hilary Claytensmith G4JKS, 115 Marshalswick Lane, St. Albans, probably knows more about the details than anyone else.

**Wolverhampton ARS.** John Cook G8EDG, 75 Windmill Lane, Castlecroft, Wolverhampton tell me that the club meets every Monday 8pm at Neachells Cottage, Stockwell End, Tettenhall, Wolverhampton, so if you feel you'd like to go along you're welcome or write John for more info. He is also on Wolverhampton 763617.

**Mid Lanark ARS.** The Wrangholm Community Centre is home for the club GM3PXK every Friday 7.30pm, with a continuous programme of lectures and films that ought not to be missed if you can possibly make it. Doug Smillie GM4FKD knows all about the forthcoming attractions, at the club centre in Jerviston Street, New Stevenson, Motherwell.

**Exmoor RC.** Successful RAE courses seem to characterise this group which has club call G8SSS and over 20 licensed members. Every Thursday, 7.30pm, at "Loughrigg", East Street, South Molton, and if you want someone to hold your hand when you get there try secretary Pat Jemmison, XYL of G8RZE, at "Homedale", Brayford, N. Devon.

**Stevenage & District RS.** Another RAE course-conscious mob, to the extent of running two classes simultaneously, depending upon what you know when you start. So run along at 7.30pm, to the Plant B Staff canteen, British Aerospace Dynamics, Stevenage, on any Tuesday and enjoy yourself.

**Congleton ARC.** Glad to hear from you for the first time with short but well-produced newsletter. Club call is G8PFY and secretary Neville Clayton G8UYT, 2 Moorfields, Leek, Staffs, or Leek 385992, will tell you all about the threatened lectures to come, about SSTV, RTTY and building a synthesiser for your rig. Congleton note: there are around 30 licensed amateurs within a two-mile radius of the Town Hall! Talk-in to the club should present no problems!

**Thornton Cleveleys ARS.** Another one new to the column. First and third Wednesdays, 7.45pm, St. John Ambulance Hall, Fleetwood Road, Thornton, Lancs, "next to the Gardener's Arms". That ought to help! RAE classes plus slow Morse over the air from G3ZRZ are just two of the attractions. Coming events are "Looking at the Early Days" by G6DN on Jan. 7, and a film on the manufacture of transistors on Jan. 21, but A. Parr G3IWP, 43 Argyll Road, Poulton-le-Fylde, can tell you more.

**Wakefield & District ARS.** Holmfield House, Denby Dale Road, Wakefield at 8pm alternate Tuesdays, which, after a little calculation, means meetings on Jan. 4 and 18 but no details of programme so far. Contact Richard Sterry G4BLT, 1 Wavell Garth, Sandal, Wakefield, Yorks, who'll supply the details, or listen to the RSGB news from GB2RS on S22 at 9.30am Sundays.

**Liverpool & District ARS.** Tuesdays, 8pm, Conservative Rooms, Church Road, Wavertree, with sale of surplus equipment on Jan. 6 and G8NNX chatting on commercial radio techniques on the 13th. G3AHD pumps out c.w. practice sessions on 2m on Thursdays just to keep you out of trouble. Reg Simmons G3PNS, 62 Daneville Road, Liverpool L4 9RG, won't mind if you get in touch as he is new to the job of secretary and probably has nothing else to do!

**Meirion ARS.** First Thursdays, 7.30pm, Ship Hotel, Dolgellau. That's nice and short! Jan. 8 has GW4BIF on s.w.r. problems, and discusses the G5RV aerial. Two for the price of one! Or try to make Feb. 5 for s.w.l. Bob Smith on power station instrumentation. Megawatts instead of milliwatts! More from Dave Morgan GW8PKA, Penybont, Gellilydan, Blaenau Ffestiniog, Gwynedd, or ring Maentwrog 341. Hope I've got all that right.

A note from the **White Rose RS** of Leeds tells me of a s.w.l. contest from Jan. 24 1500GMT to Jan. 25 0900GMT on the 1·8, 3·5 and 7MHz bands with c.w. and telephony sections, with "world-wide publicity" I have to say that with such a restricted operating period especially on the l.f. bands, there is not going to be much enthusiasm from outside the UK. However if you are interested drop a line in advance to Dave Whitaker, Hillcourt, 57 Green Lane, Harrogate, Yorks, for more info.

# Medium Wave Broadcast Band DX


by Charles Molloy G8BUS

Reports to: Charles Molloy G8BUS
132 Segars Lane, Southport PR8 3JG.


"Do North American medium-wave stations QSL?" is a question often asked. Most will if you send a reception report giving details of the programme you heard. It should go to the Chief Engineer so that he, or one of his staff can check it against the station log which is held and compiled at the transmitter site. In the United States every station is obliged to maintain a log of what actually goes out over the air.

## North American QSLs

What sort of information should be included in the report? Titles of pieces of music are not listed in the station log so it is a waste of time referring to them! Details of sponsors (jingles), time checks, weather reports, station identification, news items, titles of programmes, names of announcers, all these are the things to mention and most come over the air around the hour or the half-hour as programmes change and identifications are made. Ideally one should start five minutes before the hour or half-hour, but this may not be possible. There is a well-known law which ensures that if there is going to be a fade then it will occur at station identification time.

## Model Reception Report

The following is the format I have used for many years:

| | |
|---|---|
| The Chief Engineer<br>W---Radio<br>New York City<br>N.Y.<br>USA | DXer's Address in<br>block capitals<br>Date |

Dear Sir,

I had the pleasure of listening to your programme on----kHz at 1955hrs EST on Friday the 7th November 1980 (equivalent to 0055hrs GMT on the 8th November). This is what I heard:

1955 The----show
1959 "brought to you by----beer"
2000 "W----Radio New York" News at 8 o'clock
2003 Weather report. Temperature 45 degrees
2003½ Next news at 8.30
2004 Basketball Commentary

Reception was with a BRT400 communications receiver and a


◄ KSL, a rarity from Utah

WHDH, a 50kW broadcaster on the east coast ▼


medium-wave loop antenna. Your signal was strong with some fading and there was some interference from a station in Venezuela on the same channel.

I hope this report will be of interest to you and I would be very grateful if you could send me a verification of reception (QSL) if the above programme details agree with your station log. An International Reply Coupon, to cover return postage, is enclosed.

Many thanks
Yours sincerely
(Name in Block Capitals)

This is the format I have used for a number of years. The introduction and ending are a matter of personal choice but there are a number of things to note about the rest of the report. There is a change of date at midnight but you are listening to a time zone five hours back where yesterday's date still applies. Eastern USA is on EST (GMT−5), the Atlantic provinces of Canada are on AST (GMT−4) and Newfoundland is on NST (GMT−3½). It is better to quote the date and local time at the station but it is possible to get into a muddle over summer (daylight saving) time which starts and finishes on different dates in the UK and North America. If in doubt quote GMT but not BST. Give the time to the nearest half-minute if you can.

Always send return postage in the form of an International Reply Coupon (IRC), which can be obtained from the stamp counter of larger post offices. You are outside the service area of your DX catch and the station is really doing you a favour by replying at all. Some DXers worry about not having the full postal address. I have used the type of address in the model report for a number of years and I have never had one returned by the Post Office. Provided you mention the callsign and the location announced over the air then your report should be delivered, but of course if you can get hold of the full address, then use it.

What sort of QSL can you expect? Usually a QSL card though some stations reply by letter. Cards make an attractive display when mounted in a photo album. How long should the report be? Unlike a s.w. report, which should indicate that the listener actually listened to the programme, a report to a medium-wave broadcaster does not have to be long provided it contains a number of verifiable items. A ten minute period starting five minutes before the hour will probably be enough, even if there is a fade in the middle of it.

## Readers' Letters

"I have recently bought for a fiver an oldie wireless set called the Orion Imp," writes **N. H. Parr** of Lutterworth, who wonders if he can use a loop with the receiver's ferrite rod antenna switched out. The ferrite rod antenna in most receivers performs a dual function: as an antenna and as an antenna tuning coil. If you disconnect it then there will be no tuning coil and the receiver will not work.

One solution is to remove the ferrite rod antenna and fit a tuning coil in its place, if you can find a suitable inductor. A better solution is to construct a loop with a small shelf near the centre. The receiver is placed on this shelf in such a way that the nulls of the ferrite rod antenna and the loop coincide. Loop and receiver are now rotated together, coupling between them being by induction. There is no direct connection between the two and if a coupling winding is already fitted to the loop then it is left disconnected.

Reader **G. S. Ferguson** (Warrington) refers to the standard "40in" loop which is fitted with a 500pF tuning capacitor and 220pF fixed capacitor, which can be switched in parallel so that the medium waves are covered in two stages. He wonders what the two frequency ranges are. It may be possible to cover the band in a single range depending on the minimum capacitance of the main winding and of the tuning capacitor. If you cannot reach the l.f. end then a parallel capacitor and switch will be required and there will be quite an overlap between the two ranges.

## DX Heard

From Barking in Essex comes a report of reception of the 5kW WCSH on 970kHz, which is located at Portland, Maine on the eastern seaboard of the United States. **Andy Small,** at the controls of his Hammarlund SP600JX and modified loop which was described last month, says: "I only heard this station for a few minutes with station identification, a weather check and a piece of music---I was however able to convince the station of my reception." Andy thinks readers may be interested to know that with a difficult-to-hear station it is possible to receive a verification for a report that only contains a few programme details (depends on the details!).

WCSH, which has been on the air since 1926 is, at the time of writing, in the process of an ownership change.

WNYZ has been applied for as a new callsign and if this comes off then the call WCSH may soon disappear for good.

Local radio enthusiast **Adrian Child** of Dorchester uses a Starfinder II portable with internal ferrite rod antenna. He reports hearing Radio Carlisle on 756kHz (397m) at 0700 with QRM from West Germany; Radio Norfolk on 855kHz (351m) at 1630 with QRM from Spain and Berlin; Manx Radio 1368kHz (219m) fading in at 1615 and Radio Birmingham/Radio London "fading slowly in a rhythmic pattern" on 1450kHz (206m). On 1152kHz Birmingham and Plymouth Sound could be picked out by "turning the receiver towards the transmitters, thus making use of the directional properties of the internal aerial."

# Short Wave Broadcast Bands

by Charles Molloy G8BUS

**Reports: as for medium wave DX, but please keep separate.**

When I am asked which antenna is the best for short-wave reception I have to reply with another question. What do you want to listen to? There is no single antenna that will match the needs of the DXer on the one hand and the short-wave listener on the other. The DXer's aim is to pick up distant and perhaps weak stations for the sake of doing it. That is what that side of the hobby is all about and the programme value, if any, is of secondary importance. The s.w.l. is interested in programmes and he may be trying to listen to a moderately strong signal in a crowded band. The requirements of the two can be quite different although many DXers do some short-wave listening as well. A couple of examples from my own listening may illustrate what I mean.

## Listening to DX

The English broadcast from the Argentine Foreign Radio is on 11 710kHz in the 25m band at 2300 on Mondays to Fridays. At this hour, especially in winter, the band is not crowded and there is little danger of overloading the receiver with strong signals so I use the BRT400, long wire, antenna tuning unit and occasionally the Codar PR30 preselector as well.

## Listening to Locals

As a regular listener to the Austrian *Short-Wave Panorama* on a Sunday evening, I have found that my long wire does not give satisfactory reception on 6155kHz in the 49m band. There is a lot of interference (QRM), splash, etc., which reduces the programme value of the signal. A shorter antenna used with the r.f. gain control turned right down usually provides a nice clean signal with little QRM. This is with the BRT400 which is a valved receiver and is less prone to overloading than modern semiconductor sets.

## Which Antenna is Best?

The simplest solution is to have more than one antenna. If you can, erect a long wire and match it to the receiver with an a.t.u. This is the set-up for listening to Latin America on 19m and 25m in the evening or to Radio New Zealand or Tahiti in the morning.

Indoor antennas are to be avoided wherever possible as they pick up electrical interference. TV receivers are the main culprits and they radiate directly as well as from the mains wiring, but other electrical equipment can cause trouble too. A whip mounted on the window ledge or on the roof, and fed to the receiver via a screened lead is better. An antenna switch, mounted close to the receiver, gives you the immediate choice of antenna and the opportunity for a comparison between them. It is always more interesting to experiment than to theorise as it is the results that count.

If you are using a portable with a built-in whip antenna then hesitate before connecting a long wire to it. You will certainly pick up more stations but you may, if you overload the receiver, hear several at once. If a receiver does not have an antenna socket then it is safe to assume that it is only intended for use with its own antenna.

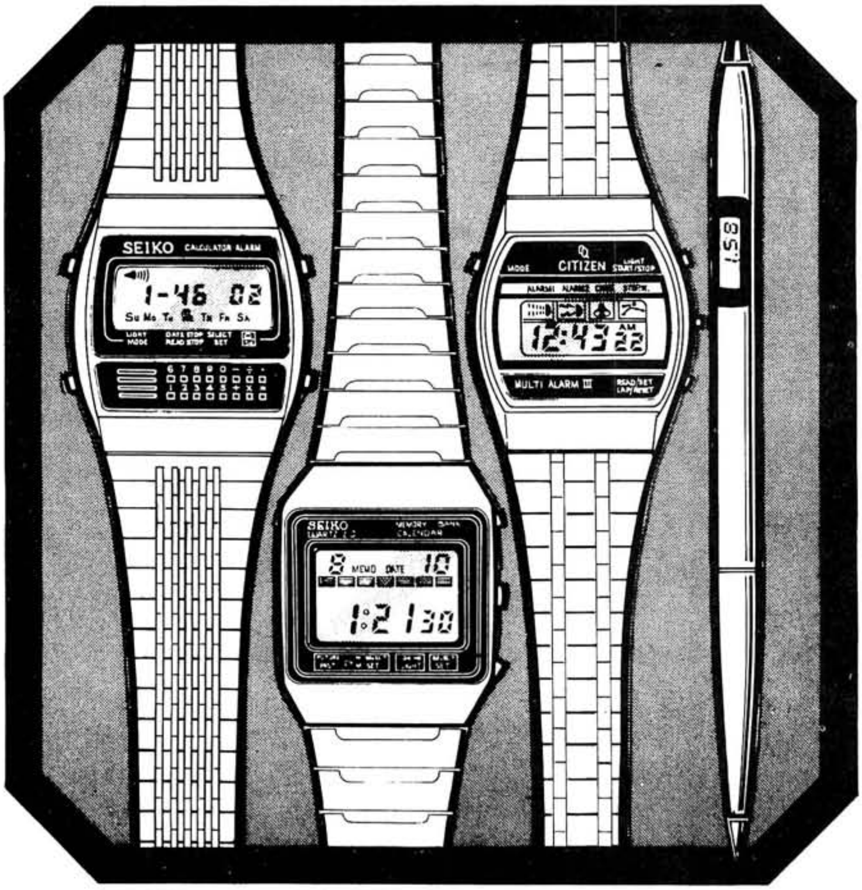
## Receiver Calibration

"How can I calibrate my receiver without using an expensive calibrator," asks reader **A. Scott** of Birmingham who uses a two-transistor home-made short-wave receiver. **L. Harding** of Upton-on-St Leonards has found a partial solution to the problem when using his Vega 206. He notes the position of the pointer relative to the figures on the tuning scale and he can find one station on the 31m band simply by setting the pointer over the centre of the figure 9 of the 9·5MHz mark.

Why not try the home-made logging scale described in the December 1980 issue of this column. You can then plot frequency against log scale reading on a piece of graph paper using known s.w. stations for calibration points. Many announce their frequency over the air and at the h.f. end of the 31m band you will find a number of time and frequency standard stations on 10MHz which are

**A recent QSL from Radio Japan**

# JANUARY SALE




**To: Mitrad 68/70 High Street, Kettering, Northants**

Please send me:

- ☐ Seiko Quartz Calculator Alarm Watch(es) at £48.80 (inc p&p)
- ☐ Seiko Quartz Memory Bank Watch(es) at £28.80 (inc p&p)
- ☐ Citizen Multi-Alarm Watch(es) at £28.80 (inc p&p)
- ☐ Pen Watch(es) at £11 (inc p&p)

**Total value of my order £** ____________

I enclose cheque/PO or debit my Access/Barclaycard

No. ____________ Signature ____________

Name ____________ (block letters please)

Address ____________

☎ Credit card holders may telephone (0536) 522024 24 hours a day stating card number for immediate attention. All orders despatched within 7 days. Delivery subject to availability. Full refund if not completely satisfied.
Mitrad. Registered in England No 2554356. Code PW 2/81

# EXTRA SPECIAL OFFER QUARTZ WATCHES

## AT 'GIVEAWAY' PRICES

**SEIKO QUARTZ CALCULATOR/ALARM Only £47.95 + 85p p&p** Continuous display of hours, minutes, seconds with day, alarm indicators. Optional display: month, date, AM/PM with day indicator. Calculator (16 key) performs arithmetic, percentage, constant and power calculations. 12 hour alarm with AM/PM indication, rings twice a second for 10 seconds, then four times a second for 10 seconds. Display flashes as battery life nears end. Back light. Water resistant. Adjustable stainless steel strap.

**SEIKO QUARTZ MEMORY BANK CALENDAR Only £27.95 + 85p p&p** Continuous display of hours, minutes, seconds, day, date; 12 hour or 24 hour cycle. Optional monthly calendar display of month, year and dates for designated month with Sunday dates flashing. (Any month Jan 1930 to Dec 2009). Memory bank stores up to 11 dates, displays 'MEMO' and flashes on designated dates. Display flashes as battery life nears end. Back light. Water resistant. Adjustable stainless steel strap.

**CITIZEN QUARTZ MULTI-ALARM with timer, stopwatch facilities. Only £27.95 + 85p p&p** Continuous display of hours, minutes, seconds with AM/PM indication. Optional display of month, date, day. 12 hour capacity timer, sounds alarm at end of countdown. Time signal chimes every hour on the hour. 12 hour capacity stopwatch. 12 hour alarm with AM/PM indication and spare alarm for added convenience. Indicator flashes as battery life nears end. Back light. Adjustable stainless steel strap. Available with black/white or black/grey face.

**MITRAD PEN WATCH Only £10.15 + 85p p&p** Elegant stainless steel ballpoint pen combined with a quartz precision timepiece. The five function LCD watch displays hours, minutes, seconds, month and date and has a computerised four year date memory. In presentation case with spare pen refill.

This is a representative selection from the collection of guaranteed leading make and own brand watches offered through Mitrad's 7 day distribution system and backed by Mitrad's own service organisation. For complete product range, ring or write for catalogue. Trade price list available for bulk orders.

**MITRAD**

**The premier mail order house specialising in quality products and superior after-sales care.**

**MITRAD 68/70 High Street, Kettering, Northants. Tel: (0536) 522024**

# SOUND ADVICE – SOUND VALUE

A GOOD START is essential to short wave listening and expert advice is important in achieving this – So here's some – If you've made up your mind to buy a receiver you should be aware it will perform only as well as the antenna it sees. The old adage regarding wire antennas "As long and as high as you can" is still good, but at best is only good for PEAK PERFORMANCE on one or two frequencies, at worst none.

Whichever frequency you tune your receiver to, for PEAK PERFORMANCE on all frequencies you need good matching between your Receiver and Antenna to hear the best from it. If you plan to listen on the high frequency bands up to 30MHz then you know you can't have an antenna for every frequency! Or can you? – Well, not quite! BUT we can offer you MUCH IMPROVED PERFORMANCE from your receiver by using an antenna tuning unit, that will electrically change the length of your antenna to match the frequency you select – In other words – A MATCH AT ALL FREQUENCIES.

You'll see many antennas being advertised under gimmicky names, but when it comes down to it they're only random wires or odd configurations. At the end of the day, if you're expecting the performance the manufacturers specified, then you'll still have to buy an antenna tuning unit.

Tell you what we'll do – we'll prove it to you – we'll give you one ABSOLUTELY FREE when you buy your FRG 7 or FRG 7700 and we'll give you complete advice on an antenna to suit your available space, which should only cost you a couple of pounds! So let's put the offer in big print for you!

**1 YAESU FRG 7 + AMTECH 200 ATU £199.00**
**1 YAESU FRG 7700 + AMTECH 300 ATU £309.00**
**VAT included**

What's the difference between the Amtech 200 and Amtech 300? Well both will tune any random length of wire but the Amtech 300 will do a little extra – it will also tune co-axial fed antennas – Their normal selling price? The Amtech 300 **£39.95** – The Amtech 200 **£25.95** – What can you lose? So get cracking MAKE A GOOD START! HAVE PEAK PERFORMANCE FROM THE OFF.

**JAYBEAM – HYGAIN – BANTEX – AMTECH – CUSHCRAFT – SWAN – ATLAS**
**and 50 other major lines – all ex stock**

AMCOMM

## AMCOMM SERVICES

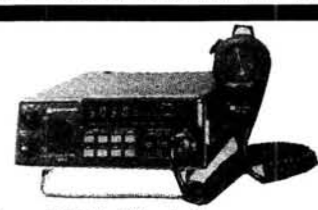
**194A NORTHOLT ROAD, SOUTH HARROW, MIDDX.**
**Tels: 01-864 1166 & 01-422 9585**

Opening hours: Tues–Sat 9.00–5.30, Sundays by appointment. Closed Monday.

YAESU

---

## THE LATEST 2M ALL-MODE MOBILE YAESU FT480R NOW IN STOCK



### C8800 2m FM Mobile

The C8800 is a matching unit to the C7800 with the same features covering the 2m band in 5 or 25kHz steps (this is switchable from the rear panel). S20 and S22 are pre-programmed and available at a touch of a button, the unit has a 3 position RF gain to attenuate strong signals such as repeaters. Provision is made for two repeater offsets (600kHz is fitted as standard) at **£252** inc. VAT.


### KDK 2025 2m SYNTHESIZED 25w TRANSCEIVER

- ★ Custom designed microprocessor control
- ★ 25kHz *and* 12.5kHz synthesizer steps!!
- ★ 'Instant QSY', 10 times rate button
- ★ 25 Watts of reliable RF output
- ★ Band scan between any 'easy set' limits
- ★ 10 write-in non-volatile memory channels
- ★ Memory scanning with hold facility
- ★ Standard ± 600kHz or any repeater split

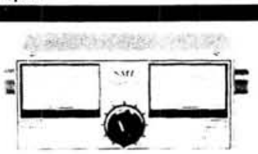
**New Low Price £225.00 inc. VAT**

**SWR200B** swr/power meter covering 3–200MHz 50/75 Ohm power range 3–30MHz, 20/200/2kW, VHF 2/20/200W **£40.20.**

**UH74** SWR & power meter switchable HF, 2m & 432MHz with remote heat at **£16.40** inc. VAT.

As EK-150 but with four memories each capable of storing 256 bits making a total of 1,024 bits. This can be recalled separately or in sequence for one long message. **£135** inc. VAT.

**PX402** 13·8V DC 3 amp continuous 4 amp max fully stabilized power supply with overload protection **£22.95** inc. VAT. P&P £2.00.
Also available:
**PH5000,** 5A continuous, 7A surge. **EP2500,** 25A continuous, 30A surge.



**SWR25:** This ever-popular twin SWR and Power meter covers 3·5–150MHz at **£12.65** inc. VAT. P&P 50p.

**DL-30** Dummy load 25W DC-150 MHz **£6.35** inc. VAT. P&P 25p.
**T-100** 80W Dummy load DC-500 MHz **£24.10** inc. VAT. P&P 25p.
**T-200** 150W Dummy load DC-500 MHz **£35.60** inc. VAT. P&P 25p.

**TERMS OF BUSINESS:** Please note all above items **PRICE INCLUDES VAT.** Please send cheques or P.O's or quote Barclaycard or Access No. to: **B. BAMBER ELECTRONICS, 24 HOUR PHONE SERVICE (0353) 860185.** Callers welcome Tues, Sat. 9.00 am-5.30 pm.

Buy it with Access

## B. BAMBER ELECTRONICS

**5 STATION ROAD LITTLEPORT CAMBS CB6 1OE**

BARCLAYCARD VISA

easily identified by their clock-type one second pulses. They are also to be found on 2·5MHz, 5MHz, 15MHz and 20MHz when propagation is favourable.

## Short-Wave Radar

There have been a number of enquiries about the machine-gun type pulses that can be heard wandering about the short-wave bands in an unpredictable way. This is over-the-horizon radar which seems to be a permanent feature on the short-wave bands these days, though it is a lot less troublesome now than it used to be. This type of QRM started in the USSR a few years ago and was the subject of a number of complaints at the time, but it has been reported that other countries have become involved since then.

The reason for the apparent aimless wandering of the signal is rather interesting. It is thought that the transmitter is linked to ionospheric sounding equipment in such a way that the radar operates close to the critical frequency at any moment in order to obtain optimum propagation.

## Beams and Bearings

Some readers are puzzled when they hear transmissions that are beamed away from them. Well, these beams are not like the pencil beam from a torch. A better analogy would be a light that is brighter in some directions than in others. There is also the possibility of round-the-world reception which takes about one seventh of a second. If you hear a broadcast with a pronounced echo on it then the echo may be from a signal that has travelled round the globe.

Radio waves travel along a Great Circle path and not "round the latitude" as one reader suggests. The GC path is the shortest distance between two places on the earth's surface. If you have a terrestrial globe then stick a pin in London and another in Vancouver. Stretch a piece of thread between the two pins and its track on the globe is the GC path between London and Vancouver which, rather surprisingly passes close to Iceland and is the route aircraft take. There are two GC Tracks between any two points on the earth, a long one and a short one. In the case of Australia the "short" path is across Russia, China and SE Asia, while the "long" path is the South Atlantic, South America and the South Pacific. You can obtain a Great Circle map centred on London, from the Radio Society of Great Britain, 35 Doughty Street, London WC1N 2AE, for £2.10 post paid. This map which is on a flat surface and is completely unlike any other map (you won't recognise New Zealand), shows the GC track and enables you to measure the Great Circle distance from London to any place in the world.

It is useful to know the GC bearing if you are interested in directional antennas, but it is also valuable if you are concerned about propagation. VNG, which is the time signal station at Lyndhurst in Australia, can be heard on 7·5MHz in the UK in the late afternoon during the winter. Propagation must be by the short path which is in darkness at this time, and VNG is a good pointer to propagation on this path. The signal does suffer from QRM from a Chinese station at times.

## DX Heard

Iceland now seems to have a regular service on 12 175kHz in the evening. I've heard it on several occasions around 1930 with quite a good signal using the BRT400 and 60ft long wire. Reader **P. Harrison** (Scunthorpe) has an Eddystone 730/10 and his log includes Uganda on 5025kHz (60m) at 1830 and Iran in English on out-of-band 9022kHz at 2005.

A Trio R-1000, 150ft long wire and Mizuho KYZ Skycoupler (a.t.u.) are in use at Wakefield by **Stephen Bowler,** who reports hearing Radio Australia on 21 680kHz at 1903, Radio Pakistan with English identification on 15 485kHz at 1830, and HCJB in Ecuador in English on 21 480 at 2030.

"Can anyone explain the appearance of BBC1 (TV) sound on approximately 13 700kHz?" asks **Mark Slater** who lives at Beckenham. **Cen Rudd** GW4BIQ of Swansea has an FRG-7 which he used with an 80m trap dipole to pick up Radio Israel on 9815kHz at 2000. This programme is also transmitted on 11 655, 9425 and 9009 at this time and on 11 655, 9815, 9435 and 7412kHz at 2230.

# VHF Bands

**by Ron Ham BRS15744**

**Reports to: Ron Ham BRS15744**
**Faraday, Greyfriars, Storrington,**
**Sussex RH20 4HE.**

Although more than 100MHz apart, the 2m and 10m bands have a lot in common, mainly I think because both bands are subject to the whims of the earth's atmosphere and, each in their own special way, are good hunting grounds for the DXer. I was reminded of this early on November 3, when I heard an SM on 10m telling a VK about the prevailing good conditions on 2m.

## Solar

Despite unfavourable weather conditions, **Cmdr Henry Hatfield,** Sevenoaks, used his spectrohelioscope at every opportunity between October 21 and November 11. During his observations on October 22 he counted five sunspot groups, and on the 30th he saw approximately 12 groups and the remains of a large loop prominence near the north pole of the sun. On November 2 he could still see 12 groups, but one of them contained "a large ugly spot surrounded by seven small ones." Henry suggested that this was the cause of the severe noise storm that he was recording at 136MHz and 198MHz and I was recording at 143MHz. Each of us recorded a variety of individual solar bursts during our radio observations on October 21, 23, 24 and 31 and November 1, 2, 3, 5, 6, 7 and 10 (Fig. 1).

During the morning of November 10, Henry counted four sunspot groups, one of which was a long chain of about 30 spots. Between 1126 and 1200, he saw a double flare in one group, a small flare in another, an eruptive prominence on the solar limb and the actual event which generated the burst of radio noise that we both recorded at 1139 (Fig. 2).

## The 6m Band

At 1500 on October 22, **Hugh Cocks,** near Battle, Sussex, using a Hallicrafters S27 receiver, heard c.w. signals from the USA. Around 1300 on the 29th a few Ws were calling, and about the same time on November 1 he

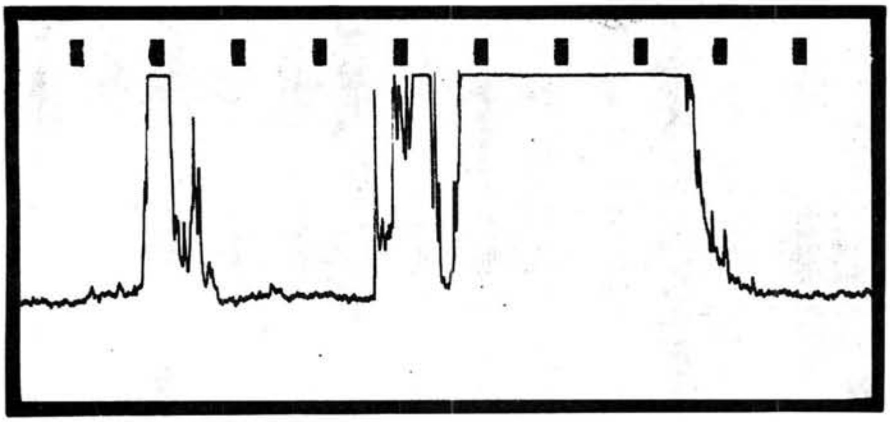
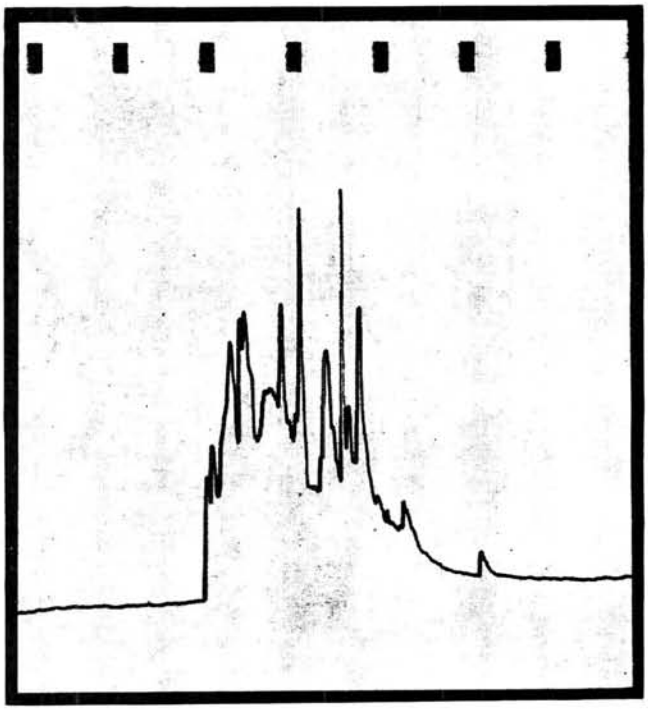


**Fig. 1: Two solar bursts which overloaded the author's 143MHz receiver around midday on November 3**

**Fig. 2: The solar burst recorded by the author at 1139 on November 10 and witnessed by Henry Hatfield with his spectrohelioscope**

heard a VP2. For a short period around 1240 on October 30, **Barry Ainsworth** G4GPW, Lancing, received signals from the South African beacon ZS6PW on 50·032MHz and at 1413 on November 5, I heard weak s.s.b. signals on the band.



## The 10m Band

For a large part of each of the 22 days between October 21 and November 11, the 10m band has been generally wide open and giving many enthusiasts a chance of hearing or working some real and sometimes rare DX. Almost every morning, Japanese and Russian stations were predominant among the many signals on the band. For instance, at 0930 on October 28 I enjoyed armchair copy of a QSO between an LA and a JA, and at 0850 on November 1 I tuned among the strong stations and heard VK4NIC/Aeronautical Mobile working into the UK. At 0846 on the 10th, it was fascinating to hear the very strong echoes on the signals of G4DXA when he was calling CQ and beaming toward VK and ZL, and on a French station when he replied to a JA.

Conditions on 10m were also very good on November 11, and at 0750 I heard a 58 signal from ZL2AZU while he was working a DF, but when the German station replied his signals were subject to severe echoing, as were those of G3IIY when he worked the ZL soon after. "The bands have been alive, not only with 28MHz amateurs but also with possibly Russian and certainly American utility stations, and on October 27 I heard American voices in short bursts as high as 53·9MHz," writes **Harold Brodribb,** from St Leonards-on-Sea, Sussex. Harold has logged amateur signals from most parts of the USA on 10m, and has identified several of the harmonics from lower frequency broadcast stations that frequently come up between 28MHz and 35MHz when conditions are good.

One of the best ways of finding out what the band is like at any particular time is to listen for the signals from the various beacon transmitters which operate for 24 hours per day from strategic sites around the world. The October issue of the International Amateur Radio Union's *Region 1 News* lists 21 such stations (Table 1), most of which are operational and in the International Beacon Project scheme, co-ordinated by **Alan Taylor** G3DME, QTHR. I usually check the 10m beacon frequencies around 0830 and 1345 each day using a long wire antenna into a Yaesu FR-101, and during the period in question I heard signals from A9XC on 22 days, DK0TE 16 days, DL0IGI 19 days, VP9BA (mainly at midday) 14 days, 3B8MS 12 days and 5B4CY 22 days. Although the average signal strength of DL0IGI was about 539 it did, as usual, reach 599 when Sporadic E was about during the early morning of October 26. **Ted Waring,** Bristol, often hears the signals from the Canadian VE3TEN and South African ZS6DN beacons, not listed in Table 1, and during the last week of

**Table 1: Beacons on 28MHz**

| Callsign | Frequency kHz | Callsign | Frequency kHz |
|---|---|---|---|
| DL0IGI | 28 205 | VE7TEN | 28 252 |
| WD4MSN | 28 207 | DK0TE | 28 257 |
| 3B8MS | 28 210 | ZS6PW | 28 274 |
| GB3SX | 28 215 | DF0AAB | 28 277 |
| 5B4CY | 28 220 | YV5AYV | 28 280 |
| ZL2MHF | 28 230 | VP8ADE | 28 284 |
| VP9BA | 28 235 | VS6HK | 28 290 |
| LA5TEN | 28 237 | W6IRT | 28 888 |
| OA4CK | 28 240 | WD9GOE | 28 894 |
| A9XC | 28 245 | DL0NF | 28 992 |
| EA2HB | 28 247 | | |

October he was picking up signals from VE2TEN, a low power propagation study beacon in Quebec.

**G. Clothier** RS31665, Bristol, using an FRG-7 and a quarter-wave ground-plane in the loft, frequently listens for the 10m beacon signals and when he hears YV4AYV on 28·282MHz, another at present unlisted beacon, he then looks for DX in the South America region. Like me, RS31665 has found that A9XC is the most consistent beacon on the band. G. Clothier is a member of the RSGB Bristol Group; was a listener back in the 1920s and once held the RSGB number, BRS5! Readers' reports about the reception of beacon signals are always welcome by Alan Taylor for the RSGB, and me for publication in this column.

On November 1, **Gerry Brownlow** G3WMU, worked LA, LU, W6 and W8 from his home in Brighton, and during the afternoon of the 2nd he parked his car outside the radio building at the Chalk Pits Museum, Amberley, Sussex and with his FT-7 and a "G" whip antenna worked stations in Russia, Scandinavia and the USA.

## Tropospheric

The prevailing high atmospheric pressure of 30·3in (1026 mbar) on October 20 began to fall rapidly at 2300, and by midnight on the 21st it was down to 30·0in (1015 mbar) and falling. It was therefore no surprise when I switched on the gear at 0730 on the 21st and heard a mobile station in Cornwall working GW mobiles through the Bristol Channel repeater GB3BC, R6 and several continental broadcast stations in Band II. This short-lived disturbance spread into the 70cm band, and with a dipole feeding my receiver, I heard 579 signals from the beacon in Sutton Coldfield GB3SUT. The pressure remained low until midday on the 25th when it rose to 30·1in (1019 mbar), and by noon on the 30th it was back to 30·3in where it stayed until about 0200 on November 1. Then a gradual fall set in, and true to form a tropospheric opening took place which lasted for a few days.

Between 1200 and 1300 on October 26, **Simon Hamer,** Presteigne, Wales, listening in Band II, noticed a lift and heard Sandi Jones playing Haydn's *Serenade* by the Scottish Dragoon Guards on BBC Radio Solent, stereo signals from the ILR stations in London, Capital and LBC, and music from Lille. I first noticed the main disturbance at 0045 on November 1, when signals from GB3BC were just opening the squelch on my TM-56B. By 0800, the repeater's signals were very strong and remained so for most of the 1st and 2nd. On the 1st, Gerry Brownlow, using an FT-101, a Microwave Modules Transverter and a 9-element Tonna aerial, heard two EAs and an HB9 on 2m s.s.b., and later heard an F6 calling "CQ Scandinavia only".

Between 1850 and 2100 on the 1st, **Ken Smith** BRS20001, Horsham, heard very strong signals from several French broadcast stations in Band II, and from midday on the 1st to late on the 2nd I received signals, averaging 539, from GB3SUT. At 0148 on the 2nd, still using my humble dipole, I heard G8GXE calling CQ on 70cm with his aerial beaming toward the north from Slough in Berkshire, suggesting that the troposphere was acting as a good reflector to part of his signal. Simon Hamer sent an interesting log for his Band II reception on November 1 and proved, by listening to Gershwin's *Porgy and Bess* from Caen, and music in stereo from Capital Radio and LBC, that DX hunting also has good entertainment value. During the evening, Simon logged 10 French broadcast stations between 88MHz and 100MHz, and at 1930 on the 4th he received signals from BBC Radio London in short bursts.

## News Items

Congratulations to **Jonathan Reed,** Alresford, Hants, who at the age of 14 years and 10 months passed the RAE with credits in both parts and now sports the callsign, G8YMH. I will look forward to receiving your reports, Jonathan.

**Alan Baker** G4GNX, tells me that the Sussex Mobile Rally will be held, as before, at Race Hill in Brighton, on 19 July 1981.

# TV

**by Ron Ham BRS15744**

**Reports: as for VHF Bands, but please keep separate.**

"The F2 season started with a bang on October 14 with smeary colour bars at 0938 on Channel R2, and a smeary, circular electronic pattern on Channel R1," writes **Nicholas Brown.** Good news for the future: according to a report in the *West Sussex Gazette* (9 September 1980), the subject of a television satellite for taking programmes to and from member countries, has been under discussion in the European Parliament.

## Pictures via F2

Between approximately 0830 and 1000 on almost every morning from October 22 to November 12, there was a jumble of strong pictures on Ch. R1, 49·75MHz, due to natural changes taking place within the F2 (upper) region of the ionosphere. It is obvious from a careful study of the screen that more than one signal is present and it becomes even more obvious when listening to the variety of television sync pulses on a communications receiver tuned to 49·75MHz. Owing to the multi-path reflections of the signals, these pictures are smeary, the captions are out of focus and it's not unusual to see several images, especially when a single figure is featured on the screen.

**Hugh Cocks,** near Battle, Sussex, using a Bush 125 receiver, a 4-element Band I beam and a pre-amp, has also seen the early-morning mixture on R1, but at 0830 on

**Table 1: Far east 625-line television frequencies in Band I (Ref. *WRTVH* 34th Edition)**

| Country | Channel | Vision MHz | Sound MHz |
|---|---|---|---|
| Australia | 0 | 46·25 | 51·75 |
| Australia | 1 | 57·25 | 62·75 |
| Australia | 2 | 64·25 | 69·75 |
| China | C–1 | 49·75 | 56·25 |
| China | C–2 | 57·75 | 64·25 |
| China | C–3 | 65·75 | 72·25 |
| New Zealand | 1 | 45·25 | 50·75 |
| New Zealand | 2 | 55·25 | 60·75 |
| New Zealand | 3 | 62·25 | 67·75 |


**Fig. 1: Four SSTV pictures received from the USA by Sam Faulkner**


**Fig. 2: SSTV pictures from Argentina and Nigeria**

October 24, he heard sync pulses on the Australian Channel 0, 46·25MHz (see Table 1), and around the same time on the 27th he resolved what looked like a news programme on that channel. Both Nicholas Brown, Rugby, and I saw the Russian test card (made up of small squares) emerge from the mixture on the 28th and 29th, and at 0948 on the 28th there were five clear images of an announcer wearing glasses.

At 0918 on the 31st there was the usual smeary mixture, then 10 minutes later the shape of an announcer appeared with only one image, I assume he was introducing a new programme, because at 0930, there was a strong picture of cliffs and the sea rolling in, but the captions were too blurred to read.

## Tropospheric

At 0730 on October 21, using my 405-line receiver fed with a dipole at 30ft a.g.l., I received strong pictures from the IBA transmitter at Lichfield on Ch. 8. This system serves me as an indicator for tropospheric conditions toward the north of England. When the atmospheric pressure is high and I am in the radio room, I leave this set running with just receiver noise on the screen, and if a picture builds up then I know that it's time to check the v.h.f. bands for DX.

This was proved at 0045 on November 1 when a weak picture from ATV on Channel 8 was one of the first indications I had that a tropospheric opening had begun, and by 0900 the picture was strong and subjected to co-channel interference. At 0900 on the 2nd, the HTV caption was riding up on the ATV colour bar test card on Ch. 8, and at 0905 the *Good Morning* caption from ATV was predominant once again. **Ken Smith,** Horsham, noted the severe patterning on several u.h.f. channels during the evening of the 1st, and said that both the BBC and IBA warned their viewers about the prevailing interference. Ken also saw signs of French pictures around Ch. 21. "The current ridge of high pressure covering northern Europe has led to a number of excellent tropospheric catches from Finland (up to 200 miles away), undisturbed by local stations in the early morning, thanks to the one hour time difference," writes **David Appleyard,** from Uppsala, Sweden, who received almost perfect pictures from Aland on Ch. E5, 175·25MHz and Turku Ch. E7, 189·25MHz at 0700 on November 2 and 3. David was using an 8in National Panasonic receiver with its own telescopic aerial standing on the window sill of his fifth-floor flat.

## Sporadic-E

During a brief period of Sporadic E around 0958 on October 26, I received pictures from Russia on Ch. R1 and bursts of sound on the R1 sound channel, 56·25MHz. During another short-lived event, David Appleyard watched an animal cartoon film followed by an ice hockey match on Ch. R2, 59·25MHz, between 1125 and 1155 on November 2.

## SSTV

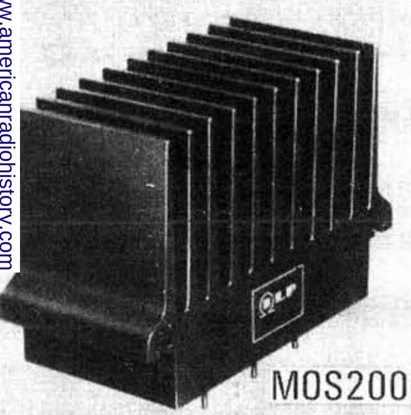
One of the delightful aspects of slow scan television is that it is possible to see the face behind the call, **Sam Faulkner,** Burton-on-Trent, has sent me four such pictures he received from the USA to prove the point, Fig. 1. During late September he also received pictures from Argentina LU5AN and Nigeria 5N0DOG, Fig. 2. It may not be generally known that one of the advantages of SSTV is that the pictures can be stored on a normal audio tape recorder and played back into the equipment when required. One of Sam's favourite monitoring spots is the SSTV calling channel on 28·680MHz.

ILP

**SIMPLY AHEAD and staying there**

# The range grows bigger... better...

## New Profile Amplifiers - Two New Series



MOS200

HY60

### MOSFET

**CHOOSE AN I.L.P MOSFET POWER AMP** when it is advantageous to have a faster slew rate, lower distortion at higher frequencies, enhanced thermal stability, the ability to work with complex loads without difficulty and complete absence of cross-over distortion. I.L.P's exclusive encapsulation technique within fully adequate heatsinks has been taken a stage further with specially developed computer-verified 'New Profile' extrusions. These ensure optimum operating efficiency from our new MOSFETS, and are easier to mount. Connection is via five pins on the underside. **I.L.P MOSFETS ARE IDENTICAL IN PERFORMANCE TO THE COSTLIEST AMPLIFIERS IN THIS EXCITING NEW CATEGORY BUT ARE ONLY A FRACTION OF PRICES CHARGED ELSEWHERE.**

| Model | Output Power RMS | Distortion Typical at 1KHz | Slew Rate | Rise Time | Signal/Noise Ratio DIN AUDIO | Price & VAT |
|---|---|---|---|---|---|---|
| MOS120 | 60W into 4-8Ω | 0.005% | 20V/μs | 3μs | 100dB | £25.88 + £3.88 |
| MOS200 | 120W into 4-8Ω | 0.005% | 20V/μs | 3μs | 100dB | £33.46 + £5.02 |

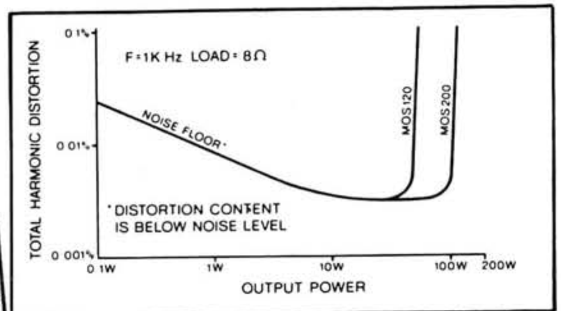
### BIPOLAR

STANDARD O/P TRANSISTORS

**CHOOSE AN I.L.P BIPOLAR POWER AMP** where power and price are first consideration while maintaining optimum performance with hi-fi quality and wide choice of models. From domestic hi-fi to disco and P.A., for instrument amplification, there is an I.L.P Bipolar to fill the bill, and as with our new Mosfets, we have encapsulated Bipolars within our New Profile extrusions with their computer-verified thermal efficiency and improved mounting shoulders. Connections are simple, via five pins on the underside and with our newest pre-amps and power supply units, it becomes easier than ever to have a system layout housed the way you want it.

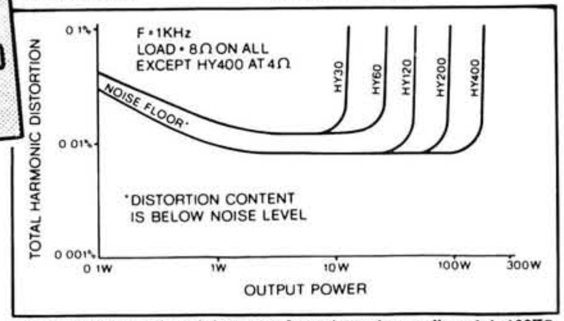
| Model | Output Power RMS | Distortion Typical at 1KHz | Slew Rate | Rise Time | Signal/Noise Ratio DIN AUDIO | Price & VAT |
|---|---|---|---|---|---|---|
| HY30 | 15W into 4-8Ω | 0.015% | 15V/μs | 5μs | 100dB | £7.29 + £1.09 |
| HY60 | 30W into 4-8Ω | 0.015% | 15V/μs | 5μs | 100dB | £8.33 + £1.25 |
| HY120 | 60W into 4-8Ω | 0.01% | 15V/μs | 5μs | 100dB | £17.48 + £2.62 |
| HY200 | 120W into 4-8Ω | 0.01% | 15V/μs | 5μs | 100dB | £21.21 + £3.18 |
| HY400 | 240W into 4Ω | 0.01% | 15V/μs | 5μs | 100dB | £31.83 + £4.77 |

**ILP POWER AMPS ARE ENCAPSULATED FOR THERMAL STABILITY AND LONGER LIFE**




Load impedance both models 4Ω-∞ Input sensitivity both models 500mV

Input impedance both models 100KΩ Frequency response both models 15Hz-100KHz – 3dB

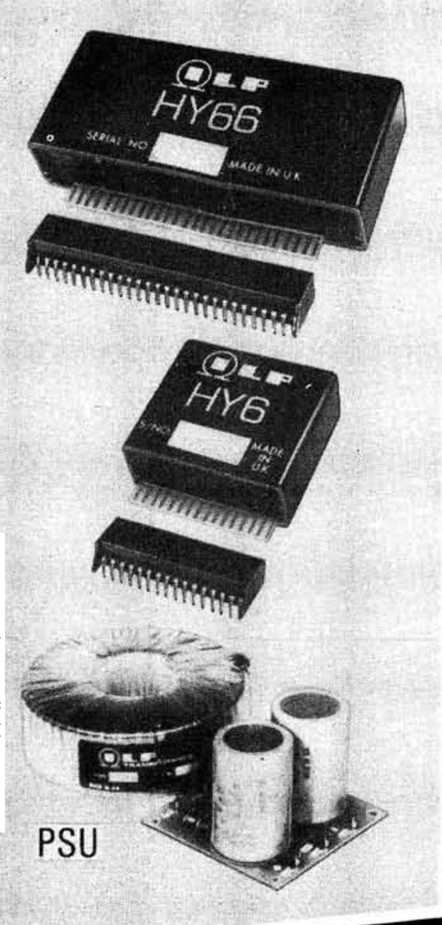



Load impedance all models 4Ω-∞ Input sensitivity all models 500mV

Input impedance all models 100KΩ Frequency response all models 15Hz-50KHz – 3dB

**THE NEW PROFILE EXTRUSIONS**

The introduction of standard heatsink extrusion for all I.L.P. power amplifiers achieves many advantages: – Research shows they provide optimum thermal dissipation and stability. Slotted shoulders allow easy mounting; standardisation enables us to keep our prices competitive. Surfaces are matt black, anodised for higher thermal conductivity. Extrusions vary in size according to module number.




NO QUIBBLE 5 YEAR GUARANTEE
7-DAY DESPATCH ON ALL ORDERS
BRITISH DESIGN AND MANUFACTURE
FREEPOST SERVICE

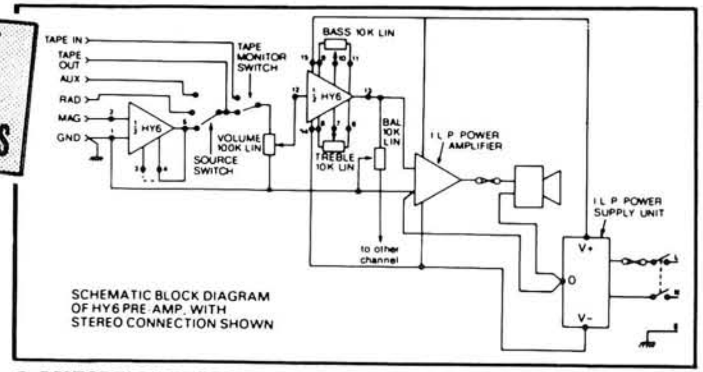
# I L P PRE-AMPS

**HY6** (mono) and **HY66** (stereo) are new to I.L.P's range of advanced audio modules. Their improved characteristics and styling ensure their being compatible with all I.L.P power-amps both MOSFET and BIPOLAR, giving you chance to get the best possible reproduction from yc ır equipment. HY6 and HY66 pre-amps are protected against short circuit and wrong polarity. Full assembly instructions are provided. Mounting boards are available as below.
Sizes – **HY6** – 45×20×40 mm. **HY66** – 90×20×40 mm.
Active Tone Control circuits provide ±12dB cut and boost.
**Inputs Sensitivity** – Mag. PU. –3mV: Mic – selectable 1-12mV: All others 100mV. **Tape O/P** – 100mV: **Main O/P** – 500mV: **Frequency response** – D.C. to 100KHz – 3dB.

**HY6** mono £6.44 + 97p VAT Connectors included
**HY66** stereo £12.19 + £1.83 VAT Connectors included

**B6** Mounting Board for one HY6 78p + 12p VAT
**B66** Mounting Board for one HY66 99p + 15p VAT

COMPATIBLE WITH ALL ILP MODULES



SCHEMATIC BLOCK DIAGRAM OF HY6 PRE-AMP, WITH STEREO CONNECTION SHOWN

- DISTORTION TYPICALLY 0.005%
- S/N RATIO – 90dB (Mag. P.U. – 68 dB)
- 38 dB overload margin on Mag. P.U.
- LATEST DESIGN HIGH QUALITY CONNECTORS
- ONLY POTS, SWITCHES AND PLUGS/SOCKETS NEED ADDING
- NEEDS ONLY UNREGULATED POWER SUPPLY ±15 to ±60v

# I L P POWER SUPPLY UNITS

Of the eleven power supply units which comprise our current range, nine have toroidal transformers made in our own factory. Thus these I.L.P power supply units are space-saving, more efficient and their better overall design helps enormously when assembly building. All models in the range are compatible with all I.L.P amps and pre-amps with types to match whatever I.L.P power amps you choose.

**PSU30** ±15V at 100mA to drive up to 12 x HY6 or 6 x HY66 **£4.50** + 0.68p VAT
• *THE FOLLOWING WILL ALSO DRIVE I.L.P PRE-AMPS*
**PSU36** for use with 1 or 2 HY30's **£8.10** + £1.22 VAT
• *ALL THE FOLLOWING USE TOROIDAL TRANSFORMERS*

| | | |
|---|---|---|
| **PSU50** | for use with 1 or 2 HY60's | **£10.94** + £1.64 VAT |
| **PSU60** | for use with 1 HY120 | **£13.04** + £1.96 VAT |
| **PSU65** | for use with 1 MOS120 | **£13.32** + £2.00 VAT |
| **PSU70** | for use with 1 or 2 HY120's | **£15.92** + £2.39 VAT |
| **PSU75** | for use with 1 or 2 **MOS120** | **£16.20** + £2.43 VAT |
| **PSU90** | for use with 1 HY200 | **£16.20** + £2.43 VAT |
| **PSU95** | for use with 1 **MOS200** | **£16.32** + £2.48 VAT |
| **PSU180** | for use with 1 HY400 or 2 HY200 | **£21.34** + £3.20 VAT |
| **PSU185** | for use with 1 or 2 **MOS200** | **£21.46** + £3.22 VAT |

IN A RANGE OF 11 MODELS USING LATEST TOROIDAL TRANSFORMERS

## 1971-1980
## TEN YEARS OF PLANNED PROGRESS

When, in 1971, Ian L. Potts founded his now world-famous company, he saw the need for a different and more rational approach to exploiting to the full, the potential that lay in modular construction. New thinking was badly needed. The result was a range of modules revolutionary in concept. The rightness of this new thinking is shown by the size of the company today, its new factory, its vast exports, its acceptance by constructors as *the* modules to build with. The range grows bigger and better. Exciting new lines (in no way conflicting with existing ones) are well past drawing board stage. This is why I.L.P are simply ahead and staying there.

★ **Freepost facility**
When ordering or writing about I.L.P products, you do not need to stamp the envelope. Mark it FREEPOST plus the code shown in the address below. We pay the postage for you.

★ **TO ORDER** Send cheque or money order payable to I.L.P Electronics Ltd and crossed. Or pay by ACCESS or BARCLAYCARD. Cash payments must be in registered envelope; if C.O.D. payment is wanted, please add £1.00 to TOTAL value of order.

BRITAIN'S LEADING QUALITY MODULE SUPPLIERS

To: I.L.P ELECTRONICS LTD. CANTERBURY CT2 7EP
Please supply ..........
.......... Total purchase price £..........
I enclose Cheque ☐ Postal Orders ☐ International Money Order ☐
Please debit my Access/Barclaycard Account No. ..........
..........
NAME ..........
ADDRESS ..........
..........
Signature ..........

ALL U.K. ORDERS DESPATCHED POST FREE

ILP ELECTRONICS LTD.
FREEPOST 1 Graham Bell House, Roper Close, Canterbury, Kent CT2 7EP.
Telephone (0227) 54778 |Technical (0227) 64723| Telex 965780
Available also from MARSHALLS, WATFORD ELECTRONICS and certain other selected retailers

# SMALL ADS

The prepaid rate for classified advertisements is 28 pence per word (minimum 12 words), box number 60p extra. Semi-display setting £9.50 per single column centimetre (minimum 2·5 cms). 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).

## 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.*

When replying to Classified Advertisements please ensure:

(A) That you have clearly stated your requirements.

(B) That you have enclosed the right remittance.

(C) That your name and address is written in block capitals, and

(D) That your letter is correctly addressed to the advertiser.

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

## Receivers and Components

**BRAND NEW COMPONENTS BY RETURN**

**HIGH STABILITY RESISTORS.**
¼W Carbon Film E12 Series 1R-10M. (E24 2R-6M2)—**1p**
½W, ¼W & 1W Metal Film E12 Series 10R-2M2—**2p**
**CAPACITORS.**
**MULLARD Min. Ceramic E12 100V 2%** 1.8pf. to 47pf.—**3p**
2% 56pf. to 330pf.—**4p.** 10% 390pf. to 4700pf.—**4p**
**Plate Ceramic 50V Wkg. Vertical Mounting.**
E12 22pf. to 1000pf. & E6 1K5pf. to 47Kpf.—**2p**
**Miniature Polyester 250V Wkg. Vertical Mounting.**
.01, .015, .022, .033, .047 & 068 mfds.—**4p**
0.1—**5p.** 0.15 & 0.22—**6p.** 0.33 & 0.47—**8p**
0.68—**11p.** 1.0—**15p.** 1.5—**20p.** 2.2—**22p**
**ELECTROLYTIC. Wire Ended (Mfds/Volts).**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.47/50 | 5p | 22/25 | 6p | 100/25 | 7p | 470/25 | 11p |
| 1.0/50 | 5p | 22/50 | 6p | 100/50 | 8p | 470/40 | 16p |
| 2.2/50 | 5p | 47/16 | 6p | 220/16 | 8p | 1000/15 | 15p |
| 4.7/50 | 5p | 47/25 | 6p | 220/25 | 8p | 1000/25 | 18p |
| 10/50 | 5p | 47/50 | 6p | 220/50 | 10p | 1000/40 | 35p |
| 22/16 | 6p | 100/16 | 7p | 470/16 | 11p | 2200/16 | 20p |

**TANTALUM BEAD SUBMINIATURE ELECTROLYTICS.**
0.1, 0.22, 0.47, 1.0, 2.2 ≠ 35V & 4.7 ≠ 6.3V—**14p**
4.7/16V & 25V—**15p.** 10/16 & 22/6—**20p.** 10/25—**29p**
10/35V, 22/16V, 47/6.3V, 68/3V & 100/3V—**30p**
15/25, 22/25, 47/10—**35p.** 47/16—**80p.** 220/16—**£1.20**
**Polystyrene 63V Wkg. E12 Series Long Axial Wires.**
10 pf. to 820 pf.—**3p.** 1000 pf. to 10,000pf.—**4p**
**TRANSISTORS.**

| | | | | | |
|---|---|---|---|---|---|
| BC107/8/9 | 10p | BC182L | 8p | BF197 | 10p |
| BC147/8/9 | 10p | BC184L | 8p | BFY50/51/52 | 18p |
| BC157/8/9 | 10p | BC212L | 8p | BFX88 | 25p |
| BC547C/8C/9C | 7p | BCY70 | 15p | 2N2926 | 7p |
| BC557C/8C/9C | 7p | BF194 | 10p | 2N3055 | 50p |

8 Pin D.I.L. i.c's 741 Op/amp.—**18p.** 555 Timer—**24p**
Holders 8 pin—**9p.** 14 Pin—**12p.** 16 Pin—**14p.** 28 Pin—**25p**
40 Pin—**30p.**
**DIODES (p.i.v./amps).**

| | | | | | |
|---|---|---|---|---|---|
| 75/25mA | 1N4148 | 2p | 1250/1A | BY127 | 10p |
| 100/1A | 1N4002 | 4p | 400/3A | 1N5404 | 14p |
| 800/1A | 1N4006 | 6p | 60/1.5A | S1M1 | 5p |
| 1000/1A | 1N4007 | 7p | 30/150mA | AAY32 | 12p |

**ZENER DIODES.**
E24 Series 3V3 to 33V 400mW—**8p.** 1W—**10p**
**L.E.D.'s** 3 mm. & 5 mm. Red—**10p.** Green, Yellow—**14p**
Grommets for 3 mm.—**1½p.** Holders for 5 mm.—**2p**
**FUSES. 20 mm. Glass.** 100mA to 5A. Q.B.—**3p.** A/S.—**5p**
**VOLTAGE REGULATORS**+. 5V, 8V, 12V, 15V 100mA.—**35p**
5V, 8V, 12V, 15V, 18V & 24V 0.5A—**60p.** 1A—**65p**
**PRESET POTENTIOMETERS**
50mW & ¼W 100R to 1MO.—**6p**

**THE C. R. SUPPLY CO.**
**127, Chesterfield Road, Sheffield S8 0RN.**
**V.A.T. Inclusive Prices, Postage 15p**
**(FREE over £5.00)**

**PREWAR ONWARD VALVES, WIRELESS.** SAE. Sole Electronics, 37 Stanley Street, Ormskirk, Lancs.

**1920 VMCR 1960**

Old wireless sets, valves and components. Repair, overhaul & restoration. SAE for lists:
**VINTAGE MODERN & COMMUNICATIONS RADIOS,**
**The Old School, Staindrop,**
**Nr. Darlington, Co. Durham.**
**Tel: Staindrop (0833) 60452 or 60630**
*(24 hour telephone answering service)*

**CRYSTALS** Brand new high-precision. You benefit from very large stocks held for industrial supplies. All normal freq standards, baud rates, MPU, and all magazine projects inc: HC33/U: 1·0, 1·008, 2·5625 MHz, **£3·50.** 1·280 MHz, **£4·15.** HC18/U: 4·0, 5·0, 6·0, 7·0, 8·0, 9·0, 10·0, 10·7, MHz **£3·00.** 12·0, 15·0, 16·0, 18·0, 20·0, 6·9375, 38·6667, MHz, **£3·25.** Selected freqs stocked in Glider, Marine and 27 MHz bands. Any freq made to order in 6 weeks from **£3·90.**
**FILTERS** Your best source for 6 and 8 pole and monolithics for AM, CW, SSB, FM, on 455 kHz, 1·6, 9·0, 10·7, 21·4 MHz, etc.
Prices inc. VAT and UK post. SAE lists.
**P. R. GOLLEDGE ELECTRONICS**
**G3EDW, Merriott, Somerset, TA16 5NS.**
**Tel: 0460 73718**

**WE SUPPLY** most Vintage Radio component parts with a friendly service worldwide. British Vintage Radio Components Co., 57, Weldon Park, Weldon, Nr. Corby, Northants. Tel. Corby 61875.

**PROFESSIONAL TOOLS AT DISCOUNT PRICES**

Send 14p. stamp for free catalogue and price list.

**TRI-tronic Marketing Ltd.,**
**9, Badby Leys, Rugby, CV22 5RB**
**Tel: (0788) 812895.**

**CLEARANCE PARCELS:** Transistors, Resistors, Boards, Hardware. 10lbs only £5.80! 1,000 Resistors £4.25, 500 Capacitors £3.75, BC108, BC171, BC204, BC230, 2N5061, CV7497 Transistors, 10 70p, 100 £5.80. 2N 3055, 10 for £3.50. S.A.E. Lists: W.V.E. (1) 15 High Street, Lydney, Gloucestershire.

**PRACTICAL WIRELESS CIRCUIT BOARDS**

| | | | | | |
|---|---|---|---|---|---|
| Feb 79 | Hythe Rx | £4.00 | May 80 | NBFM Demod | £1.30 |
| Mar 79 | Soundlite Conv | £4.00 | Jun 80 | Acoustic Flash | £1.00 |
| Dec 79 | Radio Control Rx | £1.50 | Jun 80 | Nimbus Base Station | £2.60 |
| Jan 80 | Radio Control Enc | £2.00 | Aug 80 | Railway Controller | £1.70 |
| Jan 80 | Radio Control Tx | £1.50 | Sept 80 | Tamar (six boards) | £12.00 |
| Jan 80 | Speech Processor | £1.80 | Sept 80 | 2 Metre Conv | £1.30 |
| Jan 80 | Wideband Amp | £0.70 | Oct 80 | Direct Con Rx | £1.60 |
| Apr 80 | Signal Generator | £2.80 | Oct 80 | Nimbus P.S.U. | £0.90 |
| Apr 80 | Nimbus Transceiver | £4.90 | Nov 80 | Field Test Set (2 boards) | £1.60 |
| Apr 80 | Nimbus Modulator | £0.75 | Nov 80 | Resistance Meter | £0.70 |
| May 80 | 100S Timer | £1.30 | Dec 80 | Bird Scarer (2 boards) | £1.60 |

ALL BOARDS TOP QUALITY GLASS FIBRE **POST FREE**

Boards not listed sent on approval on request. We are always pleased to hear from readers who prefer to design their own circuits and can produce "one offs" at very reasonable charges. Send SAE for leaflet "How To Produce Artwork".

**H.T.E. (PRINTED CIRCUIT BOARDS) DEPT P.W.**
**50 Milnefield Avenue, Elgin, Moray 1V30 3EL.**

**BALLARD'S OF TUNBRIDGE WELLS** have moved to 54 Grosvenor Road, no lists. S.A.E. all enquiries phone Tunbridge Wells 31803.

**CRYSTALS MADE TO ORDER** within 6 weeks. 4-105MHz, wire or pins. £3.90 each inclusive. HARTLEY CRYSTALS, Green Lane, Milford, Godalming, Surrey GU8 5BG.

**VALVES**

Radio – T.V. – Industrial – Transmitting
Projector Lamps and Semiconductors
We Dispatch Valves to all parts of the world by return of post, Air or Sea mail, 4000 Types in stock, 1930 to 1976. Obsolete types a speciality. List 50p. Quotations S.A.E. Open to callers Monday to Saturday 9.30 to 5.00 closed Wednesday 1.00. We wish to purchase all types of new and boxed Valves, Projector Lamps and Semiconductors.

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

**BOURNEMOUTH/BOSCOMBE.** Electronic components specialists for 33 years. Forresters (National Radio Supplies) late Holdenhurst Rd. now at 36, Ashley Rd., Boscombe. Tel. 302204. Closed Weds.

**8 PAGE LIST FREE.** Thousands of different items, all at cut price. Send SAE to PC Electronics, Thornhill, Romsey Road, Whiteparish, Salisbury.

**Southern Valve Co.,**
**2nd Floor, 6 Potters Road, New Barnet, Herts.**

Tel: 01-440 8641 for current prices & availability, all popular valves stocked. **NO CALLERS**, SAE Lists. Cash with order. Same Day Postal Despatch. Telephone afternoons preferred.

Valves, Tubes, Aerials etc by LEADING-MAKERS. Send SAE Lists or Phone for current prices. Counter or MAIL ORDER. NO COD. Speedy Despatch assured. No order under £1.

**Philip Bearman, 6 Potters Road, New Barnet, Herts.**
**Tel: 01-449 1934/5** (1934 Recording Machine).
Telephone for Shop Hours.

**VHF CONVERTERS** 50-500MHz. 28-30MHz IF output. Complete receivers also available. SAE data, lists. H. Cocks, Cripps Corner, Robertsbridge, Sussex. Tel. 058083-317.

## Books and Publications

**FULL REPAIR** data any named T.V. £5.50, with circuits, layouts, etc., £7. (AUSW) 76 Church Street, Larkhall, Lanarks ML9 1HE.

**Build your own**

**P.A., GROUP & DISCO SPEAKERS**
by R. F. C. Stephens
Save money with this practical guide. Plans for 17 different designs, line source, I.B., Horn and Reflex types, for 8"-18" drive units. **£3·95** post free ($8 overseas).

**THE INFRA-BASS LOUDSPEAKER**
by G. Holliman
(full constructional details for versions using 15", 12" and 10" drive units.) **£2·95** post free ($6 overseas)

**THE DALESFORD SPEAKER BOOK**
by R. F. C. Stephens
This book is a must for the keen home constructor. Latest technology DIY designs. Plans for I.B., and Reflex designs for 10-100 watts. Also unusual centre-bass system. **£2·20** post free ($5 overseas).

**VAN KAREN PUBLISHING**
**5 SWAN STREET, WILMSLOW, CHESHIRE**

## Aerials

**TONNA (F9FT) AMATEUR ANTENNAS** for 2m, 70cm, and 23cm bands. Send 30p for full catalogue. RANDAM ELECTRONICS (PW), 12 Conduit Road, Abingdon, Oxon. OX14 1DB.

**ANTI-TVI TRAP DIPOLES**

1981 Range: Shortwave Listener

Indoor models **£14.50 & £27.50**
Outdoor models **£30.00 & £36.00**
Lists 10 × 8 in 17p SAE, Aerial Guide **50p**
Indoor and Invisible Aerials **£3.50**
Callers Welcome Tel: 03986-215
**G2DYM, Uplowman, Tiverton, Devon.**

**COPPER AERIAL WIRE** 14swg hard drawn 70' £3.50, 140' £7.00 inc VAT. Postage £1.75. T.M.P. Electronics, Supplies, Britannia Stores, Leeswood, Nr. Mold, N. Wales.

**TV-DX**

FM-DX and all domestic reception requirements – Fringe or 'Local'. Aerials, Amplifiers, Boosters, Filters, Hardware – and the knowledge. Our new 1981 Catalogue costs 40p. SAE all enquiries, please.

**SOUTH WEST AERIAL SYSTEMS**
**10, Old Boundary Road,**
**Shaftesbury, Dorset.**
**Tel. (0747) 4370.**

## Record Accessories

**STYLI,** Cartridges for Music Centres, etc. FREE List no. 29 for S.A.E. includes Leads, Mikes, Phones etc. FELSTEAD ELECTRONICS (PW), Longley Lane, Gatley, Cheadle, Ches. SK8 4EE.

## Software

**SINCLAIR ZX80 COMPUTOR OWNERS,** amateur radio programs, now available. SAE for list, J. Martin, 114, Briggs Fold Road, Egerton, Bolton, Lancs.

## Wanted

**WANTED.** Single side band unit 2000, for Grundig 2100 model. Phone 041-883-2371.

**ELECTRONIC COMPONENTS PURCHASED.** All types considered – Must be new. Send detailed list – Offer by return – WALTONS, 55A Worcester Street, Wolverhampton.

## Clubs

**ATTENTION ICOM, KENWOOD OWNERS!**

If you'r not receiving our monthly Newsletter your equipment is not tuned into a wealth of information! Details S.A.S.E.

**Bill Bryan G3RKC,**
**c/o Users International Radio Clubs,**
**20, Thirlmere Court,**
**Felixstowe, Suffolk IP11 9SN.**

## Courses

**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 prospectus requests ring 01-946 1102 (24hr Recordacall).

## Educational

**TECHNICAL TRAINING**

Get the training you need to move up into a higher paid job. Take the first step now—write or phone ICS for details of ICS specialist homestudy courses on Radio, TV, Audio Eng. and Servicing, Electronics, Computers, also self-build radio kits. Full details from:

**ICS SCHOOL OF ELECTRONICS**
**Dept. 277D Intertext House, London SW8 4UJ**
Tel. 01-622 9911 (all hours)
State if under 18

**COLOUR TV SERVICING**

Learn the techniques of servicing Colour TV sets through new homestudy course approved by leading manufacturers. Covers principles, practice and alignment with numerous illustrations and diagrams. Other courses for radio and audio servicing. Full details from:

**ICS SCHOOL OF ELECTRONICS**
**Dept. 277D Intertext House, London SW8 4UJ**
Tel. 01-622 9911 (all hours)
State if under 18

**CITY & GUILDS EXAMS**

Study for success with ICS. An ICS homestudy course will ensure that you pass your C. & G. exams. Special courses for: Telecoms, Technicians, Electrical Installations, Radio, TV & Electronics Technicians, Radio Amateurs, Full details from:

**ICS SCHOOL OF ELECTRONICS**
**Dept. 277D Intertext House, London SW8 4UJ**
Tel. 01-622 9911 (all hours)
State if under 18

**CAREERS** in Marine Electronics, Courses commencing September and January. Further details, The Nautical College, Fleetwood FY7 8JS. Tel. 03917 79123.

**TELEVISION COMPUTER & RADAR SYSTEMS SERVICING**

**TWO YEAR full-time Modular Diploma course to include a high percentage of practical work.**

- ELECTRONIC PRINCIPLES
- MONO TV & CCTV
- COLOUR TV & VCR
- DIGITAL TECHNIQUES
- COMPUTERS & MICROPROCESSORS
- RADAR

**Each of the above Modules are 12 weeks in duration. Individual Modules can be arranged for applicants with suitable electronics background.**

**Tuition fees (UK & Overseas) £400 per Module. – Computer Module £500.**

*Next session starts January 5th.*

(Also available 2½ year course in Marine Electronics & Radar.)

Prospectus from:

**LONDON ELECTRONICS COLLEGE**

**Dept: PP, 20 Penywern Road, London SW5 9SU. Tel: 01-373 8721.**

## For Sale

**PRACTICAL WIRELESS 1972-1977.** Two copies missing. Offers? Neame, Tillsend, Stapleford, Salisbury, SP3 4LT.

**PANASONIC RF2800 DIGITAL,** quality portable. Value £220. As new, £85. 6, Athelstan Close, Axminster, Devon.

**0.5mm PVC EQUIPMENT WIRE** on 200m reels. Single and bicolours £4.00 per reel including P+P and VAT. Selbac, 65, Penrhyn Avenue, Litherland, Liverpool. L21 6ND.

**PW/PE/REC/TV 1964-75 50p.** SAE for refund if sold. C. Redwood, 45A, Lulworth Avenue, Poole, Dorset.

**TECH R.F. SIGNAL GENERATOR.** 120 KC to 500 Mc £55. 051-9285619.

**TWO HF TRANSCEIVERS**

TYPE FT7B YAESU YC7B DIGITAL FREQUENCY AND AERIAL TUNER.

*STILL UNDER GUARANTEE*

**FOR QUICK SALE £425 EACH.**

**PLEASE PHONE 0244 300555.**

**NEW BACK ISSUES OF "PRACTICAL WIRELESS"** available 90p each, post free. Cheque or uncrossed P.O. returned if not in stock. BELL'S TELEVISION SERVICE, 190 Kings Road, Harrogate, N. Yorks. Tel: (0423) 55885.

**UK AIRCRAFT FREQUENCIES** List £1. UK Marine Frequencies List £1. Including HF VHF. PLH Electronics, 20, Vallis Road, Frome, Somerset.

**FOR SALE.** Regency VHF/UHF synthesized scanner receiver, perfect working order with mains P.S.U. £120. Ring Keynsham (near Bristol) 5164.

## Service Sheets

**30,000 SERVICE SHEETS IN STOCK**
**COLOUR MANUALS ALSO AVAILABLE**

TV Monos, Radios **£1.25** – Tuners **£1.** – Tape Recorders, Record Players, Transistors from **£1.25** – Car Radios, Stereograms, Radiograms from **£1.25** – Except Colour TV Circuits from **£2.** – State, if circuit will do, if sheets are not in stock. All TV sheets are full length 24 x 12", not in Bits & Pieces. All other Data full lengths. Free Fault Finding Chart or TV Catalogue with order. Crossed P.O.s returned, if sheets not in stock. S.A.E. please.

**C. CARANNA**
**71, Beaufort Park, London NW11 6BX**
**01-458 4882 (Mail Order)**

**SERVICE SHEETS,** Radio, TV etc., 10,000 models. Catalogue 24p, plus S.A.E. with orders, enquiries. TELRAY, 154 Brook Street, Preston PR1 7HP.

**BELL'S TELEVISION SERVICES** for Service Sheets on Radio, TV etc., £1.00 plus S.A.E. Colour TV Service Manuals on request. S.A.E. with enquiries to B.T.S., 190 Kings Road, Harrogate, N. Yorkshire. Tel. (0423) 55885.

**SERVICE SHEETS** from 50p and S.A.E. Catalogue 25p and S.A.E. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex.

**G.T. TECHNICAL INFORMATION SERVICE**
**76 CHURCH ST., LARKHALL, LANARKS.**

***Any full size service sheet – still only £1 + s.a.e.***

Thousands of different sheets & manuals in stock (many of these only obtainable from us)

**Repair data your named T.V. £6 (with circuits £8)**

**Domestic Equipment Manual Vol. 1 £13.50 (updatings free for 1 year)**

S.A.E. for free newsletter, price lists, any quotation, bargain offers, unique T.V. publications. 2 big catalogues listing thousands of service sheets and manuals with £4 worth of vouchers – special offer **£2** + large s.a.e.

**Phone: 0698 883334 anytime. Callers 4–6 pm weekdays, Sat. after 10.**

## Miscellaneous

**MORSE CODE TUITION AIDS**

Cassette A: 1-12 w.p.m. for amateur radio examination.
Cassette B: 12-24 w.p.m. for professional examination preparation. Each Cassette are type C90.
Morse Key and Buzzer unit for sending practice.
Price each Cassette (including booklets) **£4·75.** Morse Key and Buzzer **£4·75.**
Prices include postage etc. Overseas Airmail £1·50 extra.

**MHEL ELECTRONICS (Dept 2), 12 Longshore Way, Milton, Portsmouth PO4 8LS.**

**SUPERB INSTRUMENT CASES** by Bazelli, manufactured from P.V.C. Faced steel. Hundreds of people and industrial users are choosing the cases they require from our vast range. Competitive prices start at a low £1.05. Chassis punching facilities at very competitive prices. 400 models to choose from. Suppliers only to Industry and the Trade. BAZELLI, (Dept No. 25), St. Wilfrid's, Foundry Lane, Halton, Lancaster LA1 6LT.

## THE SCIENTIFIC WIRE COMPANY

**PO Box 30, London E.4**
**Reg. Office 22 Coningsby Gdns**

### ENAMELLED COPPER WIRE

| SWG | 1 lb | 8 oz | 4 oz | 2 oz |
|---|---|---|---|---|
| 10 to 29 | 3.10 | 1.86 | 1.10 | .80 |
| 30 to 34 | 3.50 | 2.00 | 1.15 | .80 |
| 35 to 39 | 3.95 | 2.36 | 1.34 | .98 |
| 40 to 43 | 5.10 | 2.97 | 2.28 | 1.42 |
| 44 to 46 | 6.00 | 3.60 | 2.50 | 1.91 |
| 47 | 8.37 | 5.32 | 3.19 | 2.50 |
| 48 to 49 | 15.96 | 9.58 | 6.38 | 3.69 |
| **SILVER PLATED COPPER WIRE** | | | | |
| 14 to 22 | 5.30 | 3.03 | 1.85 | 1.20 |
| 24 to 30 | 6.50 | 3.75 | 2.20 | 1.40 |

Prices include P&P and VAT.
Orders under £2 please add 20p. SAE for list.
Dealer enquiries welcome.

**C.W.A.S. ALARM.** Send now for the latest discount catalogue of Professional Burglar Alarm Equipment. C.W.A.S. Alarm, 11 Denbrook Walk, Bradford BD4 0QS, W. Yorks. Phone 0274 682674.

**PSYCHOTRONIC GENERATORS,** gravity lazers, electrokinesis, electrophotography, skinvision. SAE 4 × 9" Paralab, Downton, Wilts.

### ENAMELLED COPPER WIRE

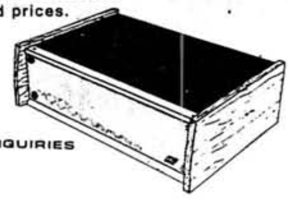
| SWG | 1 lb | ½ lb | ¼ lb |
|---|---|---|---|
| 10 to 19 | 2.95 | 1.70 | 0.85 |
| 20 to 29 | 3.05 | 1.75 | 0.95 |
| 30 to 34 | 3.45 | 1.90 | 1.00 |
| 35 to 39 | 3.75 | 2.10 | 1.15 |
| 40 to 43 | 4.95 | 2.75 | 2.15 |
| 44 to 46 | 5.90 | 3.50 | 2.40 |

**FREE WIRE TABLES WITH EACH ORDER**

**INDUSTRIAL SUPPLIES**
**102 Parrswood Road, Withington, Manchester 20**
*Prices include P & P in UK*

**If it's a case of making your project look good, then use one of ours.**

Simply send a S.A.E. for Details and prices.



TRADE ENQUIRIES INVITED.

## H. M. ELECTRONICS. P.W.

271a/275a Fulwood Road.
Broomhill
Sheffield S10 3BD

**OUT NOW!!** The 1981 Greenweld Components Catalogue, 60p Discount Vouchers, Reply Paid Envelope. Free Bargain List & Data Sheet. Only 75p. Greenweld, 443B, Millbrook Road, Southampton SO1 0HX.

## TIME EXACT?

**MSF CLOCK** is ALWAYS CORRECT – never gains or loses, self setting at switch-on, 8 digits show Date, Hours, Minutes and Seconds, auto GMT/BST and leap year, also parallel BCD output and audio to record and show time on playback, receives Rugby 60KHz atomic time signals, built-in antenna, 1000Km range, **£54.80.**
**LOSING DX?** DIG out the RARE DX with a Tunable Audio Notch Filter, between your receiver and speaker, BOOST your DX/QRM ratio, 40dB notch, **£10.90.**
**V.L.F.?** EXPLORE 10-150KHz, Receiver **£13.70.**
**CAN'T FIND DX?** Get SPOT-ON with a Crystal Calibrator, between your antenna and receiver, 1MHz, 100, 25KHz markers to vhf, bypassed when off, MORE DX, **£19.80.**
**LONG WAVE DX?** Exciting 100-600KHz Converter to 4.1-4.6MHz, built-in antenna tuner, **£13.90.**
**MISSING DX?** Make them HEAR YOU with a Speech Compressor, between your microphone and transmitter, BOOST your POWER up to 4 times, **£9.90.**
**60KHZ RUGBY RECEIVER,** as in MSF Clock, serial data output, built-in antenna, 1000Km range, **£15.70.**
*Each fun-to-build kit includes all parts, printed circuit, case, postage etc, money back assurance so GET one NOW.*

**CAMBRIDGE KITS**
**45 (PP) Old School Lane, Milton, Cambridge.**

## P.W. PROJECT PCB'S

**(All Boards to be Pre-paid CWO)**
*Please add P&P @ 25p to each Board.*

| | | | | | |
|---|---|---|---|---|---|
| Sept. 80 | WRO 95 | 65p | Oct. 80 | WRO 91 | 4.50p |
| Sept. 80 | WAD 634 | 1.85p | Oct. 80 | WRO 97 | 95p |
| Sept. 80 | WRO 96 | 1.85p | Oct. 80 | WRO 82 | 2.30p |
| Sept. 80 | WRO 86 | 65p | Nov. 80 | WAD 641 | 60p |
| Sept. 80 | WRO 87 | 2.25p | Nov. 80 | WK 101 | 58p |
| Sept. 80 | WRO 88 | 1.40p | Dec. 80 | WR 103/103A | 1.40p |
| Sept. 80 | WRO 89 | 1.30p | Dec. 80 | WR 101 | 1.30p |
| Oct. 80 | WRO 90 | 4.50p | Dec. 80 | WR 102 | 1.30p |

Fibreglass Strip Boards (3" × 4") 14 strips **60p each**
PCB's made to your own specification. Prototypes or production runs. Full photographic facilities.

*Details or quotation from:*
**WINSTON PROMOTIONS (P.W.)**
**9 HATTON PLACE, LONDON EC1N 8RU**
**TELEPHONE 01-405 0960/4127**

## KEEP ONE HANDY IN THE WORKSHOP

**BURNEZE**

The unique aerosol treatment for minor burns and scalds. From Boots and other Chemists.

## PLEASE MENTION PRACTICAL WIRELESS WHEN REPLYING TO ADVERTISEMENTS.

## HOMEBRU RADIO

(Mail order only)

**Helford components:–**

| | |
|---|---|
| VFO P.C.B. | **£1.15** |
| Buffer P.C.B. | **£1.15** |
| G4CLF P.C.B. | **£4.24** |
| SL1612 | **£1.56** |
| SL1621 | **£2.07** |
| SL6270 | **£2.51** |
| SL1640 | **£2.07** |
| SL6310 | **£2.51** |
| 2N5771 | **£0.31** |
| BA182 | **£0.36** |
| 78L06 | **£0.59** |
| J304 | **£0.54** |
| J310 | **£0.87** |
| FX2249 per pair | **£0.60** |
| SBL-1 = (MD108) | **£4.90** |
| SL560C | **£4.97** |

+ Postage & Packing £0.30.

| | |
|---|---|
| VFO/CAP+12:1. 4170/75/023 | **£8.84** |
| VFO6:1 ADJ/TORQ Ball Drive 5620 | **£4.41** |
| 4 Gang (Preselect) CAP. 5318/4/102 | **£7.73** |
| (Preselect) Reduction Drive. 5870/3 | **£1.76** |

+ Postage & Packing £0.45.

**HELFORD**
(Troubleshooting by the designers.)
Any problems send S.A.E. + Invoice Number.

## HOMEBRU RADIO

**(Mail order only)**
**55 Ashley Road, Parkstone, Poole BH14 9BT.**

## PROGRESSIVE RADIO

*ALL ORDERS DESPATCHED BY RETURN POST*

**SEMICONDUCTORS.** 2N5062 (100V 800mA) SCR **18p.** BX504 opto isolator **25p.** CA3130 **95p.** TBA800 **50p.** Tag4443 SCR **45p.** Texas R1038 power trans. **50p.** TDA1151 **25p.**
**SWITCHES.** Min. toggles, SPST 8×5×7mm **42p.** DPDT 8×7×7mm **55p.** DPDT c/off 12×11×9mm **77p.** HEAVY DUTY-DPDT 240VAC 10 Amp **35p.** PUSH TYPE, push on 16×6mm **15p,** push to break version **17p,** MERCURY (TILT) SWITCH, 1"×¾" **35p.**
**ANTEX SOLDERING IRONS:** Models C15, CX17 and X25 all **£3.95** each. NSA1198 8½ digit multiplexed displays, com. cath. with data sheet **£1.45p. SPECIAL OFFER** TIL209 Red LED's 10 for **75p.** 0.2" LEDS, red, yellow, green **10p** each.

**LINEAR I.C.'s.** LM300 **40p,** LM301 **55p,** LM308 **£1.30,** LM324 **£1.00,** LM388 **95p,** LM358 **50p,** LM386 **90p,** LM3900 **80p,** LM3909 **75p,** CA1310 **£1.70,** CA3018 **£1.00,** CA3028 **£1.30,** CA3035 **£2.20,** CA3046 **85p,** CA3098 **95p,** CA3130 **95p,** CA3140 **37p,** MC1303 **£1.40,** MC1312 **£1.60,** MC1330 **£1.40,** MC1458 **40p,** NE550 **£1.00,** NE544 **£1.40,** NE565 **£1.70,** NE566 **£1.70,** TAA550 **40p,** TAA621 **£2.20,** NE556 **50p,** C106D SCR **35p.**
**GPO TELEPHONE DIALS £1.00** (new). **JACKSONS C804** 50pf var. capacitors **50p** each.
**TOOLS.** 5 piece precision screwdriver sets, individual handles only **£1.05** set.
**JUMPER TEST LEAD SETS.** 10 pairs of leads with insulated crocs each end **90p.**
**40KHZ TRANSDUCERS,** RX/TX **£3.50** pair.
**STC BREAK GLASS FIRE ALARM UNITS,** new with mounting box **£1.50p.**
**MINIATURE SOLID STATE BUZZERS.** 2 voltages available, 6 or 12VDC **75p** each, Loud 12 volt buzzers **65p.**
*Cash with order please, official orders welcome from schools etc., please add 30p postage and packing. VAT inclusive. SAE for latest illustrated stock list.*

**31, CHEAPSIDE, LIVERPOOL L2 2DY**

**MARCO TRADING**

**LOW PROFILE I.C. SOCKETS**

| | 1+ | 100+ | | 1+ | 100+ |
|---|---|---|---|---|---|
| 6 pin | 7p | **5.5p** | 20 pin | 16p | **14p** |
| 8 pin | 8p | **6p** | 22 pin | 18p | **16p** |
| 14 pin | 10p | **8.5p** | 24 pin | 20p | **18p** |
| 16 pin | 11p | **9.5p** | 28 pin | 28p | **20p** |
| 18 pin | 13p | **11.6p** | 40 pin | 32p | **31p** |

**TRANSFORMERS (ALL 240V Primary)**

| | | |
|---|---|---|
| 6-0-6 | 100ma | **£1.00** |
| 6-0-6 | 250ma | **£1.60** |
| 9-0-9 | 75ma | **£1.00** |
| 12-0-12 | 50ma | **£1.00** |
| 12-0-12 | 100ma | **£1.50** |
| 9-0-9 | 1A | **£2.40** |
| 12-0-12 | 1A | **£2.86** |

Carbon film resistors ¼W 5% low noise E12 series 2·2 ohm to 10M **2p each**

Special resistor pack 10 of each value 2·2 ohm to 2M2 730 resistors only **£6**

**BRIDGE RECTIFIERS**

| 1.5A | | 2.0A | | 6.0A | | 10.0A | | 25.0A | |
|---|---|---|---|---|---|---|---|---|---|
| 50V | **36p** | 50V | **38p** | 50V | **70p** | 50V | **£2.25** | 50V | **£2.38** |
| 100V | **38p** | 100V | **43p** | 100V | **73p** | 100V | **£2.34** | 100V | **£2.41** |
| 200V | **41p** | 200V | **44p** | 200V | **76p** | 200V | **£2.60** | 200V | **2.51** |
| 400V | **43p** | 400V | **51p** | 400V | **84p** | 400V | **£2.79** | 400V | **£3.20** |
| 600V | **47p** | 600V | **58p** | 600V | **95p** | 600V | **£3.54** | 600V | **£4.75** |
| 800V | **54p** | 800V | **65p** | | | | | | |

Wholesale/Quantity prices available.

**400mw Zener Diodes**
2.7v, 3v, 3.3v, 3.6v, 3.9v, 4.3v, 4.7v, 5.1v, 5.6v, 6.2v, 6.8v, 7.5v, 8.2v, 9.1v, 10v, 11v, 12v, 13v, 13.5v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 36v, 39v, 43v, 47v, 51v, 56v, 62v.
**PRICE: 8p** each, **75p**/10, Any 100 for **£6.** BA154 **4p,** BA156 **9p,** BY126 **12p,** OA10 **35p,** BY127 **12p,** OA90 **10p,** OA91 **10p,** OA200 **5p.**

**1 Watt Zener Diodes**
3.3v, 3.6v, 3.9v, 4.3v, 4.7v, 5.1v, 5.6v, 6.2v, 6.8v, 7.5v, 8.2v, 9.1v, 10v, 11v, 12v, 13v, 13.5v, 15v, 16v, 18v, 20v, 22v, 24v, 27v, 30v, 33v, 36v, 39v, 43v, 47v, 51v, 56v, 62v, 68v, 75v, 82v, 91v, 100v, 110v, 120v, 130v, 150v, 160v, 180v, 200v.
**PRICE: 15p** each, Any 100 **£12.50.**

**WIREWOUND RESISTORS**

| | |
|---|---|
| 2.5 Watt 5% Values: 0.22 ohm to 270 ohm | **Price: 18p each** |
| 5 Watt 5% Values: 10 ohm to 12K | **Price: 21p each** |
| 10 Watt 5% Values: 15 ohm to 25K | **Price: 24p each** |
| 4 Watt 5% & 10% Values: 1 ohm to 10K (Flameproof) | **Price: 22p each** |
| 7 Watt 5% & 10% Values: 0.47 ohm to 22K (Flameproof) | **Price: 24p each** |
| 11 Watt 5% & 10% Values: 1 ohm to 22K (Flameproof) | **Price: 28p each** |
| 17 Watt 5% & 10% Values: 1 ohm to 22K (Flameproof) | **Price: 35p each** |

**SPECIAL OFFER: METAL SLIDER POTENTIOMETERS**
Length of track: 60mm, 500 ohm LIN Mono **30p.** 50K LOG Stereo **40p.** 100K LIN Stereo **40p.** 1 Meg LOG Stereo **40p.** ALL PRICES INCLUDE FREE KNOBS TO FIT.

**MARCO TRADING, Dept. PW5, The Old School, Edstaston, WEM, Shropshire, SY4 5RJ. Tel: (094 872) 464/465.**

# MAIL ORDER PROTECTION SCHEME

### INTRODUCTION

The Office of Fair Trading have agreed that the notice of the Mail Order Protection Scheme to appear in periodicals carrying mail order advertising should appear as follows:—

### "MAIL ORDER ADVERTISING

**British Code of Advertising Practice**

Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfill orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch, as this may be needed.

**Mail Order Protection Scheme**

If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Practical Electronics will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

(1) You have not received the goods or had your money returned; and

(2) You write to the Publisher of Practical Electronics summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the Advertiser has been declared bankrupt or insolvent.

This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not, for example, payment made in response to catalogues etc., received as a result of answering such advertisements. Classified advertisements are excluded."

**OSMABET LTD** We make transformers amongst other things.

**TRANSFORMERS TO ORDER**
We have capacity for the supply of transformers to specification, either one off, or production runs, your enquiries please.

**LOW VOLTAGE TRANSFORMERS: Prim 240V ac.**
6·3V 1·5A **£3·00;** 3A **£4·15;** 6A CT **£7·90;** 12V 1·5A **£3·75;** 3A CT **£7·90;** 6A CT **£9·75;** 15V 0·5A **£3·00;** 18V 1·5A CT **£7·90;** 24V 1·5A CT **£7·90;** 3A CT **£9·75;** 5A CT **£1800;** 8A CT **£2925;** 12A CT **£3750.**

**MIDGET RECTIFIER TRANSFORMERS: Prim 240V ac.**
6-0-6V 1·5A or 9-0-9V 1A **£3·40** each; 12-0-12V 1A or 20-0-20V 0·75A **£4·15** each; 9-0-9V 0·3A or 12V-0-12V 0·25A or 20V-0-20V 0·15A **£3·00** each.

**LT TRANSFORMERS TAPPED SEC: Prim 240V ac.**
0-10-12-14-16-18V 2A **£7·50;** 4A **£9·40;** 0-12-15-20-24-30V 2A **£8·25;** 4A **£12·00;** 0-20-30-60V 1A **£9·00;** 2A **£12·00;** 0-40-50-60-80-100-110V 1A **£12·00.**

**AUTO & ISOLATION TRANSFORMERS 240/110V a.c.**
30 to 4000 watts, many types ex stock, Lists.

**MAINS TRANSFORMERS. SPECIAL OFFER. Prim**
240V ac, 300-0-300V 80 Ma; 6.3V 1A CT; 6.3V 1A **£5.50;** 250-0-250V 60 Ma: 6.3V 1 A **£3.00;** 9V 3A **£2.50;** 25V 300 Ma **90p.** 15-0-15V 0.5A **£2.50.** 12V 4A **£4.00.**

**LOUDSPEAKERS**
$1\frac{1}{2}$", $1\frac{3}{4}$", $2\frac{1}{4}$", $2\frac{1}{2}$", $2\frac{3}{4}$", 3", $2\frac{1}{2}$" 8Ω **£1.25** each; 3" 35Ω, $3\frac{1}{2}$", 3, 8, 16, 80Ω, 7" x 4" 3 or 80Ω **£1.75;** 8 x 5" 25Ω **£2.50.** Goodman 5" Hi-Fi speaker mid range, C/M 8 25 watt systems **£6.50.** Goodman $3\frac{1}{2}$" Tweeters C/M, 8Ω for 25W systems **£2.50.** 4" 10 watts 8Ω **£3.50.** 8" 25W 8Ω **£6.00.**

**"INSTANT" BULK CASSETTE/TAPE ERASER**
Instant erasure of cassettes, and any diameter of tape spools, demagnetises tape heads, 200/240V ac. leaflet **£8.00.**
Cassette/Tape Head Demagnetiser, **£3.50.**

**EDGWISE LEVEL METER FSD 200/μA**
Size 19×18×20mm 800Ω **£1·50.**

**CHARGING METERS $1\frac{3}{4}$in diameter**
2A or 3A **£1·25** each; 5A or 10A **£1·50** each.

**MINI FLEX CABLE**
4 core, for Intercom, telephone, burglar alarm extensions, etc, white pvc, 10 metres **£2,** 100 metres **£15.**

**POWER SUPPLY, TWIN OUTPUT Prim 240V ac:**
New, British manufacturer, smoothed d.c. output 20V, 1.5A, plus STABILISED output of 15V 100 Ma, plus further 12V ac 0.5A, complete with diagram, **£4.50.**

**O/P TRANSFORMERS FOR VALVE AMPLIFIERS**
P.P..sec tapped 3-8-15Ω A-A 6KΩ, 30W **£17·50;** A-A 3KΩ 50W **£26·00;** 100W (EL31, KT88 etc) **£35·00.**

**.G.E.C. MANUAL OF POWER AMPLIFIERS**
Covers valve amplifiers 30W to 400W **£1·25.**

**MULTIWAY SCREENED CABLE, PVC COVERED**
36 way **£1,** 25/**75p;** 14/**50p;** 6/**25p;** 4/**20p.**

**CONDENSERS** AC 50Hz, 4.33/250v; 6/330v, **£1.50.** Electrolytic 400 mfd 400V **75p;** 2000/30V **30p;** 2200/40V **40p;** Paper tubular, W/E, 4/160V; 6/160V **30p** each, 2mfd 150V **25p,** 0.1mfd 2KV **50p,** 150+200+200/300v, **75p.**

**CARRIAGE EXTRA ON ALL ORDERS**
**ALL PRICES INCLUDE V.A.T.**

**Callers by appointment only. S.A.E. Enquiries, Lists.**

**46, Kenilworth Road, Edgware, Middsx.**
**HA8 8YG. Tel: 01-958 9314**

# H.A.C. SHORT-WAVE KITS

## WORLD-WIDE RECEPTION

'H.A.C.' well known by amateur constructors for its Short Wave receivers, now offers a complete range of kits and accessories which have been up-dated to suit the novice and the expert.

£14·50 INCLUSIVE – the ever popular and easy to construct DX receiver Mark III; containing all genuine short wave components, drilled chassis, valve, accessories and full instructions.

AT LAST – a battery eliminator kit, which will last you a lifetime – for use in all H.A.C. valve receivers. H.T. batteries are now unobtainable, this will solve your problems for only £9·60.

T TWIN TRANSISTOR RECEIVER, selective, sensitive and with fantastic reception, yet needing only a single PP3 battery, at £17·50 this receiver is outstanding value, and will give you hours of interest and entertainment.

NEW – TRIPLE-T RECEIVER, a more advanced super three transistor receiver, loud, clear reception, value unequalled at bargain introductory price of £24·00.

All orders despatched within 7 days. Send stamped and addressed envelope now for free descriptive catalogue of kits and accessories.

**SORRY, NO CATALOGUES WITHOUT S.A.E.**

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

# BAKER SPEAKERS "STAR SOUND"

Post £1·50 ea.

**GROUP 45–12** **£15**
12in. 45 watt
4, 8 or 16 ohms.

**GROUP 75–12** **£22**
12in. 75W professional model. 4, 8 or 16 ohms
Response 30 — 16,000.
With aluminium presence dome.

**DISCO 100/12** **£26**
12 in 100W model
8 or 16 ohm

**DISCO 100–15** **£29**
15in. 100 watt
8 or 16 ohms.

**AUDITORIUM 15** **£35**
Bass woofer 15in. Special cone surround
Heavy duty cone. 60 watts. 20 to 8000 cps.

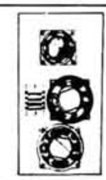
**E.M.I. $13\frac{1}{2}$ × 8in SPEAKER SALE!**

With tweeter. And crossover. 10W. State 3 or 8 ohm. **£9·95** Post £1
*Illustrated*
**15W model** **£10·95**
8 ohms Post £1

**GOODMANS 20 Watt Woofer**
Size 12 × 10in. 4 ohms. Rubber cone surround. Hi-Fi Bass unit. **£8·50** Post £2·00

**GOODMANS TWIN AXIOM 8**
8 in. 15 ohm Hi-Fi Twin Cone
Special unit 15 watts **£8·00** Post 95p

**EMI MINI MODULE KIT 3-way Loudspeaker System, EMI 5in Bass, 5in Middle, 3in Tweeter, with 3-way Crossover and Ready Cut Baffle. 15 × $8\frac{1}{4}$in.**
**Full assembly instructions supplied. Response = 60 to 20,000 cps 12 watt RMS. 8 ohm. £10 per kit. Postage £1.50.**



**R.C.S. LOUDSPEAKER BARGAINS**
3 ohm. 6 × 4in. £1·50. 7 × 4in. £1·50. 8 × 5in. £3·00. $6\frac{1}{2}$in. £3·00. 8in. £3·50. 10in. £3·50. 12in. £4·50.
8 ohm. $2\frac{1}{2}$in. £1·50. 3in. £1·50. 5in. £1·50. 10in. £3·50. 12in. £4·50
16 ohm. 6 × 4in. £1·50. 7 × 4in. £1·50. 5in. £1·50. 8in. £3·50. 12in. £4·50. 10 × 6in. £3·50..

**LOW VOLTAGE ELECTROLYTICS**
**1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 10p.**
**500mF 12V 15p; 25V 20p; 50V 30p;**
1000mF 12V **20p;** 25V **35p;** 50V **50p;** 1200mF/76V **80p.**
2200mF 6V **25p;** 25V **42p;** 40V **60p;** 2000mF/100V **£1·20.**
2500mF 50V **70p;** 3000mF 25V **50p;** 50V **65p.**
3300mF 63V **£1·20;** 4700mF 63V **£1·20;** 2700mF/76V **£1.**
5000mF 35V **85p;** 50V **95p;** 5600mF 76V **£1·75.**

**HIGH VOLTAGE ELECTROLYTICS**

| | | | | | |
|---|---|---|---|---|---|
| 8/350V | **35p** | 8+8/450V | **75p** | 50+50/300V | **50p** |
| 16/350V | **45p** | 8+16/450V | **75p** | 32+32+32/325V | **75p** |
| 32/350V | **75p** | 20+20/450V | **75p** | 100+100/275V | **65p** |
| 50/350V | **80p** | 32+32/350V | **50p** | 150+200/275V | **70p** |
| 50/500V | **£1.20** | 50+50/500V | **£1.80** | 220/450V | **95p** |

**MANY OTHER ELECTROLYTICS IN STOCK**

**TRIMMERS** 10pF, 30pF, 50pF, **5p.** 100pF, 150pF, **15p.**
**CONDENSERS VARIOUS,** 1pF to 0·01mF, **3p.**
**PAPER** 350V-0.1 **7p;** 0·5 **13p;** 1mF 150V **20p;** 2mF 150V **20p** 400V–0·001 to 0·05 **5p;** 0·1 **15p;** 0·25 **25p;** 0·47 **35p.**
**MICRO SWITCH SINGLE POLE CHANGEOVER 20p.**
**SUB-MIN MICRO SWITCH, 25p.** Single pole change over.
**TWIN GANGS,** 500pF **£1;** 365pF **£1;** 365+365+25+25pF.
**TWIN GANG,** 385pF **£1;** 365pF **£1;** 365+365+25+25pF. Slow motion drive **£1;** 25pF **95p;** 120pF **50p;** 3 gang 365p **£2.**
**NEON PANEL INDICATORS 250V.** Amber or red **30p.**
**ILLUMINATED ROCKER SWITCH.** Single pole. Red **65p.**
**RESISTORS.** 10Ω to 10M. $\frac{1}{4}$W, $\frac{1}{2}$W, 1W, 20% **2p;** 2W, **10p.**
**HIGH STABILITY.** $\frac{1}{2}$W 2% 10 ohms to 1 meg., **8p.**
Ditto 5%. Preferred values 10 ohms to 10 meg., **3p.**
**ALUMINIUM CHASSIS 18 s.w.g.** Undrilled, 4 sides, riveted corners; 6 × 4 × $2\frac{1}{2}$in.—**£1·20;** 8 × 6 × $2\frac{1}{2}$in.—**£1·50;** 10 × 7 × $2\frac{1}{2}$in.—**£1·90;** 14 × 9 × $2\frac{1}{2}$in.—**£2·50;** 16 × 6 × $2\frac{1}{2}$in.—**£2·40;** 12 × 3 × $2\frac{1}{2}$in.—**£1·50;** 12 × 8 × $2\frac{1}{2}$in.—**£2·20;** 16 × 10 × $2\frac{1}{2}$in.—**£2·70. ANGLE BRACKET** 6 × $\frac{3}{4}$ × $\frac{3}{4}$in.—**25p.**
**ALUMINIUM PANELS 18 s.w.g.** 12 × 12in.—**£1·30;** 14 × 9in.—**£1·20;** 6 × 4in.—**36p;** 12 × 8in.—**90p;** 10 × 7in.—**80p;** 8 × 6in.—**60p;** 14 × 3in.—**60p;** 12 × 5in.—**60p;** 16 × 10in.—**£1·40;** 16 × 6in.—**90p.**
**BLACK PLASTIC** construction box with brushed aluminium facia size $6\frac{1}{4}$ × $4\frac{3}{4}$ × 2" **£1·50.** Many other sizes.
**BRIDGE RECTIFIER** 200V PIV $\frac{1}{2}$ amp **50p.** 2 amp **£1·00.** 4 amp **£1·50.** 8 amp **£2·50.**
**TOGGLE SWITCHES** SP **30p.** DPST **40p.** DPDT **50p.**
**MANY OTHER TOGGLES IN STOCK. Please enquire.**

**BSR P207 BUDGET SINGLE PLAYER** ideal for disco or small two-speed Hi-Fi system with stereo cartridge and cueing device. **£15** **Post £2**

**BSR STEREO CARTRIDGES** SC7 medium SC8 High output **£2.** Sonotone 9T AHC **£3.** V.100 Magnetic **£7.**
**WIRE-WOUND RESISTORS** 5 watt, 10 watt, 15 watt **15p.**
**CASSETTE MOTOR.** 6 volt **£1·00.**

## MAINS TRANSFORMERS

Post 99p

| | | | |
|---|---|---|---|
| 6V, 500mA | **£2·00** | 6-0-6V 100mA | **£1·80** |
| 12V, 100mA | **£1·30** | 9-0-9V 50mA | **£1·50** |
| 12V, 750A | **£1·75** | 12V. 3 a. **£3·50;** . 5 a | **£4·00** |
| 10-0-10V 2amp | **£3·00** | 10V, 30V, 40V, 2 amp | **£3·50** |
| 30V, 5 amp and 17V-0-17V, 2 amp | **£4·00** | 20V, 1 amp | **£3·00** |
| 0, 5, 8, 10, 16V, $\frac{1}{2}$ amp | **£2·50** | 20V-0-20V, 1 amp | **£3·50** |
| 9V, 3 amp | **£3·50** | 2 of 18V, 6 amp, each | **£11·00** |
| 15–0–15V 2 amp | **£3·00** | 12-0-12V, 2 amp | **£3·50** |
| 30V, 2 amp | **£3·50** | 9V, $\frac{1}{4}$ amp | **£1·50** |
| 30V, $1\frac{1}{2}$ amp | **£3·30** | 28V, 1 amp+28V 1 amp | **£5·00** |
| 20V, 40V, 60V, 1 amp | **£4·00** | 32-0-32V 6·5A | **£11·00** |

## Radio Components Specialists

**337 WHITEHORSE ROAD**
**CROYDON, SURREY, U.K. TEL. 01-684 1665**
**POST 50p. ACCESS-BARCLAY-VISA LISTS 20p.**
**CLOSED WED.**

# INDEX TO ADVERTISERS

# Thanet Electronics

## for ICOM

## the amateur's professional friends

**This month we are showing you:**

IC-451 UHF Base Station
IC240 – The best value for money in synthesized rigs.
Theta 7000E – An outstanding communications computer.
IC202S / IC402 – A pair of magnificent sideband portables.

**On these, and all our other products:**

* we offer a full year's warranty on all parts and labour
* Free delivery for all transceivers, using registered first class post

IC2E – Probably the smallest made, extra sensitive handy talkie.
IC251E – Must be the best value in 2M base stations.
IC255E – A great value 25W mobile transceiver.
IC260E – The ideal choice for multimode mobile.

* All prices including V.A.T.
* H.P. and Part Exchange welcome

## IC-451 UHF Base Station


**£579 inc. V.A.T.**

ICOM are proud to annouce the introduction of the 70cm version of their famous 2m base station – the IC-251. Of course, it is engineered to the usual high ICOM standards and includes such features as:-

* 3 memory channels
* Automatic repeater shift on switch-on
* Additional selectable shift for European DX
* Selectable channel steps for FM (supplied with 25KHz – others are diode programmable)
* Full power control on SSB/CW/FM
* Superb receiver performance using MOSFETS
* Multipurpose scanning
* Covers 430-440 MHz
* Xtal controlled Toneburst
* Cool running chopper power supply

**Also available from our shop in Herne Bay are:**

* MICROWAVE MODULES
* J-BEAM
* RSGB PUBLICATIONS
* WESTERN
* G-WHIP
* BEARCAT
* ANTENNA SPECIALISTS
* YA ESU MUSEN
* VIDEO GENIE COMPUTERS

**IMPORTANT**

We would like you to phone, or write to us so that we can give you as much detailed information as possible on any particular product. Use our 24 hour ansafone when calls are cheap.

Send for Technical Details

## Thanet for ICOM

143 RECULVER RD.,
BELTINGE,
HERNE BAY, KENT.
Tel: 02273/63859

Published on approximately the 7th of each month by IPC Magazines Limited, Westover House, West Quay Road, POOLE, Dorset BH15 1JG. Printed in England by Chapel River Press, Andover, Hants. Sole Agents for Australia and New Zealand—Gordon and Gotch (Asia) Ltd.; South Africa—Central News Agency Ltd. Subscriptions INLAND and OVERSEAS £11·80 payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex. 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.

# The IC-240 - The start of a revolution in 2 meters transceivers

£169 INCL.

- Easy channel selection with minimum knob twiddling – yet with all the normal FM channels available – an all important safety feature.
- A fully automatic tone burst which operates only in repeat mode with NO buttons to press either on the front or on the back of the set.
- Instant reverse repeat at the flick of a switch without any re-tuning or memory programming.
- A very sensitive receiver with a spurious response performance far better than the average and a very clean transmitter with excellent clear, crisp modulation. (We measured a sensitivity of 0.1 uv pd for10dB sinad).

SPECIFICATIONS

| | | |
|---|---|---|
| **GENERAL** | | |
| Semiconductor Complement | Transistors | 34 |
| | FET | 7 |
| | IC | 13 |
| | Diodes | 33 to 128 depending on channels |
| Frequency Range (for specification) | 144-146MHz | |
| Voltage | 13.8 VDC Negative Ground | |
| Current Consumption | TX | 2.0AMP at 10W |
| | RX | 700MA at MAX Audio<br>400MA Squelched |
| Size | 58mm (h) x 156mm (w) x 218mm (d) | |
| Weight | 1.9 kilograms | |
| Antennas Impedance | 50 OHMS | |
| Number of Channels | 22 channels selected from any of the 80 channels on 25KHz spacing. | |
| Frequency Control | Stabilized Master oscillator PLL programmed by diode matrix | |
| **TRANSMITTER** | | |
| Power Out | 10 watts | |
| Deviation | 5KHz | |
| Microphone Impedance | 500 OHMS | |
| Spurious Level | Lower than -60dB below carrier | |
| **RECEIVER** | | |
| Modulation Acceptance | F3 | |
| Type | Double Superhet, 1st I.F. 10.7MHz, 2nd I.F. 455kHz | |
| Receiver Sensitivity | 0.4uV or better | |
| 1 Microvolt S+N/N | 30dB or better | |
| Spurious Response | 60dB or more attenuation | |
| Bandpass | ± 7.5KHz/-6dB, ± 15KHz/-60dB | |
| Squelch Sensitivity | -8dB below 1 microvolt | |
| Audio Output | 1.5 watts or more into 8OHMS | |

FOR ONLY £640.00 INCL.


# Tono Theta 7000E A great computer on offer from Thanet

The new THETA 7000E means that every Amateur can enjoy the visual display of CW, RTTY and ASCII in both transmit and receive modes. Just connect the TONO to any TV set via the antenna terminals or to a page printer from the parallel port provided. Bring up your CW speed in receiving or sending by either watching receiver sent or from recorded cassettes. Connection to the transceiver is via the key, phone and mic sockets.

Some of the Outstanding Features
COMMUNICATIONS COMPUTER THETA 0-7000E 0-7000E
UHF and Composite Video Output * Printer interface * Wide range of transmitting and receiving speeds – 10CW speeds + 8RTTY * Built-in demodulator for high performance for 170, 425 and 820 Hz shift * Crystal controlled modulator for ASFK – Hi or Lo tone * Convenient ASCII key arrangement * Large capacity display memory – 2 pages 32chr x 16 lines split screen for Rx & Tx if required * Automatic transmit/receive switch * Anti-noise circuit * Battery backed-up memory 7 channels of 64chrs * Send function * Buffer memory – 53 character type ahead, rub out function * Simultaneous access of the memory – 53 character type ah
LF (line feed) cancel function * Cursor control function * Word mode operation * Automatic CR/LF (72, 60 or 80 chrs per line) * Echo function * Word Wrap around function * Transmit/receive in ASCII mode or RTTY * CW indentification function * Mark and break (space and break) system * Monitor circuit & CW practice function * Variable CW weights * Cross pattern checking output terminal * Log computer output provided * Test message function (Ry and QBF).

Phone or write for the price list of accessories for this unit.

## IC-202S
## £169 INCL.

# What a tremendous pair

The IC-202S is a very well designed 2m SSB portable. It offers: 3W pep output on USB, LSB and CW. * Large Battery capacity (HP11 type) or Nicads if you wish * A special VXO circuit to provide smooth tuning and crystal stability needed for SSB operation on 2m * Each of the four 200kHz band positions allows operation anywhere in 2m. (Supplied with 144-144.2 and 144.2-144.4) * Top of the band Oscar xtals available for "cross-pond working" * It has a DC socket and SO239 sockets for mobile or base station working, barefoot or as a prime mover * Mobile mounting brackets, Nicad packs, chargers, cases all available options. You must agree, a very versatile well proved rig.

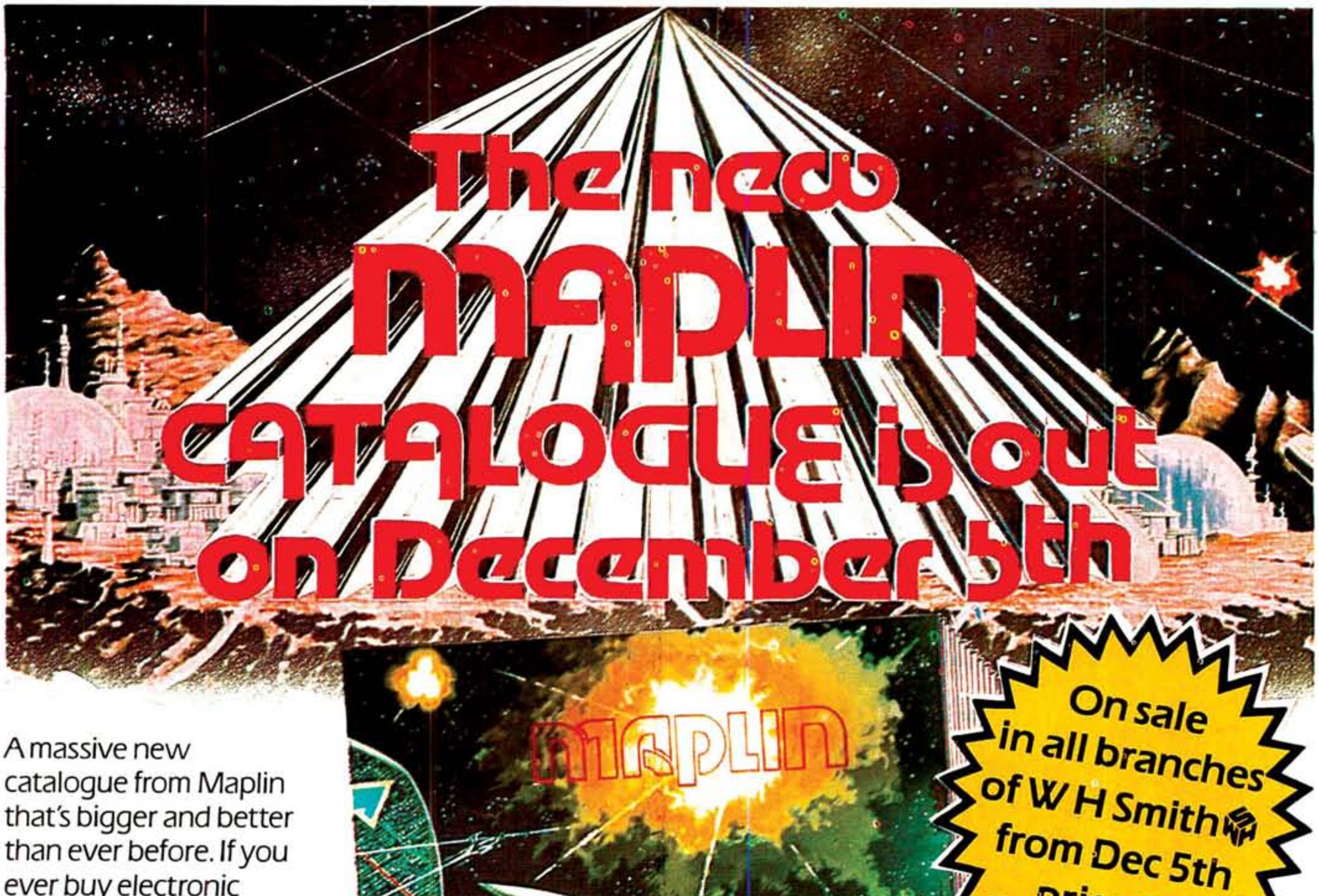
**Their versatility is well worth an enquiry.**

## IC-402
## £242 INCL.

The 70cm twin of the 202S having very similar features, covering the frequency range of 432-435.2 MHz.

Send for Technical Details

# Thanet for ICOM




**On sale in all branches of W H Smith from Dec 5th price £1**

A massive new catalogue from Maplin that's bigger and better than ever before. If you ever buy electronic components this is the one catalogue you must not be without. Over 300 pages, it's a comprehensive guide to electronic components with thousands of photographs and illustrations and page after page of invaluable data. We stock just about every useful component you can think of. In fact, well over 5000 different lines, many of them hard to get from anywhere else. Hundreds and hundreds of fascinating new lines, more data, more pictures and a new layout to help you find things more quickly.

**PLUS LOW PRICES**
such as
Resistors from 1½p
Multimeters from £4.25
Ni-Cads from £1.15
Stereo Headphones from £3.49
Radios from £2.95
Over 300 Books
21 Different ranges of capacitors, etc.,
etc., etc.,

Post this coupon now for your copy of our 1981 catalogue price £1.

Please send me a copy of your 320 page catalogue. I enclose £1 (Plus 25p p&p). If I am not completely satisfied I may return the catalogue to you and have my money refunded. If you live outside the UK send £1.68 or 12 International Reply Coupons.

I enclose £1.25

Name__________

Address__________

PW. 2.81

MAPLIN

Maplin Electronic Supplies Ltd.
All mail to: P.O. Box 3, Rayleigh, Essex SS6 8LR.
Telephone: Southend (0702) 554155. Sales (0702) 552911.
Shops:
159-161 King Street, Hammersmith, London W6. Telephone: (01) 748 0926.
284 London Road, Westcliff-on-Sea, Essex. Telephone: Southend (0702) 554000.
Both shops closed Mondays.