A Practical Guide To Making Printed Circuit Boards

Build The PW Challenger 3.5MHz Receiver

Making It Even Smaller By Doug DeMaw W1FB

The Global GDO Mk.II Dip Meter Reviewed

Getting Started - The Practical Way
Special Offer, CB High & Low, Newsdesk '92, Club News, Maths For The RAE and much more!
In the battle of the stations, the FT-990 all-mode HF transceiver is the clear winner. Based on the same remarkable performance, ease of operation and the features of the FT-1000. The FT-990 is an extraordinary achievement, compare the advantages yourself. Feel the silky smooth tuning, hear the dual digital SCF (Switch Capacitance Filter) provide unsurpassed reception quality never before obtained. Be heard with the CPU controlled RF FSP (RF Frequency-Shifted Speech Processor) for the extra pile-up "PUNCH." See the lightweight and compact FT-990 with built-in AC switching power supply. The FT-990 is a true champion HF rig without compromise. Leave it only to Yaesu to offer powerhouse performance that leaves the rest far behind.

Dual VFOs With Direct Digital Synthesis (DDS):
Two ten-bit DDS plus three eight-bit DDS.

High Dynamic Range:
108dB RF circuit design with quad FET first mixer similar to the FT-1000 as only Yaesu's unsurpassed tradition can provide.

CW 500Hz Crystal Filter (Included).

Dual Digital SCF Filter and IF Shift, IF Notch:
Superior interference reduction.

Automatic Mode-Dependant AGC Selection.

Full and Semi-Break In CW Operation:
With built-in iambic memory keyer with BFO offset and CW spot. Key jacks on both front and rear panels.

6-Function Multimeter.

Adjustable RF Power Output:
With internal heatsink and whisper-quiet temperature switched squirrel cage blower.

Adjustable Level Noise Blanker:
For a wide variety of noises and woodpecker.

CPU Controlled RF FSP (RF Frequency Shifted Speech Processor):
For better intelligibility and pile-up "PUNCH" for competitive situations.

High Speed Automatic Antenna Tuner:
With 39 memories.

50 Memories:
Independent ATU and mode/IF filter memory.

Multimode Selection on Packet/RTTY:
Switchable FSK tone, RTTY shift and CW pitch.

Front Panel RX Antenna Selection:
Allows quick switching.

Digital Voice Storage (DVS-2):
Option provides instant playback of 10-second receive memory, plus two 8-second or 4-second "CQ" contest messages on transmit.

Built In Switching AC Power Supply:
Reliable performance with significantly reduced size and weight.

Band Stacking VFO System:
Each VFO register memorizes your most recent operating frequency, mode, bandwidth and chartser information for instant return to your favourite frequency and mode.

Accessories/Options:
Ond IF-SSB Narrow 2.0kHz, XF-449C-21-01 (Ond IF CW Narrow 25kHz), SC-6 (External Speaker), MD-10 (Desk Microphone), WJ-77M Transceiver)
Packet Panorama has been held-over this month.

Regular Articles

66 Advert Index
54 Backscatter
31 Bargain Basement
31 Book Reviews
64 Book Service
18 Club News
15 Competition Corner
13 Keylines
16 Newsdesk '92
53 Radio Diary
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Morse Weekend.

Don't miss your flight to Dayton Hamvention, see page 21 for more details.

Contact the Editor for more details of our proposed special weekend.

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We would like to wish everyone

A HAPPY AND PROSPEROUS NEW YEAR

Now the shop has re-opened, we can offer you full demonstration facilities, with spares and service back-up on all 'STANDARD' equipment. We are also main agents for KENWOOD, YAESU, ICOM, ALINCO, and on the commercial side many of the well known brands such as Communicue, Cleartone, Maxon, plus marine mobile and portable equipment so the next time you want to re-fit your luxury cabin cruiser, give me a call!

73 'de NORMAN

STANDARD EQUIPMENT

HAND HELD EQUIPMENT

C050 Accessories

C150/C528 Accessories

C160 Accessories

C250 Accessories

C350 Accessories

C450 Accessories

C550 Accessories

C650 Accessories

C750 Accessories

C850 Accessories

C950 Accessories

C1050 Accessories

C1150 Accessories

C1250 Accessories

C1350 Accessories

C1450 Accessories

C1550 Accessories

C1650 Accessories

C1750 Accessories

C1850 Accessories

C1950 Accessories

C2050 Accessories

C2150 Accessories

C2250 Accessories

C2350 Accessories

C2450 Accessories

C2550 Accessories

C2650 Accessories

C2750 Accessories

C2850 Accessories

C2950 Accessories

C3050 Accessories

C3150 Accessories

C3250 Accessories

C3350 Accessories

C3450 Accessories

C3550 Accessories

C3650 Accessories

C3750 Accessories

C3850 Accessories

C3950 Accessories

C4050 Accessories

C4150 Accessories

C4250 Accessories

C4350 Accessories

C4450 Accessories

C4550 Accessories

C4650 Accessories

C4750 Accessories

C4850 Accessories

C4950 Accessories

C5050 Accessories

SCANNERS

OTHER EQUIPMENT

YUPITERU HAND HELD SCANERS AND ACCESSORIES

YUPITERU MOBILE/BASE SCANNERS AND ACCESSORIES
FM DUAL BANDER
TM-732E

In the fast-moving world of mobile communications, Kenwood's new TM-732E FM dual-band transceiver is a winner. Despite its compact design, the TM-732E packs a host of advanced features such as dual receive (including VHF+VHF and UHF+UHF), built-in DTSS and pager functions. The detachable front panel has a high-visibility LCD display to provide instant intelligence on operational status. And on-the-move operation is facilitated by a multi-function microphone. TM-732E offers true pole-position performance.

Enjoy all advantages of these superior features: ■Detachable front panel for maximum freedom of choice during installation (requires optional PG-4K/PG-4L kit) ■Dual receive on same band (VHF+VHF or UHF+UHF) with one antenna ■Audible frequency identification ■Multi-function microphone ■Built-in DTSS with pager function ■Tone alert system ■Separate speaker terminals for each band (switchable) ■Automatic band change (ABC) ■Multi-scan functions ■50 split memory channels or 64 simplex memory channels plus 1 call channel (switchable)
WATERS & STANTON
UK's LARGEST SELECTION OF HAM RADIO PRODUCTS

Fast 24 Hour Mail Order. Phone Before 12.30 AM
Send for our free catalogue and Mail Order Price List

NEW MFJ ANTENNA ANALYSER £99.95
Model MFJ-267 This self powered analyser will let you measure hf aerial resonance, 1.8-30MHz, and VSWR without the need for any transmitter power. Simply connect to coaxial cable to measure VSWR and resonance. Ideal for rapid aerial design and installation. Great club investment! £99 (£4.50)

MIC/ TNC Switch
A great ideal. Lets you have both TNC and mic permanently connected to rig. Just press to switch over. Suitable for all major brands inc Yaesu ICOM Kenwood ALINCO etc. Comes with 8 pin plug ready wired.

THE BEST

FREE 24 HOUR DELIVERY

NEW PRODUCTS

QRO Locater Maps. Just released! Covers Europe in full colour with lots of detail plus beacons and full instructions. £27.95

AMERITRON HF LINEARS

100 Watt dual band linears £59.95
10 Watt linears £49.95

MFJ Products from Stock! 300W HF ATU
The MFJ-948 is a complete 300 Watt aerial tuner that will match any aerial with full metering available. A bullet proof aerial tuner which switches the entire package. Fascinating value! £219.60

Other MFJ Products:
MFJ-945D ATU in above kit with 30MV dummy load, 149.00
MFJ-981B ATU plus switch load and meter. Super! 69.95
MFJ-364 YS-5 dummy load. DC50MHz 69.95
MFJ-260B 25MV dummy load DC160MHz 35.95
MFJ-812B HF 30-300 Watt power meter 31.95
MFJ-910 Fabulous world clock with timer 29.95
MFJ-33 Packet radio handheld. Super guide! 6.95
MFJ-1286 Gray Lee Morse Programme for IBM 32.85
MFJ-514A Digital Tachograph 0.5-350rpm 99.95
MFJ-1040 1.8-54MHz tx/rx preselector 99.95
MFJ-1047 Telemetry station. 0.5MHz-950MHz 94.95
MFJ-1217 TNC/Microphone interface 89.95
MFJ-726 Solar powered battery. Brilliant idea! 99.95
MFJ-557 Self contained CW practice key and oscillator 29.95
MFJ-407B Electronic key. 8-5WPM Self powered 99.95
MFJ-931 Artificial HF ground unit. Ideal for flats etc. Phone 8256 6107 from Stock! 99.95
MFJ-704 HF Low Pass Filter
MFJ-1068 Dual tone dial top clock. LCD Display Phone 8256 6107

VSWR POWER METERS

SX-100 1.6-60 MHz, 30-300 3kHz 97.00
SX-100A 1.6-60 MHz, 30-300 3kHz 69.00
SX-400 140-525 MHz, 5-200 watts 75.00
SX-600 1.6-125 MHz, 5-200 watts 125.00
SX-2000 1.8-120 144MHz, 50-200 watts 40.00
SX-9000 1.8-160 144MHz-1200MHz, AUTO 190.00

BASE STATION ANTENNAS
CP-4 2m/70cms High Vertical whip 1.5kW 149.00
CP-5 2m/70cms Vertical whip 1.5kW 195.00
CP-6 1.8-525 MHz, 5-20-200 watts 209.00
CP-11 2m/144MHz Vertical whip 1.5kW 255.00
CP-17 2m/70cms 5/8/1 whip 0.15kW 96.00
CP-22E 2m/70cms 5/8/1 whip 0.15kW 58.00
CP-707 2m/70cms 5/8/1 whip 0.15kW 22.50

FIELD GLASS VERTICALS
X-120 2m/70cms 4.5/7.2db gain 1.7m long 109.95
X-200 2m/70cms 4.5/7.2db gain 1.7m long 159.95
X-400 2m/70cms 4.5/7.2db gain 1.7m long 149.95
X-1000 2m/70cms 9.5/13db gain 2.7m long 219.00
V-2000 2m/70cms 2.5/5db gain 2.7m long 129.00
V-2000S 2m/70cms 4.5/7.2db gain 0.5m long 109.95

MOBILE ANTENNAS AND MOUNTS
NR-07C Mobile antenna 5/8/1 whip PL-259 25.95
NR-6C Mobile antenna 5/8/1 whip PL-259 23.95
NR-06C Mobile antenna 5/8/1 whip PL-259 21.95
NR-05C Mobile antenna 5/8/1 whip PL-259 19.95
NR-10C Mobile antenna 5/8/1 whip PL-259 17.95
NR-08C Mobile antenna 5/8/1 whip PL-259 15.95
NR-07C Mobile antenna 5/8/1 whip PL-259 13.95
NR-06C Mobile antenna 5/8/1 whip PL-259 11.95
NR-05C Mobile antenna 5/8/1 whip PL-259 9.95
NR-07C Mobile antenna 5/8/1 whip PL-259 7.95
NR-06C Mobile antenna 5/8/1 whip PL-259 5.95
NR-05C Mobile antenna 5/8/1 whip PL-259 3.95
NR-07C Mobile antenna 5/8/1 whip PL-259 1.95
NR-06C Mobile antenna 5/8/1 whip PL-259 0.95
NR-05C Mobile antenna 5/8/1 whip PL-259 0.95

FREE 24 HOUR DELIVERY
ALINCO ELECTRONICS GmbH.

The Choice of Those With "More Sense Than Money"

**DJ-S1E**
The DJ-S1E for 2 metres provides the ideal answer for those who need a low cost, compact, yet comprehensive handheld. Requiring 6 AA cells, this transceiver features LCD readout, 40 memories, scanning, battery save, programmable steps, 3 power levels, call channel, illuminated dial, rotary tuning and 5 Watts maximum power output (12V DC).

£179.00

**DJ-F1E**
The DJ-F1E for 2 metres has all the features of the DJ-S1E but includes full keypad control, 700mAH ni-cad pack and universal AC hoh charger. Acknowledged as the fastest selling handheld, its additional features include DTMF, Pager and Code Squelch, Priority, Reverse repeater, illuminated keypad, auto power off, electronic tuning etc.

£239.00

Both models provide reception of Marine FM & Aeronautical AM bands.

ALINCO STOCKISTS:

**AVON:** G4TJB (0934) 512757; Upingtons Tele-Radio Ltd (0272) 557732; Amatul (0272) 699352

**BUCKINGHAMSHIRE:** Photo Acoustics Ltd (0908) 610622

**CAMBRIDGESHIRE:** Link Electronics (0933) 45770

**CHESHIRE:** CB77 Communications (0270) 584440; Flightdeck Ltd 061-499 9350

**COUNTRY DURHAM:** Border Communications 091-4109 6969

**DORSET:** Poole Logic (0202) 683093

**EDINBURGH:** Intronics 010-35532 163 1009

**ESSEX:** Waters & Stanton (0702) 206835

**HAMPSHIRE:** Pambourough Communications (0252) 518009

**HAMPSHIRE:** Sinclair Electronics (0703) 307 555; Nevada Communications (0705) 662 145

**HAMPSPHERE:** Iskate (0703) 650077

**HANTS:** Eastern Communications (0293) 872191

**ISLE OF MAN:** Audio & Domestic Spares (0624) 815889

**LANCASHIRE:** Channel 21 (0720) 580000

**LONDON (CENTRAL):** Lee Electronics (071-985 5906)

**LONDON (EAST):** Pali-Fones (071-436 0022); Waters & Stanton (04024) 44765

**LONDON (NORTH):** Radio Shack 071-624 7174; Amateur Radio Comms (09252) 2988

**LONDON (NORTH EAST):** Spectrum Communications 0191-558 0854

**LONDON (SOUTH):** Waters & Stanton (04024) 44765

**LONDON (WEST):** Waters & Stanton (04024) 44765

**NORFOLK:** Eastern Communications (0963) 650077

**NORWICH:** Waters & Stanton (0908) 615786

**NORTH HUMBERSIDE:** Heatherlite Communications (0966) 550921

**NORTHERN IRELAND (BELFAST):** Omnicom (0501) 42295

**NORTHERN IRELAND (LONDONDERRY):** Tyrone Electronics (0662) 242011

**NORTHUMBERLAND:** RAS Nottingham (0602) 206207

**SCOTLAND:** Jaycee Electronics Ltd (0592) 764996

**TUPE & WEAR:** Alyntronics 091-726 1002

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22 Main Road, Hockley, Essex SS5 4QS. Tel: (0702) 206835 / 204965

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12 North Street, HORNCHURCH, Essex. Tel. (04024) 44765

**WATERS: & STANTON ELECTRONICS**

VISA & ACCESS MAIL ORDER: 24 Hour Answerphone. Open 6 days a week 9 am - 5.30 pm

**WATERS: & STANTON ELECTRONICS**

Rail: Liverpool Street/Hockley or District Line/Hornchurch
Until now, you needed to carry both a transceiver and a wideband receiver to enjoy a QSO and wideband receiving. Icom now offer two new handhelds, which combine a 144MHz or 430MHz transceiver with wideband receive capability.

Receive it all from 25-950 MHz*

VHF and UHF frequencies plus simultaneous 2-frequency receive capability are within your reach. Choose from a ham band signal and another from FM broadcasting, TV audio, VHF air band, marine band and more in the AM, FM or wide-FM mode.

This feature also enables simultaneous 2-frequency receiving on the ham band or cross-band QSO with a dual band FM transceiver.

**specification guaranteed: 50 - 905.

Complete and compact

These ruggedly-built, splash-resistant handhelds fit snugly into your hand.

Full 5 Watt output power

By connecting an external 13.5 - 16V DC power supply, a full 5 Watts of output power is available. You can choose 3.5W, 1.5W or 500 mW of low output power.

Separate indications and controls

The large easy-to-see function display with lighting shows operating frequencies, S-indicators, and memory or call channels for both bands. Independent volume and squelch controls allow you to change settings in each band separately.

24-hour clock with an ON/OFF timer

This function can be used for convenient scheduled QSO and standby receiving, turning the transceiver ON and OFF as specified to conserve battery power.

Appearing simultaneously are the clock and transmit frequency for total monitoring capability.
Advanced scan functions
Find desired stations swiftly with the full scan, programmed scan, memory scan, memory skip scan and priority watch. These operate independently on each band and allow undesired frequencies and memory channels to be skipped.

Total recall capability
Store and retrieve all necessary frequencies with 96 channels as follows:

<table>
<thead>
<tr>
<th>Ham band</th>
<th>Wideband receiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory ch.</td>
<td>30 60</td>
</tr>
<tr>
<td>Call ch.</td>
<td>1 1</td>
</tr>
<tr>
<td>Scan edge ch.</td>
<td>2 2</td>
</tr>
</tbody>
</table>

Ready to operate
A battery pack or battery case, wall charger, flexible antennas, hand strap and belt clip come with the transceiver.

Other attractive features
Listed below are a few of the other sophisticated features.

- Triple tuning system: direct keyboard entry, the up/down keys or main dial on the top panel.
- Pocket beep, tone squelch and subaudible tone encoder functions.*
- 15-digit auto dialling with 4 DTMF memory channels for.
- One-band indication for simplified operation.
- Monitor function to check the repeater input frequency.
- Fully programmable offset frequency.
- External DC power jack with charging capability. (Except for the BP-85.)
- A variety of tuning steps separately programmable for each band.
- Simple 1750 Hz tone call transmission for the IC-2SRE and IC-4SRE.
- Memory masking function for first recall of often-used channels and hiding of seldom-used channels.
- Memory transfer function.
- PTT lock function.
- Lock function for the keyboard and main dial.
- Automatic power saver for longer operating times.
- Automatic power-off function.
- SET mode for critical settings.
- Transmit/receive indicator.
- Accepts all battery packs and battery cases for 'S' series transceivers.

For more information and the location of your nearest ICOM dealer contact us at the address below.

Mail orders taken by phone. Instant credit & interest free H.P. Interlink despatch on same day if possible

Post to: Icom (UK) Ltd.
Dept PW Sea Street Herne Bay Kent CT6 8BR
Telephone: 0227 741741 (24hr). Facsimile: 0227 360155
Look after your radio with AMCARE

Through AMCARE you can now insure for breakdown and/or loss/damage for your amateur radio equipment. Optional cover is available for loss/damage from unattended vehicle. Breakdown cover on its own is the best way to extend the warranty after the initial twelve month period at a very reasonable cost.

Full details available on request.

Scheme administered by Communications Support Ltd.

---

Preliminary specifications include the following:

- All mode SSB, CW, AM, FM
- All band TX general cover RX
- 100W PEP output (25W AM carrier)
- Matching FP800C P.S.U.
- TCXO3 oscillator option
- DVS2 speech recorder option
- Computer controllable
- Optional internal or remote A.T.U.
- D.D.S. circuitry
- Optional SSB narrow filter

---

**FT-990 HF TRANSCEIVER**

Based on the remarkable performance and easy operation of the FT-1000, Yaesu's new FT-990, combines the basic technical features of that top-of-the-line model with several recent advances resulting in a spectacular performer at a very reasonable price.

Utilising Direct Digital Synthesisers (DDS) and the extremely quiet receiver circuitry of its big brother, the FT-990 delivers silky smooth tuning, pure local signals and clear reception of even the weakest stations.

So if you're looking for top performance in an HF transceiver, try out the FT-990.

You might just fall in love!
SMC for all your accessories

COMET ANTENNAS

COMET produce arguably the best quality base and mobile antennas available today on the amateur radio market. Dearingen radio amateurs will appreciate the stunning combination of amazing performance and aesthetically pleasing styling of some of the latest range of antennas available from COMET via SMC, the authorised UK distributor.

BASE ANTENNAS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB300</td>
<td>2m/70cm IS - 6.60S W</td>
<td>5.10/10.90</td>
</tr>
<tr>
<td>CB752</td>
<td>2m/70cm IS - 8.5dB/11.9dB</td>
<td>8.5/11.9</td>
</tr>
<tr>
<td>CB1200</td>
<td>2m/70cm IS - 8.5dB/11.9dB</td>
<td>8.5/11.9</td>
</tr>
</tbody>
</table>

FILTERS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT-30G</td>
<td>10.65cm 100W</td>
<td>10.6/15.6</td>
</tr>
<tr>
<td>CT-60G</td>
<td>10.65cm 100W</td>
<td>10.6/15.6</td>
</tr>
<tr>
<td>CT-10G</td>
<td>10.65cm 100W</td>
<td>10.6/15.6</td>
</tr>
<tr>
<td>CT-20G</td>
<td>10.65cm 100W</td>
<td>10.6/15.6</td>
</tr>
</tbody>
</table>

METERS SWR/PWR

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF-10</td>
<td>2m/70cm SWR</td>
<td>3.75</td>
</tr>
<tr>
<td>HF-40</td>
<td>2m/70cm SWR</td>
<td>3.75</td>
</tr>
<tr>
<td>HF-80</td>
<td>2m/70cm SWR</td>
<td>3.75</td>
</tr>
</tbody>
</table>

COAX SWITCHES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE - 2</td>
<td>2-20cm 100W</td>
<td>20</td>
</tr>
<tr>
<td>CE - 3</td>
<td>2-20cm 100W</td>
<td>20</td>
</tr>
</tbody>
</table>

ACCESSORIES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM-1R</td>
<td>Mini turner 2mm</td>
<td>20</td>
</tr>
<tr>
<td>CBM-2R</td>
<td>Mini turner 2mm</td>
<td>20</td>
</tr>
</tbody>
</table>

Prices for postage on all the above items are coded as follows:

- A = £1.00
- B = £0.50
- C = £0.25

SECOND-HAND EQUIPMENT

Below is a selection of second-hand equipment available from our H.Q. showroom - contact individual branches for details of their current second-hand stock.

VHF/UHF HF TRANSCEIVERS

<table>
<thead>
<tr>
<th>Code</th>
<th>Brand</th>
<th>Frequency</th>
<th>Type</th>
<th>Gain (dB)</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT-900</td>
<td>ICOM</td>
<td>2m/70cm</td>
<td>IS - 100W</td>
<td>10.0/15.0</td>
<td>£250.00</td>
</tr>
<tr>
<td>FT-800</td>
<td>Yaesu</td>
<td>2m/70cm</td>
<td>IS - 100W</td>
<td>10.0/15.0</td>
<td>£350.00</td>
</tr>
</tbody>
</table>

VHF/UHF HF TRANSCEIVERS continued

<table>
<thead>
<tr>
<th>Code</th>
<th>Brand</th>
<th>Frequency</th>
<th>Type</th>
<th>Gain (dB)</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT-770</td>
<td>ICOM</td>
<td>2m/70cm</td>
<td>IS - 150W</td>
<td>15.0/20.0</td>
<td>£350.00</td>
</tr>
<tr>
<td>FT-780</td>
<td>Yaesu</td>
<td>2m/70cm</td>
<td>IS - 150W</td>
<td>15.0/20.0</td>
<td>£450.00</td>
</tr>
</tbody>
</table>

DATA/COMPUTER

<table>
<thead>
<tr>
<th>Code</th>
<th>Brand</th>
<th>Frequency</th>
<th>Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT-771</td>
<td>ICOM</td>
<td>2m/70cm</td>
<td>IS - 150W</td>
<td>£350.00</td>
</tr>
<tr>
<td>FT-781</td>
<td>Yaesu</td>
<td>2m/70cm</td>
<td>IS - 150W</td>
<td>£450.00</td>
</tr>
</tbody>
</table>

SECOND-HAND HANDHELD EQUIPMENT

- Up to £1000 instant credit. A quotation in writing is available on request, subject to status.
- 12 months parts and labour warranty.
- Prices and availability subject to change without prior notice.
- Same day dispatch wherever possible.

Powers by the smallest 9A continuous PS040KIE via the extremely popular 2A PS030KIE, to the top of the range 5A PS034KIE, all the PsQ range of PS0's feature variable voltage from 3-15V and switchable voltage current metering. Most the PS030 and PS040 have a single lighter socket, convenient for powering your handheld. Also available from Daiwa are some good quality SWR/PWR meters and coax switches.

POWER SUPPLIES

<table>
<thead>
<tr>
<th>Code</th>
<th>Brand</th>
<th>Frequency</th>
<th>Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS040</td>
<td>Icom</td>
<td>2m/70cm</td>
<td>IS - 150W</td>
<td>£350.00</td>
</tr>
<tr>
<td>PS030</td>
<td>Yaesu</td>
<td>2m/70cm</td>
<td>IS - 150W</td>
<td>£450.00</td>
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<td>PS034</td>
<td>Kenwood</td>
<td>2m/70cm</td>
<td>IS - 150W</td>
<td>£550.00</td>
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LINEAR AMPLIFIER

<table>
<thead>
<tr>
<th>Code</th>
<th>Brand</th>
<th>Frequency</th>
<th>Type</th>
<th>Price</th>
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</thead>
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<tr>
<td>LA220</td>
<td>Icom</td>
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</table>

Practical Wireless, February 1992
Many amateurs and shortwave listeners in London and the South East were saddened when KW was forced to close back in October. However, KW has reopened, under new ownership and management — breathing fresh life into the world of hobby radio.

We'll still be stocking a wide range of equipment and accessories, carefully preselected to give you quality and value for money — and to make sure if things do go wrong, WE CAN BACK IT UP! We'll have everything you need from morse keys to datacoms and can supply complete stations from mains plug to antenna.

Our policy is try before you buy and that is why all our demonstration equipment is up and running, waiting for you. If you really want to be sure, bring in your old rig for comparison! (We'll be happy to let you trade it in!)

By the time you read this, the show-room should be full of the latest HF transceivers, VHF mobiles and handhelds. We'll also have receivers, scanners, PSUs, SWR bridges, etc etc. A quick look at our brand list will show roughly what we do — if it's not there — ask! We're here to help! The map shows where we are, and we're easy to find, and we're open six days a week.

I look forward to seeing you very soon and to welcoming you to the biggest and brightest emporium in the country!

73 TOM CROSBIE G6PZZ

IN STOCK NOW!

- **ALINCO**
- **ADONIS**
- **AOR**
- **ARRL**
- **AKD**
- **BENCHE**
- **BNC**
- **BARENC**
- **DELCOM**
- **DAA**
- **DIAMOND**
- **DEWSBURY**
- **EMOTATOR**
- **ERA**
- **FAIRMATE**
- **GLOBAL**
- **HIMOUND**
- **ICOM**
- **JRC**
- **KENWOOD**
- **KANTRONICS**
- **KENPRO**
- **LOWE**
- **MALDOL**
- **NAVICO**
- **OPTOELECTRONICS**
- **PACCOM**
- **RSGB**
- **RF CONCEPTS**
- **RF SYSTEMS**
- **SONY**
- **SIGNAL**
- **SAGANT**
- **TONNA**
- **WIN**
- **YAESU**
- **YUPITERU**

A bag full for a Fiver!

Opening Hours: Monday-Saturday 9.30am-5pm (Mon open 10am, Sat close 5pm)
DUAL DISPLAY

£49.95

Autoranging. Large display plus 32-segment bargraph. Data hold, range control, diode and continuity check. Measures to 1000 VDC, 700 VAC, 10A AC/DC, resistance to 30 megohms. With moulded rubber holster. Requires 2 "AA" batteries. 22-167 £49.95

COMPACT AUTORANGE

£29.95

Autoranging. Features diode-check, auto polarity. Easy-to-read LCD display, low-battery indicator. Measures AC/DC volts, DC current and resistance. Fuse protected. Requires 2 "AA" batteries. 22-166 £29.95

MINI DMM

£22.95

Mini DMM. With built-in test leads. Measures 1000 VDC, 750V AC, 200mA DC current. Resistance to 2 megohms. Built-in transistor checker NPN/PNP hFE, 1.5 and 9v battery checker. Requires 9v battery. 22-9022 £22.95
THE SALE OF THE CENTURY continues...

This month I want to build up the second hand stock. If you wish to update your existing station, (including accessories) I will pay you top money for your part-exchange equipment. Phone today or call in. Remember we are only 1 mile from the M4 motorway and just across the road from Northfields underground on the Piccadilly Line.

YAESU
FT-1000  Sold more than any other UK retailer- unbeatable trade-ins!  PHONE
FT-890  The latest HF Mobile/Base the successor to the FT-757  PHONE
FT-990  I've got another delivery of ten in stock. Competitors not invited  PHONE
FT-736RX Quad band base with 270/6m fitted, just how many are left??  PHONE
FT-767SX A complete Ham Shack in one box, HF/28/70, ATV/P9U  PHONE
FT-5200 Remote head dual-band mobile  PHONE
FT-28R  Successor to the FT-23 series. Wide band receive included!  PHONE
FT-76R  As above, but on 70cm PM. Wide band receive included!  PHONE
FT-470R Dual band head, FNE10 NiCad/charger special offer.  £319

KENWOOD
TS-950SD Top of the range HF base station from Kenwood  PHONE
TS-830S The budget alternative to the 950  PHONE
TS-450S Still using an FT-707? Forget it!! I'll give you £350 TRADE-IN  PHONE
TS-690S The same fantastic design HF all mode Gen. Cov. But with 6m  PHONE
TM-741E Five pages of super mods for this one only from Martin Lynch  PHONE
TM-241E 50W on 2m with modified wide band receive  £299
TH-77E Dual band handle very compact  PHONE

ICOM
IC-970E/H The best 2m/70cm/22cm Base station  UNPRINTABLE
IC-735 Several immaculate trade-ins available, save over £250! ONLY  £749
IC-725 The tough alternative to “BUDGET” HF operating  PHONE
IC-726 As with the IC-725 but with 6m fitted  PHONE
IC-7000HX Latest wide band receiver - with Icom approved HF conversion  £1200
IC-92E New dual-band Handle, December prices were good, but January??  UNBEATABLE
IC-2SRE 2m + scanner, expensive, but usual ICOM technology and build quality  PHONE
IC-6SRE As the IC-2SRE but this time on 70cm transceiver and W/B scanner  PHONE
IC-P2E The latest sub-miniature 2m handle from Icom in stock  PHONE
IC-P4E As per the IC-P2E but on 70cm  PHONE
IC-R1 Sub miniature pocket scanner. Ex-demo’s from only  PHONE

ALINCO
DJ-560E Dual band handle with NiCads/charger/CTCSS/DTMF W/B RX  £299
DJ-F1E 2m Pocket TCVR with AM Airband RX! FREE case...  PHONE
DJ-S1E As above without K/B or NiCads and charger  PHONE
DJ-X1E Latest miniature wide band scanner - in stock!  PHONE
DR-599E New dual band mobile remote head power  PHONE

IC-R7100HF TS-950SD IC-725 FT-1000 FT-736R

In addition to new transceivers and accessories, don’t forget I still have the largest selection of used equipment available in the UK. I am very willing to take your equipment in part-exchange – Phone with your requirements NOW!

Latest 1992 computer generated second hand list available FREE!!
Updated twice a day - not every other week like most - PHONE FOR YOUR COPY!

73 MARTIN G4HKS

Martin Lynch is a Licensed Credit Broker.
Full written details upon request. Typical APR 32.9%
PHONE 081-566 1120

For fast mail order Tel: 081-566 1120.
Please add £10.50 for 48 hour delivery.
SHOP OPENING HOURS: Tuesday - Saturday 10 - 6pm.
24 hour Sales HOT LINE 0860 339 339 (after hours only.)
FAX order line open 24 hours.
In my opinion, the heart of the radio hobby today is still the local club. Without the various clubs spread throughout the land, radio enthusiasts would be in trouble.

Behind each club, there’s usually at least two or three very hard working people - the committee. They struggle to bring in interesting speakers, arrange events and encourage new members. They often struggle even harder to extract annual subscriptions from members!

What makes the work of the club committee even more remarkable, is that very often they’ve been in the job for many years. They’re usually re-elected, because either no-one else wants the job, or because members are more than happy to let someone else do the organising. Apathy rules, okay?

Helping The Committee

Helping the committee to run the club, is something we should all be doing, but we often don’t do it very well. In the east Dorset area, I know of one very keen and dedicated amateur who is involved with the running of two clubs - if one wasn’t enough!

How many clubs do you know, where the office of honorary secretary and treasurer are combined? I know of at least two clubs in the UK where one person (in the case I’m thinking about, a lady is involved) has three jobs, and these dedicated people need all the help they can get!

So, this year I am going to make it my personal crusade to help clubs. I intend to support the hard-working officials and keen members, as much as possible. In fact, we have already started, and as a result PW is being overwhelmed with club news, and information on what you are organising.

Bursting At The Seams

Our re-introduced ‘Club News’ page has proved so popular, that it’s bursting at the seams every month. So much so, that Steve Hunt, our art editor, has had to really shrink the typeface to get all the information on the page.

Although we are very pleased to try to get all the information in, the very small print isn’t easy to read and the page looks very plain. This uninviting look is a great disadvantage to a page that provides an excellent insight into what’s going on throughout the UK (and abroad).

The page has become so full of information, that clubs are now reporting new members have been attracted by the information printed on the page. This is exactly what we are aiming at - new blood!

But, if the page is so densely-packed, it requires a magnifying-glass, potential readers may be put off the page. So, to avoid having to provide a magnifying glass (as jokingly suggested in last month’s ‘Receiving You’) we’ve come up with another idea.

Club Co-operation

In return for the co-operation of radio clubs and groups, we have decided that ‘Club News’ will be allocated two pages whenever necessary. However, that doesn’t mean you can all write more news! It does mean though, that if you all keep the information to the briefest notes possible, we will be able to use larger print.

Please try to provide just enough material about your club until the next PW is published. Clubs or groups that don’t have regular meetings, or are spread throughout the UK, Europe or the world, will be mentioned whenever possible.

I don’t want to be forced to introduce any form of ‘turn and turn about’ system.

There’s room for everyone if you keep it short!

We are also planning to include photographs featuring local clubs. So, if you want to see YOUR club members and QTH on the pages...get those shutters snapping!

Club Photographs

The club photographs should be sent to PW’s News editor, Sharon George. The more interesting the pictures are, the better. I’ve already been promised a photo of a prominent member from a club in the English Midlands, working ‘stroke P’ (pachyderm?) on 144MHz, while on an elephant ride (I’ll believe it when I see it!).

Pictures on a page densely packed with text can put some people off. It’s unfortunate if readers are put off the club news section. Many groups tell me that they get ideas for their clubs, from other people’s published activities. The old argument that radio enthusiasts only want to read about their own club’s activities, seems to be a myth.

Don’t forget, that cheery photo of your club ‘Natter Night’, or the hilarious constructional effort from your recent ‘Desert Island Radio’ contest, could bring you new members. The pictures could also start a few ‘club twinning’ arrangements up and down the country (why not abroad?), and that, surely can’t be a bad thing can it? You never know, you could even talk to each other on the bands!

Rob Mannion
G3XFD

Queries

We will always try to help readers having difficulties with a Practical Wireless project, but please note the following simple rules:
1: We cannot give advice on modifications to our designs, nor on commercial radio, TV or electronic equipment.
2: We cannot deal with technical queries over the telephone.
3: All letters asking for advice must be accompanied by a stamped, self-addressed envelope (or envelope plus IRCs for overseas readers).
4: Make sure you describe the query adequately.
5: Only one query per letter please.

Back Numbers & Binders

Limited stocks of many issues of PW for past years are available at £1.65 each including post and packing.

Binders, each holding one volume of PW are available price £5.50 each (£1 P&P for one, £2 for two or more). Send all orders to the Post Sales Department.

Subscriptions

Subscriptions are available both for the UK and overseas. Please see current issues for the latest prices.
Dear Sir

I am writing about the Morse-Master, published in PW June 1991. I have now completed two and find they work well at 5V. I've eliminated the battery pack and now use my shack supply of 13.8V running into a 5V regulating circuit using a 7805 regulator. The 5V circuit is easily built on a piece of Veroboard. As I send c.w. to friends who are learning Morse, three evenings a week, it is more convenient than using batteries.

Keep up the good work PW and my best wishes to you and your staff. By the way, I'm the chap who drops into your office during the spring bank holidays. Hope to see you again soon for circuit boards.

E. A. Parr GOEMX
Earlsdon
Coventry

Editor's comment: Thanks for the modification tip Mr Parr, we're always interested to hear about modifications to PW projects. I hope your friends pass their Morse exam soon. Perhaps we might even see them taking their Morse Test during our proposed Morse Weekend in the late spring/early summer (further details in January 'Keylines').

★★★ STAR LETTER ★★★

Dear Sir

I am presently taking the RAE course at Rayleigh in Essex. I am finding it very enlightening, if at times hard going, having left school some 25 years ago!

I have thought, been doing a lot of listening on my scanner, and one thing I have noticed is the frequent use of Q-codes on 144MHz. I have been looking at the RSB's RAE Manual and elsewhere, I've read that the use of Q-codes on 'phone is bad operating practice. It is to be avoided unless reception is poor, or there is a language difficulty.

Have Q-codes now become accepted for general use on 144MHz?

Alan Radley
Thundersley
Essex

Editor's reply: You have posed an interesting question Alan. My family have often said that radio amateurs use too much jargon. Perhaps the Q-code has turned into jargon, rather than being a useful c.w. 'shorthand' for often used terms and statements. What do you think readers, do we abuse the Q-code on the air (not just on 144MHz) and in conversation or not?

Dear Sir

Ref: My recent letter. I'm glad I wrote to PW for help. I cannot begin to thank you enough for your 'phone call telling me of the ad' placed in your magazine. Thanks to you I have found the Mizuho MX-14S 14MHz rig I was desperately searching for.

After your call, I phoned the number you gave me which belonged to Terry Wood G4MIZ. Not only was he surprised that a radio amateur from the USA was calling him on the 'phone, he had only just put the ad' in the day before!

About six weeks ago before this search started, I ordered what was the last new MX-14S for sale in England from Waters & Stanton. To my dismay, the radio was stolen in the mail and all that arrived at my door was an empty box. My money was refunded, but I was still in search of a Mizuho. Without your call I could have been looking for ever. In fact I even made calls to Japan, with no luck!

I've had my licence for about 18 years, and am still fascinated by the hobby. My main mode of operation is QRP s.s.b. My family originates from England, and we have traced the family tree back to about 1600. Anyway my wife and I love England, and we are there every year or two or whenever we can get away.

Maybe next time we are there, I can show you my appreciation by taking you out to lunch or dinner. What you did was beyond the call of duty. If there is anything I can do for you here in the USA please call or write.

Thanks again, and it was a pleasure talking to you on the 'phone. I work all the h.f. bands and will look for you on the air. My best wishes to everyone on Practical Wireless.

Bill Ruppert WB9BQG, Glenview, USA

Editor's reply: It was a great pleasure to help you Bill. The opportunity only came by an amazing coincidence, when (quite by chance) Bill's original letter asking for help, arrived on my desk as I was reading potential adverts for 'Bargain Basement'. I read the letter and felt very angry that his original transceiver had apparently been stolen between the UK and the USA. I had intended to publish his letter asking if anyone else had a Mizuho transceiver for sale. However, I realised this wasn't necessary when I read the next letter. It was from G4MIZ who wanted to sell his Mizuho! To cut a long story short, I immediately rang Bill, quite forgetting the time difference! A very sleepy WB9BQG answered the 5am alarm call (sorry Bill!) but he woke up very quickly when he heard the news! We don't normally short-circuit 'Bargain Basement' in this way, but I feel sure readers will understand the circumstances were exceptional.

Dear Sir

I have been interested in radio for many years. During this time I have collected and read many articles written by F. C. Judd G2BCX. Possibly, like many others who have an interest in radio, I have learnt a lot from Mr Judd, especially his excellent articles on antennas.

The main point of my letter is who is F. C. Judd? Would G2BCX consider writing an article about himself, and his expertise on radio. I am sure this would be of interest to all your readers.

John Bidgood, Eastleigh, Hants

Editor's reply: I've no doubt that Fred Judd G2BCX will be quite flattered by your letter John! Again, we have another coincidence, because Fred has recently announced his retirement from antenna design work requiring roof and ladder climbing. We will be featuring G2BCX in a 'Radio Personality' spot soon, to pay tribute to this very prolific writer. Despite the fact that he's retiring from antenna work requiring climbing, etc., he admits to being in his mid 70s! Fred will continue to write for PW on a regular basis.
Dear Sir

I am a radio amateur and a CB operator. For some time now CB in this area has been under a blanket of very bad interference. My TS530 amateur bands rig has an overlap on the 28MHz allocation, so I am able to receive down to 27935MHz (into the CB UK section) - so I thought I'd listen - although I realise I cannot resolve FM.

I was astonished to find that there is more SSB activity on this overlap than on the amateur section! No wonder our UK CB allotment is in such bad shape. Are these stations legal? I realise other countries don't use 27.601MHz to 27.999MHz for CB - and possibly use these frequencies for something else?

Could PW enlighten readers about this? Is there any way these southern European countries will have allocations on the CEPT CB frequencies? If I bought a CEPT frequency CB, would I be clear of this SSB activity?

Hector Cole G3OHK
Workington Cumbria

Editor's reply: Hector has come across a very great problem. You've only got to listen between 26 and 28MHz to realise that there is much illegal activity on SSB from within the UK. I recently had an (unsigned and un-addressed) request from a "very keen and dedicated" (quote) illegal SSB operator, suggesting that PW included articles and band reports, etc., for them in future! As regards Europe, with the possible exception of Italy, I think that SSB operation on 27MHz CB is illegal. However, down here in the south, there seems to be a very active group using AM and SSB. From my own experience, there also seems to be a plentiful supply of illegal AM and SSB equipment (including 100W linear amplifiers) openly on sale at car boot sales throughout the country.

Unfortunately, because radio amateurs are not allowed to buy the strictly illegal multimode CB transceivers, they remain in circulation. If we were allowed to purchase and convert such transceivers to 28MHz, it seems to be a useful source of relatively cheap equipment would be established, helping to reduce another nuisance at the same time. But even though we could help, apart from reporting the activity to the Radio Investigation Service, our hands are tied - I'm afraid Hector!

We are delighted to receive your letters, but do try to keep them short. It helps us, and makes it easier to get more letters in!

---

Dear Sir

I have been a reader of Practical Wireless for more years than I care to remember. Now, although the magazine's appearance may have improved dramatically from F.J. Camm's original format, the one thing certainly not improving by any stretch of the imagination, is the increasing number of bad printing errors and mistakes made in the magazine.

Have you ever considered what effect these have on anyone trying to construct anything from your articles? It has got so bad, that one dare not lift up the soldering iron to begin any of your projects until at least six issues later than the issue carrying the last part of a particular project, to ensure that all the errors, mistakes and updates have been seen. Are these genuine mistakes, or perhaps some conniving plan to guarantee sales of future issues?

As this letter is highly unlikely to be published in PW, I feel I should say I think you should spend more time, energy and money trying to eliminate these mistakes. Try to improve the quality of PW for your readership. Instead of squandering it all on some worthless logo, which all of us are likely to end up paying for when you will inevitably push the cover price up afterwards.

Dr Angus Johnson
Kirton-by-Leen
Nottinghamshire

Editor's reply: The 'buck' stops at the editor's desk. I'm afraid Dr. Johnson and I can only apologise. The entire team is striving to stop any errors (no matter how small) creeping in. The only way, so it seems, to stop errors occurring with constructional projects, is to increase the lead time. So, it's with that in mind we have held over one major project, the PW 'Churchill' SSB base-station, until we have built at least two prototypes. This project has already been under development for two years. The wait will be worth it I feel.

However, this sort of (very necessary) approach does mean that probably only one big project with several smaller ideas, can appear every year. In between, we shall continue to offer simpler constructional articles, which have all been built and tested. Also, now that we are completely self-contained with p.c.b., artwork and placing, etc., the chances of errors are reduced.

Finally, the change to a better paper and higher quality presentation is necessary to present an easier read, with much improved clarity on drawings, p.c.b. overlays and photographs.

---

Win A Ramsey Electronics FTR-146 Transceiver!

You could win the kit transceiver built and reviewed in the January 1992 issue of Practical Wireless, by PW's editor G3XFD, and kindly donated by Reycem Communications. Just imagine what you or your radio club friends could do with this handy little rig! To win, all you have to do is estimate correctly just how long it took Rob to build the FTR-146. The only clues we're going to give you is that it took longer than 15 hours, but didn't take longer than 35 hours! The winner will be the entrant estimating the exact, or nearest, time taken to build the FTR-146.

Just enter your estimation of the time taken to build the kit, and complete the tie-breaker in no more than 20 words. Send your entry in with the coupon below, complete with the corner flash. The first two runners-up will receive one-year subscriptions and the second pair of runners-up will receive six-month subscriptions.

The editor's decision is final, and no correspondence will be entered into.

"I'd like to win the Ramsey FTR-146 transceiver because........"

Name .................................................................
Address ............................................................
.................................................................
.................................................................
.................................................................

Hours ............................................................
Mins .............................................................

Competition Corner
Feb 92
Scarborough ARS Diamond Jubilee

To celebrate the Diamond Jubilee of the Scarborough ARS, an Award Certificate is being made available, each certificate being signed by the President and Chairman. The award is to commemorate the founding of the society in 1932 and is available to all radio amateurs and short wave listeners.

All contacts must be made between January 1 and 31 December 1992. Log extracts are acceptable but must indicate contacts or reception reports confirming the following:

One contact with the society's HQ station, G4BP and five contacts with members of Scarborough ARS.

Contacts may be by any mode, on any band but contacts via repeaters will not be accepted.

All claims will be verified by the Awards Manager and the society's decision will be final. Claims must be accompanied by £2 sterling, $3 or 5 IRCs.

Applications are to be made to:
Awards Manager, G4BP
C/o 10 Lowdade Avenue
Scarborough
North Yorkshire
YO12 6JW.

COMPETITION WINNERS

June 1991 Spot the Difference Competition
Winner: B. Johns, Renfrewshire, Scotland.
Runners-up: Miss P. West, Paignton, Devon, Fred Ward, Littleover, Derby.

July 1991 Wordsearch Competition
Winner: Janet Mary, Crowborough, East Sussex.

August 1991 Spot the Difference Competition
Winner: B. Sinivas, Andhra Pradesh 533001, India.

September 1991 Wordsearch Competition
Winner: Ken Thompson, Blake, WA, USA.
Runners-up: John Lynch, Croydon, Surrey, Peter Hunter, Bowthorpe, Norfolk.

October 1991 Spot the Difference Competition
Winner: Lee Avedya, Istanbul, Turkey.
Runners-up: S. F. Lara, Port Talbot, West Glamorgan, Mr D. Sweeney, Liverpool.

August 1991 Spot the Difference Competition
Winner: B. Johns, Renfrewshire, Scotland.
Runners-up: Miss P. West, Paignton, Devon. Fred Ward, Littleover, Derby.

June 1991 Spot the Difference Competition
Winner: B. Johns, Renfrewshire, Scotland.
Runners-up: Miss P. West, Paignton, Devon. Fred Ward, Littleover, Derby.

The 1992 Radio Listener's Guide

This is the fourth and latest edition of the Radio Listener's Guide - a unique 58-page book for anyone who listens to radio.

Within the guide, easy-to-use maps show the frequencies for all the radio stations in the UK. These include Radios 1, 2, 3, 4 and 5, BBC local, independent and community radio stations. Foreign stations broadcasting in English are also listed.

This year, the guide also includes articles by the BBC, the Radio Authority, The Voice of the Listener, Sony and Blaupunkt, and for the first time, it lists stations transmitting from the Republic of Ireland.

You can use it in the car, caravan or at home. Find stations quickly and easily - at home and while on the move. Tune to your favourite radio stations while travelling, or tune to one of the many stations you never knew existed.

The 1992 Radio Listener's Guide costs £3.25 (including postage) and is available from the publishers at the following address:
The Radio Listener's Guide
FREEPOST, PDQ Publishing
PO Box 41, Didcot, OX11 8BR.
Tel: (0235) 816229.

Theft

On Saturday 16 November, at the Tesco Stores car-park, Culverhouse Cross, Wenvoe, Cardiff, a Yaesu FT-230R 144MHz v.h.f./f.m. only 5/25W transceiver, serial No. 2F.041377 was stolen. The theft occurred between 11.45am and 12.15pm. The car was parked slightly away from others in the area, and was broken into by use of a screwdriver in the door locking key hole, which was forced. The offence was reported to the supermarket manager and the Ely police station, Cowbridge Road West, Cardiff, tel: (0222) 222111 Ext. 218.

An individual was noted in the area, walking an Alsatian dog. He was short, stocky and wearing faded-blue denim, no coat or hat. Any FT-230R offered for sale should therefore be checked.

Can You Help?

Alan Stokes of 3 Alison Road, West Derby, Liverpool, Clubmoor, Liverpool L3 9AD, is searching for a cassette compartment door for a Pye TR-0726/05 radio/cassette recorder and an on-off switch for a Philips AR-060 radio recorder.

David Cross (South Oxfordshire area) on (0491) 32292 between 6 and 6.30pm is looking for a home for several boxes of loose radio and TV valves, which are in uncertain condition.

Mr J. G. Williams, ‘Alltwen’, 44 Mayfield Drive, Buckley, Clwyd, North Wales CH7 2PN, is looking for a circuit diagram, manual and any other details of the Trio JR-310. He will gladly refund any costs incurred.

Raymond Davidson G7FHD, 23 Wicklow Street, Middlesborough, Cleveland TS1 4RG, needs some help to identify an old frequency counter-timer. The only identifying marks are ‘Counter Timer 901’ on the front panel, with a small panel on the rear stating ‘901M 80S 3809’. Can readers solve this mystery for G7FHD?

Street Alarm

New from Maplin Electronics is ‘Street Alarm’, a very compact personal alarm with an extremely tough black plastic case. Thanks to its slim size, it can be carried easily by hand or attached to a belt using the very rigid clip moulded into its housing.

A large pink button, which is recessed to prevent accidental operation, is pressed to operate an extremely powerful 130dB siren, guaranteed to draw attention to passers by. To deactivate the alarm, the button is simply pressed again. The unit is powered by a PP3 9V alkaline battery (not included) which will provide up to six months of normal usage.

Overall dimensions are 50mm x 60mm x 32mm. Weight 114g with battery.

The Street Alert Alarm (ZC37S) costs £19.95 inc. VAT. Maplin Electronics on (0702) 552911 for enquiries.

In Need Of An Elmer!

We recently received a “Help! I'm in great need of an Elmer” letter from 22-year old David Jones, of Bury, Lancashire.

He's been interested in radio and electronics for about seven years, but would now like to get on the air, instead of just listening.

He finds the ‘maths’ side of the RAE difficult, and would therefore be most grateful if someone in his area could help.

If anyone can offer their help to David, please write to him, c/o ‘Newsdesk’ at our editorial offices, and we’ll pass all correspondence on to him.

Please send in all of your news items to Sharon George at the editorial office in Poole.
New Radio Club

Situated in the heart of rural Wales, in the beautiful Victorian town of Llandrindod Wells, a new radio club has recently been formed. They are known as the Mid-Wales ARC. Affiliation to the RSGB is at this moment in hand, and tentative steps are being taken towards having their own repeater station set up locally.

The club have high hopes of a very successful team, but are still open to any advice and/or assistance from whatever source. Anyone travelling in their part of the world, will be made most welcome, if they wish to call in and visit.

For any further details, please contact:
Len Rees
‘Dunblair’
Tremont Road
Llandrindod Wells
Powys LD1 5EB.

Radio Link Special Event Station

On Saturday 29 February 1992, from 8.30am to 5pm, three members of Radio Link will be operating an amateur radio special event station, from the Eagle Shopping Centre manager’s office, in Copeland Square, Derby, with a callsign of GB1ECD (Great Britain One Eagle Centre Derby).

The amateur radio station will operate on 144MHz, and various local personalities will visit the station during the day. The members hope to make contact with amateur radio stations within a 113km (70 mile) radius of Derby.

The company, CIN Properties Limited, who own the Eagle Shopping Centre, have sponsored Radio Link’s daily request programme over the last two years.

Radio Link was formed in April 1974, and this voluntary organisation and registered charity now provides a hospital radio service to the following hospitals:
- Derby City Hospital
- Derbyshire Royal Infirmary
- Derbyshire Children's Hospital
- Kingsway Hospital
- Nightingale Continuing Care Unit
- Radio Link’s studios are based under Ward Two of the Derby City Hospital, Uttoxeter Road, Derby.

For further information, contact:
John Huddlestone G1UJX
Secretary/Press Officer
c/o 8 Wilmot Avenue
Chaddesden
Derby DE2 6PL.

Cushcraft

Cushcraft Corporation have recently appointed Shropshire-based Specialist Antenna Systems Ltd., as their UK distributor. They will promote this high-quality range of amateur antenna products, together with a wide range of commercial products, previously not seen in the UK. For further details, contact:
Specialist Antenna Systems Ltd.
Radfords Field
Maesbury Road
Oswestry, Shropshire SY10 8EZ. Tel: (0691) 670440.

Osvestry, Tracing A Winner!

At the recent Bridgend rally, the winning ticket in their prize draw, unfortunately, had no buyers name or call sign written on it. The winning ticket was Yellow 106.

They are trying to trace the winner, so if anyone can help them please contact Charles Sedgebeer on (0656) 860434.
**Aylesbury Vale RS meet 1st & 3rd Wednesdays, 7.45pm at the Roast Beef Bar, Blackbird Leys, Oxford. Further details from Paul ACL 59513 or Steve ACL 59514.**

**Bromsgrove & District ARC meet Thursdays, 7.30pm at Avoncroft Arts Centre, South Bromsgrove, Worcs. Further details from Neil RG8MNY.**

**Chesterfield ARC meet 1st & 3rd Mondays, 7.30pm in the Orwell Lodge Hotel, Polwarth Terrace, Edinburgh. Further details from Derek G3ZOM of the Amateur Radio Observation Service.**

**Crews & District ARC meet 1st & 3rd Tuesdays, 7.30pm in the Running Man Public House, Pallon Lane, Halifax. On the 'History and Development of the Amateur Radio Service' by Paul ACL 59513.**

**Derwentside ARC meet Wednesdays, 5.30pm in the 'Smoothie' Bar at the 19th King's Lynn Scout HQ, North Runcton. Further details from Derek G3ZOM of the Amateur Radio Observation Service.**

**Dover & District ARC meet Wednesdays, 7.30pm at the Church Hall, Easington Colliery, County Durham. For further details contact Barrie GW7EXH.**

**Great Lumley ARS meet 2nd & 4th Thursdays, 7.30pm at the Forest Ring Community Hall, St. Martin's Court, Northallerton. On the 'History and Development of the Amateur Radio Service' by Paul ACL 59513.**

**Heathfield & District RS meet 3rd Mondays, 8pm at the Hall Green Scout HQ, Selly Oak, Birmingham. Further details from Brian GW4LWA and Neil RG8MNY.**

**Kettering ARC meet Tuesdays, 7.30pm at the Church Hall, Kettering. On the ‘Two-Way Radios and their Use in Ham Radio’ by G4LGA. Further details from Geoff Philpotts GWOLBI at 33 Nant Gwyn, Trelewis, Mid Glamorgan.**

**Leeds & District RS meet 2nd & 4th Thursdays, 7.30pm at the 19th King’s Lynn Scout HQ, North Runcton. Further details from Derek Frank GWGMOL on (0532) 811189.**

**Louth & District ARC meet 1st & 3rd Mondays, 7.30pm in the Ram Inn, Taunton, Somerset. For further details contact Trevor GL57W.**

**Manchester & District ARC meet 1st & 3rd Thursdays, 7.30pm at the Old Village Hall, Wednesbury. Further details from John ML32V.**

**Northwich & District RS meet 2nd Mondays, 7.30pm at the Royal Arms Hotel, Northwich. Further details from the Secretary, c/o Swavesey District Council, Council Offices, Argyle Road, Swavesey, Kent CM191HG.**

**Rhyll & District ARC meet 1st & 3rd Mondays, 7.30pm in the Owrell Lodge Hotel, Polwarth Terrace, Edinburgh. Further details from Paul ACL 59513 or Steve ACL 59514.**

**Shelley & District ARC meet Thursdays, 8pm at the Church Hall, Uphill Road, Shelley, Sheffield. For further information, contact Nigel O L19P on (0909) 274773.**

**Silverside RC meet Fridays, 7.30pm at the 19th King’s Lynn Scout HQ, North Runcton. Further details from Neil RG8MNY.**

**Syston & District ARC meet 1st & 3rd Tuesdays, 7.30pm at the Ram Inn, Taunton, Somerset. For further details contact Trevor GL57W.**

**Waddington & District ARC meet Mondays, 7.30pm at the 19th King’s Lynn Scout HQ, North Runcton. Further details from Neil RG8MNY.**

**Whitby & District RS meet Mondays, 7.30pm at the Great Lumley Scout HQ, Northallerton. For further details contact John Randall G30AZ, 243 Basingstoke.**

**Worcester & District ARC meet Thursdays, 8pm at the Church Hall, Hereford. For further details contact the Secretary, c/o Swavesey District Council, Council Offices, Argyle Road, Swavesey, Kent CM191HG.**

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**For more information on Amateur Radio, please visit**

- [The Radio Society](https://www.radio-society.org)
- [Amateur Radio Observation Service](https://www.amateur-radio-observation-service.org)
- [Radio Society of Great Britain](https://www.rsgb.org)

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**Additional Reading:**

- [The Ham Radio Handbook](https://www.hamradiohandbook.com)
- [Amateur Radio Today](https://www.amateurradio.com)

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**More News About the Radio**: The 22nd is a 'Home-brew Test Gear' evening, the 15th is a 'G4EGL Weekend', which is an informal & committee meeting, February 5 is 'Construction Techniques' by Paul ACL 59513, the 12th is 'Novice Licences' by Dave BDY40. Jack Simpson G3NJO on (0663) 747001.

**North Bristol ARC hold their meetings at S.E.H., 7 Bramason Crescent, Northville, Bristol. Chris Budd G0OLO on (0454) 618004.**

**Nottingham ARC meet Thursdays, 7.30pm at the Sharonwood Community Centre, Mansfield Road, Nottingham. Further details from Rex Beestall GILA! on (0533) 733740.**

**Peele RAS meet 7pm & 2nd Fridays, 7pm at Leudeborough. Information from Constable Hill Site, Bournemore & Poole College of FE. January 10 is 'Making Printed Circuit Boards’. Details from Neil RG8MNY.**

**Presidential is open to all employees and ex-employees of the Prudential company and their families. Further details contact John Randall G30AZ, 243 Basingstoke.**

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**Special Offers:**

- [Radio Society-related merchandise](https://www.rsgbofficialmerchandise.com)
- [Amateur Radio Software](https://www.rsgsoft.com)

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**Contact Information:**

- [Peele RAS](https://www.peeleras.org)
- [Nottingham ARC](https://www.nottinghamarc.co.uk)
- [Presidential](https://www.prudentialarc.org)

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**For More News on Page 21:**

- [Radio Handbook](https://www.hamradiohandbook.com)
- [RSGB](https://www.rsgb.org)
ICOM (UK) Ltd. have opened two excellent ham retail stores in Birmingham and Herne Bay, Kent and we don't think you will find anything to beat them!

Our Birmingham store is under the management of Gordon G3LEQ ably assisted by John G8VIQ, the Herne Bay store is managed by Chris G8GKC. All have years of experience in Amateur Radio sales and will give a friendly service and a good supply of coffee.

Both stores have a full range of amateur products. We also have liquidated stock from the old KW Communications Ltd available at rock bottom prices. This includes such top brand names as Kenwood, Yaesu and Tentec. We have taken over the retail side of Ray Withers Communications who continue to trade in commercial and broadcast radio systems.

The Birmingham Store is in the same location as Raycom - just off Junction 2 on the M5. Our Herne Bay store is at ICOM headquarters.

Part exchanges are welcome and all major credit cards accepted. There are also certain Privilege Member Cards which will be honoured!

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Practical Wireless, February 1992
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**WEST MIDLANDS DY6 8XZ**
South Dartmoor ARC meet Mondays, 8pm at South Dartmoor School, Balla Lane, Ashburton, Devon. This radio club has become a hub for local enthusiasts - a meeting place for those who share a passion for radio and communication. A Novice-run radio club, contact Peter Thornhill GZGZK, 21 Elmbank, Buckfastleigh, Devon TQ11 6X. Tel: (0390) 671234.

South Dorset RS meet 1st Tuesdays, 7.30pm in the Wexness Lounge of Weymouth Football Club. On February 4 they have a ‘Mass Adventures of A Wartime RAF Radio Operator’ - Ted G3ETA. Geoff Gwillian G4FJQ, 13 Overlonds Road, Wyke Regis, Weymouth DT4 9BS. Tel: (0300) 791164.

South Notts ARC meet at Highbank Community Centre, Farnborough Road, Chilwell Estate. Not only one adult - the rest being school-age youngsters! Although anyone wishing to join in is welcome. Contact Tony Goddard G4WLB, 36 Raleigh Road, Nottingham NG3 2EL. For further details, contact Trevor G4BH (on home of (0905) 671234.

Southgate ARC meet at Winchmore Hill Cricket Club Pavilion, Firs Lane, Winchmore Hill, London N21. January 9 is a talk on ‘Computing In Amateur Radio’ by Guy Chalmers G4VGH at 53 Grove Road, Wellescombe, Southport, Wirral L41 6AP. Tel: (070) 425657 (6-7pm).

Spa Valley ARC meet Thursdays, 8pm in Old Bank Working Men’s Club, Farnborough Road, Chilwell Estate. Not only one adult - the rest being school-age youngsters! Although anyone wishing to join in is welcome. Contact Tony Goddard G4WLB, 36 Raleigh Road, Nottingham NG3 2EL. For further details, contact Trevor G4BH (on home of (0905) 671234.

South West Amateur Radio Club meet at premises near Throsk, Stirlingshire CV36 4PE. Tel: (0608) 291291. AOTS is Round Robin, v.h.f. mobile/base station practice sessions are held between 7.30 and 9pm. More details from Ian Carter on 0427 83091.

The Three Counties ARC meet every 1st Thursday, 7.30pm at the Railway Hotel, Liphook Hampshire. Kevin Roche G1GGS on (0420) 636891.

Thornbury & District ARC meet at the Unitarian Church, Chapel Street, Thornbury, 7.30pm, talks start at 8pm. CW practice sessions are held between 7.30 and 9pm. January 15 is Ted G1GBT on ‘DF & Map Reading’, the 22nd is a v.h.f.t/h. activity/natter night and the 29th is a bonus natter night/t.t. activity. More details from H. Crammnet G1GEE at Rose Cottage, The Naithe, Oldbury-on-Severn, Bristol, Avon BS51 1TR. Tel: Thornbury 411000.

Torbay ARC meet Fridays, 7.30pm at the ECC Social Club, Highways, Newton Abbot. January 10/17th/31st/February 7 are Club nights and January 24 is a monthly meeting & construction cup judging. More details from Andy Stafford G4VPM on (0905) 329095.

Trowbridge & District ARC meet at 8pm, in the Territorial Army Centre, Victoria Road, Trowbridge, Wiltshire, 8pm. More details from Ian Carter on (0380) 82606.

Trent Valley ARC meet 3rd Thursdays, 7.30pm at Downs Lawn Tennis Club, Holland Avenue, Chester, Churn, Surrey with natter nights on 1st Mondays, in the Downs Bar. January 12 is 153MHz AF CW contest. 16th is ‘Erasing Marks and Antennas for Contest’ by Andy Brooker G4ZZW and the 18th is 3.5MHz AFS Phone by Brian Shelton GOMEE, 22 Berkeley Street. January 3 is a Projects evening, the 21st is a New Year social and February 10 is a ‘Computing In Amateur Radio’ by Guy Chalmers G4VGH at 53 Grove Road, Wellescombe, Southport, Wirral L41 6AP. Tel: (070) 425657 (6-7pm).

Tweedgrange & District ARC meet at Granville Park, Berleick Gardens, Winchmore Hill, London N21. January 9 is a talk on ‘Computing In Amateur Radio’ by Guy Chalmers G4VGH at 53 Grove Road, Wellescombe, Southport, Wirral L41 6AP. Tel: (070) 425657 (6-7pm).

Tunstall & District ARC meet at Great Billingham Community Hall, The Old Fire Station, Double Street, Spalding, 8pm. More details from Ian Carter on (0380) 82606.

Tufton & District ARC meet 1st & 3rd Mondays, 7.30pm at the H.R.A. Headquarters, New Kent Road (off Malborough Road), St. Albans, Hertfordshire. 2nd Tuesdays are their activity evenings and 4th Tuesdays are their main monthly meetings. On January 28 Mr R. McKeever will give a talk entitled ‘Medical Losses’ More details from WALTER Crate G3PMF, 5 The Crescent, Abbots Langley, W. Hertfordshire. Tel: Hertfordshire 84208.

Wakefield & District RS meet Tuesdays, 8pm in First Floor Rooms, Oasis Community Centre, Prospect Road, Ossett. On February 11 they have a rally preparation. John Bailey G9MWA on (0924) 26004.

West of Scotland ARS meet Wednesdays, 7.30pm at the Scout HQ, 21 Embank Street, Glasgow. For further details, please contact John Power GOKTD, 9B Box 599, Glasgow G3 60H.

Whitton ARC meet Fridays, 8pm at the Whitton Community Centre, Percy Road, Whitton, Twickenham. On January 24 they have a ‘Humpy-Dumpy’ Pantomime. More details from Rosalind Carter, 15 Park Close, Hounslow, Middlesex. Tel: 081-894 2950.

Wiesbaden ARC - DAY1A - is a club mainly for US military personal stationed anywhere near Wiesbaden, Germany. For more details, contact Robert Kipp DJ9PU, Hoplign, 21, D-4070 Landen, Germany. Tel: (0511) 262323.

Wigwamshire ARC meet Thursdays, 7.30pm at the Community Education Office, Starner Academy. More details from Ellis Gaston GOM8PK, 3 Victoria Buildings, Caintryan, Starner, Dumfries & Galloway DG1 8RA. Tel: (0581) 2202.

Wimbledon & District ARC meet 2nd & last Fridays in St. Andrews Church Hall, Herbert Road, Wimbledon SW19. On January 10 they have a general activity evening and the 31st is ‘Solomon Isles DXpedition’ by Nigel Cawthorne G3TXF. Chris Frost G1KGB, 61 Selbourne Avenue, Tolworth, Surrey KT6 7NR. Tel: 081-287 9427.

Wirral ARC meet 1st & 3rd Wednesdays, 7.45pm at ivy Farm, Arrow, Park Road, Birkenhead, Wirral. More details from Alec Seed G3F00 on 051-644 6094.

YOUR SPECIAL FLIGHT IS WAITING!

SO DON'T MISS THE DAYTON '92 HAMVENTION, 30th MAY - 1ST JUNE 1992!

Last year’s trip to Dayton '91 was a resounding success, and readers have clamoured for more. So, here we are again, inviting you to come and fly with us to Dayton, Ohio, home of the Hamvention. Enjoy yourself at the biggest amateur radio show in the world. Reserve your seat now...we really don’t want to leave you behind!

Five Nights In Dayton

The Dayton '92 holiday starts at Gatwick airport on Wednesday 22 April, when we fly to Charlotte in North Carolina. After changing aircraft in Charlotte, we fly straight into Dayton. When we arrive, accommodation is no problem, as we’ll be staying for five nights in the Day's Inn in the heart of downtown Dayton.

Our stay gives you plenty of time to explore the giant Hamvention and many of the local attractions.

We'll be returning home via Charlotte on Monday 27, but we can also arrange extended stays and there's even a special extra holiday in Florida available to tempt you further!

Marvellous And Cheap

Food in the USA is marvellous, and so cheap! There's so much to see, to do and to eat during the trip, plus of course all the radio bargains. If the family wants to come, make sure they do, there's so much for everyone on this trip.

The cost of this superb opportunity is £579.95 per person. But don't worry, you only have to pay out £75 now to reserve your seat, with the balance payable in mid-February.
The Global GDO Mk.II Dip-Meter

Rob Mannion G3XFD, regards the dip-meter as being one of the really essential items of test equipment for the shack. So, knowing how keen he is on 'home-brewing' and using his own 'dipper', we let him try the newly-imported 'Global' Mk.II model.

I regard the dip-meter as being an essential piece of equipment to have in the shack. I've had one for many years, and to be honest, my present 'dipper' uses a 6C4 valve!

No doubt many of you will not be impressed with the news that I still 'swear' by my old valved 'dipper'. Despite that, I've no doubt that most of you will agree that the good old-fashioned meter really does provide an excellent dip indication.

Of course, I have built various modern circuits, but I still prefer the valved model. It's a bit of a nuisance having to trail a mains lead about at times, but that's only a small disadvantage in my opinion.

Suitable Meter

One of the main reasons why I still use my valved 'dipper', is that I can't find a suitable meter to replace it with. One or two meters imported from the far east proved unreliable, and the dip indication was often very poor.

Another drawback of imported dip-meters, which I consider is important (but others may not) is the frequency coverage. My home-brew meter covers from 60kHz to 160MHz. Over the years this wide coverage has proved immensely useful. I can check everything from 85kHz i.f. transformers to inductances for 144MHz.

Commercially made 'dippers' however, rarely work below 1.5MHz. Despite this disadvantage, they certainly look better than my old valved job, and the tuning scales and dials are much easier to use.

So, bearing in mind what I've said, I was interested to hear that the Global GDO Mk.II TR Dip-Meter was being imported by Waters and Stanton. I gladly accepted the invitation to try one of the meters, to see if it would wean me away from my old valved model!

What's A Dip-meter?

Just in case you ask 'what's a dip-meter', I'll start off with two statements: Firstly, a dip-meter is a calibrated tuneable oscillator, provided with an indicating device (usually a meter). The circuit is so arranged, that the dip-meter indicates when a tuned circuit, is resonant at the same frequency as the instrument is tuned to itself.

Traditionally, the valved types provided a 'dip' (in other words a decrease) in the meter reading, hence the term 'dip' meter. The 'dip' was an indication that part of the feedback energy of the dip-meter's oscillator was being absorbed by a circuit tuned to the same frequency.

Unfortunately, and to confuse matters a little, other circuits can be employed which actually increase the meter reading on resonance! Despite this, such instruments are still called 'dippers', because the actual sensing part of the device still works in the same way.

The only difference with this type of dip-meter, is the indicating circuitry. This is arranged to make the meter movement move towards full-scale deflection (rather than away from full-scale deflection) when indicating resonance.

The second statement I have regarding the dip-meter, is that it can be 'all things to all men'. That's another way of saying that they are extremely versatile instruments and do many different jobs.

A carefully designed and built dip-meter, can provide a great number of services for its user. Apart from providing an indication of a tuned circuit's frequency at resonance, with the 'dip', it can be used as a very basic signal generator.

They can also be used as absorption wavemeters, monitoring receivers, and as a simple form of capacitor tester. You can also use them, by comparison checks, to identify unknown capacitors and inductors. In other words, I don't think you should be without a dip-meter in your shack!

Questionable Reliability

Unfortunately, in recent years many dip-meters imported from the far east, suffered from questionable reliability. In fact the situation became so bad, that several UK importers withdrew them from sale, because of customer 'returns'.

To get over this problem, Waters and Stanton have started importing the dip-meter again. But before the meters are put on the market, they are thoroughly checked and calibrated.

Each dip-meter is put through a series of tests, before passing onto the final quality-control stage. Only then are the meters released for sale.
Attractive Instrument

The Global Mk.II has an attractive, well laid-out design. The tuning scale, marked off in colours and figures, is quite easy to read. I found it was a comfortable hand-held size.

Each range coil has a coloured band, which matches to the colour on the thumb-operated tuning scale. On either side of the large tuning scale, a further aid to identify the ranges is provided by the letter associated with each range, being boldly marked on the casing.

The instrument, as supplied, covers from 1.5 to 250MHz. I was pleased to find that it gave good ‘dips’, and that very few ambiguous readings (false dips) occurred.

The calibration was reasonable, when you bear in mind that the dip-meter is not intended as a precision instrument. I often wonder, when I’m using my own meter, how much more I could have progressed in my early radio days, if I’d had a dip-meter then!

In those days, I spent half my time trying to find out what frequencies I was tuned into. Unfortunately, in the mid-1950s, I hadn’t heard of dip-meters. However, I can at least make sure that my young school radio club members know how to use the dip-meter to advantage. They, at least, can save time and frustration when they are winding coils and adjusting antennas.

Frequency Coverage

In practice, I have found the frequency coverage of my own dip-meter to be a good trade-off. In other words, what my meter lacks in v.h.f. coverage, is made up by the useful low frequency coverage.

My radio club members build medium wave receivers, before building more advanced equipment. They also like to renovate and use surplus 455kHz i.f. strips and other broadcast reception type equipment.

My dip-meter comes in very useful for this work. We can easily identify medium and long wave coils, i.f. transformers, etc., to great advantage.

Unfortunately however, the Global Mk.II dip-meter, in common with the majority of ready-made or kit instruments, doesn’t cover below 1.5MHz. I think this omission is strange, because it reduces the instrument’s versatility, especially as there’s much equipment using i.f. below 1.5MHz.

However, having criticised the lack of low frequency coverage, I was pleased to find the v.h.f. range was more than adequate. The Colpitts type oscillator used in the meter, thanks to the very sturdy silver-plated pins on the coil, proved to be very stable, which was quite a surprise!

On the v.h.f. ranges, there were far fewer ambiguous dips than I expected. The sudden ‘drop out’, where the oscillator stops unexpectedly, which is so common with transistorised dip-meters, didn’t happen once with the meter I used.

The adjustable ‘sensitivity’ control enabled me to adjust the meter for full-scale deflection on all ranges. I also found that variations in meter-indications, as frequency was increased or decreased, was only a gradual process. Any variations could be easily compensated for by using the sensitivity control.

Important Feature

Another important feature on the meter, is the inclusion of a modulation facility. A three-position sliding panel-mounted switch, selects either the main dip-meter oscillator, oscillator and modulation or the battery check.

With the modulator switched on, a 2kHz tone is modulated on the dip-meter’s signal. This proves useful because the characteristic tone, makes the dip-meter’s carrier easily detectable amongst the mass of heterodynes on some frequencies.

It’s very necessary on receivers not equipped with a beat frequency oscillator (b.f.o.). This is because without it of course, you’ll only hear a slight hiss from the receiver under test. With the modulation switched on, the job is made much easier.

Summary

After the test period, which included a session at the school club I help to run, I have only two reservations regarding this dip-meter. One is the fact it does not work below 1.5MHz* which could add to its versatility, and the other is more of a request regarding frequency range markings.

I’m going to suggest to the manufacturers, that the useful little table indicating the coil reference letter, and the frequency coverage, be transferred to the front panel. It would be much more useful there, especially when the meter is first purchased!

Altogether, I found the Global G.D.O Mk.II Dip-Meter to be very useful piece of equipment.

Unlike many, cheaper, imported meters it worked well, was stable and reasonably accurately calibrated.

I feel that this meter will prove to be very useful in the enthusiast’s workshop. With a multimeter and a dip-meter, you’re quite well equipped. I wouldn’t be without a ‘dipper’ of some sort or other.

* Waters and Stanton have replied to my comments, and they report that they are looking into the possibilities of an add-on kit to provide coverage of the lower frequencies on the Global dip-meter.

Specifications

<table>
<thead>
<tr>
<th>Frequency coverage</th>
<th>1.5 to 250MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of coils</td>
<td>6 (plug-in)</td>
</tr>
<tr>
<td>Band A</td>
<td>1.5 to 4MHz</td>
</tr>
<tr>
<td>Band B</td>
<td>3.3 to 8MHz</td>
</tr>
<tr>
<td>Band C</td>
<td>6.8 to 18MHz</td>
</tr>
<tr>
<td>Band D</td>
<td>18 to 47MHz</td>
</tr>
<tr>
<td>Band E</td>
<td>45 to 110MHz</td>
</tr>
<tr>
<td>Band F</td>
<td>100-250MHz</td>
</tr>
<tr>
<td>Internal modulation</td>
<td>Approx. 2kHz sine wave</td>
</tr>
<tr>
<td>Crystal oscillator</td>
<td></td>
</tr>
<tr>
<td>test facility</td>
<td>1 to 15MHz, in FT-243 holder</td>
</tr>
<tr>
<td>Power supply</td>
<td>9V internal battery</td>
</tr>
<tr>
<td>Current consumption</td>
<td>2mA maximum</td>
</tr>
<tr>
<td>Semiconductors</td>
<td>2 transistors, 1 diode</td>
</tr>
<tr>
<td>Circuit</td>
<td>Colpitts type oscillator</td>
</tr>
</tbody>
</table>

My thanks go to Mike Hayden of Waters and Stanton Electronics, for the loan of the review instrument. The Global G.D.O Mk.II Dip-Meter is available from them at £69 including VAT, plus £5 postage and insurance, at 22 Main Road, Rickley, Essex SS5 4Q8. Tel: (0702) 206835/204965.
To start off our p.c.b. ‘theme’ in the magazine this month, we’ve asked the Rev. George Dobbs G3RJV to give us some practical advice. He’s aiming to help you make your own p.c.b.s for some of the interesting projects coming up in PW this year. And, as usual, George has come up with an appropriate quotation:

“Water, water, everywhere and the boards did shrink.....”

Samuel Taylor Coleridge 1772-1832.

If you take a quick look into almost any piece of electronic equipment these days, you’ll realise that printed circuit boards are now the standard way to construct an electronic circuit. A printed circuit board (p.c.b.), sometimes called an etched circuit board, is formed by chemically etching away parts of a copper foil which is cemented to an insulated sheet.

The copper left after etching provides the actual wiring between the components in the circuit. Usually the components are placed on the non-copper side of the board, with their leads going through small holes in the board and copper leads. After mounting, the components are soldered to the copper foil tracks.

**Neat And Convenient**

Etched circuit boards are a neat and convenient way to mount circuits. The components are held firmly in place and the wiring can be neat and direct.

They are also very useful for small or large batch production of the same circuit. Copies of the board can be made, which not only help the duplication of the circuit, but also produce an accurate copy of the master board.

**Appropriate Method**

Most amateur constructors only want to make one copy of a circuit board, so any method appropriate to the task can be used. Many amateur constructors like to use a p.c.b., even for one-off projects, because they are a reliable and tidy method of construction.

It’s very simple to design and build p.c.b.s for even the simplest amateur project. Many designs in books and magazines provide printed circuit board layouts, and it’s easy to copy these layouts for a one-off board.

All the materials required, are available from amateur radio suppliers. The chemical process is simple and, with a few basic precautions, very safe.

**The Requirements**

The basic requirements for making your own p.c.b. projects is a stock of copper-clad board. The usual material is an insulated board, with a thin layer of copper, usually 0.0027 in thick, cemented on one or both sides. However, initially we will deal with single-sided boards.

It really pays to use good quality board. I would use nothing other than good glass fibre board. Cheaper Paxolin or phenolic board is available, but the epoxy-based glass fibre board offers the best quality. It also has the added advantage of being slightly translucent. This means that the copper track will be visible (especially if held up against a bright light) from the top of the board. This is helpful when adding components.

**Etch Resist**

The next basic requirement is an ‘etch resist’ material. This is placed on the board, prior to chemical etching. Portions of the board covered with the etch resist material, retain the copper during the etching process.

There are many types of etch resistant material which the amateur can use for one-off boards, and several methods of applying the material to the board.

The final basic requirement is a chemical etchant. There are several suitable chemicals, but for amateur use Ferric Chloride is the easiest to obtain, and probably the easiest to use provided you follow some simple rules.

**The Design**

The amateur constructor may have to design the layout from a circuit. Alternatively, they may already have a suitable p.c.b. layout from an article in a magazine or book.

If an existing design from an article is being used, after checking that it’s an actual size print, you should make a photocopy to save harming the original. If the printed design is larger or smaller than actual size, there’s no problem either.

Fortunately it’s easy, these days, to find a ‘zoom’ photocopier at a local copy shop to produce an actual size drawing. This copy will then be used in the same way as an original design.

**Not Difficult**

Designing your own p.c.b. from a circuit is not difficult, and your technique and final results will improve with practice. But, unless you own a sophisticated computer-aided (CAD) printed circuit board system, the job is first done by trial and error. If you own a sophisticated computer-aided (CAD) printed circuit board system, the job is first done by trial and error. My attempts usually involve a lot of rubbing out and relocation of components, before I’m satisfied with the final layout.

Once you’re under way, you’ll see that having the main components available is a great help. It means that the spaces between the leads or contacts can be accurately marked by placing the component on the paper.
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<td>2m handy with artificial intelligence</td>
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<td>Superb value 2m/70cm base station</td>
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<td>FT290R</td>
<td>MKII famous 2 metre all mode</td>
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<td>Dualband handheld with ex. receive</td>
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<td>C???</td>
<td>New tri-bander soon!!</td>
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<td>Miniature hand scanner</td>
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<td>DJ-S1E</td>
<td>Budget 2m handy super styling</td>
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<td>Latest specification hand scanner</td>
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<tr>
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**Track Marked In**

When the layout is satisfactory the track can be marked in by using a ball-point pen. Make the markings clear and press hard with the pen.

The positions of the pads are enlarged to a ‘blob’ rather than a dot. This represents the top of the circuit, but the actual tracks are on the underside.

All the track and pad positions must now be marked on the reverse of the paper. Use a ball-point pen again, and don’t forget to press hard. This should result in the pen-lines being visible underneath, and marked in on that side.

The correct way to do this is to use a ‘light box’, which brightly illuminates the paper from below. You use it by placing the paper face down on the box. The light shining through then reveals the tracks.

Many amateur constructors won’t have a light box but placing the paper, against a window in daylight, will do the same job. The p.c.b. artwork is now complete, with the layout on one side, and the tracks and pads marked on the other side.

The next task is to transfer the track and pad design to the board as etching resistant material (usually called ‘etch resist’). To do this, there are a number of methods.

**Free From Grease**

Copper-clad board can only be successfully etched if the surface is clean and free from grease. Any dirt left on the copper, may well act as an etch resist material itself, and leave unwanted areas of copper on the board.

The copper surface should be cleaned until it shines. A good cleaning material is wire wool. I prefer to use standard kitchen materials to clean my boards.

First, I squirt neat washing-up liquid on the board. Then I sprinkle household abrasive cleaner (Ajax, Vim, etc., will do the job) onto the liquid, before rubbing the whole surface with a warm, wet cloth.

This process degreases and cleans the surface in one go. Finally, you should rinse the board in hot water, dabling it clean on a paper kitchen towel, avoiding finger contact with the now prepared copper surface.

**Tape Technique**

The tape technique is the simplest method of making an etch resist surface on a p.c.b. It’s ideal for quick, one-off boards, but is not suitable for boards that contain a lot of detail.

In essence, this method consists of covering the copper side of the board with adhesive tape or plastic. It’s then removed, with a sharp knife, uncovering those parts which are to be etched, exposing them to the etching fluid.

With this technique, I normally use strips of masking tape, allowing a large overlap on each strip. However, I have used the Fablon type of sticky-backed plastics covering material and even self-adhesive address labels! Whatever you use, the material should be chosen so that markings can be made on it with a pencil or a felt-tipped pen.

When using this method, you should first cut the piece of copper clad board to the size of the p.c.b. design. Then cover it with masking tape or other suitable material.

The easiest way to transfer the layout to the tape surface, is to use carbon paper. Cut a piece of carbon paper to the size of the board and lay it, carbon surface down, onto the masking tape. The board design with the tracks and pads is placed, face-side upwards, on the carbon paper.

Secure the paper to the board with a couple of small pieces of masking tape. Draw over all the tracks and pads, pressing down hard, with a ball-point pen.

When the artwork and the carbon paper are removed, the design should be seen on the masking tape surface. It’s a good idea to ‘thicken-up’ the lines with a felt-tipped pen and a ruler.

**Sharp Knife**

Using a sharp modelling knife, or better still, a scalpel, carefully cut along the edges of the tracks. It’s easier to convert the tracks into rectangular blocks rather than thin and stylistic lines. Remember the tracks must remain ON the board: they will be retained copper (as they are protected from the etching process).

This method lends itself to the ‘minimum etch technique’, that is, leaving as much spare copper on the board as possible. The spare copper is joined to ground (or earth) on the circuit, and provides a low impedance ground-plane around the board. So, you can cut out the tracks as ‘islands of copper in a sea of copper ground-plane’.

Once the tape has been removed, the board is ready for etching. You may find that the edges of the cuts have lifted slightly. If they have, place a sheet of clean paper over the board and rub firmly all over the surface with the back of a comb, to ensure the edges are firmly adhered to the surface.

**Surface Mount Boards**

The masking tape technique may also be used for another method of p.c.b. construction, the ‘surface mount’ board. Perhaps you have seen surface mounted boards using tiny components without leads.

It’s also possible to surface mount normal components on a board. This method has several advantages in some types of circuit.

With this technique, all the parts are mounted on the copper side of the board. Their leads are cut short and they are soldered directly onto the tracks.

This method requires thick tracks of the “island” type. It has the advantage that no holes are required in the board, and components can be easily taken off the p.c.b., and changed during experimentation.

With this technique it is also possible to design the layout directly onto the board. I have used this method in prototyping, progressing directly from a circuit diagram to a complete board in a very short time.

To use the surface mounting technique, cover the board with tape in the way I’ve already mentioned, then take a pencil or felt pen and mark out the components on the board.

It’s even possible, in some cases, just to re-draw the circuit on the board and translate it directly into a layout. You only have to tidy up the lines with a pen and ruler.

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Fig. 3: The most commonly used etching chemical, ferric chloride, shown in dry powder and liquid form.

Fig. 4: The G3RJV etching assembly! Clothes pegs (once used for this job, don’t even consider them for wash-day ever again!) provide a simple and secure way of holding the p.c.b. vertically in the etching fluid (see text).
and then cut and etch.

With this process, no holes are required and the components solder directly onto the copper surface. Many commercial linear amplifiers are built in this way.

**The Felt-Tip Pen Method**

The felt-tip pen method is probably the most popular method of making P.C.B.s for most amateurs. With this method, the board is marked with etch resistant material using a pen, or in some cases a brush.

Special etch resistant felt-tip pens are sold for P.C.B. work, but I use ordinary spirit-based felt tipped pens. Most spirit-based pens provide good etch resistant markings, and they can be bought cheaply in a variety of widths andpoint styles.

Which pens are best? Well, a good test is to pull the cap off the pen and sniff the tip. If you want to sniff it again, it's probably a good etch resistant pen! Editorial note: Take care, as some of the solvents used in this type of pen, are petroleum-based and can have the same effect as the well-known 'glue' vapours.

My favourite felt-tip is the Pentel N50 Bullet Point Permanent Marker. It has a bullet-shaped point which can lay down quite thin lines. When it's pushed firmly onto the board it will also make a good 'blob' for a solder hole or pad. For thinner lines, I use one of the fine permanent markers made for writing on overhead projector transparencies.

**Surface Clean**

Naturally the copper surface must be clean and grease free, before the pen markings are made. Sometimes however, the copper surface is reluctant to take the markings if it's very clean and smooth.

If this happens, place the board into the etching solution for a few seconds, then remove and wash it. This provides a dull, but clean surface, which can often help the marking fluids 'stick'.

**Two Ways**

There are two ways to transfer the p.c.b. artwork to the copper surface. They are the carbon paper method and the 'punch and join' technique. These methods can be useful for home-drawn layouts or layouts copied from magazines.

The carbon paper method is exactly as I've already described, except that the carbon paper is placed directly on the copper surface. The carbon marks then form the basis of the lines and pads which are drawn in by hand with the felt pen.

Don't be timid when drawing the tracks. On professional boards, the tracks are often slender, but on amateur boards they can be as thick as the space allows.

If large areas of copper are to remain on the board, these can be formed by laying down several layers of felt-tip pen markings. It's also possible to cover large areas with a small brush and nail varnish (a good etch resist material) or even strips of masking, or plastic tape.

**Punch And Join**

The 'punch and join' method is my favourite. To use this technique, secure the artwork (original or magazine) to the cleaned copper board, using a little sticky tape along a couple of edges.

Each pad marks the point where a hole has to be drilled. It's helpful in the drilling stage, if these points have been marked with a centre punch, so it's best to mark them at this stage.

I use a spring-loaded punch, pressing down on each pad or hole point. When the positions have all been punched, the artwork is removed. The copper will now have a series of punch marks on the surface.

Now you should take the felt-tipped pen (the Pentel N50 Bullet marker is ideal here) and make a blob mark on each punch mark. These marks provide a pattern of dots for the pads. I then draw in the tracks free-hand between the pads. A small ruler can be used for a neater board.

**Rub-Down Lettering**

Most readers will already be familiar with the Letraset or other brands of rub-down lettering. These are dry transfers, which are rubbed down onto a surface, to provide neat lettering or graphics.

A whole range of rub-down dry transfers are made for P.C.B. fabrication. It's possible to buy sheets for pads, integrated circuit pins, lines and other components ‘footprints’. The transfers can replace the felt-tip pen in either of the techniques described above. I have made very attractive P.C.B.s using the punch and join technique with rub-down transfers.

A basic set of transfer sheets to suit most amateur radio applications, would include several sizes of pads, several thicknesses of lines, a sheet of tice pads and, if required, a few curved lines.

The lines can also be obtained in rolls. Both the roll-type and the sheet-type lines, are placed on the surface and cut to length with a sharp knife, then rubbed down. It's best to use one of the purpose made spaltulas to rub down the transfers, although a blunt pencil tip may be used.

**Using A Combination**

I have also used a combination of the rub-down transfers together with hand-drawn lines, which were marked down with felt-tip pen. In this context, the i.e. pin spacings provided by the transfers are very useful, as they provide an accurate footprint for the pins.

I have often used these transfers, and then added the tracks using a pen and the result has been successful. But please take care when you're adding transfers, and try to keep your fingerprints off the board!

**Hot And Cold Water**

I live in a large Edwardian house with extensive cellars, which include a room with a sink and hot and cold water. My wife and I (reluctantly!) share the room for our photographic darkroom and my p.c.b making area. The etching process is not dangerous or even tricky, but a few sensible rules must be observed.

The most popular etchant, ferric chloride, is a poison. It marks the skin, but worst of all, it stains cloth. A ferric chloride stain on a towel (an evil dark brown colour) will NOT come out. You have been warned!

So, in the interests of domestic harmony, it's best to keep the etching process way from food and household goods. Some people buy a large deep plastic bowl for etching. Please try and keep all the materials within its confines. Use rubber gloves and plastic tweezers and avoid splashing the liquid.

**Dry Form**

Ferric chloride is supplied in dry form (crystals or pellets) or in concentrated solution. The dry form is cheaper, and once mixed the solution is stable and keeps well.

The mixing proportions are...
PCB Special

usually one part dry ferric chloride to two parts water. IMPORTANT NOTE: Add the ferric chloride to the water - NOT the other way round. When the crystals dissolve, heat is given off, so add the solids slowly to the water.

The concentrate solution will have instructions on the container, telling you how much water has to be added. Ferric chloride is best stored in solution because it is very hydrophilic, and it will quickly absorb water from the atmosphere.

Having said all this, I have used this form of chemical etch for years, and apart from the odd splash on a shirt sleeve, I have never had any problems. So, don’t let the precautions discourage you from having a go, just take care and take sensible precautions.

Speeded Up

The etching process is speeded up if the solution is slightly warm. The process is also aided by agitation of the solution. A fresh warm solution (20°C or so) will take 1.5 to 20 minutes to etch a board. A cold solution will take 30 to 45 minutes. If the process is taking much longer than 45 minutes the solution is probably spent and should be replaced.

A number of boards, depending upon the size and amount of copper being removed, can be etched in the same solution, but each successive etching process will take a little longer.

The etching process must take place in a plastics or glass container. Plastics trays of the type used for photographic developing type are very commonly used for etching, and they are quite cheap to buy.

There’s some debate about etching boards face upwards, or face downwards, in the solution! Some people like to place the board copper side up and sink it in the tray, gently rocking the tray from time-to-time.

Others prefer to float the board, copper side down, on the surface of the etchant. This is done because they consider that this method prevents the waste products from sinking, preventing them interfering with the etching process.

I do neither as I etch my boards sideways! My p.c.b.s are etched in jars (jam jars or coffee jars) for small boards, and a plastics cereal container for larger boards.

The container is filled to near the top, and I attach a wooden clothes-peg onto one edge of the board. The peg must avoid any of the tracks.

Then I lower the board onto the edge, into the solution. Then I place a wire rod across the top of the jar or container, and also through the spring hole in the clothes-peg.

Standing Vertically

The board remains standing vertically in the solution. From time-to-time I give the board a twirl in the solution, this is to stir the liquid and free any deposits.

The board requires frequent checks during the etching period. The secret is to stop the process when all the unwanted copper is removed, but not to allow further etching.

This is because of a problem known as ‘under track etching’. It starts once the copper has been etched away from the exposed places on the board. The process will then continue with the solution eating away under the etch resist...under the tracks we need!

When the etching process is complete, remove the board, plastic tweezers are useful, and wash off all the etchant in tap water. The etch resist itself must now be removed.

If you’ve used tape, it will simply peel off. Pen marks and transfers are best removed with steel wool or household scouring powder. Etch resist from the popular Dalo fibre-tip p.c.b. pens, can be removed easily with switch cleaner or methylated spirits.

Next job is to closely inspect the board for small bridges of copper between the tracks. Holding a glass fibre board up to a strong light, can help check for this problem as they are normally translucent.

Special Drill

If the etched board is not to be used with the surface mount technique, holes must be drilled for the component leads. These holes are small, around 0.8mm or 1mm, and require a special drill or a collet on a bench drill.

Many radio component suppliers sell lightweight 12V drills with small chucks suitable for such drills. If a hand-drill is available, a small collet chuck can be used in the existing chuck.

The drills are thin and break very easily. A drill stand is very useful, and several of the 12V powered drills have a stand as an optional extra.

Warning: Do not use a normal household electric drill, even with a collet chuck. If you do, the chances are it will quickly break your small drills and ‘drill’ you with small fragments!

Before I start drilling, I prefer to make a centre-punch mark at each drill point. The small drills tend to ‘walk’ across the surface if a freehand stab is made at the board.

Drill with care. It can be a tedious job, but it’s even more tedious if the last drill breaks before the last hole is drilled!

Cleaning Again

The board should now be complete for use. However, it’s a good idea to clean the copper surfaces again before the soldering begins.

A useful item for this job is a p.c.b. abrasive cleaning block, sometimes called a polishing block. These blocks are made from a polishing compound bonded in an elastic material.

Finally, I often add a layer of clear protective lacquer. A special spray-can lacquer can also be obtained. This laquer protects p.c.b.s from dirt and oxidation, but it can be soldered through. Commercial p.c.b.s are usually tinned or plated, and some manufacturers sell tinning solutions for boards.

Photo-etched Systems

Nowadays many radio amateur constructors make their p.c.b.s using the photo-etch system. This technique is very similar to the process used for making commercial boards.

It’s a more expensive process, but is quite simple and gives very professional looking boards. It can also be used for making copies of the same board, which is especially useful for amateur radio clubs and groups.

In this process, the copper is covered with a photosensitive resist. The pattern of the circuit is transferred by placing a photographic ‘positive’ over the board, and then exposing it to ultra-violet (UV) light.

The tracks on the positive are opaque, and the areas to be etched are clear. After exposure to the UV light, the board surface is chemically developed, like a photographic film. After washing in water, this leaves a pattern of tracks and spaces that can be etched in the normal way.

For this process, the amateur requires:

1. Photo-sensitised copper-clad board
2. An ultra-violet light box
3. A developing solution

All of the necessary parts are now readily available from component stockists. It’s also possible to buy an aerosol spray to photo-sensitise normal copper-clad board.

I have found the results with the photo-sensitising sprays to be variable. Because of this prefer to buy the prepared board, although it is considerably more expensive than normal copper-clad board.

There are many ultra-violet light sources available, although many people make their own. Even though the tubes, other bits and starters are widely available, I managed to persuade my wife to buy me one for Christmas a few years ago!
Choice Of Developer

I'm going to offer firm advice on the choice of developer. It has been usual to develop the exposed boards with a solution of sodium hydroxide (caustic soda). Unfortunately, it's not very nice stuff!

Fortunately, we can now avoid caustic soda. This is because the German company 'Seno' has produced a range of p.c.b. chemicals, that includes a developer SN110 (SN111 for spray-on resists) which is free of caustic soda.

This useful material comes in a sponge-ended applicator, like some shoe cleaners. It's harmless and has a shelf-life of two years. The chemical is simply wiped on the board, and is in my experience quite economical in use. Seno also supply a photo resist applicator SN100, a resist stripper SN120, and a de-oxidiser SN130, for cleaning boards.

Technique Ideal

The photo-etch technique is ideal for taking p.c.b. artwork from books or magazines. Using this method you can hijack any of the p.c.b. artwork from PW!

The method is to photocopy the artwork onto a clear acetate sheet of the sort used in overhead projection. Many high street copy shops will do this job, and even supply the sheets, although they're not cheap.

It must be a dry-powder copier, but most of them are of this type these days. A single copy may not be opaque enough for UV light exposure. You should hold it up to the light to see how dense the black appears. If one is not opaque enough, two copies can be used, one on top of the other and carefully aligned.

Mirror Image Tip

A tip I can offer here, is to get the two copies as a mirror image to prevent parallax distortion. To do this, make a simple copy onto an acetate sheet. Then put the sheet in the copier as the master, but turn it over to give the mirror image.

This second copy can be placed over the first copy so that the acetates are copier-toner side, to toner side. This ensures that the thickness of the sheet does not come between the two copies. This method can produce very good reproductions of p.c.b.s from magazines and books.

Full details of the photo-etch method are usually supplied with the materials. It's a fascinating technique, and one which is well worth exploring for the excellent results it can provide.

Well, I hope you've now got enough interest to 'have a go' yourself. Do try making your own boards, it's a marvellous way of making some really attractive, and extremely interesting projects.
Passport To World Band Radio 1992
Editor-in-Chief: Tony Jones
International Broadcasting Services Ltd.
385 pages, price £14.50
Available from PW Book Service, £1 post and packing.
Every year this book provides a window on the world of radio listening. The 1992 edition is no exception. Packed throughout its 385 pages with useful information and product guides, this book is a must for any listener's bookshelf. Readers often ask us for advice regarding what equipment to buy, and quite frankly a book of this calibre provides much, if not all of the answers. It's worth buying the book just for the 1992 buyer's guide, let alone all the information on frequencies, features on broadcasters, where to listen and when to listen."
This month, the Rev. George Dobbs G3RJV takes a look at 'graph paper' layouts and describes another practical project, an audio amplifier for you to build.

**Getting Started The Practical Way**

If you walk into almost any high street stationers, ask them for a pad of 0.1in graph paper, the chances are that they'll not have any in stock. The usual reply is "We have plenty of 1mm grid graph paper, that's what everyone uses these days, everything is metric”.

If you meet this response, be ready to reply! Your answer should be "yes, everything is metric except your cash till, the calculators you sell, your television and radio set, your audio system, your............"!

Almost all equipment has a p.c.b., and the standard pin spacing for the i.c.s they contain is 0.1in. The world of the p.c.b. is a world of 0.1in squares!

The concept of 0.1in as a unit (perhaps we should say a tenth of an inch) is not quite as whimsical as it might seem. I can remember my son once doing homework where the answers were odd things like 3/8cm!

**Last Month's Project**

In last month's project, we built a little multivibrator circuit on a perforated board layout which used a matrix of 0.1in. The layout duplicated a printed circuit board, and I've no doubt that some of you would have built the optional p.c.b. version.

This time, we are going to build a circuit which includes an i.c., using the same methods. How do we arrive at the layout for a circuit using 'pert' board, or a p.c.b. I hear you ask? Well, the answer to that question lies in being able to locate and buy some of the precious 0.1in grid graph paper. But first of all, let's consider this month's project.

**Useful Amplifier**

A small audio amplifier is a very useful item to have around the amateur radio workbench. It can be used as a piece of test equipment, or it can be added to projects requiring an audio output.

The circuit we're about to build, Fig. 1, will appear again in more complex projects later in the series. This handy little circuit uses the popular LM386 i.c. audio amplifier.

![Fig. 1: The circuit diagram and connection details of the LM386 audio amplifier project. The power supply voltage can be between 6 and 9V, audio input is applied at SK1 and the speaker can be any small type of around 8Ω.](image)

**Complete Package**

The LM386 is a complete audio frequency (a.f.) amplifier capable of up to 300mW output. This is just enough to drive a loudspeaker, and yet the device comes in a small, 8-pin dual-in-line (d.i.l.) package.

The pin connections of the LM386 are shown in Fig. 2. The voltage gain of the amplifier is internally set at 20. This is done to keep the number of external components to a minimum.

However, the addition of an external capacitor and resistor between pins one and eight, will allow the voltage gain to be increased to any value between 20 and 200.

If pins one and eight are left unconnected, an internal resistor sets the voltage gain to 20. Connecting a 10µF capacitor between pins one and eight, bypasses the internal resistor and the voltage gain becomes 200.

The gain is controlled by adding a resistor in series with this capacitor. For example, if a resistor of 1kΩ is connected in series, the gain becomes approximately 50.

It should be clear that here we're talking about the maximum overall gain of the amplifier. It's usual to add a volume control on the input of the circuit, to allow the user to vary the gain up to this circuit-dictated value.

**Useful Feature**

Another useful feature of the LM386, is its low quiescent current drain. This is the term used to describe the amount of current taken up, just to make the amplifier 'tick-over', without handling any signal. This makes it particularly useful for battery operation, as a lot of a.f. amplifiers drain batteries very quickly.

The LM386 will also operate over a wide range of voltages, between 4 and 12V. From my experience, the best power supply level for minimum distortion is around 9V.

**The Circuit**

As you can see in the amplifier circuit, Fig. 1, I have used a 1kΩ resistor, R1, in series with the capacitor, C5, between pins one and eight. This resistor may be reduced to give a higher voltage gain.

The capacitor, C2, on pin seven is a bypass capacitor, and it's recommended by the manufacturers to ensure stability. Further stability is encouraged by adding R2 and C5 across the output.

The circuit formed by R2 and C5, is sometimes called a Zoebel Filter, and it helps to prevent the i.c. oscillating. These small packages have a lot of gain, and bypass capacitors should be mounted close to the pins of the i.c. The capacitor, C6, decouples the supply voltage line.

**A Layout**

A layout for the circuit on 'pert' board (viewed from the top) is shown in Fig. 5. The drawing also shows the matrix of holes including those which aren't used.

How did I arrive at this layout? The simplest way is to gather all the components, the circuit diagram, a sheet of 0.1in grid graph paper, a soft pencil and an eraser.

The components will give the spacings between the connections. More experienced constructors often know what such spacings are, and they can work without having the parts to hand.

Many experienced constructors also do their layouts from the underside (the interconnections side) of the board. But I'm not clever enough to think upside down! So, I work on the layout viewed from the top of the board.

**Marking Out**

The exercise is now to mark the layout out on the graph paper. You do this by following the circuit paths, and working out the component spacings using the component themselves.

There are some basic rules you must follow, which also apply to most types of circuit. Here they are:

Try to make all circuit paths as short as possible.

Try to keep the input away from the output.

Place decoupling and bypassing capacitors as close to the i.c. pins as possible (putting a ground connection all round the board helps component placement).

The eraser is essential, as it's often a trial and error...
process. Remember, that the layout doesn’t need to follow the placement of components in the circuit diagram. A circuit diagram is a little like the London Underground Map - it shows how the parts are connected to one another, but it does not show their actual places on the finished board.

Why not try it for yourself. Use the circuit in Fig. 5, in conjunction with Fig. 1, and the required components to make your own layout drawing. It may well turn out better than mine!

**Track Arrangement**

The diagram, Fig. 3, shows how the layout appears as a p.c.b. track arrangement. Comparing this with Fig. 4, shows that the track layout is the same, although it’s viewed from the other side.

Building the amplifier is simple, just drop the components into the correct holes and wire them up. The LM386 can be wired directly into the board. However, I would advise the less experienced constructor to use an i.c. socket. This is a base into which the LM386 can be plugged, after all the other components have been fitted and checked.

Take care with the pin orientation! The i.c. socket gives you a second chance, which is best taken before the power is applied for the first time.

When using ‘perf’ board, the surplus wire on the components will probably be long enough to use for the interconnections. Extra connections can be made with tinned copper wire. Check the placement of C3, C5 and C6, as these are polarised capacitors.

**Using The Board**

The circuit diagram in Fig. 1, shows how to connect the LM386 board ready for use. A suitable supply would be a 9V battery connected to the positive (+) side of S1. The loudspeaker can be a small 8Ω speaker, and a 10kΩ logarithmic potentiometer is added to the input as a volume control. The dotted line connecting S1 and R4, indicates that the two controls are ‘ganged’. This means that the on-off action of S1 is controlled by the spindle of R4. In other words, the volume control and switch S1 are combined.

A quick way to test the amplifier is to apply power and place a finger on the input, which is pin three. This should produce a buzzing sound.

Then you should repeat this check on the input side of the volume control. Rotate the control to see if it’s wired the right way round, and the volume increases as the control is turned to the right. If everything’s okay, that’s it all finished.

**Shopping list**

<table>
<thead>
<tr>
<th>Components</th>
<th>Value</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon film 5% 0.25W</td>
<td>10Ω</td>
<td>1</td>
</tr>
<tr>
<td>22Ω</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>1kΩ</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Resistors (rotary)</td>
<td>10kΩ</td>
<td>1</td>
</tr>
<tr>
<td>Capacitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disc ceramic 1nF</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>100nF</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Electrolytic (16 or 25V d.c. working suitable)</td>
<td>10μF</td>
<td>1</td>
</tr>
<tr>
<td>100μF</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Integrated Circuit</td>
<td>LM386</td>
<td>1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Matrix board ('perf' board), solder, connecting wire, prepared board for p.c.b. version (available from PW/PCB Service). Potentiometer for volume control (see text), battery for power supply and small speaker.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You now have an audio amplifier! You can use it for many little jobs. Next time, we’ll combine it with another useful circuit to make the PW Oscamp (more about that later!). If you haven’t had a go at making your own p.c.b., now’s your chance with an ideal project. Cheerio until next month, and I wish you and all your family a very happy new year.
Making Small

In his first article in *Wireless*, the world radio writer Doug DeMaw discusses techniques towards greater miniaturisation if that seems to be desirable.

Are you one of today's experimenters who likes to build compact equipment? Certainly, the industrial electronics trend is towards keeping things compact and orderly. Amateurs who construct portable equipment tend to 'scrunch' their equipment as much as is practicable, and this is a necessary means to an end for hikers and campers especially.

It is my perception that QRP operators in particular feel that the equipment, and to some extent even the antenna, should be small in order to qualify as QRP gear. I confess that I am one of those people, even though the assembled station need not be miniature for most applications.

The physical dimensions of a particular piece of equipment should be based, in part, upon operating convenience. That is, will there be ample finger room for operating the controls of a small receiver or transmitter?

If you are a large person with 'fumble fingers' like mine, you may prefer a bit of 'breathing space' around the panel knobs and switches. The chosen dimensions of your project must, therefore, be based on practical considerations.

One Approach

The photograph, Fig. 1, depicts one approach to miniaturisation that I often use. The picture shows a high-performance, 7MHz direct-conversion receiver. High-Q, slug-tuned inductors (the J. W. Miller 43 series) are visible inside the module. These, along with air-dielectric variable trimmers, are used for tracking the tuneable oscillator and detector tuned circuits. These components are installed on one of the vertical walls of the basic module.

A two-section variable capacitor (main tuning) is mounted to the bottom plate of the box. The active sections of the receiver circuit can be seen at the right in the photo. They are installed on a p.c.b., which also serves as one vertical wall of the assembly.

Double-sided Board

The box is made from sections of double-sided p.c.b. A 40W pencil-type of soldering iron is used to join the walls and the floor of the box. A screening wall, also made from p.c.b. material, is located between the oscillator and detector tuned circuits. This screen not only helps to isolate the tuned circuits, it also provides the necessary rigidity for the box. Without the inner wall, the v.f.o. can shift frequency from stress on the box, or from vibration.

You'll also spot that the copper on the ground-plane side of the main p.c.b. (left front of the photograph), has been etched away in the area where the local oscillator components are situated. This helps stability, by eliminating unwanted parasitic capacitors, which are formed by the p.c.b. conductors and the ground-plane.

Glass-fibre epoxy-resin p.c.b. insulation is not a very stable dielectric material. Heating effects, however minor, cause changes in capacitance between the conductive material on each of the boards. Removal of the ground-plane copper laminate near the oscillator circuit, cures this problem.

More Complex Circuits

If you are building more complex circuits, such as superhets, there's no reason why the top cover of the box you've made can't contain additional circuitry. Likewise, this technique can be used for the rear and front walls of the assembly.

The major consideration is that we must keep heat-generating components away from the local-oscillator part of the module. For example, in the ideal situation, we would locate the local oscillator of a receiver or transmitter in its own shielded box, spaced away from the main module.

I have built modules that were similar to the one shown in the picture. In one particular version, the

---

Fig. 1: Doug DeMaw's approach to 'making it even smaller' is clearly illustrated in this picture. An idea of the relative size of the project (a high-quality receiver) can be obtained by the size of the components, especially the i.c. in the bottom right hand side of the photograph.
It Even Aller

Article for Practical Wireless, February 1992

renowned amateur DeMaw W1FB, techniques to help us miniaturisation - even a conflict in terms!

local oscillator was isolated from heat by using a double-sided p.c.b. wall, with foam insulation between the two walls.

The approach helped to prevent the migration of heat that was generated elsewhere in the circuit, to the local oscillator board. With this method I used a spacing of approximately 13mm between the double wall sections.

The Completed Assembly

If you look at the photograph in Fig. 1, you can see the completed assembly. It must have a top cover in order to prevent dirt and changing air currents from reaching the inner components, especially those of the local oscillator.

You may use another section of p.c.b. for the cover. It can be tacked into position using solder at six or eight points. This procedure allows easy removal with solder wick or a sucker later on.

A front panel is also needed. I used a shaft extension on the tuning capacitor shown in the photo', to provide front panel adjustment by means of a vernier slow-motion drive. The completed module was then attached to the bottom plate of the equipment box, using suitably sized screws and nuts.

Final Thoughts

Now that I’ve given you some ideas, perhaps it’s time to have a few final thoughts on the approach I’m suggesting. The dimensions of the module discussed (and seen in Fig. 1, and Fig. 2) are: 76 x 63 x 102mm and the same circuit would occupy a space of 101 x 178mm if laid out horizontally. The cabinet height would need to be approximately 76mm with the change in format.

I built the module discussed in this article, a number of years ago. It’s obvious by looking at the photographs, that the same circuit could be reduced by a factor of two. This would be possible, if a tighter p.c.b. layout was adopted in conjunction with smaller coils and capacitors.

Additionally, surface-mounting techniques(s.m.t.) using surface-mounting devices(s.m.d.s) are ideal for aiding the miniaturisation of today’s projects. This especially applies if you are dedicated to building equipment that’s suited to gnomes and other small beings!

In any event, I hope that this article has provided some food for thought before you start your next small project.

Doug DeMaw W1FB.

Note: The general circuit for the receiver discussed in this article, plus suitable p.c.b. artwork, can be found in Doug’s newly published 2nd edition of The W1FB QRP Notebook, (completely revised and expanded) which will be available from the PW Book Service in the near future.
As promised, we now present Steve Ortmayer G4RAW's 'Challenger' simple receiver, to complete the basic station. As with the transmitter, you have the choice to go for the 'instant' drawing-pin board method, or the p.c.b. project.

It was the 'Test Sets' used by Novice trainees, which are made on a drawing-pin and board system that gave me the original idea. I then set out to build a complete Novice h.f. station using drawing pins.

Fig. 1: The PW Challenger receiver circuit diagram.

Last time, I showed you how to make the transmitter and hopefully some of you are on the air already! Now it's time to have a go at the receiver.

It's the same procedure as before, and if you wish you can build the receiver using the drawing-pin plan first. After you've proved it, and yourself perhaps, you might like to proceed onto the p.c.b. design. This can be done, using the board layout Rob Mackie (the PW technical artist) has provided.

International Circuit

The circuit I've used, Fig. 1, has rather an international flavour. This is because it combines ideas from other designs by G3RJV, W1FB and ZL2BMI!

It's a direct-conversion receiver with a simple v.f.o., an r.f. amplifier, diode mixer, a.f. pre-amplifier and a LM386 audio output amplifier. I've built many similar receivers, and they have been very successful in receiving stations from all over the world.

You can regard the various sections of this receiver as 'building blocks'. They can then be tried out in different ways to make other receivers.

There are however, one or two simple rules to obey. The main rule to remember is the amount of r.f. energy you allow into the mixer. This is because 'passive' diode mixers need more energy than active transistor mixers.

In this circuit the v.f.o. output is controlled by the capacitor, C1, between the v.f.o. and the mixer. This capacitor's value can be varied until you get the best results, or you 'zapp' the mixer diodes with too much v.f.o. output!

Listening Tests

If you build the v.f.o. first, it can be tested by listening for it on a receiver, or with a frequency counter. The output can be checked with a diode probe.

The tuning slug in L1 will allow a wide range of frequencies to be covered, but this may not be enough, and C4a and 4b may have to be changed. As a rough guide, you can try values between 200 and 500pF.

A useful tip I can offer, is that you build the audio amplifier first. Once you've built the a.f. side of the receiver, it's very easy to work backwards so to speak.

Testing the amplifier is very easy. With power
Fig. 2: Drawing-pin layout for the Challenger receiver.

Fig. 3: The copper track layout for the p.c.b. version.

Fig. 4: Component and overlay diagram for the Challenger (p.c.b. version) receiver.
How Much? Approximately £10 (depends on your junk box plus board costs for p.c.b. version)

How Difficult? Beginner

I recommend that you build the drawing-pin board version first, before you try the p.c.b. version which is shown in Figs. 3 and 4.

Shopping List

**Resistors**
- Carbon film 0.25W 5%
  - 10Ω
  - 390kΩ
  - 1.5kΩ
  - 10kΩ
  - 100kΩ
  - 1MΩ
  - 5.6MΩ

**Resistors Linear Rotary**
- 4.7kΩ or 5kΩ
  - 1

**Capacitors**
- Ceramic
  - 100pF
  - 150pF
  - 330pF
  - 1nF
  - 1.8nF
  - 0.1
- Non-standard value composite capacitor 430pF (nominal)
  - 2

**Electrolytic Capacitors**
- 25V d.c. working
  - 10µF
  - 220µF
  - 470µF

**Variable capacitors**
- 50pF
  - 1
- 100pF
  - 1

**Semiconductors**
- BC549
  - 2
- 1N4148
  - 2
- 2N3819
  - 1

**Integrated Circuit**
- LM386N-1
  - 1

**Inductors**
- L1 (for drawing-pin board project) 40 turns (tapped at 10 turns) of 32s.w.g. enamelled copper wire on 4.8mm coil former with a tuning slug (coil former from Maplin Electronics, can be the same type as used for p.c.b. version).
- L1 (for the alternative p.c.b. project) Maplin ref: LB20W Bakelite coil former with core (former 722/2).
- L2 42 turns on T50 2 toroid.
- Radio frequency choke RFC1 8 turns of 32s.w.g. enamelled wire on a ferrite bead.
- T1 comprises 10 turns of 28s.w.g. trifilar wound (see text) on FT-37-43 toroid. Note: The dot shows the start of each winding.

**Miscellaneous**
- Aluminium panel, phono type sockets for antenna and 12V d.c. power supply, 3.5mm jack socket or socket suitable for earphone used, knobs, slow-motion drive, brass drawing pins, connecting wire, miniature coaxial cable, wood base and screws.

---

**Using The Challenger**

Having built the receiver, I thought it best to try using the Challenger on the ideal section of the 3.5MHz band, and that’s the QRP section (of course!). What better frequency could there be for testing the receiver, than 3.560MHz, the QRP calling frequency?

Using my 1W 'Bean Tin' transmitter (I really ‘mean’ that, as it is in a bean tin!) on 3.560MHz, my first QSO call brought a reply from G3JVF. 'Smudge' G3JVF, in Derby, was running 2W and I copied him at first CQ call.

By the third QSO I had worked all the way up the band, with Smudge continuing to call CQ, until I had a QSO with G3IVF in Chippenham in Wiltshire. He was also running QRP, and I was really pleased that the receiver was working so well. So, go on and have a go, it’s a really simple challenge and it’s great fun!

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**SHOW ROOM OPENING TIMES**
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This month, 'Quaynotes' continues looking back into the origins of CB radio in the UK, with a special emphasis on the 934MHz service.

**Japanese Visit**

A year or so before this period, a close friend of mine spent some time in Japan visiting various manufacturers of radio and audio equipment. Some of the manufacturers were already supplying 27MHz equipment to the USA and other countries. They also had v.h.f. transceivers in production for operation at 900MHz. He enquired, "Could these be easily modified to operate on 934MHz for the UK market??" The answer was an immediate "Yes, they could!"

His next question was "how about antennas?" Again, the answer was quick in coming. The Yagi Antenna Company of Tokyo could supply them!

**Development Slow**

Even after CB had been made "legal", the development of 934MHz equipment was slow. Those already on 27MHz were reluctant to "go high". This was understandable since the price of sets and antennas for 934MHz was, like the frequency, a bit on the high side! Of course, at the time there were no antennas being made for this band.

The commercial antenna came later of course. But it was some time before 934MHz was being sold in the UK toward the end of 1981. Despite this, there were no antennas being made for this band.

The commercial antenna came later of course. But it was some time before 934MHz equipment, with a performance comparable with that in common use for amateur and commercial v.h.f. and u.h.f. bands, became generally available.

**Development Slow**

Even after CB had been made "legal", the development of 934MHz equipment was slow. Those already on 27MHz were reluctant to 'go high'. This was understandable since the price of sets and antennas for 934MHz was, like the frequency, a bit on the high side! Of course, at the time there was little real evidence to convince potential users of the u.h.f. allocation. Most potential users had no way of knowing that performance generally, and 'communication range' on 934MHz would be equal to, or better than that obtainable at 27MHz. Well, as we now know, the 934MHz service has proved itself.

**Working Ranges**

Working ranges at 934MHz are quite equal to those obtained on the amateur 144 and 430MHz v.h.f. and u.h.f. bands. This is dependent on the r.f. power and antennas of course, and they are a little greater than line-of-sight distance.

This is because the path of radio waves at these very high frequencies, is bent a little by ambient tropospheric conditions. As a result they tend to follow the curvature of the earth to a greater extent than might be expected.

To give you an idea, for comparison purposes, the table, Fig. 2, covers the theoretical 'radio distance' for transmitter and receiver antenna heights up to 30m. For a transmitter antenna height of 10m and receiving antenna height of 6m, (marked *) the 'radio distance' is in the region of 23km. These figures, in keeping with the results obtained from the Post Office Radio Branch tests made in late 1979, which the example in Fig. 1 shows.

**Working Distance**

Remember however, that actual working range will also depend on other factors. They include (a) the directivity gain of the antenna used for transmission and therefore the e.r.p., the antenna used for reception and (b) the nature of terrain and attenuation due to the concrete jungles we know as towns, along the path of transmission.

There are times however, when tropospheric 'refraction' occurs (commonly called 'lift') conditions). When these conditions occur, they may (for some indeterminate period) greatly increase working range over long distances within the UK, and even to European countries.

Well, I sincerely hope that you were interested in my quick look at 934MHz, and the previous part dealing with the origins of CB radio in the UK. It was aimed especially at newcomers to CB radio, and those of us who might have forgotten the struggles we had to get the service going! Now that we have covered this often neglected area, next time I'm going to take a look at the more 'practical' aspects of the subject. Catch you later,
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ADD-ON DIGITAL READOUT

The new HOWES DFD4 Digital Frequency Display adds “Digital Readout” to analogue type receivers and transceivers. If you own an FG7, FT101, TS520, etc., then we had you in mind when we designed this kit. You can even add digital readout to a surplus WW2 receiver, or domestic broadcast set.

The DFD4 can accommodate any IF frequency offset, VFOs that tune normally or “backwards” - all with a resolution of 100Hz. Versatile indeed! A small buffer module for easy connection to the radio is included in the kit. Why not give me a ring to discuss its use with your rig, or send an SAE for more details?

DFD4 Kit: £39.90
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PLEASE ADD £1.20 P&P to your total kit order (£3.00 for hardware).

HOWES KITS are produced by a professional RF design and manufacturing company. They contain a good quality printed circuit board with screen printed parts locations, full clear instructions and all board mounted components. SAEs and technical advice are available by phone during office hours. Please send an SAE for our free catalogue or specific product data sheets. Normally all kits are in stock and delivery is within 7 days.

72 & 73 from Dave G4KQH, Technical Manager

AA4 ACTIVE ANTENNA FOR SCANNERS

The HOWES AA4 gives full coverage from 25 to 1300MHz in a neat compact package. The antenna is only just over 16 inches long, and is designed to be the answer to space/visability problems for home or portable operation. A low noise microwave IC is used as the active element. This "high tech" approach gives good performance with a low parts count, making construction straightforward. Reviewed in the November ‘90 Short Wave Almanac. Excellent performance in a small space!

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SPA4 BROADBAND PRE-AMP

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Tel: (0327) 60178
Mathematics For The RAE

Before we get down to this month’s topic, I’ll give you the answers to last month’s questions.

First the series answers:
(i) 320Ω
(ii) 83kΩ
(iii) 183Ω
(iv) 120 560Ω
(v) 293Ω

For the parallel combinations the answers were:
(i) 3Ω
(ii) 7.674Ω
(iii) 142.20Ω
(iv) 4.91Ω
(v) 120.55Ω

Now we must get down to this month’s business!

Ohm’s Law

The most fundamental rule used in electronics must be Ohm’s Law. Almost all calculations in electronics make use of this at least once. If it is so important I hear you say, what is Ohm’s Law? The answer is, that Ohm’s Law is the relationship between Voltage (V), Current (I) and Resistance (R).

\[ V = I \times R \]

This law, or rule, says that the current (I), flowing through a resistance (R), is dependent on the voltage across the component, and its resistance. The voltage across a component is sometimes known as the ‘Potential Difference’ (p.d.).

Consider the drawing Fig. 1, where the p.d. is \( V \), the voltage across the resistor R. This voltage forces a current, \( I \), to flow through the resistor. In words, the rule says: the voltage across the resistor is directly related to the current flowing through the resistor, multiplied by the value of the resistance. The mathematical relationship is:

\[ (i) \quad V = I \times R \]

Using a little of the algebra that we’ve used before, we can come up with two other ways of writing it:

\[ (ii) \quad R = \frac{V}{I} \]
\[ (iii) \quad I = \frac{V}{R} \]

All calculations are carried out using standard units. So let’s put a few figures into the equation. If \( V = 10V \) is one volt and \( R = 2\Omega \), then from (ii) above, \( I = \frac{10V}{2\Omega} \), or 5A. If the voltage (\( V \)) changes to five volts then \( I \) will become 2.5A (\( \frac{5V}{2\Omega} \)).

If we keep the voltage steady at five volts, but change \( R \) to 10Ω, the current through R (p.d. = 5V) returns to 0.5A (\( \frac{5V}{10\Omega} \)). Fairly simple isn’t it?

More Than One

Now let’s add another resistor. Look at Fig. 2. The same rule still applies but there are now two resistors in series. From our last session you remember that for resistors in series, we just add the resistance values together. So, \( R_{series} = R_1 + R_2 \), and from Ohm’s law \( I = \frac{V}{R_{series}} \). Each resistor has it’s own p.d. across it, \( V_1 \) for \( R_1 \) and \( V_2 \) for \( R_2 \). The sum of voltages \( V_1 + V_2 \) is equal to \( V \). The same current, \( I \), flows through \( R_1 \) and \( R_2 \). We can see that the voltages across each resistor are proportional to the resistance values. But more of this later when we cover potentiometers.

**Triangular Tricks**

The triangular drawing, Fig. 3, is a graphical trick method of remembering how to apply Ohm’s Law. “But how do I use it?” I hear you say.

The way to use the method, is to cover up the letter of the unit you’re trying to find. Then the other two letters show you how to go about calculating the unknown unit’s value. Let’s try doing an example and we’ll assume I want to find the resistance, but I only know what p.d. there is, and what current is flowing.

To find resistance (R) from voltage (V) and current (I), you should cover up the letter R. You can now only see the letters, V and I. They’re shown as \( \frac{V}{I} \) ("V-upon-I"), meaning volts divided by amps.

Similarly to find the current, cover up the I, and you see ‘V-upon-R’ (volts divided by resistance).

To find voltage cover the V. All you see is ‘I-by-R’, or multiply amps by Ohms.

**A Simple Voltmeter**

Now it’s time to get back to a little exercise, making a voltmeter. We’ll take a look at Fig. 4, the circuit of a simple voltmeter. This is the form of many multi-range voltmeters. From the specifications, we know that, meter M1 has a full-scale deflection (f.s.d.) of 50µA. This is the current that has to flow through the meter to give a full-scale reading of 100% (no matter what the face markings are). We also know that the meter behaves as if it is a resistor of 2kΩ value. This is called the ‘internal resistance’ of the meter.

Using the Ohm’s Law triangle, what p.d. is needed to give 50µA current flow through the meter? The answer, from \( \frac{V}{I} = R \times \text{f.s.d.} \), is 100mV (0.1V, (50,10^-6)*2,10^3)). This is of little use if we wish to measure, say, 1V f.s.d. Somehow we must ‘drop’ the extra voltage. This we do by putting one or more series resistors into circuit.

From terminal B in Fig. 4, the total resistance between that (terminal B) and the common terminal is \( R_1 + R_2 \) (plus the internal resistance of the meter). The current for f.s.d. has to be 50µA, and it must flow through both resistors. So what must the total resistance be?

Cover up the R in the triangle of Fig. 3, and you can see \( V \) (one volt) over ‘1’ (50µA f.s.d.) so we can calculate R. The answer is 20kΩ (25Ω, 10^-5, 10^4). This total has to include the 2kΩ internal resistance of the meter. So \( R_1 = 18kΩ \) (20kΩ-2kΩ).

**Homework Again**

A little work will help to get the mind supple again after the festive season. Using the voltmeter of Fig. 4, and remembering we’ve already calculated the value for \( R_1 \), calculate the values of \( R_2 \) and \( R_3 \) to give the following voltage ranges for f.s.d.

Don’t cheat! The answers are provided at the end for you to check your work.

(i) Five volts (5V) between common and terminal C.
(ii) 10 volts between common and terminal D.
(iii) 50 volts between common and terminal E.

**The Answers**

You didn’t cheat did you? Here are the answers.

(i) \( R_2 = 80kΩ \) (68kΩ + 12kΩ in standard values).
(ii) \( R_3 = 100kΩ \).
(iii) \( R_4 = 800kΩ \) (680kΩ + 120kΩ in standard values).

**Theory**

This month Ray Fautley G3ASG, talks about Ohm’s Law. Then he shows you how you can use it in calculating the resistors needed to make a simple meter, into a multi-range voltmeter.

A rule to remember:

“Resistors in series share the total voltage in proportion to their resistance values.”

Fig. 1: A simple, single resistor Ohm’s Law problem.

Fig. 2: This is essentially the same problem as Fig. 1, even though it may look different.

Fig. 3: The Ohm’s Law Triangle. See the text about how to use it in calculations.

Fig. 4: A simple five range voltmeter. See the text to find what the values are.

Practical Wireless, February 1992
44

CHEMISTRY BOOKS

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The World of ATV Point

Andy Emmerson G8PTH takes a look at what's happening in the world of ATV repeaters, news from New Zealand, Scotland and North Wales.

Several ATVers in the Auckland area were plagued by QRM on their 70cm simplex TV reception, caused by f.m. stereo stations (88-108MHz) and the three Sky channels on u.h.f. broadcast TV. Mike decided to do something about this and read up the chapter on filters in the RSGB VHF-UHF Handbook. He writes, "The first one I built used a quarter-wave wavelength tuned line with coupling lines and a piston trimmer capacitor, all put inside a copper-clad p.c.b. box."

On the regular Sunday night ATV net I tried it out receiving Bruce ZL1BLB. As the beam heading is right at the main commercial TV transmitter site, the QRM is very bad. The receiver pre-amp is a bipolar one (MRF901) and there is no tuned circuit to the base, only a simple T-type high-pass filter I put in earlier to reduce the 88-108MHz signals. With the filter the QRM is now barely there and I get good sound and colour, so the filter is not too sharp. Makes me think, why didn't I do it sooner?"

Scottish Slow-Scan

Thomas GM4CAU, writes from Aberdeen that he had a letter from G0KYL who was interested in an SSTV two-way on 144MHz. "A week past Saturday (August 31) I had a three-hour QSO (with lots of pictures) with Johnny G0KYL thanks to a tropo opening. We had solid 5-9 signals both ways. Unfortunately, Johnny is only operational on eight seconds mode, so I was unable to 'air test' my other speeds, although I have tested them on receive in the h.f. bands.

"Other news on the SSTV front. In recent weeks I have been having a regular Sunday sked on 7MHz with G3MTQ and G4HYD (Birmingham), both of whom are QRV on SSTV. Now this sked is at 14.00 local time on 7.095MHz plus or minus QRM. It is intended primarily for those who have built the G3WCF/4ENA system, given up after running into problems or have added modifications. In other words, it is a regular place to meet and exchange ideas on the G3WCF/4ENA (and other hardware) systems."

"One Sunday we were joined by Jac G4WITAN who was in New Zealand on his way to Australia. The evening I have been watching some good 32 sec. pictures on 14MHz from CT1ANO in QSO with several EU stations."

News From North Wales

Finally a letter from John GW3MEO in Prestatyn. "On behalf of John GW3JG and myself, we thought a short activity report might be welcome from this part of the UK."

"I have been building 23cm gear for the last few months and now have the bits and pieces for a low-power f.m. TV station. Due to the lack of signals to receive, my enthusiasm was on the wane and then I discovered I could receive GB3MC, which is an n.b.f.m. repeater and beacon on 1267MHz (RM0) for which I would like to thank the owners. GB3MC has proved ideal for my antenna and pre-amp development and opened my eyes to the delicious possibilities of f.m. TV pictures from John."

"John GW3JG has been very busy at work lately but nevertheless has produced a 1W 23cm TX and an n.f. TV receiver based on the Wood & Lisk modules. So you can imagine that when John and I realised we were both ready to do tests, 23cm soon warmed up. Although we are not far apart there are plenty of houses in the way, and for a couple of weeks I received the best signal from John by pointing the antenna upwards to receive his signal reflected off a tree. But raising my antennas 12ft solved the path problem and I was very pleased to receive my first good f.m. TV pictures from John, a rare treat. The picture noise is now even less than our local broadcast BBC reception, P5++ if that's possible, both ways. FM is really impressive with regard to picture quality and pictures to noise ratio."

"The Severnside TV Group have acquired a 10GHz TV repeater. No, it didn't fall off the back of a lorry, but was released from its previous existence as GB3RV near Rugby. Circumstances prevented its continuance there, so it has been overhauled by TVG and now ready for installation (it is hoped) together with the 23cm TV repeater GB3ZZ at Filton."

Two repeaters are now reading the GB2RS amateur radio news on the air in sound and vision. This is an interesting development and could lead, perhaps, to all kinds of educational broadcasts. Clearly a set of guidelines is necessary, and the RSGB are looking into this. Let's hope the future is positive and gives us some interesting possibilities.

From Down Under

Our regular correspondent from New Zealand, Mike Sheffield ZL1ABS, kindly sent a copy of Break-In, the national radio club's monthly magazine. The issue in question was for August 1991, and it has become an institution since 1987, that the August magazine is an ATV special. The front cover is in colour and the content is an excellent showcase of amateur television technology.

As Mike points out, this is an achievement unequaled by RadComm, QST or the Australian Amatuer Radio. The compiler, Wayne ZL1UK, is confident he can repeat the effort again next August. Mike will probably contribute an article on the transmitter he is making from a Worthing group kit and a Mitsubishi p.a. module. He is also evaluating a Camtech transmitter and sub-carrier board (which he will sub-carrier board (which he will..."

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Reflections

This month Ron Ham congratulates an old friend, suggests an ideal opportunity, looks at interference, radio noise and a very old telegram!

First of all, my congratulations go to Dr. John Mason (Yapton, Sussex) on his recent election to the post of President of the British Astronomical Association. I have known John a long time, he is a very able astronomer, who broadcasts, lectures and writes about many aspects of the subject and does a lot to encourage youngsters to this particular science. In addition to being deputy editor of the magazine Astronomy Now, he is joint author, with Patrick Moore (Selsey), of the book The Return of Halley’s Comet (ISBN 0-85059-667-X). His ability in electronics, combined with a specialist’s knowledge of meteors, has enabled him to study this specific area in both the radio and optical fields. Along with Patrick Moore and Cmdr. Henry Hatfield (Severnoaks), John is the third of my contributors to hold this high and very important office.

Ideal Opportunity

The long winter evenings over the next three months provide an ideal opportunity to take a look, with or without binoculars or a telescope, at our ‘neighbours’ in space. Among the ‘targets’ you should select on a clear moonless night are the brilliant stars Aldebaran, Betelgeuse and Sirius, groups like the Pleiades, the constellations of Orion and Ursa Major and such radio sources as Cassiopeia and Cyg. Providing you find a site that is free from street and house lighting and car head-lamps, the sooner your eyes will become accustomed to the dark and the more detail you will see. Remember that you are standing on a revolving sphere looking outwards and upwards and, as time passes, the mechanics of the universe will be revealed.

In addition to spotting the planets and burning meteor trails, a great deal can be learnt about the heavens by a few hours (don’t forget the warm clothes) of outside observation. Your local astronomical society may well be arranging evening or night trips to specific locations, and most likely you would be welcome to go along. Such information is available by sending your request and an s.a.e. to John Green, 46 Central Avenue, North Berstead, Bognor Regis, Sussex PO21 5HH.

One of the high spots in Sussex, ‘The Trundle’ a former WWII radar station, Fig. 1, is often used by Patrick Moore, John Mason and members of the South Downs Astronomical Society for specific studies of the night skies. Incidentally, the two towers in Fig. 1 are made of wood, there were originally four on the site, but two were removed some years ago and replaced with a large mast for public service radio telephone systems.

Interference

Just like the short wave bands, the universe is changing all the time. The work of the radio enthusiast is hampered by solar activity disturbing the ionosphere, or noises from thunder-static and local electrical appliances. The astronomer also suffers from interference in the form of moonlight, man-made light and overcast skies through bad weather. Television enthusiast Peter De Jong (Leiden, Holland), tells me that the effect of thunder-storms on satellite TV uplinks has been very obvious. On November 15, he noted this effect “on the uplinks of German stations on Astra, first PRO7 faded out to almost disappearance, a couple of hours later it slowly came back, while in the meantime Tele5 started to fade out,” as heavy showers moved slowly from South-West to North-East over the uplink stations. The other Astra channels remained unaffected. On another occasion during heavy thunderstorms over Italy, the RAI (Radiotelevisione Italiana) signals on H2P were almost lost, but, at the same time, there was no effect on the signals from STAR and TVE (Spain).

Radio Noise

Untold numbers of stars, like our sun, emit noise which can be detected with specialised receivers, Fig. 2, on various parts of the radio frequency spectrum. Briefly, celestial noise covers a wide bandwidth and it sounds very similar to the background noise of a communications receiver. The receiver input in Fig. 2 (B) can be switched between a calibrated noise source (C) and the instrument’s antenna (A). This provides a basic reference point to compare with the incoming celestial noise and, if required, can be switched in periodically during an observation and the recording chart (G) will be scribed accordingly.

This is an ideal arrangement when observing the combined output of noise being emitted by the myriads of stars in our own (Milky Way) galaxy. However, it is not really necessary when observing sunspot activity because there are times when the output from our sun, being so relatively close, is so great that the noise can be heard above the strength of a terrestrial station.

On 22 October 1972 I adjusted the timing of my solar radio telescope, this was so that I could observe the midday sun and the Sagittarius arm of the Milky Way as it consecutively ‘drifted’ through the beamwidth of the 136MHz antenna. The recording was fascinating, the receiver noise level did a rise and fall between 1330 and 1600 as the sun passed through. Then a gradual increase and decrease, a gentle ‘hump’, was drawn on the chart from 1700 to
Visual And Radio Observations

Obviously the visual astronomer looks at the sheer beauty of the stars in the night sky, variations in the planets and the colourful displays of fireballs, burning meteors or an aurora. On the other hand, a radio enthusiast listens for terrestrial signals that are reflected over great distances by the moon and/or the temporary ionisation caused by decaying meteor trails and auroral displays.

For example, many astronomers frequently project the sun’s image through a telescope onto a screen looking for sunspots, and local astronomical societies form groups to observe the colour and estimate the number of meteors that enter our atmosphere during the peak of a meteor-shower. A radio observer will know if the sun is active by the amount of noise being received or if, as a result, the earth’s ionosphere has been disturbed.

An aurora that manifests during the hours of daylight can be detected by radio because of the strange (tone-A) effect it has on terrestrial signals. Auroral reflected c.w. sounds as though the operator is ‘keying a bath-waste’, and s.a.b. transmissions become a ‘ghostly’ whisper. Therefore, by combining the information gained from these different techniques, the more we will all learn about our surroundings in space.

The October Sun

Despite sometimes hazy and cloudy conditions during October, Clive Brook (Plymouth), using his own design of projection box, observed three groups of sunspots on days 14, 15 and 19 and four on days 9, 12, 17 and 18. Ron Livesey (Edinburgh) with his 50mm refractor and 38mm projection screen, identified three active areas on the sun’s disc on October 14, 15, 18, 28 and 29, four on the 9th and 17th, and five on the 3rd.

Ron is also the auroral co-ordinator for the BAA and during the month he received reports of ‘active aurora’, mainly from Scotland, for the overnight period on the 2nd, 4th, 18th and 19th, North Dakota on the 6th and 9th and Canada, Denmark and the USA on the 28th. Various other forms described as ‘corona’, ‘glows’, ‘rays and rayed arcs’ and ‘ray structures’ were seen at other times. Tony Hopwood (Worcester) and Doug Smillie (Wishaw) told Ron that between them they heard tone-A radio signals in the 50 and 144MHz bands on days 1, 2, 5, 8, 10 and daily from the 25th to the 31st. In addition to his own observations with a ‘Jam-Jar’ magnetometer, Ron learnt from Tony Hopwood, Karl Lewis (Saltash), David Pettitt (Carlisle) and Doug Smillie, that magnetic storms were recorded on days 1, 6, 7, 8, 23 and from the 26th to 31st inclusive.

Stop Press November

There was a ‘stop press’ at the end of Ron Livesey’s October report which said, “Massive aurora all night in UK on November 8/9, coronal all over Scotland in evening and West Ireland. Major bright surge seen in South England about 0130UTC, bright enough to read in at the Maidstone office at 7.17pm.” Apart from the address and received here at (Storrington) postmark by post second telegram.” Because such messages were charged by the word, they were deliberately kept brief and to the point. Such ‘telegraphese’, often transmitted by Morse code between telegraph stations and reproduced on a hand written form, Fig. 5, was then delivered on receipt, almost immediately, by a ‘telegraph boy’ on his bicycle.

Joan found another, dated 3 February 1892, which was ‘handed in at the Maidstone office at 7.17pm and received here at (Storrington) 7.46pm.” Apart from the address “To Mant Storrington” the message read “Yes” and was signed “Waghorne”. The form was enclosed in a special brown envelope (125 x 80mm) inscribed “TELEGRAM.” and underneath the words “NO CHARGE FOR DELIVERY.”
Duplicating Printed Circuit Boards

Fred Durnford from Southampton, has come up with a very simple idea. It could help individual, clubs and groups to easily reproduce small quantities of p.c.b. designs onto blank boards, using a very old method.

How many older readers can remember the Hectograph? More often known as the 'jelly-pad', this simple and very useful duplicating system was for many years, the method by which many clubs and organisations printed their newsletters, club notices, ad's and what-have-you. It's very simple to make, and the instructions sound like a recipe for a birthday-party treat!

For quite a few years now, I have been using the 'jelly-pad' to reproduce small numbers of p.c.b. designs onto p.c.b. blanks. You might like to try the method, and with a bit of experimentation, it's possible to reprint as many as 50 p.c.b.s from one 'jelly-pad'.

The Ingredients

You might think from the photograph, Fig. 1, that PW is turning into a cookery magazine. Not so! But you do need a packet of Davis Gelatine, available from your local supermarket (you'll probably find it in the 'cooking ingredients' section) for about 54p, and a suitable tray.

I've used many forms of container for the tray to hold the gelatine. The example shown in Fig. 1, is a small baking tray, available from hardware shops at around the £1 mark.

Warning: Although the gelatine is harmless (after all, it contains 5 measured sachets)

*1111111111eremenmemernmereier111118111111/11.1.18

Fig. 1.

Contents 5 measured sachets each sufficient to set 1 pint

Melted Down

Eventually, the jelly will have to be melted down again. All the dyes absorbed into it, will have to be discarded. However, all you have to do, is to go over the faint markings with an etch-resist pen. The difficult bit, the copying, has been done for you.

The pad should be able to provide 25-30 impressions before the jelly begins to crack and stick to the p.c.b. blank. It's not a fast method, but providing the original is correct, at least you'll know that all the reproductions will be accurate.

Copying Boards

When you are copying boards, let's say for a club project, a different approach has to be adopted. I have found that ordinary water-colour paints provide quite effective inks or you could use a thick felt-tipped pen (blue is best).

After the design 'master' has been painted onto paper, using a good quality water-colour, let it dry. When it's dry, place the master sheet down onto the jelly and leave it for about a minute.

Next, place a piece of p.c.b. blank onto the jelly surface. Press firmly, and when it is dry, the p.c.b. design should be visible on the copper surface. As the copper is not absorbent, the impression will not be as effective as it is with paper. However, all you have to do, is to go over the faint markings with an etch-resist pen. The difficult bit, the copying, has been done for you.

The pad should be able to provide 25-30 impressions before the jelly begins to crack and stick to the p.c.b. blank. It's not a fast method, but providing the original is correct, at least you'll know that all the reproductions will be accurate.

A Simple Job

It's a simple job to melt the jelly powder down to form the pad, providing you follow some simple rules. Firstly, pour water into the tray until it reaches approximately three-quarters full. Pour that water into a saucepan, and then heat the water until it's warm. Don't make it too warm. Imagine it's going to be a tepid bath!

Now open all five of the gelatine sachets from the packet. Pour them into the saucepan one at a time, stirring the water. Don't be tempted to put all five in at once, or you will have one great lump of gelatine which could take a long time to dissolve. You should also avoid making the liquid too hot.

If you're tempted to use a microwave oven to melt the gelatine into the water, take heed of a disaster that occurred in our kitchen. I used our microwave and ended up with a frothy gelatine soufflé, which made a terrible mess. My advice is don't, and use a saucepan instead!

Now open all five of the gelatine sachets from the packet. Pour them into the saucepan one at a time, stirring the water. Don't be tempted to put all five in at once, or you will have one great lump of gelatine which could take a long time to dissolve. You should also avoid making the liquid too hot.

The method I have described (it's very easy really) will provide a firm surface when the jelly sets. When it has set, you should be able to push a finger fairly firmly onto the surface of the jelly, and it will have a moist but resilient rubber-like feel.

The pad works in a very simple way. The inherent moisture in the jelly, draws water-based inks onto its surface. So, if you write (brightly coloured felt-tip pens are mainly water-based) onto a sheet of paper, before placing the paper (written side facing the jelly), you can start the process.

Leave the paper on the jelly for a minute or so. Then lift the paper, and you'll find the printing is left on the jelly surface. Depending on the colour of the ink, you should be able to get up to 50 impressions onto clean and dry paper. If you leave the paper on for too long, it will stick to the jelly.

Experiment With Inks

If you are prepared to experiment with inks, you can get some good results. I have discovered that the commonly available blue felt-tipped pens provide particularly good results. If you're lucky, you may even find a stationery with some old-fashioned hectograph ink in stock.

The most effective inks are glycerine-based, and with the 'recipe' I've supplied, Fig. 2, works well if it's made up correctly. By far the most effective dye to use is methyl violet (a rich dark purple colour). You local pharmacy will probably make it up for you, and they usually charge around £2 (less than the NHS prescription charge!).

Innovation Into Investment

We've always been proud of our authors and their work. Now you can join in - and win £5 - by sending circuits and projects to ‘What A Good Idea’. It's the ideal solution to the advice often offered by friends who suggest that 'You should publish that!' Circuits - accompanied by the minimum of text - must be neatly and clearly drawn in ink. Whenever possible the idea must be original, although your suggestion might be a significant improvement based on another idea. In which case you should always quote the original source. All entries will be acknowledged. Send your entry, with your name and address, to: 'What A Good Idea', Practical Wireless, Knefco House, The Quay, Poole, Dorset BH15 1PP.

Fig. 2.

Ingredients For Hectograph Ink

| 1 oz of water |
| 1 oz of gelatine |
| 1 gm methyl violet |
| 3 oz methylated spirit |

Method: Mix the water and the gelatine. Dissolve the gelatine in hot water. When this is dissolved, stir in the methylated spirit and then let the gelatine and water mixture. Shake well before use.

For green ink use methyl green.

For red ink use eosin.

See text for further instructions.
Amateurs On Manned Missions

The pair of cosmonauts in MIR have been hyper-active on 145.550MHz S.S. simplex, working many stations on the shorter days. I worked Sergei USMIR at 1644 on November 23, followed by Alexander U4MIR on the following pass at 1821, both on speech. F.M. I even made a brief radio contact with USMIR-1, using just 7W to an indoor vertical dipole!

In addition to continued radio amateur crewing of the Soviet MIR space station, many of the future shuttle missions will be staffed by radio amateurs. Bill Tyman W3XO, AMSAT Vice President of Manned Flight Missions, pictured in WB2D's photograph Fig. 1, tells us that WLFL and WOORE will be on the March 1992 mission, N5QWL will be going up in September 1992, N5FCW in March 1993, N5RAX in September 1993, and W4SIR in September 1994. Ron Parise WA4SIR is shown at the SAREX station by NASA in Fig. 2.

Wilf ON7TH, tells us that yet another European radio amateur is lined up for space flight with all the listed American shuttle astronauts. He is Dr. Dirk Frimout ON1AFD who is planned to be aboard the SST-45 mission. Any resulting 'SAREX' activity has yet to be detailed, and it’s also yet to be determined if any of these missions will rise above the UK radio horizon.

RS-10/11

RS-10 has been on continuously without fault, with both transponder and ROBOT in fine fettle. (Why can’t all our satellites be so simple to use and so reliable, and support so many old and new users?). It may well be that RS-10/11 is to be closed down on Mode A soon, as the main NAVSAT may be brought into service. When this happens, RS-10/11 will be replaced by RS-12/13 and the switching of these to Mode A. Meanwhile, Olle SM0KV back from a visit to the RS3A command station, reports that a new RS spacecraft is now being planned for the future. It will be much like RS-12/13, and will continue that function.

Jarilart FR4FP is asking stations to look for him on RS-10 on a downlink of 29.395MHz (uplink 145.895MHz) 'A' mode. Whilst the distance to Reion Island is theoretically too far for the UK, it could just be done with dense E-layer re-angulation aid or the use of the 21MHz Mode K uplink. He invites schedules by sending him a packet message to FR4FP@FR4FM using the 388BP mailbox, or by writing to Jarilart Didier FR4FP, Chemin Gaspard, 79438 St. Marie, Reunion Island, Indian Ocean.

Patrick ON1KBA, just north of Brussels writes "I am less active on RS-10 because of the rather small amount of new stations on the transponder. Most of the time you meet the same calls. I am now trying some QSOs via OSCAR-13 on Mode B, and although my station cannot compare with those very big ones that I meet on it, like a well-known Italian station using 100W to a 8 x 24 element array on the 430MHz uplink, and 4 x 17 elements on the 145MHz downlink, it does work. I only use 25W to a 21-element ATV on the uplink and a 8-element quad for the downlink, and have no means of antenna elevation. Despite these limitations I have made QSOs with DL, JW, KS, K, KC, VE, JA and JE". Patrick uses his Icom IC-R70 for 28MHz, for 2m his IC-751E transceiver, and for 430MHz his Kenwood TS-811E transceiver.

RS-12/13

With its transponder continuously on Mode K, 21MHz up, 29MHz own, RS-12 has been most reliable. The 29.454MHz ROBOT has neither been calling 'CQ' nor responding to calls, but the link is on, giving excellent mono-channel transponding to uplinks from 21.130MHz. Although the lower m.u.f.s and the shorter days have meant very little sub-horizon DX activity, it is confidently expected that by early March we shall be able to work all continents once again. A series of sub-horizon tests between ZL3GQ in Christchurch, New Zealand and myself at the end of the year produced no QSO or mutual hearing whatsoever. The Spring equinox propagation path improvement should permit this and other long distance Mode K QSOs again.

This month Pat Gowen G3IOR gives out the topical news on the most popular amateur spacecraft: RS-10/11, RS-12/13, OSCAR 10 and 13. The manned spacecraft amateur missions are covered, along with the topic of satellite 'gateways'.

SATELLITE SCENE

by Pat Gowen G3IOR

This month Pat Gowen G3IOR gives out the topical news on the most popular amateur spacecraft: RS-10/11, RS-12/13, OSCAR 10 and 13. The manned spacecraft amateur missions are covered, along with the topic of satellite 'gateways'.

Fig. 1: Bill Tyman W3XO, AMSAT Vice President of Manned Flight Missions.

Fig. 2: Ron Parise WA4SIR is shown here at the SAREX station by NASA.

Oscar-10

The OSCAR-10 satellite is still going reasonably well, and is even indicating some degree of response to commands put to it. It is believed, but cannot be proved, that the omni-directional antennas are deployed at this time.

Some beacon f.m. has been indicated even at times of potential good utilization, so perhaps the battery is beginning to weaken now. It has done very well to last this long!

Oscar-13

The OSCAR-13 levelled out in its steep dive to extinction by mid-November, and is now showing signs of perigee climb again. Sadly, it will not last, as eventually it will reverse once more. The latest calculations by Dr. Tom Clarke W3JWL indicate the probability of re-entry and consequent incineration of A-O-13 during December 1996. I have news of JR8XPV who writes that he has been active on the 23cm up and 430MHz down 'L' mode of OSCAR-13 since 13 March 1989, and has now worked 300 different stations in 27 different DXCC countries. He uses an e.i.r.p. of just 1kW or less from a single 37-element looped Yagi with the linear amplifier just below the antenna, this driven by his IC-1271. For the downlink he receives on a 20-element crossed single Yagi which has a GaAs.f.e.t. pre-amplifier just beneath the antenna going to his FT-736.

With this relatively simple system he has worked 74 different stations in JA, 71 in the USA, 56 in Germany, 34 in Italy, 12 G's, 10 VK's, 70 VE's, 51 HB9's, four each in France and Austria, three each in Belgium and the Netherlands, two GW's and two ZL's, and one each as 9H, AL76M, C30BA, CT1WW, EA8ZU, OH2DG, SM7FYW, SV1KH, TR8BL, XE1XA, YU3BA, ZJ1HJ and ZS6AXT. He writes "My system is probably one of the weakest Mode L stations, so there are some limitations to my making many c.w. and s.s.b. contacts. The satellite position must be very suitable to me so that my downlink is good." He recommends that others attempt the mode, saying "Please try Mode L with QRP like me".

Oscar-13 Schedule

James Miller G3RUH, who with Peter DB2OS and Graham VK5AHR, commands A-O-13, provides the calendar operational schedule from current until June 1992. This shows the commencement date, the planned
event, the mode(s) planned, the sun angle, and the Sun elevation/azimuth. See Table 1 to the right.

The schedule set for the attitude of 210° from the current date until January 20, 1992, is:

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Mode(s)</th>
<th>Sun Angle</th>
<th>SEL/SACZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 19 '91</td>
<td>210° Schedule</td>
<td>B JLS</td>
<td>-2 to -28</td>
<td>34/335</td>
</tr>
<tr>
<td>Jan 20 '92</td>
<td>Move to 180°</td>
<td>B</td>
<td>-44 to -39</td>
<td>21/48</td>
</tr>
<tr>
<td>Feb 24 '92</td>
<td>Move to 180°</td>
<td>B</td>
<td>-43 to -31</td>
<td>31/24</td>
</tr>
<tr>
<td>Mar 14 '92</td>
<td>180° Schedule</td>
<td>B JLS</td>
<td>-31 to +32</td>
<td>33/280</td>
</tr>
<tr>
<td>Jun 08 '92</td>
<td>Change to be announced</td>
<td></td>
<td>32</td>
<td>24/126</td>
</tr>
</tbody>
</table>

Table 1.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Mode(s)</th>
<th>Sun Angle</th>
<th>SEL/SACZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 01</td>
<td>180° Schedule</td>
<td>B JLS</td>
<td>-28 to -28</td>
<td>34/335</td>
</tr>
<tr>
<td>Nov 01</td>
<td>Move to 180°</td>
<td>B</td>
<td>-60 to -43</td>
<td>48/31</td>
</tr>
<tr>
<td>Dec 18 '91</td>
<td>180° Schedule</td>
<td>B JLS</td>
<td>-58 to -31</td>
<td>28/33</td>
</tr>
</tbody>
</table>

Fig. 3: There are times, when although above its horizon, SARA will only see Jupiter through earth's ionosphere, so blocking the giant planet's h.f. signals.

Specialised Apparatus

The cost of the rather specialised apparatus and antennas for a really effective satellite station is still a severe deterrent to many in the western world, and to even more in the third world! As satellites move to even higher frequencies, this problem further intensifies.

One way out of this situation, much of which is due to the cash and technical limitations of the average would-be user, this due to the sheer cost and/or complexity of the exclusive specialised equipment, is to use a local 'gateway'. This would act like a local repeater, having its input and output on an easily accessible mode and band. It could be 50 MHz/145 MHz, 435 or even 1296 MHz, f.m., with linking to a microwave satellite band, thus providing an ultimate DX 'repeater' that could be used by all fixed, portable and mobile stations within the coverage area. It could optimise high-gain dish antennas, and automatically computer-track the satellite, its mode of operation, signal level required, and also have frequency versatility to allow for frequency shift and a clear frequency spot, all at one QTH. Such common station 'gateways' have been used in the USA to bring many non-equipped amateurs to the satellite scene. I worked many W mobiles, and low-power speech f.m. stations using the gateway station installed by Rich Zwirko K1HTV near Washington DC.

A little cold water was seen to be poured onto this ideal in practice, at least in the more affluent USA, when N4HY met the point forcefully in the AMSAT Journal and wrote: "Whilst OSCAR-13 Mode B does provide communications, it does so in a marginal manner. One topic where I hoped for support was Gateways. I got none. Regular satellite users said (1) they would not support facilities to make it too easy for others, and (2) that no one would donate cash to build gateways, although half the amateur radio fraternity (apparently the third world!) as satellites move to even higher frequencies, this should be operational.

Fig. 4: John's computed table of eclipse times of Jupiter for SARA, from now until the end of 1993.
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Practical Wireless, February 1992
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READERS

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Radio Diary

* Practical Wireless and Short Wave Magazine in attendance

January 18: The Oldham rally will be held at the Queen Elizabeth Hall, Civic Centre, Oldham. Doors open 11am, 10.30am for disabled and for those taking the Morse test. Bar & catering facilities available and parking is free. Details from Kathy G4CEF on 061-624 7354 day or 061-652 8617 evening.

January 26: The 2nd Lancastrian rally will be held at University of Lancaster. Opening times are 10.30am for the disabled and 11am for everyone else. Further details from Sue G10BH on (0522) 64229 or OTHR.

February 2: South Essex ARS have their 7th mobile radio rally at the Paddocks Community Centre, Long Road, A130, Canvey Island, Essex. All the usual traders, Bring & Buy, refreshments, free car parking, including parking for the disabled outside the main door. Doors open 10am. Talk-in on S22. For further information contact Dave Speechley G4UVJ on (0258) 687978.

February 16: The Kidderminster & DARS rally will be held at the Harry Cheshire School, Kerbey Road, Kidderminster, Worcs. Doors open 10am. GL7TL Tel: (0384) 994019.


February 29: Tynside ARS have arranged a new venue for their annual rally, the Temple Park Leisure Centre in South Shields, Tyne and Wear. The centre offers up to 18 000 square feet of floor space, all on one level, with easy access for traders where needed. Catering facilities, including a bar on site, as well as family rooms. For those other members of the family not wishing to partake in the Rally, all the amenities of the Leisure Centre are available, including heated leisure pool and gymnasium. Plenty of free parking. Further details about the Rally from Jack G10ZO on 091-629 1178.

March 7 & 8: The London Amateur Radio Show will be held at Picquets Lock Centre, Picquets Lock Lane, Edmonton, London N9.

March 15: Wythall RC will be holding their annual rally at Wythall Park, Silver Street, Wythall (nr. Birmingham). Doors open 11am to 5pm. Usual traders, bar and refreshment facilities, Bring & Buy Talk-in S22. Admission £1. Details from Chris G0EY on 021-430 7287.

March 15: Tiverton South West Radio Club Mid-Dexon rally will be held at the Pannier Market, Tiverton. Easy access, only minutes from junction 27 on the M5. Free parking. Two halls of trade stands, Bring & Buy and mobile snack bar. Further displays and full refreshment facilities in the club room bar, which is to open throughout the day. Details from Vic G4PTC on (0635) 668101. More details from GTSW, Mid-Dexon Rally, PO Box 20, Tiverton, Devon.

March 22: Pontefract & DARS have their annual Components Fair & Spring rally at Carlton Community Centre, Carlton, nr. Pontefract. Doors open 11am to 4.30pm. Admission by programme. Bring & Buy, traders, licensed bar, bookstall etc. Talk-in on 144MHz. Car park spaces available. Extra car parking. Details from 0977-677006 or from GAAG (0977) 643101.

March 29: Bournemouth Radio Society's 54th annual Amateur Radio, Electronics and Computer Sale will be held at Kinson Community Centre, Pelhams, Milsoms Road, Kinson, Bournemouth. Doors open 11am. Admission £1, including prize draw ticket. Light refreshments available. Talk-in on S22. For further details of table bookings etc., contact Vic G4PTC on (0202) 316563 evenings after 6pm.

April 5: The Launceston 6th amateur radio rally will be held at Launceston College. Doors open 10.30am. Maggie Tel: (0409) 11019.


May 17: The 28th Northern mobile rally will take place in the Flower Show Hall at the Great Yorkshire Showground, Harrogate, north Yorkshire. Showground opens 10am. Doors open 10.45am. Talk-in on S22. Bring & Buy, bar and café. Free parking and stands. Free entry and parking of Wetherby to Harrogate Road. Separate arrangements for disabled visitors off Hookstone Wood Road. Details from Mike GM6MKK on (0423) 564553/561653 or FAX (0423) 523993 or G8JTL on 0652 861790.

* June 14: Royal Navy ARS have their annual mobile rally at HMS Mercury, Nr. Peterhead. Hants. There will be dozens of trade stands; Bring & Buy radio -controlled power boats and trains; local radio clubs and repeater groups; children's rides and amusements; vintage fire engines; TV detector vans; ices and refreshments; art and crafts' exhibition; two Grand raffles; spectacular arena displays and other attractions, making this a great day out for all the family. Talk-in on 144 and 220MHz, free parking and picknicking, free admission for children, adults £1.50, no dogs except guide dogs. For full details, contact G4VRG, 34a North Road, Bitterne Park, Southampton SO4 2JF Tel: (0703) 557469.

Practical Wireless, February 1992
The 3.5MHz Band

Sometimes it sounds nearly as bad as a London 144MHz repeater - but not quite, I must admit!

The list from Pat ON7PG is of course all c.w., and it includes CN8J, 0Y1CT, OKI1AI/YA, 4U1UN and HZ1AB. After his shortfall on 'Top Band', Ted G2HKU had a little trouble on 7MHz, when he raised U45ZE; and he did have a QRP contact with DLY7V as well.

A long letter this time from Angie G6WJ on the 28MHz band. She mentions the kind souls at special event EI6DA, then c.w. again to knock off 28MHz periods when the bands were dead. However, 18MHz s.s.b. was the mode for VK3DA, and D5SET, while 28MHz was preferred to raise A45ZZ, F5MDN, FRSGL, F6QKB, H8MEQ, P09V, SV1UM (IOTA Eu-75), TA1AL, UF6FL, VP2/ K1UF, YS1DFR, Y28BT and ZA1QA.

The news on the Bangladesh situation continues to be less than dear. John Smith VK5WS was too busy to Bangladesh, and to return thence on November 20. Soffar,yourstruly has heard nothing of Jim of S2IA or S2IB; neither has W2GC surfaced with a Bangladesh call. Keep an ear to the DX News Sheet or the grapevine for the latest gen.

ARRL has passed the word that QRM on 20m, ZA1XVZ, ZA1XVZ are DK for DXCC credit.

Still with ARRL, I hear that the YORR documentation was to reach Newington by the end of November. By the way, Tony Kent has had a local piped TV system down -converts to around 56MHz which down-converts to 28MHz operation.

The 3.5MHz roll-call includes HE7DES, 0Z4UN, SMOCCE, SM4OTI, HS8NT, GRASP/0R, HASVR, LG2TY, YT2UR, SP6BLV, OKP2VA, OK2EC, UA3ULN, RB4IXQ, RA1AE, EA3GFA for a new on the band, IE6F, IE58MK, 4L0/DR/0LFP, the usual crop of UK stations and a 'gotaway' in ZA0DXD who did work a spot.

Enter Don G3NFO, who plucked up courage for a rare foray on the band, and came out with CR3A.

The 7MHz Band

Much goes on among the cognoscenti hereabouts on 7MHz. A new reporter is G7JNMP from Ballymena. Mervyn runs a KW Atlanta, minus the a., at what comes out of the driver stage; this is around 1WV on c.w. or 500W on sideband. The antenna is an inverter vd for 7MHz up at 23m, used on all bands 7-28MHz. On 7MHz Mervyn started on Firework 1433 with a few Gates and on three days later a GM, then DF2QO, UT5HE, DJ1LE, E6EDA, GW4VAG, E6AH, GM2RKB, GM3WAO, UTSQ40, DL6CQ, E0GHI, SMS0BY, E8ET, and of course loads of GS. As a nice postscript, Mervyn mentions the kind souls at special event stations who take time out to look for the low-power merchants and pull them through.

For Don G3NFO the sole contact reported was the one with ZA0DX. Pat ON7PG keyed with JW9C, FS5AL, SM0DDO/DS, JH8SB, W7E, T22Z, PJ2J/0H5PT, ZA1TAC, JK1V/U 45T, VU2UK, COBAY, Z21HS, TRBXX, TF3CW, 4K0DL, CS4G0DV, SIU1DX, FGOP, HS0E and JT1CQ.

John G3BD0, as our picture last time showed, is a great believer in the adage that the more light shut out of the garden, the better the DX...having filled the back garden with wire John has now started on the front one. On 7MHz the effect was: U6MCF/UL7X, W7QZ (Colorado), R23X/FA2VD, RS9G/JOM, 04V, and UX0CDX. Yet another c.w. man, Ted G2HKU mentions UA0WW, UF6DR, UVST, U8LLW0, UI9ACL, and U8ZCX.

On 7MHz the 85V netted G0HGA, K4LPB, KAA1, NZ1B, A7AEW (older readers will recall him as G3ZY), EA8BY, UA0GW, WR8HZZ, UA5CM, U8LEB, UH9ZE/AU3T, UL7MG, plus q.r.p. contacts around G and a 'gotaway' in VK2RA around 0102Z.

The 28MHz Band

Don G3NFO opens the 28MHz band. He mentions BZ2RXB, DB8RH, HB9/HB9AQN, H1AN, H21ZHV, J28A, KZ2A, NTY in Utah, V47NS, V65T, VK2AZH, PM4T, P40W, PJ1B, THCF, VK8XW, YN0MDG, Z1HIG, 4JUN, 60X2, and 9L15S. Unfortuantely, G3VWC has been on qrt, having had to hand the trap dipole for a spot of trapping.

Over the water to ON7PG, where Pat seems to have connected with ZA1XDC, CK6RIS, F5PL, V29JW, BK9F, F5PSF, ZJ23J, P40J, J2F8B, THCF, XX3AUV, YN0MDG, Z1HIG, 4JUN, 60X2, and 9L15S.

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The 14MHz Band

Allegedly, 14MHz is where it all happens. Let G0LPM have first go; his q.r.p. starts off with ZA1OA, L2ZKWL, HB9/HB9AQN, H1AN, H21ZHV, J28A, NTY in Utah, V47NS, V65T, VK2AZH, PM4T, P40W, PJ1B, THCF, XX3AUV, YN0MDG, Z1HIG, 4JUN, 60X2, and 9L15S.

For Angi G0HGA we find c.w. preferred for NZ3A, KU7, KST7, WZ2A, NJ4EJ, AK1JS, K4TJW, W3TFP, U4AGKL, U4ST7, V6KRM, and various smaller fry.
Solar Data for November 1991

The first two weeks of November saw a major surge in solar activity with many X and M class flares, ionospheric disturbances, magnetic storms, short wave blackouts and surprise, a number of intense auroras! One of the biggest events during this period was a magnetic storm on November 8 which started at 0600UTC, causing widespread visual and radio auroras, followed by an X1.1/1B type flare on November 9, which pushed the geomagnetic A index up to 95 units.

From November 11 through to November 24, there was a decline in the solar activity but the geomagnetic activity remained high, being up to sub storm level on a number of days. There were a number of flares during this period, the biggest being an M4/3B on November 20, pushing the geomagnetic A index up to a level of 37 units by November 21, and causing a number of VHF openings between November 19-22.

Auroral Events

During the last week of October, numerous radio auroras were recorded in central England and this state of affairs continued throughout November. Openings were noted at my QTH on November 1, 4, 8-11, 15 and 18-22, most of them reached up to 144MHz but the event on November 8 was very intense and produced a number of interesting auroral sightings.

Mark Holloway (G4YRY) has sent me details from his log book of auroral contacts, made on the 144MHz band during the month of October. Most events were of the weak 'Scottish' variety but an opening, starting at 1415UTC on October 26, gave c.w. contacts with the 144MHz band, including widespread visual and radio auroras, followed by an X1.1/1B type flare on November 9, which pushed the geomagnetic A index up to 95 units.

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There are more new products on the way. The AR1500 is a hand-held wide band receiver. It features SSB as standard, many said it couldn't be done! Coverage is from 500kHz to 1300 MHz with no gaps. Channel steps are programmable in multiples of 5KHz and 12.5KHz. Copies are available in WFM, WFM AM and SSB (USB, LSB & CW with the SPO switched on). Many features have been carried across from the popular and reliable AR2000 receiver to include an even smaller cabinet. The AR1000 truly has to be seen to be believed. There are 1000 memory channels and the usual AROR collection of search, lockout, priority etc. Power is supplied from an internally fitted NiCad pack or from an external 12V DC source, all accessories are provided to enable you to switch on and start listening. All this from a small cabinet of approx 170mm (H), 55mm (W), 45mm (D) including projections except aerial. The weight is a mere 345g with NiCad fitted.

The AR3000A is a follow-on from the highly acclaimed AR2000. Many major improvements have been implemented at the request of enthusiasts. The tuning control is now ‘Tree running’ to provide a smooth feel for SSB/CW. x 10 buttons have been added to make step size faster and more convenient. All information is contained on the LCD instead of a separate status LED indication. The RS232 facility has a switch on the rear panel to enable/diable operation. Memory clear and full microprocessor reset functions are available from the front panel. The re-writing of microprocessor firmware using an even more efficient language has further increased scan and search speeds.

There are more new products on the way including ACSBPACS, AOR2000 faceplate decoder/printer, WA2000 active aerial etc. Please send a S.S.A.E. (£6p for further details on these exciting new models and the AR2000).
enough to walk around outside. Bob Minton GW1WHO (I081) reports that he, along with several other members of the Cardiff Astronomical Society, had an excellent visual sighting of the aurora, the best in fact since the intense event of 13 March 1989. Bob is also active on the 440MHz band and was able to enjoy the radio aspects of the event. Using an Icom IC-751E, 180W BNOS amplifier and a 13-element Yagi, he made many c.w. contacts including G1TKR (JN66), G1HAG (JN79), GM4JO (J030), GM4SKF (K002).

Ralph Sachs G2CZS (J001) noticed that several American stations on the 28MHz band during the morning of November 8, had a watery and burrly sound indicative of an impending aurora. He asks if there is any correlation between the effects noticed on 28MHz and auroral conditions on 144MHz? Has anyone any views on this? Ralph looked for signs of aurora on the 144MHz band but didn't hear anything until the evening, when he made c.w. contacts with GM4CXP, G1THG (J041) and OZ7LX (J055). He also used s.s.b. to work DYSYAU (J041). Ian Connors G2OUT, the RSGB v.h.f. Awards Manager, was the only one to report that the aurora also coincided with the 144MHz c.w. cumulative contest making that evening's session very exciting. Among his c.w. contacts were HB9B2A, O1KFDM, O1ZFFP, SP20FW and SP4SEF.

Although Ela GB9KM managed to make a number of good s.b. contacts on the 28MHz band, most of her time was spent on the 50MHz band contacting a total of 54 stations located in G, GD, GU, DL, F, LA, OZ, PA and SM. Having mastered the technique of detecting auroras, Derek G1THG was pleased to catch the event on the 8th but found that conditions on the 50MHz band were very noisy making it difficult to copy stations. He did however get to log, GB9KM (J001), GW8ERL(DU71), PA0ERA(J021), PA0AEU (J022) and PA3FYM (J022).

Unusual Propagation

Graham Atkinson G3DHE@I (I074) is a newcomer to the 50MHz band, becoming QRV in August 1991 with a Yaesu FT757, an RN transverter and a 5-element FBTY. He detected the aurora, his first ever, at 1600UTC, using an Icom IC-720A. The antenna array is a group of four 18-element 4218XL Cushcraft Boomers, with full azimuth and elevation control. Goeran is looking for schedules and can be contacted at Kellstroomsvegen 1, S-8920 Domsjoen, Sweden.

The photograph, Fig. 1, shows the 144MHz e.m.a. array at the QTH of DJ3WJ. The system consists of four 11-element Yagis fixed to a roof mounted mast, a method commonly used in Europe, especially Germany. Special eave joints are used at roof level to enable the mast to enter the loft space without allowing any ingress of water.

To his knowledge Bjarne WSUN has provided me with details of 'Skymoon', a graphics based PC program providing real-time moon tracking and e.m.e. scheduling. Additionally, Skymoon also features latitude-longitude to locator conversion, azimuth direction and distance between two terrestrial locations, sun greyline tracking, timed schedule sequence alert alarms and much more. Send me an s.s.b. if you want more details of this software.

The 50MHz Band

Band conditions on 50MHz during November were excellent, but many occasions were geographically selective therefore denying everyone a good chance of working the DX. It was particularly surprising that the path to America, with a very good event occurring in central America and the Caribbean area with CD2XX, HIBA, KP2A, KP4EIT, KP4EOR, T2IHZL and 9Y4VU getting in many log books. Phew, I hope you weren't out shopping!

There were a number of days throughout November when propagation allowed contacts into North America, but these were few and far between and not at the level that many were expecting. Jim Treybig W6JKV operating as PJ7/W6JKV, provided many people with a new country, his expedition being worked from the UK on November 6, 18, 21 and 23. Other callsigns heard during the month included HZ2GEI, T12DXD, T12NA, YN1CC, N4HSM/6YS, W5AS/6YS and the HCS8IX and FY1TBF beacons.

African openings were prevalent, especially during the first two weeks of the month, allowing contacts to stations in central Africa, with a particularly surprising that the path to Africa, mainly from the UK. Among the stations heard on this path were EA9G, EA9RA, EA9HA, EA9U, EA9YB, EA9YP, EA9V and EA9W.

Although the majority of countries in Europe have obtained 50MHz operating privileges, there still exist a number, especially in eastern Europe, that has not. It is therefore pleasing to see
record that Estonia has now granted access for radio amateurs to the band 50.005 to 50.500MHz. Operators are allowed to use c.w. s.s.b. or f.m. with a maximum power of 200W e.r.p., except in the Tallin area where the limit is set at 50W e.r.p. One of the first stations to be heard on the band was ES5IT, via meter scatter.

Czechoslovakia is another country to have recently obtained permits for the 50MHz band. They became QRV on December 15, with band conditions based on that which exist in Germany, although it is believed there are restrictions in the OK1 and OK2 districts.

Sovereign Military Order of Malta

In previous issues of PW I have mentioned the Sovereign Military Order of Malta (SMOM), a rare and unusual DXCC country that has been activated on the 50MHz band with the callsign 1A0KM. The SMOM is a fully independent entity with an ancient tradition and glorious history, being founded in 1099 and recognised in 1113 by Pope Paschal II. From 1310 to 1522, it had the Sovereignty on the Island of Rhodes, but in 1530 it moved to the Island of Malta, remaining there until 1798 when Napoleon Bonaparte forced the Sovereignty into exile.

After a number of temporary seats, the Order established itself in Rome in 1834 where it holds several extra-territorial areas. In 1991, the Maltese government agreed to give the Order exclusive use of a fortress, a palace and a church and although the SMOM's headquarters will remain in Rome, the terms of the agreement between Malta and SMOM may create yet another DXCC country! The amateur radio station 1A0KM, which is located in Rome, is normally activated on the 50MHz band by Alfonso Porretta I4610 and QSLs can be obtained via his home QTH, Largo S Pio V 16, I-00165 Roma, Italy.

The 70MHz Band

The results of two 70MHz contests held in 1990 have just been released by the RSGB v.h. Contests Committee. In the c.w. event the top six places were taken by EI5F/KP (296 points, 22 QSOs), G3VIP (196/19), G4ASR (151/25), G5JYP (146/16), G3HYH (132/24) and G4ZUK/ P (103/7). The top six places of the single operator section of the 1989 70MHz Trophy contest were taken by G4P10 (84 QSOs), G4ASR (78), G3VUK (64), G51SWH (63), G3HYH (60) and G4FOH (58).

Paul Martin EI2CA, has provided details of a 70MHz Activity Award, to celebrate the Diamond Jubilee of the Irish Radio Transmitters Society (IRTS). Operators in the UK must work 36 different countries or regions. The rules can only be contacted once, irre-

spective of the final identifier such as -/M or -/P. No QSLs are required but a log extract certified by two other radio amateurs is necessary. Applications should be made to EI2CA, 15 Merrion View Avenue, Dublin 4, Eire. There is no charge for the award, and in addition, he first station to qualify will receive an engraved cut glass Galway crystal trophy. Sounds like an excellent idea to promote activity on the band.

The 430MHz Band

Dramatic news concerning the 430MHz band, came in a statement issued at the end of November by the Radiocommunications Agency. The request, on behalf of the Primary User of the band, ordered that all amateur radio transmissions between 432.000 to 433.000MHz, in an area covering JO03, JO04, JO09, JO14 and half of JO03 and JO04, be reduced to a power level of 10dBW e.p.p. e.r.p. for the month of December. This power level, incidentally, is equivalent to 10W into a dipole or less than 1W into a medium size Yagi. All users of the band were affected, including narrow band modes, f.m. repeaters and packet radio links.

Hopefully, this one-off request will not impact on the Primary User of the band but will not effect our secondary usage of this valuable part of the radio spectrum.

VHF News

Calum Macpherson GM0EEX, on the Isle of Skye, reports that the recent winds got the better of his antenna system but expects to be QRV fairly soon.

Paul Bradbear GM7GU, mentions that his home QTH in Leuchars, Fife, is favourably placed for working Scandinavian and Germany, but is not so good for making contacts into England. Therefore, most of his activity at present is being carried out from a portable site on East Lomond Hill (IO96). From this location he can normally work into central England under fairly band conditions and was very pleased recently to have a QSO with G7HJN/P in West Sussex (IO90). Paul uses an Icom IC275H running 100W, a mast-head low noise amplifier and a 3-element ZL Yagi, as the picture Fig. 2 shows, although by the time this appears in print he will be using a 12-element Yagi. He is very interested in the WAB scheme and reports that when operating as GM7GU/P he can normally be heard on Sundays, between 1100-1500UTC, on either 144.280MHz or 144.320MHz.

South Scandinavian Expedition

A number of operators, including I0JAS, K10IR, WA3YVN, WA4JJS, KSVT, W8MBK and W7KNT are planning to operate on h.f. 50MHz and 144MHz a.m.e. from the South Scandinavian Islands (VP8), South Atlantic, for a two week period around the end of March. All equipment for the expedition, including four Kenwood transceivers and three linear amplifiers, was loaded aboard an American research and scientific vessel, the Abell-J, in October 1991.

The ship has already left its home port of Massachusetts to complete a tour of the Caribbean area and is now heading into the Antarctic Ocean for two scientific expeditions before sailing to Ascension Island, arriving around March 14, to pick up the DXpedition group. After a seven day journey they will arrive at Thule, South Scandinavian Islands to set up the stations. I will provide further details of this expedition in the next issue of PW.

VHF Operation from Albania

What is believed to be the first operation from Albania, on the 144MHz band, took place recently between October 25 - November 1. Members of a Hungarian group, including HG1YA, HG1YU, HG4DP, HG4ZB, HG6XT and HG5KS, used the callsign ZA00DXC to make 28 m.s. and 4 e.m.e. contacts. Countries worked via meteor scatter included DL, HA, HB, I, DE, DK, PA, SP and UB whilst moonbounce picked up DJ9CJ, SM7BAE, NS6LZ and W5UN.

ORZ Contest!

To help you to obtain the IRTS 70MHz Activity Award, the following is a list of 70MHz contests being held in the first quarter of this year. RSGB cumulatives will be held between 0900-1100UTC on January 26, February 9 and 23, March 1 and 15. The contest exchange consists of RST, serial number, locator and QTH. The annual 70MHz fixed station contest will be held on March 29. A 144MHz c.w. contest is being held on January 19 between 1000-1600UTC. It has sections for the fixed station single operator and open category. Listeners are also invited to compete.

The German amateur radio society, DARC, are holding a winter field day contest during the weekend of February 1-2. The 129MHz section will be held between 0900-1100UTC with the 2.3GHz-47GHz section following on from 1100-1300UTC, both of these on February 1. On Sunday 2nd, the 430MHz section will run from 0900-1100UTC being followed by the 144MHz section between 1100-1300UTC. On February 2, the RSGB are holding a 430MHz fixed station and Affiliated Societies (AFS) contest. Scandinavian activity contests will be held between 1800-2200UTC on the following dates, 50MHz on January 28 and February 25, 144MHz on January 7 and February 4, 430MHz on January 14 and February 11, Microwave on January 21 and February 18. A full set of rules can be obtained from myself on receipt of an s.a.e.

Deadlines

Please send your letters to reach me by the end of the month. I always write up the column in the first week of the following month. Don't forget that I also receive messages via packet radio at my mailbox GB7TCM and I can also be contacted at my DX cluster GB7DXC.

Photographs of your shack, antennas or any h.f. activity are especially welcome. Other pictorial items such as QSL cards, awards, certificates etc are also required. They will all be returned to you.
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Practical Wireless, February 1992
**Back-Scatter**

**Broadcast Round-up**

Reports to Peter Shore via the PW Editorial Office

It is possible that readers may have noticed a change to the signals of the UK relays of Radio Canada Internationale in the last few weeks. Up until the end of October, relays emanated from the BBC World Service Daventry site in the British Midlands. But, with the planned closure of Daventry in the Spring of 1992, RCI’s two 300kW transmitters were shifted to the Skelton transmitting station in Cumbria, which has recently undergone a major equipment upgrade. Frequencies and times are listed below.

Another broadcaster will soon be using Skelton as well. Radio Japan has agreed to lease airtime on the nearest transmitter to the site for up to 10 hours daily, to beam programmes to Europe, which is at present poorly served, despite the Gabon relays on Africa No 1. The BBC World Service fought off the competing Soviet Ministry of Radio, which seems prepared to lease transmitters left, right and centre these days.

If you want to keep even more up-to-date with news from the broadcast bands, try tuning in to Radiofax. Andy Burnham tells me that Radiofax is on the air every Monday and Tuesday on 6.205 and 12.015MHz. The broadcasts are repeated at 30 minute intervals and contain media, technical and science news, together with DX information.

On February 3, the World Administrative Radio Conference held in Torremolinos, Spain. The WARC-92 will examine frequency reallocation across the spectrum, and some extension of the short wave broadcast bands is expected. Frequency tables of broadcasters below 10MHz and adjacent to existing broadcast bands.

There is much interest in the battle to advance the date for the introduction of single-sideband in the broadcasting sectors. One broadcaster is extra, but otherwise with such good performance, the RF-B45 can be recommended.

**European Stations All Times GMT(=UTC)**

- **Albania:** has been moving around the bands again. Radio Tirana’s English is at 0700 on 9.725, 7.215 and 1.75MHz, whilst the African broadcast at 1530 is well received on 11.853 and 9.73MHz. Some language services have been disbanded in the last month or two and more could suffer the same fate. Read the details first in Back-Scatter.

- **Roy Merrill reports, amongst other things, that Radio France International’s current schedule with English:**
  - 1400-1500 on 17.65, 21.77 and 11.91MHz (Xian)
  - 1600-1700 on 6.175, 11.705, 15.53, 17.52, 17.795 and 17.85, 11.705 and 12.015MHz are carried by Africa No 1

- **Relays of RFI via Hungary are heard:**
  - 0600-0700 on 15.53MHz
  - 0700-0800 on 15.53 and 17.69MHz
  - 1600-1800 on 15.46MHz

- **Deutsche Welle’s present schedule of short wave transmissions includes many broadcasts in parallel with sub-carriers on Astra (11.229GHz sub carrier 7.56MHz) and Eutelsat (1.163GHz sub carriers 7.20 and 8.10MHz):**
  - 0010 on 11.865, 9.77, 9.84, 9.8, 9.565, 7.14, 7.154, 5.085 and 6.004MHz
  - 0200 on 17.52, 9.115, 9.689, 9.515, 7.285 and 5.035MHz
  - 0600 on 17.875, 15.425, 15.815, 13.78, 13.81 and 11.746MHz
  - 0900 on 21.60, 15.41 and 9.565MHz (to Africa)
  - 0900 on 21.68, 21.65, 21.465, 17.82, 17.915 and 9.165MHz (to Asia and the Pacific)
  - 1600 on 17.51, 6.159, 15.415, 15.105, 11.785, 8.957, 9.615, 7.225 and 6.17MHz

- **United Nations:**
  - **The Italian Radio Relay Service, the small Milan-based station which operates in single-sideband and services programmes from the United Nations, is suffering from some interference from BBC World Service transmitting to Turkey and the Balkans.** However, the station is on the air weekdays 0600-0800, 0500-1500 and 2030-2200 on 1.7125MHz. At weekends, the frequency is either 7.125 or 7.30MHz between 0500 and 1600 and from 2030 to 2200. Alternative channels are 7.29 and 9.15MHz. The transmitter is an old Swiss PTT sender and is fitted with computer-driven frequency change.

- **News from Russia includes details of three easily received new stations:**
  - **Radio Rezonas is heard 0500-0700, 1300-1400 and 2000-2200 on 11.853MHz in parallel with medium wave outlets on 1.395MHz and 584kHz. Roy Merrill reports that the station experiences problems from time to time, for on November 10th at 1300 there was disjoined audio and long periods with no modulation. The station identifies clearly as "Radiostantsa Rezonas".
  - **Roy Merrill also reports that Radio Alia is a station with lots of folk music and a schedule:**
    - 0700-1500 on 11.955MHz
    - 0730-1600 on 7.40MHz
    - 1530-0700 on 6.155MHz
    - 1630-1800 on 5.04MHz
    - 2200-0700 on 5.04MHz

- **There is a strongly heard parallel transmission in the afternoon on 3.90MHz and a weaker signal on 6.94MHz.**
  - **Radio Pamyat is new, and is noted at 1528 signing-on clearly on 12.04MHz. There is a trumpet solo and orchestral music used for its first day, followed by "Govorit Radiostantsa Pamyat, radioprograma...".**
  - **Whilst the station is heard quite well there is no channel QRM until 1700 when VOA in Chinese signs-off.**
  - **From elsewhere in the former Soviet Union, Radio Vilinus is now heard at 2230 on 9.71 and 9.75MHz and at 0000 on 17.69, 17.505, 15.18, 9.71 and 7.40MHz. Meanwhile Radio Kiev has vanished according to Roy Merrill. Anyone know where it might be?**
  - **The British Hour of Radio Moscow is at 2100 and has been traced to 15.425, 12.06, 12.055, 12.05, 9.895, 9.885, 9.795, 9.765, 9.725, 9.72, 9.71, 7.39, 7.34, 7.33, 17.5, 9.6 and 9.595MHz.**

**Middle East And Africa**

Tehran is heard with English:

- 1130-1230 on 11.93, 11.79, 9.685, 9.525 and 7.215MHz
- 1300-2030 on 15.26, 9.022 and 6.035MHz
- 0030-0130 on 15.26, 9.72 and 9.022MHz

Radio RSA’s winter schedule is active now with English:

- 0400-0500 on 15.23, 11.90 and 7.22MHz
- 1000-1100 on 15.23MHz
- 1100-1200 on 11.90, 11.8 and 9.555MHz
- 1500-1600 on 15.16, 11.88 and 7.21MHz

Other European languages include French:

- 0300-0500 on 15.365, 15.12 and 11.92MHz
- 0500-0700 on 17.815, 15.365 and 15.12MHz
- 1800-2000 on 15.365 and 11.88MHz

**Portuguese**

- 0400-0500 on 7.23MHz
- 0500-0800 on 11.92MHz
- 0600-0700 on 15.145MHz
- 2000-2100 on 0.945MHz
- 2100-2200 on 0.915MHz

All of these broadcasts are directed to the African continent.

The Republic of Yemen Radio is still clearly heard on 5.95 and 9.778MHz at 0251 when the station signs-on. A bird calling and chirping for around 90 seconds is followed by what appears to be the National Anthem. Announcements are in Arabic.

**Asia And The Pacific**

Radio Afghanistan has English to Europe at 1800 on 9.635, 7.215 and 6.145MHz.

Radio Korea’s relay via RCI Sackville has moved from 1030 to 1130 and changed from 11.715 to 9.95 MHz, but reception is poor in Europe for the same reason as the Yamata relay of RFI channel.

Simon Hamer writes to say Radio New Zealand has dropped 13.785MHz in favour of 15.12, apparently because so few sets in the target area have the frequencies and times.
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