

Radio & Electronics

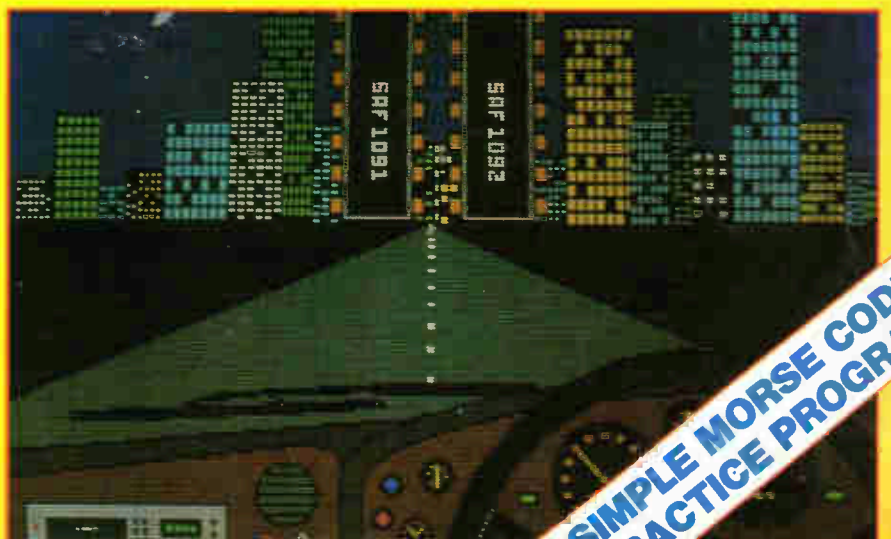
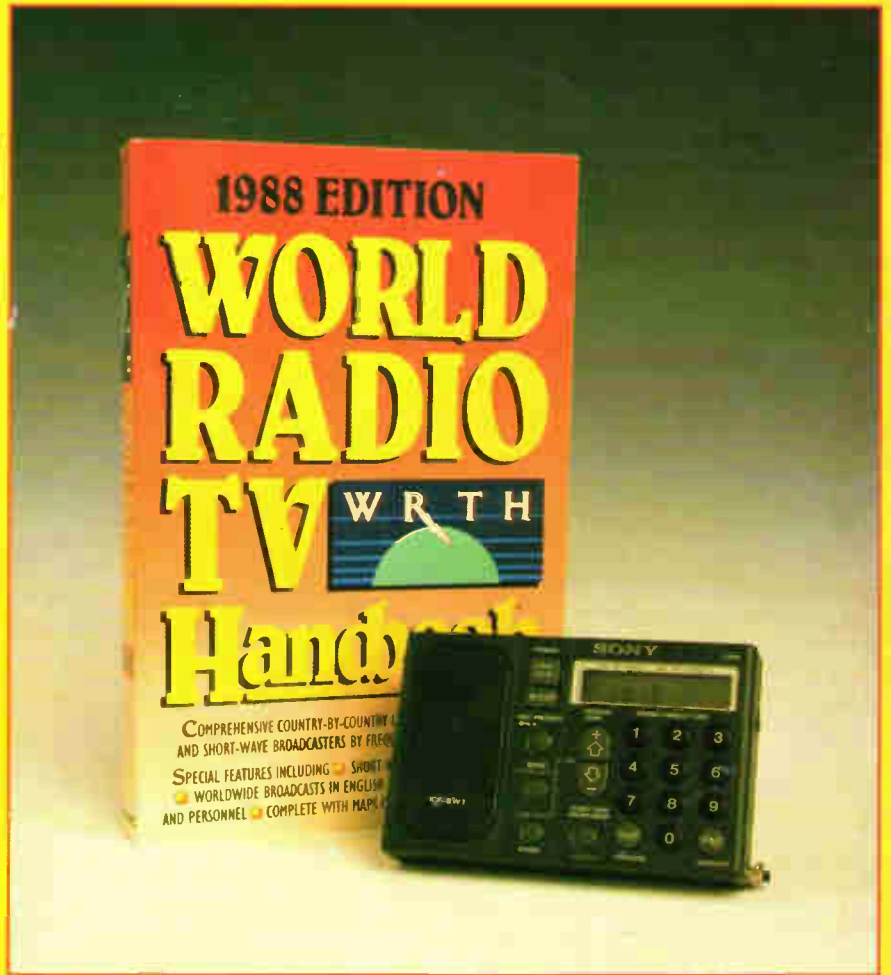
The communications and electronics magazine **World**

CONSTRUCTION:
POOR MAN'S
AMPLIFIER

DIODES:
SOME UNUSUAL
APPLICATIONS

SIMPLE RX:
WITH DIRECT
CONVERSION CAPABILITY

MSF CLOCK:
SIMPLE, CHEAP
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World Radio History

SIMPLE MORSE CODE
PRACTICE PROGRAM



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NEW PRODUCTS

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YAESU

FT767 GX RWC MK2



Yaesu offer our own improved version of this fabulous HF-UHF transceiver, we fit a small SMD chip component mod board in the VCO to improve the RX dynamic range by up to 20dB, FOC when purchased new from us. If you are lucky enough to own the FT767 already, send your unit + £59.50 and we will fit it for you! (inc. return carriage). Also available at some Yaesu dealers. **YAESU HAVE ADOPTED OUR UP-GRADE IN CURRENT PRODUCTION MODELS.**

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- G5RV HALF SIZE HF ANTENNA ready to use £16.50
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- Yaesu FRG9600 RWC Mk2 60-950MHz 'N' Connector Fitted £495.00
- Yaesu FRG9600 RWC Mk3 HF 100KHz-950MHz plus Mk2 Spec £695.00
- Yaesu FRG9600 RWC Mk5 HF 50KHz-950MHz Active Mixer £625.00
- icom ICR7000 25M 2GHZ superb quality professional Rx £859.00
- icom ICR7000 AH7000 Receiver plus Matching Discone £937.50
- Kenwood RZ1 New 25-905MHz Mobile Wide and Narrow AM FM PDA
- Fox VHF-UHF Multi Function Mobile Scanner FM only £139.00
- Uniden Bearcat UBC 50XL VHF-UHF 10ch H held Scanner £99.50
- Uniden Bearcat UBC 70XL VHF-UHF 20ch Miniature H held £199.00
- Uniden-Bearcat UBC 100XL VHF-UHF Airband H held Scanner £189.00
- Uniden-Bearcat UBC 175XL VHF-UHF-Airband Desk-Top £175.00
- BJ200 Mk2 VHF-UHF-Airband-Military Airband H held £220.00
- AOR 2002 25-550, 800-1300MHz Desk-Top Mobile AM FM £469.00
- Sony Air 7 Top Quality VHF-Airband Handheld Scanner £245.00

Package deal on above Mk3 5 FRG9600 c/w AH7000 discone, G5RV, PA4 AC PSU, complete receiving station HF-UHF including delivery UK mainland Add £100.00 to above price

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- icom ICR 1 HF Top Grade Communications Receiver £799.00
- Sony PRO80 HF VHF Handheld Scanner c/w accessories £345.00
- Sony 2001D Short Wave Airband DE11XF RX with ANI kit £395.00

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* - Extended Receiver coverage available, call for details

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- *YAESU FT73R FNB10 2.5W (5W) 70CMS C/W CHARGER £259.00
- *ICOM MICRO 2E 2.5W 2MTR HANDBELD WITH CHARGER £209.00
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- FT690RMK2 6MTR 2.5W MULTIMODE STANDARD ACCES £429.00
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Opening hours 9am-5.30pm 6 days, late nights Thursday & Friday till 7pm.

SCANNERS

Bearcat by uniden



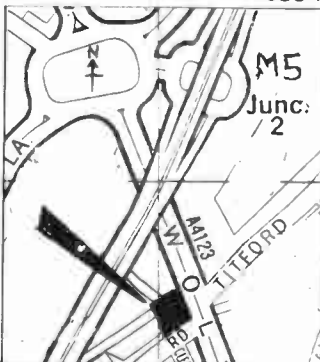
UBC 175XL



UBC 100XL

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Safety in the shack

Some of the constructional projects featured refer to additions or modifications to equipment; please note that such alterations may prevent the item from being used in its intended role, and also that its guarantee may be invalidated.

When building any constructional project, bear in mind that sometimes high voltages are involved. Avoid even the slightest risk - safety in the shack please, at all times.

Whilst every care is taken when accepting advertisements we cannot accept responsibility for unsatisfactory transactions. We will, however, thoroughly investigate any complaints.

The views expressed by contributors are not necessarily those of the publishers.

Every care is taken to ensure that the contents of this magazine are accurate, we assume no responsibility for any effect from errors or omissions.

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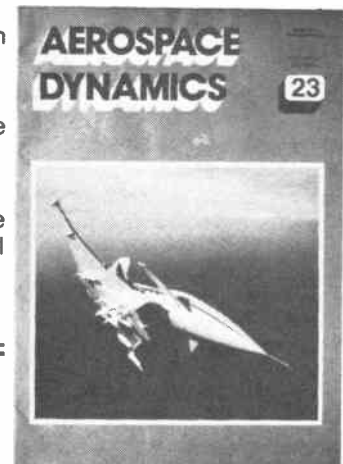
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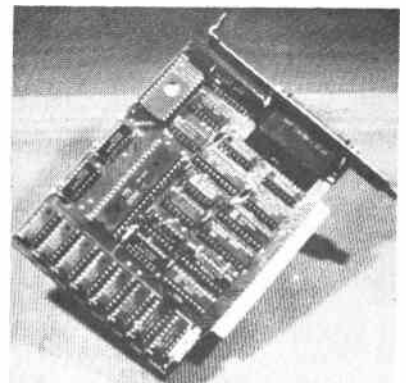
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PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.

Readers, don't forget to mention **Radio & Electronics World** when making enquiries

SMALL WORLD



The Sony ICF-SW1S, pictured on the front cover, is the latest world band receiver from Sony. Claimed to be the smallest in the world, it measures a miniscule 118.2 x 71.4 x 23.7mm (w/h/d) and comes in its own smart attaché case along with various extras.

With a frequency range of 150-29995kHz on AM and 76-108MHz FM, the SW1S has features normally associated with much larger receivers. It has a built-in clock, band search, direct frequency entry, manual tune, ten memories and much more.

The additional extras

include an ac to dc adaptor, an external antenna control console and an active antenna. Also included is the *Sony Wave Handbook*, with lists of useful frequencies world-wide, a comprehensive instruction manual and beautifully-styled miniature earpieces. Available from Sony outlets everywhere for £250, this is a most interesting little radio.

Sony (UK) Ltd,
South Street,
Staines,
Middlesex TW18 4PF.
Tel: (0784) 67000.

DIFFERENTIAL THERMOMETER

Electronic Temperature Instruments Limited have recently introduced a new differential thermometer; a low cost device designed for the heating and ventilating engineer.

It can be used as a

regular hand-held digital thermometer for measuring temperatures from -50 to +450°, with 1° resolution, repeatability and accuracy.

By plugging any two of the ETI standard temperature probes into either of the two sockets on the instruments, it is possible to read both probe

LOW COST SCOPE

Thandar Electronics Ltd has introduced a 20MHz dual trace general purpose oscilloscope under the Leader brand name, the LBO-1020.

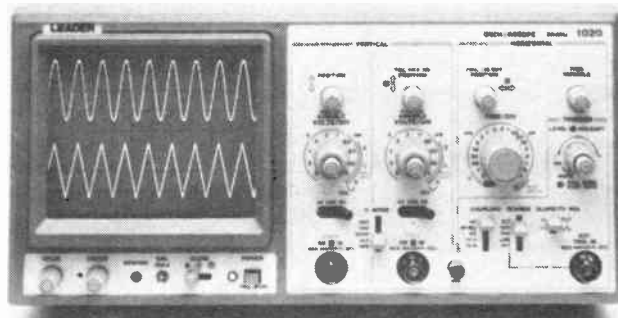
It is a 5mV/div, 20MHz (500µV/div, 4MHz) portable dual trace oscilloscope with a maximum sweep speed of 50ns/div (mag x10) and 150mm CRT with internal graticule.

Two major features are an illuminated graticule and a special trigger pick-off circuit which ensures synchronisa-

tion with composite video signals. Alternate trigger mode allows the stable display of two asynchronous signals plus display modes for CH-1, CH-2, Chop, Alt, Add and Polarity CH-2 Invert plus X-Y operations.

The LBO-1020 is supplied complete with probes at a price of £315.00 + VAT.

Thandar Electronics Ltd,
London Road, St Ives,
Huntingdon,
Cambs PE17 4HJ.
Tel: (0480) 64646.



temperatures and the difference between them. This facility allows, for example, the temperature drop across radiators or the temperature flow and return to be directly displayed.

The Therna differential thermometer is designed to meet the needs of the heating engineer in both general temperature measurement duties and specific applications in commissioning, service and maintenance of installations.

The price of each thermometer is £65.00 and a wide range of probes is available from £8.50 each.

ETI Ltd,
P O Box 81,
Worthing,
West Sussex BN13 3PW.
Tel: (0903) 202151.



COMPUTER UNDERSTANDS ENGLISH

Tome Associates believes it has developed the world's first personal computer software system to understand ordinary English.

A research programme, originally sponsored by the British Library and helped by the European Space Agency, has developed a relatively inexpensive programme (£495 + VAT) that allows untrained users to access vast databases.

Tome Searcher is an intelligent system which attempts to understand users and establish their information needs exactly. It helps users whose first language is not English by providing alternative ways of expressing a query. This is vitally important as English is the language of the world's main databases.

According to Jeremy Horwood, Tome's commercial director, the film 2001 envisaged HAL, a computer which understood and spoke English. He believes that by 2001 science fiction will have become science fact - although hopefully any Tome product will be better disciplined!

*Tome Associates Ltd,
PO Box 1,
Stotfold,
Herts SG5 4LT.
Tel: (0483) 810905.*

TOME SEARCHER

A young British company has developed a product which can allow even the untrained PC user direct, expert access to many millions of textual references.

This product, which is in effect a computerised specialist librarian or 'expert intermediary', is known as a Tome Searcher, and was officially launched in March at the Royal Institution of Great Britain in London.

Tome Searcher is designed to accept questions in freely expressed English, which means quantities of accurate, textual information can be quickly retrieved, without the user worrying about codes and commands or even remembering a phone number or password. In fact, Tome Searcher is so simple to use it

PRINTER/PLOTTER BUFFERS

Roalan International have recently released the Ditron range of very competitively priced printer buffers that fit inside an IBM PC/XT/AT (or compatible) or the IBM Personal System 2 model 30.

These half-length cards enable the computer to print a file in the background without slowing down other operations. Without a buffer on PCs, nothing else can be done whilst the printer is in use.

The buffer intercepts all data sent to the PC's parallel port, stores it in on-board RAM and then sends it out to the printer or plotter at the correct data rate. This then frees the PC for other tasks whilst printing or plotting takes place.

The card comes in three memory sizes: a 64K version which will store about 30

is not even supplied with a manual.

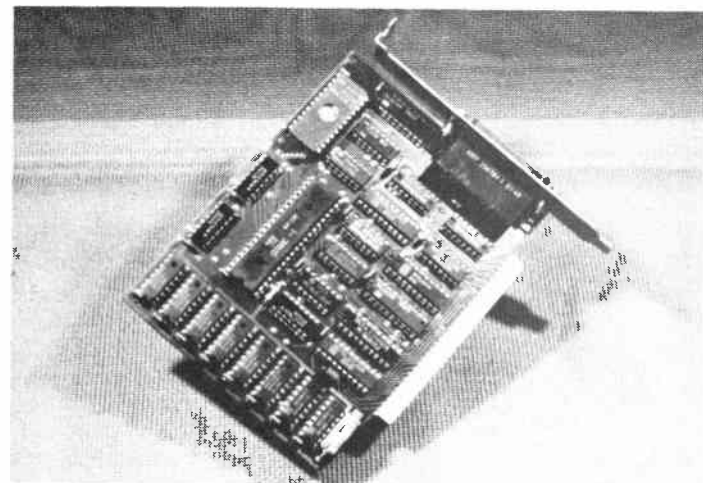
Today's online databases are vast; specially trained librarians within large companies and institutions are the only people competent to make good use of these vital information resources. With Tome Searcher, anyone who needs immediate, up-to-date, technical or commercial information can retrieve it without training.

*Tome Associates Ltd,
PO Box 1,
Stotfold,
Herts SG5 4LT.
Tel: 01-579 2142.*

ON-BOARD EPROM

The latest addition to the Texas Instruments TMS7000 series of 8-bit microcomputers feature 4K of on-board EPROM in addition to other on-chip features. It is now available from Jermyn.

Known as the TMS7742, the new NMOS-based processor has the same powerful 8-bit architecture as existing TMS-7000 family MCUs but is also reprogrammable, making it ideal for prototyping and facilitating low-cost user upgrades. The device offers full hardware and software compatibility with existing 7000 family ICs. A universal



pages of text at £145; a 256K version which will store the equivalent of 130 pages of text at £195 and the top of the range 1M card, ideal for plotters, at £450.

For those who use a serial RS232 printer or plotter there

is a parallel to serial converter available at £119.

*Roalan International,
Britannic House,
28 St Peters Rd,
Bournemouth BH1 2LP.
Tel (0202) 296358.*

programming procedure, similar to that used for the TMS2732 EPROM, is adopted.

In addition to 4K of EPROM, the TMS7742 has 256 bytes of on-chip RAM, acting as a high speed register file with an operating frequency of 5MHz. Maximum baud rate is 625 kilobits. Other on-chip features include three 8-bit timers, two with 5-bit prescale and one with 2-bit prescale.

In common with other members of the TMS7000 family, the new device has a register to register architecture, allowing direct register arithmetic and other logical operations to bypass the accumulator. Up to 64K of external address space is also provided, and the chip runs from a single 5V power supply.

*Jermyn Distribution,
Vestry Road,
Sevenoaks,
Kent TN14 5EU.
Tel: (0732) 450144.*

DATA BUFFER

First Source are launching a new 256K data buffer, featuring serial/parallel input/output, with a choice of baud rates, at a cost of only £250.

Capable of storing documents of up to 128 pages, the

data buffer can be used to feed data from computers, operating at a range of data rates, to any slower I/O device such as a printer or modem.

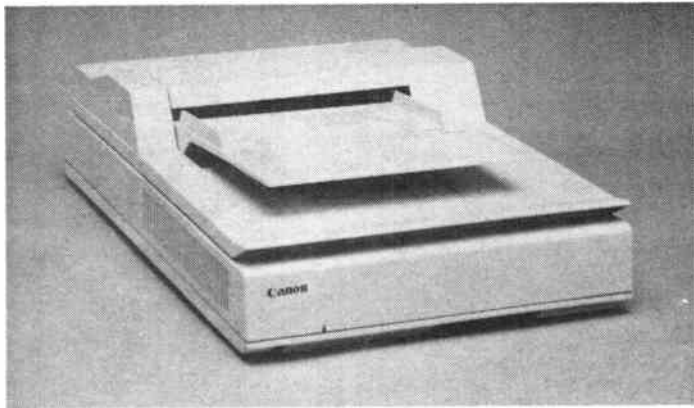
The First Source DB256 offers a range of advanced facilities and can be used to buffer computers and peripherals operating at different data rates, or even a mixture of serial and parallel equipment.

Serial data can be accepted at between 75 and 9600 baud, and output at between 50 and 9600 baud. In addition, the buffer can be configured as serial to serial, parallel to parallel, parallel to serial or serial to parallel. Centronics compatible parallel and RS232C serial input output ports are provided.

Other useful features of the DB256 include hold and copy facilities. This means that data can be stored until required and multiple copies of lengthy documents and graphics projects can be obtained. Empty, data arriving and full indications are provided, and a reset facility is available.

*First Source,
The Business Centre,
Coine Way,
Watford,
Herts WD2 4ND.
Tel: (0923) 246102.*

PRODUCT NEWS



FLAT-BED SCANNER

The new IX-12 from Canon is a compact, flat-bed image scanner for use with desktop publishing systems, word processing, picture drawers and graph processors.

They are available at a recommended retail price of £1,145 including interface. The new machine is totally software compatible with the

existing IX-12, which is now priced at £995 and is packaged with the same interface for connection to IBM PC/AT compatible computers, including the Canon A200 II and A200 EX.

Pages from books or bound documents can be easily scanned, and an optional automatic document feeder capable of handling 20 A4

originals is also available for an additional £495.

The maximum scanning density is 300 dots per inch (dpi) both horizontally and vertically and the speed for an A4 page is 8 to 16 seconds, depending on density. High density scanning of graphics or photographs is also possible with 32 grey shades.

The optional optical character recognition software is ReadRight, from OCR Systems, which automatically recognises a wide variety of typesets and point sizes. Pages can be read at between 20-30 characters per second on a PC-compatible computer, or as fast as 50-60cps on an AT-compatible machine.

*Canon (UK) Ltd,
Canon House,
Manor Road,
Wallington,
Surrey SM6 0AJ.
Tel: 01-773 3173.*

French, Greek/maths, Swiss, German and Spanish.

*Anglia Microwaves Ltd,
Radford Business Centre,
Radford Way,
Billericay,
Essex CM12 0BZ.
Tel: (0277) 630000.*

ADD-ON IEEE-488 CARD

The AD50488 interface card, introduced by Measurement Limited, provides complete IEEE-488 functionality on a 3/4 size board compatible with the IBM-PC bus to create a powerful instrument controller.

The software driver is contained in the on-board firmware, with no additional disc software required. Neither is there a need for system memory space due to the use of on-board ROM and RAM. The AD50488 supports standard IEEE-488 command mnemonics as well as BASICA, BASIC compiler and many other languages.

Other features include the ability to assign each device on the IEEE-488 bus and a high data transfer speed. Data can be transferred at speeds of 67Kbytes/sec with program I/O and 300Kbytes/sec with DMA.

*Measurement Ltd,
Berrington Road,
Leamington Spa,
Warwickshire CV31 1NB.
Tel: (0926) 35411.*

PC SUPER CARD

The CIL Group have developed a plug-in intelligent multifunction interface card for use with IBM PC, XT and AT computers and compatible types. It provides 8 analogue inputs (16 bit), 4 analogue outputs (16 bit), 4 relays and 16 logic input/output lines.

Advantages include cost, accuracy, multitask applications and simplicity. A Z80 microprocessor with 40Kbytes of buffer RAM is used to simplify operation to a range of straightforward ASCII commands. This simplifies its interface to the various languages used by

the host computer and maintains its independence during certain multitask operations. Multitask operations include data acquisition, waveform generation and certain comparator control functions.

These cards are produced by the CIL Group at their manufacturing plant in Lancing and are available at a price of £415 each.

*The CIL Group,
4 Wayside,
Commerce Way,
Lancing,
West Sussex BN15 8TA.
Tel: (0903) 765225.*

WHITE SCREEN

A new generation of computer terminals from Anglia Microwaves Ltd feature easily programmable keyboards, a compact 15-inch screen and 'paper-white' phosphor.

Both standard and secure versions of the Comex 8000, feature a fast refresh rate (64Hz) to give a sharp display with very low flicker, reducing eye strain.

The terminals are supplied with a friendly and flexible software package called 'FENIX' that makes it easy to programme any key to generate strings.

The 8600 reduces electromagnetic 'leakage' to an absolute minimum, and a fully ruggedised unit is available. Its low frequency radiation is just 26mT/s and the RS232 communication ports can be adopted for use with fibre-optic cabling.

Both types have a DIN-standard key layout and all keys are autorepeat, with n-key roll-over. Display formats can range from a standard 24 lines x 80 columns up to 34 lines and with 255 columns using horizontal scrolling.

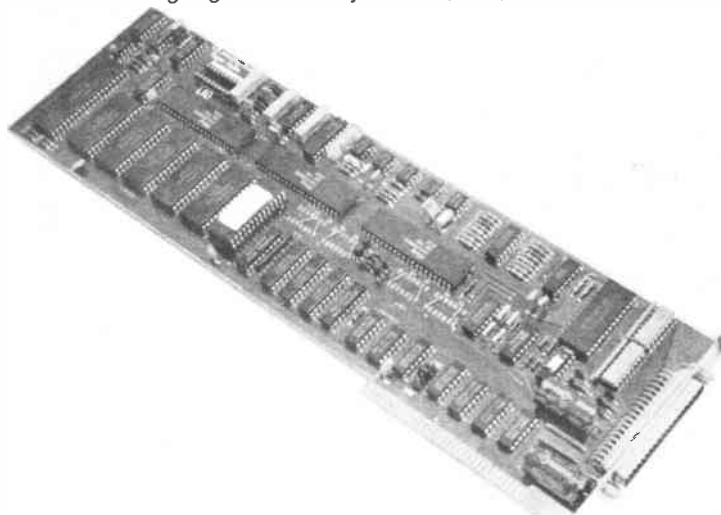
Multiple language fonts are supported, covering English, Swedish, Danish/Norwegian,

TRANSPUTER MODULES

Rapid Silicon demonstrated a new range of Inmos transputer modules at the MDS 88 show, where they were used to provide the processing power for a four-aircraft flight simulator.

The new range includes two motherboards - one for use with an IBM PC, AT or XT (B008-1) and the other in double Eurocard format. The motherboards can be 'stacked' to build large systems and are configured by plugging in one or more of the new modules.

*Rapid Silicon, Rapid House,
Denmark Street,
High Wycombe,
Bucks HP11 2ER.
Tel: (0494) 457248.*



SIGNAL SOURCES

The Marconi 6150A series of microwave AM-FM signal sources from STC Instrument Services are tunable solid-state oscillators which use a GaAsFET as the active element with a YIG resonator. Offering full IEEE-488 or IEC control with the optional 6140 GPIB adaptor, the user is able to interface commands from the bus to an instrument.

A wide range of modulation facilities are offered via several panel-selectable modes. CW is a single low-residual FM mode, whilst SWP enables swept frequency when a 0 to +10V drive is applied to the rear panel auxiliary or BNC sockets. A combination of CW and SWP offers slow sweeps (<1Hz) or steps between frequencies with low residual FM using rear panel sockets

and external drive whilst FM provides fast frequency modulation up to ± 20 MHz deviation for ± 10 V input to the front panel BNC socket at up to 100kHz for -3dB response.

Other modes are RF OFF, INT AM ON and AM. All the AM functions are performed using a PIN modulator. AM and FM functions are independent, allowing complete control of the signal source. The rear panel auxiliary socket enables remote control of centre frequency, output power, 1kHz internal modulation, RF on/off and display.

*STC Instrument Services,
Dewar House,
Central Road, Harlow,
Essex CM20 2TA.
Tel: (0279) 641641.*

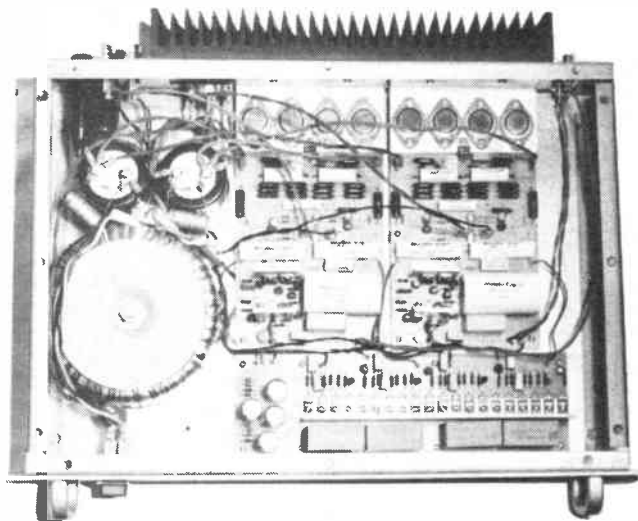


PERFORMANCE AMP

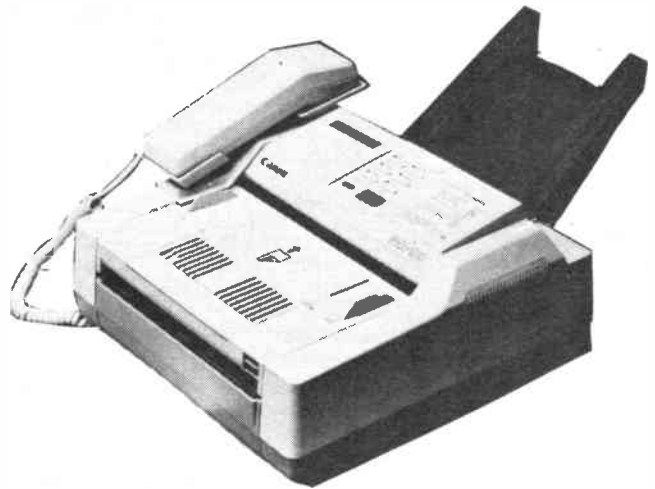
Audiokits Precision Components have introduced a new, high performance power amplifier to their range of amplifier kits. The Virtuoso power amplifier matches the

Virtuoso preamplifier.

The amp is designed to provide approximately 100 watts RMS stereo into an 8 Ω load, with additional options for 150W and 200W bridged mono operation.



COMPACT FAX



A new Group 3 Canon Fax-210 is a simpler version of the company's popular Fax-230, and is aimed at users who require high speed, high quality facsimile but not such advanced features as auto-dial, redial, confidential transmission and delayed timer transmission and polling.

Fitted with a telephone handset as standard, the new machine is available at a recommended retail price of £1675 (excluding VAT) and shares many of the Fax-230's basic features, including half-tone mode with up to 16 shades of grey for clear reproduction of graphics and photographs.

An A4 document can be transmitted in as little as 15 seconds, and easy operation is aided by an automatic 10-sheet document feeder and an LCD prompt display. Poor quality originals can be enhanced by 'fine' or 'darker' controls.

Measuring 356 x 350 x 164mm, the Fax-210 takes up less desk space than most typewriters and can also be used as a personal photocopy facility.

*Canon (UK) Ltd,
Canon House,
Manor Road,
Wallington,
Surrey SM6 0AJ.
Tel: 01-773 3173.*

SPEECH SYNTHESIS IC

NEC's new speech synthesis IC, μ PD7759, enables up to 1Mbit of external memory to be addressed.

Employing ADPCM (adaptive differential pulse code modulation) coding, the chip is capable of generating speech of such excellent quality that accents and dialects can be perfectly reproduced.

Packaged in 40-pin DIP format, the μ PD7759 can be teamed with NEC's 1Mbit mask ROM, μ PD23C1000, as well as UV-EPROMs.

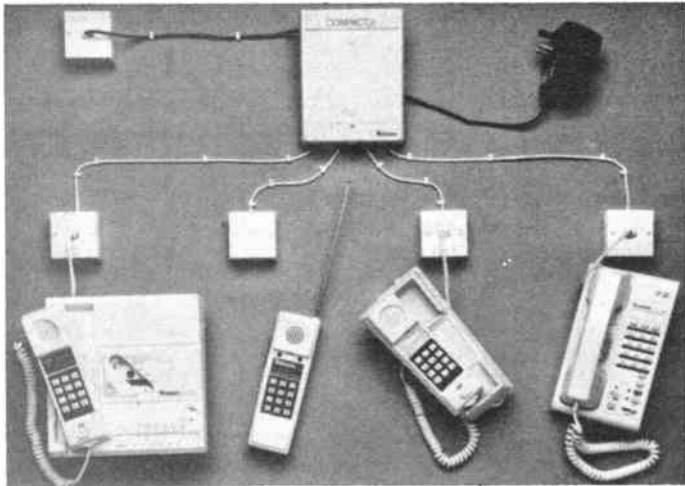
Standard versions of the Virtuoso use high quality components throughout, comparable with some of the better quality manufactured amplifiers. The upgraded versions use the highest quality components currently available.

Prices for the Virtuoso kits start at around £300 for a standard stereo amplifier going up to around £800 for a 200W bridged mono amplifier in the larger 3U size case. The amplifiers are designed for optimum sound quality rather than specifications.

*Audio Precision
Components,
6 Mill Close,
Borrowash,
Derby DE7 3GU.
Tel: (0332) 674929.*

*NEC Electronics (UK) Ltd,
Cygnus House,
Linford Wood Business
Centre,
Linford Wood,
Milton Keynes MK14 6NP.
Tel: (0908) 691133.*

PRODUCT NEWS



ONE-LINE

Betacom Limited, one of the UK's most rapidly-expanding telecommunications companies, is introducing Compact 4 – a one-line telephone system designed for use in both domestic and business environments.

The system operates from one exchange line offering an immediate capacity of up to four extensions, although as many as 12 can be connected if required. The central control unit – measuring only 18.5 x 15 x 3cm – is very simple to install, connecting into the mains using an ac adaptor (supplied) and into the BT master socket.

The Compact 4 is available in both a standard pack, containing the central processing unit and an ac mains adaptor, and a Plus pack, containing the CCU, an ac mains adaptor, four extension sockets and a full DIY assembly kit. The system will be priced at £159.99, and £189.99 for the Plus kit.

*Betacom Ltd,
Unit 12,
Ponders End,
Industrial Estate,
Duck Lees Lane,
Enfield,
Middlesex EN3 7TQ.
Tel: 01-804 9909.*

NEW ICs FOR CARS

A new pair of integrated circuits from ITT, the SAF1091 and SAF1092, are now in production for designs of programmable speedometers and mileage indicators in cars.

Use of ICs in automotive applications saves space and the effort involved when using large amounts of cabling, reduces the weight of the car and in the long term saves money.

It also considerably increases the number of functions possible.

The set of circuits has seven available programming pins, so it can easily be adapted for use in different makes of car. Both 12 and 24V supplies are suitable.

The SAF1091 incorporates a proximity switch, a voltage regulator, overvoltage protection, a current source and pulse output.

The SAF1092 is the timing IC which processes the pulses for the 1091.

An LC oscillator coil placed near the drive shaft measures the speed of the car. Measurement is effected by the variation in the conduction caused by a metal strip attached to the revolving shaft.

This creates a pulse signal proportional to the speed of the car which is fed to the SAF1092 and processed. The SAF1091 then uses the information to indicate the speed of the car on a moving coil meter and to log the cumulative miles covered on a stepping motor. The circuits are manufactured in 18 pin plastic packages.

*ITT Semiconductors,
145-147 Ewell Road,
Surbiton,
Surrey KT6 6AW.
Tel: (0703) 229041.*

VARIABLE PUMP

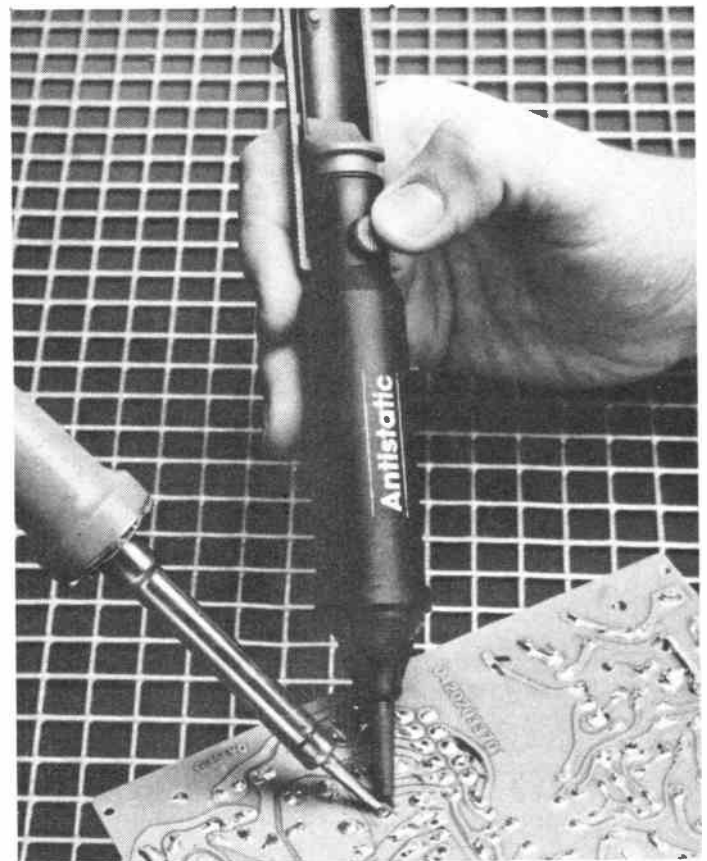
Ceka's range of specialist tools for the electronics industry has been augmented with a new antistatic desoldering pump, featuring a variable spring action suction pump.

The suction power is varied by unthreading the nozzle of the pump and turning the spring to either the 'soft' or 'strong' suction position which provides a strong but muffled and recoilless suction.

The desoldering pump is made from black antistatic nylon glass plastic and clears solder through a heat resistant and non-stick carbon fibre tip upon reloading.

The desoldering pump is supplied in an individual wallet with full instructions for £11.

*Ceka Works Ltd,
Pwllheli,
Gwynedd,
North Wales LL53 5LH.
Tel: (0785) 612254.*



DIMMER CONTROL KIT

A touch-sensitive lighting on/off and dimmer control unit which replaces normal lighting switches is available now in kit form from Electronic & Computer Workshop.

Briefly touching the switch sensor area switches lights on or off, while holding the finger in contact operates the dimmer function and changes the lighting level. The level cycles up and down from maximum to minimum brightness in approximately 3.5 seconds.

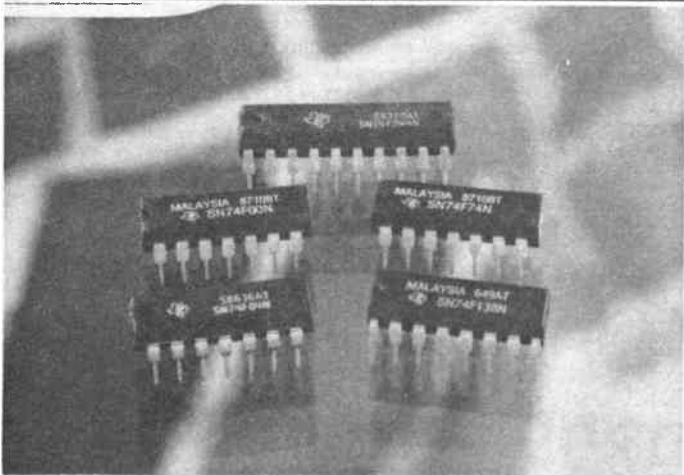
Lighting loads of up to 2A (500W) can be handled, suffi-

cient for most domestic room lighting applications. In addition, the switches can be linked together to allow any number of remote switching positions.

Available by mail order from ECW, the K2652 touch-sensitive dimmer switch kit costs £16.22 including post/packing and VAT.

*Electronic & Computer
Workshop Ltd,
Unit 1, Cromwell Centre,
Stepfield,
Witham,
Essex CM8 3TH.
Tel: (0376) 517413.*

FAST DEVICES



New from Online Distribution is a range of new competitively priced 74F (FAST second source) devices by Texas Instruments.

The 74F devices are pin-for-pin, functional and electrical direct second sources to the popular FAST range. Some 29 74F functions are available, with another 50 to come.

Already available are gates, flip-flops and octals in DIL packages for use at commercial temperatures. SO packages will be available.

*Online Distribution Ltd,
Melbourne House,
Kingsway,
Bedford MK42 9AZ.
Tel: (0234) 217915.*

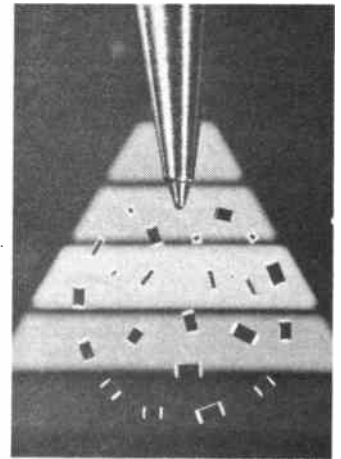
CHIP RESISTORS

A new series of chip resistors is available in any size down to 0503 and can be used in either wire bonding or soldering applications. It has been launched by Welwyn's Special Products Division. The CR series complements the WCR range of standard resistors offered by Welwyn's Film Resistor Division.

The availability of AQAP 1 release, showing compliance with international defence standards, makes the resistors ideal for defence applications.

The rectangular shape and small dimensional tolerances of the CR series make it easy to handle by automatic methods. It is also suitable for surface mounting or hybrid microcircuit applications.

Five face, wrap around solderable terminations with nickel barriers give outstanding leach resistance during wave or reflow soldering. The product withstands up to 30 seconds of immersion at



260°C. A gold-terminated version is also available for wire-bonding applications.

Any value within the range OR2 to 5M can be supplied and tolerances go down to 0.5%. The operating temperature range is -55°C to +125°C.

*Welwyn Resistors,
Bedlington,
Northumberland NE22 7AA.
Tel: (0670) 822181.*

METAL FILM RESISTORS

Dale-ACI have extended their range of compact commercial metal film resistors with the CCF-50, which covers the entire 10 ohm to 1 megohm value range, with 96 values per decade.

Occupying the same space as a conventional 1/8W metal film resistor, these precision 1/4W components feature 1% tolerance and a temperature coefficient of only 100ppm over a wide -65°C to +165°C temperature range. The small size of these components together with their close tolerance and good stability makes them a suitable, inexpensive replacement for type BB and CB carbon composition types, as well as for conventional metal film resistors. Standard 0.020in leads are provided for use with automatic component placement equipment.

Performance characteristics of these high quality components meet or exceed MIL-R-10509. Under MIL-R-10509 environmental tests, resistance was found to vary by typically only 0.1% under conditions of thermal shock, low temperature operation, short time overload and

mechanical shock. Maximum working voltage is 200 RMS.

*Dale-ACI Components Ltd,
River Park Industrial Estate,
Berkhamstead,
Herts HP4 1HL.
Tel: (04427) 72391.*

MULTIWAY CONNECTORS

The BICC-Vero Trident range of rectangular multiway connectors is now available from House of Power, the UK distributor.

The design of the rectangular connectors is based on the requirements of the MIL-C-28748 military specification, resulting in an extremely reliable and robust system which will withstand extremes of vibration, shock, temperature, humidity and corrosion.

The connectors are available with 14, 18, 20, 26, 34, 50 and 75 ways, and a wide range of accessories, plus jacking and mounting hardware, is also stocked.

*House of Power,
Electron House,
Cray Avenue, Orpington,
Kent BR5 3AN.
Tel: (0689) 71531.*

LOW POWER OP AMP

RR Electronics has introduced the PMI PM-1008, a low-power, precision, externally-compensated op amp. It is pin and function compatible with OP-08 and 108 amplifiers, but offers better dc precision.

Super beta input devices and Zener-zapped current cancellation cut input bias currents, even at high temperatures. The PM-1008 has only 600pA maximum bias current over the full military temperature range of -55°C to +125°C. At 25°C, bias current is only 100pA maximum.

Precision gives the PM-1008 almost universal applicability. Offset voltage and drift are 120µV and 1.5µV/°C maximum, while power-supply and common-mode rejection are better than 114dB.

Drawing only 600µA supply current, the PM-1008 is specified for use over a wide supply range: from ±2V to ±20V. Unlike many other low-power amplifiers, the PM-1008 has good noise characteristics, only 17nV/Hz at 10Hz.

External frequency compensation allows the ac response of the PM-1008 to be tailored to different applica-

tions with one capacitor. The flexibility thus achieved allows one op amp to cover many different uses.

Applications include battery-powered and portable precision instruments, long-term integrators and light detectors. The PM-1008 is available in TO-99 metal cans and plastic dips.

*RR Electronics Ltd,
St Martins Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.*

WIRE STRIPPER

An indispensable item for any tool box is a gadget that makes wire stripping fast and simple.

Ceka's new adjustable precision wire stripper can cater for diameters of 0.25mm to 0.8mm which are selected by turning a clearly marked adjustment wheel.

The stripper is priced at £25.50.

*Ceka Works,
Pwllheli,
Gwynedd,
North Wales LL53 5LH.
Tel: (0758) 612254.*

NEXT ISSUE

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James Dick rolls his own in the shack

AIR TRAFFIC CONTROL CENTRES

Brian Kendal continues his series on aviation electronics with a look at technology to keep tabs on airspace

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Model 888.....	£17.00 per kit
Model 940.....	£17.00 per kit
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Please state model type/mark when ordering. Spare valves available for other models. All valves can be supplied separately. Prices include postage and package.

**345 Stockfield Road, Yardley
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NEWS DESK

Skitrek update

Preparations for the Transpolar Skitrek were continuing at the time of writing as the Digitalker on UoSAT OSCAR-11 was being tested. Thousands of classrooms around the world have received the AMSAT teacher's guides and will be following the expedition through the use of follow-up progress reports. Progress reports will be read on AMSAT nets, transmitted through packet radio networks and will appear on the WORPK AMSAT digital BBS (1-515-961-3325).

Dimitri Shparo UA3AJH, expedition leader, was in Canada recently while the Skitrek Communications team from the CRRL, under the leadership of its Presi-

dent Tom Atkins VE3CDM, visited the Russian communications team in Moscow.

Pirates pay royalty

The music industry is calling for private copying royalties to be levied on blank tapes and hardware. In the UK, the Copyright Designs and Patents Bill has reached the report stage in the House of Lords and the European Parliament will examine a green paper before Easter. Ministers are recommending that governments of member states adhere to the Berne Convention when legislating on copyright issues.

Spain and Portugal are introducing royalties on hardware and blank tapes, both audio and video. The Netherlands intends to follow suit

and the Attorney General of Australia supports a royalty on blank tapes or hardware.

Meanwhile, the American record industry has abandoned the Copycode system developed by CBS. This system is designed to filter out a very narrow frequency range centred on 3840Hz, which happens to be near the note B-flat.

Digital audio tape recorders were to be fitted with circuitry that would automatically switch off the recorder when it detected that 3840Hz was missing. Legislation will no longer go ahead because Copycode does not always work and it degrades sound quality, probably because it removed frequencies so close to B-flat.

The 'cold' bird hots up

Eutelsat, the European Telecommunications Satellite Organisation, has filled all ten transponders on its F4 satellite and will soon be offering more than 19 television channels.

The transponders have been allotted with a three-year commitment to Denmark, Germany, France, Italy, Norway and Spain. All are in the Spot West beam, except for a lease to Spain in

the Atlantic beam and a right of first refusal to Italy in the Spot East beam.

Andrea Caruso, Eutelsat's director general, pointed out that a recent campaign, which described the third satellite as a 'cold' bird, had obviously been premature.

Radios at the summit

When the joint army and civilian expedition, Jade Venture, scaled the 8,027 metre high Mount Xixabangma in Tibet, both men and machinery were put through a gruelling test. Lt Col Henry Day of the Royal Engineers, who led the 30-strong team last September, was assessing the suitability of Philips Telecom radios for use this year by the British Services Everest Expedition.

Lt Col Day's expedition required equipment robust enough to withstand the harsh Himalayan environment and still provide the vital communication link between team members.

Philips Telecom supplied two PF85 and four PFX lightweight portable 'pocket-phones', remote antennas and battery chargers. Three specially adapted solar battery chargers and a directional antenna were also provided.

Suspense story for the Harrier



Aircraft antennas

The best position for antennas on any vehicle, aircraft, ship or car is usually determined using scale models or by calculation. The limitations imposed by both these arrangements mean that it is often necessary to measure antenna performance on the vehicle itself.

Of course, trying to do this with an aircraft in flight is extremely expensive and not particularly accurate. The next best thing is to raise the aircraft off the ground on a stable platform, such as the one being used with the British Aerospace Harrier GR5 aircraft pictured on last month's cover sitting on the turntable.

The antenna test range turntable is situated at Dynamics Division in Bristol where, under contract to Military Aircraft Division, comprehensive measurements have been made of

some of the aircraft's many antenna systems.

The Harrier is installed on a wooden platform which is attached to a 35ft (10.6m) diameter, 70 tonne capacity level turntable. Measurements are then taken over a very wide frequency range using transmitting antennas over 1500 yards (1.37km) distant.

Despite the size and weight of the loaded turntable, its angular position can be controlled and positioned to fractions of a degree, so that precise orientation of narrow beam antennas can be determined.

The antenna test facility can accommodate any land vehicle up to the weight of a battle tank. An additional smaller turntable is also available. The test site is complemented by two anechoic chambers and the latest comprehensive mathematical modelling techniques.

BT relishes big MAC

This summer, British Telecom's Cable and Satellite Division plans to demonstrate a new European standard MAC transmission system for direct-to-home satellite television.

Users will be able to choose the programmes they receive and the system provides facilities for billing and customer enquiries. BT is inviting programme providers to participate in the low powered satellite demonstration and it hopes to have a fully operational system ready for the launch of higher powered satellites.

C'est magnifique

Racal Telecommunications has joined Cofira (Compagnie Financiere pour le Radiotelephone), the consortium which will establish and operate France's analogue cellular radio network, beginning in Paris in 1989 and expanding to cover 85% of the French population.

One of the principal shareholders, Compagnie Generale des Eaux, will be awarded a fifteen-year licence to operate the 160 duplex channels in the 450MHz band.

Racal gained its expertise in cellular radio from setting up the Vodafone network in the UK and will co-operate with Compagnie Generale des Eaux to develop a pan-European service.

IOM VHF

Eddystone Radio Limited, the Birmingham-based division of Marconi Communication Systems Limited, has won a £63,000 order from Manx Radio to supply a stereo VHF/FM transmitting system for Manx Radio's station at Carnane, near Douglas, and another at a site on Snaefell, a mountain well known to motorcycle enthusiasts for the TT race.

The Carnane system comprises two 2kW Eddystone 1707 transmitters, equipped with dual synthesized stereo drives and a changeover facility, which feed a dual-polarised antenna system. The installation at Snaefell Mountain is similar but comprises two 500W Eddystone 1706 units.

Manx Radio has a history

unique in broadcasting. It was the pioneer in commercial radio, being the first commercial station to come on-air in the British Isles in June 1964. Manx Radio now operates on three separate channels, 1368kHz (219 metres) on the medium wave together with 89.0MHz and 97.3MHz in stereo on the FM/VHF band. When the new Eddystone transmitters go on-air, the FM/VHF band will change to 97.2MHz. Manx Radio will then reach the majority of the island's 64,000 population, over 80% of whom currently listen in.

Programme uplink

ERA Technology Ltd has been awarded a contract by the Independent Broadcasting Authority (IBA) for two turnkey antenna systems to provide the programme uplink for its UK direct broadcast satellite (DBS) service. This service will relay television signals from the satellite direct to consumers' homes.

The two large earth station antennas will be the first in the UK to operate in the new DBS frequency bands of 17.3-18.1GHz (uplink) and 11.7-12.5GHz (downlink) allocated at the 1977 meeting of the World Administrative Radio Council (WARC77).

A critical element of the antenna system will be the high performance feed chain and inter-facilities link. These will be required to operate with three high power radio frequency channels and are designed to carry the full five channels allocated to the UK. Both antennas will be equipped with tracking systems to enable accurate alignment with the satellite in geostationary orbit.

The IBA plans to introduce DBS into the UK after February 1989, by which time the antennas should have been installed and commissioned.

JerCTV

Jersey Cable Limited has acquired the assets of the Rediffusion cable television system in Jersey.

Jersey Cable will operate the existing cable network and will begin to upgrade sections of it in the coming year. Rediffusion will have a

shareholding in Jersey Cable and they will continue to provide administrative and technical services to the new company.

Other shareholders in Jersey Cable include Asric Holdings Ltd, Channel Islands Communications (Television) Ltd, The Guiton Group, Harriscope Cable Corporation, IVS Enterprises Ltd, IVS (Jersey) Ltd and Deputy Derek Maltwood.

The present Rediffusion cable network serves over 5,000 subscribers in Gorey, St Saviour, St Helier, St Aubins and St Brelades. There are some 1,450 subscribers taking the two channel premium Cablevision service which Rediffusion began offering in 1984. The present network requires substantial upgrading to increase its capacity from six to 30 or more channels.

The company will also be applying to the USA for permission to expand the network.

Band Three, two, one!

Band III radio was finally inaugurated on 1st March, in the exotic surroundings of the Roof Gardens in Kensington. Dedicated reporters from this magazine, manfully suffering the champagne and canapés, managed to ask a National Mobile Radio executive a few pertinent questions.

Band III, as you will know, is the frequency band around 200MHz vacated by television when it moved on to new allocations. Effectively, the band has now been divided into three – one for present use, one for future expansion and the last being reserved for new technology.

NMR Ltd have been awarded licences to operate 20 channels in the London region and 19 in both the Birmingham and Manchester regions. It is hoped to cover the country within 18 months, though 'the odd farmer in Auchtermuchty' will probably never be able to take part – you have been warned!

Three million pounds has been pumped into the development, and the combined talents of National Radiofone, Storno, BT and Motorola have been utilised

to bring the project to fruition. Repeater systems are 'on the cards'. Calls will be free, with a standing charge of approximately £20 per mobile per month, and potential users can be 'up and running' within three days of asking for the system. Inter-region operating is possible. Voice and data communications will both be available and transmissions will be protected.

Only one shadow appears on this glittering scene – the threat that TV may ask the DTI to re-allocate these frequencies for its own use. Watch this space for future developments...

CoMIC relief

The UK's four principal microwave companies have now joined forces on a collaborative programme to develop a range of Microwave Integrated Circuit (MIC) building blocks.

Referred to as Microwave Common Modules, the MICs will be developed to meet the future needs of the European microwave systems industry.

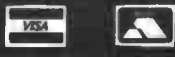
The programme, sponsored by the UK MoD, is a collaborative venture between Ferranti Computer Systems (Microwave Division) Ltd, M/A-Com Ltd, Marconi Electronic Devices Ltd and Plessey Microwave Ltd, who collectively form the Microwave Common Module Group (MCMG).

All four companies have committed extensive development effort to the programme aimed at producing single-substrate MIC modules, the first of which becomes available this year.

Standards CEPT up

Following an EEC decision, the Directors General, Telecommunications, of the European Conference of Post and Telecommunications Administrations (CEPT) have decided to establish an autonomous European Telecommunications Standards Institute in conjunction with industry and users.

The institute will be established in Sophia Antipolis, Nice, France and it will progressively take over the work on technical pre-standardisation and standardisation hitherto undertaken by CEPT.



P.M. COMPONENTS LTD

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INTEGRATED CIRCUITS

AN103	2.50	LA4430	2.50	AL1327Q	1.10	TA7809P	3.95	TC4760	2.50	1UA4050	2.95
AN124	2.50	LA4461	3.50	SN7474	1.50	TA7811AP	2.95	TC4800	2.50	TDA4600	2.50
AN214	2.50	LC7130	3.25	SN7421	0.85	TA7629	2.50	TC4801	2.50	TEA1009	1.35
AN236	1.95	LC7131	5.50	SN76023N	3.05	TA8310A	3.50	TC4830S	1.95	U1C41C	3.50
AN239	2.50	LM317	2.50	SN76110N	0.85	TA8320A	3.50	TC4900	2.50	UPC566H	2.95
AN240P	2.50	LM323K	1.95	SN76115N	1.25	TA8350A	1.95	TC4940	1.85	UPC575C2	
AN247	2.50	LM324N	0.45	SN76226DN	1.95	TA8570	1.95	TDA4401	2.20	UPC10001H	
AN260	2.95	LM3800N	1.50		2.95	TA8621	3.95	TDA10003A	3.95	UPC1020H	
AN262	1.95	LM3808N	2.95	SN76227N	1.05	TA8621S	2.95	TDA10006A	1.95	UPC1024H	
AN264	2.50	LM383T	2.95	SN76228N	2.95	TA8661B	1.95	TDA1010	2.15	UPC1025H	
AN271	3.50	LM390N	3.50	SN76533N	1.65	TA8700	3.95	TDA10005	2.25	UPC1181H	
AN301	2.50	LM1011	2.50	SN76650N	1.15	TA8930	3.95	TDA10035	2.50	UPC1182H	
AN303	3.50	M5155L	2.50	SN76660N	0.90	TA8930B	1.95	TDA10103	2.50	UPC1185H	
AN313	2.95	M51513L	2.30	STK011	7.95	TA9120A/S/B/C	1.00	TDA10200	2.95	UPC1191V	
AN315	2.25	M51521L	1.50	STK014	7.95	TA9120B	1.00	TDA10201	2.95	UPC1350C	
AN316	3.95	M83705	1.50	STK015	5.95	TA9231	1.30	TDA10202	2.95	UPD2114LC	
AN321	3.95	M83752	2.50	STK018	7.95	TA9395	1.50	TDA10203	2.95		
AN342	2.95	M83757	2.50	STK025	11.95	TA9395B	1.50	TDA10204	2.95		
AN362L	2.50	MC1307P	1.00	STK032	7.95	TA9570	1.95	TDA10205	2.95		
AN612	2.15	MC1310P	1.95	STK078	11.95	TA9800	2.60	TDA11270Q	1.95		
AN632	3.95	MC1327	1.70	STK085	8.95	TA9810	2.50	TDA1327	2.70		
AN7140	3.90	MC1327Q	0.95	STK415	7.95	TA9810G	2.50	TDA20002	1.95		
AN7145	3.90	MC1349P	1.75	STK433	7.95	TA9820	1.10	TDA20003	2.95		
AN7145M	3.95	MC1350P	1.75	STK437	7.95	TA9820C	1.10	TDA20011	1.95		
AN7150	2.95	MC1351P	1.75	STK439	7.95	TA9830	1.10	TDA20020	2.95		
BA521	3.50	MC1356	1.58	STK461	11.50	TA9840	1.25	TDA20030	2.95		
CA1352E	1.75	MC1495	3.00	STK463	11.50	TA9850Q	1.35	TDA20040	2.95		
CA3086	0.48	MC1496	1.75	STK0015	7.95	TA9850Q	1.35	TDA20050	2.95		
CA323E	1.95	MC1723	2.75	STK0039	7.95	TA9860C	1.48	TDA2150	1.95		
CA331EM	2.50	MC1750L	2.75	TA7061AP	1.50	TA9870	1.50	TDA2160	2.50		
CA3140S	2.95	MC14106P	2.95	TA7072	2.65	TA9871	1.50	TDA2251	4.50		
CA3140T	1.15	MC1418CP	2.95	TA7073	3.50	TA9872	2.50	TDA2252	4.50		
CA3140V	1.15	MC1418CP	2.95	TA7073P	3.50	TA9873	1.95	TDA2253	4.50		
CA3140W	1.15	MC1418CP	2.95	TA7109P	3.50	TA9874	1.95	TDA2254	4.50		
CA3140X	1.15	MC1418CP	2.95	TA7120P	3.50	TA9875	1.95	TDA2255	4.50		
CA3140Y	1.15	MC1418CP	2.95	TA7120P	3.50	TA9876	1.95	TDA2256	4.50		
CA3140Z	1.15	MC1418CP	2.95	TA7120P	3.50	TA9877	1.95	TDA2257	4.50		
CA3140AA	1.15	MC1418CP	2.95	TA7120P	3.50	TA9878	1.95	TDA2258	4.50		
CA3140AB	1.15	MC1418CP	2.95	TA7120P	3.50	TA9879	1.95	TDA2259	4.50		
CA3140AC	1.15	MC1418CP	2.95	TA7120P	3.50	TA9880	1.95	TDA2260	4.50		
CA3140AD	1.15	MC1418CP	2.95	TA7120P	3.50	TA9881	1.95	TDA2261	4.50		
CA3140AE	1.15	MC1418CP	2.95	TA7120P	3.50	TA9882	1.95	TDA2262	4.50		
CA3140AF	1.15	MC1418CP	2.95	TA7120P	3.50	TA9883	1.95	TDA2263	4.50		
CA3140AG	1.15	MC1418CP	2.95	TA7120P	3.50	TA9884	1.95	TDA2264	4.50		
CA3140AH	1.15	MC1418CP	2.95	TA7120P	3.50	TA9885	1.95	TDA2265	4.50		
CA3140AI	1.15	MC1418CP	2.95	TA7120P	3.50	TA9886	1.95	TDA2266	4.50		
CA3140AJ	1.15	MC1418CP	2.95	TA7120P	3.50	TA9887	1.95	TDA2267	4.50		
CA3140AK	1.15	MC1418CP	2.95	TA7120P	3.50	TA9888	1.95	TDA2268	4.50		
CA3140AL	1.15	MC1418CP	2.95	TA7120P	3.50	TA9889	1.95	TDA2269	4.50		
CA3140AM	1.15	MC1418CP	2.95	TA7120P	3.50	TA9890	1.95	TDA2270	4.50		
CA3140AN	1.15	MC1418CP	2.95	TA7120P	3.50	TA9891	1.95	TDA2271	4.50		
CA3140AO	1.15	MC1418CP	2.95	TA7120P	3.50	TA9892	1.95	TDA2272	4.50		
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CA3140BD	1.15	MC1418CP	2.95	TA7120P	3.50	TA9907	1.95	TDA2287	4.50		
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CA3140CG	1.15	MC1418CP	2.95	TA7120P	3.50	TA9936	1.95	TDA2316	4.50		
CA3140CH	1.15	MC1418CP	2.95	TA7120P	3.50	TA9937	1.95	TDA2317	4.50		
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CA3140CK	1.15	MC1418CP	2.95	TA7120P	3.50	TA9940	1.95	TDA2320	4.50		
CA3140CL	1.15	MC1418CP	2.95	TA7120P	3.50	TA9941	1.95	TDA2321	4.50		
CA3140CM	1.15	MC1418CP	2.95	TA7120P	3.50	TA9942	1.95	TDA2322	4.50		
CA3140CN	1.15	MC1418CP	2.95	TA7120P	3.50	TA9943	1.95	TDA2323	4.50		
CA3140CO	1.15	MC1418CP	2.95	TA7120P	3.50	TA9944	1.95	TDA2324	4.50		
CA3140CP	1.15	MC1418CP	2.95	TA7120P	3.50	TA9945	1.95	TDA2325	4.50		
CA3140CQ	1.15	MC1418CP	2.95	TA7120P	3.50	TA9946	1.95	TDA2326	4.50		
CA3140CR	1.15	MC1418CP	2.95	TA7120P	3.50	TA9947	1.95	TDA2327	4.50		
CA3140CS	1.15	MC1418CP	2.95	TA712							

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

Installation of the RSGB's new president took place at Ipswich on January 30th. Sir Richard Davies G2XM is the latest to fill this office.

When introducing Sir Richard, the Society's retiring president, Mrs Joan Heathershaw G4CHH said that he had held many notable positions in a busy life and it was an honour for the Society to have him as their 54th president.

In his reply, Sir Richard said that he was much honoured to wear the historic chain of office, especially during the Society's 75th anniversary year. He said he first held an artificial aerial licence in 1934 and obtained his callsign, G2XM, in 1936.

In his address, he outlined the Society's anniversary celebrations scheduled for July. He stressed the importance of the 'Youth into Electronics via Amateur Radio' project and told of the work being done by the Society in this area. He thanked the DTI for its initiative in sponsoring the Young Amateur of the Year Award and for agreeing to issue the GB75 callsign for special event stations associated with the celebrations.

In closing, Sir Richard urged all those present to make every effort to get more people to join the Society, pointing out that more members would mean a stronger society able to provide greater benefits.

Mrs Heathershaw has proved herself to be quite a remarkable advocate for amateur radio during her terms of office. She has been tireless in her attendances at amateur radio functions and the views she has expressed in her addresses on such occasions have been thought-provoking and very appropriate to the problems facing amateur radio.

In her seasonal message, printed in the December issue of *Radio Communication*, she commented on the fact that her year had been mainly devoted to planning for the future. She reminded her readers that 'this is no time for complacency or negative thinking'.

'Throughout the year', she commented, 'we have concentrated our efforts in reorganising the Society's resources to meet the challenges which face amateur radio as we go into the nineties. We are living today in a more competitive world where influence is all important. We need to make more impact on government.'

She followed this train of thought again later in her presidential AGM address. She said that amateur radio had reached a critical stage in its history, not only in Britain but throughout much of the world, and added that the next few years would have a great influence in the future. She said that the result of these years could make the difference between amateur radio being only a '... passing fad in the history of this planet or becoming an important part of modern day life in a world becoming more and more dependent on high technology.'

Mrs Heathershaw went on to say that the rate of increase in the number of amateur radio licences had been slowing down for some time and it appeared that saturation point had been reached. There had been a net increase of only 60 licensed radio amateurs in the UK between July 1986 and July 1987, she said, adding that if the number of amateurs began to decrease, '... then most certainly the writing is on the wall for the future.'

The national society could not argue in favour of new frequency allocations, she continued, and the position might be reached where bands used for decades might be allocated away from the amateur service. She said no one was pretending that allocations would be removed overnight, but it was common knowledge that there were enormous pressures on the radio frequency spectrum and, if the number of licensed amateurs decreased, losses were inevitable.

The full text of Mrs Heathershaw's address can be found in the January 1988 issue of *Radio Communication*.

UoSAT message changes

Those who use the UoSAT satellites will know that for the past few years it has been possible to hear a recorded message telling of orbital predictions and operational data by ringing Guildford 61707 and 61202 for UoSAT 1 and 2 respectively.

A feature of this recorded message has been the very pleasant female voice which gave the message! This voice had remained anonymous until it announced recently '... this message will be the last I shall be giving!' This calamity sparked off enquiries about whose voice it was

and whether there would be recorded message facilities any more.

We are pleased to report that the service will be continued on the same telephone numbers (see above). The presentation of the data has been altered and the voice is now a male one. We found out that the previous attractive female voice was that of Sylvia Tyler of the Information Centre, University of Surrey. She wrote to say she had so much enjoyed recording the UoSAT bulletins, which she had done for the last seven years, and was really sad at having to give it up.

'It has always been a pleasure for me and in a strange way I feel I have made many unseen friends.' She recalled the time when UoSAT 2 went silent just after its launch. 'That was really stressful for everyone concerned, but how pleasurable it was to be able to say, 'It's back!'

Dr Martin Sweeting, director of the project, was in the Himalayas at that time and the message was sent out to him on the BBC World Service that UoSAT 2 was back in operation!

Sylvia is not leaving the university and thus hopes to keep in touch with the satellite team. Many thanks, Sylvia, for the pleasure your bulletin recordings have given your unknown listeners.

Changes have been taking place, too, in relation to the news-sheet, *Space*, produced weekly by the Earth Satellite Research Unit at Aston University in Birmingham. This was edited by Carol Durows and contained much useful data for those interested in the solar cycle, solar data, satellite launches and decays, etc.

In a message entitled *End of Predictions*, dated February 25th, Carol said that, due to the decision to redeploy her within the university, she was leaving the Earth Satellite Research Unit at the end of that week. ESRU's future was still to be resolved at the time of writing and it was feared that *Space* would have to cease publication. She wished all her readers 'a sad goodbye'.

UoSAT C to be built

A third UoSAT-OSCAR spacecraft, UoSAT C, is now being built at the Spacecraft Engineering Research Unit at the University of Surrey in Guildford. Launch facilities have been agreed with NASA on a Delta rocket scheduled for

late 1988, with a 43° inclination, 500km circular orbit.

It will carry engineering, science and communications experiments developed through collaboration between professional engineering and amateur radio communities. These experiments will develop further the mission objectives of UoSAT 1 and 2. The UoSAT programme is intended to complement the AMSAT-OSCAR, RS and FUJI-OSCAR amateur radio communications satellites by providing a space, science and engineering facility readily available to both amateur and professional experimenters.

UoSAT C, like the previous UoSAT missions, will rely heavily on international collaboration – specifically with members of AMSAT-UK, AMSAT-NA in the USA and Canada, VITA, QUADRON, NASA, the British National Space Centre and the European Space Agency.

Another expedition to the Arctic

In addition to the Transpolar Skitrek Expedition, which we have mentioned on previous occasions, another scientific expedition to the North Pole is being carried out, this time by the Polar Universal Natural Science Organisation (PUNS).

In 1986, members of this expedition flew to Ward Hunt Island, located off the north coast of Canada, about 450 miles south of the geographic North Pole. This is a favourite location for explorers setting off on journeys to the North Pole.

During their visit in 1986, they undertook a scientific programme including flora and fauna surveys, meteorological observations and air sampling for evidence of industrial pollution in the Arctic region. Ice sampling was carried out down to 10 metres.

Radio propagation studies were completed using computer predicted optimum working frequency charts provided by Racal Communications, covering radio paths from Europe right down to the Antarctic. Amateur radio operations were achieved by Laurence Howell GM4DMA/VE8 using Racal equipment on all HF amateur bands, supplied from 24 volt batteries charged by two wind generators.

In February this year another expedition was organised, this time to complete PUNS's scientific programme and also to try to reach the North Pole without additional support, supplies or mechanical transport – a distance of about 450 miles.

The members of the expedition this

time are the well-known explorer Sir Ranulph Fiennes, Dr Mike Stroud, Oliver Shepard and Laurence Howell GM4DMA/P/VE8. The latter should be active again on the amateur bands.

At the time of writing, they were due to leave the base camp pulling specially designed sledges en route for the North Pole.

Laurence Howell and his wife Morag, who is also a radio amateur with the callsign GM1ILL, were planning to keep 24-hour radio watches, contacting the ice team on the hour every hour.

Both of them will also undertake as much amateur radio activity as time allows, using SSB and CW on 14MHz and CW on the 10MHz band. It is hoped to use the Russian satellites RS 10 and 11, too. They should be operational until mid-May.

Both Laurence and Morag are qualified marine radio operators and they will be establishing radio links with commercial traffic. In 1986, when they were last operating from Ward Hunt Island, 80 metre nets were frequently heard from early evening onwards, thanks to the very quiet radio conditions in that part of the world. Radio amateurs should have a good time looking for this expedition on the bands.

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ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Yes, it's activity time again! A healthy crop of letters has arrived, so let's dip in and see if your neck of the woods features this time round.

Activity on 70 and 23cm

The first communication is from Henning SM0EKG in Gullholmen, Sweden. He says, 'I am not yet active on ATV, only on SSTV. Fast-scan ATV is not really established in Sweden yet, but hopefully it will grow soon.'

There is more activity in the Oxford area, from where Jeff Jefferies G8PX writes, 'We have been keeping up our local skeds on Tuesday and Thursday evenings; also Sunday mornings on 70cm.'

'As I have no antenna for 23cm I cannot report what is going on, but the odd bit of eavesdropping indicates that Des G3NNG, of Faringdon, has received G4CRJ and some stations in the Midlands on 23cm, and has a transmitter ready to fire up.'

'One new station has appeared on 70cm ATV - Norman G6ASA. He has a good site on Cumnor Hill and obtained a rig and a Sony camera at a bargain price at the RSGB HF rally (Milton Common). At present, he has only one watt, but will soon be running 40 watts from a linear he is fixing up. Phil G6MKK has reappeared, only to go QRT with a blown transistor which should soon be replaced. He has an MM linear, which should increase his power to 30 watts.' Good work in the Oxford region, then, and I hear rumours that studies are still afoot to build a TV repeater in the neighbourhood.

The frozen North

Moving north to Ashton in Makerfield, near Wigan, we have a letter from Mike G1LWX who says, 'Just a few lines to let you know of activity here in the North West. At the present moment, it seems zero in this neck of the woods, although there are quite a few stations down in Stoke working through their local repeater, GB3UD. I must admit that I, myself, have been inactive for 18 months, owing to a move of QTH, plus having been in the throes of obtaining planning permission, etc, for what the XYL calls 'that thing in the garden'.'

'However, I am now back on 70 and 23, and I monitor the calling channel whenever I am in the shack. The line-up for 23 is a home-brew loop yagi, a Camtec pre-amp, a Wood & Douglas front end and VIDIF board, with home-brew sound demodulator. The transmitting side is a Solent 1 watt Tx. It is hoped to up the power, using a BLV93, as soon as funds allow.'

'In spite of being 30-plus miles from

the Stoke repeater, I receive a P4 signal from it and have managed to access it using just 1 watt. Stations worked include G3OGD, G4DVN, G1GST, G3DFL, G4CBW and G1OLX. G1DDA and G4CBW have been worked simplex, with a strength of P5 both ways. So, how about asking for some activity in the North-West? I will help as much as possible. If any station requires info, they can phone (0942) 72015.'

Slow-scan too . . .

Some slow-scan news comes from our regular scribe, Roland G4UKL, down in deepest Cornwall. 'There seems,' he writes, 'to have been a considerable upturn in the number of slow-scanners on the bands. On my screen, during the past five months, have been 79 new European stations, 42 with colour - both line sequential and composite modes.'

'The IVCA European SSTV net has been running since October 11th and, because of his central location, near Lake Constance, DJ0GF both calls the net and regulates the traffic. He does have blind spots and, as he cannot see everything, I act as forward relay, with EA5FIN in La Monga picking up the eastern Mediterranean stations. After a good start, the net encountered some delays, caused by individuals taking too much time discussing their specific problems. Some of these, because of language limitations, were not understood by all and, as a consequence, the transmission and relay of pictures dwindled, as did the number of stations which called in during the following weeks.'

'Secondary problems were the time of the net and finding a frequency in the slow-scan band that was not occupied by CW and R/T stations. The latter is always troublesome: R/T DXers may only faintly hear SSTV signals from distant stations and promptly call CQ DX or tune up. One fact of life the SSTVer soon learns, is that IARU band plans are largely ignored or are not known. Even the RSGB typically gets it wrong. I cannot see how overcrowded bands can sustain the rising level of activity without keeping to the recommended band plans. Some interference is malicious and deliberate, whilst others choose to exercise their right to 'use any part of the frequency allocation they like'. This bloody-mindedness is acceptable, according to them, because the licence 'doesn't mention band plans' and because they 'know their rights'. Perhaps there is a case for including band plan allocations in the RAE syllabus!'

'After this digression, I will now tell you the manner in which the problem is to be solved and the manner in which the

IVCA is to be conducted from now on.

'The net will originate at 1400 GMT, using, as near as possible, 14.23 for the SSTV calling frequency. The recommended working frequency is 14.35, plus or minus. This is to avoid a frequency clash with the North American SSTV net. The first hour of the net will be for the transmission and relay of pictures. The next hour or so will allow technical discussion, questions and experiment. Pictures can also be sent. In this way we hope to satisfy all interests.'

'Regular callers into the net include I1HJP, CT1AKD, DJ1KR, DK3UG, HB9ANT, EA5FIN, SP4KM, SM5EEP, SP1UY, PA3CIZ, G0ALV, LZ1OW, PA3EKI, SP5DDJ, CT1PS, OE1HAB, GW0HWK plus DJ0GF and G4UKL. 'Visitors' include K4TGC, WA2FDL and VO1SA.'

'Robot UK Ltd tell me that they are concentrating more on the commercial side of their activities. Models 450C and 800 have been discontinued, but the Robot 1200C is still currently available. As a matter of interest, the Robot 1200C costs \$1499 in the States and is usually haggled down to \$1350. With 1.48 dollars to the pound, the UK price was £1395: at the time of writing, the exchange rate is 1.83, but the 1200C curiously remains at £1395!'

Hmm, nothing curious about that to my thinking, Roland. Most importers try to justify the one-for-one dollar to pound conversion with the same kind of arguments you would use for selling snow to Eskimos.

. . . and a dissenting view

Mike Stone WB0QCD is extremely concerned about the IVCA's move to 14.35MHz. 'They want to go near the band edge for better protection against interference, but I must differ. 14.230MHz has been recognised (ever since SSTV was agreed on the HF bands) as the place to meet and send ham TV pictures. It has been published in countless articles, journals and handbooks and it would take years to spread the word about any change. Just because the vocal minority wants to see a change, it does not mean that an established practice should be uprooted over a weekend.'

'I have questioned the IVCA SSTV organisation many times and, at the risk of opening up new wounds, I think the motivation behind this issue must be questioned. Once again, the IVCA has failed to seek out the opinions of other SSTVers or SSTV supporting groups (such as the larger USATVS membership). This, as they should know, was a near-fatal blow to such rapid decisions in the past.'

'By the way, this is not the first time the

IVCA has sought such a QSY move. Last time, it got shot down for lack of support. A whole new generation of impressionable SSTVers is now active, none of them able to remember the past. It is fortunate that a few of us old-timers are still active. We do not forget the problems with the IVCA so easily.

Interfering DXers

'Yes, 14.230 is plagued with interfering DXers who do not, and probably will never, respect the beauty of sending visual pictures. Has anyone thought that perhaps, just perhaps, it is the attitude of some SSTVers on QRM responses that infuriates these DX hounds even further? I have been ashamed at some of the language and tactics used on 14.230MHz by a few SSTVers over the years. 14.230MHz has enough daily SSTVers monitoring and operating the frequency to keep it respectfully clear for TV contacts. If a battle begins, use tact, not higher power. Never acknowledge the interfering station, try to explain that SSTVers are huddled in one small area so they don't interfere with other users. Once the culprit realises he is irritating successfully, his ego is inflated.

'The idea that moving clear of 14.230 to 14.35 will make the problems go away and make SSTV 'fun again' is very naive, to say the least. One must ask what happens to 14.230MHz when everyone QSYs to the other end of the band. Someone is ignoring the established phone-patch groups on the high end of the band. Go there and listen some time. I don't think they will tolerate the shrilling SSTV tones of the newcomer any more than the DXers who are already used to it.

'Something else to think about: commercial interests are always chopping off the very end segments of our precious bands. What will happen if that ever takes place on 20 metres? I can tell you the result - 14.230MHz will never be recovered! The fall of 14.230MHz will be the fatal blow to an already hurting SSTV mode. The mode needs more friendliness, fun and companionship, not just a clear frequency. The IVCA attempt to QSY is clearly yet another ill-conceived plan to separate the cliques on SSTV even further.'

Strong words. What do you think? How much clout does the IVCA have? Is it right to take these decisions? Is the situation in Europe comparable? Is the world of SSTV riddled with cliques? Are

SSTVers rude and do they deserve their own fate, or are there too many DX hounds who ought to brush up on band plans? Can 20 metres muddle on, or do we need a wider debate? Should the RSGB get involved?

Drop me a line so I can print your opinion! Do let me have all your activity news at the same time.



Mobile ATV can generate some spectacular transmissions. Marc F3YX has equipped his car with forward and rearward-looking cameras which require no attention while driving. Here, he is sending a driver's eye view on 1255MHz. The inset picture, top left, is being received live on 438.5MHz from F1EDM, near Etretat.

A recent phone call from HC62 (no name known, sorry) in Walton-on-Thames raised the question of aerial polarisation once more: which is more appropriate to the conditions on 934MHz, horizontal or vertical? We have discussed this before several times and, since passions can run quite high on this issue, I must make sure that I don't miss out any viewpoints before stating my own.

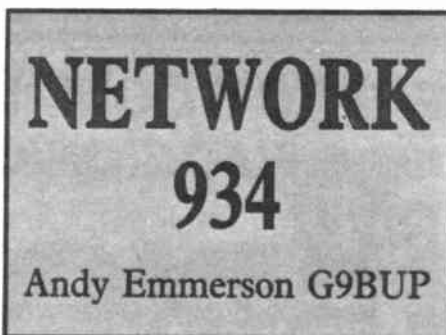
HC62 is a member of the Hampton Court (Surrey) Radio Group and says that last summer he changed his aerials to horizontal polarisation, or flatside as he calls it. Since that time he has received only two calls, from Golders Green and from BH172 in Weybridge, and wonders what can be done to encourage people to go horizontal, either for mobile or homebase use.

He suggests that people could put up three aerials with a remote switch to select a vertical omnidirectional antenna or horizontal and vertical beams, and also that one evening each week people could use vertical polarisation from home.

Retrograde step

Personally, I think that this would destroy the progress we have achieved on 934 and would benefit almost no one, so let's take a closer look at why this is the case.

When we transmit radio waves they leave the antenna in an orderly fashion, guided by the orientation of the metal elements. If those elements are horizontal the signal is said to have horizontal



polarisation and to recover that signal at the receiving end we need to have the second antenna lined up with the same polarisation. Sometimes a slight tilt or twist gets a marginally better signal; this is because radio signals can undergo a degree of shift or local reflection, but generally this rule holds good.

Theory . . .

Radio theory says that horizontal polarisation has the advantage over vertical polarisation at VHF and UHF; obstructions such as hills and buildings seem to have less influence on horizontally polarised transmissions, while interfering signals (poorly suppressed car and motorcycle ignition systems, for instance) tend to be vertically polarised.

Furthermore, the objects which tend to absorb and reflect radio signals locally are also vertically polarised; things like trees, lamp posts and even the mounting poles for antennas. It is for this reason that broadcast television and FM radio

use horizontal polarisation in most countries, to minimise signal loss through absorption and interference.

At 934MHz all these arguments still hold good; the advantages of horizontal polarisation are pretty marginal but real, especially on ultra long distance contacts, as Mike Devereux (TC01) has demonstrated. Furthermore, what interference does exist on 934MHz - from cellular radio - is vertically polarised. All this should add up to a convincing argument for selecting nothing but horizontal polarisation, so why do most people use vertical? Is it technical ignorance or perversity?

. . . and practice

It is, in fact, common sense and a recognition of reality. A lot of 934MHz operation is by mobile stations and it is a fact of life (and science) that it is easier to design and make gain antennas which are vertically polarised. In other words, if you want to transmit with horizontal polarisation from a vehicle, you don't have a wide choice of aerials.

If you use a yagi beam you would have to have an assistant to continually change its direction to keep in touch with the mobile or base station you were talking to - not a very practical solution!

OK, you say, aren't there any omnidirectional antennas with horizontal polarisation? What about halos? Well, they have next to no gain and, anyway, nobody makes them for 934MHz. No, the sad fact is that there is no miracle flatside antenna suitable for mobile use.

What about base stations? Couldn't they use horizontal polarisation? They could but, accepting that mobiles have to use vertical polarisation and that all existing homebase stations also use this, why set yourself apart from the rest of the scene? Again, there are no convenient omnidirectional gain antennas for horizontal polarisation, so you are stuck with a beam pointing in one direction only. You are then doomed to missing nearly all calls because they will be coming in from directions other than that to which you are beaming. The whole idea of a beam is to concentrate all your gain in one particular direction, but that also means you can't eavesdrop on the band in general.

Vertical polarisation fans, on the other hand, have the ideal solution. They can use a collinear 'stick' for all-round listening and then swap to the beam to bring the DX station in more loudly. However, by remaining with vertical polarisation, you doom yourself to sticking with a tiny minority of stations.

They had exactly the same polarisation battles on amateur radio in the past, but in the end the majority won. I therefore cannot possibly support a changeover to horizontal on 934MHz and I hope you now understand why.

Activity in Essex

Our regular scribe, Mick Miller UK569, sends news of the Essex area group of the 934MHz Club UK. On 5th February the group was invited along to the Southend and District Amateur Radio Society to give a talk and promote the 934 band (what a good idea!).

The chairman of our group, Frank Glendenning UK016, was elected to do the talking and was introduced to those attending by Steve UK017/G1GXP. The evening was a great success, with a good turnout, and Frank answered many questions at the end ranging from antenna polarisation to operating procedure.

Some of those attending said that they wouldn't mind using the band but were not happy about the high cost of 934 equipment. The chairman of the Southend ARS, Colin G4YPW, was pleased that some of the members already used the band and agreed with them that the standard of operation in our area was high.

He then invited any member of the 934 Club UK who would like to attend any of the society's meetings to join them at the Roachway Centre, Rochford on Friday evenings. He also said that the society would be pleased to attend our (the 934

Club UK) mobile rally with demonstration stations, as they did last year, which brings me to my next plug!

Our fourth mobile rally will be held on Sunday, 21st August at Brentwood, Essex. To get there, come off the A127 onto the A128 towards Brentwood and follow the signs. It will be in a field behind the Halfway House (which faces on to the A127) and just before the Thorndon Park Country Club. All are welcome. Hot dogs and ice creams will be available on site, with a Little Chef and a pub the length of a few G5RVs away!

Special event station, GB0NTF, should be operating HF packet radio and on two metres, thanks to the Southend ARS. Any more information on the above can be obtained from Steve Blinkhorn, 102 Lord Roberts Avenue, Leigh on Sea, Essex.

We have also just confirmed a 934MHz talk and demo for the Barking Amateur Radio Club on 10th June - what a busy little group we are!

I couldn't agree more. The link-up with amateur radio clubs has got to be a good idea; united we stand, divided we fall. However, I cannot believe that Essex is the only county where organised 934 activity goes on, so let me know about your goings on, too.

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VP138	20	Assorted LED Displays, Our mix, with data	£5.00	VP298	3	MC1310P Stereo Decoder, 14 pin DIL	£2.00	VP254	1	25g Etchant Granules (Ferric Chloride) makes 1/2 pint	£1.00
VP147	1	Pair Opto Coupled Modules	£0.60	VP299	3	CA3065 Pos. Volt. Regulator, 1.7v-46v, 8 pin T05	£2.00	VP255	1	Etching Pen. Etch resistant. Spare tip. Blue	£1.00
VP199	4	LD707R LED Displays, CA	£1.00	VP400	1	27128 128K Eprom	£2.50	VP258	1	Multicore Solder, 5m total 10 and 22 SWG	£1.00
VP203	15	Triangular shape LED's, mixed colours	£1.00	VP401	2	LM317T Adjust. Voltage Regulator, 1.5A	£1.00	VP259	1	PCB Holder. Fully adjustable from 0-320mm wide and to any angle. Complete with iron stand and sponge. Strong metal construction with rubber feet. Very high quality	£15.00
VP204	10	Large Green LED's, 5mm	£1.00	VP402	1	2114 4K Static Ram	£2.00	VP286	2	25g Resist PCB Transfer Sheets, Assl. symbols/lines	£1.00
VP205	10	Small Green LED's, 3mm	£1.00	VP404	1	TA7204 Audio Amp I.C. 4.2w, 13v, 2-4 ohms	£2.00	VP405	2	Steel Rules 1 x 4", 1 x 4", measuring ins and mm	£1.00
VP206	10	Large Yellow LED's, 5mm	£1.00	VP432	8	CD4016B	£2.00	VP406	1	Junior Hack Saw & 3 blades + hobby knife & 2 blades	£1.00
VP207	10	Small Yellow LED's, 3mm	£1.00	VP433	6	CD4017B	£2.00	VP407	1	10 Piece Needle File Set	£3.00
VP208	10	Large LED's clear showing Red, 2"	£1.00	VP434	10	CD4024B	£2.00	VP408	1	4 Piece Stainless Steel Tweezer Set	£4.00
VP241	2	ORP12 Light Dependant Resistor	£1.50	VP435	10	CD4028B	£2.00	VP409	1	Set of 4 min. low cost Side & End Cutters, snipe & combination Pliers 5" insul. handles	£4.50
VP242	3	Tri-colour LED's, 5mm dia., 5mA 2v, R.G.Y	£1.00	VP7413	4	7413 Dual NAND Schmitt Trigger, 4-input	£1.00				
VP243	3	Tri-colour LED's, Rectangular 5mm, R.G.Y	£1.00	VP7440	4	7440 Dual 4-input, Positive-Nand Buffer	£1.00				
VP246	10	Orange LED's, 5mm large	£1.00	VP7470	4	7470 And-gated Positive-edge-triggered Flip-Flop w/IN preset	£1.00				
VP267	8	Stackable LED's, Rectangular, mixed, R.G.Y	£1.00	VP7480	4	7480 Gated full Adder	£1.00				
VP266	15	LED Panel Mounting Clips, metal and plastic, 3-5mm	£1.00	VP7481	4	7481 16-bit Random Access memories	£1.00				
VP269	2	Red Flashing LED's, 5mm	£1.00	VP7484	4	7484 Decade Counter	£1.00				
VP284	2	Opto-Isolator IL74-4N27, single	£1.00	VP7491	4	7491 8-Bit Shift Register	£1.00				
VP285	1	Dual Opton-Isolator ILD74	£1.00								

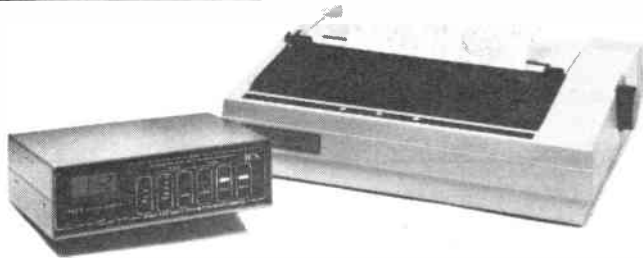
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As a general coverage receiver costs between £500 and £800 new, any short wave listener or radio amateur needs to be very dedicated or very rich to consider purchasing such an item without first having some idea that he or she is going to get full benefit from the investment. If one is prepared to accept a number of limitations, a simple receiver can be built for tens rather than hundreds of pounds and with fewer disadvantages than the price might suggest. All communications receivers are complicated devices using multiple frequency translations to isolate the required signal from the multitude in the band of interest. If we limit ourselves to a single frequency band and use the technique of direct conversion then, with a couple of ICs and five transistors, we can build a receiver that will easily allow us to hear stations from all over the world.

Of the many bands available, the 20 metre band was chosen as it is the most popular of the intercontinental communication bands whilst still being low enough in frequency to allow simple oscillator designs to be used. This band, however, is not open for 24 hours a day and listening will be restricted during the low part of the sunspot cycle. The design can be modified to receive the lower amateur bands by changing the oscillator and RF tuned circuits. Few other alterations are necessary.

Direct conversion

In the communications receiver (Figure 1) the incoming RF is mixed with a variable first oscillator signal to generate a fixed first intermediate frequency which in older receivers was about 1.6MHz. A high first IF allows for good second channel rejection, but gives low selectivity for adjacent signals unless very narrow and hence expensive

filters are used. The easier option is to drop the high first IF to a lower second IF by a second mixer stage and use the selectivity of the low intermediate frequency amplifier to reject the adjacent channels.

Direct conversion overcomes the cost and complexity problems of this type of receiver because the incoming RF is directly converted to an audio signal and we use a selective AF filter followed by a high gain AF amplifier to give a signal we can hear.

To examine direct conversion let us look at an incoming upper sideband (USB) signal that would have had a 14.200MHz carrier if this were not removed prior to transmission (see Figure 2a.) In the direct conversion receiver we mix the band of signal frequencies with a stable signal of 14,200,000Hz generated within the receiver. In the mixer the sum and difference frequencies are generated and the difference, which is an AF signal, is filtered out from the remaining frequencies which are all radio frequencies. It is reasonably easy and cheap to make a highly selective AF filter

Consider the situation with a CW signal, shown in Figure 2b. If the incoming signal is at 14.100MHz then an oscillator at either 14.099 or 14.101MHz, both differing from the incoming signal by 1kHz, will resolve the CW signal. Thus the CW signal will appear twice in the tuning range of the direct conversion receiver. With a sideband signal a very interesting effect occurs (see Figure 2c.)

Returning to our USB signal with the missing carrier at 14.2MHz; if the receiver's oscillator runs at 14.2MHz then the signal is resolved correctly, but consider what happens when the oscillator is at 14,203,300Hz. The USB has the higher RF signal frequencies with higher AF frequencies, but with the oscillator at 14,203,300Hz the incoming RF is treated as an LSB and the higher RF frequencies become the lower AF frequencies. Although the signal is resolved and the bandwidth of the receiver is twice the audio amplifier bandwidth, the frequency inversion makes it impossible to understand what is being said. This is apparently a serious disadvantage but, in practice, your ears tend to select the intelligible sounds and

20m Direct Conversion

from a number of capacitors and inductors, as this is a lowpass filter with a high cut-off rate above 3kHz. These principles of reception are also true for LSB and CW signals. If the oscillator is only slightly away from the correct frequency then the signal will still be resolved, but the audio tone will be higher or lower depending on the difference.

ignore the other noises, so the direct conversion receiver gives astounding results considering its low cost and simplicity.

The receiver shown in Figure 4 is based on the block diagram of Figure 3. In this unit most of the gain comes in the AF amplifier, not like a normal communications receiver where most of the gain comes in the IF amplifier. The

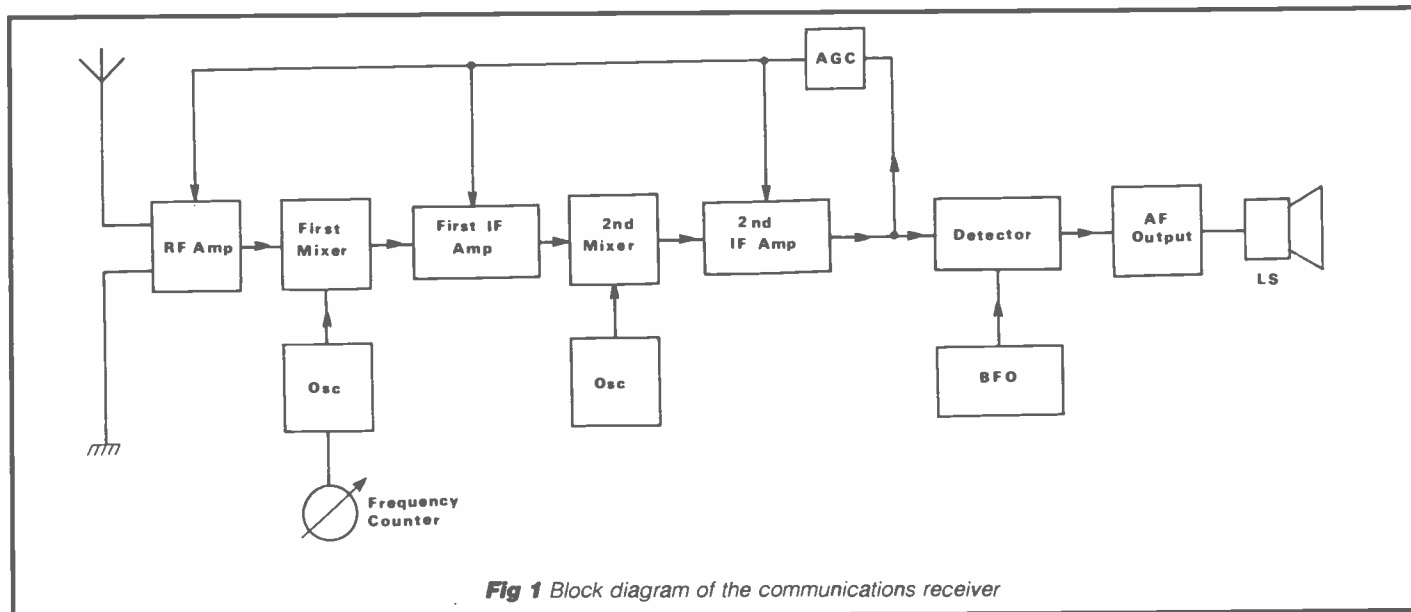


Fig 1 Block diagram of the communications receiver

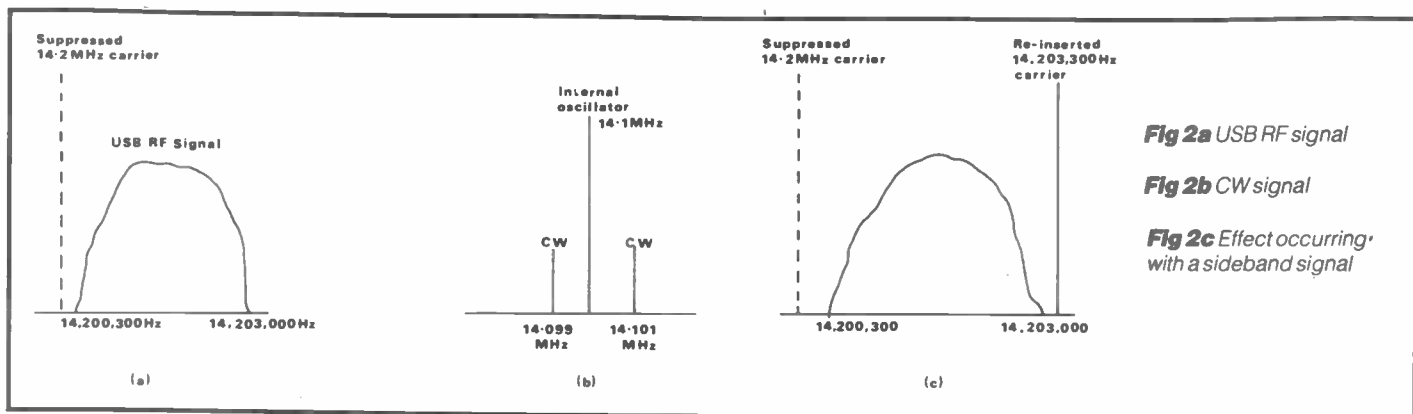


Fig 2a USB RF signal

Fig 2b CW signal

Fig 2c Effect occurring with a sideband signal

output was designed for Walkman type headphones to prevent annoying the rest of the family.

Local oscillator

The essential item of the receiver is the 14MHz local oscillator, which must be stable when set but variable over the band of frequencies we wish to receive, 14,000 to 14.350MHz in this case. I did not like the idea of having to make the necessary inductors, so all of the coils

primary coil. Although an MPF102 FET is given in the components list, many RF FETs can be used and during development the 2SK55 and BF245 gave outputs identical to the MPF102. The only point to note with these other FETs is that, compared with the MPF102, the pin layout of the package is reversed and the device will need to be turned round the opposite way from Tr1 in Figure 5.

The primary of L1 is tuned to resonate in the 14MHz band by the parallel

single varicap is used than a problem occurs because its capacitance varies as the oscillator operates, since the varicap's capacitance varies as its bias varies. To overcome this, the oscillator uses the back to back common cathode varicap pair in a single TO92 package, in which as one diode loses bias the other receives extra bias and the capacitance remains stable.

Another problem is that both diodes must be held in reverse bias even though the anode voltage at the upper end, connected to the coil, will be varying at the 14MHz frequency. This is overcome by making the central bias voltage higher than the peak RF voltage at the top end of the coil. The bias voltage is derived from the portion of the output voltage of the 8V regulator IC1 selected by the potential divider, consisting of the ten turn potentiometer Vr1 and resistor R1. A ten turn pot, though costly, was chosen because the indicating dial used with this type of pot can normally be directly calibrated in frequency. There is no

Receiver by David Silvester

are chosen from the Toko range.

The local oscillator consists of L1 and Tr1 with the associated circuitry of a fairly standard Clapp oscillator. D1 and R23 provide bias for the FET and the feedback occurs through a tap on the

capacitors C4, C5 and the variable capacitance diode pair (varicap for short) IC2. The capacitance of the varicap diode pair needs only to vary over 1pF to obtain the full output frequency range of the receiver. If a

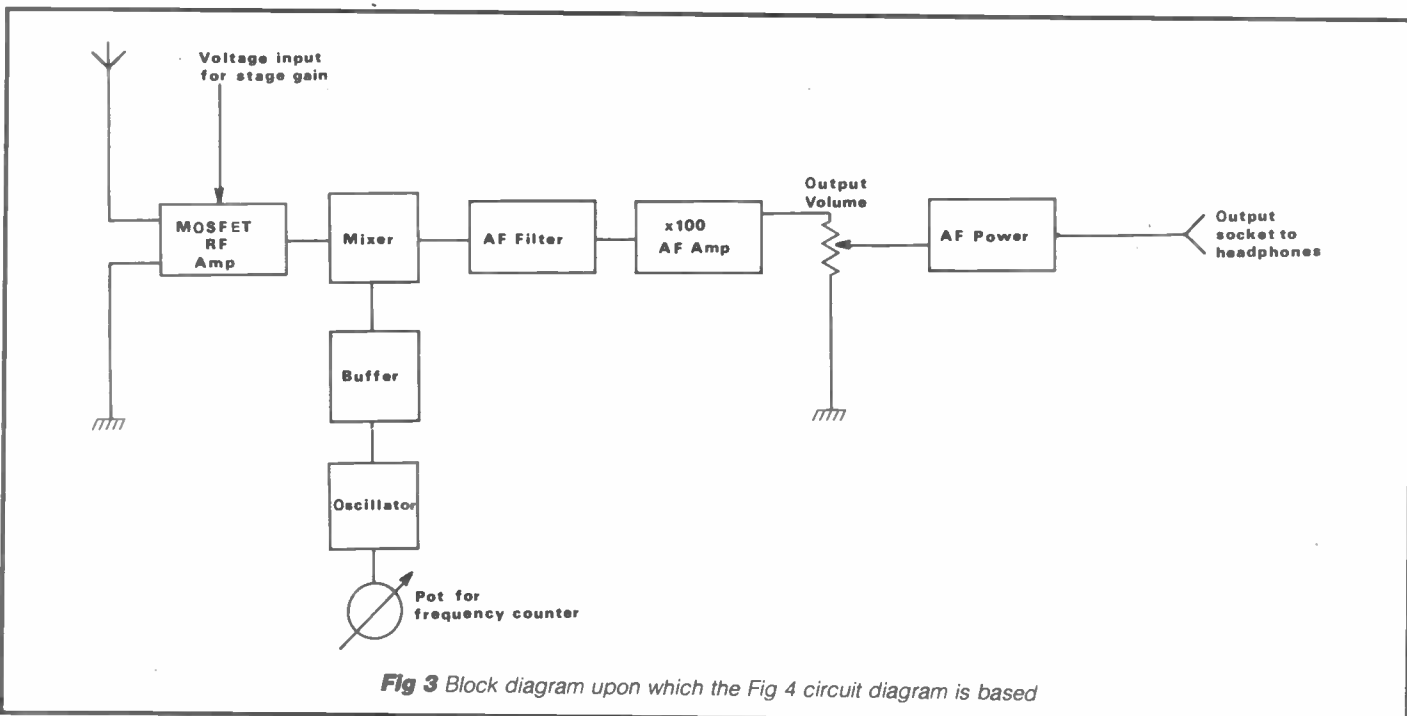


Fig 3 Block diagram upon which the Fig 4 circuit diagram is based

20 METRE RECEIVER

reason why the cheaper tuning option of two pots, one providing the rough band position and a second giving the fine tune, cannot be used if cost is a serious problem.

Capacitors C1, C2 and C3 provide stability for the tuning voltage and prevent the oscillator signal feeding back into the voltage stabiliser. R4 and C8 isolate the oscillator signal from the power supply at 12V.

The second stage consists of a buffer amplifier to prevent loading of the oscillator and to give the necessary injection voltage to gate 2 of the dual gate mixer Tr5. This consists of two transistors, with Tr2 providing the necessary gain and Tr3 as the emitter follower buffer. Tr2 is fed from a second winding on L1; base bias for the transistor Tr2 comes from R3 and R24 through the winding. Tr2's emitter dc bias comes from R6, but negative feedback to stabilise the stage gain is generated by the parallel resistance of R6 and R5, since at radio frequencies the impedance of C9 can be ignored. R8, C10 and C11 isolate the buffer stage from the supply rail. The output from the buffer is 5V peak to peak and passes to the mixer stage via capacitor C12.

RF circuit

The RF circuit consists of the 14MHz tuned amplifier and the mixer. The RF amplifier has been included to prevent any possibility of the oscillator signal feeding back to the antenna system and being radiated. Both circuits use dual

gate MOSFET transistors. Though 3SK85s were used as they are inexpensive, a number of different MOSFETs, such as the 3N201 and 40673, will also be suitable. All of these MOSFETs contain gate protection diodes for ease of handling but, if available in the junk box, the older unprotected types, eg 3N140, can be substituted if extreme care is taken when soldering them. The RF amplifier Tr4 is connected to the antenna via the tuned transformer L2. R10 sets the dc bias for Tr4's source whilst C15 holds the source at ac ground. The tuned transformer L3 forms the load for the amplifier.

The second gate of the MOSFET is connected to a variable bias voltage derived from the same 8V stable supply that feeds the oscillator tuning. Varying this bias voltage alters the transconductance of the MOSFET and this alters the gain of the amplifier stage. This gain control is used to prevent overload of the mixer stage and the first AF amplifier.

The second winding on L3 passes the amplified antenna signal to gate 1 of the mixer stage and also provides its dc bias. In the mixer, the bias for gate 2 is held at the same dc potential as the source via R11. R12 sets the dc bias for the mixer and C20 and C21 hold the mixer's source at ac ground. In the mixer, a series of frequencies are generated of which only the AF signal is used. R13 is the load for the mixer with the usual stage isolating components, R14 and C23. The capacitor

C22 shorts to ground any RF components at the drain of the mixer, and C24 and R25 pass the audio signal to the AF filter.

AF filter and amplifiers

The AF filter consists of L4, L5 and C25 to C29. This stage is a lowpass filter with a high cut-off rate above 3kHz to attenuate signals outside the normal SSB transmission frequencies. This does lead to the possible reception of more than one CW signal if they are closely spaced, but it was felt that most users would be listening to SSB transmissions and the filter was fixed at the lowpass filter shown. C30 working into the 2k2 input impedance of the first AF amplifier gives the low frequency 3dB cut-off to the band at about 600Hz but, due to the low rate of attenuation with frequency of the resistor capacitor filter, this cut-off point is adequate for SSB reception.

The AF amplifier has two stages, a simple inverting op amp biased for use with a single power supply and a dedicated low power amplifier. The first stage is a standard circuit with an input impedance of 2k2 ohms defined by R15 and a voltage gain of 100 (equivalent to 20dB) set by the feedback resistor R18.

As the receiver only has a single power supply of 12V, the non-inverting input to the op amp has to be held at about 6V to put the op amp into its linear operating region. This voltage is provided by R16 and R17 with C31 to remove any ac from the op amp input. The capacitor C33 removes the dc offset at the output of IC3 and passes the AF signal to the volume

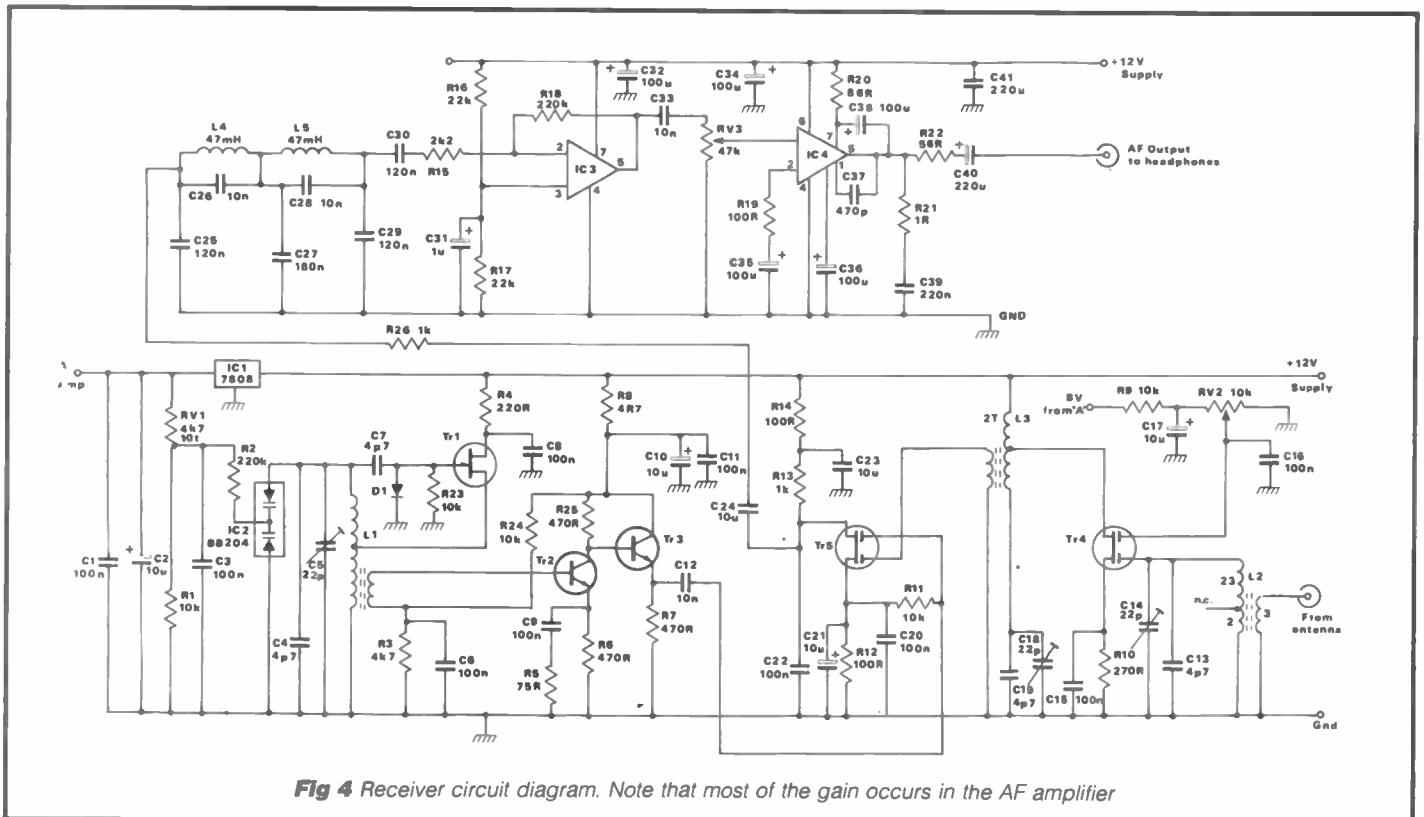


Fig 4 Receiver circuit diagram. Note that most of the gain occurs in the AF amplifier

control Vr3 and on to the power amplifier IC4. This stage has a voltage gain of 35dB and a theoretical power output of 2 watts but, for use with headphones, the load consists of resistor R22 in series with the headphones to cut down the volume.

With the stereo headphones, the two earpieces are connected in parallel to give a load impedance of 4 ohms. C40 isolates the dc on the output of the power IC from the headphones. To ensure stability, all of the ICs in the AF amplifier have capacitors across their supply pins and the input also has a noise rejection capacitor, C41.

Construction

The whole circuit, except for the three potentiometers, is mounted on a single PCB, shown in *Figure 5*. This board has the lower surface etched to form a track pattern and the upper surface left as a solid ground plane. When making the board, the lower surface will be exposed, developed and etched as usual but the upper surface will need to be kept covered to prevent any removal of the copper layer. In the final stage of PCB production, holes will be drilled through all of the pads of the lower surface; a 1mm drill seems the best size for this operation. Next, solder in the four through-board connections, shown in *Figure 5* by the circled crosses. Lastly, all the remaining holes on the upper surface must be deburred and a small area around each hole must be removed to prevent the component leads that pass through the board shorting to the ground plane. Either a small drill or a Veroboard spot face cutter can be used for this purpose.

In many cases the components have one end soldered to the upper ground plane and not to the track surface of the board. Those components that have their ends connected to the upper ground plane have an X on the end soldered to the upper surface (*Figure 5*). Some coils and the dual in-line ICs need to be connected to ground, so their ground pin is soldered to a pad on the lower surface of the board, then a second through-board connection is made.

Care needs to be exercised when building the PCB, as the components are tightly packed in some areas. The ground plane is a good conductor of heat as well as electricity and a fairly large soldering iron needs to be used if joints to the ground plane are to be successful. If a large soldering iron is used to solder the small pads on the lower surface, care must be taken to avoid damaging them. The two dual in-line ICs were soldered onto the board, instead of using sockets, as board mounting is advantageous with inexpensive ICs like these.

The only components not on the board are the three potentiometers. The pots Vr1 and Vr2 only carry dc signals, the RF components being shorted to ground by

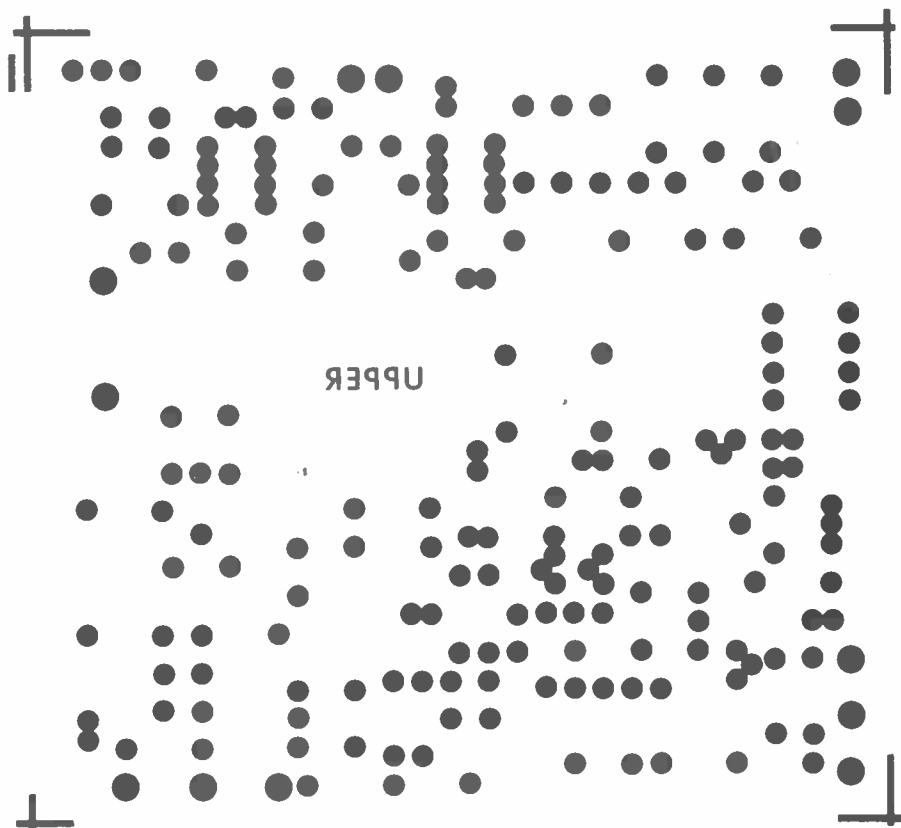


Fig 5 PCB, upper surface. This is left as a solid ground plane

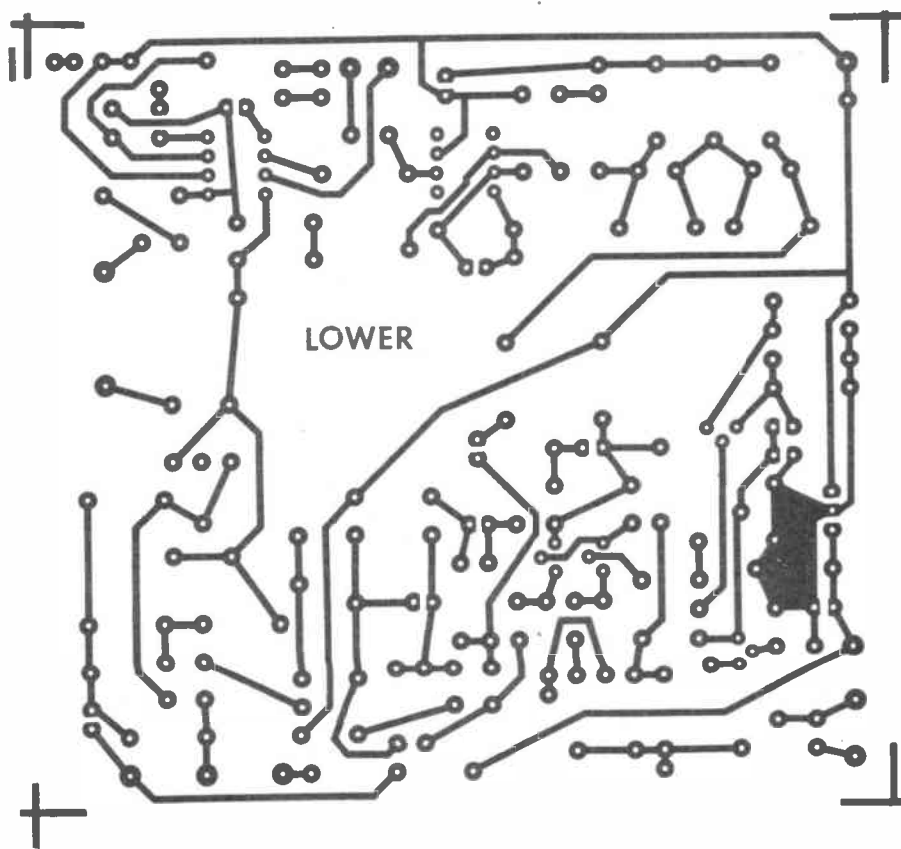
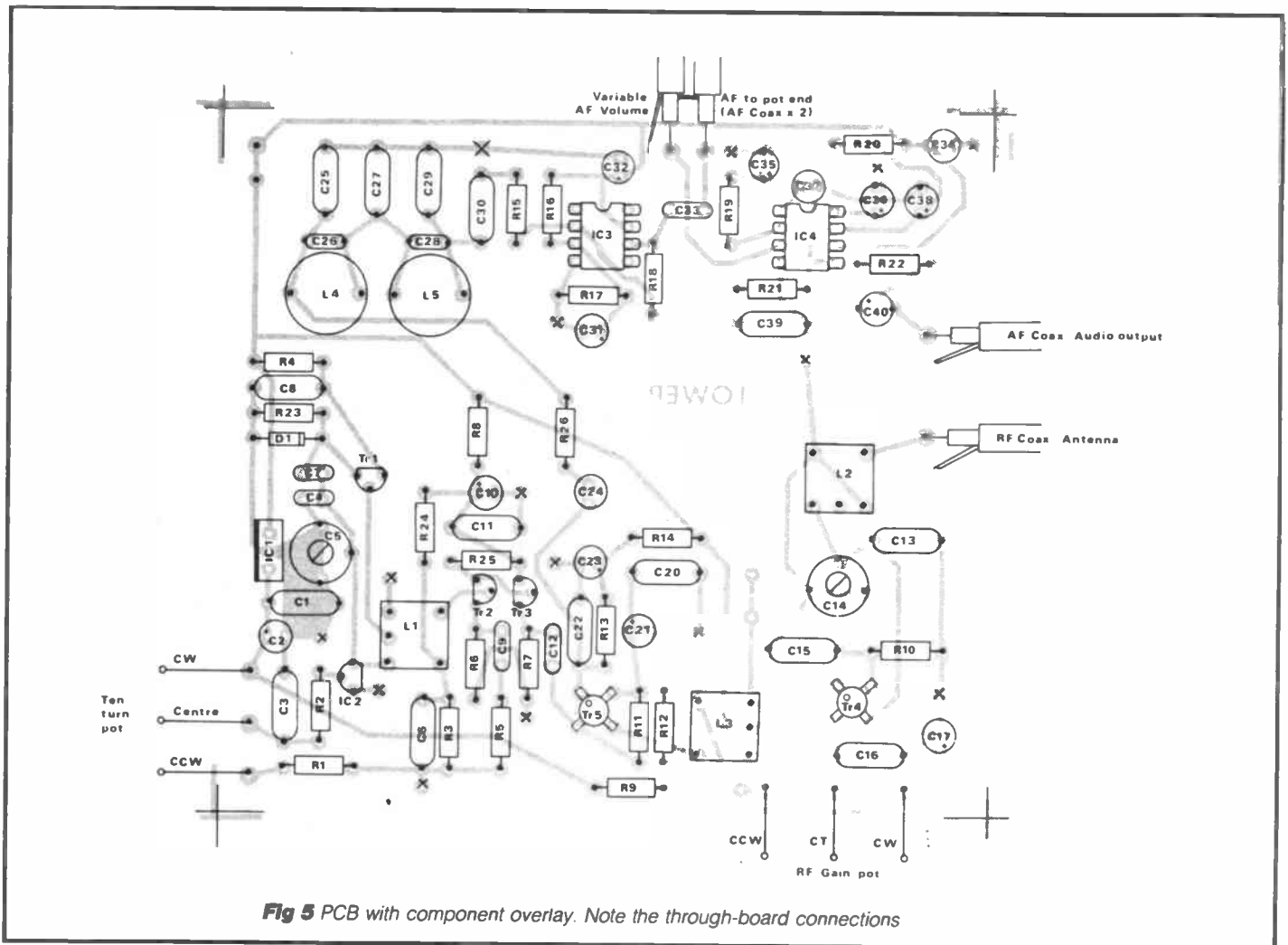


Fig 5 Track pattern for the PCB

20 METRE RECEIVER



the capacitors connected across. These two pots are connected to the PCB by single strand hook-up wire. The third pot Vr3 carries AF signals and is connected to the PCB with audio co-ax cable for screening. Only one of the co-ax screens is connected to the pot, otherwise an earth loop could be introduced. The other section of co-ax has the screen cut back and only the central core is connected.

The antenna connection uses a short length of UR43 or similar 50 ohm RF co-ax, to prevent pick-up from the oscillator, and the audio output also uses a piece of audio co-ax. In all cases where a wire leaves the board, the wire or central conductor passes through the board and is soldered to a pad on the lower surface. In the case of the co-ax cables, the outer conductor is soldered to the upper surface of the board. Using these co-ax cables, the receiver's off board layout is not critical, although it is advantageous to route the antenna input away from the oscillator.

The board, pots and input sockets for the antenna, the 12V power supply and the headphone socket are all fixed into the box. A circular area around each

mounting hole for the board needs to be solder tinned to ensure that the ground plane securely connects to the case via the mounting bolts and metallic standoffs.

The live tracks on the underside become sandwiched between the box and the ground plane, although strict attention must be paid to ensure that none of the lower surface connections touch the box. The pots are connected so that a clockwise rotation of the knob increases frequency or audio output. The clockwise end of Vr1 connects to the pad going to C1 and C2, the Vr2 clockwise end to the pad to R9 and C17 and the clockwise end of Vr3 to the pad to C33, otherwise the controls will not work in the expected manner and the rig will be difficult to use.

I have always found it best to split the screen of the RF co-ax into two tails and attach them to two tags fixed to the co-ax socket's mounting bolts. The choice of audio output socket will depend on the plug fitted to the headphones. Rather than replace this plug a mating socket of the correct size can be used, but the two terminals that carry the different signals in a stereo signal will be connected

together at the socket. The 12V power input may be either by way of wires and a grommet or one of the 'power plugs', depending on the constructor's preference. Two types of ten turn pot are suitable, either a round dial scaled from 0 to 100 and a number in a window which varies between 0 and 9, or a larger dial mechanism with a direct readout. Round dial types have large control knobs which ease the tuning but are more complicated to read.

Direct readout types have a smaller tuning knob. Construction should cause no problems, but the usual care should be taken, especially over the connections to the ground plane as there is no indication of the correct position for the component from the holes alone.

Aligning the rig

The ease of setting up the rig depends on the amount of equipment available. The rig is designed to work from a 12V power pack, normally intended for powering CB and low power amateur rigs, with an actual output voltage of about 13.6V. Although the aluminium box used to house the receiver is a good electrical screen, it does not give any

magnetic shielding and the magnetic field in the 12V power supply can couple to the two inductors L4 and L5, giving a very distorted audio output. The separation only needs to be a few inches with the PSU on the side away from the inductors.


All three of the variable capacitors are initially set to a central position and the potentiometer Vr1 is set so that the voltage at the end of R2 is 8V. This should be at the fully clockwise end of Vr1 if the pot has been installed correctly, and equates to an oscillator frequency of about 14.4MHz. If an oscilloscope is available, connect this to the emitter of Tr3 then adjust the core of L1 until the peak to peak voltage at the emitter is 5V. Ignore the frequency at this stage. Finally, the frequency can be set close to 14.4MHz using C5.

A digital frequency meter (DFM) is most helpful in setting the frequency range of the oscillator and in calibrating the receiver, but this can be carried out with the help of someone who has a communications receiver. Check with the DFM or the communications receiver that the new rig will tune over the range 14.0 to 14.4MHz and, if required, calibrate the ten turn tuning pot.

If no scope is available, the core of L1 can be set to the correct frequency with C5 left in the central position and the oscillator output will be sufficiently correct for the purpose. Once the oscillator is set, aligning the rest of the receiver is simply a case of adjusting either the cores of the remaining inductors or the capacitors C14 and C18 for the maximum audio signal. This signal may be either an off air transmission or a low level output from a signal generator or grid dip oscillator.

True alignment of the receiver requires a crystal calibrator to calibrate the ten turn pot dial in terms of frequency. Without this item, the only option is to use off air signals to try to find the amateur band, although this will take some time.

Setting up the antenna

I set up a long wire strung from an upstairs window to a post on the end of the garden fence, with the feed wire coming through a small hole in the downstairs window frame near to the receiver. This inverted L antenna needs a good ground connection, and consists of a 3ft section of copper pipe hammered into the ground and an earth cable passing through the same hole as the antenna feeder. With this cheap aerial I have so far heard many countries in Europe, plus North and South America, which should please amateurs or short wave listeners used to more sophisticated equipment. Moreover, this rig gains its fascination not only because it performs well and is inexpensive, but also because you built it yourself. 

Parts List

Resistors (all 250mW 1 or 5% carbon or metal film)

R1,9,11,23,24	10k
R2,18	220k
R3	4k7
R4	220R
R5	75R
R6,7,25	470R
R8	4R7
R10	270R
R12,14,19	100R
R13,26	1k0
R15	2k2
R16,17	22k
R20,22	56R
R21	1R0
Vr1	4k7 ten turn
Vr2	10k linear
Vr3	47k log

Capacitors

C1,3,6,8,9,11,15,16,20,22	0.1µF ceramic
C2,10,17,21,23,24	10µF 16V electrolytic
C4,7,13,19	4.7pF ceramic
C5,14,18	2 to 22pF trimmer rotary type
C12	0.01µF ceramic
C25,29,30	120nF polyester
C26,28,33	10nF polyester
C27	180nF polyester
C31	1µF 63V electrolytic
C32,34,35,36,38	100µF 16V electrolytic
C37	470pF ceramic
C39	220nF polyester
C40,41	220µF 16V electrolytic

Semiconductors

IC1	78L08 8V regulator
IC2	BB204 dual varicap
IC3	LF351 or TL071 FET input op amp
IC4	TBA820M
Tr1	MPF102 (see text for suitable alternatives)
Tr2,3	BC547 or any plastic or metal cased equivalent
Tr4,5	3SK85 (see text for suitable alternatives)

Inductors

L1	Toko KANK3334R
L2,3	Toko KANK3337R
L4,5	Toko 181LY473

Miscellaneous

Ten turn pot indicator knob
Knobs for RF and AF volume controls
Diecast aluminium box, 190x110x60
RF input socket, either BNC or SO239
Walkman type headphones and suitable stereo jack socket
Power input socket
Short lengths of UR43 RF co-ax and audio co-ax cables, in addition to some lengths of hook-up wire and ¼ inch standoffs

If you have any queries about constructional articles, contact us at the editorial address on page 3.

This article describes a very simple mains driven amplifier which has been especially designed for use with the Poor Man's Receiver, described in the December 1987 issue, and the Simple AM/FM Tuning Head, described in the April 1988 issue. The total cost of the amplifier, power pack and speaker, all mounted in a case, should not exceed about £12. If the amplifier is used with the Poor Man's Receiver, it will require an extra output jack to the receiver, wired across the large winding of the output transformer.

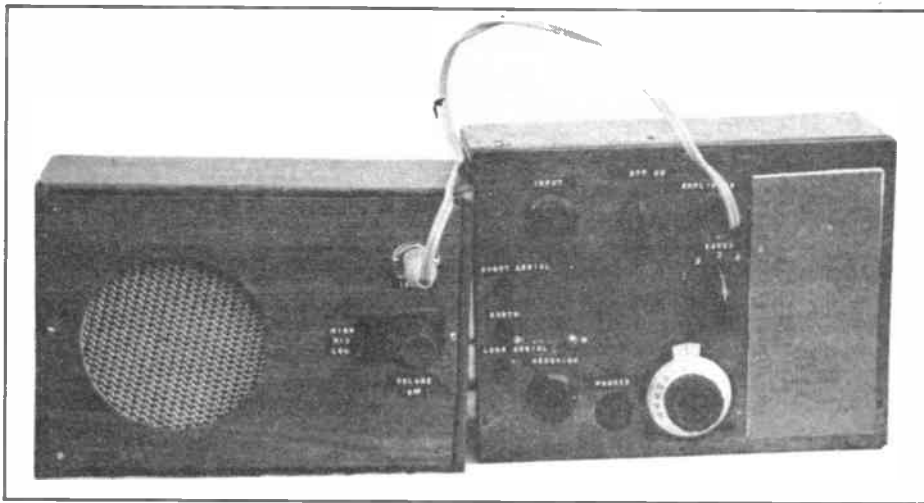
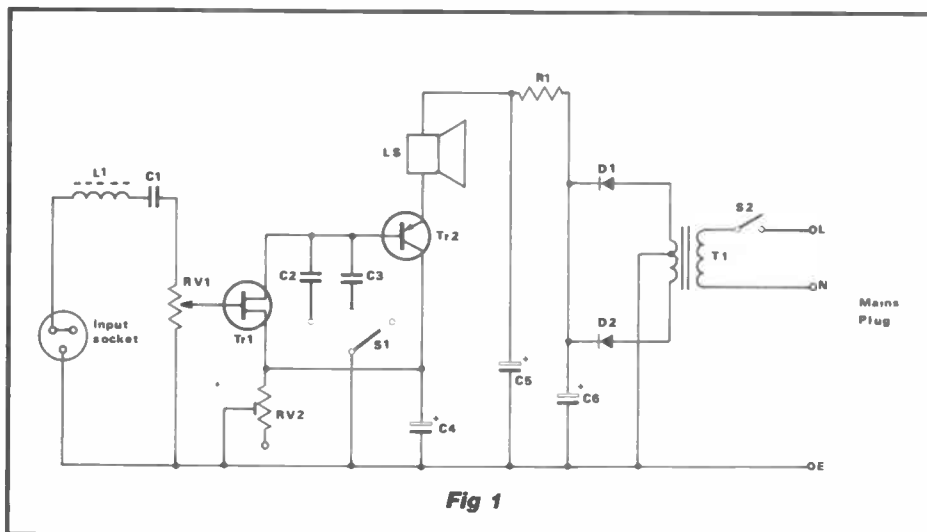
Figure 1 shows the circuit. The output from the feeder unit is applied through L1 and C1. L1 filters out any residual VHF currents which can cause problems if they are present. C1 isolates the volume control, RV1 and the gate of the FET transistor Tr1. The output of the FET is directly coupled to the input of the power transistor Tr2, a germanium PNP device. This form of coupling allows maximum signal strength.

RV2 selects the correct bias for Tr2 and, because there is a large negative feedback voltage, it ensures absolute stability. If Tr2 tends to draw more current, the voltage across RV2 increases. This reduces the current through Tr1 and reduces the bias voltage at Tr2.

C4 prevents unwanted negative feedback of the signal. The common collector connection of Tr2 gives 100% negative voltage feedback, though it still allows power amplification.

Full wave rectification takes place through D1 and D2, providing ample smoothing in conjunction with R1. RV2 must be a proper volume control potentiometer. A preset device would run much too hot and might burn out.

Tone control is provided by S1 in conjunction with C2 and C3. The specified switch has three contacts, so that the capacitors can be arranged to give progressive treble cut as the knob is moved from top to bottom. Some constructors might choose the much more common 'centre off' type of slide switch which has no contact for the off position. In this case, the two capacitors will have to be wired to give treble cut on either side of the central position of maximum treble response.



The amplifier in use with the Poor Man's Receiver

POOR MAN'S

Sir Douglas Hall
complement his
described in

The speaker should be connected so that direct current through it causes the cone to move outwards a little. The right way can be found by experimenting before the speaker is screwed into place. Although these excellent speakers have one terminal marked with a red line, there appears to be no consistency about which terminal is marked positive! If a different speaker is used it should have a nominal impedance between 25 ohms and 35 ohms, and be capable of handling at least 2W, as there is direct current passing through it in addition to the alternating signal current.

It is suggested that all components, including the speaker, be mounted on a plywood panel which can then form the front of a plywood cabinet. Alternatively, some suppliers have surplus speaker cabinets for sale. Incidentally, although Brian Reed's catalogue correctly describes it as 4½in, the speaker is more often designated 5in.

To mount the slide switch, first cut a small panel from a piece of paxolin, Formica, or even from a plastic coffee jar

lid, as shown in Figure 2a. Use the mounting lugs of the switch to mark the three small holes through which the lugs will pass. Cut a slot in the small panel for the three leads to pass through. Before the switch is mounted on the small panel, solder the three leads to the appropriate switch contacts as shown in Figure 2b. Now mount the switch firmly to the small panel, bending over the ends of the lugs to secure it.

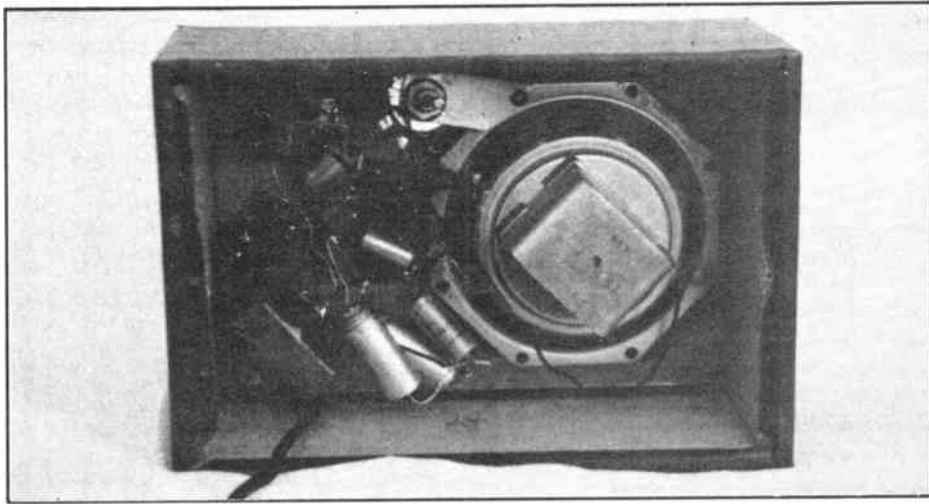
This panel, complete with switch, can now be mounted on the main panel, which must first have had a slot cut in it to allow the leads to pass through (Figure 2c). The small knob will appear sideways, instead of standing up vertically from the panel, but it is perfectly easy to use.

T1, the heatsink and RV2 can all be cemented to the panel, or attached by small brackets or clamps. Make sure that the base and emitter pins of Tr2 do not touch the metal of the heatsink.

The specified connector has a 1½ metre lead, and it should be cut down to about one-third of this length. When the full 1½ metres was used, there was a tendency for peculiar performance at some VHF frequencies. I think this is due to the lead trying to act as half of a dipole aerial in conjunction with the telescopic aerial in the tuning head. No difficulties arise with half a metre. The remaining part of the lead can be stripped down and used for wiring.

Setting up

First adjust RV2 to insert maximum resistance. Clip a voltmeter, set to give a clear indication of 4V, across the



An inside view of the back of the amplifier

AMPLIFIER

with a project to
Poor Man's Rx,
December 1987

speaker. The positive lead goes to the speaker terminal connected to R1. Switch on and adjust RV2 until the voltmeter registers 4V.

Transistor characteristics vary widely between FETs. This is a nuisance when directly coupled circuits are used with-

out an external resistance at the output. The sole load is the input impedance of the following transistor; consequently RV2 will require very different settings for different specimens of FET. In fact, with some transistors, there might be insufficient resistance in RV2 for a correct setting. With others, the correct bias might not be available even with a zero setting. A notable exception is the BF244B which has close tolerances, and is therefore strongly recommended for this circuit. The AD162 is also just right for Tr2.

Prices

I obtained all the components, except for Tr1 and Tr2 and the items under the miscellaneous heading from Brian Reed, who advertises regularly in this magazine. The total cost came to £7.24 plus an 18p stamp towards postage. Add 20p if paying by cheque - this totals £7.62. I suggest the two transistors should be obtained from Electrovalue Ltd, of 28 St Jude's Road, Englefield Green, Egham, Surrey TW20 0HB, unless they are available at a local shop.

This firm no longer charges carriage or packing on UK CWO mail orders. This is a big saving on small orders, as many firms charge up to £1 or more. Tr1 costs 40p and Tr2 80p. To this must be added 18p VAT, making £1.38 in all. This brings the total for components to exactly £9 and leaves a generous £3 for the miscellaneous items, keeping within the estimated £12. The miscellaneous items should all be available from local electrical and DIY shops.

Errata

In this short series of occasional articles I have described two simple medium and long wave portable receivers, a short wave design, an AM/FM tuning head with optional internal amplifier which doubles as a portable receiver, and now a small mains driven

amplifier for use with the two previous designs. My object has been to help those who like to undertake simple constructional projects and to understand how they work. That is why they have all used discrete components.

All the circuits are my own and, after publication, it is so easy to find small improvements here and there. However, only one such improvement has surfaced so far. This is to the circuit shown in Figure 2 on page 31 of the November 1987 issue (*Poor Man's Receiver*). Control is made smoother if RV1 is changed from 4.7k log to 2.2k or 2.5k linear. (It was actually shown in error as 47k).

Incidentally, there are some other errors in the November article. In Figure 2, the bottom end of RV2 should be free, not joined to the junction of RV2 and R1. There should also be a note that RV2 should be adjusted for best results. In Figure 4 on page 32, the preset resistor to the left should be marked RV3 and not RV2. Finally, in the sixth line from the bottom of the middle column of page 33, L3 should be changed to L2. NEW

Components List

Resistors

- R1 5R6 wire wound 2W
- RV1 22k log 1/4in spindle with S2
- RV2 30R wire wound pot (not preset)

Capacitors

- C1 1µF plastic/poly
- C2 0.1µF plastic/poly
- C3 0.022µF plastic/poly
- C4 : 1000µF 6V electrolytic
- C5 1000µF 16V electrolytic
- C6 1000µF 16V electrolytic

Inductors

- L1 10µH VHF choke
- T1 12-0-12V 1/2A transformer

Semiconductors

- Tr1 BF244B
- Tr2 AD162
- D1 BY126
- D2 BY126
- Heatsink for T066

Switches

- S1 1p3w slide
- S2 with RV1

Speaker

- LS 4 1/2in 30R

Connectors

- 3 pin din plug with screened lead
- 3 pin din socket

Knob

- Type K210B 1/4in

Miscellaneous

- Wood screws, bolts, nuts as required
- Plug for feeder unit, as required
- Mains lead and plug, as required
- Plywood for panel
- Plywood, panel pins, speaker gauze, or made up case

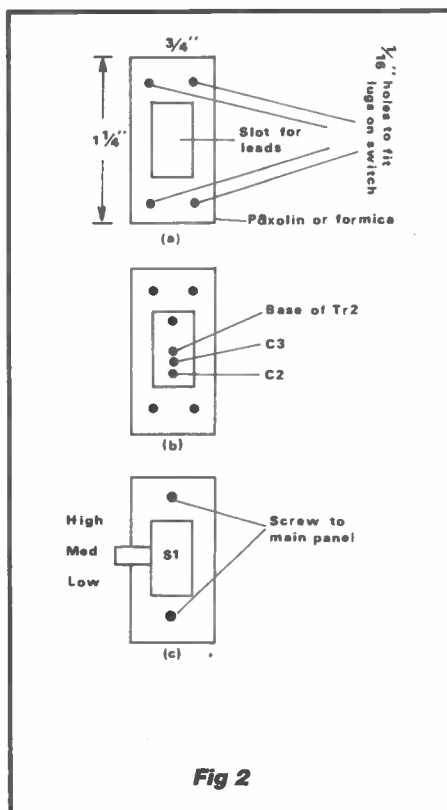


Fig 2

A SIMPLE MORSE CODE PRACTICE PROGRAM

by A Dean

Most amateurs, after taking the RAE, will ultimately wish to obtain a Class A licence, which involves passing the 12 words per minute Morse test. Many computer programs have been written in the past in the interest of improving the fluency of Morse reception, and I'm afraid that this program is yet another! There is, however, a subtle difference between some other programs and this program which, in my opinion, makes the magic 12 wpm figure easier to achieve.

All Morse practice programs allow the speed of transmission to be varied, but this is usually done across the board by changing dot, dash and space time intervals. The program listed below sounds each character at the equivalent of 12 wpm, yet allows the time interval between the characters to be varied. In this way the listener will get used to the sound of characters at the required rate but may allocate himself more or less time for mentally decoding between characters.

The program is written in Amstrad Locomotive BASIC and will therefore only work on the CPC range of computers. Extensive use is made of the SOUND command which makes conversion for other computers, perhaps with the exception of the BBC, difficult if not impossible.

The long and short of it

To enable the program to send Morse at the equivalent of 12 wpm, we need to calculate the length of the dots, dashes and the spaces between them at this speed.

Obviously, it would be much more difficult to receive Morse at 12 wpm if the words were very long, so as a guideline a five letter word, usually PARIS, is used in order to estimate speed. We also know the relationships between dots, dashes and spaces, which are as follows:

- 1) The dot is assumed to be the standard period of time, so . . .
- 2) A dash should last for the same period as 3 dots
- 3) The space between each dot or dash of the SAME character should be equivalent to the length of a dot
- 4) The space between each character should be 3 dots in length

5) The space between each word should be around 7 dots in length.

Bearing in mind the above relationships, we are able, with a bit of arithmetic, to calculate the length of a dot at 12 wpm using the word PARIS. If this is sent 12 times in a minute, then to

send it once (including a word space) takes $\frac{1}{2}$ of a minute, ie 5 seconds. If the number of dot-length periods are totalled for the word, again including the word space, we find that it comes to 50 (see *Figure 2* for explanation). It follows therefore that a dot period must be 100

```
10 REM ***** MORSE PRACTICE PROGRAM *****
20 MODE 1
30 WINDOW #0,1,40,3,25:WINDOW#1,1,40,1,1
40 PAPER 0:PEN 1
50 DEFINT a-z
60 DIM l(36)
70 DIM c(36,6)
80 FOR a=1 TO 36
90 READ l(a)
100 FOR b=1 TO l(a)
110 READ c(a,b)
120 NEXT: NEXT
130 x=20:y=40:REM for 12WPM
140 A$="MORSE PRACTICE PROGRAM "
150 FOR n=1 TO LEN(A$)
160 A=ASC(MID$(A$,n,1))
170 PRINT CHR$(A);
180 IF A=32 THEN 210
190 A=A-64
200 GOSUB 470
210 NEXT
220 CLS:CLS#1:LOCATE 40,5:PRINT" MENU"
230 LOCATE 40,6:PRINT" ====="
240 LOCATE 28,7:PRINT"LETTERS ONLY.....(L)"
250 LOCATE 28,9:PRINT"NUMBERS ONLY.....(N)"
260 LOCATE 28,11:PRINT"LETTERS/NUMBERS MIXED....(M)"
270 LOCATE 28,13:PRINT"CHANGE SENDING SPEED....(S)"
280 PRINT:PRINT"PLEASE SELECT"
290 K$=INKEY$:IF K$="" THEN 290
300 k$=UPPER$(k$)
310 IF K$="L" THEN P=1:F=25:GOTO 360
320 IF K$="N" THEN P=27:F=9:GOTO 360
330 IF K$="M" THEN P=1:F=35:GOTO 360
340 IF K$="S" THEN GOSUB 620
350 GOTO 220
360 CLS:CLS#1:PAPER#1,1:PEN#1,0:PRINT#1,"PRESS ANY KEY TO STOP"
370 RANDOMIZE TIME
380 FOR n=1 TO 5
390 a=INT(RND(6)*F)+P
400 IF A<27 THEN PRINT CHR$(A+64);ELSE PRINT CHR$(A+22);
410 GOSUB 480
420 NEXT
430 k$=INKEY$:IF k$<>" " THEN 660
440 SOUND 1,120,y,0:REM word space time
450 PRINT " ";
460 GOTO 380
470 REM sound a letter
480 FOR b=1 TO l(a)
490 SOUND 1,120,c(a,b),15
500 SOUND 1,120,10,0:REM dot space
510 NEXT
```

```

520 SOUND 1,120,x,0:REM letter space time
530 RETURN
540 DATA 2,10,30,4,30,10,10,10,4,30,10,30,10,3,30,10,10,1,10,4,10,10,30,10
550 DATA 3,30,30,10,4,10,10,10,10,2,10,10,4,10,30,30,30
560 DATA 3,30,10,30,4,10,30,10,10,2,30,30,2,30,10,3,30,30,30,4,10,30,30,10
570 DATA 4,30,30,10,30,3,10,30,10,3,10,10,10,1,30,3,10,10,30,4,10,10,10,30
580 DATA 3,10,30,30,4,30,10,10,30,4,30,10,30,30,4,30,30,10,10,5,10,30,30,30,30
590 DATA 5,10,10,30,30,30,5,10,10,10,30,30,5,10,10,10,30,5,10,10,10,30,5,10,10,10
600 DATA 5,30,10,10,10,10,5,30,30,10,10,10,5,30,30,30,10,10
610 DATA 5,30,30,30,30,10,5,30,30,30,30,30
620 CLS:LOCATE 10,10:INPUT "RELATIVE SPEED (0-100)";SP$:SP=VAL (SP$)
630 IF SP>100 OR SP<0 THEN 620
640 X=5*(104-S):Y=2*X
650 RETURN
660 INPUT#1,"PRESS ENTER KEY FOR MENU";K$
670 GOTO 220

```

Fig 1 Printout of program for Morse generation, continued from previous page

milliseconds in length (5 seconds/50 dots = 0.1 second/dot). We now know also that a dash is 300 milliseconds in length.

The program

The program will send letters, numbers or a mixture of both as selected from the menu, in random groups of five. The characters are displayed on the screen as they are sent for checking purposes, so don't be tempted to cheat! The relative speed of sending can be set by selecting the 'S' option on the menu. A value of 0 leaves the longest pauses between characters, and the maximum value that can be entered (100) represents 12 wpm.

Use is made of the Amstrad's sound chip to sound the dots and dashes and, since the duration in the SOUND command is in 10 millisecond units, we need to specify the value 10 or 30 in the command for a dot or dash respectively. The data in lines 540 to 610 contain the required values for all letters and numbers, each preceded with the number of dots or dashes which make up

the character. For example, letter A is stored as 2,10,30. The data for all characters is read into a 2 dimensional array C (,) and the length of the characters into the array L ().

Integer variables are used throughout to speed up program execution since, even though the program spends most of its time waiting for sounds to finish, the accessing and calculating times for real variables can add additional delays, making the Morse sound a little jerky.

The space between the dots or dashes (1 dot's length) is produced by making a 100 millisecond sound at zero volume in line 500. The sound chip queues up the sounds and executes them one after the other, which means that the character may appear on the screen a short while before the code for the character is sounded. Whilst on the subject of the SOUND command, CPC464 owners will have to change the amplitude parameter in line 490 to 7, since that is maximum volume on this machine.

The inter character and inter word time intervals are again obtained using

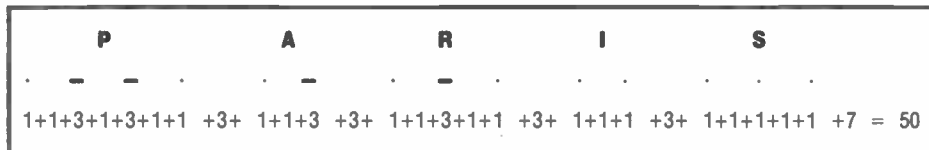
a zero volume sound (lines 520 and 440 respectively), although the periods are varied according to the demanded speed.

Program modifications

The program is by no means final and is open to minor (or even major) modifications by the reader (let's face it, we all love to hack!). Some CW experts prefer a shorter dot period to improve the readability of the Morse and may wish to experiment using different dot or dash lengths in the data statements.

Amplitude envelopes may be added to round off the rather harsh beep sound. Tone envelopes can even be added just for fun to produce chirp (with the advent of synthesized transceivers, the younger ones may never have witnessed this entertaining phenomenon!). If you don't trust yourself, you may wish to set the pen ink to be the same as the paper ink whilst sending is taking place so that the characters cannot be seen, and reset the ink before viewing the results (around line 660).

Fig 2 Illustration of method used to calculate dot lengths



RTTY for the Amstrad

PCBs for this article, published in our January issue, will soon be available from this office. Details of this offer, made available by popular demand, will be given as soon as possible in a future issue.

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100.....£14.43	\$2.65	2	4.....£9.10
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250.....£24.73	P \$3.30	4	8.....£12.59
500.....£38.10	P \$4.85	5	M 10.....£16.11
1000.....£69.10	P \$4.85	6	P 12.....£17.66
1500.....£89.13	P \$5.95	8	S 16.....£23.59
2000.....£107.24	P \$5.95	10	20.....£37.22
3000.....£156.36	C/A 12	24	30.....£38.39
6000.....£321.30	C/A 15	30	30.....£34.03
		40	40.....£44.46
		20	40.....£44.46
			50.....£59.95
			60.....£67.74
			55.75
50V or 25V or 25-0-25V		0.5	
0.5	1.....£8.28	\$1.90	1
1	2.....£9.54	\$2.00	2
2	4.....£11.66	\$2.50	3
3	A 6.....£13.48	P \$2.50	4
4	M 8.....£18.46	& \$2.95	5
5	P 12.....£23.47	P \$2.95	6
6	S 16.....£33.29	\$3.25	8
8	10.....£39.40	\$3.70	10
10	24.....£47.19	\$3.90	12
			24.....£53.72
			54.75
24V or 12V or 12-0-12V		2x 12V Secs	
5	5.....£3.31	\$1.70	150.....£9.12
5	1.....£3.97	\$1.80	5.....£3.97
5	2.....£4.53	\$1.90	2.....£4.53
5	4.....£4.38	\$2.00	4.....£4.38
5	3.....£10.99	\$2.15	1500.....£36.73
5	A 8.....£11.70	P \$2.20	2000.....£54.92
5	M 12.....£14.20	& \$2.40	4000.....£121.23
5	P 16.....£16.90	P \$2.80	3000.....£141.17
5	S 20.....£22.78	\$3.20	5000.....£217.91
5	30.....£28.28	\$3.30	7500.....£287.40
5	40.....£40.37	\$3.75	10KVA.....£287.40
5	60.....£57.96	\$4.45	
5	83.....£66.74	\$5.75	
50V or 25V or 25-0-25V		0.5	
0.5	1.....£8.28	\$1.90	1
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24V or 12V or 12-0-12V		2x 12V Secs	
5	5.....£3.31	\$1.70	150.....£9.12
5	1.....£3.97	\$1.80	5.....£3.97
5	2.....£4.53	\$1.90	2.....£4.53
5	4.....£4.38	\$2.00	4.....£4.38
5	3.....£10.99	\$2.15	1500.....£36.73
5	A 8.....£11.70	P \$2.20	2000.....£54.92
5	M 12.....£14.20	& \$2.40	4000.....£121.23
5	P 16.....£16.90	P \$2.80	3000.....£141.17

Let's get going on E.L.F.!

by H G Woodhouse

What are the wavelengths of the world's most powerful man-made transmitters? Think carefully before you answer. Their combined power is many millions of kilowatts.

The answer is the world's power supply networks on 50Hz and 60Hz, having wavelengths of 3,728 miles and 3,107 miles respectively.

By our amateur standards, they are not really very efficient radiators. Since the single or multiphase lines are always out of phase and close together the net radiation is quite small. They really act more like transmission lines. At the other end, they have dummy loads consisting of our electric fires and other devices. Despite this inefficiency, they will put quite a good signal into your audio amplifier if you attach an aerial to the phono socket.

Frequencies of this order are known as

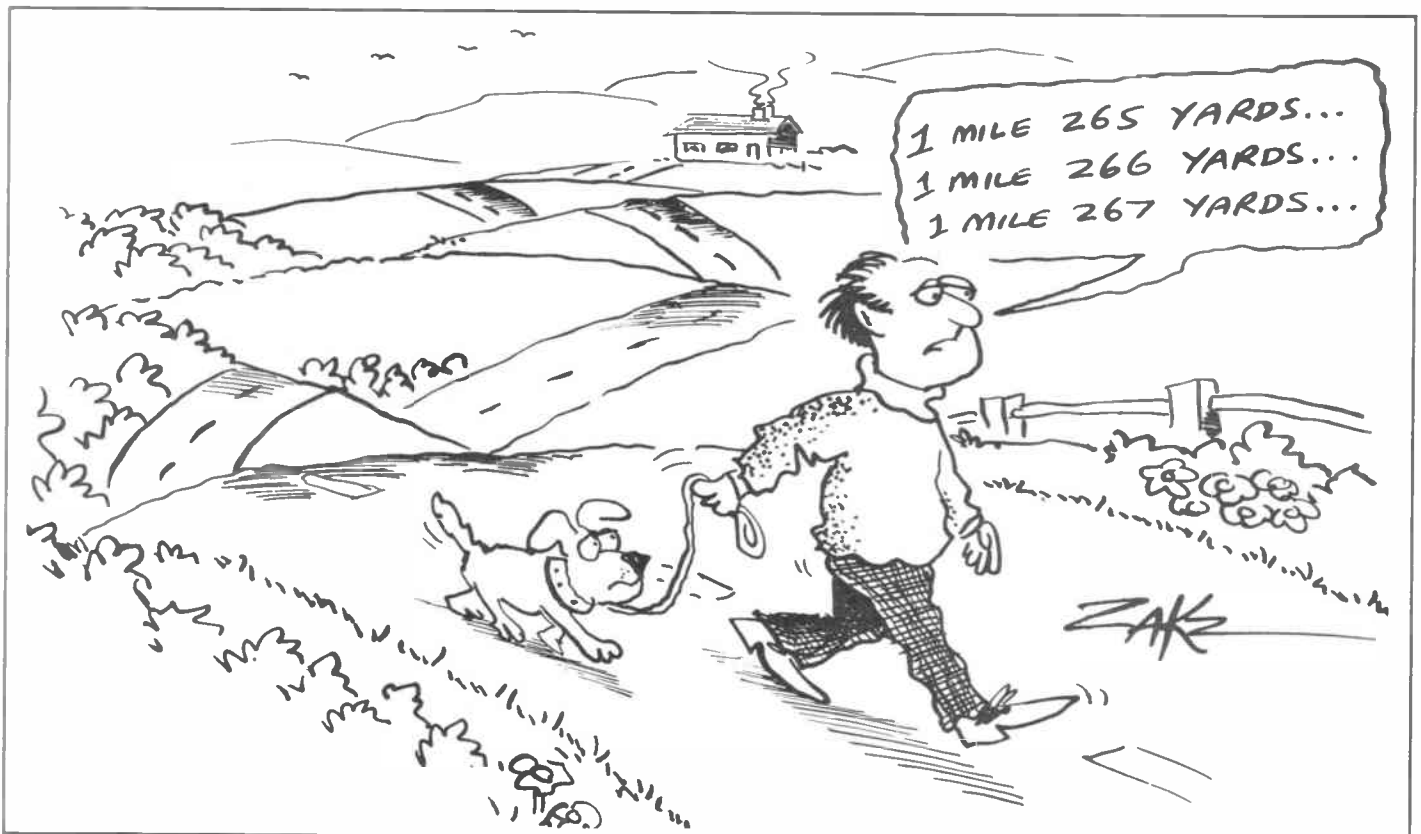
'ELF' or 'Extra Low Frequency'. Let's see what would be involved in setting up an amateur station. Firstly, so as not to interfere with the service provided by the national electricity grid, we will use 30Hz.

I suppose we should start with the aerial. A half-wave dipole is the easiest for the beginner to handle, so you should measure out from your house 1,554 miles in each direction. You do not need to measure it exactly, since minor errors can be corrected by your ATU. If you do get standing waves, it is a good idea to make the feeders the same multiple of 1,554 miles long. Height is, of course, very important, but to keep the project practical I should aim for around 1,000 feet for the towers (see Note 1). You will need about eight to the mile, or 24,864 altogether. I believe there may possibly be some second-hand masts available at

Pori in Finland.

This type of antenna is for horizontal polarisation. If you prefer vertical polarisation, you can use a conventional Marconi aerial. Bury about 200 radials in the ground, each 1,554 miles long, then use a hydrogen-filled balloon to elevate a vertical wire - which unfortunately also needs to be 1,554 miles long. If you use thin wire, a 10³ cubic metre balloon will do nicely (see Note 1).

For the PA stage, you can use a few hundred 807s strapped in parallel. They can be obtained quite cheaply on the surplus market. The tank coil could consist of about 10,000 turns of ½in copper water pipe wound on a 4 foot former. This will tune nicely with a Farad tuning capacitor. If it overheats you can pass water through the coil, but you may have problems with shorting at the ends. The PA can be driven by any standard



ICOM

IC-4GE 70cm FM Handportable

The IC-4GE is the first in a line of new handportables to be announced from ICOM. The small compact style provides easy operating and rugged durability. Other models for 2mtrs and 23cm will be released later this year.

A full 6 watts of RF power is available when using the IC-4GE with the option IC-BP7 nicad pack. The IC-4GE is equipped with a total of 20 memory channels. Each memory can independently memorise frequency, offset direction and frequency.

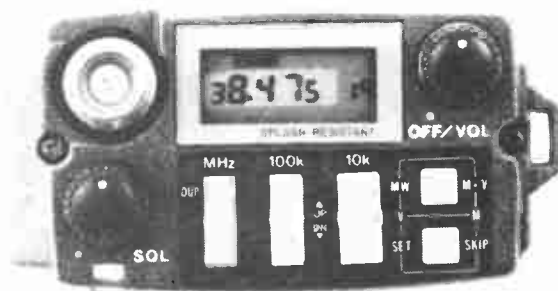
All circuits are designed using low power dissipation techniques to create a special power save circuit in the transceiver. The power saver circuit functions if no signal is received or no switch operation is performed for more than 30 seconds. In addition, the power saver circuit can be turned off for packet communications.

Two different scans, programmed scan and memory scan are provided and in addition memory skip channels can be programmed to skip selected memory channels during memory scanning operating. The squelch monitor function allows you to monitor weak signals without having to adjust the squelch control. The high impact case is splash resistant by the inclusion of rubber gaskets. The IC-4GE is supplied with a IC-BP3 nicad battery pack, flexible antenna, AC wall charger, belt clip and wrist strap. It is compatible with many of the existing accessories for ICOM's IC-2/4 and IC-02/04 series of handportables.

Also available for the IC-4GE is a large range of optional accessories including a variety of rechargeable nicad power packs, dry cell battery pack, desk charger, headset and boom mics and new slimline speaker mics. For more information on the IC-4GE or any other ICOM handportable contact your local ICOM dealer or ICOM (UK) LTD.



◀ Actual Size ▶



Icom (UK) Ltd.

Dept REW, Sea Street, Herne Bay, Kent CT6 8LD. Tel: 0227 363859. 24 Hour.

Count on us!



IC-575, 28/50MHz Dual band multimode.

The ICOM IC-575 base station has been developed to meet the demand for advanced communications for the recently acquired 6m band. Similar in appearance to the IC-275/475 2m and 70cm base stations, the beauty of this new transceiver from ICOM is that it gives you the best of both worlds, 6 & 10m in one compact unit. The IC-575 covers 28-30Mhz and 50-54Mhz.

Operating modes are SSB, CW, AM & FM. Power output is 10 watts (AM 4 watts) with a front panel control to reduce output for QRP operations. A pass band tuning circuit narrows the I.F. passband width, eliminating signal in the passband. A built-in notch filter eliminates beat signals with sharp attenuation characteristics.

Some PLL systems have difficulty meeting the lockup time demands placed on them by new data communications. This is why ICOM developed the DDS (Direct Digital Synthesizer) method. With a lockup time of just 5msec the DDS method allows the IC-575 to handle data communications such as packet or AMTOR. 99 programmable memories can store frequency, mode, offset frequency and direction. A total of four scanning functions for easy access to a wide range of frequencies, memory scan, programmed scan, selected mode memory scan and lock out scan. The IC-575 has an internal A.C. power supply, but can also be used on 13.8v DC for mobile or portable operation.

Optional accessories available are the UT36 voice synthesizer, the IC-FL83 CW narrow filter, SM7 external loudspeaker, HP2 communication headphones and SM8/SM10 desk microphones. Other transceivers available in this range are: IC-275E 2m multimode 25w, IC-275H 2m multimode 100w, IC-475E 70cm multimode 25w, IC-475H 70cm multimode 75w.

IC-505, 50Mhz Transceiver

The IC-505 is a 6mtr BAND SSB, CW, FM (Optional) transceiver. It can be used as a portable or like other transceivers of this type as a base station unit. When used with an external 13.8v power supply the 505 gives 10 watts RF output, 3 watts or 0.5 watts on low power is available when using internal batteries. Other features include 5 memories with memory scan, program band scan, dual VFO's with split operation.



The easy-to-read LCD readout includes frequency, memory scan and call modes. Full metering of battery condition signal strength and power output is provided. When fitted with the optional EX248 FM unit the IC-505 offers 50MHz operation at an affordable price.

Helpline: Telephone us free-of-charge on 0800 521145. Mon-Fri 09.00-13.00 and 14.00-17.30. This service is strictly for obtaining information about or ordering Icom equipment. We regret this cannot be used by dealers or for repair enquiries and parts orders, thank you.

Datapost: Despatch on same day whenever possible.

Access & Barclaycard: Telephone orders taken by our mail order dept. instant credit & interest-free H.P.



DIODES REVISITED

Joe Pritchard discusses the behaviour of diodes and how to make use of them successfully

We tend to think of diodes as rectifiers or detectors, but they have other uses as well, as I hope to show in this article.

Let's begin with a brief look at the electrical properties of a semiconductor diode. The circuit shown in *Figure 1* will produce the characteristic curve shown in *Figure 1b*. There are two interesting points to note about this graph. Firstly, when the anode is more positive than the cathode, the diode doesn't conduct a significant amount of current until a particular voltage, called the *forward voltage drop*, has been overcome. This is slightly different for each diode, but is in the area of 0.6V for a silicon diode and 0.2V for a germanium diode.

Secondly, when the anode is *less* positive than the cathode, no appreciable current flows until quite a high voltage is applied. This voltage is

called the *peak inverse voltage*. Once exceeded, the current flowing causes the diode to heat up until - *phut!*

These two facts explain much of the diode's behaviour and form the basis for many applications. For example, diodes built to take advantage of the phenomenon in my second point above are used in voltage regulating circuits - Zener diodes.

However, that's enough theory for this article, so let's get on with some diode applications.

Diodes as protection devices

The diode's ability to allow current to flow in one direction only is often made use of in its role as a protection device; it prevents negative voltages getting where they shouldn't. However, a less obvious use for diodes is in limiting the magnitude of a voltage, either positive or negative, at a particular point in a circuit. Zener diodes, which I briefly mentioned earlier, can limit or clamp a voltage to a value depending upon the diode. Normal diodes can work in the same way,

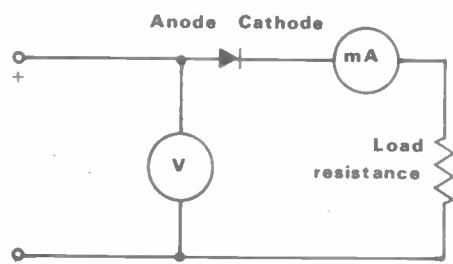


Fig 1a

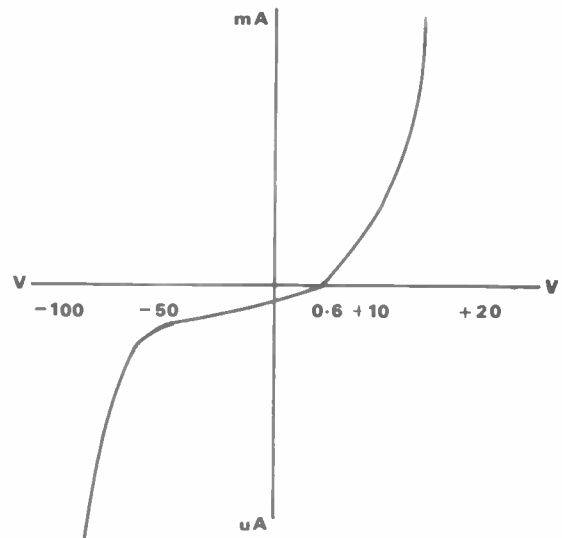


Fig 1b

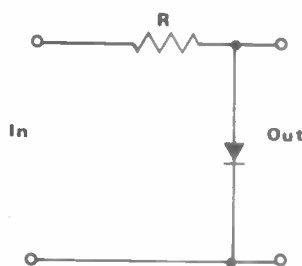


Fig 2a

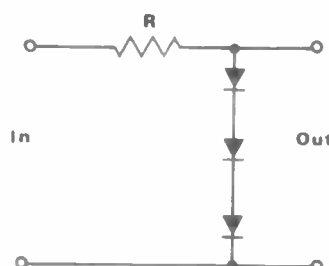


Fig 2b

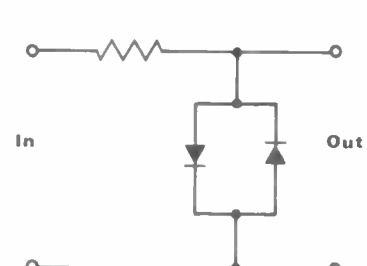


Fig 2c

although they are not as versatile. The simplest type of diode voltage clamp is shown in *Figure 2a*.

Whenever the input voltage exceeds the forward voltage drop of the diode (0.6V for silicon, 0.2V for germanium) the diode will begin conducting. Resistor R serves to limit the current through the diode. By putting a few diodes in series, we can get a voltage limiter that has a limiting value of the sum of all the forward voltage drops of the diodes. Thus, *Figure 2b* shows a circuit which will clamp at about 1.8V. It is impossible to be completely accurate about these things, because the forward voltage drop varies slightly between diodes, even those of the same type.

Protection circuit

The clamp shown in *Figure 2c* will limit incoming signals to the range -0.6 to $+0.6$ V. This is often featured in radio receivers as a protection circuit for the sensitive front end circuits. Connected between the aerial and earth of the receiver it will offer some protection in the presence of very strong local signals or nearby lightning strikes – not, however, direct hits!

It is also used in noise limiter circuits, where the configuration is often called a clipper, as it removes noise pulses from input signals. To do this properly, you need to adjust the input signal for best results, see *Figure 2d*. Of course, if you put a signal with peaks greater than 0.6V or less than -0.6 V into this limiter, then the signal would be distorted. This property has been made use of in fuzz boxes for guitarists.

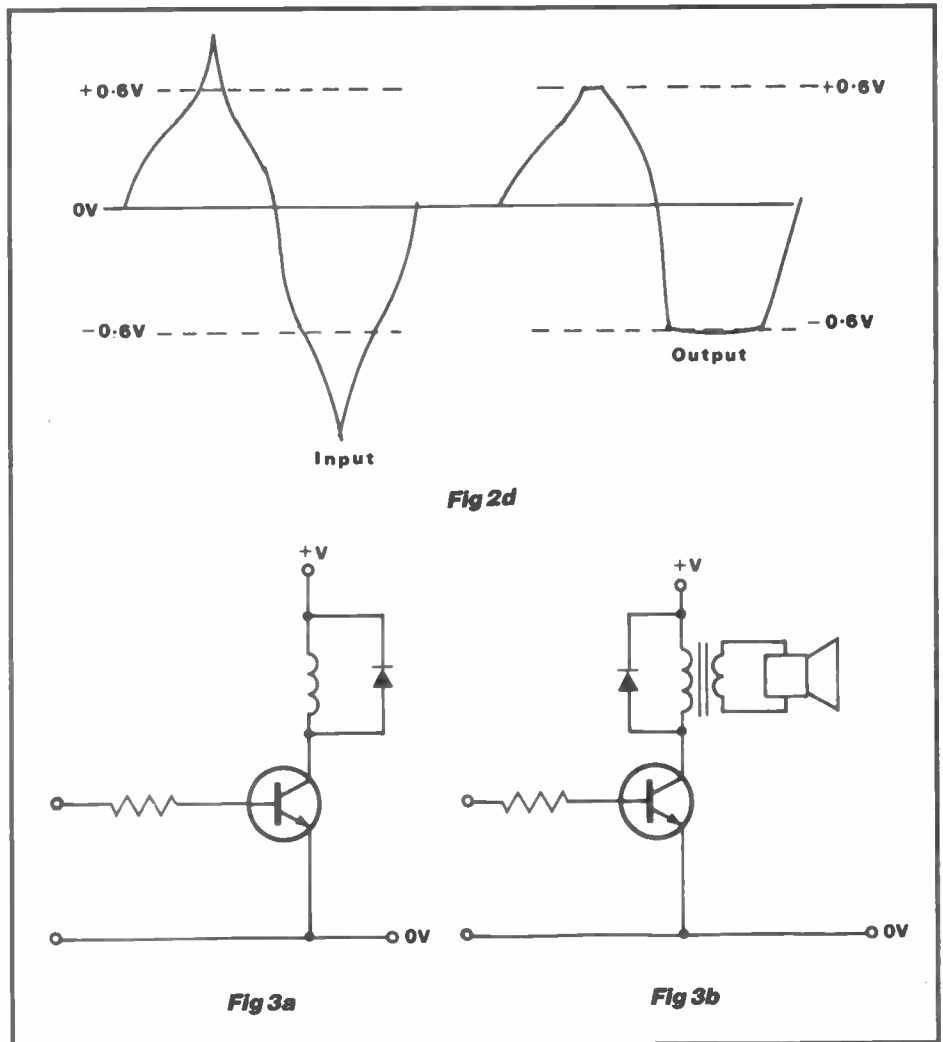
Something more

Another use of the diode as protection for circuitry is shown in *Figure 3*. The diode protects the transistor from the inductive effects of the relay coil which is the collector load of the circuit. While the relay is turned on, current flows through it.

However, as soon as the transistor turns off and current stops flowing, the collapsing magnetic field of the relay coil induces a voltage in the coil which, in this circuit, would have the effect of putting a considerable voltage at the transistor collector; enough, perhaps to exceed the transistor ratings and destroy it completely!

The size of this voltage depends, amongst other things, on the current being passed through the relay and the speed at which it was stopped. Thus, transistors switching heavy duty relays quickly would tend to have a short but merry life, were it not for the diode clamping the voltage at the collector to no more than 0.6V.

It's not just relays that can cause this problem. Any inductive component, whether motor, relay or transformer, which is subject to rapid and sudden



changes in current should be bypassed by a diode in this way.

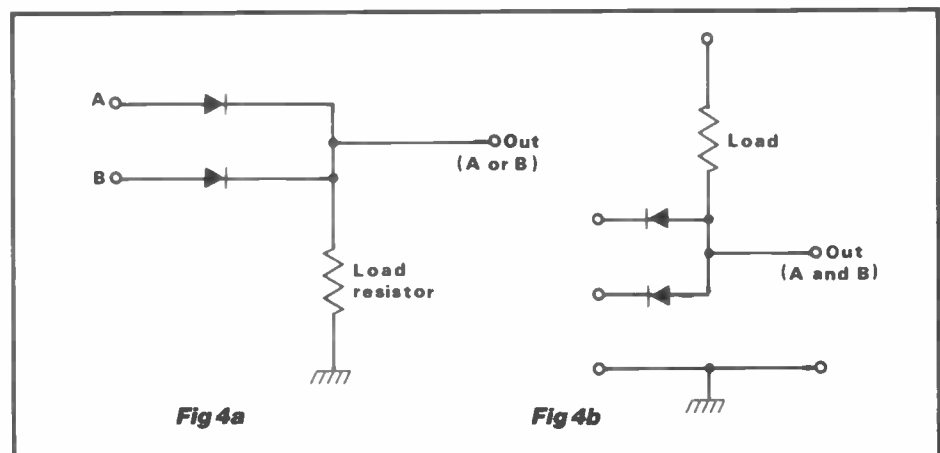
Diodes as voltage references

The Zener diode allows us to regulate voltages quite accurately. However, the voltage clamping action of a normal diode can be used to provide a very 'rough and ready' voltage reference. The circuit in *Figure 2b* could, in fact, be used to produce a reference voltage in the

region of 1.8V. This technique is used in the BBC micro to provide a reference voltage for the on-board analogue to digital converter.

Diodes as logic gates

Despite my relatively tender years, I can remember the use of diodes to produce logic gates. On the whole, this may seem a little redundant today, due to the cheapness of logic packages, but



DIODES REVISITED

there are occasions when it can be a useful trick to know. A typical case is where a simple two input AND gate is required in a circuit that does not contain any chips that can provide this logic function. Rather than use a 7400 series chip and waste most of it, we can use two diodes, as shown in *Figure 4a*.

With this type of logic circuitry, we can't allow an input to float; it *must* be connected to either a 0V signal for logic 0 or a 5V signal for logic 1. To see how it works, take the OR gate. Taking either A or B to 5V will result in a PD of (5 forward voltage drop) volts between the output and 0V. With the AND gate, taking either

Figure 4b shows a different use for the OR gate, ensuring a smooth switch-over between two power supplies feeding a single circuit. Input A could be from a mains power supply, and B from a 12V battery.

When the mains supply failed, current would be drawn from the battery supply. The device provides the output load previously provided by R.

Voltage multiplication

When dealing with ac signals, we can use a transformer to step voltages up or down. However, we can also use diodes to boost voltages up to a very high level. These circuits involve capacitors and diodes and are called voltage multipliers. They can be used to supply many thousands of volts, but at a low current.

Figure 5 shows a typical circuit for a voltage doubler circuit ($V_{out} = 2 \times V_{in}$). These can be placed in series to boost up the voltage as many times as you want. Clearly, for high voltages suitable

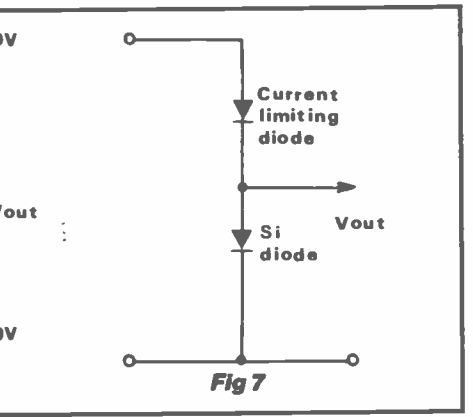
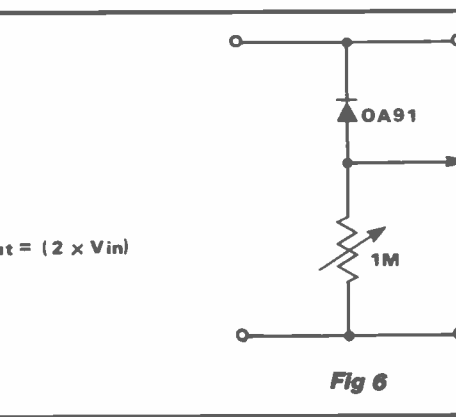
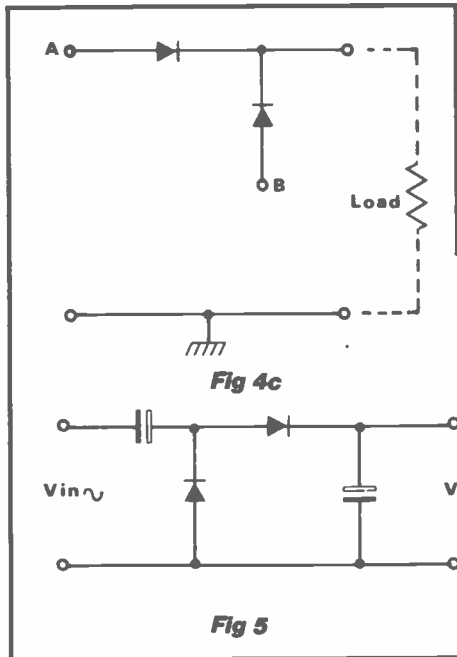
Voltage doubler circuits also appear in simple radio circuits at the detector stage.

Due to the fact that diodes are semiconductors, they respond to light and heat in varying degrees. The circuit in *Figure 6* will allow you to use the properties of the diode as a heat sensor. Paint the diode black to cut out incidental light and to allow it to absorb more heat (from sunlight, etc). The diode can act as a light sensor, though it is a good idea to use a lens arrangement to focus the light onto the pn junction. Clearly, if you are using the diode as a light sensor you shouldn't paint it black!

The leakage current of the germanium diode – the current that flows when the diode is reverse biased – is quite small, but increases with incidental heat or light. The leakage current observed with silicon diodes is generally much smaller.

Silicon diodes

These diodes are best as temperature



input to 0V will result in a potential of one forward voltage drop between the output and ground. Good germanium diodes are useful here, giving very high '1' (4.8V) and very low '0' (0.2V) outputs.

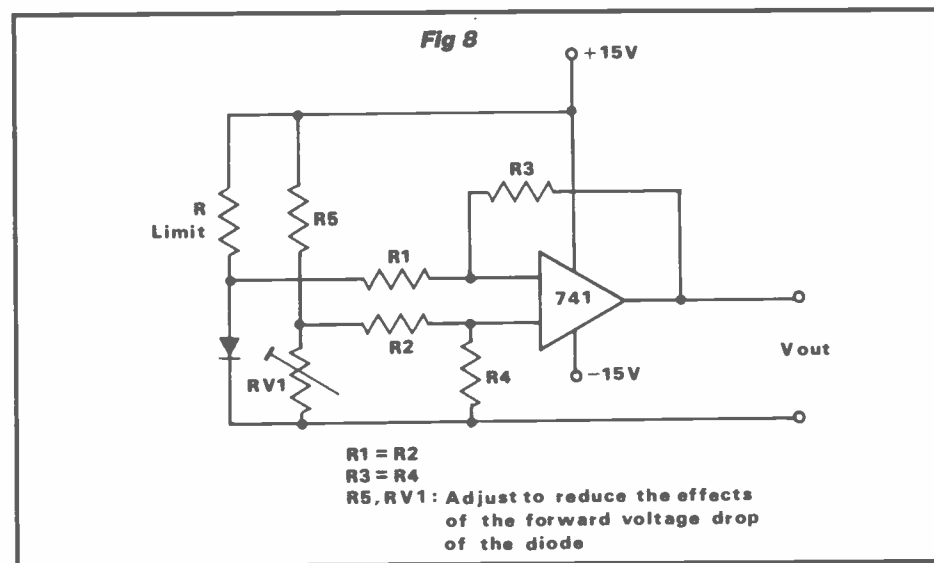
rated capacitors and diodes are needed in the circuit, and these aren't always cheap! Should you wish to experiment with such a circuit, the input can be obtained from a simple oscillator circuit.

sensors and are used as shown in *Figure 7*. Note that this time the diode is forward biased, that is, a current flows through it. We don't use the leakage current of the silicon diode, because it's quite tiny and is less sensitive to changes in light or temperature.

The potential difference across the diode in *Figure 7* will fall by 2mV for each degree centigrade the temperature rises, or increase by 2mV for each degree centigrade the temperature falls.

This variation can be amplified and allows a diode, with a suitable amplifier, to act as a thermometer. It is necessary to use a differential amplifier in this application, because the small change in voltage per degree change in temperature is superimposed on the 0.6V forward potential drop of the diode. Such an amplifier can be found in any textbook on operational amplifiers, and a typical arrangement is shown in *Figure 8*.

I hope that this article has given you new ideas for using diodes. There are, of course, many more applications for common diodes, and many more for the more exotic types.



Ray Marston continues his investigation of IC audio processing circuits by looking at active filter designs

In last month's edition of *Data File* we started off this new mini-series by introducing the reader to the basic concept of 'audio processing' circuitry. We then went on to show a variety of op amp based linear amplifier circuits. This month we continue the audio processing theme by looking at a variety of passive and active audio filter designs.

Audio filters

Audio filter circuits are used in signal processing systems to reject unwanted frequencies and pass only those wanted by the user or designer. The simplest form of audio filter is the passive two-component R-C or C-R types, as shown in *Figures 1b* and *1c*.

In the simple passive R-C filter of *Figure 1a* the capacitor acts like an open circuit at low frequencies and like a short circuit at high frequencies, so this circuit passes low frequency signals but rejects (severely attenuates) high frequency ones. The output of this lowpass filter in fact falls by 3dB at a 'break' or 'cross-over' frequency (f_c) of $1/(2\pi RC)$, and then falls at a rate of 6dB/octave (= 20dB/decade) as the frequency is increased beyond this value (see *Figure 1b*).

Thus, a 1kHz lowpass filter gives about 12dB of rejection to a 4kHz signal, 20dB to a 10kHz one, and so on.

In the simple passive C-R filter of *Figure 1c* the capacitor again acts like an open circuit at low frequencies and like a short circuit at high frequencies, so this circuit passes high frequency signals but rejects low frequency ones. The output of this highpass filter is 3dB down at a break frequency of $1/(2\pi RC)$, falling at a 6dB/octave rate as the frequency is decreased below this value (see *Figure 1d*). Thus, a 1kHz filter gives 12dB of rejection to a 250Hz signal, a 20dB to a 100Hz one, and so on.

Each of the above filter circuits uses a single R-C or C-R stage known as a '1st order' filter. If we could simply cascade a number ('n') of identical types of these

filter stages, the resulting circuit would be known as an 'nth order' filter and would have an output slope, beyond f_c , of $(n \times 6\text{dB})/\text{octave}$. Thus, a 4th order 1kHz lowpass filter would have a slope of 24dB/octave and would give 48dB of rejection to a 4kHz signal, 80dB to a 10kHz signal, and so on.

Unfortunately, simple R-C filters cannot be directly cascaded, since they would then interact and give poor results; they can, however, be effectively cascaded by incorporating them into the feedback networks of suitable op amp circuits. Such circuits are known as active filters, and *Figures 2* to *8* show practical examples of some of them.

Active filter circuits

Figure 2 shows the practical circuit and formula of a maximally-flat (Butterworth) unity gain 2nd order lowpass filter with a 10kHz break frequency. This circuit's output falls off at a rate of 12dB/octave

beyond 10kHz and is thus about 40dB down at 100kHz, and so on.

To alter the break frequency, change either the R or the C value in proportion to the frequency ratio relative to *Figure 2*; reduce the values by this ratio to increase the frequency, or increase them to reduce the frequency. Thus, for 4kHz operation, increase the R values by a ratio of 10kHz/4kHz, or 2.5 times.

A minor snag with the *Figure 2* circuit is that one of its C values should ideally be precisely twice the value of the other, and this can result in some rather odd component values. *Figure 3* shows an alternative 2nd order 10kHz lowpass filter circuit that overcomes this snag and uses equal component values. Note here that the op amp is designed to give a voltage gain of 4.1dB via R1 and R2, which must have the values shown.

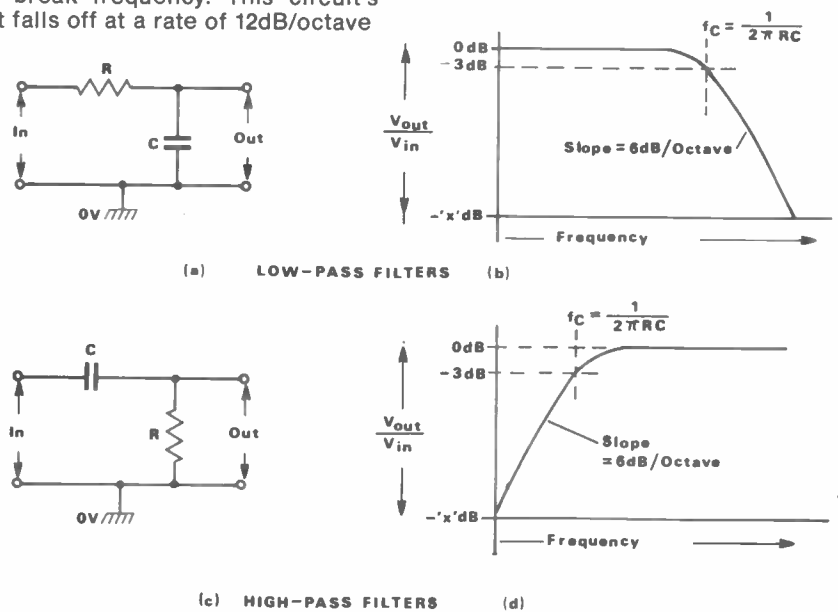


Fig 1 Circuits and response curves of simple 1st order R-C filters

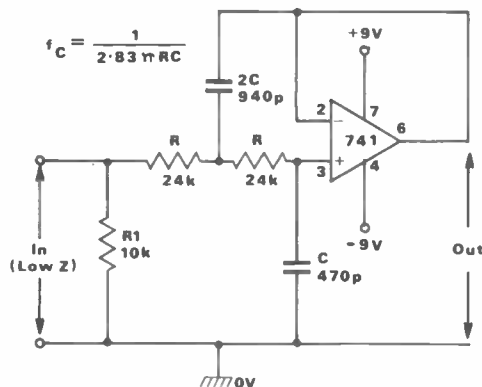


Fig 2 Unity gain 2nd order lowpass active filter

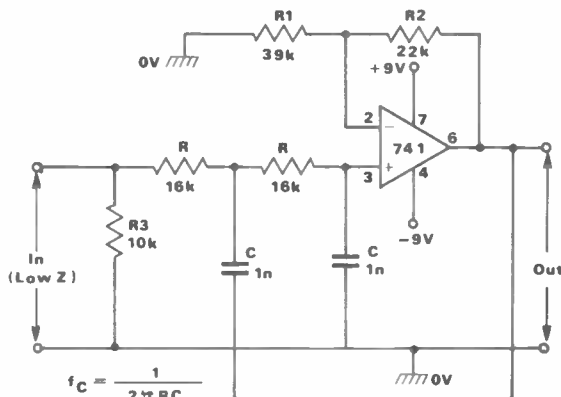


Fig 3 'Equal components' version of 2nd order 10kHz lowpass active filter

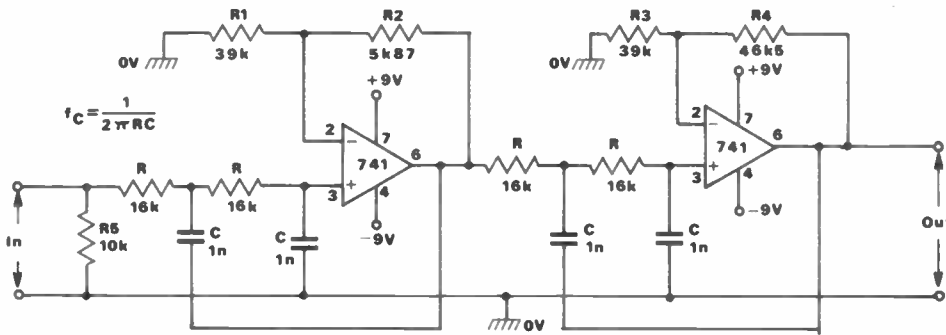


Fig 4 4th order 10kHz lowpass filter

Figure 4 shows how two of these equal component filters can be cascaded to make a 4th order lowpass filter with a slope of 24dB/octave. In this case gain-determining resistors R1/R2 have a ratio of 6.644 and R3/R4 have a ratio of 0.805, giving an overall voltage gain of 8.3dB. The odd values of R2 and R4 can be made by series-connecting standard 5% resistors.

Figures 5 and 6 show unity gain and equal component versions respectively of 2nd order 100Hz highpass filters, and Figure 7 shows a 4th order highpass filter. The operating frequencies of these circuits, and those of Figures 3 and 4, can be altered in exactly the same way as in Figure 2, ie, by increasing the R or C values to reduce the break frequency, or vice versa.

Finally, Figure 8 shows how the Figure 6 highpass and Figure 3 lowpass filters can be wired in series to make (with suitable component value changes) a 300Hz to 3.4kHz 'speech' filter that gives 12dB/octave of rejection to all signals outside this range.

In the case of the highpass filter the C values of Figure 6 are reduced by a factor of three to raise the break frequency from 100Hz to 300Hz. In the case of the lowpass filter the R values of Figure 3 are increased by a factor of 2.94, to reduce the break frequency from 10kHz to 3.4kHz.

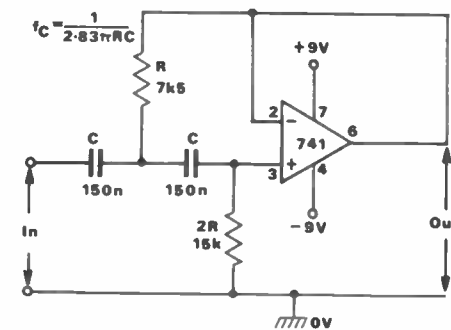


Fig 5 Unity-gain 2nd order 100Hz highpass filter

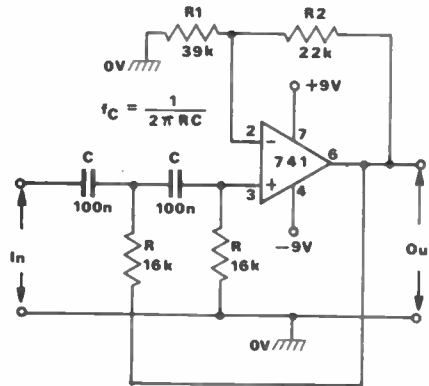


Fig 6 'Equal components' version of 2nd order 100Hz highpass filter

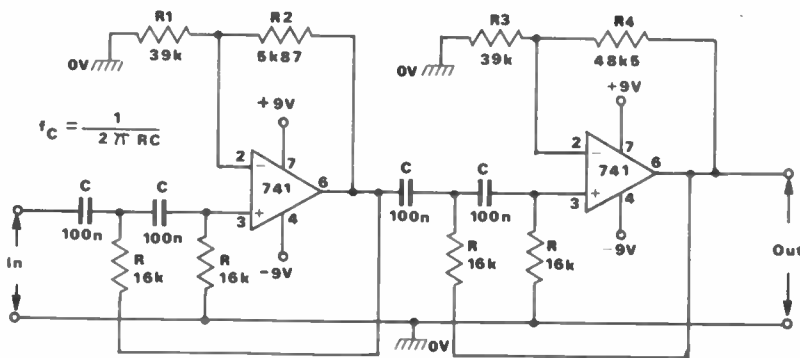


Fig 7 4th order 100Hz highpass filter

Variable active filters

The most useful type of active filter is that in which the cross-over frequency is fully and easily variable over a fairly wide range. Figures 9 to 11 show three practical examples of 2nd order versions of such circuits.

The Figure 9 circuit is a simple development of the highpass filter of Figure 5, but has its cross-over frequency fully variable from 23.5Hz to 700Hz via RV1. Note in this circuit that the resistive arms of the C-R networks have identical values (unlike Figure 5, so this design does not give maximally-flat Butterworth operation, although it nevertheless gives a very good performance. The

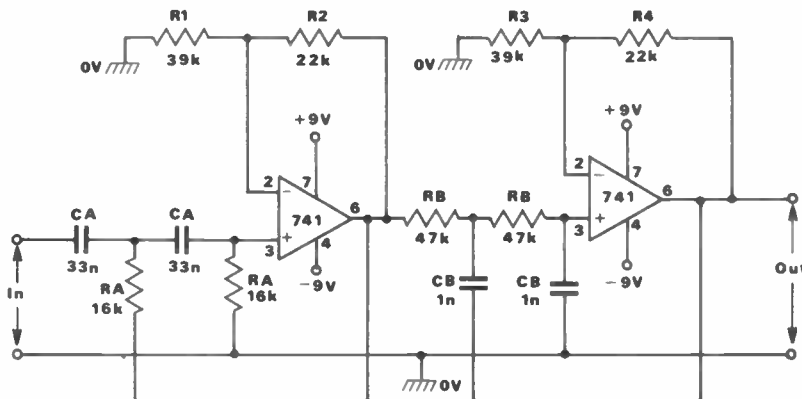


Fig 8 300Hz to 3.4kHz speech filter with 2nd order response

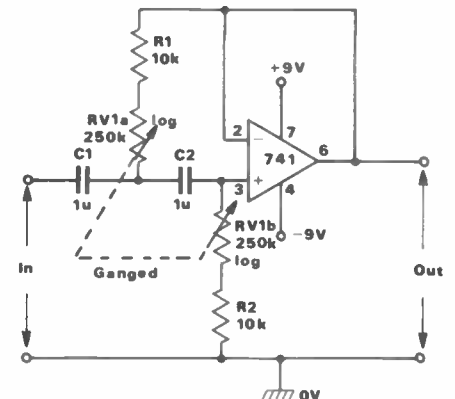


Fig 9 Variable highpass filter, 23.5 to 700Hz

reader should note that this circuit can be used as a high quality turntable disc (record) rumble filter; fixed versions of such filters usually have a 50Hz cross-over frequency.

The *Figure 10* circuit is a development of the highpass filter of *Figure 2*, but has its cross-over frequency fully variable from 2.2kHz to 24kHz via RV1 and again does not give a maximally-flat Butterworth performance. Note that this circuit can be used as a high quality scratch filter; fixed versions of such filters usually have a 10kHz cross-over frequency.

Figure 11 shows how the above two filter circuits can be combined to make a really versatile variable highpass/low-

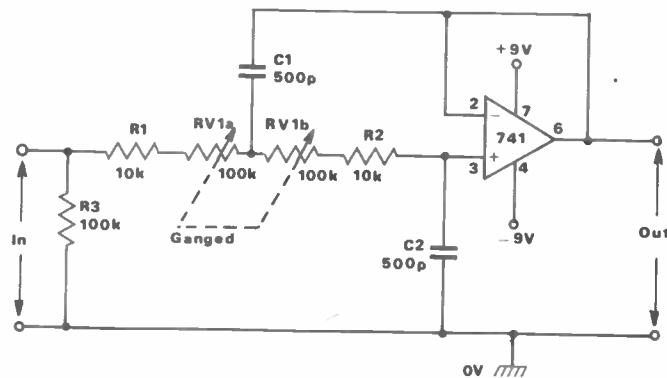


Fig 10 Variable lowpass filter covering 2.2kHz to 24kHz

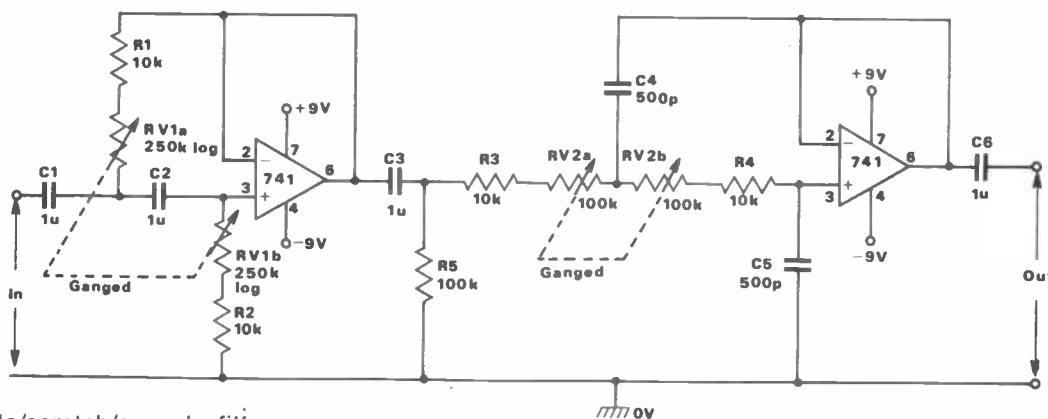


Fig 11 Variable highpass/lowpass or rumble/scratch/speech filter

pass or rumble/scratch/speech filter. The highpass cross-over frequency is fully variable from 23.5Hz to 700Hz via RV1 and the lowpass frequency is fully variable from 2.2kHz to 24kHz via RV2.

Tone control networks

The most widely used types of variable filter circuit are those used in audio tone control applications. These allow the user to alter a system's frequency response to either suit his or her individual needs or moods, or to compensate for anomalies in room acoustics, etc. We shall be looking at a practical example of such a circuit shortly. First, however, let's look at some basic tone control networks.

Figure 12a shows the typical circuit of a passive bass tone control network (which can be used to effectively boost or cut the low frequency parts of the audio spectrum). *Figures 12b to 12d* show the equivalent of this circuit when RV1 is set to the maximum *boost*, maximum *cut* and *flat* positions respectively.

C1 and C2 are effectively open circuit when the frequency is at its lowest bass value, so it can be seen from *Figure 12b* that the *boost* circuit is equivalent to a 10k-over-101k potential divider, and gives only slight attenuation to bass signals.

The *Figure 12c cut* circuit, on the other hand, is equal to a 110k-over-1k divider, and gives roughly 40dB of bass signal attenuation. Finally, when RV1 is set to

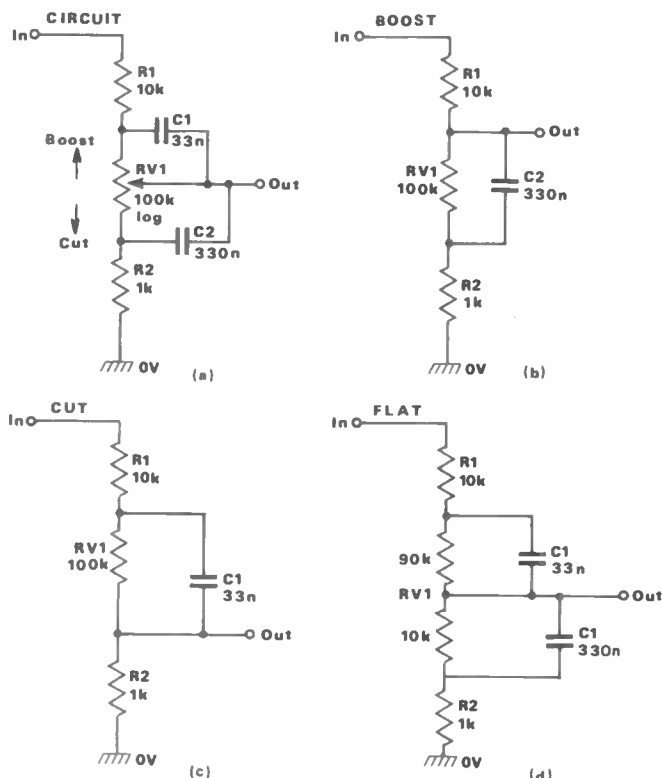


Fig 12 Circuit and equivalents of bass tone control network

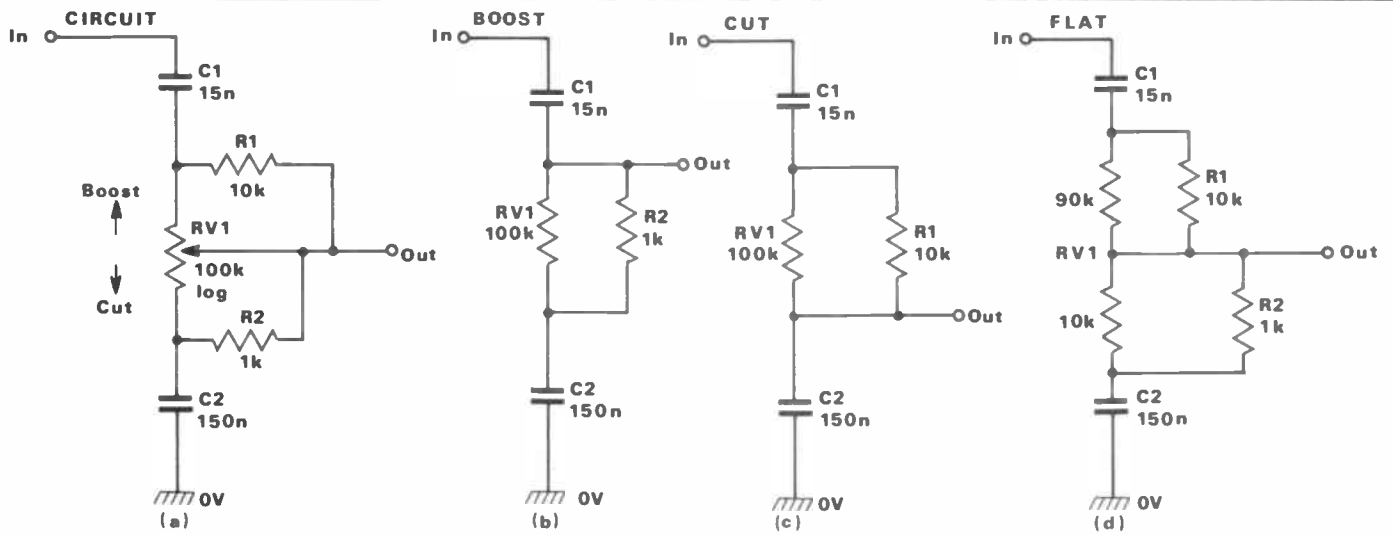


Fig 13 Circuit and equivalents of treble tone control network

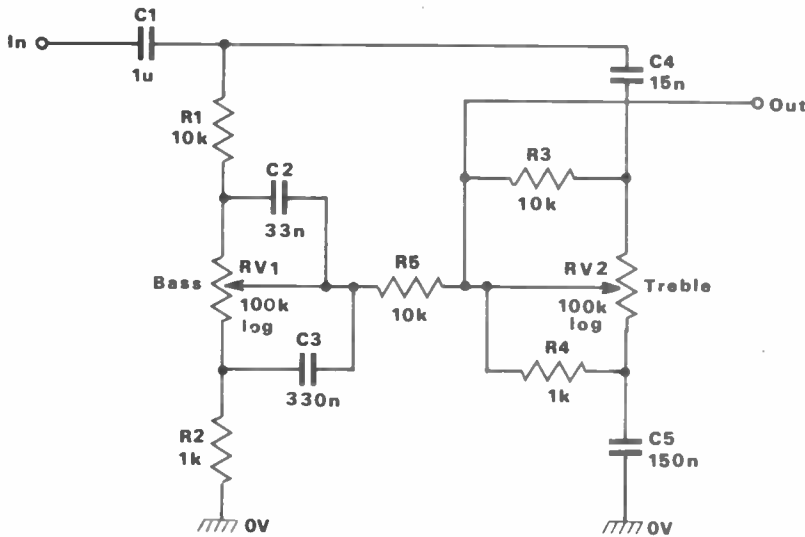


Fig 14 Passive bass and treble tone control network

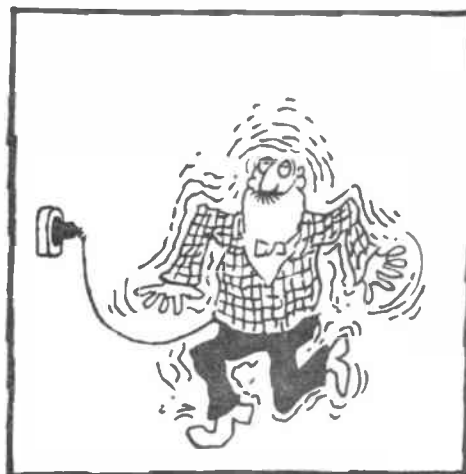
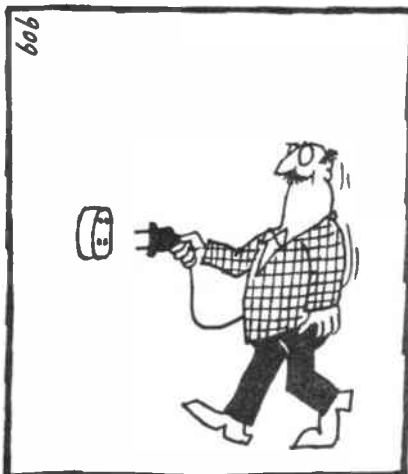
the flat position shown in Figure 12d (with 90k of RV1 above the slider, and 10k below it), the circuit is equal to a 100k-over-11k divider, giving about 20dB of

attenuation at all frequencies. Thus, the circuit gives a maximum of about 20dB of bass boost or cut relative to the flat signals.

Figure 13 shows the typical circuit of a passive treble tone control network (which can be used to effectively boost or cut the high frequency parts of the audio spectrum), together with its equivalent circuits under the maximum boost, maximum cut and flat operating conditions. This circuit gives about 20dB of signal attenuation when RV1 is in the flat position and gives maximum treble boost or cut values of 20dB relative to the flat performance.

Finally, to complete this month's edition of *Data File*, Figure 14 shows how the Figure 12a and 13a circuits can be combined to make a complete passive bass and treble tone control network; 10k resistor R5 has been added to minimise unwanted interaction between the two circuit sections. The input to this circuit can be taken from an amplifier's volume control and the output can be fed to the input of the main power amplifier.

In next month's edition of 'The File' we'll continue the audio processing theme by looking at a variety of active tone and filter networks and at various amplitude control circuits. PREV



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 220/16 8p; 220/25, 220/50 10p; 470/16, 470/25 11p
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SPECTRUM WATCH

by John Andrews

Last year I recounted the tale of Captain Midnight, a gifted TV technician who managed to jam one of the American subscription TV channels and substitute his protest message.

Now an even more bizarre incident has occurred which you might find amusing – it's not exactly broadcast TV nor amateur TV but it's certainly 'self training in the art of radio-telegraphy' or whatever the regulations say.

Late November last year, TV viewers in Chicago were shocked when a hacker wearing a Max Headroom mask and naked from the waist down took over programming.

Two stations were affected, WGN and WTTW, and the take-over lasted 90 seconds on each occasion. The transmission, which involved bad language and nudity (only partial), upset TV executives since it occurred on a Sunday evening. The press reports give only one viewer's reaction (which was positive) and if Sunday evening television in Chicago is like it is here, no doubt many of the audience found the intrusion an improvement.

The first hack took place, in fact, during the sports segment of WGN's evening news broadcast on Channel 9; the second happened later that night when WTTW (Channel 11) was twelve minutes into showing Doctor Who. It was on his second appearance that Max was audible and he didn't seem to be too happy (he was being spanked with a fly swatter).

The pirate transmissions were achieved by interrupting microwave relays from the legitimate stations' studios to the local transmitters; WGN's remote transmitter is on top of the John Hancock building, while WTTW's is on the Sears Tower.

Security officers at the Sears Tower reported that someone had entered the remote transmitter facility at the top of the 100-plus floor building and the Federal Communications Commission is now investigating.

The FCC had some success after Captain Midnight's hack of Home Box Office satellite transmissions in spring 1986 and secured a conviction. John MacDougall, 25, of Florida later

confessed to being the video pirate and in a deal with the prosecutors was relieved of \$5,000 and placed on probation for a year.

BBC-TV for Norwegian viewers

Nearly 200,000 cable TV viewers in Norway are now able to receive what have been called the 'least worst television programmes in the world'.

Currently, eight hours of BBC output is being transmitted to the Norwegians, from 4pm to midnight, and this may soon be increased. Apparently English language programmes have always been popular with the Norwegians, so now they can have their fill of the stuff if they are prepared to pay a supplement (though the first eight months are free owing to a legal dispute).

The service is being extended to most major cities in Norway; previously just a few viewers in a very small area at the southern tip of the country were able to see the programmes direct by reception across the North Sea.

Norway is the fifth country outside the UK to accept BBC broadcasts; Belgium started in 1984, followed by France, the Netherlands and Denmark. When will this cultural domination end?

New FM stations for Manx Radio

Eddystone Radio Ltd, the Birmingham-based division of Marconi Communication Systems Ltd, doesn't only make communications receivers, or diecast boxes!

The firm has won an order from Manx Radio to supply stereo VHF/FM transmitting equipment worth £63,000.

It is being installed at the island station's site at Carnane, near Douglas, and at another location on Snaefell mountain, an area well-known to Isle of Man TT race enthusiasts and connoisseurs of the antique Snaefell Mountain Railway. It should be on the air by the time you read this.

Carnane's new system comprises two 2kW transmitters, while Snaefell's new equipment is two 500W units. They will enable the station, heard by more than 80 per cent of the island's 64,000 population, to reach the majority of them on VHF. No doubt it is heard outside the island as well.

Manx Radio was Britain's pioneer commercial station, coming on the air in 1964, the same year as Radio Caroline. Current frequencies are 1368kHz (319 metres) plus 89.0MHz and 97.3MHz on stereo FM. The VHF frequencies were due to change to 97.2MHz with the opening of the new transmitters.

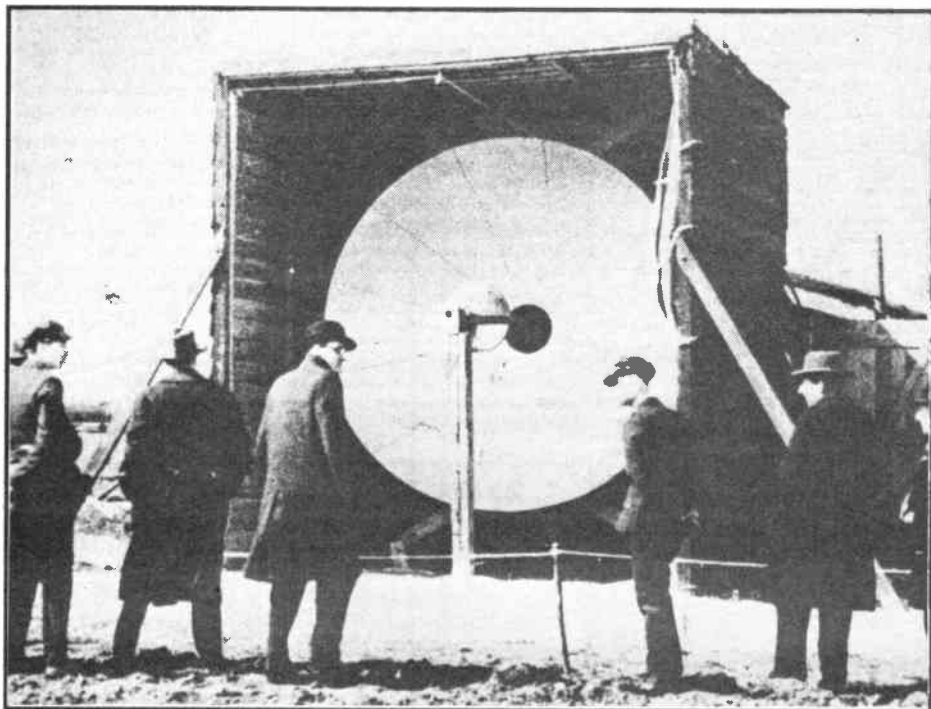
High-tech stuff from the States

The US defence (or should I say *defense*) budget is sufficiently generous still to fund some pretty strange devices

Microwaves are such a modern concept – or seem to be – that it comes as a bit of a shock to think that they were being employed *commercially* more than 50 years ago. A 2GHz link connected Lympne Airport across the English Channel with another at St Ingelvert in northern France.

This followed the first tests made from St Margaret's Bay (near Dover) on March 31st, 1931.

Here are the dignitaries attending the world's first public demonstration of transmission by microwaves (called micro-rays in those days). The company involved was STC, who supplied this photo. Note how it was thought necessary to build a wooden shed over the 3 metre-diameter dish aerial. Perhaps that's a way of getting round planning permission difficulties with the satellite dish in your back garden!



using radio energy, strange enough to warrant mentioning them here. Of course, to the folk employed in the electronic warfare field there is nothing unusual at all in employing advanced techniques . . .

First of all, we have a stealthy airship which, according to *Microwave Journal* 'could change the face of naval warfare in future'. Stealth systems take advantage of the fact that it is possible to change the shape of an object, at least as far as radar is concerned. The idea is to make it virtually invisible to radar and thus able to take the enemy by surprise.

A \$35 million contract has therefore gone to Westinghouse Airship Industries, a joint venture of the Westinghouse Corporation and Airship Industries of Britain, who are prime contractors for the US Navy's airship programme. They will put an E-2C target detection and tracking system on the airship, develop a unique antenna system for it and then test the feasibility of using airships in an airborne early-warning role.

In a separate development, a radio frequency expendable decoy (RFED) system is being designed for the US Air Force by Brunswick Corp. Strips of metal foil, known as 'chaff', are ejected from

aircraft and interfere with the ranging systems of missiles sent to intercept them. Once ejected, RFED will alter the flight path of oncoming radar-guided missiles away from the aircraft dispensing the chaff.

RFED features continuous, broadband frequency coverage which matches the acquisition frequencies of ground and airborne-launched missiles.

Yacht-Cam is a British first

A small Northamptonshire company, TV-2 Communications, teamed up with Marconi to revolutionise coverage of last year's Americas' Cup yacht race. Live action TV pictures, transmitted from on board the American yacht in the final, were transmitted to homes all over the world. This was the first time such a broadcasting technique has been used on a yacht, adding a new dimension to spectator enjoyment of this skilled sport.

The installation aboard the 12-metre yacht *Stars and Stripes* was carried out by Marconi at the request of Australian broadcaster Channel 9 and the American cable sports channel ESPN. The signals of the crew at work and the views from on board were transmitted to a helicopter circling overhead.

Then, on another microwave

frequency, the signals were re-transmitted from the helicopter to the Americas' Cup studios of Channel 9 and ESPN in Fremantle, Western Australia. From here, the live TV pictures were sent by satellite to all major broadcasters world-wide.

By transmitting pictures from on board the yacht, broadcasters were able to get away from the normal 'tiny white triangle on a blue background' kind of picture normally achieved with yacht racing and give viewers a grandstand seat. The two firms have collaborated in similar projects in the fields of motor racing, power boats and motor cycles.

Sign-off

A Canadian source tells the tale of British technicians from the Telecommunications Research Establishment (TRE) who were seconded during the last war to work in America.

TRE was the cover name for the main development centre for radar and its technicians were instructed not to mention any place names or the word 'radar' in any letters they wrote back to their loved ones at home. One bright spark thought it was all right if he spelled everything backwards, however. VIEW

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We are particularly keen to receive construction articles, so if you have designed and built a project which you think could be of interest to other readers we would be pleased to receive your contribution. Construction tips and techniques would also be of great interest.

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MSF CLOCK

By Michael Farrell

This clock, similar to the 'Rewbichron 2' described in the April 1983 issue of *Radio and Electronics World*, is one I have designed and built myself. The board is simpler and cheaper than its predecessor because all the functions are handled in a single chip: the 8748 EPROM microcontroller.

As before, the clock continues running if MSF fails. The display can be switched

to time or date and a high degree of noise-immunity is built in.

The prototype has been running successfully for several months, and the approximate cost of parts was £25.

A photocopy of the original article can be obtained by sending an SAE to the Editorial Department, *Radio and Electronics World*, Sovereign House, Brentwood, Essex CM14 4SE.

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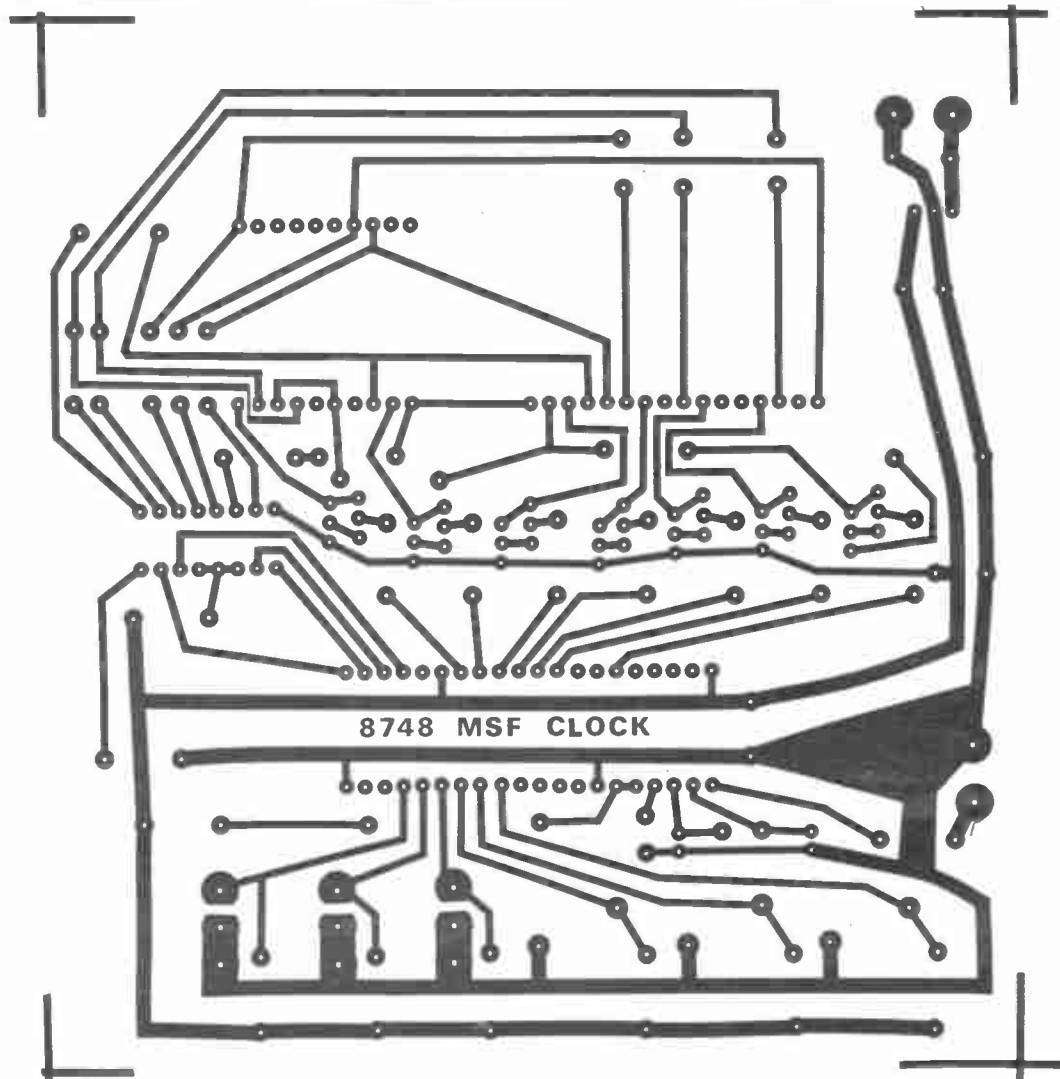
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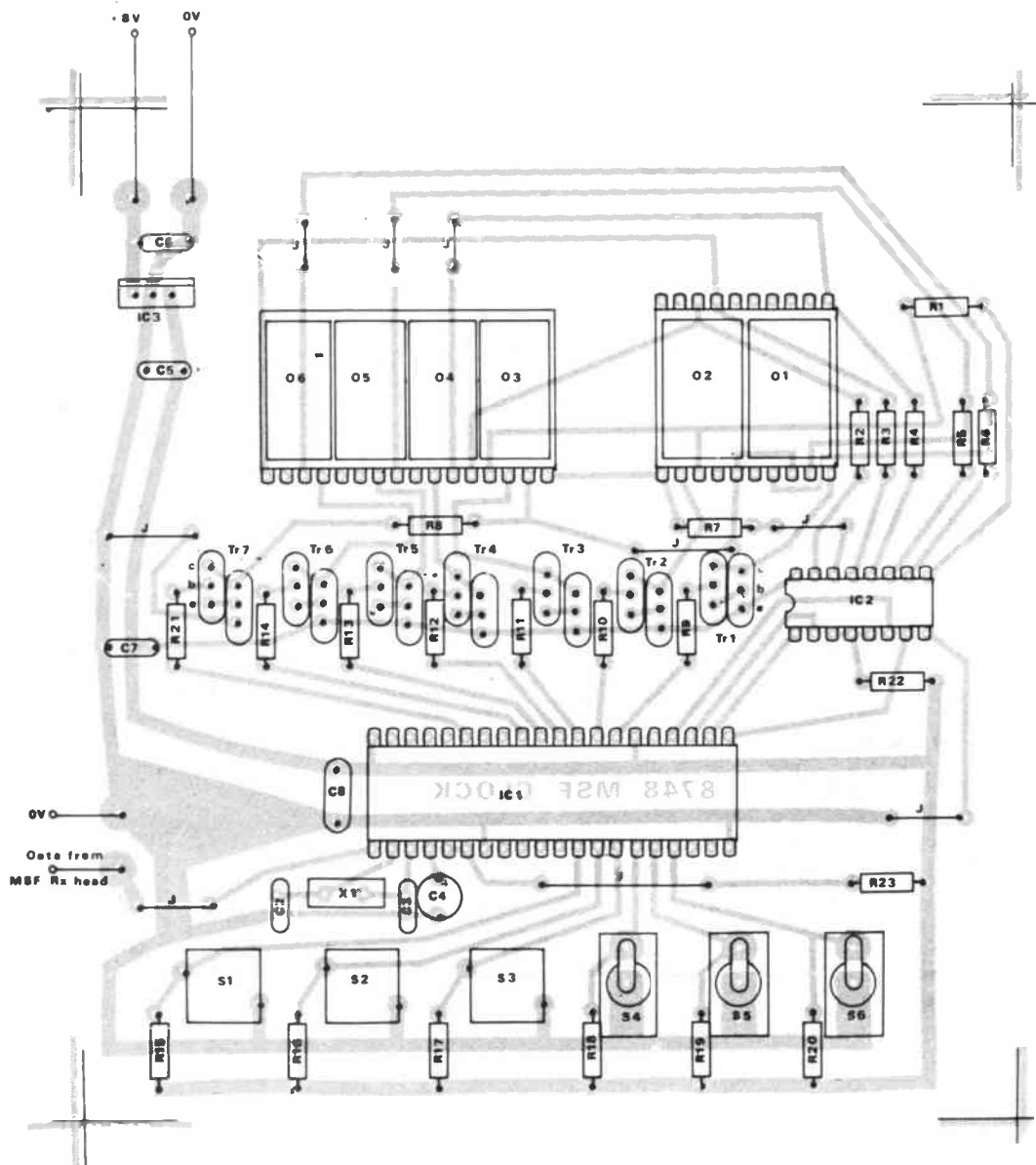
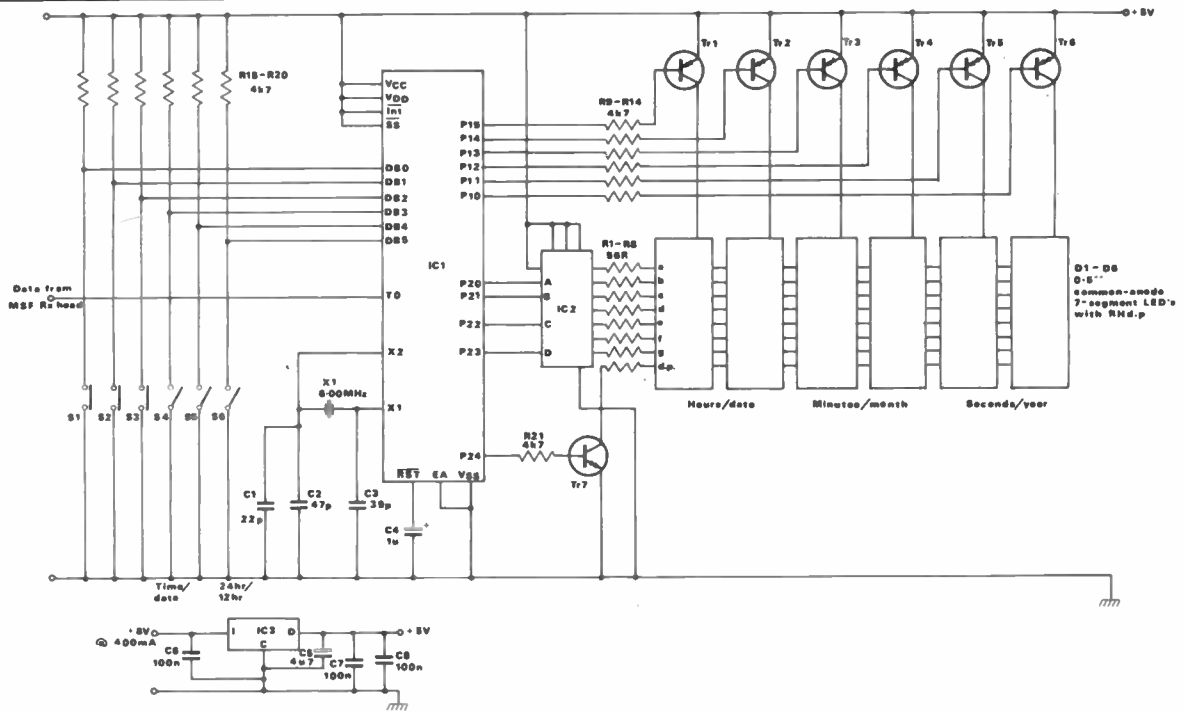
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Tr7 Darlington pair of ZTX300
IC1 8748
IC2 7447A
IC3 μ A7805

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Xtal 6.000MHz crystal
PCB

Approx cost: £25





Latest Literature

SCANNERS 2

by Peter Rouse

This is the second volume of a very popular book for the SWL. One indication of the quality of volume 1 is the fact that the editorial copy is the best-used book in the office!

Volume 2 follows the same clear, easy to read format and is presented in the warm and friendly style which is Mr Rouse's trademark—and what else would you expect from one of our authors?

Scanners 2 carries on where *Scanners* left off—the original text explained the basics of communications and scanning, as well as having extremely useful frequency lists. Volume two is intended for scanner owners who have a little more technical knowledge and who want to build simple accessories.

The computer-control of scanners is examined in

detail (and, for once, 'detail' means 'helpful detail'). For anyone wanting to embark on this interesting aspect of the hobby, this will be a most welcome chapter.

The frequency lists are extended in this volume to give details of US allocations, six metre beacons, television channels and much more. If you own volume one, you'll want this—if you don't, why not buy both?

Argus Books Ltd, £9.95. ISBN 0-85242-924-X

WORLD RADIO TV HANDBOOK

It's that time of year again—the clubs will dredge out their hard-earned savings, normally sane amateurs will start busking in the street for a few extra pence...yes, the *WRTV Handbook* is out.

Pictured in glorious technicolour on this month's

cover, the new edition has the usual abundance of information about what's on the airwaves. Covering long, medium and short wave, listing names and addresses of radio and TV stations, this is the book to look for.

The alternative title for this book should be 'Everything you ever wanted to know about radio and TV but were afraid to ask'. The only problem being, of course, that with such a mass of information to collate, there are inevitable sacrifices, mostly in the form of a necessary brevity.

The annual receiver review includes a road test of the Kenwood R5000, though there's no mention of the Sony ICF SW1S pictured nestling up to the *WRTVH* in the cover photo. Think we pipped them to the post!

There's really no need for further details—it's here, so get your copy ASAP and prepare for a new season of listening!

Pitman Publishing, £17.95. ISBN 902285 13

LOUDSPEAKER AND HEADPHONE BOOK

by J Borwick

This is a weighty tome, about 1½in thick and

hardback to boot. The intention is to provide a comprehensive technical reference book for both the theoretical and practical aspects of loudspeaker and headphone performance. Upon closer examination, it would be rather churlish not to agree—each chapter deals with a new subject, starting from the theory behind the 'black box'.

The history, principles, safety aspects and characteristics are investigated, and the various parts of each unit are looked at.

Data are provided in the form of tables, graphs and diagrams, making this a very convenient reference book for the engineer or student.

Some information found in the book is not available elsewhere: details of electrostatic loudspeakers and headphones, plus the latest techniques for the computer-aided design of drive units, crossover networks and enclosures.

This is an expensive text, but one that would be well worth obtaining for those who need an in-depth knowledge of the subject.

Butterworth Scientific Ltd, £57.50. ISBN 0 408 01387 7

Rohde & Schwarz

This is the latest edition of the Rohde & Schwarz house journal, introducing their newly developed instruments.

These include a TV synchronised syncer for displaying and analysing the D2-MAC signal and the TV-Sat channel test transmitter SFSK. This gives measurements on FM demodulation equipment for the IF signals of all European telecommunication and radio broadcasting satellites.

Many more topics are dealt with in this journal from a company whose equipment is respected throughout the world.

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House of Power

Now available from House of Power is the *Unitrode Linear Integrated Circuits Databook*. This is a comprehensive guide to the functions and applications of the Unitrode ranges of power, control and interface circuits.

Products covered in the book include power supply circuits, power driver and interface circuits. Also included is information on the range of discrete semiconductors.

A number of application notes are included in the book, as is information on packaging and surface-mount interconnection.

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Schlumberger

A new brochure from Schlumberger describes the 3531 Data Acquisition System - a new and more advanced version of the industry-standard Orion datalogger.

Potential applications are suggested in areas throughout industry and the major features of the datalogger are discussed.

*Schlumberger-Solartron,
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Dale-ACI

Dale's new catalogue features major product introductions in key areas including surface mount passives, inductors, film resistors and resistor networks. New surface mount wire-wound resistors and oscillators have also been introduced.

Covering chip potentiometers, oscillators, inductors, resistors, resistor networks, toroid/transformers, connectors and thermistors, the new Dale catalogue contains information intended for the design engineer.

Components new to the

catalogue include autoplacable TNPW series precision thin film chip resistors, featuring a temperature coefficient of only $\pm 25\text{ppm}/^\circ\text{C}$, compared to a minimum value of $\pm 100\text{ppm}/^\circ\text{C}$ for thick film chips.

The range of conventional film resistors has been extended with the new CCF-60 series, rated at 0.75W (350V). New inductive products, including new high current filter inductors, have also been introduced.

*Dale-ACI Components Ltd,
River Park Industrial Estate,
Berkhampsted,
Herts HP4 1HL.
Tel: (04427) 72391.*

British Aerospace

This quarterly journal, containing articles written by employees, gives all sorts of interesting info which will appeal to electronics and aviation enthusiasts alike.

There are articles on Lyman, an ultra-violet space observatory, and *CONDOR*, which is a contraband detector. Most unusual!

To obtain a copy, write to the editor, Mr P Lawrence, at the address below.

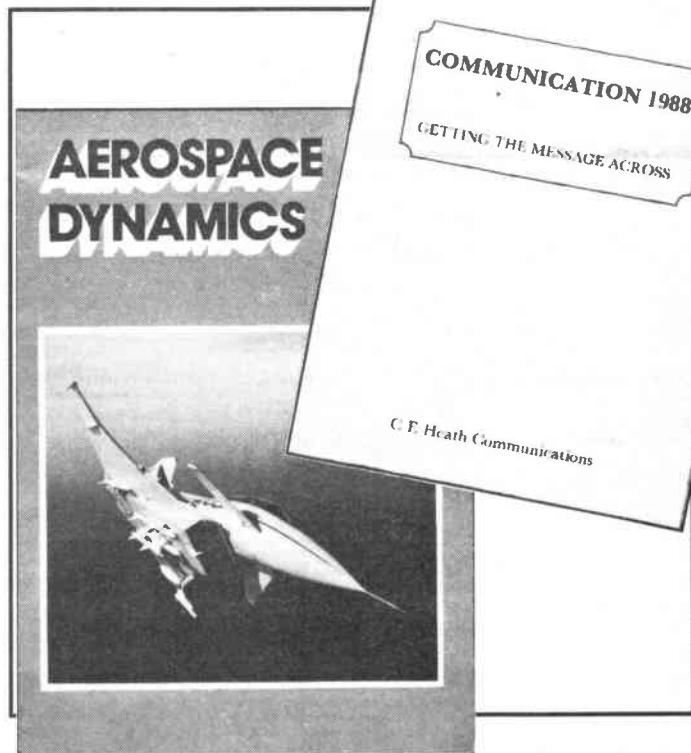
*British Aerospace PLC,
11 Strand,
London WC2 5TJ.
Tel: 01-389 3918.*

Crotech

Engineers, hobbyists and electronics enthusiasts will find much of interest in Crotech's new *Test Measuring Instruments Catalogue*.

It contains a selection of cost-effective oscilloscopes, audio test equipment and accessories. The oscilloscopes include Crotech's new model 3133, a dual-trace 25MHz instrument. This features variable hold-off, a built-in component comparator and a triple output dc source.

For testing and developing AF systems, Crotech offers the Type 2017 auto-tune distortion analyser/level meter. This is described along with a precision low-distortion signal generator



and output power meter, and these three items integrate to form a complete AF test system.

*Crotech Instruments Ltd,
2 Stephenson Road,
St Ives,
Huntingdon,
Cambridgeshire PE17 4WJ.
Tel: (0480) 301818.*

C E Heath Communications

If you are considering pension schemes, the new booklet from C E Heath could prove most useful. Entitled *Communications 88 - Getting the Message Across*, this conservatively-coloured leaflet is a guide to the forthcoming changes to occupational pension schemes which are due to take place this year.

Anyone wishing to know more should contact the company at the address below.

*C E Heath Ltd,
169 Kings Road,
Reading,
Berks RG1 4EY.
Tel: (0734) 597951.*

Anglia Microwaves Ltd

Anglia Microwaves Ltd has made available Comlinear Corporation's high speed,

wide-bandwidth signal processing components product guide.

The new guide lists the full range of Comlinear's family, including the new monolithic circuit which is based on a new concept in fast operational amplifiers. Models with bandwidths of up to 300MHz are included (CLC400), with a switching time of 12ns to 0.05%. Also mentioned is the CLC231 buff amp, specifically designed for signal buffering applications.

The product guide describes linear (video) amplifiers, a category that includes the CLC104, which has a bandwidth of 1100MHz and a rise/fall time of 0.315ns.

Comlinear's new CLC940 track and hold amplifier (called Flash-Track) is detailed, illustrating its superiority for track/hold applications.

The guide gives information on the packaging options and important technical details, showing the extensive capabilities of this product family.

*Anglia Microwaves Ltd,
Radford Business Centre,
Radford Way,
Billericay,
Essex CM12 0BZ.
Tel: (0277) 630000.*

MERLIN

MERLIN WAY, BOWERHILL,
MELKHAM, WILTSHIRE SN12 6TJ
Tel: 0225 706886

SYSTEMS

Look out for Merlin Systems at the following rallies and exhibitions. RSGB VHF Convention at Sandown Park Racecourse on the 01/05/88. Doncaster Radio Rally at Bircotes Sports Centre, Bawtry on the 02/05/88. 31st Northern Mobile Rally at the Great Yorkshire Showground, Harrogate on the 15/05/88. You may also call at the Warehouse but please ring first.

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10	47uF 25v	35p
5	47uF 250v	80p
5	50uF + 50uF 200v	80p
10	100uF 10v	35p
10	220uF 10v	30p
10	220uF 16v	35p
10	220uF 25v	40p
10	220uF 40v	45p
10	220uF 50v	45p
2	220uF 400v	£2.00
3	225uF + 25uF 380v	£1.00
10	470uF 25v	35p
10	470uF 50v	40p
2	470uF 200v	£1.00
5	1000uF 25v	35p
5	3300uF 25v	80p
5	3300uF 35v	80p
5	4700uF 16v	30p

PAPER CAPACITORS

QUANTITY	DESCRIPTION	PRICE
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10	2200pF 2Kv	35p
10	.1uF 200v	35p
10	22uF 200v	35p
10	33uF 250v	40p

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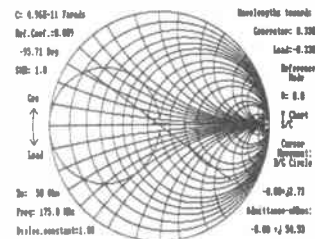
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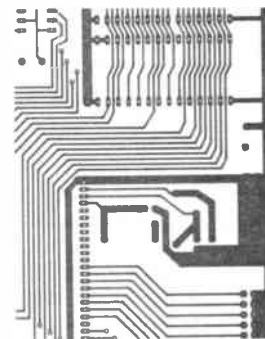
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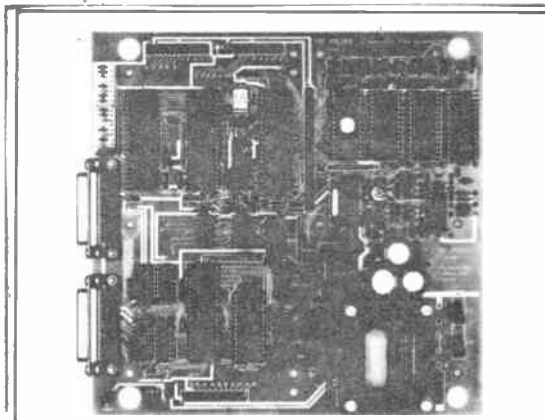
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DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

The most significant long distance television reception occurred at the beginning of the month thanks to the peak in activity of the Quadrantids meteor shower. Extra vigilance on the lower channels of Band III paid dividends with quite a few 'pings' of test cards and programmes.

Sporadic-E signals were evident towards the end of January. On the 20th, Russian and Italian programmes were noted and a particularly good opening on the 28th provided further excellent quality signals in Band I.

All in all, a reasonable month for DX-TV activity considering the time of year but, sadly, tropospheric reception was lacking.

Quadrantids

There have been two reports of identified Band III meteor shower DX. On January 3rd, Simon Hamer managed to read the 'KANAL 1' identification at the top of the Swedish PM5534 test pattern as it briefly emerged on channel E8. However, the best was yet to come.

During the early hours of the 4th, Mark Dent of Leeds resolved the vision buzz of

a PM5544 on channel E7 using a scanner. The aerials were directed towards Iceland at the time and Mark feels certain that the signal came from the high-power Hafell transmitter.

We are inclined to agree with him because Iceland is the only country to show the test card throughout the night. Unfortunately, the signal was far too weak to show up on the TV. According to Mark, the meteor shower activity peaked at 0200 GMT on the 4th. Mark and his colleague, Kevin Jackson, have devised a computer program to calculate optimum reception times.

Lunchtime SECAM

An extremely welcome sporadic-E opening on January 28th produced Eastern European signals on channels R1 and R2. The opening was already in progress at switch-on at 1235 GMT and still in evidence at 1320. The reception consisted of an orchestral programme with SECAM colour bursting through at times. The transmission is thought to have come from Poland. The OIRT FM radio band towards the upper end of Band I was also active.

DX-TV log for January

The reception log for January has been supplied by Simon Hamer of New Radnor in Powys.

03/01/88: RUV (Iceland) radiating the 'RUV ISLAND' PM5544 test pattern at 1457 GMT on channel E4; SVT (Sweden) on channel E8 with the 'KANAL 1' PM5534 test pattern at 1459 GMT; SVT E4 at 1500 GMT on the PM5534; NRK (Norway) on channel E2 received with the clock caption showing half past seven. All reception via MS.

19/01/88: NRK on channels E2 and E3 with the 'NORGE TELEVERKET' version of the PM5544; TVP (Poland) seen on channel R2 showing the test card (dark-background PM5544).

20/01/88: TSS (Russia) on channel R1 with news broadcast (BPEMR); RAI (Italy) on channel IA during programmes - identified by 'RAI UNO' in the corner of the picture.

26/01/88: CST (Czechoslovakia) on channel R1 radiating the 'RS-KH' EZO test card; DR (Denmark) on channel E3 with the 'DR DANMARK' PM5534 test pattern.

Our thanks to Simon for sending his DX-TV reception log, which shows just

PHOTO FILE ● PHOTO FILE ● PHOTO



Fig 1 Opening programme each evening on Egyptian TV, the Koran



Fig 3 Identification caption used by a Syrian television station

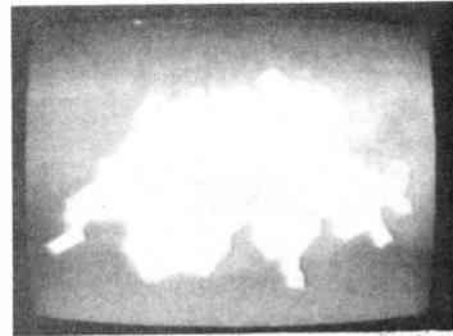


Fig 5 Weather forecast from the Swiss Television service

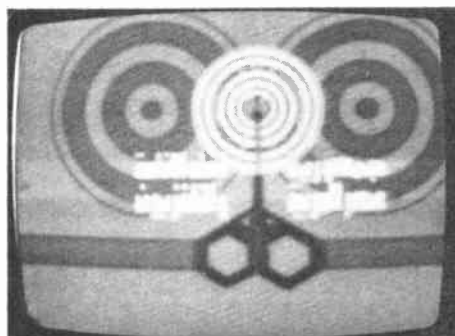


Fig 2 Egyptian news programme broadcast in the Arabic language



Fig 4 FuBK test card from Bavarian Television in West Germany

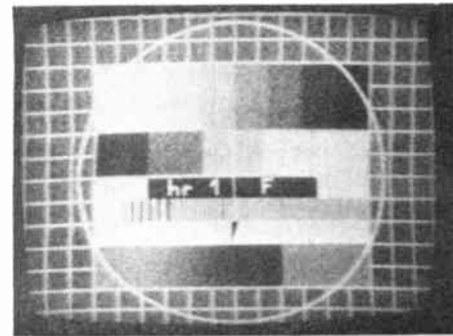


Fig 6 Test card from Hessischer Rundfunk, West Germany

DX-TV RECEPTION REPORTS

what can be received during January with a little patience.

24-hour TVE?

Iain Menzies noted an early morning sporadic-E opening on January 3rd between 0530 and 0615 consisting of pop videos from the south on channels E2 and E3. It seems there is a strong possibility that TVE-1 (Spain) have introduced round-the-clock broadcasting following the introduction of satellite TV transmissions over Christmas.

The Christmas edition of the Spanish TV guide *TV Plus* lists all-night programmes from December 31st until January 2nd. Over the past couple of years TVE-1 have significantly increased the number of programme hours, perhaps in an attempt to compete with some of the satellite TV services.

The introduction of Breakfast TV meant that test transmissions were confined to a meagre ten minutes at 0645. If TVE have introduced 24-hour broadcasting, it might be welcome news for DX insomniacs! Perhaps the familiar GTE test card will now be a thing of the past and nocturnal bullfights will be all the rage. Wonder how the bulls will be able to see in the dark?

Exotic reception

Major Rana Roy at his Indian location has experienced reception which could be a form of TEP (Trans-Equatorial-Skip). Reception occurred on several dates throughout October and November and took place between 1500 and 1930 local time. The details are as follows:

18/10/87: Thailand on channel 3 between 1845 and 1915. The sound was clear but the pictures were distorted with multiple images not unlike F2-layer reception.

26/10/87: A Chinese station on channel 2 at 1500 with Thai TV coming up several times on the same channel. The sound was strong. Signals faded at 1618.

30/10/87: Frequency gratings at 1500. These looked very strange due to multiple images. Chinese writing could be seen at times, but not very clearly.

02/11/87 to 07/11/87: Regular activity from Chinese stations on channels '2' and '3' between 1500 and 1800.

29/11/87: Chinese station on channel '2' between 1630 and 1715.

Similar activity has not been experienced since the end of November, but on January 1st, an excellent tropospheric opening brought in signals from Pakistan, including UHF E21 for the first time. Rana could not believe his eyes when he saw a BBC1 caption announcing a film entitled 'Oh, You are Awful!' Unfortunately, signals ended abruptly at 2335.

According to the January issue of the Dutch BDXC magazine, strange signals have been noted in Europe, too. For instance, a Belgian DXer resolved a PM5544 with a dark background. This occurred during an opening to Russia on

November 4th, 1987 on channel E2 and was encountered at 1130 UTC coming from an easterly direction. At 1135 some form of opening caption appeared and at 1137 UTC a clock was shown with the time +7 hours UTC.

Also, 6 metre contact was made between the UK and Africa during October and the following events were noted:

08/10/87: England to Botswana on 50110MHz at 1720 UTC.

17/10/87: England to Namibia on 50110MHz at 1040 UTC.

22/10/87: Scotland to Botswana on 50110MHz at 1650 UTC and also England to Botswana on 50110MHz at 1547 UTC.

TC DXers please note!

Joop Prosée has written from the Netherlands commenting about unsolved DX mysteries, particularly the reports of test cards appearing on unofficial channels. Over the past few seasons there have been several reports from experienced DXers of the Finnish test card being seen on channel E2. The only Band I channels presently used for the YLE1 network are E3 and E4 as the two high-power E2 outlets ceased operation many years ago.

Joop suggests that the only possibility is a low-power Swedish relay and, according to a recent 'SR' publication, many such relays still exist. YLE also suggested this theory, but we fail to see why the Swedish relay should be transmitting YLE signals in the first place, unless it is a special outlet for Finnish broadcasts.

Several DXers have noted the Südwestfunk studio identification on channel E2 when the West German FuBK test card has been received. There are no Südwestfunk outlets on this channel and low-power Band I relays do not exist in West Germany, so the incorrect identification must be due to switching errors. Joop points out that in the Netherlands such switching errors are noticed regularly, mostly through mutual interchanges between the ARD members (WDR, HR, SDR, etc).

Joop goes on to say that DXers should refrain from naming the Dutch TV networks NOS1, NOS2 and NOS3. The networks are officially named NED1, NED2 and NED3. NOS is only one of the many programme contributors to the Dutch network with a broadcast licence. Referring to the Dutch TV networks as NOS is very much like calling BBC2 'OU' just because the Open University uses this network!

Another frequent error among TV DXers, according to Joop, is the naming of the Greek broadcasting organisation. Naturally, the majority of enthusiasts refer to it as EPT because that is how the Greek letters appear at the top of the PM5534 test card. However, the Greek 'P' is an 'R' in the Roman alphabet so the

organisation should be called 'ERT', which means Elleniki Radio and Television.

Similarly, the Roman equivalent of a Russian letter often mistaken for a 'U' is really a 'C'. Hence, identification captions for 'Tsentralnaia Televideniija', which means 'Central Television', should read 'CT'.

DXers should not refer to the Russian test card as the '0167 test pattern'. Its correct title is the 'UEIT', an abbreviation of 'Universalnaia Elektroticheskaja Ispitatelnaia Tabliza' which translates as 'Universal Electronic Inspection Card'.

New DX publication

The publication *TV DX For Beginners*, by TV DXer Simon Hamer, has been completely revised and expanded to 20 pages (A5 format). Primarily aimed at helping newcomers to the hobby, the 2nd edition provides useful information to assist anyone with their first attempts at TV DX reception.

It discusses TV systems, channel allocations, modes of propagation, DX receiver systems, teletext reception and recording DX reception with a normal VCR. There is also a section on amateur and mobile TV DXing, illustrated with photographs of test cards and captions from European TV services received in the UK. It is available from HS Publications, 7 Epping Close, Derby DE3 4HR; £2.95, UK postage; £3.75, airmail.

New DX-TV catalogue

A new catalogue is available from HS Publications featuring a wide range of DX-TV publications together with news about equipment suitable for long distance television reception, including the popular D-100 DX-TV converter. Two first class postage stamps (or three IRCs for readers overseas) should be sent for a copy of the new catalogue.

Spanish TV/FM station guide

The 1988 edition of José Paul Laborda's *Guide to Spanish FM and TV Stations* is soon to be published. The price will be 1485 pesetas. Further information is available from José, PO Box 38015, E-08080 Barcelona, Spain. Please don't forget to enclose one IRC for a reply.

BATC rally

The 1988 BATC rally will be held at the Post House Hotel in Crick (near Rugby) on Sunday April 24th, 1988. The hotel is easy to find. Turn off the M1 at Junction 18, head east for two hundred yards and the hotel is on the left.

The BATC rally covers virtually all aspects of television, including DX-TV, with displays and demonstrations plus many trade stands. All being well, the authors of this column will be there to demonstrate the hobby. If the excitement and the traipsing around makes you weary and brings on a thirst, there's

always the Percy Pilcher bar!

Reception reports

Auroral reception was experienced by Iain Menzies of Aberdeen on January 6th, 13th, 14th, 15th and 16th. Reception consisted of Norway on channels E2 and E3 and Russia on R1. Iain comments that according to the newspapers the aurora on the 14th was the best in living memory.

Terry Powell of Leeds has written giving details of his DXing history. His enthusiasm was prompted during the sixties when, by accident, he found foreign stations while twiddling with the tuner on a dual-standard receiver. However, it is only over the past eight years that he has DXed regularly.

A Grundig P55 245-9 multi-standard colour receiver is now used and his location (the highest point in Leeds) ensures good quality results, particularly during periods of enhanced tropospheric reception. A D-100 DX converter system has recently been acquired in time for the coming sporadic-E season.

Countries already encountered via sporadic-E propagation in Band I are Spain (more times than anywhere else!), Russia, Italy, Iceland, Morocco and many others. Receiving aeriols provide wide-band coverage on each band with a three-element array for Band I and a five-element for Band III. Twin (stacked) Triax BB grid aeriols are coupled to a 26dB gain masthead amplifier for UHF reception.

Peter Singleton of Gravesend tells us that reception from the Goes transmitter in the Netherlands is possible most of the time. In fact, he refers to it as his local. All three services are available and reliable teletext reception can be picked up for hours at a time with very little character loss.

Peter has asked, 'Why on earth were channels 43 and 46 chosen for the Bluebell Hill transmitter in Kent?' Apparently, during the slightest tropospheric lift, TVS and BBC2 transmissions are subject to interference from the Egem BRT1 and BRT2 transmitters in Belgium which also use these channels.

Sporadic-E down under

Duncan Fraser has written from his New Zealand location describing the sporadic-E season which has just come to an end in the southern hemisphere. His letter begins, 'I think the less said about this season, the better!' which seems to imply that it was rubbish. Apparently, the number of openings has been down on other years. An experienced DXer in Auckland, reporting in late January, claimed only eight 'foreign' openings compared with 26 over a similar period last year.

Other enthusiasts in the southern hemisphere have had similar results: a poor season. Duncan logged recognisable pictures from Australia on 36 days as

Location	Channel	Projected starting date
Kobenhavn	53	5th April, 1988
Abenra	27	1st July, 1988
Hedensted	30	15th August, 1988
Videbok	40	1st October, 1988
Tommerup	22	15th November, 1988
Svendborg	32	15th November, 1988
Viborg	56	1st January, 1989
Thisted	28	1st January, 1989
Hadsten	26	15th February, 1989
Nibe	35	1st April, 1989
Tolne	37	1st April, 1989
Varde	33	15th May, 1989
Jyderup	48	1st July, 1989
Vordingborg	58	15th August, 1989
Nakskov	52	15th August, 1989
Ry (Bornholm)	56	1st October, 1989

opposed to the anticipated 55. This may not sound too bad, but many of the openings were very brief or extremely weak. There were only a couple of days with intense activity from a wide area.

During the previous season, it was possible to see Australia's ABC National Television Service open up two or three times as it was received from different time zones. This year, Duncan was lucky to see it open up once.

Reception from Samoa was so infrequent this season that an aerial specially cut to channel A2 was only used for 10 to 12 minutes!

The New Zealand Television Service (TVNZ) have now commenced experiments using new channels. Unfortunately, the authorities are very tight-lipped about what is going on. Until now, UHF has not been used in New Zealand, but in the Wellington area intermittent test transmissions have taken place on approximately channel E56. Similar transmissions are occurring on a new Band III channel. Until now, New Zealand Band III channels have terminated at NZ9, equivalent to channel E10 in Europe. The new NZ10 channel is approximately E11. According to Duncan, the vision carrier is 700kHz higher.

Incidentally, the lowest Band I TV channel in New Zealand is NZ1 at 45.25MHz vision. NZ2 coincides with the European channel E3 and NZ3 with E4. It uses System B which has a sound carrier 5.5MHz higher than the vision. The colour system used is PAL.

TV-2 transmitters in Denmark

Michael Summers Larsen of Denmark has forwarded information concerning major changes affecting TV in Denmark. The TV2 network will consist of high power transmitters, many having an ERP of 600kW. This is bad news for those who regularly use high-gain equipment on some of these channels to watch programmes from neighbouring Germany and Sweden.

By early April, the new UHF transmit-

ters at Copenhagen should have entered service. DR programmes will be on channel E31 while TV2 will use E53. The DR channel E4 transmitter is expected to continue operating for a few more years.

Local TV in Copenhagen is expected to move to a new transmitting site at Gladsaxe and new channel allocations are expected.

Service information

Monaco: Although the Philips PM5544 test pattern is normally used for test transmissions, Tele-Monte-Carlo are occasionally radiating the FuBK pattern with 'TELE MONTECARLO' identification before programmes commence.

Syria: A new medium power UHF transmitter has recently entered service on channel E26. It broadcasts SRT programmes in PAL colour as opposed to SECAM, which is used by its other transmitters. We can only assume that the transmissions are intended for viewing in neighbouring countries.

Finland: A new YLE-3 transmitter is now in operation on channel E54 with an ERP of 120kW.

Yugoslavia: The late-night sponsored TV transmissions called 'Programme Plus', broadcast last summer by some of the JRT regions, have been replaced. The new extended transmissions are called 'I NOC I DAN' and originate from the Sarajevo-1 network. It is aired between 2200 and 0100 local time and broadcast via the Sarajevo-1, Beograd-1, Zagreb-1 and Novi Sad-1 outlets.

Cyprus: Three new transmitters have commenced operation broadcasting Bayrak Radio-TV Kurumu programmes. These are:

Selvilitepe BRTK-3 E41 370kW;
Selvilitepe BRTK-1 E44 370kW;
Sinan Dagi BRTK-1 E8 100kW (vertically polarised).

This month's service information was kindly supplied by Gösta van der Linden (Rotterdam), the Benelux DX Club (Netherlands) and David Bocca Corsico Piccolino (Vigevano, Italy).

MEDIUM WAVE

DXING



by Steve Whitt

Last July I carried a short item in the news section of this column about broadcasting in the Falklands. This month, however, it is possible to take a closer look at radio on these remote islands located 12700km from London.

For many years no one took much notice of the Falklands. It took the Argentinian invasion in April 1982 to make people sit up and take interest. Until then, the islanders had traditional lifestyles in which the Falkland Islands Broadcasting Station (FIBS) played an important but rather parochial role.

In many ways, the Falklands are like the Australian outback. Both have a very dispersed population, heavily dependent on sheep rearing and similar activities, so radio becomes a vital lifeline and not just a source of entertainment. In addition to broadcast radio, most island communities were equipped with marine band short wave radios through which the equivalent of the Australian Flying Doctor could be reached.

Everything changed with the arrival of Argentinian troops, who took over the studios and transmitters of FIBS as soon as they moved into Stanley. Under their 'benevolent' authority, Patrick Watts was kept on as station manager, though the Argentinian influence did extend to programming. Some Spanish material was, in fact, broadcast for the Argentinian troops.

Even under the best propagation conditions, it was always difficult to hear FIBS if listeners were any significant distance from the islands, so the chances of any DXer actually hearing these Argentinian programmes seems pretty remote. However, I'm sure that someone will probably prove me wrong and write to say that not only did they hear the station during this special period in its history, they also received verification.

At about this time, another station (run by the Ministry of Defence and also a real DX rarity) took to the air from BBC transmitters on Ascension Island. For just one month, Radio Atlantico del Sur broadcast anti-Argentine propaganda, including advice to surrender, to the invading troops in the Falklands.

It wasn't long before the British Task

Force landed on the islands and, faced with an advancing enemy, the Argentinians blew up the 5kW medium wave transmitter located at Stanley (it used to operate on 536kHz). They also removed a number of key components from the transmitter, making repair impossible, and, before the British arrived, they mined the medium wave aerial site to make it unusable.

After the liberation of Stanley on June 15th 1982, the task of getting FIBS back on the air was begun. The solution was for FIBS to operate via its marine band transmitters, originally used prior to hostilities on 2370kHz in parallel with medium wave. The short wave service raised its power to 3.5kW and used either 2380kHz or 3958kHz.

It was then that the Services Sound and Vision Corporation (SSVC) became involved with FIBS. SSVC is the parent organisation of the British Forces Broadcasting Service (BFBS) and, within a fortnight of hostilities ceasing, SSVC had sent one of its project engineers out to the islands. However, the special situation meant it was a further 12 months before a VHF-FM service could be provided for Stanley. In the interim, FIBS was producing four hours of programmes per day, supplemented by BFBS programmes from Britain. These programmes continued to be aired on short wave, where they were reported from time to time by listeners in Europe.

A further year passed before new VHF-FM transmitters were installed at Mt Pleasant and Mt Maria, one of the highest spots in the Falklands. Although Mt Maria's height makes it almost ideal for a VHF transmitter site, it suffers from several problems. This situation came to a head about 18 months ago.

The top of Mt Maria is remote and windswept and has been unmanned since the departure of a small army signals out-station. The lower mountain slopes are mined, it is unreachable by land and access by air is hazardous because the mountain top is shrouded in cloud about 95% of the time.

To keep the unmanned 2kW transmitter running, FIBS relied on regular supplies of diesel fuel, carried by the armed forces in a Chinook helicopter. At

about the same time, SSVC sent a mobile studio to Stanley to generate local BFBS programmes. Towards the end of 1986, this studio moved to Mt Pleasant, where most of the British troops were stationed.

The SSVC considered replacing the Mt Maria transmitter with a medium wave service for a variety of reasons, not the least of which was the rising fuel bill - Chinooks don't come cheap at £8,000 per hour. A new 10kW transmitter was planned and transported to a site at Bush Rincon, about 10km east of Mt Pleasant. In fact, if all has run according to plan, the new medium wave service should have been inaugurated on 550kHz by the time you read this column.

This brings us bang up to date with FIBS. The Falklands conflict has had a major impact on the station, turning it from a sleepy few-hours-a-day station into a modern 24-hour broadcaster linked via satellite direct to BFBS headquarters in London.

FIBS still produces about four hours of its own material each day. This is mainly prime time programming as it's difficult to imagine a drive time or rush hour on the Falklands. Around 50 hours per week of local BFBS material supplements FIBS programmes and another 50 hours is fed from London. News is live every hour on the hour via satellite from the BFBS Bridge House studios in London.

As for the future, SSVC has been involved in plans to extend radio coverage to South Georgia, although this seems unlikely, and to extend TV programming to cover Stanley, which is much more likely. Like other British outposts overseas, it is likely that there will be a BFBS operation in the Falklands as long as British troops are there.

To round off the FIBS story, it is worth noting that the new 550kHz signal should make a very interesting DX target for the European medium wave enthusiast. Not only is the station located on a reciprocal latitude to London, there is also the possibility of enhanced reception as the great circle is almost north-south and the entire path passes over the sea.

Dial-Search

I was pleasantly surprised recently when I received a review copy of *Dial-Search* by George Wilcox. This handy-sized paperback sets out to help the home listener make the most of a portable radio and its own aerial. That is indeed where it succeeds, though there is no denying that the book would still be of value in a serious DXer's shack.

Although the book is subtitled 'Guide to European Broadcasting' and mentions MW, LW, VHF and SW on its front cover, it is not quite as comprehensive as it might first seem. The emphasis is definitely on MW stations since only three pages are devoted to VHF (in the UK) and another three cover European SW broadcasts.

On the other hand, the book is a comprehensive source of information on all UK stations (MW and VHF) and on all major European stations. Not only does it contain basic listings, there is also

information on music programming, networks and English language broadcasts. It includes an easily-understood seven-page introduction to radio listening. A book I recommend, especially to medium wave newcomers.

Dial-Search 5th Edition (1988/89) is a 46-page A5-format paperback with two useful fold-out colour maps of Europe and Great Britain. It costs £3.25 from shops or is available by mail order at £3.60 in the UK and £4.00 overseas (or 18 IRCs). Order direct from the publishers, George Wilcox, 9 Thurrock Close, Eastbourne, East Sussex BN20 9NF.

Special event radio '88

On February 25th 1988, the Home Office gave the go-ahead for special event radio (SES). The station's purpose and guidelines are broadly similar to previous years, but there are some important changes. Special event radio uses low-powered freely radiating transmitters or induction field systems to broadcast at festivals, conventions, shows, sports events, etc. The broadcasts can be received on normal radios at the site of the event.

In contrast with previous years, the Home Secretary has now announced that:

1. VHF operation is now authorised with 50mW typical (1W max) power.
2. Applications for licences can be made any time (six weeks prior to operation) instead of only at the start of the year;

this means that a comprehensive list of licensed stations is not available.

3. There is no upper limit on the number of licences available; in the past two years only 31 licences were issued to cover 59 separate events.

Neither the Home Office nor the DTI publishes a list of licensed stations, but I will attempt to keep this column up to date with news on SES stations.

Quick tip

To hear a daily report on sunspots, A indices and solar flux try listening to R Australia - it's easier than WWV from Boulder, Colorado. Reception on 9655kHz short wave has been excellent every day in February; listen for a report presented by Mike Bird between 0825 and 0830hrs UTC.

If you're interested in offshore/independent radio then *Communicate '88* is for you. It is a free radio convention being held on September 24th in the Spanish Hall at the Winter Gardens in Blackpool. This date coincides with the Blackpool illuminations so it is advisable to arrange accommodation well in advance. I'm led to believe that the cost will be about £10. If you would like more information, send an SAE to Anoraks-UK, PO Box 539, Blackpool FY1 4RE.


DX file

It's around this time of year that DX statistics for the previous year get compiled and published by radio clubs.

Although many DXers feel that 1987 was a bit of a let-down DX-wise, even taking account of the DX usually associated with a sunspot minimum year, it turns out that a very good variety of DX was heard. This was due, in the main, to the impact of several DXpeditions that travelled to northern Scotland and to Anglesey to hunt down the rare stuff.

If we take a quick look at transatlantic reception, which is of interest to many medium wave listeners, we'll see that a total of 31 US states was heard in the UK during 1987, including the usually elusive states of Washington, New Mexico, Oregon and Idaho. In Canada, every province was heard many times, though the Yukon and North West Territories, where only a handful of low power stations are broadcasting, were not heard at all.

Moving south, it seems that 1987 was a pretty reasonable year for the Caribbean, but less so for Central America. Of 24 Caribbean island countries, 20 were heard here in Britain, which is not bad really, and, indeed, 1987 did provide some of the best medium wave DX for many years. Let's hope that the aggressive start of sunspot cycle 22 doesn't have too much impact on medium wave DX prospects for 1988.

That's it for another month so, till next time, keep those dials tuned to the medium waves and feel free to drop me a line c/o *R&EW* with any news, views, queries or ideas. 

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On these pages we present details of interesting contacts from clubs and individuals. We would be happy to receive any similar items from readers

Well, well-Welwyn!

News has reached us from one of the country's Nice Places - Welwyn Garden City, where Welwyn-Hatfield ARC members meet (lucky things). Not content with living in the Queen of suburbs, they also hold two meetings every month, one formal and the other informal.

May's formal meeting, subject to confirmation, will be a talk by Cirkit (or a representative thereof) on May 2nd. The informal meeting will be a general discussion on May 16th to prepare members for the HF Field Day, which is in June. Sigh... it all sounds so idyllic.

All formal meetings are held at Lemsford Village Hall, Brocket Road, Lemsford, while informal meetings take place at Knightsfield Scout HQ, opposite Ingles, Welwyn Garden City. Both meetings start at 8pm and are on the first and third Mondays of the month. Club nets on S15 (phone) on the second and fourth Mondays at 8pm mean members won't miss their meetings too much between dates.

For those who yearn for still more club activity there is CW on 144.157 on the third Tuesday of the month at 8pm. To join the club, or find out more about club activities, contact Roger Curtis G0CYC QTHR or on (0707) 324958.

Newport for old

Newport Amateur Radio Society will be holding a grand surplus equipment/junk sale on May 15th. The venue will be Brynglas House, Newport, Gwent. It will be open from 11am to 4pm, though the disabled will be allowed in from 10.30am.

The amateur's delight, a junk stall, will be there along with a flea market for those who are itching for a bargain. An auction will be held from

12pm; items for this will be accepted from 10am. Furthermore, snacks and refreshments will be available. Sounds too good to miss!

Talk-in will be on S22, by GW1NRS. Any money raised during the course of this event will fund the display of amateur radio that NARS are putting on at the Royal Welsh National Eisteddfod later in the year. Incidentally, the club wants Welsh-speaking amateurs to contact them to help with this event.

To find out more about the club, or to volunteer for the Eisteddfod fun, contact Bob GW4IED on (0633) 280958.

Happy valve-day

There's a real treat in store for Southgate ARC members this month - Stan Woods, the celebrated Marconi historian, is giving the third of his annual lectures. This one is entitled the 'History of Valves, part three'. We cleverly figured out that the first and second lectures were probably parts one and two...

This club meets from 7.45pm, on the second Thursday of each month, at the Holy Trinity Church Hall (upper), Green Lanes, Winchmore Hill, London N21. Club contact is Brian Shelton, on 01-360 2435.

Sent to Coventry

Coventry Amateur Radio Society seems to be taking a break from its usual hectic programme this month, with only two events scheduled - the regular nights on the air with Morse tuition on May 6th and 20th.

The club usually meets every Friday at 8pm in Baden Powell House, 121 St Nicholas Street, Radford, Coventry. Anyone who wants to know what else is on this month should contact Jon Ward G4HHT on (0203) 610408. There must be something

happening! Perhaps it's a dark secret...

Happy birthday

This year is the RSGB's 75th anniversary, and there will be many celebrations of this auspicious occasion up and down the country - and across, as the Pembrokeshire Radio Society would like to point out.

On May 21st, they will be holding a special event at the Further Education Centre, Tower Hill, Haverfordwest, Pembrokeshire. The doors will open at 11am and then it will be fun and frolics all the way, with the society operating under a special callsign, GB75PRS.

If you want to send a message to the world, or just tell the XYL that you'll be late for tea in style, why not drop by? Scouts and Guides trying for their communications badges could also come closer to achieving this qualification.

The station hopes to have three transceivers in operation - HF phone, HF Morse and VHF. CW will be between 3.515 and 3.540. Visitors are invited to bring their vintage equipment along, either for exhibiting or for identification by a panel of experts. We're going to take a BR sandwich, but *that* probably wasn't identifiable when new...

To find out more about the special event or the club, contact Brian Smith GW0IER on (06462) 2825.

Long live Longleat!

The famous Longleat Rally takes place this month - organised by the City of Bristol RSGB group. This year is the 31st anniversary of the inauguration of this splendid event and the rally will start at 10am on Sunday, June 26th.

To find out more about this rally, contact Brian Goddard G4FRG, the Chairman of the Bristol RSGB Group, on (0272) 848140.

Copper nitrate

'Allo 'allo 'allo... Wot's all this then? Chelmsford Amateur Radio Society is coming over all legal this month, with a visit to that most concrete of edifices, the Chelmsford Police HQ.

This meeting, on May 3rd, takes the place of the usual get-together at the Marconi club. 'Twill be an arresting sight, methinks, if a dry one. I don't suppose the members will want to get too well acquainted with the bars... Let's hope there's no charge for the day out.

CARS meets on the first Monday of the month at 8pm, normally at the Marconi college in Arbour Lane, Chelmsford. To find out more about the club, contact Roy G3PMX or Ela G6HKM on (0245) 360545.

Rally-go-round

Interesting things are afoot in East Suffolk this month, with the advent of the twelfth annual East Suffolk Wireless Revival Rally.

Organised jointly by Ipswich Radio Club and Martlesham Radio Society, this popular rally is scheduled for Sunday, May 29th. Among the many exciting features will be an RSGB book stall, and aerial testing range, packet demonstration, vintage radio display, CW pile-up competition and a transceiver clinic (gasp).

After that lot, plus the usual bring-and-buy and car boot sale, it won't be just the transceivers that need first aid!

At a paltry £1 admission, this sounds like a good family day out. There's even a children's play area and model flying display. Talk-in will be on S22, given by the Felixstowe DARS, using the callsign GB3PO and GB31H.

Further details can be obtained from Jack Tootill G4IFF, on (0473) 464047. Stand space should be booked through Colin Ranson G8LBS on (0473) 688204. The venue is the Civil Service Sports Ground, Straight Road, Bucklesham, Ipswich.

Spring is sprizz

The rallies, like the spring flowers, are upon us in strength. Kelso ARS, ably assisted by the Borders ARS, will be hosting the fifth Anglo-Scottish Rally in the Tait Hall, Kelso on Sunday, May 1st from 11am to 5pm.

There will be stalls, Morse tests (booked through the RSGB), a bar, snacks, raffles

and all those rallyish things that endear them to amateurs everywhere.

Admission is £1, though juniors, XYLs and YLs will be admitted free, which could cause severe congestion with all those amateurs staggering in, wearing the XYL's purloined Sunday best and stiletto heels.

At the risk of being lynched by enraged hams, we continue (bravely) by adding that a trip to this beautiful borders town is well worthwhile – what better way to spend a holiday weekend?

For further information, or advice about finding accommodation, contact B Covers GM4VIB, QTHR or on (0573) 24054.

ISWL'87

We have received a newsletter from the International Short Wave League – reformed after the extinction of the original fine old club in 1986.

ISWL '87, as they call themselves, is especially concerned with the needs of the SWL, though there are plenty of events to keep the licensed ham busy – there are nets on 3.550 CW at 10am and on 3685 SSB at 10.30am on Saturdays, with Dick Rugg G2BRR. Nets on Monday and Tuesday are at 8.30pm on 3535 CW and 7pm on 3.700 SSB with Peter O'Neill GW4UZL.

The ISWL would like to hear from readers interested in joining the club – the man to contact is J May G1GWG, 10 Clyde Crescent, Wharton, Winsford, Cheshire CW7 3LA. Don't let the League go QRT again!

Express service

There is a very busy club up North – the South Manchester Radio Club, in fact. With three meetings this month, members will be kept quite active.

On May 13th, David Yorke G4JLG (and co!) will be discussing the conversion of the '88' set.

May 20th heralds the AGM, with an 8pm start. The annual fun and games are about to begin!

There will also be a meeting on the 27th, though the evening's events have still to be arranged.

All meetings commence at

8pm at Sale Moor Community Centre, Norris Road, Sale, Cheshire. Details of forthcoming events can be obtained from David Holland on 061-973 1837.

Open all hours

Farnborough and District Radio Society will be hosting an open evening on May 11th, giving the curious (or the lonely XYL) a chance to see the workings of the club.

May 25th brings the HF Field Day review with Morse practice courtesy of G0FNW.

Farnborough and District RS meet at the Railway Enthusiasts Club, 103 Hawley Lane, Farnborough, from 7.30pm. To find out more, contact Tim G4UQE on Camberley 29321.

Parkanaur

The Mid-Ulster Amateur Radio Club is holding its annual Parkanaur Radio Rally on Sunday, 15th May this year. Irish amateurs should note, however, that the club has organised a new venue, the Silverwood Hotel, Lurgan, County Armagh.

Doors will open at noon to reveal the usual trade stands, a bring-and-buy stall, an RSGB bookstall, QSL bureau and more. There is no need to get lost, either, as talk-in will be on S22 FM 145.550.

This is a charity event, all proceeds going to the Stanley Eakins Memorial Fund, so don't begrudge the £1.00 entrance fee.

If you are interested in attending this worthwhile event and would like further information, contact Sam White on (07662) 22855.

Spaced out

The Wirral Amateur Radio Society is joining in with the hobby's current enthusiasm for satellite communications with a lecture by G3VHQ entitled 'Orbital Predictions for Satellites', on May 4th.

The club headquarters are at Ivy Farm, Arrowe Park Road, Wirral L49 5LW. Further information is available from the secretary, G3VEB, QTHR or from the group's chairman, Roy G4ZCA, on (051) 638 1346.

Radio showcase

Rugby Amateur Transmitting Society members are currently preparing for the

NOTES FROM THE PAST

With the preparations for the RSGB's 75th anniversary convention at the NEC well and truly under way, it is interesting to read some comments made about the 1953 exhibition

Another RSGB exhibition – the seventh – has come and gone. There was little which could be categorised as 'new', and a number of the standard lines and established favourites were absent. This was regrettable, as I like to feel that this occasion is as representative as possible of amateur radio. It is intended to be a public one, and at no time of the year is the hobby more in the public eye.

As always it was a great occasion for amateurs from widely separated regions to get together, and many must have found the visit worthwhile for this alone. David Godwin (a newcomer to the amateur market) exhibited a range of separately available foundation units which can be assembled as a TVI-proof table-top transmitter. Unfortunately the bottoms were kept screwed on, so visitors were not able to see much of the 'works'.

Panda Radio also had their 'Table-Topper' on show and also a new low-power rig, the 'Panda Club'.

This table-top emphasis is markedly symptomatic of the trend in recent years. In amateur design the formerly popular 6-foot-odd rack-and-panel seems to be increasingly falling out of favour.

Also in the fashion were our old friends, E J Philpotts Ltd, who had a couple of 3-tier table-top racks on show, one fully enclosed. Now the housing situation is getting a little easier, it is curious that amateurs are anxious to squeeze their stations onto a corner of the dining room instead of spreading it around a spare room shack.

Home-made

The amateur constructors section was of great interest and some very elaborate apparatus was on view. Many visitors must have wondered whether all of it worked as well as it looked.

The standard of finish was extremely high and the marking of controls was of a high order. Modern transfers are most effective if carefully used.

Rugby Hobbies Festival, to be held this month, where they plan to run a special event station.

In view of the present concern about the apparent lack of enthusiasm for the hobby among young people, events like this are important

showcases, increasing public awareness and creating interest.

The society welcomes new members at its weekly meetings. These are held every Tuesday at 7.30pm at the Cricket Pavilion, outside Rugby Radio Station.

SHORT WAVE NEWS

FOR DX LISTENERS

By Frank A Baldwin

All times in UTC, **bold** figures indicate the frequency in kHz

Amongst the Tropical Band signals from Latin America that can be heard here in the UK during the coming season, those emanating from Colombia will most certainly be of interest to readers of these columns.

Updating the present position according to the latest information available, our review is arranged in frequency order, dealing with those Colombian stations currently active on the 60 metre Tropical Band (**4750** to **5060**kHz). In each instance the programme language is Spanish.

Colombia – on the air

Radio Super in Medellin operates a 24-hour schedule on **4780.3**. The 2kW transmitter occasionally succeeds in putting signals into the UK. Radio Super was widely reported in the short wave listener press some years ago when on its old channel of **4875**, but seldom appears now in DXers' lists.

Ecos del Combeima, Ibaguè, is also on the air around the clock but on **4785.2**. With a power of 5kW, it was thought last year to have become inactive but has since been identified on the Super Radio Network. It can be heard when in the clear after the Brazilian station Radio Caiari in Porto Velho on **4785** signs off at 0500.

In Valledupar, Radio Guatapuri on **4815** is on the air irregularly from 1000 to 0400 in the Caracol Network. At 10kW, it was another of the Colombian transmitters commonly and widely reported a couple of years ago but now, probably because of the irregular operation, it rarely features in short wave columns.

Inactive until a few months ago, Radio Bucaramanga, Bucaramanga has sprung to renewed life on its previous frequency of **4845**. At 1kW, the schedule is from 1000 to 0400, but it is reportedly closing at 0405.

Frequently heard and reported are the signals from La Voz del Cinaruco, Arauca, on **4865.1**. In the Caracol Network it also identifies as La Voz de la Frontera carrying programmes from 0900 to around 0400 but closing at 0200 on Sunday. The power is 1kW.

Another member of the Super Radio Network is Ondas del Meta in Villavicencio. Operating irregularly to a 24-hour schedule on **4885**, with a power of 5kW, it has also been reported as signing on at 0750 and off at 0430.

Nowadays, like Radio Guatapuri – and probably for the same reason – its signals are only occasionally heard by the DXing fraternity.

Not so often reported, but for a different reason, are the programmes of Armonias del Caqueta in Florencia. On **4915**, it operates from 1000 to around 0300 on Sundays only with a power of 3kW. For a logging of this one, an early Sabbath listening session is therefore necessary.

The frequency of **4945.5** represents the most favoured tuning point for Colombian reception within the 60 metre band. Caracol in Neiva works to a 24-hour schedule with a power of 5kW. After the Brazilian 50kW Radiobras station, Radio Nacional, in Porto Velho on **4945** signs off at 0200 (Sundays at 0100), sidesplash-free reception of Caracol is provided.

Ondas del Ortegua, Florencia, is in the Todelar Network and is on the air from 1000 to a sign-off time which can be at 2200, 2300 or 0030. Having a power of 1kW, it identifies as Emisora de los Campesinos on **4975.1**. The programming from Radio Cinco in Villavicencio is not often heard.

Its signals are transmitted on a frequency of **5040** around the clock in the Cadena Group Radial Colombiano Network. Radio Cinco has a power of 2kW.

Frequently appearing in DXers' logbooks are entries of La Voz de Yopal. From Yopal, this 1kW transmitter succeeds in the European listening stakes, operating from 1100 to 0100 on the Caracol Network. The identification and slogan is 'La Voz de Yopal, **1350**, HJZD onda larga, **5050**, HJPY onda corta, Peonera de la PRadio en Casanare'. From midnight until closing time is the favoured period for reception of the signals from La Voz de Yopal. After sign-off, a careful listen will often result in hearing the close down of the co-channel Radio Jesus del Gran Poder in Quito, Ecuador, which goes off the air at, or around, 0105.

Out of band

Although outside the upper limit of the 60 metre band, the attention of newcomers is drawn to a Colombian station which operates on **5095**. Cadena Sutatenza in Bogota represents an easy to receive opportunity for listening to a typical Colombian transmission. Having a power of 50kW on a relatively clear frequency, listening to Cadena Sutatenza is recommended when starting to log the signals from that South American country, Colombia.

ON THE AIR

The stations featured below have all been logged and identified by the writer during the few weeks prior to publication.

AFRICA

Algeria

Algiers on a measured **7246.5** at 0732, announcements, songs and music of the locality in the Kabyle programme for North Africa, scheduled from 0700 to 0800.

Gabon

Africa Number One, Libreville on **11940** at 0720, some African style music, this being followed by music and French songs in the European man-

ner. This transmission in French is directed to West Africa and is timed from 0600 to 0755 daily.

Ghana

Accra on **4915** at 2000, three pips and one tone time-check followed by the station identification as Ghana Broadcasting Corporation, Radio One. Then comes the news and news comment, all in English, then into a vernacular programme at 2030. At 50kW, Accra radiates programmes in English and vernaculars from 0525 to 0905 (Saturday and Sunday until 2305) and from 1200 to 2305.

Guinea

Conakry on **7125** at 0634, songs in French and vernacular, YL announcements in vernacular, some piano music then OM with the station identification in French at 0645. Conakry is on the air in French and vernaculars from 0600 to 0800 and from 1200 to 0100 (Sunday from 0800 to 0100). The power is 18kW.

Malawi

Blantyre on a measured **3380.5** at 0316, when a heated discussion in Chichewa was in progress. Blantyre operates irregularly in Chichewa and English. With a power of 100kW, it is scheduled from 0253 to 1110 and from 1300 to 2210. From September to May inclusive the times are from 0253 to 0530 and from 1750 to 2210. The frequency can vary from **3380** to **3381**.

Mali

Bamako relay of Radio Beijing on **9745** at 2030, 'East is Red' on chimes, OM with the station the identification at commencement of the English programme for Africa timed from 2030 to 2130.

Nigeria

Kaduna on **4770** at 1957, a talk about conservation then African drums at 2000 followed by the station identification and the local news,

all in English. On this frequency, Kaduna radiates Home Service 2 programmes in English and vernaculars from 0400 to 2305. The power is 50kW.

Swaziland

Swazi Commercial Radio, Sandlane on **4980** at 1844, OM with a USA-recorded religious talk in English. Programmes in English are featured Monday to Friday from 1630 to 2030, Saturday from 1730 to 1900, Sunday from 0500 to 0600 and from 1700 to 1800. The power is 100kW.

CENTRAL AMERICA

Dominican Republic

Radio Clarin, Santo Domingo, on **11700** as early as 2005, a talk followed by the station identification during a La Voz CID (Cuba Independiente Democratica) transmission. Radio Clarin is on the air in Spanish to Central America from 1500 to 2200, the power being 50kW.

SOUTH AMERICA

Argentina

Radio Rivadavia on **9115** at 2148, OM with an excited futbol (football) commentary in Spanish. This station operates in the USB (upper sideband) mode, abruptly signing off on this occasion at 2154.

Brazil

Radio Guarani, Belo Horizonte on **6050** at 0355, OM with a talk in Portuguese. Radio Guarani is on the air around the clock with a power of 10kW.

Colombia

La Voz de Yopal, Yopal on **5049.9** at 2327, OM with the station identification, folk music and songs in Spanish. A feature of this station is that frequent identifications are made and that the frequency can vary slightly on occasions. The schedule is from 1100 to 0100 in the Caracol Network, the power being 1kW.

Paraguay

Radio Nacional, Asuncion, on **9735** at 2142, OM with a football commentary with mentions of Paraguay and Argentina and a goal. Radio Nacional operates from 1000

to 0600 in Spanish and Guarani (an Indian language), the power being 100kW.

Venezuela

Radio Valera, Trujillo on **4840** at 0253, a programme of local pop music and songs, OM with the station identification, some announcements in Spanish, the National Anthem and off at 0257. Radio Valera is scheduled in Spanish from 0900 to a variable sign-off, sometimes as late as 0400. The power is 1kW.

ASIA

China

CPBS Beijing on **5320** at 1542. Chinese orchestral music and songs during a Home Service 1 programme. The schedule is from 2000 to 0025 and from 0800 to 1730, the power being 10/15kW.

Bangladesh

Dhaka on **4890** at 0118, YL with a newscast in English until 0120 then into a Bengali programme. At 100kW, Radio Bangladesh operates on this channel, mostly in Bengali, from 0000 to 0330 and from 1300 to 1600, with a power of 100kW.

India

AIR (All India Radio) Madras on **4990** at 0110, a discussion in Hindi then YL with the station identification 'All India Radio' at 0115.

Iran

Tehran on **3779.3** at 1908, OM with a talk in Turkish then some classical music in the European manner, all subject to interference from an amateur sideband transmission. With a power of 50kW, Tehran transmits on this channel from 1515 to 1830 in Russian, Farsi and Arabic, from 1830 to 2030 in Turkish and English and from 2030 to 2130 in Farsi.

Jordan

Amman on **11920** at 0639, local style music and songs with announcements in an Arabic programme for the Eastern Middle East, scheduled from 0330 to 1500.

Pakistan

Islamabad on **7385** at 1832, local music and songs then OM with the station identification during the Urdu programme directed to the Arabian Gulf and the Middle East, from 1800 to 1900.

tification during the Urdu programme directed to the Arabian Gulf and the Middle East, from 1800 to 1900.

Saudi Arabia

Riyadh on **9870** at 2020, Arabic songs and music in the Arabic transmission intended for Europe and timed from 1700 to 2130.

Taiwan

The Voice of Asia, Taipei on **7445** at 1535, OM with a talk about the local political scene then some Chinese orchestral music. This English programme for Central Asia is timed from 1530 to 1630.

The Voice of Free China, Taipei on **11825** at 0909, YL with a talk, OM with announcements in the Chinese presentation to South East Asia, scheduled from 0900 to 1200.

SOUTH-EAST ASIA

North Korea

Radio Pyongyang on **6400** at 1557, martial music, YL with some announcements, three pips and one tone then YL with the station identification followed by some orchestral music, all in the Korean transmission to East Asia, scheduled from 2100 to 1900.

Philippines

Voice of America, Tinang on **9555** at 1502, OM with a talk in the Chinese programme directed to Central Asia from 1100 to 1600.

PACIFIC

Australia

Shepparton on **15240** at 0715, OM with comment on local and world news in the English programme for the South Pacific, timed from 2100 to 0730.

Carnarvon on **17715** at 0707, OM with a newscast in the English programme for South Asia, scheduled from 0100 to 0900.

Guam

KTWR on **9820** at 1148, YL with a song, OM with announcements and the station identification in Japanese, chimes interval signal at 1200 then YL with the identification at commencement of the Mandarin programme for East Asia.

New Zealand

Wellington on **15150** at 0616, OM with a talk about nuclear powers and world affairs in the English presentation to the Pacific timed from 0330 to 0700.

CLANDESTINE

La Voz del CID on **6305** at 0345, a discussion about Cuban affairs, folk songs and music, chimes and the station identification at 0400 followed by a political talk in Spanish. This transmission is directed to Central America, but the schedule is unknown at the time of writing.

La Voz del CID on **11635.2** at 2210, OM with a talk having many mentions of Cuba. This Spanish programme is directed to Central America and is timed from 1100 to 2300. Also heard when in parallel on **9940**.

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Malabo, Equatorial Guinea on **6250** at 2118, a programme of local pops with announcements in Spanish. With a power of 10kW, Malabo is on the air in Spanish and vernaculars from 0500 to 2205.

Harare, Zimbabwe on **3305** at 1810, YL and OM with a discussion in vernacular. The power is 100kW and the schedule in English and vernaculars is from 0330 to 0615 and from 1545 to 2200. The frequency can vary to **3306**.

NOW LOG THESE

Radio Nacional, Luanda, Angola on **3375.7** at 0150, songs and local style music, YL with announcements then OM with the station identification in Portuguese at 0200.

With a power of 10kW, Radio Nacional, Luanda transmits programmes in Portuguese from 1800 to 0530. The nominal frequency is **3375** but, as may be noted, variations do occur.

Radio Nor Andina, Celdin, Peru on **4459.8** at 0418, YL with some noticias (personal family messages), these being followed by folk songs and music. Radio Nor Andina is on the air in Spanish and Quechua from 2200 to 0445, identifying as La Nueva Imagen en Radio (The New Image in Radio). The power is 1kW.

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Aug 88	16 Jun 88	22 Jun 88	24 Jun 88	14 Jul 88	

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<p>SERIES RATES Series rates also apply when larger or additional space to that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received. A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad series rate contracts are not interchangeable.</p>	<p>If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.</p> <p>COPY Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations.</p>	<p>Printed — web-offset</p> <p>PAYMENT Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by publication date.</p> <p>FOR FURTHER INFORMATION CONTACT Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE. (0277) 219876</p> <p>Overseas payments by International Money Order. Commission to approved advertising agencies is 10%.</p> <p>CONDITIONS 10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p>



£1 BAKERS DOZEN PACKS

Price per pack is £1.00 * Order 12 you may choose another free. Items marked (sh) are not new but guaranteed OK

- 1 - 513 amp ring main junction boxes
- 2 - 513 amp ring main spur boxes
- 5 - 3 flush electrical switches
- 7 - 4in flex line switches with neons
- 8 - 2 80 watt brass cased elements
- 9 - 2 mains transformers with 6V 1A secondaries
- 10 - 2 mains transformers with 12V 1/2A secondaries
- 11 - 1 extension speaker cabinet for 6 1/2" speaker
- 12 - 5 octal bases for relays or valves
- 13 - 12 glass reed switches
- 14 - 4 OCP 70 photo transistors
- 16 - 4 tape heads, 2 record, 2 erase
- 17 - 1 ultrasonic transmitter and 1 ditto receiver
- 18 - 2 15000 mfd computer grade electrolytics
- 19 - 2 light dependent resistors
- 20 - 5 different micro switches
- 21 - 2 mains interference suppressors
- 22 - 2 25 watt crossover units 7 way
- 23 - 1 40 watt 3 way crossover unit
- 28 - 1 6 digit counter mains voltage
- 30 - 2 Nicad battery chargers
- 31 - 1 key switch with key
- 32 - 2 humidity switches
- 34 - 96 x 1 metre lengths colour-coded connecting wires
- 36 - 2 air spaced 2 gang tuning condensers
- 37 - 2 solid dielectric 2 gang tuning condensers
- 38 - 10 diaelectric trimmers
- 41 - 6 Rocker switches 10 amp mains SPST
- 43 - 5 Rocker switches 10 amp SPDT Centre Off
- 44 - 4 Rocker switches 10 amp DPST
- 45 - 1 24 hour time switch mains operated (sh)
- 46 - 1 6 hour clock timeswitch
- 48 - 2 6V operated reed switch relays
- 49 - 10 neon valves - make good night lights
- 50 - 2 x 12V DC or 24V AC, 4 CO relays
- 51 - 1 x 12V 2C O very sensitive relay
- 52 - 1 12V 4C relay
- 55 - 1 locking mechanism with 2 days
- 56 - 1 miniature Unselector with circuit for electric jigsaw
- 57 - 5 Dolls' Houses switches
- 60 - 5 ferrite rods 4" x 5/16" diameter aerials
- 61 - 4 ferrite slab aerials with L & M wave coils
- 62 - 4 200 ohm earpieces
- 63 - 1 Mullard thyristor trigger module
- 64 - 10 assorted knobs 1/4" spindles
- 65 - 5 different themostats, mainly bi metal
- 66 - 1 Magnetic brake - stops rotation instantly
- 67 - 1 Low pressure 3 level switch
- 69 - 2 25 watt pots 8 ohm
- 70 - 2 25 watt pots 1000 ohm
- 71 - 4 wire wound pots - 18, 33, 50 and 100 ohm
- 73 - 4 3 watt wire wound pots 50 ohm
- 77 - 1 time reminder adjustable 1-60 mins
- 78 - 5 amp stud rectifiers 400V
- 85 - 1 mains shaded pole motor 3/4" shaft - 1/4 shaft
- 86 - 2 5" all fan blades fit 1/4" shaft
- 87 - 2 3" plastic fan blades fit 1/4" shaft
- 88 - 1 Mains motor suitable for above blades
- 89 - 1 mains motor with gearbox 1 rev per 24 hours
- 91 - 2 mains motors with gearbox 16 rpm
- 93 - 4 11 pin moulded bases for relays
- 94 - 5 B7G valve bases
- 95 - 4 skirted B9A valve bases
- 96 - 1 thermostat for fridge
- 98 - 1 motorised stud switch (sh)
- 101 - 1 12 1/2 hours delay switch
- 103 - 1 6v mains power supply unit
- 104 - 1 4 1/2 V mains power supply unit
- 105 - 1 5 pin flex plug and panel socket
- 107 - 15" speaker size radio cabinet with handle
- 109 - 10 1/4" spindle type volume controls
- 110 - 10 slider type volume controls
- 112 - 1 heating pad 2000 watts mains
- 114 - 1 1W amplifier Mullard 1172
- 115 - 1 Wall mounting thermostat 24V
- 118 - 1 Teak effect extension 5" speaker cabinet
- 120 - 2 pcb with 2 amp full wave and 17 other recs
- 122 - 10 mtrs twin screened flex white pvc outer
- 132 - 2 plastic boxes with windows, ideal for interrupted beam switch etc
- 155 - 3 varicap push button tuners with knobs
- 188 - 1 plastic box, sloping metal front, 16x95mm, average depth 45mm
- 243 - 2 speakers 6" x 4" 15 ohms 5 watt made for Radiomobile
- 266 - 2 mains transformers 9V 1/2A secondary split primary so OK also for 115V
- 330 - 2 6V 0.6V mains transformer, 3a pcb mounting
- 350 - 40 double pole leaf switches
- 365 - 1 7uf 660V 50hz metal cased condenser
- 453 - 453 - 2 2 1/4" in 60 ohm loudspeakers
- 454 - 2 2 1/4" in 8 ohm loudspeakers
- 453 - 1 mains operated relay with 2 sets c/o contacts
- 464 - 2 packets resin filler/sealer with cures
- 465 - 3 5A round 3 pin plugs will fit item 193
- 466 - 4 7 segment led displays
- 470 - 4 pc boards for stripping, lots of valuable parts
- 498 - 4 1000uf 25V axial electrolytic capacitors
- 504 - 1 Audax PM 8" speaker 15 ohms 5 watt rating
- 515 - 100 4BA 1 1/2" cheesehead plated screws and 100 4BA nuts
- 541 - 1 pair stereo tape head as in cassette recorder/players
- 546 - 1 bridge rectifier 600V international rectifier ref 35B100
- 548 - 2 battery operated relays (3-6v) each with 5A c/o contacts 2 pairs
- 553 - 2 lithium 3V batteries (everlasting shelf life)

5A BATTERY CHARGER KIT all parts including case only £5 add £1 postage

OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's dozen range and you can become entitled to a free gift with each dozen packs.

A classified list of these packs and our latest 'News Letter' will be enclosed with your goods and you will automatically receive our next news letter.



THIS MONTHS SNIP

3 1/2 Floppy Disk Drive, made by the Chiron Company of Japan. Beautifully made and probably the most compact device of its kind as it weighs only 600g and measures only 104mm wide, 162mm deep and has a height of only 32mm, other features are high precision head positioning - a single push loading and eject - direct drive brushless motor - 500k per disc - Shugart compatible interface - standard connections - interchangeable with most other 3 1/2 and 5 1/4 drives. Brand new with copy of makers manual. Offered this month at £28.50 post and VAT included.

CASE

Case - adaptable for 3" or 3 1/2" FDD, has room for power supply components price only £4 includes circuit of PSU Our Ref: 4P8

POWER SUPPLY FOR FDD - 5V and 12V voltage regulated outputs, complete kit of parts will fit into case 4P8 price £8 or with case £11

MULLARD UNILEX AMPLIFIERS

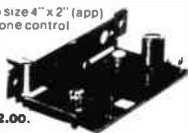
We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules - ie Mains power unit (EP9002), Pre amp module (EP9001) and two amplifier modules (EP9000) all for £8.00 plus £2 postage. For prices of modules bought separately see TWO POUNDERS

CAR STARTER/CHARGER KIT

Flat Battery/Don't worry you will start your car in a few minutes this unit - 250 watt transformer 20 amp rectifiers, case and all parts with data case £17.50 post £2

MINO MONO AMP

On pcb size 4" x 2" (app) Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of £1.15 each, or £13 for £12.00.



LIGHT BOX

This when completed measures approximately 15" x 14". The light source is the Philips fluorescent 'W' tube. Above the light a sheet of fibreglass and through this should be sufficient light to enable you to follow the circuit on fibreglass PCBs. Price for the complete kit that is the box, choke, starter tube and switch and fibreglass is £5 plus £2 post, order ref 5P69

TANGENTIAL HEATERS

We again have very good stocks of these quiet running instant heat units. They require only a simple case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1.2kw 2kw, 2.5kw and 3kw. Prices are £5 each for the first 3, and £6.95 for the 3k. Add post £1.50 per heater if not collecting.

CONTROL SWITCH enabling full heat, half heat or cold blow with connection diagram, 50p for 2kw, 75p for 3kw.

FANS & BLOWERS

5 £5 - £1.25 post 6" £6 - £1.50 post 4" x 4" Muffin equipment cooling fan 115V £2.00 4" x 4" Muffin equipment cooling fan 230/240V £5.00 9" Extractor or blower 115V supplied with 230 to 115V adaptor £9.50 - £2 post All above are ex computers but guaranteed 12 months 10" x 3 Tangential Blower. New. Very quiet - supplied with 230 to 115V adaptor on use two in series to give a cold blow £2.00 - £1.50 post or £4.00 - £2.00 post for two

9" MONITOR

Ideal to work with computer or video camera uses Philips black and white tube ref M24/306W. Which tube is implosion and X-Ray radiation protected. VDU is brand new and has a time base and EHT circuitry. Requires only a 16V dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone. only £18 plus £3 post

LOW COST OSCILLOSCOPE

Convert our 9" monitor into an oscilloscope with switched time bases to allow very high and very low frequency waveforms to be observed and measured. Signal amplitudes from as low as 10mV and as high as 1kV can easily be observed and measured. Ideal for servicing also for investigating TV, radio and audio circuits. Kit containing all the parts for the conversion and the power supply to operate from mains £25 our ref 25P3

TELEPHONE LEAD

3 mtrs long terminating one end with new BT flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price £1 ref BD552 or 3 for £2 ref 2P64

COMPACT FLOPPY DISC DRIVE EME-101

The EME-101 drives a 3 1/2" disc of the new standard which despite its small size has a capacity of 500k per disc which is equivalent to the 3 1/2" and 5 1/4" discs. We supply Operators Manual and other information showing how to use this with popular computers BBC Spectrum Amstrad etc. All at a special snip price of £27.50 including post and VAT. Data available separately £2, refundable if you purchase the drive

POWERFUL IONISER

Generates approx 10 times more IONS than the ETI and similar circuits. Will refresh your home office shop workroom etc. Makes you feel better and work harder - a complete mains operated kit case included £11.50 - £3 P&P

J & N BULL ELECTRICAL

Dept RE, 250 PORTLAND ROAD, HOVE BRIGHTON, SUSSEX BN3 5QT
MAIL ORDER TERMS: Cash, PO or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B-card orders accepted. Brighton (0273) 203500

NEW ITEMS

Some of the many described in our current list which you will receive with your parcel

POWERFUL 12V MOTOR - was intended for the Sinclair electric car. Rated approx 1/2hp £15 Ref: 15P8

BURGLAR ALARM BELL - 6" gong - OK to fix outside in the rain and shelter - mains operation £8. Ref: 8P2

AGAIN AVAILABLE - 12" mini fluorescent tubes - Price £1 each Ref: BD314

POWER PACK OF AMPLIFIER CASE - Size approx 10" x 8 1/4" x 4 1/4" plated steel - with ample perforations for cooling. Front panel has on/off switch and EEC mains inlet plug with built-in RF filter - undoubtedly a very fine case which would cost at least £50 from regular sources, our price is £5 each and £3 post. Ref: 5P111

MINIATURE BCD THUMP WHEEL SWITCH - Matt black edge switch engraved white on black - gold plated, make before break contacts - size approx 26mm high, 8mm wide, 20mm deep - made by the famous Cherry Company and designed for easy stacking - Price £1 each. Ref: BD601

EDGE METER - miniature, whole size approx 37mm x 13mm 100 ufd - centre zero scaled 0 to -10 and 10 to +10. Price £1 each. Ref: BD602

24hr TIME SWITCH - 16A c/o contacts - up to 6 on/off per day - cased intended for wall mounting. Price £8. Ref: 8P6

CAPACITOR BARGAIN - axial ended - 4700uf @ 25v Jap made. Normally 50p each, but you will get 4 for £1. Ref: 613

CLEANING FLUID - Extra good quality - intended for video and tape heads - regular price £1.50 per spray can - our Price - 2 cans for £1 Ref: 5P604

DON'T FREEZE UP! - We have had the strongest winds for over 200 years and who knows we may be in for the coldest winter, so if you have not already protected your water pipes you should do so now - our heating wire wound around the pipes will do this and will only about 50p per week to run - 15 metres (minimum length to connect to 230/240v mains) Price £5. Our Ref: 5P 109

PIEZO ELECTRIC FAN - an unusual fan, more like the one used by Madame Butterfly, than the conventional type, it does not rotate. The air movement is caused by the two vibrating arms. It is American made, mains operated, very economical and causes no interference. So it is ideal for computer and instrument cooling. Price is only £1 each. Ref: BD605

SPRING LOADED TEST PRODS - heavy duty, made by the famous Bulgin company. Very good quality. Price four for £1. Ref: BD599

CURLY LEAD four core, standard replacement for telephone handset, extends to nearly two metres. Price £1 each. Ref: BD599

TELEPHONE BELLS - these will sound off our standard mains through a transformer, but to work exactly like a telephone, they then must be fed with 25Hz 50v. So with these bells we give a circuit for a suitable power supply. Price 2 bells for £1. Ref: BD600

ULTRA SENSITIVE POCKET MULTIMETER - 4k ohms per volt - 11 ranges - carry one of these and os be always ready to test ac/dc volts to 1000. DC milliamms and have an ohms range for circuit testing - will earn its cost in no time. Price only £7. Ref: 7P2

BLOW YOUR ROOF OFF! 140 watt speaker systems - new type you must not hide! They have golden cones and golden surrounds and look really 'Bootiful'! 12 Woofer, Midrange and Tweeter and comes with a crossover at a special introductory price of £49, carriage paid. Two sets for £95 carriage paid! 140W Woofer only £35 carriage paid

SWITCH MODE PSU Mains input 2 output plus 5v at 3.5 amps plus 12v at 1.5 amps. Very compact (6 1/2" x 4" x 2"), ideal for driving 1 or more floppy discs. Regular price around £30. Our price only £10 brand new. Ref: 10P34

APPLIANCE THERMOSTATS - spindle adjust type suitable for convector heaters or similar price 2 for £1. Ref: BD582

COMPUTERS

Big consignment of computers expected in mid Jan, various makes and numbers, write or phone for details

NOVEL NIGHT LIGHT - plugs into a 13A socket. Gives out a surprising amount of light, certainly enough to navigate along passages at night or to keep a nervous child happy. Very low consumption, probably not enough to move the meter. Price £1. Ref: BD563

CASE WITH 13A PRONGS - to go into 13A socket, nice size and suitable for plenty of projects such as car battery trickle charger, speed controller, time switch, night light, noise suppressor, dimmers etc. Price - 2 for £1. Ref: BD565

SPEAKER EXTENSION CABLE - twin 0.7mm conductors so you can have long runs with minimum sound loss and for telephone extensions or burglar alarms, bells, intercoms, etc. 250m coil only £3 plus £1 post. Ref: 3P28

ALPHA-NUMERIC KEYBOARD - this keyboard has 73 keys with contactless capacitance switches giving long trouble free life and no contact bounce. The keys are arranged in two groups, the main area field is QWERTY array and on the right is a 15 key number pad, board size is approx 13" x 4" - brand new but offered at only a fraction of its cost namely £3, plus £1 post. Ref: 3P27

TELEPHONE EXTENSIONS - it is no legal for you to undertake the wiring of telephone extensions. For this we can supply 4 core telephone cable, 100m coil £8.50. Extension BT sockets £2.95. Packet of 500 plastic headed splices £2. Dual adaptor for BT plug for changing old phones. 3 for £2

MODULAR SWITCH - Panel mounting highest quality and ideal where extra special front panel appearance is required, can be illuminated if required and latching. Price - 2 for £1. Ref: BD567

WIRE BARGAIN - 500 metres 0.7mm solid copper tinned and pvc covered. Only £3 - £1 post. Ref: 3P31 - that's well under 1p per metre and this wire is ideal for push on connections.

INTERRUPTED BEAM KIT - this kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components - relay, photo transistor, resistors and caps etc. Circuit diagram but no case. Price £2 Ref: 2P15

3-30V VARIABLE VOLTAGE POWER SUPPLY UNIT - with 1 amp DC output. Intended for use on the bench for experiments students inventors, service engineers etc. This is probably the most important piece of equipment you can own (After a multi-range test meter). It gives a variable output from 3-30 volts and has an automatic short circuit and overload protection which operates at 1.1 amp approx. Other features are very low ripple output, a typical ripple is 3mV pk pk 1mV rms. Mounted in a metal fronted plastic case, this has a voltmeter on the front panel in addition to the output control knob and the output terminals. Price for complete kit with full instructions is £15 Ref: 15P7

TRANSMITTER SURVEILLANCE (BUG) - tiny easily hidden, but which will enable conversion to be picked up with FM radio. Can be housed in a matchbox, all electronic parts and circuit. Price £2. Ref: 2P52

ELMASET INSTRUMENT CASE

300x133x217mm deep £10.00 ea (£2.20)

REGULATORS

LM317T Plastic T0220 variable £1
 LM317 Metal £2
 7812 Metal 12v 1A £1.00
 7805/12/15/24 plastic 50p 100 + 27p
 7905/12/15/24 plastic 50p 100 + 27p
 CA3085 T099 Variable regulator £1
 LM338 5A variable £5

COMPUTER ICS

27128 250n³ NEW £3.50
 68008 Processor Ex-Equip £5
 27256-30 ex-eqpt £3.00
 2764-30 USED £2
 1702 EPROM ex equip £5.00
 2732-45 USED £2 100+ £1.50
 2114 EX EQPT 60p 4116 EX EQPT 70p
 6264LP15 8K static ram £3.25
 6116-3 (TC5517AP) £1.50
 4416 RAM £3.50
 ZN427E-8 £4.00
 ZN428E-8 £4.00

SURFACE MOUNTED TRANSISTORS

BCW31 BCW72 NTAV70 152836 min S0/type 100/£2.50

TRANSISTORS

BC107 BCY70. Pre formed leads full spec
 20/£1 100/£4 330/1000

POWER TRANSISTORS

POWER FET IRF9531 8A 60V P channel to 220 2/£1
 2N3055H RCA House numbered 5/£2
 2SC1520 sim BF259 3/£1 100/£22
 TIP141, 142/146, 1A ea, TIP110, 125, 42B 2/£1
 TIP35B 1.30 TIP35C £1.50
 SE9302 100V 10A DARL SIM TIP121 2/£1
 2N3055 Ex eqpt tested 4/£1
 Plastic 3055 or 2955 equiv 50p 100/£35
 2N3773 NPN 25A 160V £1.80 10/£16
 BD132 5/£1

QUARTZ HALOGEN LAMPS

A1/216 24v 150w £2.25
 H1 12v 55w (car spot) £1.50

NICKEL CADMIUM BATTERIES

7.2 Volts 1.8 A/hr C Cells in packs of 6 £5 P&P £1

ZIF SOCKETS

TEXTTOOL single inline 32 way. Can be ganged for use with any dual inline devices 2/£1.50

MISCELLANEOUS

Small Microwave Diodes AEI DC1028A 2/£1
 Moulded inductor 47 Ohm size of a 1 watt film resistor 5/£1.00
 To - 220 Heat Sink sim RS 403-162 10/2.50
 D.I.L. Switches 10 Way £1 8 Way 80p. 4/5/6 Way 50p
 180 Volt 1 watt ZENERS ALSO 12V 20/£1
 Miniature coaxial cable RG316U £0.50/metre
 Olivetti logos calculator keyboard (27) key plus 12 Digit fluorescent display on driver board (ie calculator less case, transformer and printer) £1.30
 Plastic Equipment case 9x6x1.25" with front and rear panels containing PCB with eeprom 2764 -30 and ICS 7417 LS30 LS32 LS74 LS367 LM311 7805 Reg. 9 way D plug, push button switch, din socket £1.90
 VNIOLM 60V 1/2 5ohm TO-92 mosfet 4/£1. 100/£20
 MIN GLASS NEONS 10/£1
 RELAY 5v 2 pole changeover looks like RS 355-741 marked STC 47WB05T 2/£1
 MINIATURE CO-AX FREE PLUG RS 456-071 2/£1
 MINIATURE CO-AX FREE SKT RS 456-273 2/£1.50
 STRAIN GAUGES 40 ohm Foil type polyester backed balco grid alloy £1.50 ea 10+ £1
 DIL REED RELAY 2 POLE n/o CONTACTS £1

ELECTRET MICROPHONE INSERT £0.90
 Linear Hall effect IC Micro Switch no 613 SS4 sim RS 304-267 £2.50 100+ £1.50
 Hall Effect IC UGS3040 + MAGNET £1.00
 OSCILLOSCOPE PROBE SWITCHED X1X10 £10
 CHEAP PHONO PLUGS 100 £2 1000/£18
 1 pole 12 way rotary switch 4/£1
 AUDIO ICS LM380 LM386 £1 ea
 555 Timer 5/£1 741 Op AMP 5/£1
 COAX PLUGS nice ones 4/£1
 4 x 4 MEMBRANE KEYBOARD £1.50
 15.000uF 40V SPRAGUE 36D £2.50 (£1.25)
 INDUCTOR 20uH 1.5A 5/£1
 NEW BT PLUG + LEAD £1.50
 1.25" PANEL FUSEHOLDERS 5 £1
 CHROMED HINGES 14.5 x 1" OPEN £1 ea
 TOK KEY SWITCH 2 POLE 3 KEYS ideal for car/home alarms £3
 12v 1.2W small wire ended 1 amps fit AUDI VW TR7 SAAB VOLVO 10/£1
 12V MES LAMPS 10/£1
 STEREO CASSETTE HEAD £2
 MONO CASS. HEAD £1 ERASE HEAD 50p
 THERMAL CUT OUTS 50 77 85 120C £1 ea
 THERMAL FUSE 121C 240V 15A 5/£1
 TRANSISTOR MOUNTING PADS TO-5/TO-18 £3/1000
 TO-3 TRANSISTOR COVERS 10 £1
 STICK ON CABINET FEET 30/£1
 PCB PINS FIT 0.1" VERO 200/£1
 TO-220 micas + bushes 10/50p 100/£2
 TO-3 micas + bushes 20/£1
 Kynar wire wrapping wire 2oz £1
 PTFE min screen cable 10m/£1
 Large heat shrink sleeving pack £2
 CERAMIC FILTERS 6M/9M/10.7M 50p 100/£20
 TOKIN MAINS RFI FILTER 250v 15A £3
 IEC chassis plug rfi filter 10A £3
 Potentiometers short spindles values 2k5 10k 25k 1M 2M5 new value 5/£1
 500k lin 500k log 5/£1
 40kHz ULTRASONIC TRANSDUCERS EX-EQPT NO DATA £1/pr
 PLESSEY INVERTER TRANSFORMER 11.5-0-11.5V to 240v 200VA £8 (£3)

ZENERS

5.6V 1W3 Semikron 50K available £25/1000
 Suppressor OF606 120V BI Directional Zener in 3 amp W/E package 5/£1.00

DIODES & RECTIFIERS

BAW76 Equiv IN4148 £60/10,000
 1N4148 100/£1.50
 1N4004/SD4 1A 300V 100/£3
 1N5401 3A 100V 10/£1
 BA158 1A 400V fast recovery 100/£3
 BA159 1A 1000V fast recovery 100/£4
 120v 35A stud 65p
 12FLO 12A 200V small stud 4/£1.50 100/£25
 BY127 1200V 1.2A 10/£1
 BY254 800v 3A 8/£1
 BY255 1300v 3A 6/£1
 6A 100V Similar MR751 4/£1
 VM88 800mA 100V DIL b/REC 5/£1
 1A 800v bridge rectifier 4/£1
 4A 100V bridge 3/£1
 6A 100v bridge 50p
 8A 200V Bridge 2/£1.25
 10A 200v bridge £1.50
 25A 200v bridge £2 ea 10/£18
 25A 400v bridge £2.50 10/£22

SCRs

2P4M equiv C106D 3/£1 100/£20
 MCR71-6 10A 600v SCR £1
 35A 600v stud £2
 TICV106D .8A 400v SCR 3/£1 100 £15
 MEU21 Prog. unijunction 3/£1

TRIACS

NEC Triac ACO8F 600V TO 220 2/£1
 NEC Triac 150L Tab TO220 6A 400V 2/£1
 ACOV8FGM 800mA 400V T092 TRAC 3 £1
 Diacs 4 £1
 TXAL225 8A 400V 5mA gate 2/£1 100/£35

diacs 25p

TRAL 2230D 30A 400V isolated stud £4 each

CONNECTORS

34 way card edge IDC connector (disk drive type) £1.25
 Centronics BBC Printer lead £3.00
 Centronics 36way IDC plug £4 10+ £3.50
 Centronics 36way IDC skt £4
 Centronics 36way plug (solder type) £4
 USED Centronics 36W plug & socket £3
 'D' 9-way £1; 15-way £1.50; 25-way £2
 37-way £2; 50-way £3.50; covers 50p ea

WIRE WOUND RESISTORS

W21 or Sim 2.5W 27R 10 of one value £1
 R10 0R15 0R22 2R0 2R7 3R9 4R7 5R0 5R6 8R2 10R 12R 15R 18R 20R 22R 27R 33R 36R 47R 56R 62R 75R 3R9 91R 100R 120R 180R 390R 430R 470R 560R 680R 820R 910R 1K15 1K2 1K5 1K8 2K4 2K7 3K3 3K0 5K0 10K
 R05 (50 milli-ohm) 1% 3W 4 for £1
 W22 or Sim 6W 7 of one value £1
 R47 1R0 1R5 3R3 6R8 9R1 10R 20R 27R 33R 51R 56R 62R 68R 100R 120R 180R 390R 560R 620R 910R 1K0 1K2 1K5 1K8 2K7 3K3 3K9 4K7 10K
 W23 or Sim 9W 6 of one value £1
 R22 R47 1R0 1R1 15R 56R 62R 68R 100R 120R 180R 220R 300R 390R 680R 1K0 1K5 5K1 10K
 W24 or Sim 12W 4 of one value £1
 R50 1R0 2R0 6R8 9R1 10R 18R 22R 27R 56R 68R 75R 82R 100R 150R 180R 200R 220R 270R 400R 620R 6K8 8K2 1K0 10K 15K

PHOTO DEVICES

BPW50 Infra red photo Diode 3/£1
 Slotted opto-switch OPCOA OPB815 £1.30
 2N5777 50p only
 TIL81 T018 Photo transistor £1
 TIL38 Infra red LED 5/£1
 OPI2252 Opto isolator 50p
 Photo diode 50p 6/£2
 MEL12 (Photo darlington base n/c) 50p
 RPY58A LDR 50p ORP12 LDR 70p
 GREEN or YELLOW 3 or 5mm 10/£1 100/£6.50
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