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Radio & Electronics World

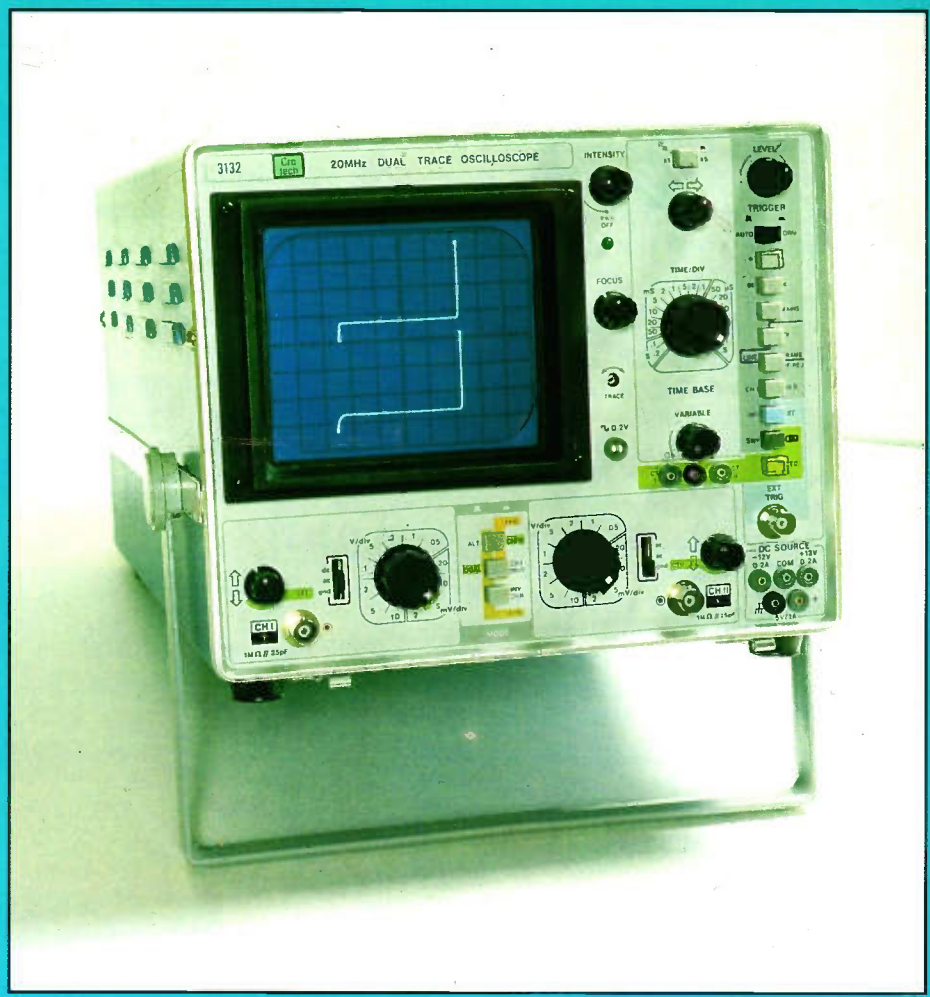
The communications and electronics magazine

MINI-MOBILE:
ICOM'S MINISCULE IC-48E TRANSCEIVER

THE MF10 CHIP:
DETAILS OF A DIGITAL FILTER

DATACOMMS:
SIMPLIFYING ERROR CORRECTION

LOGIC CIRCUITS:
ENLIGHTENING THE ILLOGICAL



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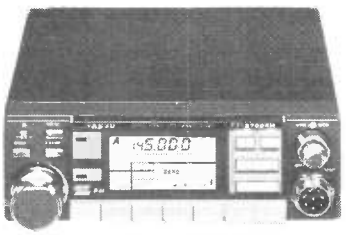

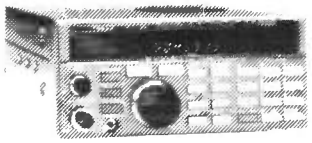

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Safety in the shack

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.

Cover Photographs

Top – Fancy a scope, free? (p57)

Bottom – Microelectronics taken to extremes (p22)

SPECIAL FEATURES

REGULARS

READER SERVICES

NEXT MONTH

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Cover date March 1987 on sale Thursday, 12 February

☐ **Publication Date**
Second Thursday of the month preceding cover date

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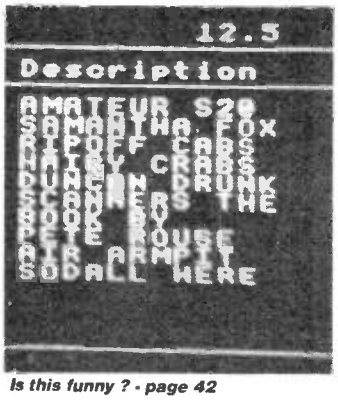
Arab mushroom growing - page 17



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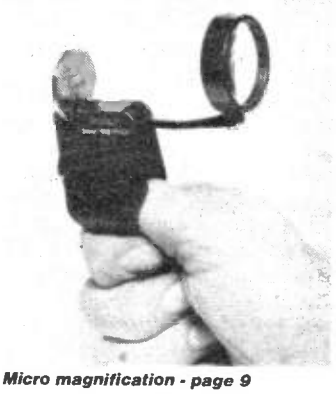


Micro magnification - page 9

PRODUCT NEWS

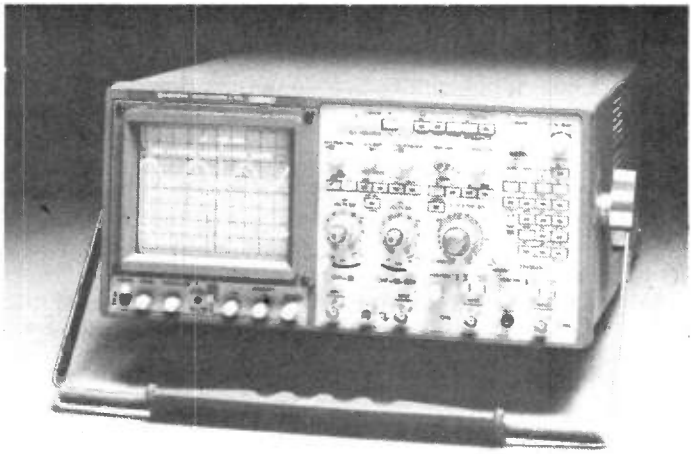
Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.
Readers, don't forget to mention ***Radio & Electronics World*** when making enquiries

SCOPE/DVM/COUNTER

New from Thurlby Electronics is the Hitachi V1150 oscilloscope with 'smart' measurement features.

The V1150 has a bandwidth of 150MHz, producing a rise time of better than 2.3 nanoseconds on all four of its input channels, and a guaranteed maximum time delay difference of 0.5ns.

In addition to its operation as a wide bandwidth real-time oscilloscope, the V1150 incorporates a sophisticated digital measurement system, which comprises an ac/dc digital voltmeter, a 150MHz timer counter, and full vertical and horizonal cursor measurement facilities.



The DVM can measure dc or ac voltage with the latter being optionally displayed in dB relative to a user-set memorised value. The counter/timer can measure frequency from 0.01Hz to 150MHz and period from 99.990ns (10ns resolution) up to 99.999ns. A further mode allows trigger events to be counted up to a maximum of 500,000 events.

The cursor measurement system provides for on-screen measurements of voltage and time related quantites via two horizontal or two vertical movable cursors which can be positioned on the waveform with very high precision. An on-screen readout of a variety of parameters can then be obtained including absolute voltage, relative voltage, voltage difference ratio, decibels, time, equivalent frequency (1/T), time difference ratio, and phase.

Thurlby Electronics Ltd,
New Road,
St Ives,
Huntingdon,
Cambs PE17 4BG.
Tel: (0480) 63570.

CLAMP METER

Now available from Electronic & Computer Workshop is an economically priced and simple to use clamp meter, the Pantec CT3101, with nine ac voltage and current measurement ranges.

Using a taut-band meter movement, the analogue CT3101 is a heavy duty design able to accommodate cable diameters of up to 28mm. Current ranges are up to 6, 15, 60, 150 and 300 amps ac with voltage ranges of 15, 300 and 600 volts. Resistance from 0 to 1k can also be measured.

Electronic & Computer Workshop Ltd,
171 Broomfield Road,
Chelmsford
Essex CM1 1RY.
Tel: (0245) 262149.

COLOUR DECODER

Brabury Limited has launched a self-contained automatic multi-standard colour decoder unit, the T510, suitable for a range of applications where colour television signals are received in more than one coding standard.

The decoder accepts composite video inputs in 625-line PAL or SECAM format or 525-line NTSC with either 3.58MHz or 4.43MHz subcarrier. In normal operation it senses the subcarrier frequency and the coding characteristics of the incoming signal and automatically configures to the appropriate decoding circuit. No manual switching or adjustment is required.

In addition to the normal RGB video and mixed sync pulse outputs, the Brabury decoder provides chroma component signals (R–Y and B–Y) together with the luminance component (Y), principally for use with Sony Betacam and Panasonic MII video cassette recorders.

Brabury Ltd,
Units 10/11,
Pipers Industrial Estate,
Pipers Lane,
Thatcham,
Berks RG13 4NA.
Tel: (0635) 68830.

BENCH MULTIMETER

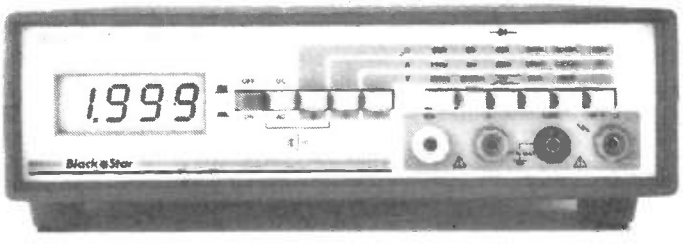
Black Star Limited has announced the latest addition to its range of instruments, the 3225 digital multimeter.

The 3225 meets users' needs for a mains-independent 3½-digit bench multimeter which is fully portable, yet avoids the problems posed by pocketable instruments in many applications.

Operating economy has been a prime consideration in the design of the 3225, resulting in a DMM which gives typically 7,500 hours use from one set of alkaline batteries. A low-battery indicator gives warning of the end of battery life before operation of the instrument suffers.

The 3225 offers 28 measuring ranges with 3½-digit resolution and basic dc accuracy of 0.25%. There are also diode test and audible continuity functions. Measurement features include ac and dc voltage in 5 ranges from 200mV to 1000V full scale, maximum resolution 100μV (ac voltage maximum 750V rms); ac and dc current in 6 ranges from 200μA to 10A full scale, maximum resolution 0.1μA; and resistance in 6 ranges from 200Ω to 20MΩ full scale, maximum resolution 0.1Ω.

The 3225 is housed in a tough grey plastic case,



shielded against electromagnetic and radio frequency interference. Readings are presented on a high contrast 0.5 inch liquid crystal display, with polarity, overrange and low battery indication.

The 3225 digital multimeter is supplied complete and ready to use, with a set of safety test leads, alkaline batteries and a comprehensive user manual. The UK price is £89 plus VAT.

Black Star Ltd,
4 Stephenson Road,
St Ives, Huntingdon,
Cambs PE17 4WJ.
Tel: (0480) 62440.

MULTIMETER

The UDL 44 digital multimeter from Rohde & Schwarz features waveform-independent rms measurement of ac voltages and ac currents up to a crest factor of 3 (TRMS), as well as measurement of frequency or period from 10Hz to 100kHz. The wide display range of 24,999 steps or 99,999 steps for frequency measurement has the advantage that commonly encountered values such as 220V ac or 24V dc voltages can be measured with highest resolution. The dc voltages, ac voltages, dc and ac currents as well as resistance values determined in a total of 17 measurement ranges are indicated on the 4½-digit display. The basic error limits are ±0.04% for dc voltage measurements, ±0.5% for ac voltage and ±0.06% for resistance measurements up to 250kΩ (±0.25% with 2.5MΩ) with a maximum resolution of 10μV for voltage measurements, 10μA for current measurement and 10mΩ for resistance.

In addition to these basic functions the UDL 44 also allows continuity checking of electrical connections (R <20Ω), with acoustic signalling, and testing of diodes.

Rohde & Schwarz,
Mühldorfstrasse 15,
D-8000 München 80,
W Germany.
Tel: (0 89) 41 29 26 25.

LOGIC PROGRAMMER

A new type of programming system which will transform any IBM PC or PC 'look-alike' into a full logic programming system, has been launched by GP Industrial Electronics. The system will be of particular interest to PC users who require a low cost method of programming bipolar PROMs, single-chip microprocessors and PALs.

The system hardware is called the XU-620 universal programming module. The software is called XUDRIVE.

The software will permit the IBM user to enter the appropriate editing and programming commands for full remote control of the XU-620 programming module, which simply plugs into the parallel port of the host PC. The IBM screen displays the information and instructions entered.

The XU-620 costs £395, the XUDRIVE software, £245.

GP Industrial Electronics Ltd,
Unit E,
Huxley Close,
Newnham Industrial Estate,
Plymouth PL7 4JN.
Tel: (0752) 342961.

DF PROCESSORS

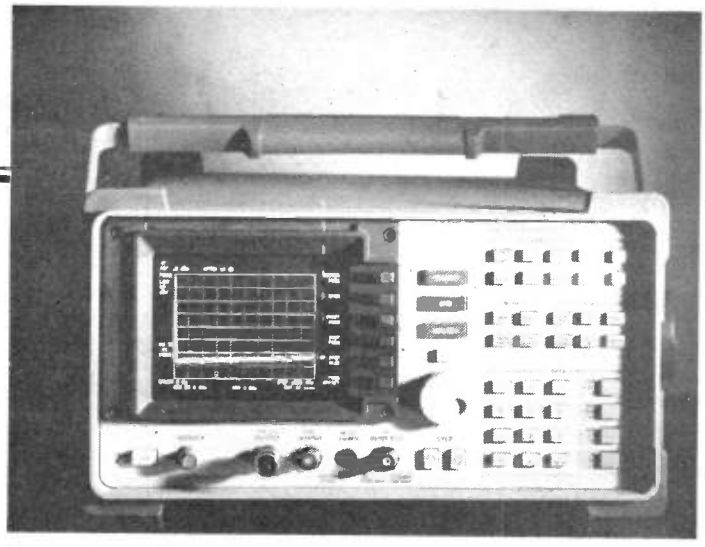
Fieldtech Heathrow Ltd has announced availability of Techcomm's TC-586 portable direction finder system.

The TC-586 system includes a DF receiver processor unit installed in a standard briefcase. The system provides reception demodulation and line of bearing information for AM and FM signals in the 25-550MHz and 800-1300MHz range.

The receiver includes a 20-channel memory scan and F1 and F2 search capability. Power is supplied by an internal rechargeable battery pack or by external 110/240V ac or +12V dc power source.

A variety of small low-profile antennas are available for ground, mobile or airborne applications. The associated antenna (also supplied) is designed to be stowed in a matching attaché case.

Fieldtech Heathrow Ltd,
Huntavia House,
420 Bath Road,
Longford,
Middlesex UB7 0LL.
Tel: (01) 897 6446.



SPECTRUM ANALYSER

Hewlett Packard's new spectrum analyser is now available ex-stock from Livingston Technical Sales. This is the first HP spectrum analyser to be made available through a distributor.

The HP 8590A RF spectrum analyser offers advanced features in a lightweight, sturdy package weighing 13.5kg.

The instrument covers the 10kHz to 1.5GHz frequency range (1.8GHz optional), with −115 to +30dBm amplitude range. Designed for easy manual operation, the 8590A is the first HP spectrum analyser to have both dedicated push-buttons, for frequently-used functions, and menu-based softkeys, which access more than 80 additional functions. Most measurements require only frequency, span and amplitude selection, the analyser automatically adjusting remaining parameters for an optimised CRT display. Optional HP-IB, HP-IL and RS232C interfaces enables full programmability, and direct output of results to printer or plotter.

Coupled with the HP 8444A tracking generator the HP8590A performs evaluations such as stimulus response measurements, eg frequency response and insertion loss. Further addition of the HP 10855A broadband amplifier and the new HP 11940A close-field probe gives a swept broadband system for EMI troubleshooting.

The unit is available for sale ex-stock from Livingston Technical Sales or on short term rental from Livingston Hire.

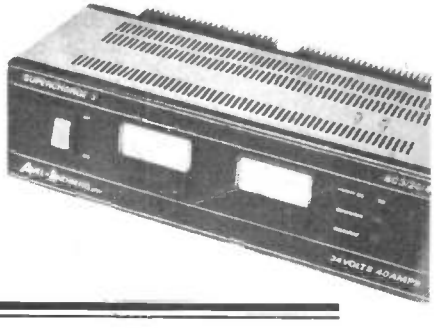
Livingston Technical
Sales Ltd,
Livingston House,
2-6 Queens Road,
Teddington,
Middx TW11 0LR.
Tel: (01) 977 0055.

CHARGER/PSU

The ability to supply electronic equipment from the mains, and from a float charged battery if there is a mains failure, is provided by the Supercharge 3 from Avel-Lindberg. The unit can be used as a nominal 27V dc, 43A max power supply, or as a battery charger with 10 to 39A adjustable charging current; and also in a combination of these roles as long as the input current of the 240V ac supply does not exceed 7.5A, using the charge current limit to set the total load. The basic elements of a dc UPS system are available in the Supercharge 3, with the options of additional switching circuits for changeover and maintenance if required.

The efficiency is between 85% and 90%; the output regulation is better than 0.5% from no load to full load, which provides fast battery recharge; and the 50kHz switching frequency enables magnetic components to be reduced considerably in weight and size. The total weight is only 7kg.

Avel-Lindberg Ltd,
South Ockendon,
Essex RM15 5TL.
Tel: (0708) 853444.



PRODUCT

AMSTRAD MODEM

Miracle Technology have produced a new WS4000 dedicated modem and interface package for the Amstrad PCW8256 world processor.

Autodial, autoanswer, full Hayes intelligence and a special Amstrad serial interface with all cables are brought together in this package for £169.95 exclusive.

Developed from Miracle's WS4000 modem, this new package offers full upgradeability from the standard V21/V23 to V22 and even V22bis. This means speeds from 300bps to 1200/75bps as standard, with 1200 and 2400bps full duplex as optional additions.

Operation is simple and requires no specialist knowledge, and a comprehensive list of UK and international databases is supplied free with every WS4000 dedicated modem.

There is no software to buy for those using Amstrad's built-in MAIL232 communications suite. For others wanting additional general purpose software the WS4000 package is available complete with ChitChat comms software for £259.90 exclusive. The modem works with both the PCW8256 and PCW8512 machines.

Miracle Technology (UK) Ltd,
St Peters Street,
Ipswich IP1 1XB.
Tel: (0473) 216141.

PHASE DETECTORS

Walmore Advanced Components have announced the availability of a new series of double balanced microwave phase detectors made by RHG Electronics Laboratory.

The PDM series of phase detectors provides a dc output voltage that is proportional to the phase and amplitude differences of the RF inputs. The dc offset voltage is minimised and is the lowest available in this type of device.

The Schottky diode quad design maximises the isolation between RF ports. Both ports utilise matching elements to ensure low VSWR, minimising errors from impedance mismatches.

The units are suitable for applications requiring relative phase between two microwave signals, such as in a phase interferometer, or to provide the phase information for a phase locked loop.

The device is provided with removable connectors and can be used for drop-in applications.

The double balanced phase detectors operate over the temperature range of −30°C to +70°C.

Walmore Advanced Components,
Laser House,
132-140 Goswell Road,
London EC1V 7LE.
Tel: (01) 251 5115.

RF MATRIX SWITCH

Wavecom's latest switch development is an RF coaxial matrix switch that offers up to 45 selectable I/O paths.

Available in the UK from Anglia Microwaves, the matrix swich is guaranteed for 1,000,000 switching cycles for each position, in versions with from four to ten I/O channels. This option allows from six to 45 RF paths, selected by a TTL-compatible control port. The switching capability is claimed to be unique, in that no other type can offer so many alternative switch paths together with the ability to connect any port to any port. Models can be specified with frequency ranges up to 18.5GHz.

Typical applications for this new product include the selection and interconnection of multiple receive and transmit antennas, filters, amplifiers, spectrum analysers and other instrumentation in development or test laboratories. Other features of the Wavecom matrix switch include latching/reset operation, a typical switching speed from 15 to 20ms and a choice of solenoid operating voltages of 6, 12, 24 or 28V dc.

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

68008 STE BOARD

Arcom's new SC008 board interfaces the 68008 processor to the STE-bus. Costing £275, it offers a powerful, low cost systems building block.

The SC008 provides an 8MHz 68008, 16K RAM, four memory sockets for EPROM or RAM expansion, two serial channels, a counter-timer/real-time clock, full non-vectored interrupt handling from the STE-bus (plus one interrupt for on-board devices), and a reset utility. It can act as a single master on the STE-bus, or as a temporary bus controller requesting access from the bus master. The board can access all of STE's 1Mbyte main memory and 4K I/O space in addition to the 192K of on-board memory.

Designed for use in both real-time and operating system environments, the SC008 can be supplied with a variety of software. Full support for OS-9/68000 is available, including development systems.

Acrom Control Systems Ltd,
Unit 8,
Clifton Road,
Cambridge CB1 4WH.
Tel: (0223) 242224.

DIGITISED PICTURES

Commodore's new digital picture storage system, Digiview, allows any subject captured by a video camera to be stored permanently on computer disc.

The Digiview system, exclusive to the Commodore Amiga, uses any black and white video camera with 221 interlace. The computer/digitiser adds colour as part of the picture enhancement process. The software makes one scan with each red, green and blue filter then combines all three scans for a full colour picture.

The digitising system together with a Panasonic WV 1410 camera sells for £368.

Commodore Business Machines (UK) Ltd,
Commodore House,
The Switchback,
Gardner Road,
Maidenhead,
Berks SL6 7XA.

LINE MATCHING

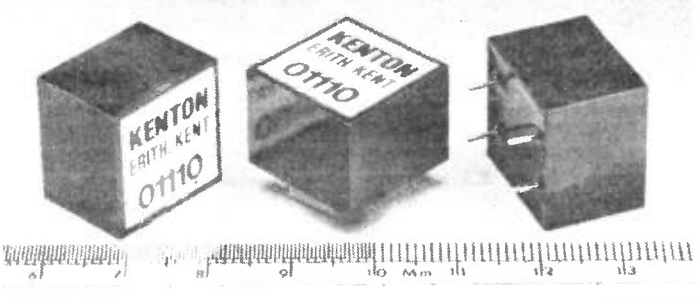
New from Kenton Research is the 01110, a miniature line isolation transformer designed to meet the interface requirements between British Telecom lines and subscriber apparatus. The device has been successfully used in equipment approved by BABT and Teleprove.

The transformer meets the requirements of British Telecom Technical Guide 26 as well as BS6305, BS6328, and BS6301 and optimises performance for 600Ω impedance circuits. It is also suitable for matching network impedance in accordance with BS6305 (Class A).

Vacuum-resin cast, the 01110 fits directly onto a printed circuit board and utilises a standard 0.1 inch pitch to give automatically a 12mm creepage between isolated windings.

The transformer offers isolation in excess of 4kV rms between winding/winding and an isolation resistance greater than 100MΩ in accordance with the requirements of BS6301.

Kenton Research Ltd,
Unit 16,
Europa Trading Estate,
Erith,
Kent DA8 1QL.
Tel: (03224) 41933.



MULTIPAGE TELETEXT

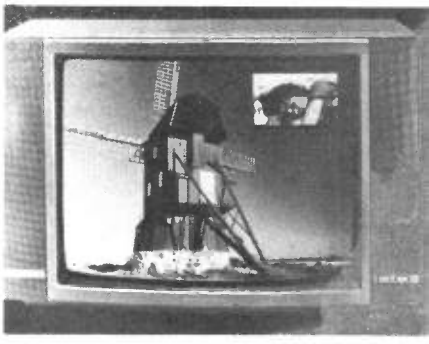
ITT Consumer Products (UK) is now supplying its 14-inch monitor-style colour portable unit, the CP3126, with the ITT-developed Multipage teletext system as standard. This system is also standard in the whole Digivision range, and is available as a retrofit upgrade for earlier models of the CP3126.

Each time a page of text is selected the Multipage system automatically collects the subsequent seven, giving users much-reduced access time to pages of related information. In addition, a rolling page facility is provided to collect up to eight sub-pages for scanning at the viewer's own pace.

The new set's features include frequency synthesis tuning with 40 programs, colour transient improvement for optimum colour contours and infra-red remote control. Full monitor/receiver facilites are provided via a Peritel (SCART) socket, giving RGB input, A/V and audio input/output. The chassis in the CP3126 is one of ITT's Monoprint series, integrating all components and controls onto a single PCB.

ITT consumer Products (UK), Paycocke Road, Basildon, Essex. Tel: (0268) 27788.

PICTURE-IN-PICTURE



The picture-in-picture processor used in ITT's Digivision Multicontrol which will overlay a second, one-third sized picture over the main TV picture, is now available from ITT Semiconductors.

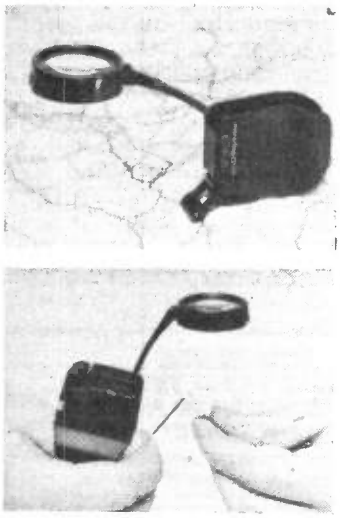
The PIP 2250 processor converts the Y, R-Y and B-Y signals into a form which can be stored in DRAM and presented to the video controller at the appropriate time. The additional RGB inputs of the VCU are used to create a border around the small picture. To retain the possibility of teletext or external RGB as an input an internal RGB switch is incorporated in the picture output processor, as well as additional RGB inputs for external RGB signals.

Six major blocks make up the PIP 2250: an A/D converter, video processor, deflection processor, picture input processor, picture output processor and a DRAM interface. The sampling rate of the small picture is every third pixel and every third line. The overlaid picture may be located in one of four predetermined positions.

The PIP 2250 forms part of the Digit 2000 system for digital signal processing in TV receivers.

ITT Semiconductors, 145-147 Ewell Road, Surbiton, Surrey KT6 6AW.

POCKET MAGNIFIER



A new pocket magnifier is now available by mail order from E Leitz (Instruments) Ltd. The Optipak features a high quality glass (rather than plastic) magnifier, offering 3× magnification, housed in a robust plastic holder. The case has an extendable millimetre scale for map work and aerial photos etc.

The Optipak costs £12.95 including p&p.

E Leitz (Instruments) Ltd, PO Box 10, Buntingford, Herts SG9 9BT. Tel: (0582) 404040.

POWER SUPPLY CASE

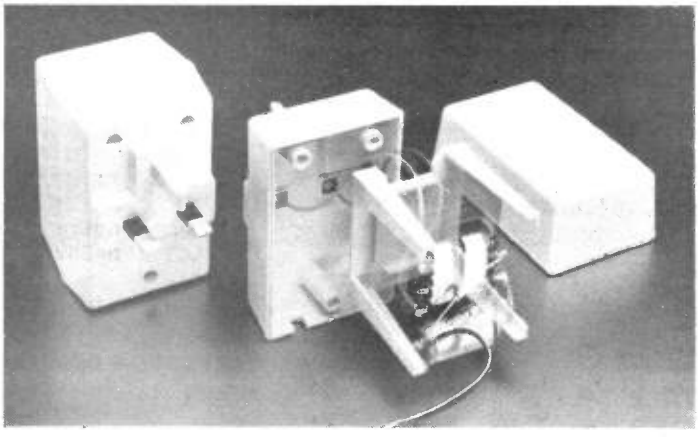
A new plastic enclosure incorporating a three-pin 13A plug and meeting the latest British Standard specification is available from enclosures company West Hyde.

The live and neutral pins are sleeved, in line with the latest requirements of BS1363, thus preventing accidental contact with live conductors if the housing is partially withdrawn from a socket.

A separate internal moulding serves as a cradle to support a standard size EI48 (No74) transformer, or as a mounting plate for other components. This moulding also secures the earth pin in position and keeps wiring at mains potential away from the low voltage circuitry.

The housing is suitable for small power supplies, spike suppressors or other devices where the equipment can conveniently plug directly into the mains supply. The case is available in either black or white and has a non-conductive earth pin as standard. Brass earth pins will be available shortly.

West Hyde Developments Ltd, 9-10 Park Street Industrial Estate, Aylesbury, Bucks HP20 1ET. Tel: (0296) 20441.



QUARTZ CRYSTALS

Now available from Online Distribution is a range of quartz crystals by the Korean manufacturer, Sunny.

The crystals (HC 18/u, HC 33/u and UM-1 type) cover all TV, microprocessor and frequency synthesizer requirements. They range from 1MHz to 48MHz, with a tolerance of ±0.0025 per cent or ±0.005 per cent at 25°C. Temperature range is −20°C to +70°C. Shunt capacitance is no greater than 7pF; ageing rate ±5ppm; seal is by solder or resistance weld.

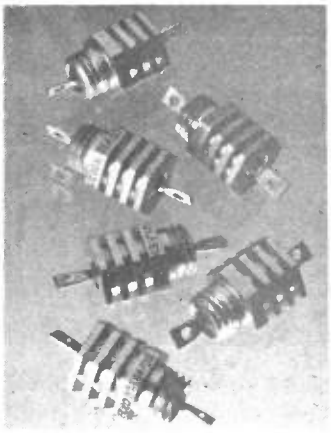
Online Distribution Ltd, Melbourne House, Kingsway, Bedford. Tel: (0234) 217915.

10mW LASER DIODE

New from Sharp, and now available from Hero Electronics, is a low cost addition to the extensive Sharp line-up of semiconductor laser diodes.

The LT027 is a 10mW maximum output laser operating at 780nm, and having a typical threshold current of 45mA. Normal operating current is typically 65mA. The device package, which is available in two case styles, also incorporates a photodiode for use as a feedback element to control the laser output. The LT027 is suitable for use with both of the Sharp laser diode driver ICs, the IR3C01 and IR3C02.

Hero Electronics Ltd, Dunstable Street, Ampthill, Beds MK45 2JS. Tel: (0525) 405015.



WIRE-WOUND RESISTORS

The HSV series metal-housed resistors from CGS save space by performing the added function of taking a connection through a bulkhead or casing, at the same time using the metalwork as a heatsink.

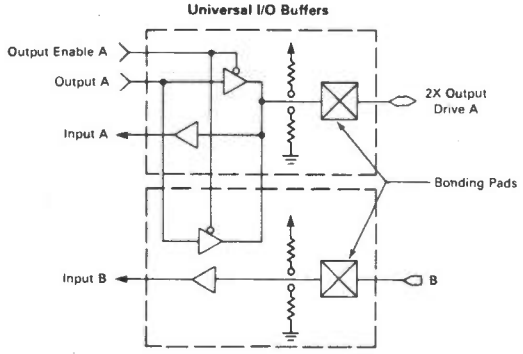
The HSV variant comes in two dissipation ranges, 15 and 25W at 25°C, and owes its dual function to a modified body style – part of the aluminium housing is threaded for fixing through the casing, and terminations are solder tags. The resistors are part of CGS' high stability HS range, components which are capable of dissipating high power in a limited space while maintaining a relatively low surface temperature. The power is dissipated rapidly as heat through the housing to the metalwork.

CGS Resistance Co Ltd,
Marsh Lane,
Lymington,
Hants SO41 9YQ.
Tel: (0590) 75255.

GATE ARRAYS

Motorola has announced the HCA62A00 series of advanced 2-micron HCMOS gate arrays with 100% input/ouput flexibility and 100% programmable power and ground pins. These features provide the designed with simple-to-use semi-custom solutions and the ability to use any pin as an input, output bidirectional, ground or power pin. Motorola offers seven configurations with densities of 600 to 8,500 gates.

The 62A00 series arrays simplify board layout and the conversion from circuit schematic to semi-custom chip by providing the customer with the flexibility to decide where to place all signal and power pins. For high output drive up to six output cells can be paralleled on-chip for 24mA through a single pin. The cells paralleled to obtain this high output drive can still be used as inputs to the array, providing high drive without reducing the number of usable pins.



PARALLELED BIDIRECTIONAL BUFFER WITH 2X OUTPUT DRIVE AND FULL PIN UTILIZATION

Motorola Inc,
PO Box 52073,
Phoenix,
Arizona 85072,
Tel: (602) 821 4426.

DSP CHIPS

Now available from RR Electronics are details of three new chips in Motorola's digital signal processing (DSP) family. All are fabricated in HCMOS.

The DSP56000 is a 56-bit general purpose, user-programmable DSP. It comprises three execution units in parallel: the data ALU, the address ALU and the program controller.

This DSP has MCU-style on-chip peripherals, program and data memory, plus memory expansion port. Other features include: 10.25 million instructions per second (MIPS); single-cycle ALU; 24 × 24 56-bit parallel multiply/accumulate; 2K × 24-bit program ROM.

The DSP56001 chip is identical except that it includes RAM instead of ROM for user flexibility.

The third chip, DSP56200, is a cascadable adaptive finite impulse response (CAFIR) digital filter. It is a DSP peripheral for computationally-intensive tasks associated with digital filtering. It fulfils two main functions, FIR filtering and adaptive FIR filtering using the least mean square (LMS) algorithm.

All three devices will be sampled by the first quarter of 1987. Design-in software packages are available now to run on VAX and IBM PC computers.

RR Electronics Ltd,
St Martin's Way,
Cambridge Road,
Bedford MK42 0LF.
Tel: (0234) 47211.

SURGECTORS

Now available from VSI is RCA's new range of surge suppressors. RCA developed these devices to protect sophisticated electronic equipment from rapid high voltage power surges.

The monolithic device consists of an SCR-type thyristor whose gate region contains a special diffused section that acts as a Zener diode. Because it combines the continuous voltage protection of the Zener with the thyristor's ability to handle high current, the Surgector provides protection against pulses which may be too rapid or too powerful for conventional devices.

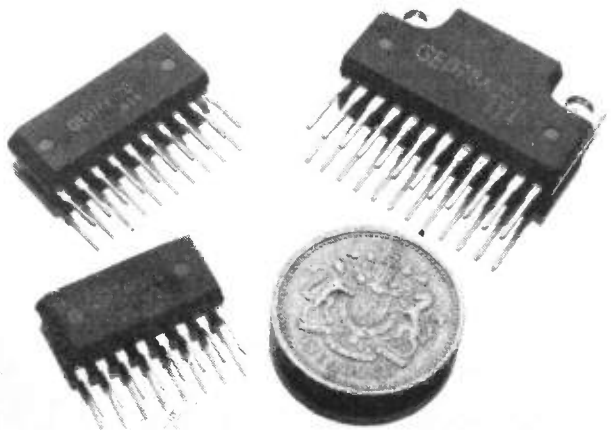
VSI Electronics Ltd,
Roydonbury Industrial Park,
Horsecroft Road, Harlow,
Essex CM19 5BY.
Tel: (0279) 35477.

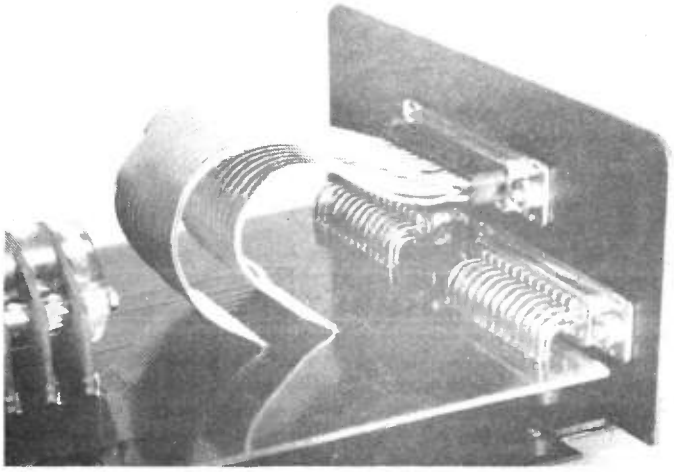
GE SIPS

Now available from RR Electronics is range of space-saving SIP power transistor/Darlington arrays made by GE Semiconductor. They are designed for high power switching, hammer drive, pulse motor drive and inductive load drive applications.

Ten different configurations are available in 8 10 or 12-pin packages, with power dissipation from 3W to 5W.

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





D CONNECTOR COMBO

A new combination of D subminiature connectors and a flexible jumper is now being manufactured by St Cross Electronics. Known as the Flexi D, this product is designed to give total flexibility in the application of D connectors to PC boards and panels. It also allows greater freedom in the PC layout, as the pin-out may be taken to 2 (or 3 in the case of 50-way) completely different locations on the PC board or to separate boards.

Flexi D features polyester constructed plug and socket insulators with connector shells of steel plated with zinc/yellow passivate. Conductor spacing is 0.1 inches with jumper conductors pre-bonded stranded 26awg, with length and various permutations to customer requirements.

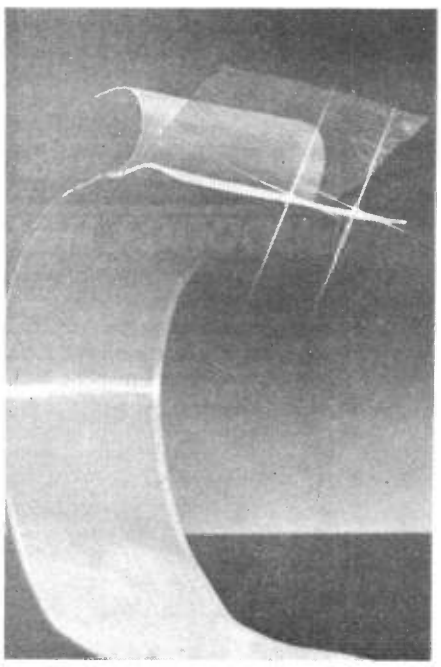
St Cross Electronics Ltd,
Unit 14,
Mount Pleasant Industrial Park,
Southampton SO2 0SP.
Tel: (0703) 227636.

RIBBON CABLE

Amphenol has developed a ground-plane ribbon cable that uses a quick stripping technique to save time on preparation for termination. Designed for computer and communications equipment using high speed switching and data transmission, Quik-Strip incorporates an integrally laminated copper mesh ground-plane with optional drain wire, affording proven crosstalk and EMI/RFI control.

The added refinement is a labour-saving method of peeling back the lamination for connector assembly. The edge of the cable is notched at the appropriate strip length and the laminate is simply peeled back with the fingers to the notch.

This cable is available with 20 to 60, 28awg 7/36 strand tinned copper conductors on a 0.05 inch pitch. Voltage rating is 300V, current rating 1A. Maximum operating temperature is 105°C.



Amphenol Ltd,
Thanet Way,
Whitstable,
Kent CT5 3JF.
Tel: (0227) 264411.

NEWS DESK

Roll up, roll up!

If you hurry (and if you've got any money left after Christmas) you can still take advantage of Comex Systems' Christmas specials.

Until 31st January Comex are offering satellite TV receivers with tunable sound, S-meter and RF modulator for £220 including VAT. They are also offering full systems comprising receiver, 1.6m GRP dish, polar mount and STS LNB (plus scalar horn) for £634 including VAT.

If you're in the market for a satellite system you'll find it hard to beat the quality and level of service from Comex (remember the satellite TV tuner project in last August's *R&EW*?), so give Paul Elliott a ring on Leicester (0533) 25084.

Satellite conference

The fifth *Financial Times* Cable Television and Satellite Broadcasting Conference, arranged in association with New Media Markets, will be held in London at the Inter-Continental Hotel on 18th and 19th February, 1987.

This two-day conference will be chaired by Lord Thomson of Monifieth, Chairman of the Independent Broadcasting Authority, and John Jackson, Chairman of Direct Broadcasting Limited, and the opening address will be given by David Mellor MP, Home Office Minister responsible for broadcasting.

For more details contact the Financial Times Conference Organisation, Minster House, Arthur Street, London EC4R 9AX. Telephone (01) 621 1355.

High capacity CD

Incomtel are to launch what is thought to be the first professional compact disc player in Europe. Incomtel see enormous potential for this machine, which has the capacity for up to 100 discs or 1000 tracks, from national and local radio stations as well as from users as diverse as clubs, leisure complexes, restaurants, hotels, etc.

The Audio-Metrics AMCDS programmable compact disc player, approximately 80% smaller than the conventional music centres it supersedes, incorporates a Japanese-developed transport system with US electronics. It measures just 22 × 17.5 × 17.5 inches and weighs 80 pounds.

The unit, once loaded with 100 compact discs to provide around 50 hours of music, gives instant automatic random access to disc and cut, either through its self-contained eight-step memory or by connecting to an external programmer or computer.

Machine vision

Built as a research project at the British Aerospace Sowerby Research Centre, Bristol, Visive is a demonstrator that simulates aspects of biological vision. Visive is a hard-wired computing device for converting image information derived from a sensor observing a natural scene into a structured digital data format suitable for processing by computer.

The object of this research is to develop machine vision systems of general utility, capable of working in real-time, which are not subject to the restrictive operational conditions, and therefore limited applications, of current 'pattern recognition' type systems.

Biological vision is the model on which the design of Visive is based. Natural selection over several million years has ensured that biological vision – the combination of eye and brain – is a highly efficient means of extraacting and handling image data. As such, many of the principles involved in human vision are applicable to machine vision. The eye is not a particularly effective sensor, but human visual perception is good because of the brain's ability to interpret the data presented to it.

Scene analysis can be divided, broadly, into three phases: imaging and the formating of the raw data; manipulation of the data to provide information suitable for interpretation; interpretation of the information to initiate some useful action. Extracting and formating image detail from raw data is the function of Visive. The success with which the succeeding procedures can be performed is dependent upon the quality of the image detail produced, and Visive is designed to produce information at a super resolution in the order of 10 times the sampling resolution.

Video input is used in experiments with Visive. The input is from a CCD (charged coupled device) camera that provides a digitised video output at the rate of 30 frames per second of an actual scene. Each frame comprises a 256×256 pixel matrix.

The selected image supplied to Visive enters its image input buffer store after first being converted into an 8-bit, 128×128 hexagonal pixel matrix. This is the spatial resolution Visive is designed to handle. Image data is stored in a fast RAM array. From here the image data is relayed to a group of microprocessor computing units at a rate of 10 frames per second.

Algorithms used in these units have been developed from the principles underlying biological vision to assess the tonal variations between pixels to identify edge points, to determine the relative strengths and orientations of these edge points, and then to associate contiguous edge points with one another to establish the boundaries of objects. Boundary data is then sent to Visive's image output buffer, where it is available for display on a video monitor screen, or on to other computing units for further analysis and classification.

United Institution

Members of both the Institution of Electrical Engineers and the Institution of Electronic and Radio Engineers, having recognised for some time that their fields of interest were converging, voted overwhelmingly (97%) at the beginning of December to join forces and create a combined Institution to meet the future needs of the profession.

The proposals will take full effect on 1st October 1988. The new body will retain the long-established title 'The Institution of Electrical Engineers' and will be the largest of the UK Chartered Engineering Institutions, having more than 100,000 members, nearly a quarter of them being resident overseas.

The new Institution will cover the art, science and practice of electrical, electronic and software engineering activities in such fields as power, control, instrumentation, broadcasting, radio, telecommunications, computers and information systems.

Mass market CAD

Robotechnic Limited have announced what is claimed to be the lowest cost, most complete computer aided design software system yet to be made available. Known as Generic CADD 2.0, the new system software will run on a standard IBM PC with graphics card and is priced at £99.00.

Generic CADD was first announced in the USA in June 1986, and by October had sold over 20,000 copies. Generic CADD 2.0 competes with products like AutoCAD, a widely accepted CAD entry level system.

Generic CADD 2.0 is the base module for a family of Generic CADD tools. Two of these have also been announced. The first, Auto-Convert, enables an AutoCAD user to swap files back and forth between AutoCAD and Generic CADD 2.0. The second add-on software tool is DotPlot, a facility that gives a standard dot matrix printer the capabilities of a simple pen plotter.

The basic hardware required is an IBM XT/AT or compatible with 384K RAM using DOS2.0 or later; two floppy disk drives or one floppy and a hard disk; and a graphics card providing EGA or CGA facilities.

Generic CADD 2.0 enables the user to draw a wide variety of objects – circles, arcs, rectangles, polygons, ellipses and true B-spline curves. Rubber banding and point and grid snapping techniques are also provided. The use of colour is encouraged by the provision of 256 colours and layers. Drawn objects can be moved, copied, erased, broken and, if required again, stored in a user-created library for later use. Such stored objects can be retrieved from the menu then rotated, scaled or stretched as required.

For more info contact Robotechnic on (01) 499 9746.

RRD report

On 18th December the Department of Trade and Industry published the first report of the Radio Regulatory Division (RRD), the DTI'S frequency allocation and enforcement section.

The division is effectively the only UK dispenser of radio spectrum, and the report is designed to familiarise current and potential spectrum users with the RRD's work. It covers the activities of the division during the financial year 1985/86 and includes details on the future plans for the spectrum and background material on the international framework.

The report has been produced in response to a recommendation in the Merriman Report (Independent Review of the Radio Spectrum 30-960MHz), presented to Parliament in July 1983.

Publication of the report coincides with a change of name for the RRD to Radiocommunications Division.

Copies are available from: The Library, Radiocommunications Division, Room 605, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

London trunked system

During November, British Telecom Baselink launched its first trunked two-way radio service to provide extensive coverage over the Greater London area.

The London Trunked System allows both 'base to vehicle' and 'vehicle to vehicle' conversations. A desktop unit installed at the user's base is linked by radio to the Telecom Tower and enables mobile units in the company's vehicles to be contacted by the base or by another vehicle from virtually anywhere within the M25 ring.

Because the new trunked system is multi-channelled, callers coming onto it are automatically allocated a free channel. If all channels are being used, a queue is set up and callers are automatically directed through a free channel when one becomes available.

Depending on how busy the system is, the length of calls is limited in relation to total usage. This ensures that a user will rarely have to 'queue' for longer than 20 seconds. Typically, calls will be set to last between one and two minutes and a tone will warn users before time-out.

In addition to the London Trunked System, British Telecom Baselink can already provide dedicated or community repeater systems throughout mainland Britain. There are plans to introduce further trunked systems by September, with the launch of a national trunked service intended for the early 1990s.

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Made by the famous **REDIFFUSION** Co. for their own professional computer system this monitor has all the features to suit your immediate and future requirements. Two video inputs: **RGB** and **PAL** Composite Video, allow direct connection to **BBC/IBM** and most other makes of micro computers or **VCR's**, including our very own **TELEBOX**. An internal speaker and audio amp may be connected to computer or **VCR** for superior sound quality. Many other features: PIL tube, Matching **BBC** case colour, Major controls on front panel, Separate Contrast and Brightness – even in **RGB** mode. Separate Colour and audio controls for Composite Video input, **BNC** plug for composite input, 15 way 'D' plug for **RGB** input, modular construction etc.etc.
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Supplied **BRAND NEW** and **BOXED**, complete with DATA and 90 day guarantee. **ONLY £149.00** as above **OR IBM PC** Version **£165.00**
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DECCA 80 16" COLOUR monitor. RGB input.
Little or hardly used manufacturer's surplus enables us to offer this special converted **DECCA RGB** Colour Video TV Monitor at a super low price of only **£99.00**, a price for a colour monitor as yet unheard of!! Our own interface, safety modification and special 16" high definition PIL tube, coupled with the **DECCA 80** series TV chassis give 80 column definition and quality found only on monitors costing 3 **TIMES OUR PRICE**. The quality for the price has to be seen to be believed!! Supplied complete and ready to plug direct to a **BBC MICRO computer** or any other system with a **TTL RGB** output. Other features are: internal speaker, modular construction, auto degaussing circuit, attractive TEAK CASE, compact dimensions only 52cm W x 34 H x 24 D, 90 day guarantee. Although used, units are supplied in **EXCELLENT** condition.
ONLY £99.00 + Carriage.

DECCA 80, 16" COLOUR monitor. Composite video input. Same as above model but fitted with Composite Video input and audio amp for **COMPUTER, VCR** or **AUDIO VISUAL** use. **ONLY £99.00** + Carr.

REDIFFUSION MARK 3, 20" COLOUR monitor. Fitted with standard 75 ohm composite video input and sound amp. This large screen colour display is ideal for SCHOOLS, SHOPDS, DISCO'S, CLUBS and other AUDIO VISUAL applications. Supplied in **AS NEW** or little used condition **ONLY £145.00** + Carr.

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All units are fully cased and set for 240v standard working with composite video inputs. Units are pre tested and set up for up to 80 column use. Even when MINOR screen burns exist –, normal data displays are unaffected. 30 day guarantee.
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GOULD OF443 enclosed, compact switch mode supply with DC regulated outputs of +5v @ 5.5a, +12v @ 0.5a, –12v @ 0.1a and –23v @ 0.02a. Dim 18 x 11 x 6 cm. 110 or 240v input. **BRAND NEW** only **£16.95**
GOULD G6-40A 5v 40 amp switch mode supply **NEW £130.00**
AC-DC Linear PSU for **DISK** drive and **SYSTEM** applications. Constructed on a rugged ALLOY chassis to continuously supply fully regulated DC outputs of +5v @ 3 amps, –5v @ 0.6 amps and +24v @ 5 amps. Short circuit and overvoltage protected. 100 or 240v AC input. Dim 28 x 12.5 x 7 cm **NEW £49.94**
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AMKEY MPNK-114 Superb word processor chassis keyboard on single PCB with 116 keys. Many features such as On board Micro, Single 5v rail, full ASCII coded character set with 31 function keys, numeric keypad, cursor pad and 9600 baud SERIAL TTL ASCII OUTPUT!! Less than half price
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The FABULOUS CPM TATUNG PC2000 Professional Business System

A cancelled export order and months of negotiation enables us to offer this professional **PC, CPM** system, recently on sale at **OVER £1400**, at a **SCOOP** price just over the cost of the two internal disk drives!! Or less than the price of a dumb terminal!!

Not a toy, the **BIG BROTHER** of the **EINSTIEN** computer, the **DUAL PROCESSOR PC2000** comprises a modern stylish three piece system with ALL the necessities for the **SMALL BUSINESS, INDUSTRIAL, EDUCATIONAL** or **HOBBYIST USER**. Used with the THOUSANDS of proven, tested and available CPM software packages such as **WORDSTAR, FAST, DBASE2** etc, the **PC2000** specification, at our prices, **CANNOT BE BEATEN!!**

The central processor plinth contains the **64K, Z80A** processor, **DUAL TEAC 55F 5¼"** Double sided **40/80** track disk drives (1Mb per drive), **PSU, 4K** of memory mapped screen RAM, disk controller, **RS232, CENTRONICS** and system expansion ports, and if that's not enough a ready to plug into **STANDARD 8" DRIVE** port for up to **FOUR 8"** disk drives, either in double density or **IBM** format. The ultra slim **92** key, detachable keyboard features 32 user definable keys, numeric keypad and text editing keys, even its own integral microprocessor which allows the main **Z80A** to devote **ALL** its time to **USER** programs, eliminating "lost character" problems found on other machines. The attractive, detachable 12" monitor combines a green, anti-glare etched screen, with full swivel and tilt movement for maximum user comfort. Supplied **BRAND NEW** with **CPM 2.2**, user manuals and full **90** day guarantee. Full data sheet and info on request.

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PC2000 Wordprocessor System with CPM and TEC FP25 daisywheel printer
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ALPHATANTEL. Very compact unit with integral **FULL ALPHA NUMERIC** keyboard. Just add a domestic TV receiver and you have a superb PRESTEL system and via **PRESTEL** the cheapest **TELEX** service to be found!! Many features: **CENTRONICS** Printer output, Memory dialling etc. Supplied complete with data and **DIY** mod for **RGB** or Composite video outputs. **AS NEW** only **£125.00**
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SPECTRUM WATCH

NIGEL CAWTHORNE G3TXF

Some time in late October the UK's cellular subscriber base eased past that of Sweden to become number one in Europe and second in the world after the USA. In mid-November Cellnet were claiming 54,000 subscribers and Vodafone 58,000, making the UK total 112,000 against Sweden's mid-November total of 107,000. It has taken the UK just 20 months to become Europe's number one cellular country.

However, before the UK's two cellular operators start the celebrations they should take a look at the cellular penetration figures measured in terms of numbers of cellular sets per 1,000 inhabitants. At 2.0 cellular sets per 1,000 inhabitants the UK is still only seventh in Europe behind the four mainland Scandinavian countries (Norway: 20.3, Sweden: 12.8, Denmark: 10.7, Finland: 9.8), Iceland (7.0) and Austria (2.2).

It is perhaps a sobering thought for cellular planners that if the UK subscriber base ever reached the penetration figure currently achieved in Norway there would then be over a million cellular subscribers in the UK!

Icelandic cellular

The prize for rapid cellular growth has to go to Iceland, where in four months the NMT-450 network achieved a customer base of 1,825 subscribers. With a population of 240,000 inhabitants this corresponds to a penetration of more than 7 per 1,000.

There appear to be two major reasons for this rapid cellular radio growth in Europe's most northerly outpost. Firstly, as Olafur Indridason of the Icelandic PTT told *Spectrum Watch*, "Icelanders like new things, and the Icelandic fishing fleet has taken to cellular in a big way."

Iceland is unique in cellular radio because three of the PTT's 29 base stations are on small islands in the sea, specifically to provide good coverage for fishing vessels. The three offshore base stations are connected into the main network by a microwave link.

October's USA-USSR summit in Iceland set a new record for the number of Intelsat satellites carrying coverage of a single event. Seven Intelsat satellites (five over the Atlantic and two over the Indian Ocean) were used in covering the two day Gorbachev-Reagan meeting. Some ten 'flyaway' C-band and Ku-band Earth terminals were in operation in Reykjavik, including Marconi-supplied Newshawks. Intelsat say that the previous record for the largest number of Intelsat satellites used in a single event was six, during the World Cup football finals held in Mexico earlier this year.

Olympic broadcasts

Preparations for the 1992 Barcelona Olympics will be the occasion of a major spending spree on broadcast and communications equipment. As part of their promotional build-up to the October decision by the International Olympic Committee, the Barcelona lobbyists had prepared a detailed study, called BIT '92, of the technological requirements of the Games, which included an outline of the broadcasting needs.

The BIT '92 study aimed to identify ways of making the most for Spain's electronics industry as a whole out of the telecommunications and information technology investments that will have to be made as part of the project. The £0.24 million study has identified 99 IT and telecommunications projects which could be included in the Olympics. Of these, forty-four have been identified as being indispensable to the holding of the Games, and among these are the radio and TV broadcast requirements.

£130 million projects

According to the BIT '92 study, if all the radio and TV projects were implemented the total spend in this area alone would be £130 million. The study concludes that in total some £300 million will have to be invested if all the proposed IT and telecommunications projects were to go ahead. Apart from broadcasting, the other key area for the Olympics is data processing.

For broadcasting, the Olympics will require 5 six-camera outside broadcast (OB) vans, 20 four-camera OBs and 18 two-camera OBs, one new large studio complex, a few new medium sized TV studios and eighteen small studios. The Olympic shopping list also includes 50 ENG units, eight radio OBs and facilities for nearly 900 commentators.

Apart from the facilities required for international radio and TV coverage of the 1992 Olympics, there are also plans for the construction of special Olympic radio and TV channels for athletes and visitors in the Barcelona area. The Olympics are also likely to give Barcelona the excuse to go ahead with a project that it has needed for some time: a new TV and communications tower. It was on the back of the 1982 football World Cup that the Spanish TV in Madrid got their new Torrespaña TV tower and studio complex.

Communications are a vital part of an operation such as the Olympics. However, one service that the Spanish will want to dramatically expand before 1992 will be the cellular car telephone service in the Barcelona area. Currently there are less than 150 cellular users in this area. In fact there are still less than 2,000 in the whole of Spain.

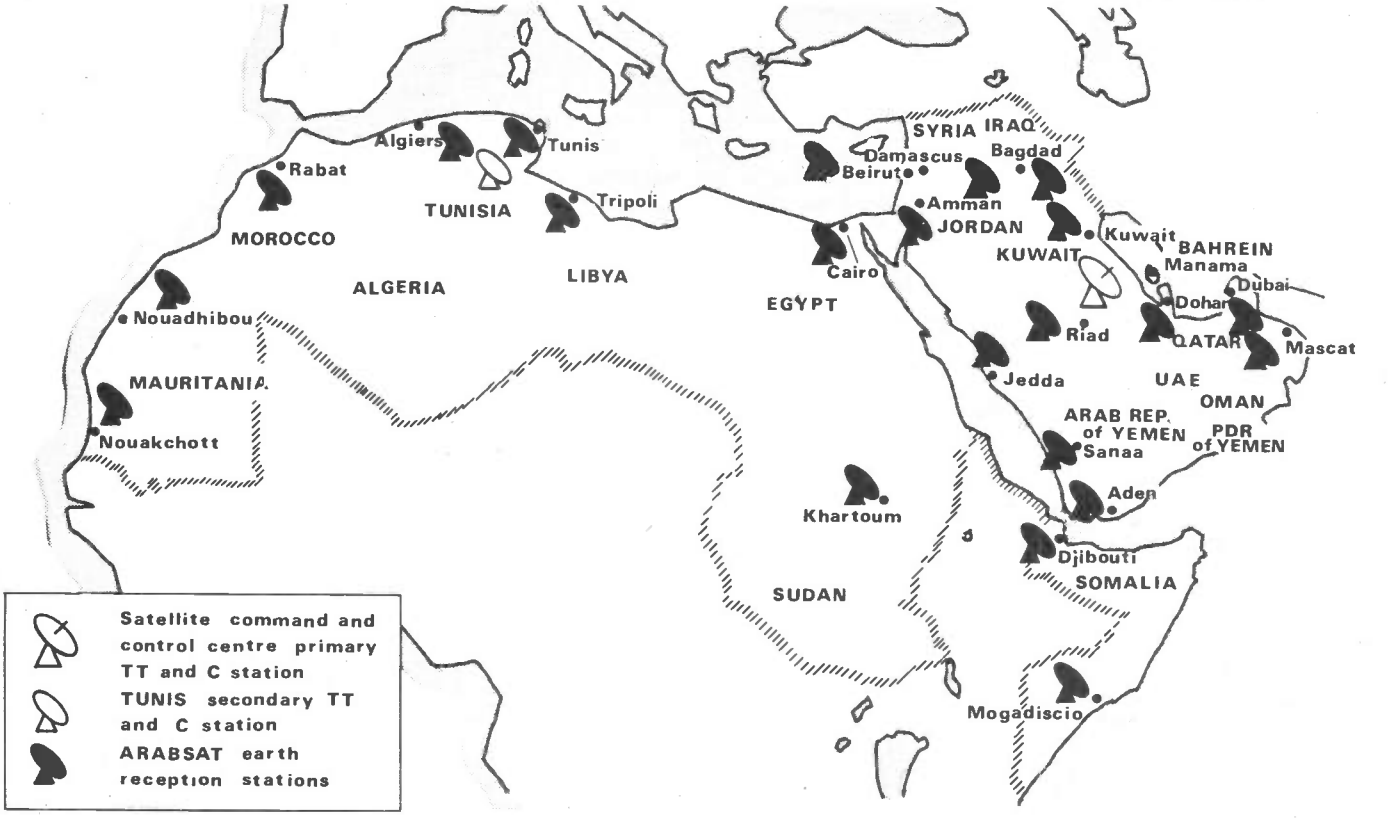
Telefónica, which operates Spain's cellular telephone network, is planning to add a further eight cities to the network during 1987. Currently the NMT-450 Spanish car telephone service is available only in Madrid, Barcelona, and in parts of southern Spain. Even by the end of 1987 the total capacity of Spain's Teléfono Móvil Automático will be only 5,000. The selection of Barcelona for the 1992 Olympics will give a major boost to both broadcasting and telecommunications projects in Catalunia, the Spanish region of which Barcelona is the capital.

Tunisia Telecomms

The world-wide calendar of telecommunications and broadcast exhibitions and conferences never ceases to get fuller and fuller. The latest

Country	System	Subscribers	Market penetration per 1,000 inhabitants
UK	TACS-900	112,000	1.98
Sweden	NMT-450	107,200	12.76
Norway	NMT-450	85,100	20.26
Denmark	NMT-450	55,700	10.71
Finland	NMT-450	47,000	9.79
Austria	NMT-450	16,300	2.14
Germany	C-Netz	16,000	0.26
Netherlands	NMT-450	11,800	0.81
France	RC 2000	7,500	0.14
Iceland	NMT-450	1,825	7.60
Spain	NMT-450	1,450	0.04
Ireland	TACS-900	900	0.26
Luxembourg	NMT-450	85	0.23
European cellular subscriber'total (November 86): 462,860			

Source: European Mobile Communications Report, EMC Publications



newcomer to the international telecommunications exhibition world is Tunis, which held the first Tunisia Telecomms exhibition and forum in early December.

Forty international companies exhibited telecommunications products at the show, which was attended by visitors from several North African countries. There was no presence at the Tunisia Telecomms forum from any UK company, even though many of their rivals from Scandinavia (Ericsson, Storno, Dancall), France (Alcatel), Germany (ANT) and Austria (ITT) were present and flying the flag for their products in the Tunisian telecommunications market-place.

The three-day conference which accompanied the exhibition brought together several key figures from the Arab broadcasting and telecommunications world, including Mr Chakroun, head of the Arab States Broadcasting Union (ASBU), the Arab equivalent of the EBU, and Mr Bairi, head of Arabsat.

Tunis is an important centre of broadcast and telecommunications activity in the Arab world. Not only does it house the ASBU headquarters but it is also the site of the second control station for the two Arabsat satellites. The primary control station is in Riyadh, Saudi Arabia.

Second generation Arabsat

Arabsat's Director General Bairi told the Tunisian conference that the time was fast approaching when the 22-nation Arabsat organisation would have to start taking major decisions concerning the next generation of satellites. Arabsat currently has two satellites in orbit (Arabsats 1A and 1B). A third (Arabsat 1C) is built and waiting to be launched.

The two Arabsats currently in orbit are not expected to be operational beyond 1992. If a second generation of satellites is to be planned then decisions will have to be made in early 1987. According to Mr Bairi a full five years will have to be allowed between the initial 'go' decision and the putting into operation of the second generation of Arabsats. One year is needed for a detailed study of the requirements, a second year is needed for the issuing of tenders and contract negotiations with suppliers, and then three further years have to be allowed for the satellites to be built and launched.

The Arabsat network is currently used for TV broadcast programme exchanges between Arab countries as well as for telecommunications traffic. There is also now a project to use the S-band (2.5GHz) transponder on one of the Arabsat birds for a pan-Arab commercial broadcast TV channel. Five transponders on one Arabsat satellite have been leased for five years to the Arab Space Scene Corporation, who are paying $40M for them. Only one (the S-band transponder) will be used for broadcasting.

According to Arabsat's own predicted coverage map this new programme, once operational, should be receivable by those in southern Britain equipped with a 2.5 GHz satellite receiver and a 3m dish. Transmissions for up to three hours a day are expected to start by next April.

The use of the S-band for satellite broadcasting is relatively rare. The only other satellite currently doing this is the Indian Insat. However, it is hoped that the single S-band transponder will give good coverage over all the 22 nations of the Arab league from Mauritania on the west coast of Africa through to the Gulf States, as well as much of Africa and southern Europe.

Tunisian cellular

Tunisia can claim to be the first country in Africa to have a cellular car telephone network. The original small network was installed in the Tunis area by Ericsson in 1982. However, the network is now being expanded to cover both Sousse and Sfax and the capacity is being increased from the present 100 subscribers to about 1,000.

The only other North African country to have made a firm decision on a cellular car telephone network is Egypt, which has opted for a Japanese system. The contract for the Egyptian system with National (Matsushita) was signed in April 1984 and the installation work of the 14-base station is currently under way, with a target opening date of May 1987.

The Egyptian cellular network will cover Cairo, Alexandria and the desert road between these two main cities. The system will operate at 800MHz and will initially use 150 radio channels and have adequate capacity for 2,500 subscribers.

There are now operational cellular car telephone networks on all five continents. REW

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1µF 50V ..... **100/£14**
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AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

One of the organisations which does much for amateur radio and yet gets very little publicity for its efforts is the International Amateur Radio Union (IARU), which was founded in 1925. It came about through a feeling in the ARRL – the American Radio Relay League, the organisation which represented American radio amateurs of that time (and still does, of course) – that there was need for a body in which the ARRL could join with the other national amateur radio societies "in a common effort to promote and co-ordinate communication between amateurs the world over; to represent their interests at international communication conferences and to encourage international fraternisation".

A meeting in April 1925 in Paris was called to which were invited prominent personalities in the amateur radio scene and representatives of radio societies of that time. Some twenty-three countries were represented.

Growing pains

Since those days the IARU has grown in line with the great growth of amateur radio itself. Many famous pioneers of amateur radio were involved in this process. There are now three 'Regions' covering the whole of the world.

As a member of the IARU, the RSGB has the right to nominate observers to attend International Telecommunication Union conferences. These are of great importance to the radio amateur as it is here that the allocation of radio spectrum frequencies is negotiated. This was particularly so when amateur radio reassembled after World War 2, following its close-down during the 1939-45 period.

There were significant conferences of this nature staged by the ITU in the years 1947, 1959, 1963 and 1971, at all of which matters concerning the occupation of the radio spectrum by amateurs came up for discussion. Amateur radio representatives were present at all these conferences, and in spite of their inexperience in such deliberations they were able to make their needs felt. It was soon realised, however, that if amateur radio was going to hold its own in the ITU decision-making process a much stronger representation had to be prepared for future activities of this sort. It was very much a world in which 'professionalism' was essential.

The IARU had meanwhile been building up its organisation. Its HQ was at the ARRL HQ in America. The President of the ARRL in 1964 was also President of the IARU, Herbert Hoover Jr W6ZH, and it was he who set the IARU on the right track in its preparation for the forthcoming ITU conference in 1979. To his name must be coupled that of our own Roy Stevens G2BVN, whose views on the matter closely followed those of Herbert Hoover, and who was Honorary Secretary of IARU Region 1 at the time.

An intensive program of travel to IARU societies around the world was drawn up, in which IARU officers and staff encouraged them to establish better relations with their radio administrations and to foster the concept that amateur radio was a valuable service to their communities and deserved the support of their administrations. This task met with more difficulties than had been expected. Many of these radio administrations proved particularly difficult to convince!

However, by the time the next ITU conference came along in 1979 an encouraging amount of support had been generated, so much so that the WARC-79 conference approved the granting of new facilities for amateur radio – the 'new' bands of 10, 18 and 24MHz.

There is much more to be done in the IARU sphere of activity for the future of amateur radio, and the more publicity that can be given to the IARU and its work the better. Readers are referred to an article in the November 1986 issue of *Radio Communications* by the current President of the IARU, Richard Baldwin W1RU, entitled *The International Amateur Radio Union – Yesterday, Today and Tomorrow* for a much more detailed exposition of this very important matter.

The International Short Wave League

The ISWL was one of the established organisations for the short wave listener which had for the past forty years or so provided the SWL with the services which make his hobby so much more enjoyable than it otherwise might be. It was renowned for its countries and callsign lists; it ran a good QSL service and the periodical, *Monitor* , was much respected and could be relied upon to keep the SWL up to date.

Unfortunately, just recently it became caught up in the problems which have befallen many of the smaller organisations these days, and in June 1986 had to close down.

Your scribe was much involved in the ISWL in its early days and its demise was sad news indeed. At its peak it was the argest SWL organisation in the world, and it was very efficiently governed by an elected council. The logo included a banner with the caption 'We Span The Globe', which just about summed up the ISWL!

However, its resilience was admirable and it was good to hear from Frank Baldwin that it is to be revived as the ISWL 87. Frank will resume the office of President, to which he was appointed in September 1985. Jim May G1GWG will become its Honorary Secretary, Mrs Evelyn May G1OFC its Assistant Honorary Secretary, Mike Gater G4ICC Treasurer and Dick Rugg G2BRR, Bernard Hughs and Ivor Davies council members.

The total refloatation costs and immediate working capital have been generously donated by the new council. The QSL bureau has been reactivated and services resumed; the journal *Monitor* will reappear early in 1987.

It is hoped that old members will rejoin and that there will be a good influx of new members. Further information from ISWL 87 HQ, 10 Clyde Crescent, Wharton, Winsford, Cheshire CW7 3LA.

Hampshire packet digipeater

The packet radio digipeater GB3HP at Olivers Battery near Winchester, Hants is now operational. It was constructed by members of AMRAC (Amateur Radio and Computer Club) and operates on 144.650MHz using the AX25 packet protocol. The hardware consists of a standard PK-80 terminal node controller supplied at a discount by ICS and a 25 watt FM PMR rig generously donated by Pace Mobile Radio. The antenna is an Isopole supplied by ICS. It is hoped to add an IBM PC clone to the repeater at a later date to provide a mailbox/bulletin board service.

The digipeater is expected to provide good coverage of Hampshire, and AMRAC would welcome any reception reports from amateurs and SWLs. They

should be sent to the GB3HP project leader, Lloyd Arrow G1JAR, 74 Britannia Road North, Southsea, Portsmouth, Hants PO5 1SL.

The satellites

Congratulations to Nico Janssen PA0DLO, who has been awarded the 'Radio Amateur of the Year' award by the Dutch Scientific Radio Foundation, on the recommendation of VERON. This was for his outstanding contribution to the amateur satellite service over many years. He is well-known on the AMSAT-UK net on 3780kHz on Sunday mornings as well as on the international AMSAT net. He has been a vital intermediary in information flow between AMSAT societies in Eastern Europe and the West.

The 25th anniversary of the first amateur radio satellite was celebrated during December. The occasion was marked by a number of organisations. The USA Project Oscar held a celebration on December 13th in the Space Science Centre at Foothill College, Los Altos Hills, California, when an opportunity to meet some of the builders of Oscar-1 took place. *QST* ran a two-part article on 25 years of OSCAR, including some information on future projects such as Phase 4.

A new magazine, *Air and Space*, published by the Smithsonian Institute, Washington, is planning an article based on interviews with such experienced AMSAT contributors as Dick Daniel W4PUJ and Jim McKim W0CY. The Institute of Electrical and Electronic Engineers, Aerospace and Electronic Systems Society magazine plans to run a group of pictures of Oscar satellites on its cover. AMSAT-UK still has some souvenier mugs of the occasion left over from its colloquium held last July, which are available for sale.

UoSAT-1 is five years old and is now the longest-serving satellite in the amateur radio satellite service. It was launched on 6th October 1981 by NASA, from the Vandenberg Air Force Base, Californja aboard a Delta launch vehicle. It has proved a remarkable success and continues to perform extremely well with no significant degradation.

The Harris Corporation of Melbourne, Florida has agreed to supply AMSAT with special memory modules for its Phase 3C spacecraft. These are of a special radiation-hardened type which it is hoped will prevent the radiation damage which OSCAR-10 has suffered. Their cost is said to be in the region of $80 – a gift indeed! A new IHU memory board for the Phase 3C spacecraft is being built which will be operationally identical with the one already installed in the satellite, but will use the Harris ICs. The current launch date for Phase 3C is August 1987.

At the time of writing, OSCAR-10 is still functioning but in a very 'shut down' mode. Some QSOs are permissible through it, but on limited power. Only very limited transmission power must be used in attempting QSOs. The transponder and the beacons are not usually on together and even when on give very weak signals.

The Japanese FO-12 has been subjected to some schedule interruptions due to the testing of some of the other systems being brought into use. REW

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RADIO AMATEUR SATELLITE CORPORATION

£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. 5 – 13 amp ring main junction boxes
2. 5 – 13 amp ring main spur boxes
4. 5 – surface mounting
5. 3 – electrical switches intermediate type, will also replace 1 or 2 way switches, white flush mounting
7. 4 – in flex line switches with neons
9. 2 – mains transformers with 6V 1A secondaries
10. 2 – mains transformers with 12V ½A secondaries
11. 1 – extension speaker cabinet for 6½" speaker
13. 12 – glass reed switches
17. 2 – ultra transmitters and 2 receivers with circuit
19. 2 – light dependent resistors
25. 4 – wafer switches – 6p 2 way, 4p 3 way, 2p 6 way, 2p 5 way, 1p 12 way small one hold fixing and good length ¼" spindle your choice
28. 1 – 6 digit counter mains voltage
30. 2 – Nicad battery chargers
31. 1 – key switch with key
33. 2 – aerosol cans of ICI Dry Lubricant
34. 96 – 1 metre lengths colour-coded connecting wire
39. 1 – long and medium wave tuner kit
41. 8 – rocker switch 10 amp mains SPST
45. 1 – 24 hour time switch mains operated
49. 10 – neon valves – make good night lights
50. 2 – 12V DC or 24V AC, 3 CO relays
51. 1 – 12V 2 CO miniature relay very sensitive
52. 1 – 12V 4 CO miniature relay
53. 2 – mains operated relays 3 × 8 amp changeover (s.h.)
54. 10 – rows of 32 gold plated IC sockets (total 320 sockets)
55. 1 – locking mechanism with 2 keys
56. 1 – miniature uniselector with circuit for electric jigsaw puzzle
60. 5 – ferrite rods 4" × 5/16" diameter aerials
61. 4 – ferrite slab aerials with L & M wave coils
63. 1 – Mullard thyristor trigger module
66. 1 – magnetic brake – stops rotation instantly
67. 1 – low pressure 3 level switch can be mouth operated
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 your choice
77. 1 – time reminder adjustable 1-60 mins clockwork
85. 1 – mains shaded pole motor ¾" stack – ¼" shaft
89. 1 – mains motor with gear box 1 rev per 24 hours
91. 2 – mains motors with gear box 16 rpm
96. 1 – thermostat for fridge
98. 1 – motorised stud switch (s.h.)
101. 1 – 2½ hours delay switch
102. 1 – mains P.S.U. 9V DC
103. 1 – mains power supply unit – 6V DC
104. 1 – mains power supply unit – 4½V DC
107. 1 – 5" speaker size radio cabinet with handle
111. 2 – musical boxes (less keys)
112. 1 – heating pad 200 watts mains
114. 1 – 1W amplifier Mullard 1172
115. 1 – wall mounting thermostat 24V
118. 1 – teak effect extension 5" speaker cabinet
120. 2 – p.c. boards with 2 amp full wave and 17 other recs
121. 4 – push push switches for table lamps etc.
122. 10 – mtrs twin screened flex white p.v.c. outer
124. 25 – clear plastic lenses 1⅛ diameter
127. 4 – pilot bulb lamp metal clip on type
128. 10 – very fine drills for pcbs etc.
129. 4 – extra thin screw drivers for instruments
132. 2 – plastic boxes with windows, ideal for interrupted beam switch
134. 10 – model aircraft motor – require no on/off switch, just spin to start
136. 2 – car radio speakers 5" round 4 ohm made for Radiomobile
137. 1 – 6½" 4 ohm 10 watt speaker and 3" tweeter
142. 10 – 4 BA spanners 1 end open, other end closed
145. 2 – 4 reed relay kits 3V coil normally open or c/o if magnets added
146. 20 – pilot bulbs 6.5V 3A Philips
154. 1 – 12V drip proof relay – ideal for car jobs
155. 3 – varicap push button tuners with knobs
169. 4 – short wave air spaced trimmers 2-30f
171. 1 – shocking coil kit with data – have fun with this
172. 10 – 12V 6W bulbs Philips m.e.s.
178. 3 – oblong amber indicators with lilliputs 12V
180. 6 – round amber indicators with neons 240V
181. 100 – p.v.c. grommets ⅜ hole size
182. 1 – short wave tuning condenser 50 pf with ¼" spindle
184. 1 – three gang tuning condenser each section 500 pf with trimmers and good length ¼" spindle
188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45mm
193. 6 – 5 amp 3 pin flush sockets brown
195. 5 – B.C. lampholders brown bakelite threaded entry
196. 1 – in flex simmerstat for electric blanket soldering iron etc.
197. 2 – thermostats, spindle setting – adjustable range for ovens etc.
199. 1 – mains operated solenoid with plunger 1" travel
200. 1 – 10 digit switch pad for telephones etc.
201. 8 – computer keyboard switches with knobs, pcb or vero mounting
206. 20 – mtres 80 ohm, standard type co-ax off white
211. 1 – electric clock mains driven, always right time – not cased
216. 1 – stereo pre-amp Mullard EP9001
232. 2 – 12V solenoids, small with plunger
236. 1 – mains transformer 9V 1 amp secondary C core construction
241. 1 – car door speaker (very flat) 6½" 15 ohm made for Radiomobile
241. 2 – speakers 6" × 4" 4 ohm 5 watt made for Radiomobile
243. 2 – speakers 6" × 4" 16 ohm 5 watt made for Radiomobile
244. 1 – mains motor with gear-box very small, toothed output 1 rpm
245. 4 – standard size pots, ½ meg with dp swrtch
249. 1 – 13A switched socket on double plate with fused spur for water heater
266. 2 – mains transformers 9V ½A secondary split primary so ok also for 115V
267. 1 – mains transformers 15V 1A secondary p.c.b. mounting
291. 1 ten turns 3 watt pot ¼ spindle 100 ohm
296. 3 car cigar lighter socket plugs
298. 2 15 amp round pin plugs brown bakelite
300. 1 mains solenoid with plunger compact type
301. 10 ceramic magnets Mullard 1" × 3/8 × 5/16
303. 1 12 pole 3 way ceramic wave charge switch
304. 1 stereo amp 1 watt per channel
305. 1 tubular dynamic microphone with desk rest
308. 1 T.V. turret tuner (black & white T.V.)
310. 2 oven thermostats
311. 1 Clare Elliot sealed relay 12V
312. 1 pressure pad switch 24 × 18 (Trigger Mat)
313. 5 sub miniature micro switches
314. 1 12" 8 watt min fluorescent tube white
315. 1 6" 4 watt min fluorescent tube white
316. 1 round pin kettle plug with moulded on lead
453. 2 – 2½ in. 80ohm loudspeakers
454. 2 – 2½ in. 80ohm loudspeakers

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 – i.e. Mains power unit (EP9002) Pre amp module (EP9001) and two amplifier modules (EP9000) all for **£6.00** plus **£2** postage. For prices of modules bought separately see TWO POUNDERS.

CAR STARTER/CHARGER KIT

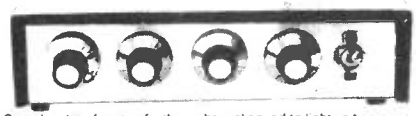
Flat Battery! Don't worry you will start your car in a few minutes with this unit – 250 watt transformer 20 amp rectifiers, case and all parts with data **£16.50** or without case **£15.00** post paid

Ex-Electricity Board. Guaranteed 12 months.

VENNER TIME SWITCH

Mains operated with 20 amp switch, one on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only **£2.95** without case, metal case – **£2.95**, adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is **£2.30**.

SOUND TO LIGHT UNIT



Complete kit of parts of a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is **£14.95** in kit form.

12 volt MOTOR BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3½" long by 3" dia. They have a good length of ¼" spindle –
1/10 hp **£3.45**
1/8 hp **£5.75**. 1/6 hp **£7.50**

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Learn in your sleep. Have radio playing and kettle boiling as you wake – switch on lights to ward off intruders – have a warm house to come home to. You can do all these and more. By a famous maker with 25 amp on/off switch. A beautiful unit at **£2.50**

THIS MONTH'S SNIP

4 High quality 7-segment l.e.d. displays, high brightness, high contrast, yours for only £2—Ideal for LIGHT RIDER (Oct '86) projects. Our reference 2P121.

MAKING SUNBEDS?

CHOKE AND STARTER for 6' 100uva tube £2, post £1 for 1 or 50p each in quantity.
TUBE HOLDERS. Canopy type spring loaded, 4 pairs for £1, 100 pairs £20, 1,000 pairs £150, post paid.

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

Woods extractors
5" £5 + £1.25 post. 6" £6 + £1 50 post
4" × 4" Muffin equipment cooling fan 115V **£2.00**
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10" × 3" Tangential Blower. New. Very quiet – supplied with 230 to 115V adaptor on use two in series to give long blow **£2.00** + £1 50 post or **£4.00** + £2.00 post for two

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Master socket (has surge arrestor – ringing condenser etc) and takes B.T. plug **£3.95**
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Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets **£11.50**

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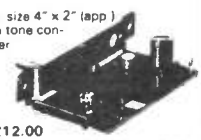

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THE ICOM IC-48E

— Examined by Ken Michaelson G3RDG —

The IC-48E is the second very compact mobile transceiver from the Icom stable that I have handled, the only difference being in the frequency range covered. The first one, the IC-28E, operated in the 144 to 146MHz band, while the IC-48E covers 430 to 440MHz.

There are, in fact, three versions of the transceiver, the IC-48A for the USA which covers 440 to 450MHz, the Australian unit, also designated the IC-48A, and the European one. Both the Australian and European versions cover the same frequency band, the difference between all three being the channel resolution. The IC-48A has programmable channel separations of 5, 10, 15, 20 or 25kHz whereas the 48E has only 12.5 or 25kHz. It is the smallest mobile unit that I have ever seen, and weighs only 1.2kg (approximately 2.5 pounds).

Anatomy

The speaker is on the underside of the unit, with the finning for the final transistors, the power cable socket and the 'N'-type antenna socket at the rear. I must comment favourably on the method of connection for the power lead and antenna. Icom use a flexible lead coming from the unit in each case, terminating in a female connector for the power lead and the 'N'-type socket for the antenna. This method of connection is, in my opinion, the best and simplest way of doing the job that I have come across. I have tried with other manufacturers' mobile rigs to fiddle the power plug into the back of the set with it installed in its mount, and also tried to connect the PL259 plug from my antenna into the chassis-mounted SO239 socket. Both these operations are very difficult if there is no room behind the set, but in the case of the Icom rig there is no difficulty at all; one can get hold of both ends and insert the necessary plug into its socket. There is also a 3.5mm socket on the rear for an extension speaker.

The illustration does not really give readers an idea of the size of the unit, so here are the dimensions: 140 × 50 × 171mm (5.5 × 2 × 6.75 inches). I think you will agree that it will fit in the smallest type of vehicle.

The front panel has all the controls mounted on it. An indicator at the top left shows green when receiving with the squelch circuit open and red when transmitting. The indicator is off when the squelch circuit is closed and the receiver is muted. To its left is the Duplex switch, marked 'DUP'. As this is repeatedly pressed it will show on the LCD 'DUP+' when the transmitting frequency is programmed higher than the receive frequency, 'DUP−' when the transmitting frequency is lower than the receive frequency, and nothing when the unit is in the simplex mode.

The switch to the right of the LED is different for the two models available. In the USA version it is labelled 'TONE' and switches the UT-29 subaudible tone encoder on or off. When the encoder is on the word 'tone' appears on the display. However, since the unit I am describing is the European version, the switch is labelled 'CALL' and its operation selects whatever frequency has been programmed into channel 21. The letter 'C' then appears in the display.

Next is the switch marked 'WRITE'. This operates in two different ways depending upon the setting of the switch below it, labelled 'VFO/MR'. When in the 'VFO' mode the WRITE switch stores the frequency displayed on the read-out in the memory channel number also displayed. In the 'MR' mode the WRITE switch transfers into the VFO whatever frequency is displayed in the memory channel. After the transfer, the rig reverts to the VFO mode.

Ups and downs

Below the VFO/MR control is a similar type of switch marked 'DOWN/UP'. This also produces different results depending upon the setting of the VFO/MR switch. In the VFO mode the operating frequency is changed by 1MHz increments, while in the MR mode its operation changes the memory channels by one-channel increments.

To the left of these switches is the tuning control. This operates normally when in the 'VFO' mode, and there are other options which I shall explain later.

Approximately in the centre of the panel is the LCD read-out. This will display a line of five words at top (four in the case of the European model) which in addition to those mentioned already include 'OW', standing for 'offset write', and 'AQS', which flashes when either version is ready to have a group code programmed when using the optional UT-28 digital code squelch unit. This unit was not supplied with the review transceiver so I cannot pass judgement on it. However, the option allows a 'personalised' squelch to be programmed, giving a range of 100,000 different code numbers. If the UT-28 is installed the UT-29 subaudible tone encoder cannot be used as there is insufficient room in the unit.

Under the word 'AQS' is the term 'D.SQL', which appears when either the optional digital code squelch or the optional tone squelch system is activated. It flashes in sympathy with the word 'TONE' when the unit is ready to have the subaudible tone number programmed for the tone squelch.

Remember this

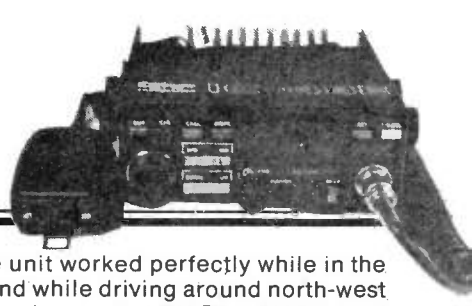
To the right of the main frequency read-out is the memory number display for '1' to '21'. When the memory is brought into action by pressing 'MR', the letter 'M' is shown below the number, but a number (the last memory used) is always shown. The tuning control in this mode acts as a memory control, each click being a different channel.

To the left of the 'M' there is the word 'SKIP'. This is very small, but serves as an indicator to show that a certain memory channel must be skipped when scanning the 21 memories. One does this by calling up that particular channel and pressing 'SET'. A beep is heard and that channel will be ignored when scanning takes place.

On the bottom line of the display is the S-meter/RF power indicator. This is a line of vertical segments growing higher towards the right as the relative signal/RF power increases. To the left of this are the final two indicators of operation, 'TS' (tuning step) and 'LOW'. 'LOW' shows that the unit is operating on low power (5 watts) which is achieved using the push-button switch marked 'HI/LOW' on the bottom of the front panel.

The last two controls on the IC-48E are two rotaries next to the HI/LOW switch. They both have double functions, the left-hand one being the gain control and on/off switch and the right-hand one the squelch/check control. The latter when turned clockwise brings in the squelch circuit and quietens the receiver, while pushing it in allows the operator to check the transmit frequency when the duplex mode is used. Useful facility this.

Reverting back to my mention of the tuning control and its extra functions, if when in the VFO mode the SET switch is pressed once, the OW (offset write)



indicator starts flashing and the amount of offset appears on the display together with the letter 'P' (programmable) or 'F' (fixed). At this stage pressing DOWN/UP one way or the other alternates between the two. The fixed offset is 7.6MHz, but on the 70cm band in England the offset is 1.6MHz. I had, therefore, to program it, setting the unit to 'P' and turning the tuning control in 25kHz steps until the read-out was 1.6MHz. The tuning step rate can also be altered between 25kHz and 12.5kHz by pressing SET a second time. If the tuning knob is turned when in this mode the tuning step rate alternates between 25kHz and 12.5kHz. A third pressure on the SET switch returns the unit to the VFO mode.

A few words about the technical specifications: the frequency control is a CPU based 5kHz (or 6.25kHz according to the model) step PLL synthesizer. It has simplex and semi-duplex capability (programmable offset) and 21 memory channels. The power supply needs to provide 13.8 volts dc ±15% with negative ground, and there is an ac mains supply available for base station operation.

The antenna impedance is the usual 50 ohms unbalanced, but in order to operate with minimum losses the socket on the transceiver is an N-type. This fact caused a little difficulty in the review unit as the SMC model SOMM magnetic base mount used had a PL259 plug on the end of its co-ax. The antenna itself was an Icom AH-32 dual-band whip, which functioned perfectly once the correct connector had been soldered on the co-ax.

The output of the transmitter in high power is 25 watts and in low power 5 watts. The modulation system is a variable reactance frequency type with a maximum frequency deviation of ±5kHz. The microphone supplied with the unit is a 600 ohm electret condenser type. It has push-to-talk and scanning switches with an on/off switch on the back bringing them into circuit, and in the case of the 48E there is also a 1750Hz tone-burst switch. The receiver is a double-conversion superheterodyne with intermediate frequencies of 23.15MHz and 455kHz and a selectivity of more than 12.5kHz at −6dB and less than 25kHz at −60dB. The sensitivity is quoted as being less than 0.18μV for 12dB sinad, and although I was unable to confirm this figure the operation of the unit gave no cause to doubt it. The audio output is more than 2.4 watts at 10% distortion with an 8 ohm load, more than enough to hear the incoming signal when in motion.

Plugging it in

The IC-48E was installed in my car quite easily. The power line, a thick red/black length with a 15 amp fuse in each lead, was attached directly to the battery (*do not* use the cigar lighter outlet for the power connections; the current drawn by the unit is too high when operating on full power, some 7.5 amps on transmit).

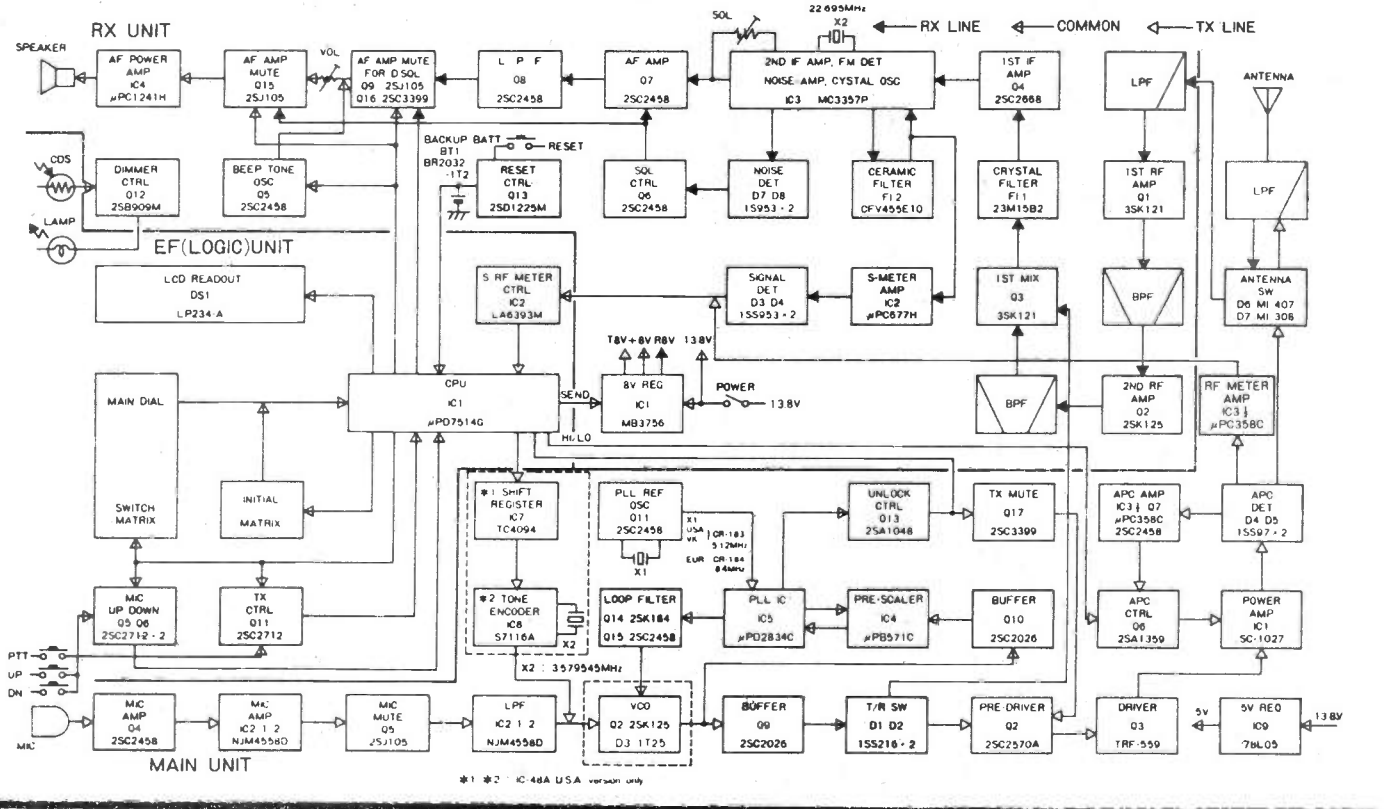
I must emphasise that the very well written owner's manual (complete with humourous pictures) should be read in detail before attempting to operate the unit.

The unit worked perfectly while in the car, and while driving around north-west London I accessed BN RB0, BV RB1, NK RB3 and LW RB6 without the slightest difficulty. I also had several simplex contacts using the FM calling frequency of 433.500MHz. In each case the report on the speech quality was good. The operation of scanning was a great help, being controlled from the microphone, on the back of which was a switch marked 'UP/DN' and 'OFF'. This switch had to be in the UP/DN position and the squelch in circuit before scanning would commence. It worked in two ways, either VFO or memory scanning, and could be carried out either in single steps or, if the 'UP' or 'DN' button on the top of the microphone was held down for about half a second, continuously.

When a signal opened the squelch the scan would stop and the unit would monitor the signal. If the signal ceased the receiver would continue scanning after about three seconds. Otherwise, scanning would resume after about fifteen seconds. It required one push on whichever button was being used to stop the scan. Having got used to this method of tuning when mobile I would not like to be without this facility in any mobile rig in the future.

The bottom line

The prices are as follows: IC-48E, £449; AH-32 dual-band whip, £34; and the SMC SOMM magnetic mount, £12.74. All the prices are inclusive of VAT and carriage. Thanks are due to Thanet Electronics Ltd for the loan of the equipment. REW



ERROR CORRECTION IN DATA-ON-RADIO SYSTEMS

Bob Redding G3VMR proposes some simplifications for use with data broadcasting

One advantage of the letter mail over any electronic system is that information doesn't get corrupted during transmission. At present error correction is probably the main topic in data communication circles. It is strongly allied to security, particularly where business and fiscal information is concerned. The other end of the scale is broadcasting-by-data, which has barely started and in which although errors can be tolerated, their avoidance is more a matter of prestige than a necessity.

Amateur communications would tend towards this end of the scale, but a main attraction of the radio packet system which has grown so fast recently is the error-free copy that it provides.

However, the premium for such clean copy is considerable:

☐ The hardware, although now down to £200, represents a considerable addition to the normal transceiver equipment and computer.

☐ It operates only one-to-one and anyone else 'listening' will probably get screenfulls of repeats, and only one side of the conversation. The latest equipment does enable one to link with a number of users, but any conversation requires a firm discipline if it is to remain coherent!

☐ A long file monopolises a channel, and is slower than plain text.

If we consider the origins, the reason will be clear. The essence of packet is the use of the X25 protocol, which was developed with the international telephone 'packet switched system' for multiplexing telephone calls on trunk circuits. It is basically a one-to-one system, and although we might adapt it for other radio purposes, alternative approaches are worth consideration.

Below is a brief outline of the subject of error correction, with a view to evolving something appropriate for radio in the context of 'one-to-many', ie broadcasting, where there is no return channel on which to say 'I don't understand'.

An overview

The earliest form of error detection was 'parity' – the addition of an extra digit according to whether the number of 1s or 0s is odd or even. One has to know what parity is being sent, and there are a surprising number of variations. However, it is now generally agreed that this is of little use for bulletin boards or radio operation and so 'no parity' is becoming standard.

The number of bits used for each character can be 5, 6, 7 or 8 and with ASCII one must be careful to distinguish between '7-bit even' and '8-bit none', for some computers will print out graphic symbols rather than text. For keyboard (asynchronous) working we also need one or more start bits and stop bits. The latter can be 1, 1½ or 2 and so the number of choices provided on equipment (and which one has to get right) in order to talk to another machine is considerable.

For packet the protocol for operating over the air is set (AX25), but one still has to get the correct setting for the protocol on the TNC to suit the local computer. So unless you are a dedicated amateur, there are many pitfalls and/or scope for the Fixit-Widget to provide a special item designed for each usage. I think we have new opportunities in 'data on radio', and so we should keep an open mind on whatever we are trying to do, and consider how we can best do it as simply as possible.

Detecting an error is only part of the process and the aim should be to correct it. There are a number of codes and techniques that do this, and find usage in data transfer within computers, eg floppy disc control and so on. Basically the data is monitored and a 'checksum' is accumulated and sent with the data. The received data is similarly counted and unless it agrees with the checksum an error is indicated.

This is the basis of packet operation, and the size of the packet of course is pertinent to how many repeats one has to send in any given circumstance. Error correction is possible to a degree dependent upon the tolerable complexity. One performs a number of mathematical functions on the raw data to provide further digits which are also transmitted. On receipt and reversal of the process, the faulty digits can be identified and often corrected. This poses a philosophical question, 'How do you check a checker?' and having no answer I propose a different approach on the basis of 'If it isn't there it can't be wrong'. That might apply to some other pitfalls, like protocols, as well.

A fresh look at codes

Perhaps the original binary code is morse, but we went to a five-state code to suit the mechanical teleprinter before solid-state logic made it easy to use binary information, both in serial and parallel modes. Although data is used in parallel it is invariably transmitted, even over short distances, in serial form, so we discuss this first.

The universally used code for computers, ASCII (standing for American Standard Code for Information Interchange), uses seven bits which give upper and lower character sets and 32 control codes. A further eighth bit is usually employed in computers for graphics and extra character sets.

However, for text and general communication we need only 26 letters, 10 numbers and a few items of punctuation, say about 40 characters in all, so less digits are clearly practicable. Circuitry and components such as UARTs are capable of handling eight or more, and we could use any digits saved to encode further information for error correction purposes.

I think we ought to make data 'error-obvious', ie we should be able to see at once whether or not the received data is valid. For example, the table shows a list of the possible combinations of 1s and 0s where there are never more than two adjacent symbols alike. This scheme of picking a code for which logic can be easily applied has a precedent in AMTOR, which was evolved by J P Martinez G3PLX in the late '70s, based on the radio telex code and being an enhancement of RTTY. (See *R&EW* June 1984 for the background). In some ways I am merely suggesting that we update our ideas to use the power of logic and storage that is readily available in the home computer.

The basis of AMTOR is the Moore code which uses 35 characters, these being with all the possible combinations of four mark (or ones) and three spaces (or zero bits). Thus it is easy to recognise whether or not a code is valid, and if not to ask for a repeat. Each of the 35 characters has two possible values – either letters or figures – chosen by means of a shift key.

No shift necessary

I propose a different but very simple rule, namely that the seven bits shall have no more than two ones or zeros adjacent. This makes it easy to test if the received signal is a valid one. There are 42 possibilities, as listed in the table together with the corresponding ASCII number. This is enough for letters and figures without the need for a shift. I suggest we reserve two symmetrical ones – numbers 85-1010101 and number 122-1100110 for control purposes. This leaves scope for a full character set of letters and numbers plus four for punctuation, eg space, full stop, comma and quotes.

Incidentally, we could reduce the number of punctuation symbols by simple logic, easily built into a computer, eg a symbol for space. One off means a space, two off means a comma, three off means full stop (period) and the next letter to be a capital so that we get upper and lower case without bothering about shifts! However, these are minor tricks of detail which are best settled by practical experience in each usage.

For fast data it is wasteful to operate a keyboard 'on-line'. Better practice would be to accumulate a message and then dump it at a fast rate. Of course this is done in packet, but I suggest that with an error-obvious code we could make the packets or messages any length we like, from a few characters to a few thousand, preferably with a checksum at the end so that we can know for certain if we have error-free transmission.

Eliminating start/stop bits

If we use such an accumulation/forwarding technique, then the operation should be synchronous to obviate the need for start and stop bits for each character. We need only a distinctive message start and finish signal, hence the ASCII codes 85 and 102 reserved above. Perhaps instead we could use even more distinctive ones, being all the ones and all the zeros, ie ASCII 0 and ASCII 127.

The rules for validation which would need building into the computer are very simple. They are:

□ Detect the start and stop signals, and for these, numbers 0 and 127 ASCII would be advantageous!

□ Observe that the digit sequence changes at least once in each three received. If so, go to a look-up table and print a character.

□ If it does not, look at the check digit and refer to a look-up table for the correction procedure.

Check digit

Conventional parity will tell little of value in this case, but we could send a useful kind of parity based on the number of double digits in the character. There can be 0, 1, or 2 double zeros (or ones) and we can send this as a 1 for odd (1 or 3) and a zero for 2. This number is shown in the third column together with a check digit based on whether or not that is odd or even. If we can extend the rule about doubles to this check digit, we find that it applies to all the eight-digit codes except 8, which are listed at the bottom of the table. Therefore we know what the last three digits are, so we have some check if there is any doubt about the check digit.

Although I haven't found a method of proving it, it appears that this one check digit can correct most of the single-digit errors in the seven-bit code, as well as showing that the check digit was received correctly. We could use a further check digit to provide more information to be more certain, eg whether the character is split 5/2 or 4/3 in its format.

Perhaps the biggest bonus of all is that, because of the form of coding, the data is symmetrical and therefore it is very easy to extract a clock frequency from the data stream to assist synchronous operation, without necessarily knowing intended speed or keeping it constant. It also means that the data looks like a frequency (for bandwidth considerations) which is desirably high – approximately half the baud rate.

Qualification: Please regard the above as illustrative only and not necessarily absolute or final. Obviously tests on data will initially use ASCII and operate asynchronously, but the advantages inherent in a fresh code are a good reason for looking at it carefully before adopting a traditional one.

Code	ASCII	Number of 00 doubles		Check digit
0010010	18	2	y	0
0010011	19	2	y	0
0010101	21	1	y	1
0010110	22	1	y	1
0011001	25	2	y	0
0011010	26	1	y	1
0100101	37	1	y	1
0100110	38	1	y	1
0101001	41	1	y	1
0101010	42	0	y	0
0101011	43	0	y	0
0101100	44	1	y	1
0101101	45	0	y	0
0110010	50	1	y	1
0110100	52	1	y	1
0110101	53	0	y	0
0110110	54	0	y	1
1001001	73	2	y	0
1001010	74	1	y	1
1001101	77	1	y	1
1010010	82	1	y	0
1010101	85	0	y	0
1010110	86	0	y	0
1011001	89	1	y	1
1011010	90	0	y	0
1100101	101	1	y	1
1100110	102	1	y	1
1101001	105	1	y	1
1101010	106	0	y	0
1101101	109	0	y	0
0010100	20	2	n	0
0011011	27	1	n	1
0100100	36	2	n	0
0110011	51	1	n	1
1001011	75	1	n	1
1001100	76	2	n	0
1010011	83	1	n	1
1010100	84	1	y	1
1011011	91	0	y	0
1100100	100	2	n	0
1101011	107	0	y	0
1101100	108	1	y	1

MENDACIOUS METERS?

Pic courtesy of Hewlett-Packard (purveyors of meters to the cognoscenti)

Ken Williams asks, 'Can you trust your meters?' (and come up with a qualified 'Yes')

From the very earliest days meters for indication and measurement have been part of the stock-in-trade of both professional engineer and radio amateur.

Unfortunately few amateurs realise that the indications do not necessarily give a true picture of the conditions existing within the circuit.

This may be due to any of a number of reasons: misreading the meter; inaccuracy of the test meter; the impedance of the test meter loading or otherwise affecting the operation of the circuit; or even, although the indications at the point of measurement may be quite accurate, due to other influences. The ability to determine the relative importance of each of these factors is often a hallmark which distinguishes the amateur from the professional.

The professional engineer goes to great lengths to ensure that his instruments are accurate by periodically returning each piece to a calibration laboratory. There they are serviced and reset to the laboratory standards. The laboratory standards in turn are periodically checked against further instruments whose calibration accuracy can be traced to the appropriate National Physical Laboratory standard.

The period between such calibration checks depends upon the type of instrument and its level of use but may typically vary from six months, for an analogue multimeter in field service, to several years for a solid-state signal generator which is rarely moved from its position on the bench.

Few private individuals could afford such luxury, for the services of a calibration laboratory are costly, but for amateur applications where very high accuracy is not a legal requirement it is normally adequate to realise that meter errors do exist and to make allowance for their presence.

Whilst most meters will give reasonably accurate indications in their early life, as they get older so they will slowly deteriorate and their readings become progressively less reliable. As may be expected, the better quality instruments suffer less than their cheaper brethren in this respect. Furthermore, their design is such that on subsequent recalibration the original accuracy can be restored.

How, then, do these instrument errors occur?

For an analogue meter it could be the inherent accuracy of the movement, the physical position of the meter, deterioration of the internal magnet, corrosion, variation of internal resistor values, dirty contacts in range switches or ageing of the hairspring.

At school and college many of us were taught that in reading a meter we should carefully interpolate between the dial calibrations in order to gain a further order of measurement accuracy. Whilst this may be acceptable when comparing a meter reading with a subsequent one, such accuracy is invalid when comparing with another meter, for manufacturing tolerances are such that even when new, few if any meters are accurate to that degree.

The normal standard in the UK for good quality analogue instruments calls for an accuracy of 2.5% *of full-scale indication*. This means, for example, that a voltmeter with a full-scale indication (fsd) of 100 volts will be accurate to 2.5 volts. This applies equally whether the input voltage is 90 volts, at which the indication could be between 87.5 and 92.5 volts, or if the applied voltage is 10 volts, in which case the indication could be between 7.5 and 12.5 volts – a possible error of 25%. Furthermore, due to manufacturing tolerances the accuracy will not necessarily be consistent across the scale.

Lesson 1

Here, therefore, comes the first lesson in reading meters: for reasonably accurate indications, ensure that the needle is in the upper half of the scale.

Meters intended for ac measurements almost invariably make use of a rectifier circuit to permit a moving coil movement to be used. In modern meters this will invariably be a semiconductor bridge, which will deteriorate little with age, but unfortunately many instruments used by amateurs are of indeterminate age and may make use of the old-fashioned copper oxide rectifiers – which do. Furthermore, many also incorporate inductive components in their design, which makes them frequency sensitive.

The ac ranges of most meters are calibrated with a 50Hz sinusoidal waveform and may well give wildly inaccurate readings if any other waveform or frequency is applied.

The physical position of the meter is also of importance. For example, AVO meters are designed to be used face upwards, whilst panel meters are intended for use in the vertical plane. Some are calibrated for use on ferrous and others for non-ferrous panels.

Although the errors generated from this cause are likely to be unimportant where only comparative measurements are being taken, allowance must be made when accurate quantitative measurements are necessary.

As a meter ages so its accuracy

decreases, for the magnet and hairspring will weaken, the shunt and series resistors vary in value due to the occasional inadvertent overload, which is inevitable in normal use, and the switch contacts will corrode due to the action of pollutants in the atmosphere.

Observe with care

In addition to the inherent inaccuracies of the meter, care must also be taken in the actual observation. The meter must be viewed from directly in front of the needle otherwise parallax error may occur, and this may amount to the equivalent of one or two dial divisions.

Better quality meters have a mirror mounted below the scale so that, by aligning the needle with its reflection, the correct viewing position can be verified.

Digital meters also suffer from inherent inaccuracy and, with age, corrosion and deterioration of internal components.

It is, perhaps, inevitable that as even a relatively inexpensive digital meter will indicate to 0.1% many users will believe that it is accurate to that degree, but in practice only the more expensive instruments are accurate to even one tenth of that and most are worse. Furthermore, almost invariably the accuracy is quoted as plus or minus one count, which means that if the last digit displayed is, for example, five, the true figure is just as likely to be four or six!

From the foregoing it may be thought that it is impossible to trust any meter but, in fact, once the limitations of metering are realised, far more consistent results are possible.

More accurate readings can also be ensured by checking the meter calibration whenever possible, such as when a colleague purchases a new high grade meter. Compare indications from a number of different voltage and current sources, note the differences on an adhesive label and attach to your own meter for future reference.

Use and abuse

Apart from the inherent inaccuracies in meters, even greater errors can arise from their method of use. With the exception of electrostatic voltmeters, all draw some power, no matter how small, from the circuit to which they are connected. Analogue meters are worse than digital meters in this respect, for sufficient power must be drawn to energise the movement. Nevertheless even the low power consumed by digital meters may be sufficient to cause misleading indications in very low power circuits.

As an example of this, consider the case of a simple transistor voltage amplifier which is fed from a 13.5V supply via a 6k8 resistor in the collector circuit.

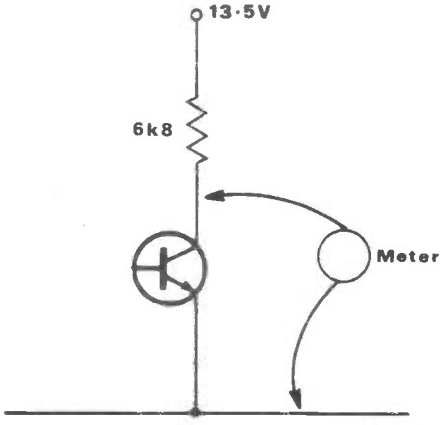


Fig 1 *Measuring collector voltage. Straightforward enough? Don't you believe it!*

In these circumstances the collector voltage would be about 6.8V.

In the extreme case, consider the effect if the collector voltage was measured by an old AVO Model 7, which has a resistance of 5000 ohms on its 10 volt range. During measurement this resistance would be in parallel with the transistor and the power necessary to energise the movement would pull the voltage on the collector down to about 4 volts.

If the same circuit was measured by an AVO 8, whose resistance on the 10 volt range is 200,000 ohms, the effect would be less and the indicated voltage would be about 6.6 volts.

If, in turn, the AVO 8 was replaced by a digital instrument with an impedance of 10 megohms or more the error due to loading of the circuit would be far less, although it would still be present, and the indication, all other factors being equal, would be very close to the correct figure.

This must not be taken as an argument that digital meters are invariably superior to analogue instruments, for in other circumstances the latter can give far more useful indications than the former. The most important lesson to be learned from this example is that the application of test equipment always affects the circuit under examination and that allowance must be made for this whenever such tests are made.

And finally . . .

The final major source of measurement error is when, although the meter readings may be accurate, external factors cause the indications to be misinterpreted.

The most common example of this in the amateur station is the measurement of voltage standing wave ratio (VSWR) and the effect of feeder loss.

Supposing, for the sake of example, that an amateur had been unwise enough to feed an aerial with a length of inferior feeder with a loss of 6dB and that the aerial was incorrectly dimensioned and

Fig 2 *The effect of a lossy feeder on VSWR*

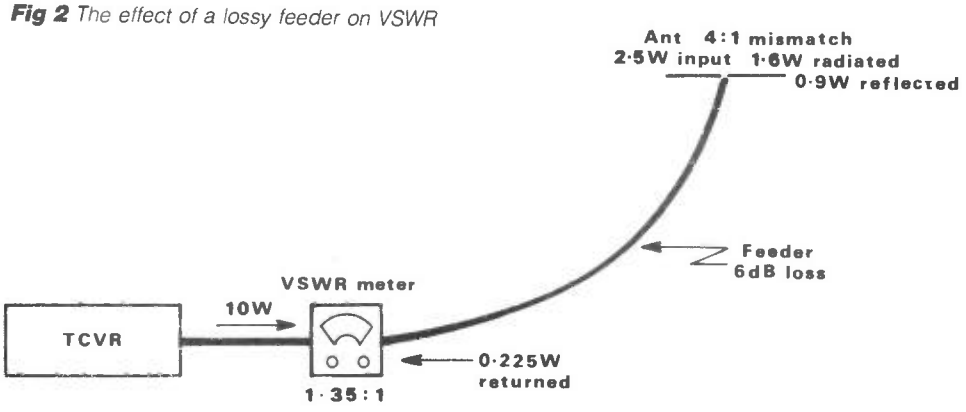
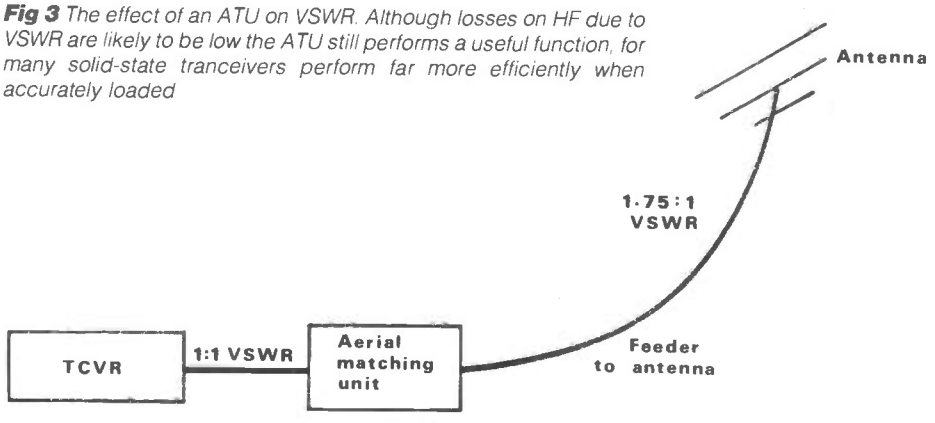


Fig 3 *The effect of an ATU on VSWR. Although losses on HF due to VSWR are likely to be low the ATU still performs a useful function, for many solid-state tranceivers perform far more efficiently when accurately loaded*



itself gave a mismatch of 4:1.

If his transmitter was giving an output of 10 watts, due to the feeder loss only 2.5 watts would reach the aerial. Due to the 4:1 aerial mismatch, 36% of the power reaching the aerial would be reflected, ie 0.9 watts. This in turn would be attenuated by 6dB on its return journey, and by the time it reached the transmitter its level would be 0.225 watts. If a VSWR meter was fitted adjacent to the transmitter, in this situation it would indicate a VSWR of about 1.35 to 1.

At this VSWR, and being unaware of the extent of the feeder loss, the unfortunate amateur would believe that he had a good aerial installation with an excellent radiation efficiency.

Experience tells

The VSWR meter can also give misleading indications on HF for a different reason. I have often heard less experienced amateurs (and others who should know better) say that their aerial had a poor VSWR, but by using a Bloggs antenna tuner the VSWR is now tuned out.

Nothing could be further from the truth. In practice, the VSWR meter is normally fitted between transmitter and ATU, and what the antenna tuner has achieved is to match the impedance presented by the aerial and feeder system to the output of the transmitter so that the transmitter 'sees' the correct impedance. The standing waves which were present on the feeder line before will still be there and will remain until the antenna is correctly matched to the feeder.

Where lies the fault?

In each of these cases the VSWR meter was giving a perfectly correct indication, but because the user did not realise the implications of the measurement the conclusions drawn were totally misleading.

Although I have given two examples of misleading VSWR indications, this could apply equally to almost every other type of measurement.

So far I have mainly dealt with normal panel and test meters, but the same considerations also apply to all other equipment. Some, notably RF power meters, are notorious for their inaccuracy, with few bettering 10%. Others, such as RF signal generators, can give inaccurate output levels if terminated with the wrong impedance.

For most amateur purposes absolute accuracy is not essential, for provided that consistent results can be obtained much valuable work can be achieved. Whenever possible, comparison checks should be performed between similar types of equipment.

For example, I possess three signal generators which between them cover all frequencies between audio and 450MHz. Where the ranges overlap their output levels have been compared, and although there is no way of knowing the absolute accuracy, consistent measurements can nevertheless be obtained right across the spectrum.

Similarly, I have four test meters: an AVO 7; an AVO 8; a Heathkit VVM; and a home-built meter. Although each will show a slightly different reading on a given input, these differences are known and can be allowed for when accurate measurements are necessary.

A pinch of salt

The moral of this article is not that meter readings cannot be believed, but that when a reading has been taken consideration must be given to the accuracy of the reading, the effect of the meter upon the circuit and the possible influence of outside factors on the conclusions drawn from the measurement. REW

LOGIC CIRCUITS

The first instalment of a series from D Stewart

Most digital systems are based on two-state devices, since it is easy to design a switch which is either open or closed, *Figure 1*, giving an output when it is closed and no output when it is open. These two states can be called, for want of anything better, '1' and '0' respectively.

In practice two kinds of semiconductor are used to implement such switches. One is the transistor-transistor logic (TTL) and the other the metal oxide semiconductor (MOS). The difference between these two devices is that TTL operates off a 5 volt supply and a logical '1' output is anything above 2 volts, with a logical '0' anything below 0.8V. MOS operates from supplies of 3V to 15V and a logical '1' is obtained when the output is lifted above 70% of the supply voltage, while logic '0' is below 30% of supply.

Systems based on two states are called binary systems and the digits '0' and '1' are known as binary digits, abbreviated to bits. As you've guessed, this system can count only up to 2 and would therefore seem to be rather limited. However, there is nothing to stop us from stacking switches to give the required output. *Figure 2* shows three switches which can count up to seven as shown by *Table 1*; the number 7 is obtained when all three switches are closed.

To count to decimal 7 we need three switches. Four switches will enable us to count to $2^4 = 16$, five switches to $2^5 = 32$ and so on.

Logic circuits are used extensively in computers and particularly in control engineering to control factory processes. For instance, we may be manufacturing something which requires various ingredients, and referring to *Figure 3* we could have an AND gate and an OR gate. When either of the signals A or B is present at the OR gate, there is an output voltage X which opens the hopper to drop material into the melting pot. But the AND gate operates only if there are signals C and D, and the voltage Y opens another hopper. Since these gates control logical operations, they are called logic gates.

AND gates

Let us not concern ourselves with circuits at the moment but only examine the symbols. The symbols for a two-input AND gate appear in *Figure 4*. The British Standards symbol is *4i*, but manufacturers still use the other two.

Table 2 is called a truth table since it verifies the truth of *Figure 4*, ie for all combinations of the input the output is proved, and we can see there is an output only when there is a voltage on both inputs (since this is an AND gate).

Using Boolean algebra, a two-input AND gate can be described as A.B = S, ie A and B equals S.

OR gates

This is another important logical operation and the symbols are shown in *Figure 5*. Once again *5i* is the British Standards symbol. The truth table for two inputs is given in *Table 3*, and there is an output when there is a voltage on either of the inputs. This would also be true for any number of inputs – a voltage on any one of them would produce an output. In Boolean algebra this is expressed A+B = S. The use of the plus sign is unfortunate since it implies 'and', but here it stands for 'or', ie A or B equals S.

Inverter or NOT gates

In many logical operations it is necessary to invert an output from one stage of circuitry before feeding it to the next stage, ie change a '1' to a '0' or a '0' to a '1'. The symbol for an inverter is shown in *Figure 6*, and *6i* is the BS symbol. Note that it has only one input and the inverse is expressed with a bar above it, ie if we feed S in we get $\bar{S}$ out, as seen in *Table 4*.

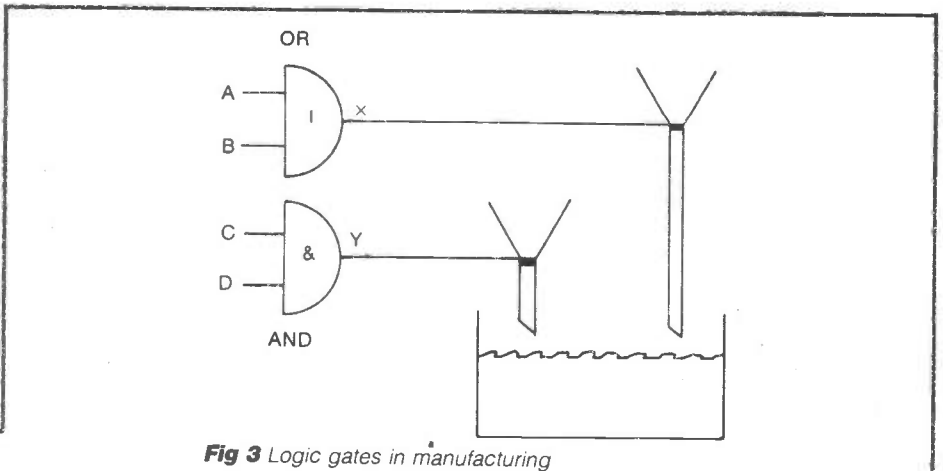


Fig 3 *Logic gates in manufacturing*

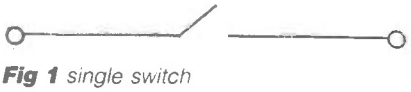


Fig 1 *single switch*

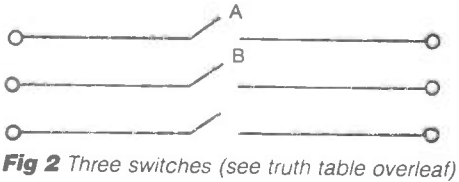


Fig 2 *Three switches (see truth table overleaf)*

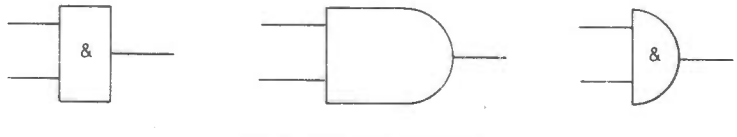


Fig 4 *AND gate symbols*

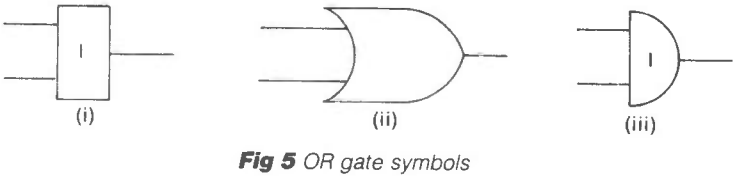


Fig 5 *OR gate symbols*

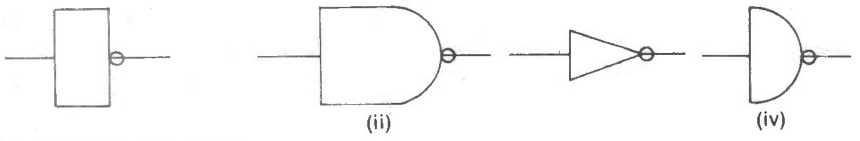


Fig 6 *NOT gate symbols*

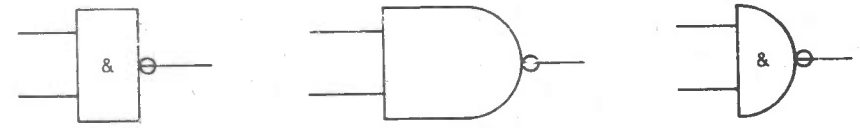


Fig 7 *NAND gate symbols*

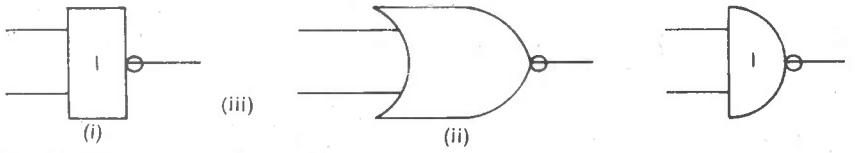


Fig 8 *NOR gate symbols*

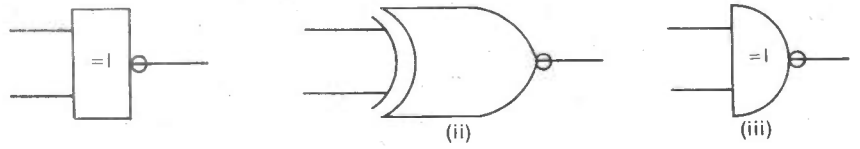


Fig 9 *Exclusive-OR gate symbols*

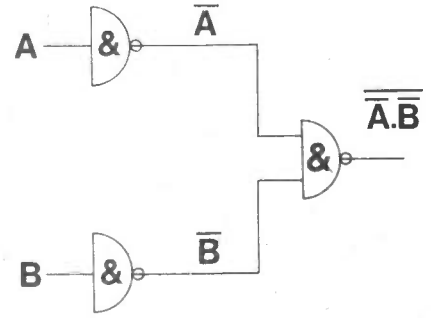


Fig 10

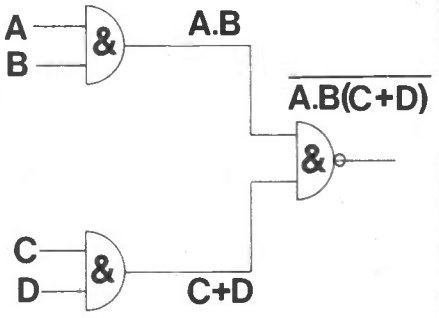


Fig 11

NAND gates

This is an abbrevation of NOT AND and therefore the output of such a gate will be the exact opposite of an AND gate, as can be seen in *Table 5*. The symbols are shown in *Figure 7* and the Boolean expression is A.B = S, ie not (A and B) equals S. The expression below the bar is assumed to be in brackets and must be evaluated before being inverted.

NOR gates

The NOR operation is an abbreviation of NOT OR so once again the output will be the opposite of that for an OR gate, as in *Table 6*. The symbols are given in *Figure 8* and the Boolean expression is $\overline{A + B}$ = S. Once again the expression under the bar is to be evaluated first and then inverted. $\overline{A + B}$ is not the same as $\overline{A} + \overline{B}$. Similarly for the NAND expression, $\overline{A.B}$ is not the same as $\overline{A}.\overline{B}$. These can easily be proved by means of truth tables:

A	B	A.B	$\overline{A.B}$	A	B	$\overline{A}$	$\overline{B}$	$\overline{A}.\overline{B}$
0	0	0	1	0	0	1	1	1
0	1	0	1	0	1	1	0	0
1	0	0	1	1	0	0	1	0
1	1	1	0	1	1	0	0	0

Since A and B can have only one of two values (0 or 1), we can summarise the rules for Boolean arithmetic from the above tables: 0.0 = 0, 0. 1 or 1.0=0, 1.1 = 1. These are the rules for an AND gate. The rules for an OR gate are 0+0 = 0, 0+1 or 1+0 = 1, 1+1 = 1 (not 2!).

By comparing *Tables 5* and *6* it can be seen that one is the inverse of the other. Therefore any logic requirement can be designed using either NAND gates only or NOR gates only, and if the final output is of the wrong polarity then we just use one more gate as an inverter. This is the principle of duality, ie one form is the mirror image of the other.

Exclusive-OR

This is an important logic function and is used in random generators and in error-checking data streams. The truth table is given in *Table 7* and the symbols in *Figure 9*. It gets its name from the fact that it excludes the case where both inputs are 1, and in Boolean algebra the expression is written A ⊕ B = S. The two switches that operate the light on the stairs follow the exclusive-OR logic, ie either switch will operate the light but not both together.

Boolean algebra

Very often when designing a whole string of logic requirements for some complex function like opening and closing hoppers in a factory process, controlling traffic lights at crossroads, working out priority commands for a lift in an office block etc, one arrives at a complex expression, say:

$$\overline{A}.\overline{B}.\overline{C}.\overline{D} + A.\overline{B}.\overline{C}.D + A.B.\overline{C}.D = S$$

Before implementing this in terms of hardware it may be possible to reduce the expression, hence saving hardware. Even if it is not reduced it will still work, but why implement a complex expression when a simpler one will do? In order to reduce the expression one must know the rules below:

$A.1 = A$ (1)

$A.0 = 0$ (2)

$A+1 = 1$ (3)

$A+0 = A$ (4)

$A.\overline{A} = 0$ (5)

$A+\overline{A} = 1$ (6)

$A+A = A$ (7)

$A.A = A$ (8)

$\overline{\overline{A}} = A$ (9)

$A.B = B.A$ (10)

$A+B = B+A$ (11)

$A+A.B = A$ (12)

$A.(A+B) = A$ (13)

$A+\overline{A}.B = A+B$ (14)

$A.(B+C) = A.B+A.C$ (15)

$A+B.C = (A+B).(A+C)$ (16)

$A.B.C = (A.B).C = A.(B.C)$ (17)

$A+B+C+\ldots = A.B.C\ldots$ (18)

$A.B.C\ldots = A+B+C+\ldots$ (19)

(18 and 19 are known as de Morgan's Theorem)

Some of the above need explaining. Remembering that the quantities A,B,C etc can have one of two values, 0 or 1, then looking at equations (1) and (4) they will equal 0 if A is 0 and 1 if A is 1.

Similarly the other equations up to (8) illustrate the logic operations AND and OR we discussed earlier. Equation (9) merely says that if we invert a quantity twice we get the original quantity, and equation (17) implies that we can operate on any of the two quantities first before association with the third.

Any of the above equations can be proved by means of a truth table, and by far the most useful is de Morgan's Theorem which is used to convert NOR into NAND and OR into AND and vice versa. Let us prove that $\overline{A.B} = \overline{A} + \overline{B}$.

A	B	A.B	$\overline{A.B}$	A	B	$\overline{A}$	$\overline{B}$	$\overline{A}+\overline{B}$
0	0	0	1	0	0	1	1	1
0	1	0	1	0	1	1	0	1
1	0	0	1	1	0	0	1	1
1	1	1	0	1	1	0	0	0

Comparing the final column of each table, we can see that one does indeed equal the other. So if we have only NAND gates and we need to implement the OR function A + B = S we simply invert it twice, which does not change the function. Then we apply de Morgan's Theorem to $\overline{A} + \overline{B}$ to give

$$\overline{A}.\overline{B}=S$$

which is then implemented as in *Figure 10*.

Just as we have built a circuit to obtain a required output, we can do the reverse. Given a circuit we can derive the output just by starting at the left (the inputs) and writing the outputs at each successive gate until we reach the final output. Given a circuit as in *Figure 11* we pencil in the output of each gate, and this can extend to any size of circuit except that the expression will get more complex at each stage.

Venn diagrams

To explain the concepts of the combinational logical OR, AND etc, Venn diagrams were invented, and some of the more common ones are given in *Figure 12*. These are fine for two variables, but what happens if there are three or four variables? The shading and colouring of overlapping circles could get quite complicated. Karnaugh maps could simplify matters.

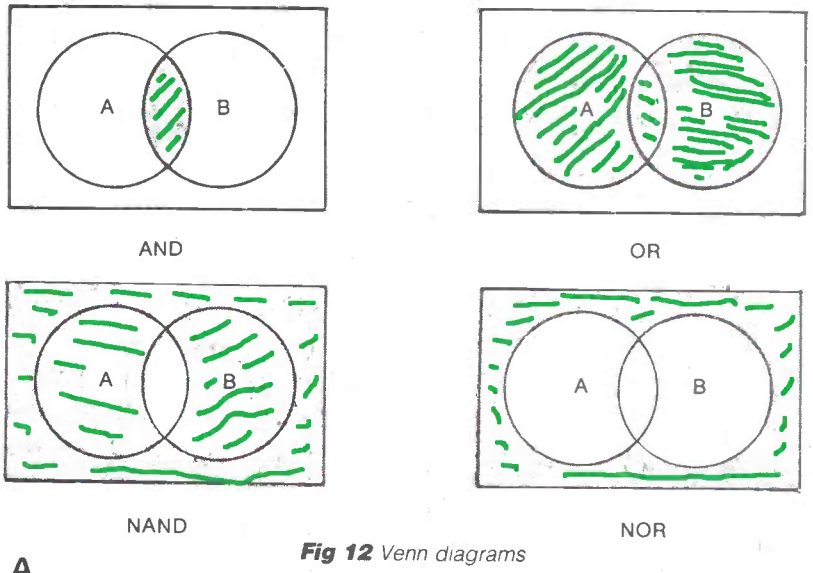


Fig 12 *Venn diagrams*

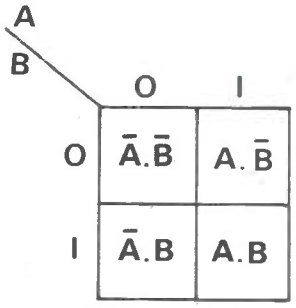


Fig 13 *Two-variable Karnaugh map*

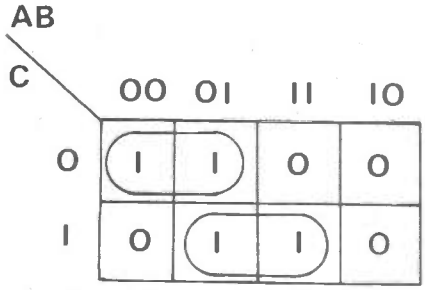


Fig 14 *Three-variable Karnaugh map*

Karnaugh maps

These are used to simplify Boolean expressions, and there is no need to understand how they work in order to use them. All we need is a few simple rules on how to group the variables. A map representing two variables is shown in *Figure 13* and it can be seen that each square represents a unique combination of the variables.

A three-variable Karnaugh map is shown in *Figure 14*, and those inputs producing an output are marked with a '1', the others are all '0'. A layman will state his requirements to an engineer in the form of a truth table, ie for certain inputs an output is required. The engineer then uses Boolean algebra or a Karnaugh map to simplify the expression by grouping all the 1s with the following rules in mind:

- ☐ form the largest groups
- ☐ include all the 1s
- ☐ form the smallest number of groups
- ☐ a 1 should not be included in more than one group unless it replaces a small group by a larger one.

TRUTH TABLES

Switch states: 0=open, 1=closed

Count	A	B	C
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Table 1

A	B	S
0	0	0
0	1	0
1	0	0
1	1	1

Table 2

A	B	S
0	0	0
0	1	1
1	0	1
1	1	1

Table 3

INPUT	OUTPUT
0	1
1	0

Table 4

A	B	S
0	0	1
0	1	1
1	0	1
1	1	0

Table 5

A	B	S
0	0	1
0	1	0
1	0	0
1	1	0

Table 6

A	B	S
0	0	0
0	1	1
1	0	1
1	1	0

Table 7

A	B	C	S
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Table 8

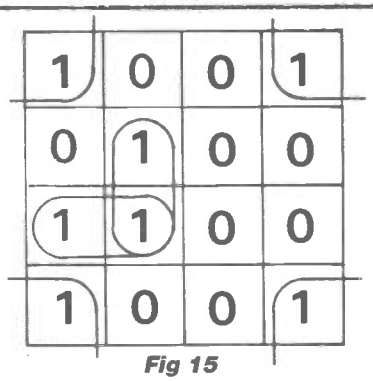


Fig 15

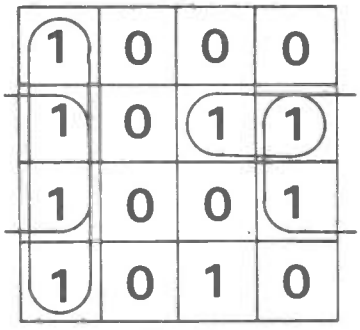


Fig 16

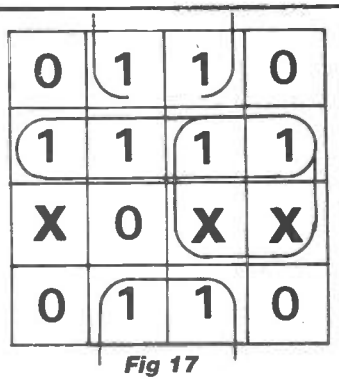


Fig 17

So, to return to *Figure 14*, a layman would state his requirements as in *Table 8*, ie an output is required when A,B and C are 0, when B only equals 1, when B and C equal 1 or when all A,B and C equal 1.

$$\overline{A}.\overline{B}.\overline{C} + \overline{A}.B.\overline{C} + \overline{A}.B.C + A.B.C = S$$

Using Boolean algebra and pairing and factorising the first two terms and last two terms, A.C (B + B) + B.C (A + A) = S

$$\overline{A}.\overline{C} + B.C = S$$

Using the Karnaugh map of *Figure 14*, the top grouping shows that B changes so we are not interested in B. But A remains $\overline{A}$ and C remains $\overline{C}$, so the group is $\overline{A}.\overline{C}$. Similarly with the bottom grouping A changes from 0 to 1 but B and C remain 1, so the bottom grouping is B.C. This gives the same simplification as using Boolean algebra.

Figure 15 shows a grouping on a four-variable Karnaugh map. The corners are grouped together because the map is considered to fold over. Similarly with the grouping of the sides of *Figure 16*.

There is one other matter before we say goodbye to Karnaugh maps. These are unspecified states or 'don't care' conditions.

For instance, in a factory process one might be controlling the pressure while manufacturing a product. Suppose we want to control it between 30 pounds and 50 pounds or between A and B. The situation A and B = 1 can never arise, so it is a don't care condition which we mark with an X on a Karnaugh map. For grouping purposes an X can be treated as a 1 or a 0, so it can be treated as a 1 if it helps to increase the size of the group or reduce the number of groups. *Figure 17* shows how X can be included or ignored, whichever is convenient.

Continued next month

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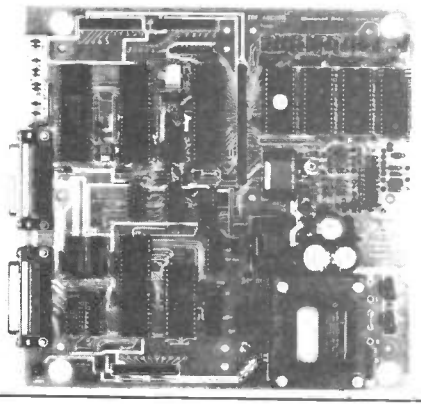

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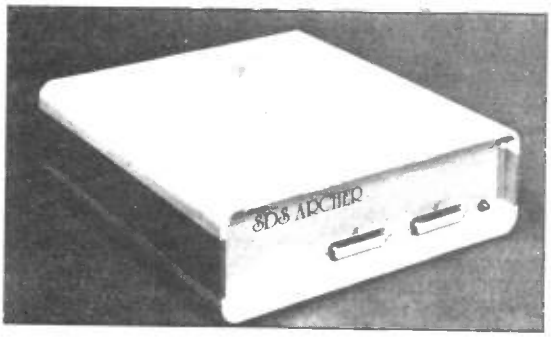

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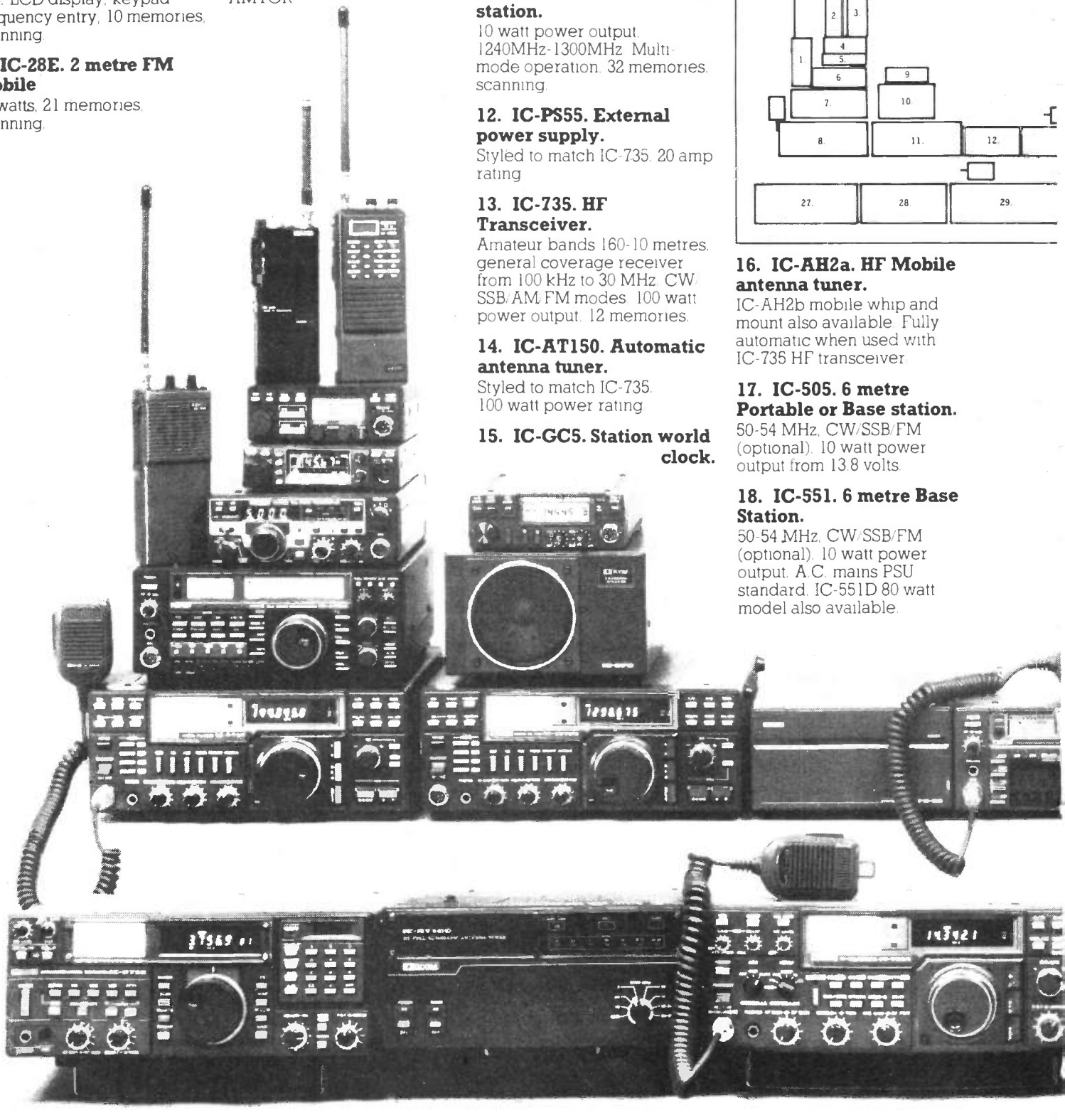

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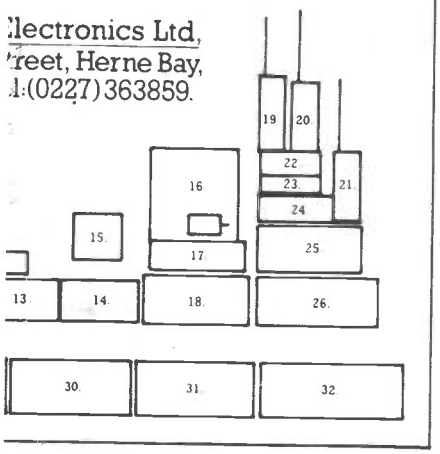

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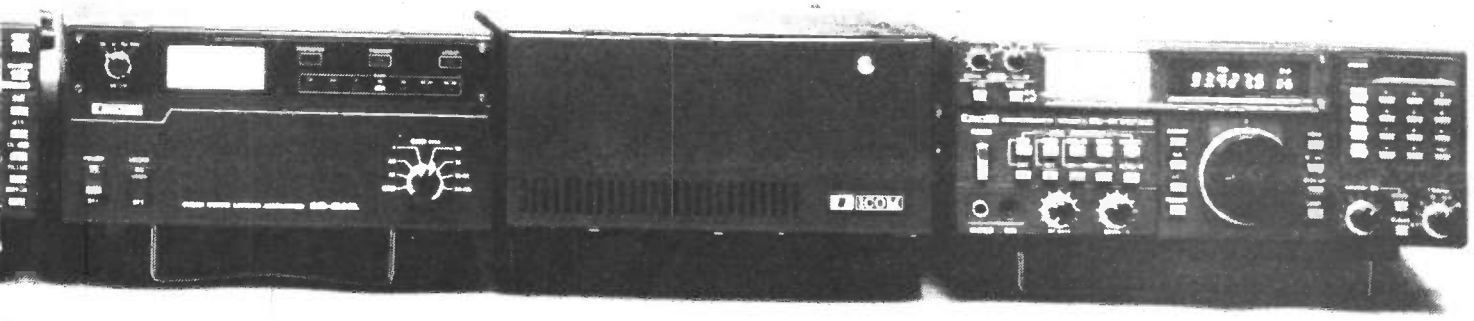

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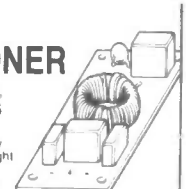
FEATURED IN ETI, SEPTEMBER 1986



It is astonishing how many people buy or build top-flight hi-fi equipment, and then connect it to a noisy, spiky mains supply. Rather like buying a Ferrari and trying to run it on paraffin, you might think. Expecting crystal clear sound, the poor music enthusiast ends up with a muddy, confused mush, and feels that he has somehow been cheated. Is this hi-fi? My music centre sounded just as good!

The domestic mains supply is riddled with RF interference, noise, transient spikes, and goodness knows what else. Computers crash, radios pop and crackle, tape recordings are spoiled and hi-fi sounds 'not quite right'. Why put up with it when the solution is so simple? The ETI mains conditioner is the lowest cost upgrade you will ever buy, and probably the most effective!

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FEATURED IN ETI, JANUARY 1987

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You are driving along the road one day when the sound of a horn makes you look behind. The driver of a milk float is cursing you for driving so slowly. A while later, an invalid carriage overtakes you, and just as you turn into your drive you hear a tractor driver mutter 'At last I can get out of first gear!'

Do you:

a) Fit a £500 Pie-in-ear in-car stereo with digital flexi-woofers and 24-band ramification?
b) Buy a set of fluffy dice and sticker saying 'My other car is a Macaroni'?
c) Give your car in part exchange for a milk float, invalid carriage, tractor?
d) Tune your engine.

The combined tachometer and dwell meter parts set contains: case with battery compartments, printed circuit board, all components, switches, plug, socket and test leads, battery connector, full instructions. The answer to the quiz, by the way, is e) Buy a bright red Lotus Esprit.

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MAINS CONTROLLER

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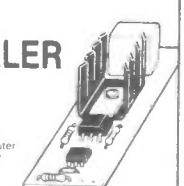

Have you ever wondered what people do with all those computer interfaces? Put your computer in control, say the ads. The Spectrabeeb has eight TTL outputs. What on earth can you control with a TTL output? A torch bulb?

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DATA FILE . . .

Ray Marston presents a brief survey of modern opto-electronic devices and techniques

Opto-electronics can be regarded as including any devices that produce an electrically-induced optical (visible or invisible light) output or an optically-induced electrical output, and the electronic techniques and circuitry used for controlling such devices. Opto-electronics is obviously a fairly large subject; in this edition of 'The File' we present a brief survey of some of these devices and techniques.

The best known types of 'light-generating' opto-electric devices are the ordinary tungsten filament lamp, the LED (light-emitting diode), the multi-segment LED array and the 'neon' or gas-discharge lamp; other types of light generator include the cathode ray tube and the laser. An associated device is the liquid crystal display (LCD), which does not in fact generate light but produces variations in the intensity of reflected ambient light.

Light-sensitive devices include photodiodes and phototransistors (which have opto-sensitive conductivity), LDRs or 'light-sensitive resistors' (which have opto-sensitive resistivity), and so-called 'solar' or 'photo-voltaic' cells (which are opto-sensitive voltage generators). Some specialist devices such as opto-isolators and opto-reflectors combine both light-generating and light-sensitive units in a single package.

Opto-electronic devices have many practical applications. They can be used to generate a wide variety of stationary or moving visual displays. They can be used to give an automatic switching or alarm action in the presence or absence of a visible or invisible light source, or to give a similar action when a person or object moves within range of a generated light source. They can be used to give remote control action via an infra-red light generator and a remotely placed detector. In some applications, fibre-optic cables can be used to form a low loss closed-circuit connecting link between a code-modulated light generator and a matching remotely placed light-sensitive device, thus forming an interference-free data link.

Filament lamps

The simple filament lamp or 'light bulb' is the best known type of light generator. It is widely used in the home, the car and in industry, can be powered from either ac or dc voltage sources, and uses the standard circuit symbol of *Figure 1a*. It usually consists of a coil of tungsten wire (the filament) suspended within an evacuated glass envelope and connected to the outside world via a pair of metal terminals; the filament runs white hot when connected to a suitable external voltage, thus generating a bright white light.

The filament lamp has two notable characteristics. One of these is that its resistance varies with filament temperature. Thus the resistance of a 12V 12W lamp is 12 ohms when the filament is operating at its normal 'white' heat, but is only 3 ohms when the filament is cold. This 4:1 resistance variation is typical of all filament lamps, and causes them to have switch-on 'inrush' current values about four times greater than the normal 'running' values.

The other notable feature of the filament lamp is that is has a fairly long thermal time constant, so that power has to be applied to (or removed from) the filament for a significant time (tens or hundreds of milliseconds) before it has any appreciable effect on light output. This characteristic enables the device to be powered from either ac or dc voltage sources, and enables the lamp brightness to be varied by using highly efficient switched-mode 'pulsing' techniques.

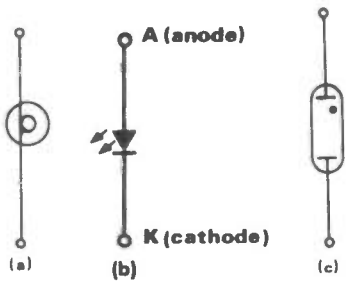


Fig 1 *Symbols representing a filament lamp, LED and neon lamp*

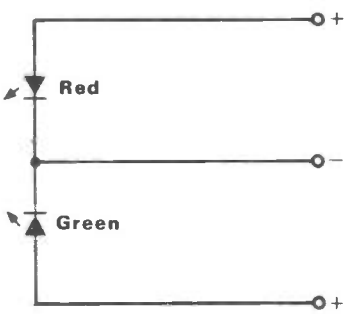


Fig 3 *Tri-colour LED showing red, green or yellow (both LEDs on)*

Light-emitting diodes

Another well-known type of light-generating device is the light-emitting diode, or LED. *Figure 1b* shows the standard circuit symbol of this solid-state device, which has electrical characteristics similar to those of a normal diode, ie it passes current in one direction and blocks it in the other, but emits light when biased in the forward direction. 'Standard' types of LED emit a red coloured light, but other types are available that emit orange, yellow, green, or infra-red types of light (*and blue now, with an SiC diode from Siemens – Ed*).

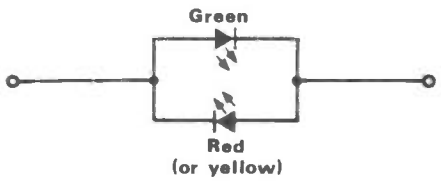


Fig 2 *Bi-colour LED showing red or green*

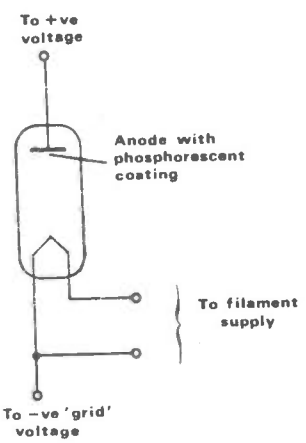


Fig 4 *Basic construction of a fluorescent display device*

LEDs require typical forward operating voltages of about 2 volts and forward currents of 10 to 20mA. They are widely available in single-LED packages, but are also available in multi-LED styles. 2-LED packages housing a pair of red and green LEDs are, for example, available in either 'bi-colour' or 'tri-colour' forms, as shown in *Figures 2* and *3*. In the bi-colour device only one LED can be illuminated at a time, so the device emits either red or green, but in the tri-colour device both LEDs can be illuminated at the same time, generating a yellow colour in addition to red and green.

Multi-LED packages are also available in 'bargraph' form, in 5 × 7 dot matrix form, and in 7-segment 'display' form.

In use, the operating current of an LED must be limited to a safe value; this can be achieved via a series resistor connected to either the anode or the cathode. Note that LEDs have very short opto-electric response times, and can easily be used to transmit coded 'remote control' light signals etc.

Neon lamps

Neon 'gas discharge' lamps can also be used as light-generating devices. They comprise neon gas and a pair of electrodes housed in a glass envelope.

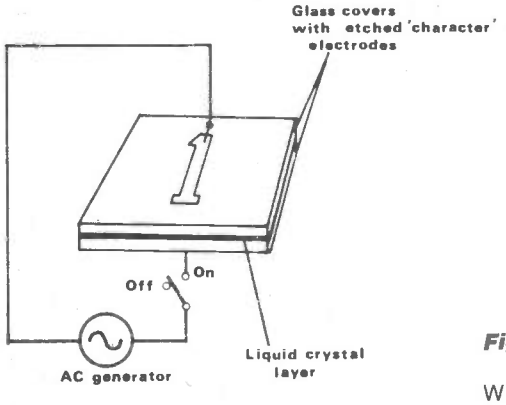


Fig 5 *Basic structure of an LCD*

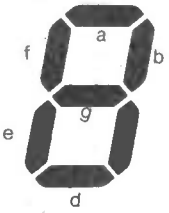


Fig 6 *Form and notations of a 7-segment display*

SEGMENTS (V = ON)							DISPLAY	SEGMENTS (V = ON)							DISPLAY
a	b	c	d	e	f	g		a	b	c	d	e	f	g	
V	V	V	V	V	V		0	V	V	V	V	V	V	V	8
	V	V					1	V	V	V			V	V	9
V	V		V	V		V	2	V	V	V		V	V	V	A
V	V	V	V			V	3			V	V	V	V	V	b
	V	V			V	V	4	V			V	V	V		C
V		V	V		V	V	5		V	V	V	V		V	d
V		V	V	V	V	V	6	V			V	V	V	V	E
V	V	V					7	V				V	V	V	F

Fig 7 *Truth table for 7-segment display*

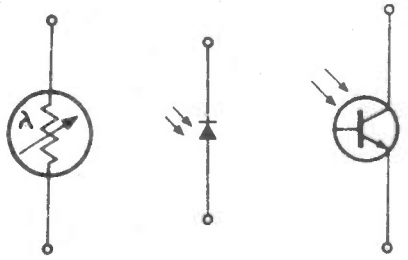


Fig 8 *Symbols for LDR, photodiode and phototransistor*

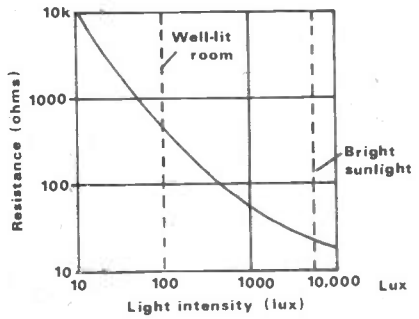


Fig 9 *Typical photo-resistive graph of an LDR with a 10mm face*

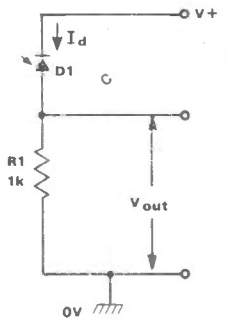


Fig 10 *Basic photodiode circuit*

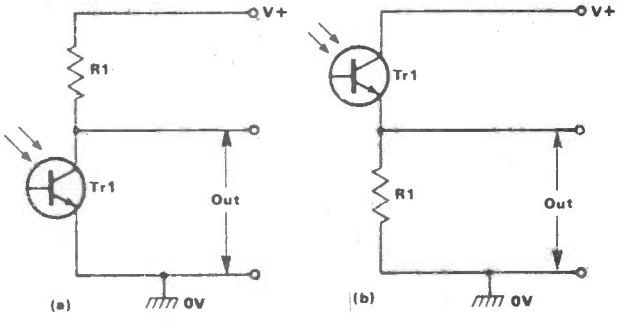


Fig 11 *Alternative phototransistor configurations*

When a suitably high 'striking' voltage is applied to the electrodes the gas becomes conductive, producing a red glow on the electrodes; if the voltage is further increased the glow spreads through the neon gas.

In use, a resistor is wired in series with the neon lamp so that the neon voltage self-limits to slightly above the 'striking' value. *Figure 1c* shows the symbol for the neon lamp, which can be powered from either an ac or dc voltage.

Fluorescent displays

Another type of light-generating device is the fluorescent or phosphorescent display, which is shown in basic form in *Figure 4*. Here, an incandescent filament (typically using a 2 volt supply) acts as a source of free electrons, which can be accelerated into a phosphor-coated anode via a suitable grid-to-anode voltage (typically about 24 volts), thus generating a visible green or blue flourescent glow. This type of device is available in 7-segment display form.

Liquid crystal displays

The four basic types of opto-electric display devices that we have just looked at inevitably consume substantial electrical power, since they actually generate light. Liquid crystal displays (LCDs), on the other hand, are used to reflect existing ambient light, and can thus operate with negligible power consumption. *Figure 5* illustrates the basic structure of an LCD device designed to display either a blank or the digit '1'.

The display device consists of a very thin layer of liquid crystal sandwiched between two glass covers which have the transparent character '1' etched onto them in the form of an externally-available pair of electrodes. Normally the liquid crystal molecules are randomly aligned, and the complete unit appears as a simple ('blank') block of transparent glass.

When an ac voltage (usually 40-100Hz) is applied across the '1'-shaped electrodes the molecules within the intervening layer of liquid crystal become agitated, taking up a mirror-like optical density that vividly reflects the character '1' from any existing ambient light source. The device reverts to its 'blank' state when the ac excitation voltage is removed.

In reality, the etched character shape (or shapes) of an LCD device can take any desired form, and in practice they are most widely used in the form of 7-segment displays. Note that LCDs are voltage-operated devices, and consume near-zero quiescent power.

7-segment displays

A very common requirement in modern electronics is that of displaying alpha-numeric characters; digital watches, pocket calculators and digital instruments are all examples of devices that use such displays. The best known display of this type is the so-called '7-segment' display; it comprises seven independently-accessible photo-electric segments (eg LED, LCD, gas-discharge, flourescent, or filament-type segments) arranged in the form shown in *Figure 6*.

The segments are conventionally notated from 'a' to 'g' in the manner shown in the diagram, and it is possible to make them display any numeral from '0' to '9' or alphabetic character from 'A' to 'F' (in a mixture of upper and lower case letters) by activating these segments in various combinations, as shown in the truth table of *Figure 7*. A wide variety of digital IC types are available for providing suitably decoded driving signals for 7-segment displays.

Photo-detectors

Photo-detectors are devices that provide a change in electrical characteristics in the presence of a change in 'light' input. The best known of these devices are the LDR (light-dependent resistor), the photodiode and the phototransistor, and *Figure 8* shows the symbols for these three devices.

The LDR is also known as a cadmium sulphide (CdS) photocell; it is a passive device that simply changes its electrical resistance in the presence of external light. *Figure 9* shows the typical photo-resistive graph that applies to an LDR with a face diameter of about 10mm.

A photodiode is a normal silicon diode that is either mounted in a transluscent case or has its semiconductor junction

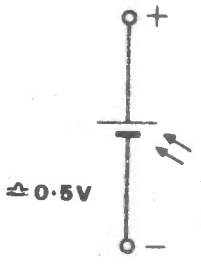


Fig 12 *A single solar cell*

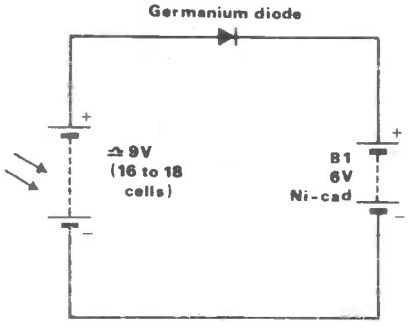


Fig 13 *Charging a nicad using a solar panel*

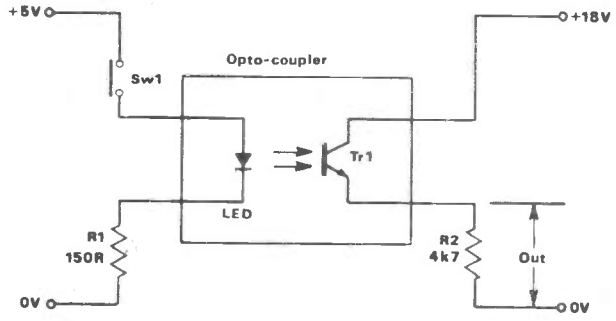


Fig 14 *Basic opto-coupler circuit*

mounted beneath an optical lens. If any silicon diode junction is reverse biased in the circuit of *Figure 10*, its reverse current value will depend on the amount of illumination on the junction face, being near-zero under dark conditions and tens or hundreds of nA under bright conditions.

Similarly a phototransistor is a normal silicon transistor with a photo-visible junction. It has a far greater sensitivity than the photodiode, and can be made to act as a sensitive light-to-voltage converter by wiring it in either of the configurations shown in *Figure 11*.

Solar cells

So-called 'solar' cells are actually photo-voltaic units that convert light directly into electrical energy. *Figure 12* shows the symbol used to represent a single solar cell.

An individual solar cell generates an open circuit voltage of about 500mV (depending on light intensity) when active. Individual cells can be connected in series to increase the available terminal voltage, or in parallel to increase available output current; banks of cells manufactured ready-wired in either of these ways are known as solar panels. *Figure 13* shows how a bank of 16 to 18 cells can be used to auto-charge a 6 volt nicad battery via a germanium diode.

The available output current of a solar cell depends on the light intensity, on cell efficiency (typically only a few per cent), and on the size of the active area of the cell face. Note that available sea level light energy is typically in the range 0.5kW to 2kW per square metre on a bright sunny day, so there is plenty of 'free' energy waiting to be converted!

Opto-couplers

An opto-coupler is a device containing an infra-red LED and a matching phototransistor, mounted close together (optically coupled) within a light-excluding package, as shown in the basic circuit of *Figure 14*. Here S1 is normally open, so zero current flows through the LED; Tr1 is thus in darkness and also passes zero current, so zero output voltage appears across R2. When S1 is closed, however, current flows through the LED via R1, thus illuminating Tr1 and causing it to generate an R2 output voltage. The R2 output voltage can thus be controlled via the R1 input current, even though R1 and R2 are fully isolated electrically.

In practice, the device can be used to opto-couple either digital or analogue signals, and can provide hundreds or thousands of volts of isolation between the input and output circuits.

Figures 15 and *16* show two useful variants of the basic opto-coupler. The first of these is the 'slotted' opto-coupler, which has a slot moulded into the package between the LED and Tr1. The slot houses transparent windows so that the LED light can normally freely reach the face of Tr1 but can be interrupted or blocked via an opaque object placed within the slot. The slotted opto-coupler can thus be used as an object detector.

The second device is the 'reflective' opto-coupler. Here the photo-active faces of the LED and Tr1 both point outwards (via transparent windows) towards an imaginary point that is roughly 5mm beyond each window, so that the LED light can only reach Tr1 via a reflective surface that is placed at or near this point. This device can thus also be used as an external-object detector.

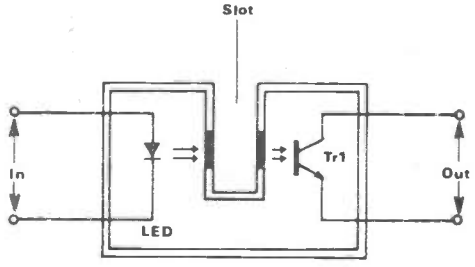


Fig 15 *Slotted opto-coupler*

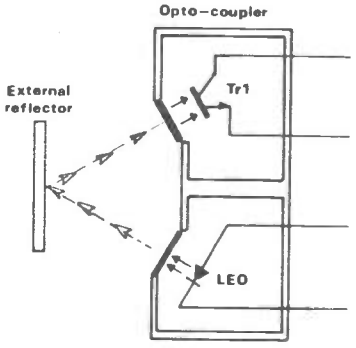


Fig 16 *Reflective opto-coupler*

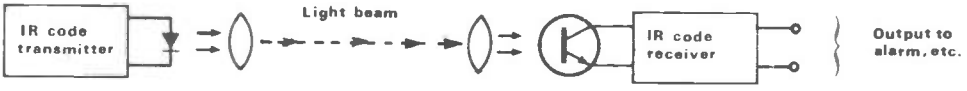


Fig 17 *Simple light-beam alarm*

Light-beam systems

One of the most important applications of the infra-red LED/phototransistor combination is in the making of 'light beam' systems, which can include light-beam alarms, infra-red remote control systems, and (with the aid of fibre-optic cables) infra-red data links. The basic principles of these systems are illustrated in *Figures 17* to *21*.

Figure 17 shows the basic operating principle of the simple light-beam alarm. Here the transmitter feeds a coded signal (usually a fixed-tone square wave) into an infra-red LED, which has its output focused into a 'beam' that is aimed at a matching infra-red phototransistor mounted on the remotely placed receiver. The circuit action is such that when the light-beam is operating the receiver output is normally off but automatically activates an external alarm, counter, or relay if the beam is interrupted by a person, animal or object. This type of system can have an effective 'detection' range of up to 30 metres.

The above system works on the pinpoint 'line-of-sight' principle, and can be activated by any 'bigger-than-a-pin' object that enters the line of sight between the transmitter and receiver

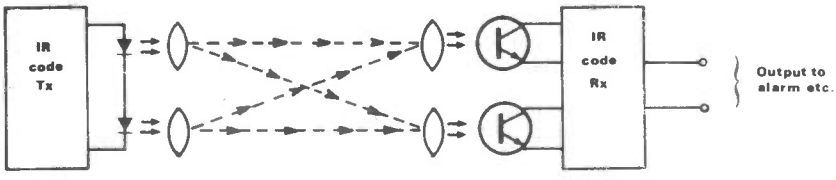


Fig 18 *Dual light-beam alarm*

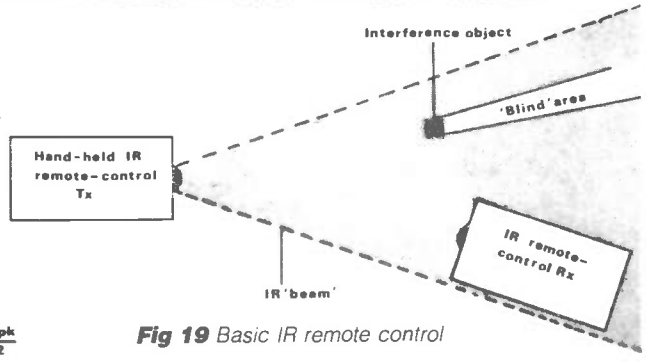


Fig 19 *Basic IR remote control*

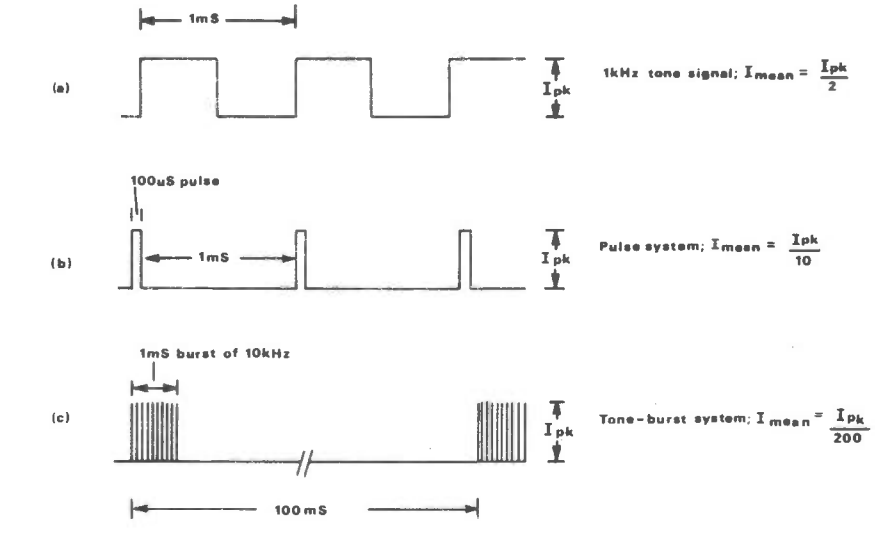


Fig 20 *Basic types of IR-beam code waveform*

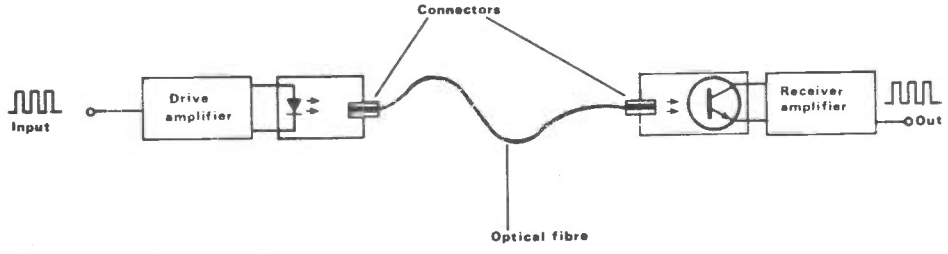


Fig 21 *Basic fibre-optic link*

lenses. Thus a weakness of this system is that it can be falsely triggered by a fly or moth (for example) entering the beam or landing on one of the lenses. The dual light-beam system of *Figure 18* does not suffer from this defect.

The *Figure 18* system is basically similar to that already described, but transmits the infra-red beam via two series-connected LEDs that are normally spaced about 75mm apart, and receives the beam via two parallel-connected phototransistors that are also spaced 75mm apart. Thus each phototransistor can detect the beam from either LED.

The receiver will not activate if one or other of the beams is broken, but only if both beams are broken simultaneously, and this will normally only occur if a large (greater than 75mm) object is placed within the composite 'beam'.

Figure 19 illustrates the operating principle of an infra-red remote control system. Here the hand-held unit transmits a broad beam of coded infra-red light, and can remotely control a receiver that is placed anywhere within the active area of this beam. Note that the transmitter and receiver do not need to be pointed directly at each other to effect operation, but *must* be in 'line-of-sight' contact; also note that an object placed within the beam can create a 'blind' area in which line-of-sight contact cannot exist.

Code waveforms

Infra-red LEDs and phototransistors are very fast-acting devices. Consequently the effective range of an infra-red 'beam' system is determined by the peak current fed into the transmitting LED, rather than by the mean transmitting current. These are important points to note when designing beam code waveforms, as illustrated in *Figure 20*.

The simplest type of 'code' waveform is the fixed-tone square wave signal, as shown in *Figure 20a*. Here the mean transmitting current is half the peak value, so this system is not very efficient. Better efficiency is shown by the 'pulse' system of *Figure 20b*, which transmits a 100μs pulse once every 1100μs and thus has a mean current consumption that is only one-tenth of the peak value. Finally, the most efficient system of all is the tone-burst system (*Figure 20c*) which, in the example shown, consumes a mean current that is only one two-hundredth of the peak value. Note that this latter system transmits a 1ms 'sample' burst of 10kHz tone once every 100ms (eg ten times per second), and is used mainly in light-beam 'intruder detecting' systems.

Most multi-channel remote control systems use a fairly complex beam coding system in which a number of 'bits' of data are sequentially transmitted within a repeating 'frame', which also repeats many times per second. Thus in each frame the first bit may contain data for channel 1, the second for channel 2, the third for channel 3, and so on. 32-channel infra-red remote-control systems are readily available.

Fibre-optics

Fibre-optic cables can, in very simple terms, be regarded as flexible 'light pipes' that can efficiently carry modulated or unmodulated 'light' signals from one point to another (even if the journey involves bends and loops) with little signal loss and complete immunity from electromagnetic interference.

The simplest application of such cables is in distributing the visible light of a single source to many different 'pinpoint' locations, as in (for example) a vehicle's instrument panel. In this instance the cables need no special treatment, and can simply be cut to length with a sharp knife. In more complex applications, such as the coded data link of *Figure 21*, the cable needs to be united with the light source and the distribution point via special connectors in order to cut down signal losses.

Two distinct types of fibre-optic cable are in common use. One of these is an inexpensive type made from polymer cable; it is easily cut, ideally suited for use with visible red light, and is best suited to short distance applications (up to ten metres). It gives a maximum attenuation of 200dB per kilometre of cable. The other type of cable uses a glass fibre construction; it is expensive and difficult to cut, but can efficiently handle infra-red signals and exhibits a typical transmission loss of only 5dB/km.

AOR'S BIG BROTHER

or SCANNERS UNDER COMPUTER CONTROL

A review by Peter Rouse GU1DKD

The AOR series of scanners, the AR2001 and 2002, have proved immensely popular, and in my own humble view the 2002 is probably the best all-round scanner you can buy at the price. The addition of what's called an RC-Pack brings either of these machines under computer control and adds a whole new dimension to scanning.

First, though, a look at the two scanners themselves. The 2001 was the first receiver to appear on the market that allowed 'no-gaps' coverage from 25 to 550MHz. It also scored over some of its earlier competitors in that far fewer spurii appeared across its tuning range.

The 2002 (which also appears as the Regency MX8000) is a revamped version with the addition of an 800 to 1300MHz tuning range, a bargraph S-meter, proper keypad buttons and a manual tuning knob. Interestingly the case is exactly the same shape and size as its predecessor. Either machine offers 20 memory channels and each channel can be individually programmed for mode and delay.

Tapping into the micro

The optional computer interface certainly is not much to look at; a plain grey box with an LED power light and a push-on/push-off switch. It comes with a short length of ribbon cable terminated in IDC plugs which connect directly to a socket on the back of the AR2002.

In the case of the AR2001 an additional adaptor is required and connecting up is slightly more complicated. The set has to be opened up and the plug carrying the keyboard connection has to be disconnected from the main PCB. This means that the AR2001 can then only be used under computer control. There is no such drawback with the 2002 as switching the RC-Pack on automatically puts the scanner under computer control.

On the rear apron of the RC-Pack is a 25-way D socket which provides a standard RS232 connection (8-bit, no parity, 1 stop bit) to the computer which can either control the scanner directly under constant control or can act as a dumb terminal just to get the RC-Pack programmed. Baud rates are set within the RC-Pack using DIP switches. The factory-set rate is 9600 baud but this can be changed to 4800 or 2400.

The pack contains its own 8-bit CPU and non-volatile memory (capacitor style power cell that will retain memory for around a month without power applied). Using the internal software a host of additional facilities are available. Now 50 memory channels can be used and notes can be written to identify the frequency user; these appear on screen when a signal is received. Additionally 10 banks of search ranges can be set up and recalled at any time.

Additional features

Preset step rates for searches on the set are limited to hops of 5, 12.5 and 25 kilohertz, but under computer control virtually any step rate from 100Hz upwards can be programmed. During search sequences the plus and minus keys on the computer (assuming they generate standard ASCII codes) can be used for up/down tuning at a nominal 70 millisecond step rate (this can be altered).

It is interesting to note that under computer control it is also possible to search outside the specified limits of the receiver. The frequency can be set to anything below 25MHz, but performance tails off sharply around 10MHz. The highest limit is 1355MHz. It is not possible to program frequencies between 550 and 800MHz (TV frequencies). Naturally reception of stations between 10 and 25MHz is far from perfect because of the relatively wide bandwidth of the IF filters in the set.

When it comes to scanning proper, a range of features is available which includes as many priority channels as you want and the ability to set the rate at which they are checked. Delay on scan channels is adjustable from 1-127 seconds.

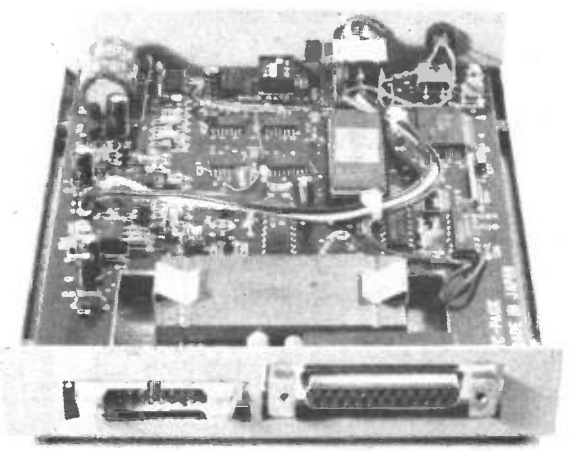
Software

So far my own experiments have been conducted solely with a BBC-B computer. On receiving the RC-Pack my first problem was to find a suitable 25-way plug to hook it to the RS432 terminal on the Beeb, as one is not supplied. Fortunately I had one, plus a suitable Domino DIN plug for the computer, and a few minutes with a soldering iron meant I was able to plug the pack to the Beeb.

With the RC-Pack switched on the AR2002 went dead and just the time showed. I booted up the only communication software I had, Mini Office II, selected 9600 baud from the available rates and then typed in 'EC', the command that 'kick-starts' the interface.

The system fired up perfectly. I will not go into detail on how things work from then on as it is simply a question of using a few new commands or following prompts. A 'Help' facility fires up a description of all the available commands.

Once frequencies have been program-

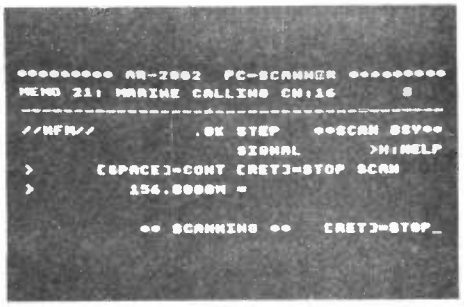


```
 5 REM COPYRIGHT PETER ROUSE 1986
 10 REM *** PROGRAMME 1 ***
 20 REM AOR 2001/2002 RC-PACK DUMB TERMINAL
 40 REM RUN THEN TYPE 'EC RETURN'
 50 REM BBC CAN BREAK AND RETURN TO NORMAL
 60 REM PROGRAMMING AFTER SETTING RC PACK
 70 CLS
 80 *FX7,7
 90 *FX8,7
100 *FX3,7
110 PRINT"RS 14"
120 *FX2,2
130 X=INKEY(1):IF X=-1THEN 170
140 *FX3,7
150 VDU X
160 *FX3,0
170 *FX2,1
180 *FX3,0
190 X=INKEY(1):IFX=-1THEN120
200 VDU X
210 IFX=10 THEN VDU X
220 GOTO 120
```

```
 5 REM *** PROGRAMME 2 ***
 10 REM  COPYRIGHT PETER ROUSE 1986
 20 REM  2002/2001 KEYBOARD/TAPE CONTROL
 30 CLS
 40 MODE1
 50 COLOUR 1
 60 *FX7,7
 70 *FX8,7
 80 T=0
 90 *FX3,7
100 PRINT"RS 14"
110 *FX2,2
120 X=INKEY(1):IF X=-1THEN 160
130 *FX3,7
140 VDU X
150 *FX3,0
160 *FX2,1
170 *FX3,0
180 X=INKEY(1):IFX>0 THEN250
190 IFT<20 THEN 280
200 *FX137,0
210 IFX=-1THEN110
220 VDU X
230 IFX=10 THEN VDU X
240 GOTO 110
250 *FX137,1
260 T=0
270 GOTO220
280 T=T+1
290 GOTO210
```

med into the memory channels, and such things as priorities and delays have been set, then the computer's break key can be hit. The scanner will carry on working and the computer can be returned to normal usage or even switched off.

Having used a commercial communications package to try out the equipment, I decided to develop a simple basic program to do the job (it was a bit tedious having to set up the various options and protocols on the Mini Office II package).



The screen format when used with standard communications software

Practical programs

Program 1 is about the simplest possible software you can use to get the computer to act as a dumb terminal. It is fractionally slower than a proper communications program in machine code but in practice this does not cause any drawbacks.

The program automatically sets the response time between the RC-Pack and computer and once 'run' you just type in 'EC' followed by return. 'EC' will not appear on screen but that is perfectly normal. The RC-Pack is then in 'Echo' mode and will start to write to the screen. The only point to watch is that if the RC-Pack has already been used with faster software it may not respond properly at first. Try giving it a slower response speed such as 'RS 50' and then re-run the software.

That simple program will allow full programming of the RC-Pack, and again once the scanner is under way the Beeb can be returned to normal usage. The beauty of this program is that the thousands of duffers like myself who cannot program in machine code can now start adding a few extras.

Program 2 is a slightly modified version that simply uses the internal cassette switching relay of the Beeb to turn a tape recorder on when a signal is received. This idea could be taken a stage further by using a stereo cassette deck so that audio is recorded on one track and screen information is stored as a file on the other track. This obviously allows the scanner to be left unattended and later playback will show who was transmitting what and on which frequency. Used in search mode it also allows new stations to be found.

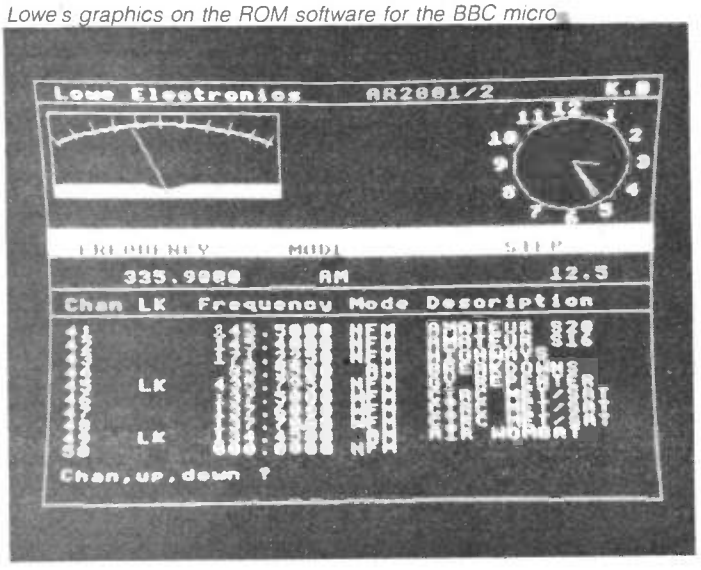
Having said all that, do note the laws concerning recording of transmissions.

Commercial programs

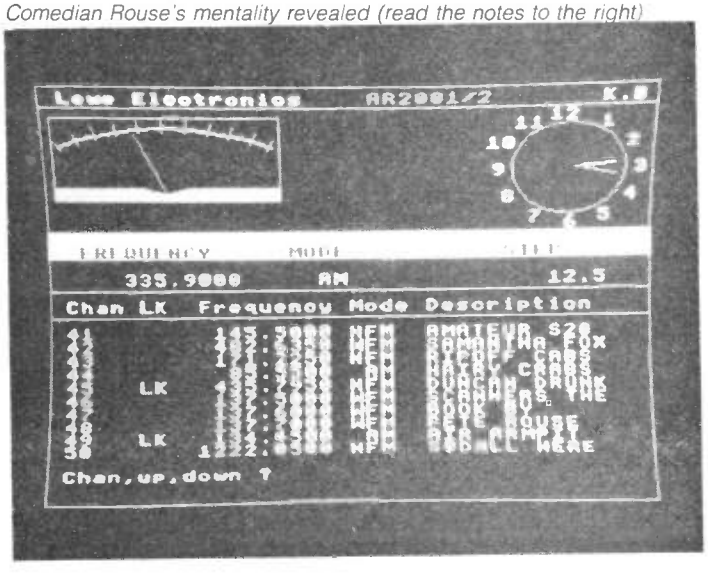
There is only one program specifically designed for the AOR RC-Pack, and that is supplied as a plug-in ROM by Lowe Electronics, who are the importers of this equipment. It is much faster to use than a conventional communications package and bypasses much of the internal software of the RC-Pack, so giving more control to the Beeb. Once memory channels have been selected these are stored on disc (channels stored in the non-volatile memory of the RC-Pack remain unaffected by use of the Lowe program) and the various functions are assigned to the programmable keys on the computer (keystrip provided).

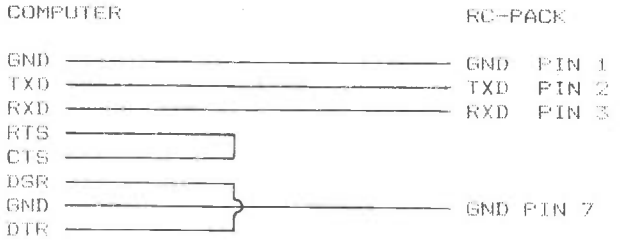
A pleasing colour graphic display provides a clock and a mock-up of a conventional moving-coil type S-meter. The ROM is accompanied by a tape which contains an instruction file and a sample program of what can be done to

Lowe's graphics on the ROM software for the BBC micro



Comedian Rouse's mentality revealed (read the notes to the right)





Computer connections (all machines)

provide extra features. These include tape recorder switching and hard copy log on a printer of the details and time of signals received.

The program is written in assembly language and a detailed description is included of what is doing what, so those with the necessary programming skills can start adding their own features.

Other computers

Any computer which either has or can have added to it an RS232 interface can be used with the RC-Pack, it is simply a matter of using communications software which has selectable baud rates. Many computers such as the Dragon 64, Sinclair QL etc have suitable ports, and their handbooks give details on how to receive and send via them. It should not be difficult to develop suitable basic programs along the lines of the one shown here for the BBC B.

Conclusions

First the moans. There is a bug in the internal software of the RC-Pack which manifests itself as one of the information lines being overwritten on the screen and then reappearing in the wrong place. It does not affect the performance, but it is annoying and on a piece of equipment as expensive as this it should not happen.

The command to kill delay is supposed to be 'DL X' which in fact has no effect whatsoever, and it is necessary to use 'DL 1' and put up with a 1 second delay as minimum.

AOR provide no information at all on what order the data is sent back and forth nor on how to use the RC-Pack in any way other than with the computer acting as a keyboard. The result is that it will be difficult for someone with only average programming abilities to write software that does away with such things as the unnecessary refreshing of the entire screen every time a signal is received. Without some better means of control, setting up the RC-Pack is rather tedious as instructions have to be entered one at a time with a complete screen refresh sequence between each one.

Many scanner users, I suspect, will find little benefit in paying a fairly hefty price for the additional features contained solely within the control box. It therefore seems likely that the set-up will appeal to two groups of scanner users, the first being those scanner buffs who want to be able to do such things as auto-log, and the second being those people like myself who are compulsive fiddlers.

I must confess to having had hours of fun finding out what I could and could not do with the computer hooked to the scanner. I suspect I have only just scratched the surface and hours more fun are in store as I play around with different programs.

Practical problems

Nearly all home micros generate dreadful signals from their internal clocks, and the harmonics from these stretch well up into the VHF bands. The system I have been reviewing is unusable if the antenna system is anywhere near the computer, and in fact even with the aerial 10 metres away from the Beeb the squelch has to be set slightly harder than normal. The obvious answer to this is to fit the computer into an earthed metal case, and that might not be as silly as it sounds.

There is no reason why a cheap computer should not be permanently connected to the scanner. Older computers and ones that have failed commercially can often be obtained quite cheaply either second-hand or even new. I have seen MSX machines being sold new at bargain basement prices of less than thirty pounds, and according to the AOR manual these machines can be hooked directly to the RC-Pack and the computer's internal software for communications can be called up with just a few simple commands. The added advantage of all this is that you need not then tie up an expensive machine like a BBC B on a dedicated operation.

One final tip is to try earthing different items of equipment. For some strange reason I noticed that hash levels dropped when I tried jumper wires between the casings of things like the disc drives, monitor and RC-Pack; it was just a case of finding the right combination.

Spectrum dumb terminal software

The following program was written by Peter Stonebridge G8ZQA for the 48K Spectrum and operates via the optional ZX RS232 adaptor. Peter says it suffers a minor problem in that because the RS232 is operated directly under the control of the Spectrum's CPU it occasionally locks up. This is no major problem, as typing-in 'continue' will get the process going again.

```
3 REM AOR 2002 BY G8ZQA
5 LET LINE=0
10 OPEN #4;"t"
20 OPEN #5;"t"
25 PRINT #5;"rs35"
30 GO SUB 100: REM send
40 GO SUB 200: REM receive
50 GO TO 30
100 LET K$=INKEY$
110 IF K$="" THEN RETURN
120 IF K$<>"" THEN GO SUB 500
200 LET K$=INKEY$#4
210 IF K$=CHR$ 13 THEN LET LINE
=LINE+1: POKE 23692,255: REM to
keep scrolling
240 PRINT K$;
250 RETURN
500 IF K$="l" THEN LET K$="ML":
REM "MEMORY LIST"
510 IF K$="e" THEN LET K$="EC":
REM "ECHO ON/OFF"
520 IF K$="c" THEN LET K$="CL":
REM "RESET RC TO START CONDITION"
530 IF K$="s" THEN LET K$="SC":
REM "SCAN"
540 IF K$="d" THEN LET K$="DL5":
REM "DELAY 5 SECONDS"
550 IF K$="p" THEN LET K$="PR":
REM PRIORITY OFF/ON"
560 IF K$="a" THEN LET K$="PA L
": REM "PASS FREQUENCY LIST"
570 IF K$="m" THEN LET K$="M":
REM "MEMORY MODE"
580 IF K$="h" THEN LET K$="SE"
1000 PRINT #5;K$;
1010 GO TO 200
```

MSX commands

According to the manual supplied with the RC-Pack, connection can be made direct to those MSX machines which have a communications port. The following commands and program lines are all that are necessary to get the set-up working.

```
SCREEN 0
WIDTH 39
10 CALL COMINI ("0.8N1NNNNN",9600,9600
20 CALL COMTERM ("0:")
```

Once you have run the above, type in 'EC' followed by return and then 'RS 5', again followed by return.

Much ta

I am indebted to Lowe Electronics of Matlock in Derbyshire not only for supplying equipment for review but also for much useful back-up information. Their software designer is working on new ideas for the AOR system and has already had some success with such things as a slow but effective spectrum analyser. They will make all software developments available in the future.

VAT-inclusive prices are currently £487.30 for the AOR2002, £255.63 for the RC-Pack and £10 for the BBC ROM and sample program tape. Note though that prices do not include carriage and are subject to the regular fluctuations of the pound on world currency markets. REW

THE MF10 FILTER CHIP

James Dick describes an IC containing two switched capacitor filters which simplifies design and eliminates the problems of critical component values

Active filtering took a quantum leap forward with the introduction of a new chip a few years ago by National Semiconductor, the MF10. Given that amateur radio – and, indeed, many other areas of hobby interest – is very much concerned with filtering, this device should prove popular with the hobbyist as well as the professional engineer.

Nat Semi call it a 'versatile monolithic active filter building block', which may be a mouthful but sums up the MF10's abilities. It is clearly designed to replace most of the conventional op-amp based circuitry for the classical filtering functions of low-pass, high-pass, band-pass and notch. The MF10 brings with it the sort of plug-in, black box technology that has been available to the digital designer since TTL became widely used oh-so-long-ago. The same functional building block approach has slowly spread throughout the analogue world (phase-locked loops, op-amps and voltage regulators) and is making its mark in filtering.

Fig 1 *A typical op-amp filter design*

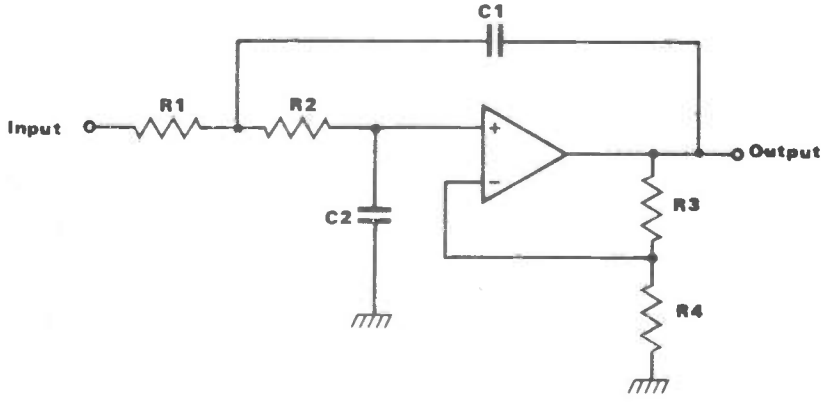
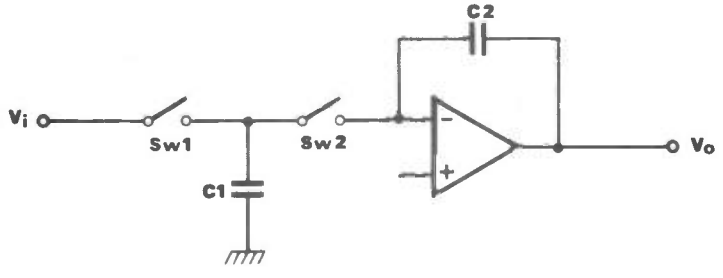


Fig 2 *An outline of the swithched capacitor technique*



Problem solver

In a typical op-amp filter design (*Figure 1*), the accuracy of the filter's frequency characteristics depends on the accuracy and tolerance of the passive components used. The designer will frequently find him or herself using one per cent tolerance capacitors – or even tighter tolerances as the filter's frequency rises. To obtain exact filter characteristics, non-standard component values often have to be used.

The MF10 has been designed to completely eliminate critically-valued components and to reduce the component count to a minimum while still allowing the filter to be tuned, a feature which is difficult to achieve with conventional designs.

Apart from simple tuning, the MF10 may be configured to act as two second order filters or cascaded to form a single fourth order type with Butterworth, Bessel, Chebyshev or Cauer characteristics.

How it works

The MF10 is based around the idea that a capacitor and a couple of switches can be made to look like a resistor. *Figure 2* is used to illustrate this principle. When S1 is closed, S2 is open and C1 charges up to the input voltage V_i. When the clock signal's polarity changes, S2 closes and S1 is opened and the charge on C1 is transferred by the op-amp to C2. Hence during one clock cycle a charge of $C1 \times V_i$ is moved from the circuit input to the op-amp's inverting input.

Since current is measured as charge divided by transfer time, the equivalent current passed by the two switches is $V_i \times C1 \times F_{clk}$ where F_{clk} is the clock frequency. Because we know the voltage across the two switches (V_i at one end, and the op-amp's virtual-ground level at the other) and the current passed, we can calculate that the switches and their capacitor look like a resistor with a value of V_i/I where I is the current passed. Hence the 'resistor' value is $1/(C1 \times F_{clk})$.

So, by substituting 'switched capacitors' into the filter design instead of resistors, a general purpose filter may be made in which the awkward-value resistors are replaced by a digital clock signal and an on-chip capacitor.

Because a digital clock signal is easy to generate for a given frequency and stability, and the on-chip capacitor can be accurately fabricated, a solution to the filter component problem has been found.

Applications

Just to show how easy it is to design with the MF10, *Figure 3* shows a simple telephony filter. The filter has a second order high-pass section set at 400Hz and a second order low-pass section set at 2kHz. Because the MF10 contains two independent sections, only one chip is required.

The discrete component values are calculated using the simple equations in the manufacturer's data sheet – a pocket calculator is optional!

The digital clock signal can be either 50 or 100 times the filter's design frequency. Since we have two filters here, two clock signals are required, one at 40kHz and the other at 200kHz. These have both to have a symmetrical duty cycle, which is why the crystal-generated signals are passed through divide-by-two flip-flops.

Another simple example is shown in *Figure 4*. This time it's a band-pass filter that might find a use as a morse-tone filter. By varying the input clock frequency from 50kHz to 300kHz, the filter may be tuned from 500Hz to 3kHz. Since the clock has to be varied in frequency, a simple oscillator based around a CMOS inverter chip might be used. Although fairly basic, with a stabilised supply such a simple oscillator will be quite suitable.

Notes

The MF10 does have its limits. The maximum clock frequency that may be used is 1.5MHz, thus limiting filtering to around 30kHz. This means that the MF10 is purely for audio applications. The Q obtainable (Q is a measure of the passband width in band-pass filters) must not exceed 300,000 divided by the passband centre frequency (in Hz). A band-pass filter centred on 5kHz should not have a Q greater than 60, for instance.

The device runs off ±7 volts and the outputs may swing to within 1 volt of either supply; output currents are limited to less than 1.5mA. A single supply of up to +14 volts may also be used, so any circuit built using an MF10 should be able to work off a mobile transceiver's PSU!

One of the more complicated limits is that aliasing must be avoided. Aliasing occurs because the switching nature of the filter effectively samples the incoming signal at the clock frequency. This produces a mixing effect which will transfer any signals near the clock frequency down into the audio band. Because the clock signal is typically many tens of kilohertz, this is unlikely to be a problem in operation but should be guarded against in circuit design.

None of the above features should detract from the ease with which the MF10 can be used. At a cost of less than £5, this excellent and exciting analogue building block is certain to be warmly welcomed by anyone designing audio filtering equipment. REW

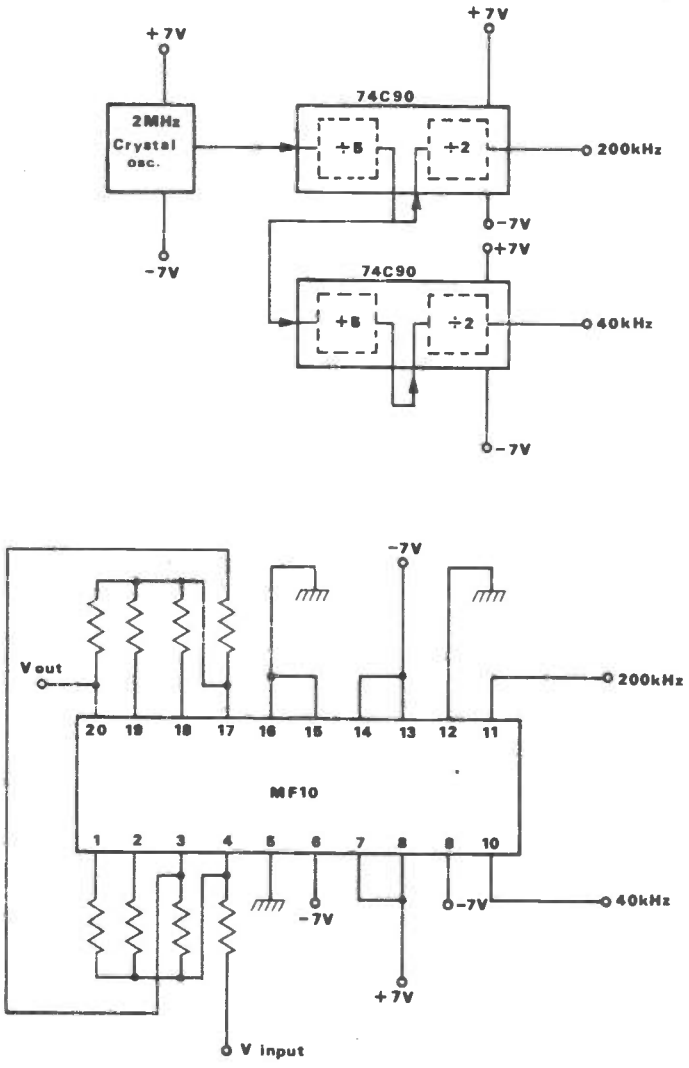
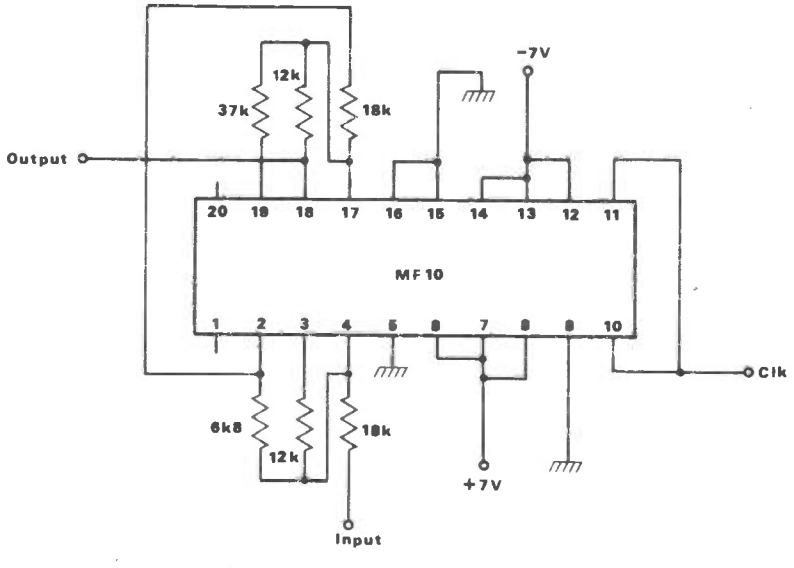


Fig 3 *A simple telephony filter. Note that resistor values are dependent upon filter type (Bessel, Cauer etc) but may all be identical (say 22k) for a simple filter*

Fig 4 *The MF10 as a band-pass filter*



Note: Clock signal derived from CMOS with a zero to +7V supply

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Got a new diary? Well here's something to fill it up with, plenty of TV contests throughout the new year!

The Winter Cumulatives are for all modes (TV, that is) and all bands, from 1900 to 2359 local time each session. The dates are Thursday 8th January, Friday 16th, Saturday 24th and Sunday 1st February.

Next on the roster is the Easter Extravaganza on Tuesday 21st April. For 70cm only, it lasts from 0001 to 2359. The May Day Microwave is what's cooking on Monday 4th May (after the BATC rally at Crick – can you stand the pace?!?). Again running from 0001 to 2359, this contest is for 24cm and above.

Summer Fun comes from 1200 Saturday 21st June to 1600 the next day, and covers all bands. Next is the International ATV Contest, which we must win. For fast-scan TV on all permitted bands it runs from 1900 Saturday 12th September to 1300 on Sunday. The Autumn Vision contest is on Sunday 25th October, running from 0001 to 2359. All bands and all modes are encompassed. Finally, there is a slow-scan day on Sunday 29th November, from 0001 to 2359. Mark all these dates in your diary now: all times are local, ie BST if in force, otherwise GMT.

There are two sections in all of these contests. Section A is for all transmitting amateurs, whether transmitting vision on this occasion or not. Category B is for SWL stations who are not in direct contact with entrants to section A. The bands open to fast-scan ATVers are 70cm, 24cm, 13cm, 9cm (3.4GHz), 5cm (5.6, 5.7 and 5.8GHz), 3cm (10GHz), 1.25cm (24GHz), 0.5cm (47GHz), 0.3cm (75GHz), 0.2cm (142GHz) and 0.1cm (248GHz). Well, that's the complete list – I wonder whether we'll have any 0.1cm entries this year...

Contest fun?

Yes please. Contests are supposed to prove that the people who win are those with the best operating practice. Who said "Whoosh, over the top"?

Talkback is generally on two metres, with calling on 144.750 (FM) and 144.170 (SSB). These are recognised ATV calling frequencies, and 144.800 seems to be used outside Britain as well. Please try to QSY from these calling channels as soon as possible to give others a chance. The last thing we want is aggro on the air; this is supposed to be a hobby and contests ought to be stimulating and enjoyable, not a slanging match!

Ignorant operators

Talking of slanging matches (writes *R&EW*'s own Mr Angry), there still seems to be some discontent about at least one pig-headed ATVer up north who insists on transmitting high power colour TV and 70cm. This operator lives on a hilltop, not too far from Manchester, and causes untold havoc both on the 70cm band and to neighbouring broadcast TV viewers. Apparently polite deputations have failed to make him change his ways, and he is now being reported to the Radio Investigation Service. I could name his callsign here but what's the point? He has already proved what a wally he is.

Operating colour TV on 70cm is antisocial and plain illegal. I know of no amateur who has installed adequate filtering to prevent out-of-band radiation from double-sideband colour TV, and the harmonic products of the colour subcarrier extend many megahertz. Add to this recipe a non-linear power amplifier and what have you got? Wideband crud and ill-feeling for miles around from the rest of the amateur fraternity. I suppose this (so-called) amateur thinks this is clever, but it's certainly not in the 'ham spirit'. I hope he has his licence revoked!

Captain Midnight again

I feel a lot better having got that off my chest! Now let's stick with silly billies and clever dicks for a moment and wind up the story of Captain Midnight. Yes, OK, perhaps you heard he was caught but I bet you don't know how, so for the hitherto untold story read on.

Captain Midnight was the pseudonym of an American amateur who was fed up with Home Box Office's plans to scramble its satellite TV transmissions of films. Captain Midnight and several thousand other home satellite viewers had been watching these films for nothing, while HBO had not been receiving subscriptions from them. To cut out these freeloaders HBO decided to scramble its signals, and by renting out descramblers it could also collect subscriptions from the freeloaders.

This action was ruining Midnight's two and a half year old satellite business in Florida, so one night he went 'whoosh, over the top' and substituted a protest message for HBO's uplink signal. Midnight (real name John MacDougall) was caught and was fined $5,000 by a Californian court. MacDougall said he was aware of the illegality of his action but hoped his actions would bring to public attention a problem which affected millions of Americans. In addition to the fine, Judge Howard Snyder placed MacDougall on probation for a year. The hearing lasted just 10 minutes, and the relatively lenient fine resulted from plea bargaining by MacDougall.

Fine, so far so good, but how do you trace the culprit after the event? In this case an amateur with TV knowledge was able to give the authorities some valuable assistance. For obvious reasons I cannot name the amateur in question.

Applying common sense, the uplink station had to be a teleport with the capability of beaming at the satellite and it had to be equipped with more power than HBO's own uplink. These details are known to the Federal Communications Commission, and narrowed the search down to a few sites. What clinched it was the fact that this amateur recognised the character generator used to make up Midnight's message as a Chyron 3, and this together with the other facts narrowed the hunt down to just three sites in the USA.

Identifying the culprit

But to find the culprit, how do you identify him? Well, the betting is that he's an amateur, isn't it? After all, he must have the technical knowledge and be sufficiently motivated and self-assured to try a stunt like this. Yes, and he probably has the same sort of mentality as a repeater jammer; from many years of hunting repeater jammers, our hero drew up a psychological profile of Captain Midnight. He's probably a bit of an introvert, on the short side and portly, short of funds and has a technician class licence – and a grudge. Most of all he is looking for attention.

Well, I can only take this on the word of my contact, but I'm told this profile fitted Captain Midnight to a tee, right down to the technician class licence!

Obviously there were other factors which contributed to his arrest – some reports say he was overheard by a scanner enthusiast while bragging about his achievement on a mobile phone – but every bit helped.

In case you wonder how MacDougall achieved his takeover, it was because he worked nights on a freelance job at a teleport, and this gave him the opportunity to wipe out HBO. Of course, you may well have a sneaking admiration for the guy: I think I do a bit, but rules are for the benefit of us all. Aren't they? Write in if you disagree ...

More satellites

Comex Systems are well-known for their kits enabling you to build up a complete home satellite receive system (see the design in *R&EW* August '86), but they now also have a range of textbooks and instructional videotapes from the USA, which will help you get even more out of your set-up.

Some of the get-in-on-the-act-quick books on satellite TV are of dubious value, but the ones Paul Elliot offers are definitely not in this category. Unfortunately they are not cheap, but you get a lot of pages for your money. You might club together with friends to get these. A brief rundown follows: the titles are self-explanatory.

The Home Satellite TV Installation & Troubleshooting Manual (313 pages, £21); *Home Satellite TV Installation* videotape (PAL VHS, £26); *Satellite & Cable TV Scrambling and Descrambling* (257 pages, £18); *Ku-Band Satellite TV* (386 pages, £20); *Hidden Signals on Satellite TV* (234 pages, £18); *World Satellite Almanac* (544 pages, £20); and *Descrambling Circuits* (£30). These books care virtually unobtainable elsewhere and contain invaluable information. Postage is extra and I suggest you send for an order form from Comex Systems Ltd, Unit 4, Bath Lane, Leicester LE3 5BF or ring (0533) 25084.

That's it for this month but don't miss the March copy. Lots of repeaters have been licensed and I'll set out the details next time.

In the meantime keep an eye out for bright spells giving us a welcome lift (tropospheric!), and do send in some letters and photos for the column! REW

NETWORK 934

Andy Emmerson G9BUP

Well, we certainly had quite a good autumn as far as lifts were concerned, much better in fact than the previous year. I hope you managed to join in the activity, as I did (to some extent!). Being in the centre of the country I cannot hope to match the DX records some of the other operators were apparently breaking...

I heard that stations in the south-west were once again working Northern Ireland, and certainly Jersey was a popular destination for quite a few people. As ever, watch out for the signs: sustained high pressure, not much wind and a rapid temperature drop in the evening. Warnings on TV about foreign interference – which they gave this time – are a dead giveaway!

Phonepatching on 934

Phonepatches are a fascinating addition to a mobile radio system: a switch, which may be manually or automatically operated, can connect the base station through to a telephone line (which may be a normal public exchange line or a works internal extension). Mobile radio users who have this facility can then make and receive phone calls from their vehicle, using a normal two-way radio, just as if they had a proper car phone. Unlike cellular radio, though, it only works from your own base station, so you have to be in range for the phonepatch to work.

To make outgoing phone calls you need to fit your rig with a new microphone which incorporates a 'touch-tone' keypad, similar to the ones on the new tone-dialling telephones. As well as the numbers 1 to 9 and 0, you also have buttons marked with a star and square (also known as hash or octothorp), and each of the buttons makes a particular combination of two tones when you push it.

When you need to make a phone call you hit a secret code combination. If you are in range of your base station you will now get the dial tone and you can dial (or rather tap out) your call as normal. As you are on a simplex circuit you will still have to key the mike with the PTT switch as normal and say 'over' each time you are handing the conversation to your telephone partner. It is as well to explain you are on a radiophone, too! When finished you touch the hash button and the whole thing clears down and resets.

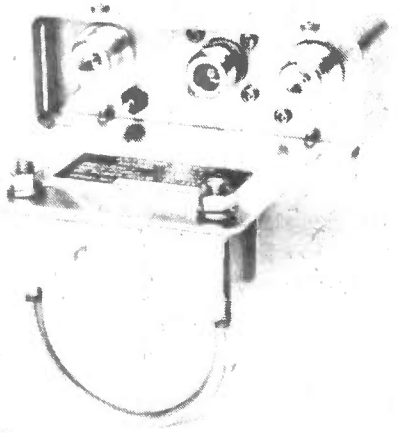
Incoming calls are heard as a ringing tone from the base station and you hit the star (or something similar) to accept the call.

Good news

Sounds great? Yes, it is a useful facility and has been available to some business users for some years. In the States (but not here) phonepatches are legal on amateur radio, and since local calls are included in the phone rental over there lots of ham repeaters incorporate a phonepatch which all can use. Well, the good news is that phonepatches are now legal on 934MHz too, and I must admit I was quite surprised when I read that the Dept of Trade and Industry and British Telecom had agreed to their use.

There are, of course, some conditions to be observed, and a number of disadvantages. Most obvious is the lack of privacy for your phone conversations, and the fact that lengthy phone conversations will tend to jam up the airwaves (and perhaps make you unpopular with other band users). Some devious people may even tape record your calls and analyse your secret access code – then they can make merry with calls charged to your phone bill.

The equipment described in the following, however, is effectively cheat-proof. More importantly, the equipment is not cheap: when you consider the complexity and limited demand for it, you will realise that this kind of apparatus cannot be knocked up in a back-street workshop for a couple of pounds. 934MHz rigs will also need additional circuitry to make them compatible.



If you want to switch between a beam and collinear antenna, a remote-controlled switch at the masthead will save the cost of two seperate downleads. A small switch beside the rig will then do the business for you, with LED lights to show which antenna is connected. Just one wire is needed between the switch and the masthead unit, and this is supplied with the control unit. Check out prices at your local 934MHz dealer

However, for business purposes the idea is a lot cheaper than cellular or other forms of radiophone, and if you need to make phone calls and don't intend to venture far from base, this would be the answer.

IQD is the answer

The manufacturer of this clever equipment is a company called IQD, well-known in the telephone interconnect business. They hail from Crewkerne in the Wess Vinglun (that's what they call it in Bristol) and their address is given at the end of this article. The following is from their technical description.

The system is configured around the Cybernet Delta One transceiver. A collaborating company, CTVR Communications Ltd of Grantham, has developed scanning equipment which for transmission finds and locks onto a vacant channel. This sends a so-called sub-audible CTCSS tone which identifies the caller as legitimate (this would in fact be impossible to imitate without very special facilities). When not transmitting, the scanner tests the channels in turn until it identifies a transmission (from your base station) with the correct sub-audible signal, which it then locks onto.

The base station radio is connected to a PABX (private switchboard) or to a normal telephone line through IQD's 'Smartpatch'. This phonepatch device decodes DTMF (dual-tone multi-frequency, or touch-tone) signals, makes a connection to the exchange, and generates dialling pulses.

The Smartpatch controls the connection at all stages. Each mobile rig is fitted with an IQD Micropad microphone with touch-tone keypad, which encodes telephone number digits into DTMF tones.

Smartpatch in use

To initiate a call the mobile user first operates the PTT switch long enough for the transmitter to find a vacant channel and for the base station to lock onto it. He then enters an access code to obtain the dialling tone from the base station; after five seconds the dial tone is interrupted to enable the caller to dial the digits of the telephone number required.

Mobile and base station lock onto a channel so long as there is transmission in either direction; if the parties wish to change to another channel at any time they can do so by maintaining radio silence for five seconds.

Smart, huh?

If this appeals to you then you will need to know the price. The Smartpatch 5700 costs £989 and the Micropad 630R keypad mikes cost £48. For the price of the modified Delta One you'll have to ask CTVR. IQD Ltd is at North Street, Crewkerne, Somerset TA18 7AR, telephone (0460) 74433. CTVR Communications Ltd can be found at Unit A3, Dysart Road Industrial Estate, Grantham, Lincs, telephone (0476) 64455.

That's it for this time: try and find time to drop me a line care of the Editor with details of any DX you worked recently. I am ready to start a league table for the best DX contacts, but you'll have to stake your claims! REW

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Mullard 5mm LED, 40 red, 30 green, 30 yellow = 100 mixed £7
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Disc/plate ceramics E12 series 1PO to 1000P, E6 Series 50V 1500P to 47000P 2p

Polystyrene capacitors 63V working E12 series long axial wires
10 pf to 820 pf – 3p. 1000 pf to 10,000 pf – 4p. 12,000 pf 5p
741 Op Amp – 20p. 555 Timer 22p
cmos 4001 – 20p. 4011 – 22p. 4017 ..... 40p

ALUMINIUM ELECTROLYTICS (Mfds/Volts)
1/50, 2.2/50, 4.7/50, 10/25, 10/50 ..... 5p
22/16, 22/25, 22/50, 47/16, 47/25, 47/50 ..... 6p
100/16, 100/25 7p; 100/50 12p; 100/100 ..... 14p
220/16 8p; 220/25, 220/50 10p; 470/16, 470/25 ..... 11p
1000/25 25p; 1000/35, 2200/25 35p; 4700/25 ..... 70p

Submin, tantalum bead electrolytics (Mfds/Volts)
0.1/35, 0.22/35, 0.47/35, 1.0/35, 3.3/16, 4.7/16 ..... 14p
2.2/35, 4.7/25, 4.7/35, 6.8/16 15p; 10/16, 22/6 ..... 20p
33/10, 47/6, 22/16 30p; 47/10 35p; 47/16 60p; 47/35 ..... 80p

DIODES (piv/amps)
75/25mA 1N4148 2p. 800/1A 1N4006 6p. 400/3A 1N5404 14p. 115/15mA OA91 ..... 6p
100/1A 1N4002 4p. 1000/1A 1N4007 7p. 60/1.5A S1M1 5p. 100/1A bridge 25p
400/1A 1N4004 5p. 1250/1A BY127 10p. 30/45mA OA90 6p. 30/15A OA47 ..... 8p
Zener diodes E24 series 3V3 to 33V 400 mW – 8p. 1 watt 12p
Battery snaps for PP3 – 6p for PP9 ..... 12p
L.E.D's 3mm. & 5m.m. Red, Green, Yellow-10p. Grommets 3mm – 1½p, 5mm 2p
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Mains indicator neons with 220K resistor 10p
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DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

As soon as the autumn leaves fall from the trees, most long distance television enthusiasts wave goodbye to any hope of further exotics on the DX bands. However, this autumn has been different, and although the main sporadic-E season has strictly ended exotics have continued to pop up out of the blue on occasion. October was no exception, and the best day for sporadic-E was the 9th when at least five unusual signals, all of them low power, came through during an intense opening from the south-east.

Tropospheric DX continued from the previous month and was present for most of the first half of October. Switzerland, Denmark, France, Belgium, the Netherlands, West Germany and East Germany were all represented during the period in Band III and at UHF.

Sporadic-E reception

Activity was noted on seven days during the month with many of the openings favouring central European countries. Iceland was an exception with two appearances – on programmes and a week later on the Philips PM5544 test pattern. Without a doubt the most productive day for signals was the 9th, when five exotics were resolved in Band I within the space of twenty-five minutes.

Kevin Jackson of Leeds was monitoring Italian programmes on channel IA shortly before 1250 GMT (there were, in fact, two stations on the same channel), and on checking E2 a similar programme appeared at 1252. This is actually a relay of RAI (Italy) situated atop Mt San Salvatore in the Ticino region of southern Switzerland. Its ERP is a mere 42W and it beams RAI 1st network programmes over Lake Lugano to the Italian town of Campione d'Italia. It's been a few years since it was last received in the UK.

The RAI reception on channel IA was replaced by transmissions from Radio-Tele-Uno which were, fortunately, showing their distinctive electronic test pattern. We have at present no exact idea of its power but it's assumed to be 1kW or less. A check on E4 revealed the Yugoslavian PM5544 sporting the identification 'JRT BGRD' at 1308 GMT. We mentioned the sighting of this card on E4 in a previous column and suggested it may have been a switching error, since there isn't a high power outlet listed for the Beograd (Belgrade) network on this channel. As this is the second sighting it can only be assumed that a new transmitter has been introduced or the output of a low power relay has been increased.

Tuning to E3, Kevin discovered another unusual Yugoslavian signal, that of Pisvir at 25W ERP showing the '-JRT SA-1' FuBK card at 1315 GMT. The final surprise came when a PM5534 card was resolved as a co-channel signal to Yugoslavia bearing the identification 'EPT' in the upper black rectangle. This originated from the low power Greek outlet at Akarnaika. Needless to say, the rest of the opening seemed rather mundane with only Spanish DX present.

Tropospheric activity

October 1st was a day to celebrate here in Derby. For the first time in almost two decades of TV DXing the Sender Freies Berlin channel E39 outlet was noted transmitting the 3rd network FuBK test pattern. Reception was in good colour and an unusual feature of the pattern was the inclusion of the time and date. A snapshot of the test pattern is shown in this month's Photofile.

On the same morning the East German 'DDR F1' colour test card was seen on E11 from the Schwerin transmitter, which is a little over 100km north-west of Berlin. Danish transmitters in Band III on E5, E6 and E7 were also present carrying the 'DR DANMARK' PM5534.

The 4th was another impressive day for tropospheric reception, especially for Kevin Jackson and Mark Dent of Leeds. The 500W Belgian relay of RTBF2, located at Brussels, was noted on channel E45, while lower down the band at channel E34 a 525-line system M transmission from the American Forces Network at SHAPE was resolved. The French 'La Cinq' transmissions, which may be doomed for closure in the near future, appeared on channels E32 and E49 during the same day.

Conditions on the 8th were again good with strong Swiss Band III and UHF signals until closedown. DX from Switzerland at UHF was also present on the 9th but at a lower level.

DX-TV log for October

This month we are featuring the log report sent in by Simon Hamer of New Radnor in Powys.

1/10/86: NOS 1 (Netherlands) E4 (Lopik); TDF (France) Canal Plus L5, 7 and 9; TDF Antenne 2 E22, 23, 39, 48, 55, 56, 62 and 65 – all tropo DX.

2/10/86: NOS 1 E4; RTBF1 (Belgium, French language network) E3 (Liege); TDF Canal Plus L5, 7 and 9 – all tropo DX. RAI (Italy) IA via sporadic-E.

4/10/86: NOS 1 E4, 5 (Roermond), 6 (Smilde) and 7 (Markelo); DR (Denmark) E10 (Vestjylland); West Germany WDR1 (Westdeutsches Fernsehen) E9 (Langenberg), E11 (Teutoburger Wald) and 30 (Nordhelle); HR1 (Hessischer Rundfunk) E7 (Hoher Meissner) and 8 (Grosser Feldberg); NDR1 (Norddeutscher Rundfunk) E5 (Kiel) and 10 (Harz West); BR1 (Bayerischer Rundfunk) E6 (Dillberg); ZDF (Zweites Deutsches Fernsehen) E34, 35 and 37; NDR3 E57 (Flensburg); HR3 E52 (Angelberg); DFF1 (East Germany) E5 (Inselsberg); TDF Canal Plus L5 (Lille). All signals via tropo DX.

7/10/86: SRG1 (Switzerland) E2 (Bantiger) with '+PTT SRG1' FuBK test pattern; RUV (Iceland) E4 (Skalafell) on *Frettir* news programme – sporadic-E.

8/10/86: SRG1 E2 on test pattern; RAI IA programmes – both signals via SpE.

9/10/86: West Germany E2 (transmitter unknown) with 'Videotext' pages; RAI IA programmes; JRT (Yugoslavia) E3 and 4 on programme schedules for the Zagreb network – all sporadic-E.

17/10/86: TVP (Poland) R2 (Warszawa); SVT1 (Sweden) E4 on 'TV1 SVERIGE' PM5534 test pattern; RUV E4 on 'RUV ISLAND' PM5544. All via SpE.

19/10/86: CST (Czechoslovakia) R1 and 2 with cartoons – SpE.

21/10/86: TVE2 (Spain) E2 (Santiago); ORF1 (Austria) E2a (Jauerling); TVP R1 and 2 – all signals via sporadic-E.

New DX-TV book

The long-awaited Babani publication entitled *A TV-DXers Handbook* is now available. Written by Roger Bunney, it is an extensively revised and enlarged edition of his previous pocket-book called *Long Distance Television Reception (TV-DX) for the Enthusiast.*

Virtually every aspect of the hobby is covered, including an expanded section on satellite TV. This book really is a 'must' for all DX-TV enthusiasts or, indeed, anyone with an interest in propagation. It's available, price £5.95, from bookshops or direct from Babani Publications, The Grampians, Shepherd's Bush Road, London W6 7NF. Sufficient postage should be added if ordered direct

PHOTO FILE ● PHOTO FILE ● PHOTO

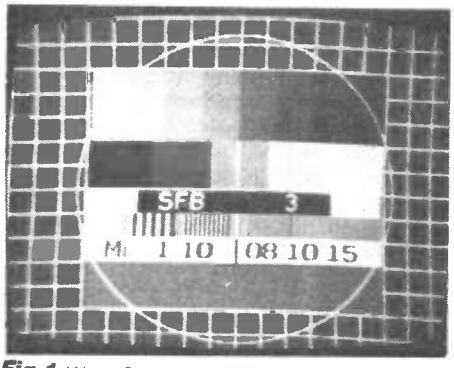


Fig 1 *West German FuBK pattern from Sender Freies Berlin on E39*

Fig 2 *American Forces Radio and TV Service ident caption received on A25 in Berlin*

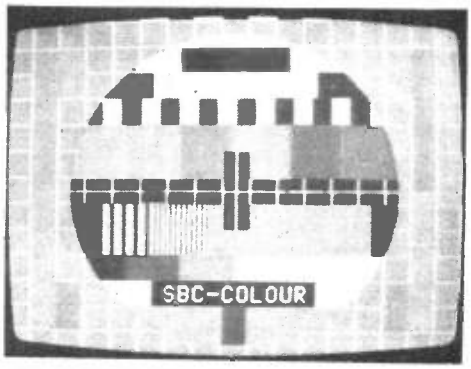


Fig 3 *Exotic PM5544 from Singapore Broadcasting Corporation on Band III*

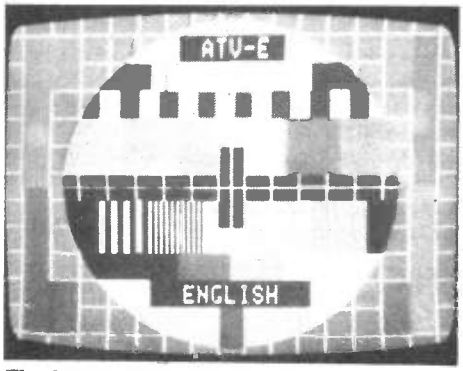


Fig 4 *Hong Kong test card as used by ATV-E, the English channel*

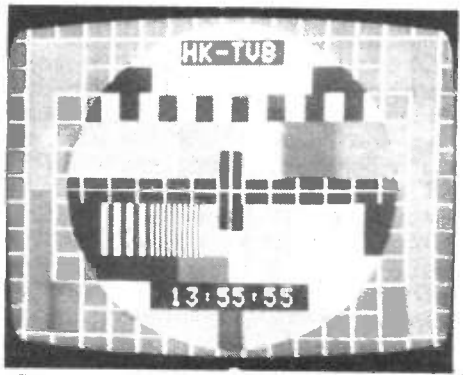
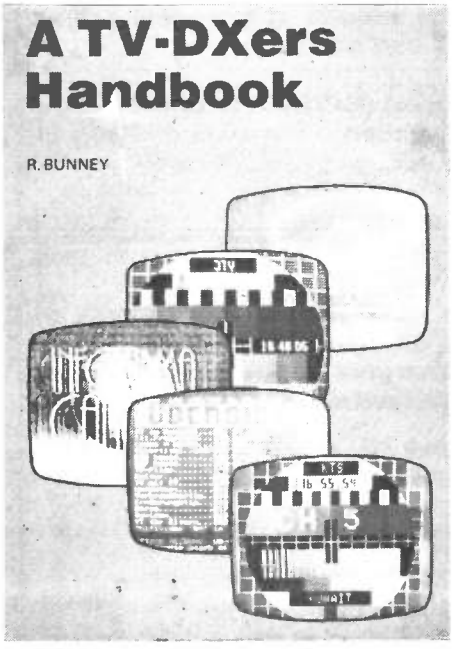


Fig 5 *Hong Kong test card, as used by HK-TVB, the Chinese channel*

Fig 6 *American test pattern spotted by Tony Harris in Florida*

from the publishers. It is also available, price £5.95 including postage (UK only), from HS Publications, 17 Collingham Gardens, Derby DE3 4FS.



Reception reports

During the early October trops Harold Brodribb of St Leonards on Sea was delighted to see West Germany on channel E9 from the Südwestfunk outlet at Hornisgrinde. The FuBK test pattern was seen with 'SWF BADN' identification. The sporadic-E opening on the 9th produced signals from central Europe which included Swiss transmissions on channel E4 from La Dôle radiating the '+PTT SSR1' FuBK test pattern.

Harold relies on the use of indoor aerials for DX reception in Bands I and III, which does tend to hamper his chances of distant exotics a little. A dipole cut to 70MHz is used for monitoring the OIRT (Eastern European) FM radio band, which lies between 63 and 73MHz. This is coupled to an RL85 communications receiver, dated 1944, which has proved a valuable aid to signal identification throughout Band I during sporadic-E openings.

Simon Hamer of New Radnor, Powys, found October 4th full of goodies during the trop opening. One of the more distant transmissions came from Danmarks Radio on channel E10 located at Vestjylland in Denmark. A foreign film was in progress during the evening with Danish subtitles superimposed. Since Simon understands the language the film was easy to follow. Many West German 1st network regions were identified during the opening, although it is interesting to note the absence of Südwestfunk. Sporadic-E was plentiful during the month with Iceland seen twice. This establishes a new record for Icelandic DX at New Radnor this year. It's been in four times!

Kevin Jackson of Leeds has received confirmation that he did indeed see the Norwegian PM5534 test pattern carrying the transmitter location 'NORDHUE' on channel E4 during the summer. We speculated (wrongly, of course!) that it might have been the 9W relay at Tretten relaying the Nordhue transmissions which originate on channel E5. NRK suggest that the most likely outlet would be Brumunddal at 8W or Vering at 3W.

They also point out that the recently introduced UHF transmitter at Gulen, radiating 1000kW, is in fact undergoing field tests by the Norwegian PTT. This is why programmes aren't aired over this channel. Testing is on an intermittent basis for the time being and the PM5534 test pattern is usually transmitted with the identification 'GULEN' in the lower black rectangle.

Mark Dent of Leeds is puzzled by a mystery ZDF station seen on channel E42 on October 5th. The only official listing of ZDF on this channel is Hogl in south-east Germany radiating at 40kW. Mark feels that this is too distant, taking into account the power of the transmitter and the strength the signal appeared on the screen. One suggestion is that it was a relay of Wesel on channel E35. This would explain why when all the other ZDF transmitters had closed down the ones on channels E42 and E35 were still active. Mark thinks they may be relayted. Two out of ten for that joke, Mark!

Canal Plus in Band I

With the rapid expansion of French Canal Plus transmissions into Band I now under way the possibility of DX reception should be even greater during the coming sporadic-E season. The Carcassonne transmitter, situated close to the Spanish frontier, and the one at Ajaccio, on the island of Corsica, have already been widely received during the 1986 season.

To recap, the French Band I channel allocations are as follows: chL2 55.25MHz vision, 49.25MHz sound; L3 60.50MHz vision, 54.00MHz sound; L4 63.75MHz vision, 57.25MHz sound.

The following Band I transmitters are known to be operating (see also *Service information).* Transmitter ERP and polarisation are included where known: chL2 Bastia (Corsica); L3 Besançon (Franche-Comte); L3 Carcassonne (Languedoc-Rouss); L3 Le Plessis Robinson (Paris-Nord) 16W ERP horizontal polarisation; L4 Etampes (Paris-Nord) 15W ERP horiz; L4 Ajaccio (Corsica); L4 Monte Brian (Rhône-Alps) 70W ERP horiz; L4 Clermont Ferrand-Ville (Rhône-Alps) 75W ERP horiz.

Our thanks to Kevin Jackson of Leeds for supplying the above information.

Service information

Jordan: All Jordanian transmissions may eventually be moved to UHF according to recent EBU information. Latest listings show 45 channels allocated throughout UHF bands IV and V with provision for a third network to supplement the existing two. It is expected that the new transmitters will replace the greater part of the present VHF allocations in the very near future. This is bad news for DXers because the 100kW E3 outlet at Suwaileh will be taken out of service.

USSR: The trend for regional or transmitter identification being included on the UEIT test pattern continues. The transmitter location 'KLAIPEDA' is now used on channels R8 and R29 which can be received in the UK during intense tropospheric openings.

Hungary: Some of the old monoscopic test cards are surviving thanks to the spread of cable television in Hungary. There are approximately 22 regional cable systems in operation. One of them at Pecs uses the good old-fashioned Marconi Resolution Chart No 1 with the service name 'VAROSI TELEVISION' in lieu of the upper grey scale and 'PECS' in lieu of the lower one. It is interesting to note that there are no transmissions from the state-owned MTV1 and MTV2 services on Mondays.

Luxembourg: Two services exist in Luxembourg. RTL transmits in SECAM colour using the French System L standard on channel E21 and in PAL colour using CCIR system B/G on E27. Both transmitters are located at Dudelange with ERPs of 1000kW. RTL Plus transmits in PAL colour on channel E7 from Dudelange with an ERP of 140kW and at UHF on channel E24 from Marnarch/Clerveaux with 20kW ERP.

France: Privatisation seems to be the 'in' thing at the moment, especially in France where the present state-owned TDF1 service will go private as from January 1st 1987. The TV5 (La Cinq) and TV6 services will finish, although these will probably be replaced by a new commercial network. Antenne 2, FR3 and Canal Plus are expected to remain unchanged.

Several new Canal Plus transmitters have recently been brought into service. These are La Roche-sur-Yon 12W ERP L4, Quimperle 1W ERP L4, Mulhouse 300kW ERP L5, Metz-Luttange 33kW ERP L5 (vertically polarised), Niort 400kW ERP (vertically polarised), Bayonne 1.5W ERP L7, Strasbourg 20kW ERP L10 (vertically polarised) and Forbach 2kW ERP on channel E28.

Our thanks to Gösta van der Linden (Rotterdam) and the Benelux DX Club (Netherlands) for supplying this month's service information. REW

The best DX-TV reports can be found in Radio & Electronics World every month. Don't miss them!

MEDIUM WAVE DXING

by Steve Whitt

Circumstance would have it that since last month's column some of the information provided has already become out of date. The medium wave band can hardly be described as standing still!

This month I have news from the Voice of America in Europe, the return of the offshore station Laser, plus some more details on special event radio in the UK. But firstly, following on from comments made by a couple of readers, I intend to take a look at what you'll hear when you tune to those North American DX stations.

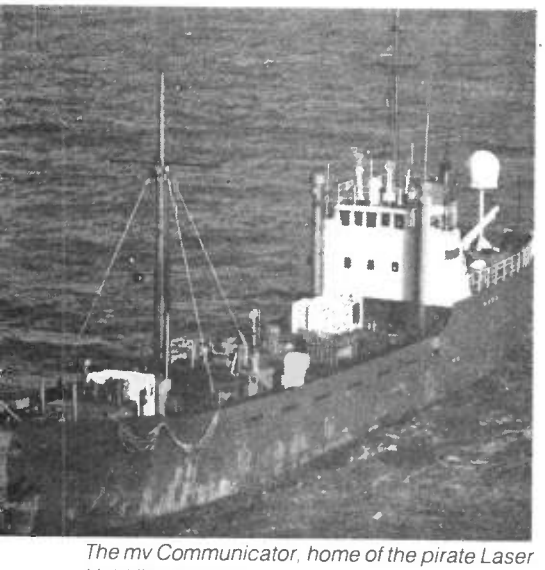
Formats

If there is one thing that characterises North American radio it is the dominance of very strict station formats. A format describes the station's programming style and, using the United Kingdom as an example, BBC Radio 3 operates a classical format whereas Radio 4 is a news and talk format station.

On the other side of the Atlantic there are over a dozen widely used formats, and it is extremely rare to hear a station that tries to mix more than one. Stations such as the ILR stations in the UK, which mix news, talk, and every musical style under the sun, are virtually unheard of.

It is not very difficult to see the reason for this segmentation; it all comes down to the sheer number of stations competing for radio audiences, each station trying to construct an individual identity for itself so that it will be recognised by the listener tuning down the radio dial. In contrast, in the UK, where very few listeners can hear more than two ILR stations or two BBC local stations, it doesn't really matter if they all sound the same, lacking imagination or individual identity.

For example, compare New York with its 17 MW stations and 20 FM stations against London with a total of just 7 stations (pirates excluded). The difference is further enhanced by the fact that, unlike in Britain, FM radio in N America does not merely carry relays of MW stations.



The mv Communicator, home of the pirate Laser Hot Hits, formerly Laser 558

A brief look at popular formats follows, together with some examples of stations on which the DXer is likely to hear them.

Album Oriented Rock: a music format that stresses the most popular cuts from current and past hit rock albums. Little news and talk. Very few on MW these days.

Progressive Rock: a variant of AOR playing 'music for music's sake' rather than for large audiences and commercial gain. Most stations are small low power college stations.

Contemporary Hit Radio: formerly Top 40, eg CJYQ St John's on 930kHz.

Rock Oldies: music, generally former hits in the era from the '60s, '70s and '80s, eg WWKB Buffalo on 1520kHz.

Adult Contemporary: the catch-all for adult audiences. Adult contemporary stations vary more widely in their music selection than any other format and often play mixes of country, pop and rock. Music is usually selected to avoid any 'rough edges', eg WNBC New York on 660kHz.

Adult Standards: tries to appeal to all adults but succeeds best with older audiences. Emphasis is on non rock music such as swing, big band and ballads, eg WMRE Boston on 1510kHz or WNEW New York 1130kHz.

Jazz: the only link between Jazz stations is their music, otherwise formats and styles vary radically. Most stations on FM.

Easy Listening: relaxing, unobtrusive music also known as 'beautiful music' or 'good music', but not to be confused with 'muzak' or other mood-control background music.

Classical: basically a fine arts format similar to our BBC R3, eg WQXR New York 1560kHz.

Urban Contemporary: includes sub-formats such as soul, disco, R&B and black music.

Country: format based on other adult formats but playing country artists. Sometimes split into 'traditional country' and 'modern country', eg WHN New York on 1050kHz.

Religious/Gospel: an adult format based on traditional gospel, contemporary Christian programming or pre-recorded preaching programmes, eg Caribbean Beacon from Anguilla on 1610kHz.

News/Talk: an information-based format including specialised programmes and phone-ins, no music, eg WINS on 1010 and WCBS on 880kHz, both in New York, and WCAU Philadelphia on 1210kHz.

Ethnic: a 'non-format' based on multilingual brokered programmes for small, non-English audiences, eg WNYM/WPOW on 1330 in New York, which carries Hebrew and Eastern European languages.

Spanish/French: an important subset of Ethnic. Spanish stations are a major force in US radio, eg WKDM 1380 in New York or WIND on 560kHz from Chicago. French radio plays an important part in Canadian broadcasting, eg CKLM Quebec on 1570kHz, which is really an Adult Contemporary station in French.

In addition there are some rather rare formats (which may turn out to be passing fads); for example there is All Weather Radio, Comedy Radio, All Horse Radio (no kidding!) and Children's Radio. Finally, as regards sport programmes this tends not to be a format in itself since many stations, of all formats, break to carry sports events.

News headlines

VOA Europe: Last month we reported the forthcoming closure of this station due to cutbacks in the budget allocated by the US Information Agency. Now, after some debate in Washington, funding for 1987 has been agreed and VOA Europe is to continue its programmes targetted specifically at a European audience. Although the existing English programmes are largely unchanged, budgetry restrictions have forced plans for a French and German service to be shelved for the time being.

VOA Europe can be heard on 1197kHz at 0000-0200, 0700-1100 and 1300-1700GMT (one hour earlier in the summer). Programmes are also carried for up to twenty-four hours per day by many FM stations (Paris, Geneva, Brussels) and cable networks.

MEDIUM WAVE DXING

Laser is back on the air calling itself Laser Hot Hits (formerly Laser 558), with a programme format similar to before. At 0300 on 16th November the *mv Communicator* set sail from Harwich, where she has been moored for the past year, leaving with full supplies on board for a 'destination of Gibraltar'. However, the *Communicator* soon took up a position close to her former moorings off the Essex coast.

Laser's North Sea neighbour, Radio Caroline on the Ross Revenge (see last month)

The ship is now equipped with three new studios, a news room and two working 20kW transmitters, although when Laser started test transmissions on 1st December they seemed to be distinctly low powered, judging by reception here in Ipswich. Look for Laser (if you haven't heard them yet) on 576kHz.

Special event radio: Further to the item in last month's column I have received information from the Home Office indicating that the closing date for applications for special event licences will be 31st January 1987. The same licensing rules as applied last year will govern the 1987 applications. The licences, which cost £450, will permit very local stations to operate for up to a fortnight at outdoor events such as festivals, county shows and sporting events.

BBC: Although BBC World Service programmes are aimed firmly at an overseas audience, they have a dedicated audience of around 250,000 people mainly in southern England where reception of the Orfordness 648kHz transmitter is possible. BBC Radio 3 has now announced that it will be relaying World Service news twice a day in addition to normal R3 news items.

This year the BBC will spend £100M on its external services, which includes a sum of £11M for the BBC monitoring services – namely those professional DXers located at Caversham near Reading.

Finally, it is interesting to compare the amount of money being spent on new transmitters by the BBC with, for example, VOA. £100M of external service money has been earmarked for new relay stations in Hong Kong and the Seychelles, whilst VOA is spending $1.2 billion on over 100 new transmitters world-wide – a big difference.

DX FILE

Since I last reported, radio conditions for the MW DXer have been rather variable and at times downright bad. Despite solar and ionospheric conditions which should have permitted long distance reception, DXing has in practice been rather restricted.

At this time of year this effect is often ascribed to an ill-defined phenomenon known as the mid-winter anomaly. Therefore not much to report, but there's no need to give up hope. Keep listening and let me know what you hear. Good DXing.

REW

Bored with a humdrum existence? Tired with a tedious life?

Fancy straying from the straight and narrow or even crossing to the wrong side of the tracks? Yes, we thought as much . . .
So what's the solution? Where's the sparkling new package to break the dreary mould? Why it's here! . . .
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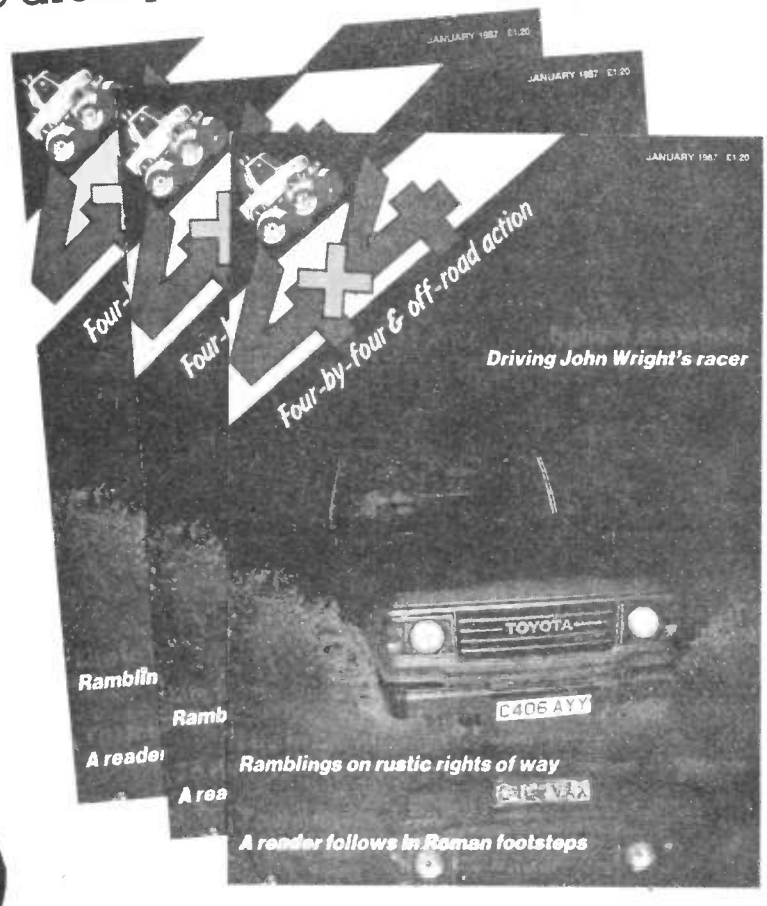
4x4 has all that's best in off-road and four-wheel-drive action. Lacking only a mushroom cloud in terms of spectacle, it's guaranteed to excite and entertain, but beware! . . . This magazine contains explicit material which some readers, especially those of a frail disposition, may find disturbing. You have been warned!



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QSO

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

Magazine exchange

There is lots of activity at the South Bristol Amateur Radio Club in the coming weeks, beginning with a photography activity evening on 28th January.

Jim G4VBU presents a lecture called 'Can I repair it?' on 4th February, followed on the 11th by a 70cm activity evening. February 18th is the time to drag out those dusty old boxes of radio magazines (you just can't throw them out, even though you'll never read them again) and take them to the club for a 'swap shop'.

An HF activity evening on the 25th winds up the club's event schedule for February.

The South Bristol ARC meets every Wednesday at the Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol BS14 0LN. For more information contact Len Baker G4RZY on Whitchurch 834282.

A classic

The Rolls Royce Amateur Radio Club (G3RR) is holding a social evening with Harry Garbick on 4th February at 8.00pm.

A month later, on 4th March, a construction contest is scheduled, so get cracking on your next piece of wonder gear.

Additionally, morse classes run every Monday at 7.30pm. The venue is the same for all events: The Rolls Royce Social Club, Barnoldswick, Colne, Lancs. Further details are available from L Logan G4ILG on (0282) 812288.

New repeater

The Stoke-on-Trent microwave repeater/beacon, GB3SE (RM3), became operational on 21st November 1986. It can be found on 1297.075MHz, and its receive input frequency is on 1291.075MHz.

When not in use as a repeater the transmitter stays on air as a beacon. Identification is by frequency shift keying at a rate of one callsign every 35 seconds, each eighth callsign being transmitted using MCW.

Repeater use is obtained by the usual method of transmitting a 1750Hz toneburst. To acknowledge the fact that GB3SE has switched from beacon to repeater, a letter 'T' in morse code is transmitted. Alternatively a letter 'H' or 'L' is transmitted if the carrier frequency on the input is more than ±5kHz from the nominal input frequency. This is followed by the repeater callsign, GB3SE in MCW. For an indication of when the repeater mode has finished (ie the through audio is inhibited), a tone of 1 second duration and 400Hz audio frequency is transmitted. The carrier will, of course, continue to radiate and the next identification callsign will be sent using FSK.

Apart from the beacon facility a number of other unusual features are incorporated. Frequency stability at 1.3GHz can be a problem, so with this in mind it was necessary to develop and build an electronic oven to house the crystal, making it possible to maintain the crystal temperature to better than ±0.2°C regardless of the exterior air temperature.

The transmit and receive frequencies are separated by 6MHz, but are frequency locked together. Thus only one crystal is used, this being shared between both Tx and Rx. Therefore, the 6MHz difference is always exact. Should the transmitter move in frequency, the receiver would move by the same amount and in the same direction, making split frequency operating much easier.

The repeater uses a phase locked loop type of audio discriminator, which has the useful feature of following off-channel signals and reproducing the recovered audio with minimum distortion (restricted only by the sides of the receiver bandpass IF filter).

At the moment GB3SE is running 6 watts ERP. The aerials in use are two Alford slots (horizontal polarisation omnidirectional). During the first 24 hours of use a total of 12 different callsigns were monitored using the repeater facility.

More information can be obtained from G8DZJ QTHR.

Packet relay stations

The DTI has given the go-ahead for the establishment of ten experimental packet relay stations.

One of the characteristics of packet transmission is that any radio station can be used as a repeater, the packets being 'labelled' with the address of the message's ultimate destination. This allows communication beyond the immediate range of a particular radio set-up, and is used in other countries. However, this particular aspect of packet communication is not allowed under the terms of the UK amateur transmitting licence, hence the need for permission from the DTI to establish experimental stations.

The project is to be administered by the RSGB, whom interested parties should contact for more details.

Mid Devon Rally

The Tiverton Short Wave Radio Club plans to hold its 1987 Mid Devon Rally on 22nd March, at the Pannier Market in Tiverton.

The doors open at 10.00am and talk-in will be on S22. Parking facilities are described as 'excellent'.

All enquiries concerning this event should go to G4TSW, PO Box 3, Tiverton, Devon EX16 6RS.

A bonny idea

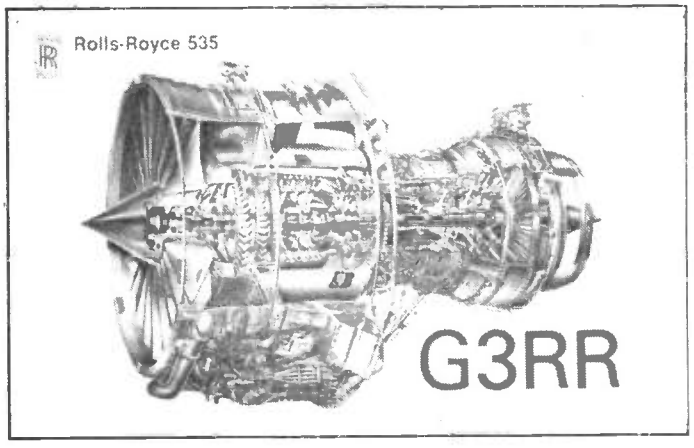
The Aberdeen Amateur Radio Society kicks off its February schedule with a junk sale on the 6th, followed on the 13th by a debate: 'Amateur radio would improve if all amateur repeaters were closed down tomorrow'. Speakers for and against the motion are invited.

A useful lecture, 'DXing on UHF/VHF with a less than average station', will be presented on February 20th by Graham Sangster GM4OBD. Last but not least, Alan Duncan takes the club's regular Beginners' Night with a talk, 'A newcomer's guide to 4m'.

The society is responsible for the WASR (Worked All Scottish Regions) award, which has been running since 1975. It is available to all amateurs showing proof of 2-way contact with one station in each Scottish region (Borders, Central, Dumfries and Galloway, Fife, Grampian, Highlands or Islands, Lothian, Strathclyde, Tayside). Contact with the Aberdeen Amateur Radio Society, GM3BSQ, may be used as a substitute for any one region. There is also an award for SWLs.

The award costs £1 or the equivalent in IRCs.

For more details of the award contact Don GM4GXD on (04676) 251.



YOUR LAST CHANCE TO WIN A CROTECH OSCILLOSCOPE!

Don't despair if you missed Brian Kendal G3GDU's history quiz last month – here's another opportunity.

The marks for each question are given in brackets, the highest possible score being 220. Entries are invited for estimated scores of 100 or more.

In the event of more than one winner, we shall arrange a special, even more difficult tie-break.

The closing date is 31st January

---

1. What had Heinrich Hertz to do with pitch? (5)
2. What was the significance of Lavernock Point and Steepholme Island? (3)
3. Why tap the coherer? (2)
4. Who was G Kemp's employer? (3)
5. What was and who invented the 'Telemobiloscope'? (5,5)
6. Which famous doctor had cause to regret the invention of wireless? (3)
7. What ever happened to the Wireless Society of London? (2)
8. What was the 'Grid Audion' and who invented it? (3,3)
9. Who was the first man to transmit a wireless signal from an aeroplane in flight to ground and where? (5,5)
10. What wavelength did Marconi use for his Salisbury Plain demonstration? (4)
11. What is a Nipkow disc? (2)
12. What was a 'Round' valve? (3)
13. For what was Paul Godley famous? (3)
14. What was and who now holds the callsign of Hiram P Maxim? (3,3)
15. Who lived at 'Coombe Dingle' and how did he affect British broadcasting history? (2,2)
16. A man whose name is well known in modern semiconductor terminology developed a four-electrode valve during World War 1; who was he? (5)
17. Who or what was 'Armstrong's nightmare child'? (3)
18. Alan Blumlein, one of the greatest geniuses in radio history, patented a device in about 1930 which did not become generally available until nearly ten years after his death, but is now used in almost every home. What was it? (5)
19. Under what circumstances did Blumlein die? (5)
20. Who is normally credited with the invention of the superheterodyne receiver? (3)
21. What was a 'Catkin' valve? (5)
22. The Marconi-Osram KT series of valves were well known – what did 'KT' stand for? (3)
23. Who manufactured the 'Melody Maker' receiver? (2)
24. Which is the odd one out: ML4, PM2, UX4, PX4? (3)
25. In what context was Mazda not International? (3)
26. Why would the Baird high definition TV system, which competed with that of EMI, have had problems giving time-checks? (5)
27. Where did the experiment take place which demonstrated to the British Government that radar was feasible? (3)
28. Before World War 2, what condition was specifically associated with amateur transmitting licences in the G2 + 3 letters series? (3)
29. Who developed what radio device at Birmingham University in 1940? (3,3)
30. When and why did World War 2 British bomber crews play with cat and mouse? (4,4)
31. Who or what were VIs? (3)
32. Who or what was Colossus? (3)
33. Why did British World War 2 bomber crews find that if Monica failed they might have to get assistance from Walter, and if so then Rebecca was no help? (10)
34. We've all heard of a Drake TR4 – but what was a TR9? (4)
35. Why should Crowborough have been proud of its Aspidistra? (5)
36. Which amateur band was the first to be withdrawn after World War 2? (3)
37. Which is the odd man out and why: Dynatron; Magnetron; Phantastron; Sanatron? (3)
38. What was Taylor Supermodulation? (3)
39. In the late 1940s, many amateurs built the 'Inexpensive Televisor' from wartime equipment. Which equipment was used and what was its original purpose? (4,4)
40. The Clapp oscillator was developed independently by a British engineer. What was his name and company? (4,4)
41. What were the operational limitations placed on a newly licenced radio amateur in the United Kingdom in 1950? (2,2)
42. What was the 80 metre 'Pond'? (3)
43. What is, or was, a Wobbulator? (3)
44. What are 1/7th second echoes? (2)
45. Using 'Q' code, encode: 'The time is'; 'What is the tone of my transmissions?' and decode: QBA?; QTE. (2,2,2,2)
46. Name two heads of state who hold radio amateur transmitting licences. (2,2)
47. What is a 'red spot'? (3)
48. The term picofarad has been in use for many years, but what was it called before? (2)
49. Loran disappeared from Top Band several years ago. What frequency does the latest version use? (5)
50. Experiments by Canadian scientists using an amateur satellite led to a major United States/USSR co-operative space venture. For what purpose is this and what is the name of the system? (4,4)

REW

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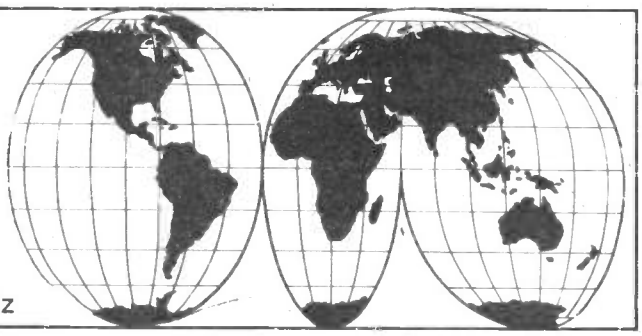

By Frank A Baldwin

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

Having completed our survey of some of the Indonesian stations currently on the air within the limits **4719** to **5500.5** in the two previous issues, we will now move on to those operating between **3204** and **4002.7** inclusive.

The Indonesian radio scene is divided into five nusantaras (networks), each comprising a main and several local transmitters covering various areas of the country. All stations are required to relay news bulletins in the Programa Nacional from RRI Jakarta.

Nusantara 1: Medan, Banda Aceh, Bengkulu, Bukittinggi, Jambi, Padang, Pangkalpinang, Palambang, Pekanbaru, Sibolga, Tanjung Karang and Tanjung Pinang.

Nusantara 2: Yogyakarta, Bandung, Bogor, Denpassar, Jember, Kupang, Madium, Semerang, Singaraja, Surabaya, Surakarta and Sumenep.

Nusantara 3: Banjarmasin, Palankaraya, Polianak and Samarinda.

Nusantara 4: Ujung Pandang, Dili, Gorontalo, Kendari, Mendado and Palu.

Nusantara 5: Jayapura, Ambon, Biak, Fak-Fak, Manokwari, Merauke, Nabire, Serui, Sorong and Ternate.

The first named in each nusantara is the main RRI transmitter.

90 metre band

DXing Indonesia on the 90 metre Tropical Band (**3200** to **3400**) is a much more difficult proposition than operating on the 60 metre band. Commercial utility interference abounds, the DXer having to constantly pit his or her operating skill against the machinations of gremlins who seemingly delight in ensuring that unintelligible noises mar many of the wanted signals. A highly selective communications receiver together with an exterior aerial array are a must if any degree of success is to be achieved on this band.

Making a start

Set the receiver on or around **3204** at 1600 when it may be possible to hear the signals from RRI (Radio Republik Indonesia) Bandung in Jawa (Java). With a power of 10kW, it is scheduled from 2230 to 0300 and from 0900 through to 1705. RRI Bandung is not often heard by listeners here in the UK, but that is all the more reason to regularly visit this channel during the season for Indonesian reception here in Western Europe, which is from September through to March.

RRI Menado in Sulawesi (Celebes) is on **3215** and is regularly logged world-wide. It is on the air with a power of 10kW from 2100 to 0150 and from 1330 to 1520 but has been reported operating irregularly around the clock.

On **3222.7**, on which frequency RRI Mataram operates from Lombok-Sumbawa in the Lesser Sundas, the schedule is from 2000 to 0400 and from 0930 to 1520 with a power of 5kW. RRI Mataram appears to alternate this channel with that of **2901**. Oh well, there is nothing quite like a conundrum enclosed within a riddle!

Frequently heard here are the transmissions emanating from RRI Bukittinggi in Sumatera (Sumatra). Nominally on **3232**, on which channel it is timed from 2330 to 0300 and from 0930 to 1655, it has a power of 10kW, but it has been reported on **3231.8** on several occasions.

In Java, RRI Banjarmasin radiates on **3249.8** (nominal **3250**). It is listed on the air from 2030 to 0215 and from 0800 to 1520 (Sunday from 2300 to 0715 and from 0900 to 1520), but has been heard programming from 1900 to 2040. With a power of 10kW, this one is only infrequently heard here in the UK.

Featured rather more often in DXers' reports is RRI Bengkulu in Sumatra. Listed on a nominal **3265**, it is actually to be heard on **3264.8**, being on the air from 2230 to 0200 (local holidays until 0300), from 0500 to 0800 and from 1000 to 1600 or on occasions to 1700. The power is 10kW, but when are the holidays?

Seldom logged

RRI Gorontalo, Celebes on **3265** radiates from 2100 to 0030 (Sunday from 2300 to 0500) and from 0830 to 1330 with a power of 10kW. The best chance of hearing this one, if such a chance exists, would be around 2200. Needless to say it is seldom heard here in the UK or Western Europe. RRI Jakarta, Java on **3276.7** carries Programa Khusus (municipal, ie locally originated programmes) from 2158 to 0100 (Sunday until 0200) and from 0758 to 1500. Programa Nacional broadcasts are timed from 1500 to 1705. The power is 1kW, hence a rating of rarely heard in the logging stakes.

In Timur (Timor), RRI Dili works to the schedule 2055 to 0030, from 0455 to 0730 and from 0855 to a variable sign-off around 1545. The power is 10kW and the frequency **3306.** A chance of logging this one will put you at the receiver controls some time from 2200 onward or from 1530 to sign-off.

RRI Jember has a power of 1kW on **3320** and works to the schedule 1900 to 0100, 0500 to 0700 and from 1000 to 1600. It has been heard transmitting on **3320.8**.

In Kalimantan (Borneo), RRI Palangkaraya at 10kW works to the schedule 2100 to 0100 and from 0900 to 1600 on **3325**. It is only seldom reported by UK DXers.

In Malaku (Moluccas), RRI Ternate on **3345** nominal, **3344.8** actual, is scheduled from 2000 to 0030, 0300 to 0600 and 0800 to 1500 with a power of 10kW. Again, a 2200 onward vigil may be necessary for this one, but beware! Co-channel with RRI Ternate – well, almost – is RRI Pontianak on **3345**. With a power of 10kW, it is on the air from 2200 to 0100 (Sunday from 0100 to 0400), from 0700 to 0730 (Sunday from 0730 to 0900) and from 0900 to 1520.

RRI Jambi, Sumatra, listed on **3355**, is on an actual **3355.3** with a power of 7.5kW from 0500 to 0900 and from 1700 to 2000.

RRI Padang on **3368** (ex **3365**) is on the air from 1730 to 2230 and from 0300 to 0600 with a power of 10kW.

Better chances

RRI Kupang, Timor with a power of 10kW is listed on **3385** from 2130 to 0015 (Sunday until 0600) and from 0900 to 1520 but is in fact on **3384.9**. Kupang on this latter frequency provides one of the best chances (but see below) of logging Indonesia on the 90 metre band, and is regularly reported by DXers worldwide.

More frequently logged than Kupang by Western European DXers are the transmissions of RRI Tanjungkarang in Sumatra. Nominally on **3395**, actual frequency **3394.9**, from 2200 to 0200 (Sunday until 0400) and from 0800 to 1700 (Sunday until 2200), the power is 10kW.

AROUND THE DIAL

Sitting comfortably? Then note the times mentioned below and tune around to the frequencies listed, whereupon some of the stations mentioned may be logged.

AFRICA

Algeria

RTA (Radiodiffusion-Television Algerienne), Algiers on **15215** at 2014, OM with a newscast of both home and world events during the English programme for North Africa and the Middle East scheduled from 2000 to 2030. On this channel Algiers radi-

ates in French from 0600 to 1030, from 1100 to 2000, from 2100 to 2200 and from 2300 to 2400, in Spanish from 1030 to 1100 and from 2030 to 2100. The power is 100kW.

Cameroon

Radio Bertoua on **4750** at 0448, OMs with a discussion in Zulu. This one is not that easily logged. The channel is beset with commercial interference, especially during the popular listening times for African stations which is during our evenings here in the UK. The schedule is from 0430 to 0800 and from 1645 to 2300 in French, Zulu and English. The power is 20kW.

Egypt

Cairo on **11665** at 1337, songs and music in the local style during the Arabic transmission for the Middle East timed from 0400 to 1800. From 1900 to 0030 there are programmes in Arabic for South Africa. The power is 100kW.

Cairo on **11905** at 0530, YL (young lady=female) with the station identification and the news in the Arabic programme for the Middle East, scheduled from 0300 to 0600. The power is 100kW.

Libya

LJB (Libyan Jamahiriya Broadcasting), Tripoli on **15415** at 1324, OM (old man = male) with a talk in Arabic in a relay of the Home Service timed from 1100 to 1500 and directed to Europe. The power is 500kW.

CENTRAL AMERICA

Honduras

La Voz Evangelica, Tegucigalpa on **4820** at 0311, OM with a religious talk in Spanish. This 5kW transmitter is on the air in Spanish from 1100 to 0500 but the closing time can vary up to 0700. The programmes are mostly religious in content.

NORTH AMERICA

USA

AFRTS (Armed Forces Radio and Television Service), Greenville, North Carolina on **15430** at 1321, YL with the station identification then OM with a news review in a transmission beamed to the North Atlantic area and scheduled from 1100 to 2200. All broadcasts by AFRTS are in English and are intended for US military personnel and their families, keeping them informed on both US and world news.

SOUTH AMERICA

Brazil

Radio Relogio Federal, Rio de Janeiro on **4905** at 0457, OM with some announcements in Portuguese, two pip time signals, sambas. Better known as Radio Relogio, this 5kW transmitter is scheduled on the air from 0800 to 0400, the minute time signals being superimposed throughout this period. Presumably the extended transmission period reported here was occasioned by a public holiday or some other special event. See also below, logged the same morning.

Radio Marjoara, Belem on **4955** at 0509, OM with a talk in Portuguese then a programme of songs and local-style music. This one radiates from 0800 to a 0300 variable sign-off with a power of 10kW.

Peru

Radio Atlantida, Iquitos on **4790** at 0216, OM with a political talk in Spanish with mentions of Cuba and campesinos (rural dwellers, ie peasants) and still talking at a 0252 retune. Logged on another occasion at 0425, OM with some promos (promotions) then the announcement "Musica Romantica" followed by music in keeping with the programme title. Radio Atlantida is often heard here in the UK and is by far the easiest of the Peruvian stations to log on the 60 metre band. The schedule is from 0900 to 0400 (Sunday from 1100 to 0430) and the power is 5kW.

ASIA

China

Xinjiang PBS (People's Broadcasting Station), Urumqi on **4330** at 1504, OM with announcements then some music and songs in the local style during a Home Service programme in Kazakh. The schedule is from 0000 to 0230, from 0530 to 0700 and from 1200 to 1700.

Yunnan PBS, Kunming on **4760** at 1540, a programme of orchestral music in the European style, heard more frequently from Chinese stations in the last few years. The Home Service 1 in Chinese is carried by Yunnan PBS on this frequency from 2150 to 0100 (Sunday until 0800), from 0250 to 0600 and from 0920 to 1600 with a power of 50kW.

SOUTH-EAST ASIA

Indonesia

RRI Padang on **4003** at 1530, OM with announcements in Indonesian, chimes then OM with a newscast relayed from Jakarta. At 10kW, RRI Padang is on the air from 1000 to 1700 and from 2300 to 0130.

RRI Banda Aceh on a measured **4954.7**, OM with what I can only describe as chants accompanied by pipe music then YL with a song in Indonesian, complete with local-style music and its occasional sound of gongs. The schedule is from 2200 to 0200 (Sunday 0200 to 0500), from 0500 to 0800 and from 1000 to close at 1600 but sometimes up to 1805. The power is 10kW.

North Korea

Radio Pyongyang on **9960** at 1430, OM with a talk in the Korean programme for Africa timed from 1400 to 1450. The English transmission for Africa is on this channel from 1500 to 1550.

Singapore

Radio Singapore on **5010** at 1530, OM with a pop song in the English language Home Service, radiated on this channel from 2200 to 0100 and from 1000 to 1630 with a power of 10kW. Also logged in parallel on **5052** (50kW).

PACIFIC

Australia

Radio Australia, Melbourne on **11945** at 0450, OM announcer with a programme of pop records in the English programme directed to South Africa from 0300 to 0500.

NEAR AND MIDDLE EAST

Bangladesh

Dhaka on **6240** at 1858, local-style music with songs in Bengali, OM with announcements and the station identification in English at 1900 followed by a newscast of local affairs and events, all in the English/Bengali programme from 1815 to 2000.

Iraq

Baghdad on **15120** at 2132, YL talk about Iraqi musical instruments and music in the English transmission for Europe, timed from 2100 to 2150.

Oman

BBC Relay, Masirah Island on **11955** at 0516, OM with a news commentary in the English language World Service, radiated on this channel from 0330 to 0530.

CLANDESTINE

An unidentified clandestine transmitter on **3920** heard at 2045, OM with a harangue in Farsi (Persian), short excerpts of military music, shouted slogans then a marching chorus. Also logged at 0307 with a similar type of programme.

Radio Iran Toilers on **9250** at 1537, OM with a talk in Farsi, heard through the accompanying jamming signal. The transmissions are in Farsi and timed from 0230 to 0300 and from 1530 to 1630.

NOW HEAR THESE

Voice of the Strait, Fuzhou, China on **2430** at 1456, Chinese music in the classical style.

Haixia 2 programmes in Chinese and Amoy are radiated from 1200 to 1800, the Amoy slots being timed from 1400 to 1415, 1445 to 1500, 1600 to 1615 and from 1645 to 1700. The power is 50kW.

Xinjiang PBS, Urumqi, China on **4220** at 1445, YL and OM with a discussion in the Mongolian Home Service. The schedule is from 1130 to 1645 and from 2300 to 0300. A relay of the Radio Beijing minority language service is timed from 1430 to 1456. The power is 50kW.

NOW LOG THESE

Kuching, Sarawak, Malaysia on **4835** at 1550, YL with a song in, presumably, Bahasia Malaysia (Malay) together with music in the local style. The Home Service in Malay and Melanau is carried on this frequency from 2200 to 0130 and from 0800 to 1600. The power is 10kW. The sign-off ceremony was wiped out by the sudden appearance of co-channel utility interference. REW

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■ AOR2002 scanning receiver + GPU5 2m collinear and GPU7 70cm collinear, £375. Icom IC-2E h/h with case and sp/mike, £125. Signal R532 air band scanning receiver complete with PSU, case, nicad pack, charger and helical, £175. All equipment in mint condition with original boxes, instructions etc. Ian G6NKB. Tel: (0509) (Leics) 502989 after 6pm

■ Maplin electronic piano, working, £100 ono. Transformers, 0-55V @5A, £10. 0-10-12-15-17V×2 @1A each, 2 off, £3 each. 0-15-20V×2 @1A each, £1.50. Toroidal 0-35V×2 @2.28A each, £6. 1000μF @150V dc reservoir capacitors, 2 off, £1 each. Panel meters, 0-50μA 4 inch, 2 off, £5 each. 0-100μA 2 inch, £3. 50 watt 8 ohm 12 inch speakers, Baker, 2 off, £10 each. 30 watt 8 ohm horns, 2 off, £3 each. Case 200 × 100 × 150mm, aluminium, new, £5. Vero G-range case, 224 × 64 × 176mm, new, £12. Gould Advance OS240 dual-trace 10MHz oscilloscope, needs good service and calibration, with manual, any reasonable offer. Magazines: *Hobby Electronics* November 1980 to December 1983 no gaps, offers. *Practical Electronics* January 1978 to November 1984 no gaps, offers. *Practical Wireless* May 1977 to December 1982 no gaps, offers. Also two HE and one PE binders, £2 each, new. All mags are bound. Prices open to offers. I Spearman, 18 Queensway, Shelley, Ongar, Essex CM5 0BN. Tel: (0277) 362197 or (0268) 22932

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■ Service manual for Fisher tuner/amp type 400-TTM. S H Bennett, 'Ashley', Lambs Lane, Lawshall, W Suffolk IP29 4PE. Tel: Bury St Edmunds (0284) 830411

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■ On/off volume squelch switch for Cobra 1486TL DX. H Hume, 17 Langton Road, Edinburgh EH9 3DA

■ Scope manual urgently required to cover Tektronix 585A Serial No 13150. I will buy or pay to borrow for copying. Please write to Peter Hatfield, 55 Elm Court, Sunbury Cross, Middlesex TW16 7DJ

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Any Video Recorder, Colour TV..... **£15.00**

State Make/Model/Type with order.
Plus £1.00 post. SAE enquiries

MAURITRON (REW)
8 Cherry Tree Road, Chinnor, Oxon OX9 4QY

* MICROCOMPUTERS
* PERIPHERALS
* INSTRUMENTATION

For fastest, best CASH offer, phone

COMPUTER APPRECIATION
Canterbury (0227) 470512
Telex: 966134

AGRIMOTORS

MERTON CB AND RADIO CENTRE
MERTON GARAGE AND POST OFFICE, MERTON.
Nr OAKHAMPTON, DEVON EX20 3DZ

OPEN 6 DAYS 9-6 LUNCH 1-2pm
(SUNDAYS BY APPOINTMENT)
SPECIALIST IN 934 MHz
SUPPLIERS OF ALL 27MHz AND 934 MHz EQUIPMENT
AMATEUR ACCESSORIES CATERED FOR
08053 200

THE SCIENTIFIC WIRE COMPANY

811 Forest Road, London E17. Telephone 01-531 1568

ENAMELLED COPPER WIRE

SWG	1lb	8oz	4oz	2oz
8 to 34	3.63	2.09	1.10	0.88
35 to 39	3.82	2.31	1.27	0.93
40 to 43	6.00	3.20	2.25	1.61
44 to 47	8.67	5.80	3.49	2.75
48	15.96	9.58	6.38	3.69
SILVER PLATED COPPER WIRE				
14 to 30	9.09	5.20	2.93	1.97
TINNED COPPER WIRE				
14 to 30	3.97	2.41	1.39	0.94
Fluxcore Solder	5.90	3.25	1.82	0.94

Please add 15% VAT. Orders under £2 add 20p.
SAE for list of copper and resistance wire.
Dealer enquiries welcome.

SPECIAL OFFER

Universal Nicad Charger with 4 AA/HP7 rechargeable batteries **£6.95** Charges any conbination PP3, AA, C and D cells

NEW Nicads available send for price list

Above items add 80p p&p goods sent by return.

CROYDON DISCOUNT ELECTRONICS (RE)
40 Lower Addiscombe Road
Croydon CR0 6AA

Radio & Electronics World

The communications and electronics magazine

SMALL ADS

This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.

RATES
per single column centimetre:
1 insertion £9.65, 3 — £9.15, 6 — £8.65, 12 — £7.75.

BEAM VIDEO

Throughout the house on Channel 36.
Price £10.50 + P&P 50p. Phone for leaflet:
Electronic Mailorder A
62 Bridge Street, Ramsbottom
Lancs BL0 9AG
Tel: 070682-3036 (24hrs)

PROFESSIONAL ELECTRONICS TECHNICIANS

Short re-training courses (3 week)

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HIGH PRACTICAL CONTENT ON ALL COURSES

Also part-time & evening courses for BTEC ONC and HNC awards or professional institutions examinations. BRITISH COMPUTER SOCIETY Part 1 (AMBCS) ENGINEERING COUNCIL Part 1 (C.Eng.)

The LONDON ELECTRONICS COLLEGE Dept,
Brompton Institute
Penywern Road, London SW5 9SU
Tel: 01-373 8721 **PRESTEL*2115495**

RADIO & ELECTRONICS WORLD SMALL AD ORDER FORM

TO: Radio & Electronics World · Sovereign House
Brentwood · Essex CM14 4SE · England · (0277) 219876

PLEASE RESERVE.....centimetres by.....columns

FOR A PERIOD OF 1 issue.....☐ 3 issues.....☐ 6 issues.....☐ 12 issues.....☐

COPY enclosed.....☐ to follow.....☐

PAYMENT ENCLOSED:..... £ —

Cheques should be made payable to Radio & Electronics World. Overseas payments by International Money Order + Credit Card

CHARGE TO MY ACCOUNT.....☐ CREDIT CARD EXPIRY DATE ☐☐☐☐

COMPANY .....

ADDRESS .....

SIGNATURE ..... TELEPHONE.....

.....

C P I

Telephone the advertising department on: 0277 219876 for details

GROSVENOR SOFTWARE (G4BMK)

AX2S Packet Radio
Dragon 32/64 and Tandy Color

A breakthrough in Packet Radio – AX25 stand-alone software in ROM cartridge, plus a built VHF 1200 Baud modem for just £99!

Full AX25 implementation with up to 6 simultaneous connections, optional beacon, and digipeater operation. HF kit available soon. Send an SAE for full details of this and RTTY CW SSTV and AMTOR.

2 Beacon Close, Seaford, East Sussex BN25 2JZ
Tel: (0323) 893378

COMPONENTS TESTER

TURNS ANY OSCILLOSCOPE WITH X-Y INPUT Facility into a valuable component Tester. TESTS all types of semi-conductors, capacitors, resistors etc. in or out of circuit and displays result on CRT. Ideal fault finding tool complete with test leads and instructions. Only £19.95 + £2.00 p&p. Send cheque/PO to:

DMR Electronics (RE)
23 Regent Street, Queensbury, Bradford, W Yorkshire BD13 1AU
TELEPHONE (0274) 882892

Computer Aided Design PCB Layout from your schematic drawings. Single and double sided. Output as either pen-plot, photo-plot or prototype PCB's. Includes component overlay, solder mask and computer drawn schematic. Further details from

TrucounT Ltd,
PO Box 11, Burntwood, Walsall, WS7 0LS, or Phone (05436) 75588

JAPANESE Ic's (PART OF OUR RANGE)

AN301 £3.50, AN7140 £2.20, AN7145 £1.95, AN7146 £2.20, BA532 £1.60, BA536 £2.40, HA1377 £2.20, HA1398 £2.75, HA13001 £2.95, LA4460 £1.80, LA4461 £1.80, LA4507 £4.25, LC7137 £2.75, M51515 £2.50, M51517 £2.80, MB3705 £1.80, MB3712 £1.50, MB3722 £3.50, MB3730 £2.50, MB3731 £3.50, MB3756 £2.60, MB8719 £3.85, STK461 £7.50, STK463 £8.40, TA7205AP £1.00, TA7222AP £1.30, TA7229 £3.25, TA7240 £2.95, TA7607 £2.95, TA7614 £2.75, TA7628 £2.95, TA7640 £1.75, UPC575 £1.00, UPC1001 £2.20, UPC1031 £1.95, UPC1158 95p, UPC1181 £1.10, UPC1182 £1.10, UPC1185 £2.50, UPC1188 £2.75, UPC1230 £2.50, UPC1277 £2.75, UPC1365 £3.60. ADD 60p POST AND PACKING AND THEN ADD 15% VAT TO TOTAL

T POWELL 16 PADDINGTON GREEN LONDON W2 1LG
OPEN MON-FRI 10AM-5PM, SAT 9AM-12 NOON.
TELEPHONE: 01 723 9246
ACCESS/VISA. TELEPHONE ORDERS ACCEPTED OVER £5.00

NEXT ISSUE ON SALE 12th FEBRUARY 1987

RF DEVICES AT ROCK BOTTOM PRICES!

Nobody beats us!

Over 30,000 RF devices at low prices

REPLACEMENT RF TRANSISTORS

MRF454 HF/SSB 80W	£18.20
MFR450 HF/SSB 50W	£11.60
MRF238 VHF/FM 25W	£12.80
MRF475 HF/SSB 20W	£2.99
2SC1969 HF/SSB 18W	£2.50
2SC2043/1307 HF 16W	£2.00
2SC1947 VHF 3.5W	£7.60
2SC1946A VHF 32W	£14.30

REPLACEMENT RF POWER MODULES

M57704/SAU3 UHF 15W	£36.00
M57712/SAV7 VHF/FM 25W	£39.00
M57713/SAV8 VHF/SSB 15W	£39.00
M57716/SAU4 UHF/SSB 15W	£49.00
M57719 VHF/PMR 15W	£29.00
M57727 VHF/SSB 38W	£45.00
M57749/SAU11 934/FM 7W	£29.00

Send £1.00 p&p and SAE for full list
All prices inc. VAT
Many Ic's and other types in stock

RAYCOM LTD
DEPT RE 584 HAGLEY RD WEST
QUINTON BIRMINGHAM
B68 0BS
021 421 8201-3
(24hr answer phone)

G4 DXX Video Electronics

For Icom, Dray, Wells, DAIWA, Datong. N934 MHz equipment, logbooks, rotators, cable, etc.

OPEN 9-5pm, Closed Wednesdays

141 Lancaster Road, Morecombe, Lancashire LA4 SQJ
Phone: (0524) 418873

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COILS AND CHOKES PREVIOUSLY MADE BY DENCO SAE PRICE LIST

8 BRUNEL UNITS, BRUNEL ROAD, GORSE LANE IND ESTATE, CLACTON, ESSEX CO15 4LU.
TEL: (0255) 424152

2 METRE COLLINEAR UVRAL X2 5/8 over 5/8

An omni directional antenna giving low angle radiation. The ideal base station vertical. Ruggedly constructed for long life.

Technical Specification

Gain	6 dB
Impedance	50 Ohms
Max Power	100 Watts
Length	3.14 metres
SWR 144 to 146Mhz	Less than 1.5
Wind Loading	4.6 Kgf at 100mph
Weight	1.2 Kgs
Mounting Diameter	25mm
Termination	Free 'N' Socket

Send cheque or postal order for £29.95 plus £2.50 postage to:

BUCKLEYS (UVRAL) LTD., BETA WORKS, RANGE ROAD, HYTHE, KENT CT21 6HG
Tel. No. (0303) 60127/60128

COUNTY GUIDE

RATES
BOXES ad sizes
20mm x 59mm single
40mm x 59mm double

Total prepayment rates	Ad space	3 issues	6 issues	12 issues
	single	£47.00	£88.00	£158.00
	double	£94.00	£176.00	£316.00

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

TO: Radio & Electronics World · Sovereign House · Brentwood · Essex CM14 4SE · England · (0277) 219876

print your copy here .....

.....

.....

.....

.....

NUMBER OF INSERTIONS REQUIRED

Single County Guide	3	£47.00	☐	6	£88.00	☐	12 £158.00 ☐
Double County Guide	3	£94.00	☐	6	£176.00	☐	12 £316.00 ☐

PAYMENT ENCLOSED £ —

Cheques should be made payable to Radio and Electronics World. Overseas payments by International Money Order

Conditions — Payment must be sent with order form. No copy changes allowed. Ads accepted subject to our standard conditions, available on request.

Registered No 2307667 (England)

C P I

ADVERTISERS INDEX

Radio & Electronics World
The communications and electronics magazine

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	⅛page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	½ page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES

colour rates exclude cost of separations

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
128 x 186 or 263 x 90	½ page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
Mar 87	15 Jan 87	21 Jan 87	23 Jan 87	12 Feb 87
Apr 87	12 Feb 87	18 Feb 87	20 Feb 87	12 Mar 87
May 87	12 Mar 87	18 Mar 87	20 Mar 87	9 Apr 87
Jun 87	16 Apr 87	22 Apr 87	24 Apr 87	14 May 87

CONDITIONS & INFORMATION

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.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

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.

Printed — web-offset.
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.

FOR FURTHER INFORMATION CONTACT
Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE
(0277) 219876

Overseas payments by International Money Order.
Commission to approved advertising agencies is 10%.

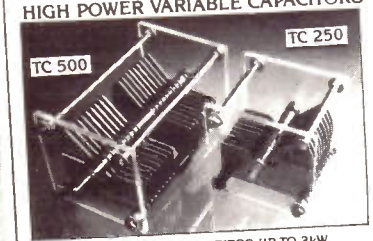
CONDITIONS
10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

TELECOMMS BUMPER CATALOGUES

CB £1
AMATEUR £1
934 MHz £1
Each catalogue is packed full of info. and includes a £2 voucher.

NEVADA AMATEUR PRODUCTS

HIGH QUALITY BRITISH MADE
HIGH POWER VARIABLE CAPACITORS



IDEAL FOR ATU's OR AMPLIFIERS UP TO 3kW

TC500 Variable capacitor
CAPACITY:- 26-500 pF
VOLTAGE:- 7.8kV Max
SIZE:- 101 x 105 x 165mm
AIR GAP:- 2mm
£28 plus £2 p&p

TC250 Variable capacitor
CAPACITY:- 13-250 pF
VOLTAGE:- 7.8kV Max
SIZE:- 101 x 105 x 88mm
AIR GAP:- 2mm
19.95 plus £1 p&p

29 MHz BASE ANTENNAS

NEVADA TC52 ½ WAVE
This top class half wave uses high grade aluminium and a low loss coil handling up to 1 KW
WIND RESISTANCE:-75 MPH
GAIN:- 2.5 dB
FREQ:- 28-30MHz
£19.95 plus £4 p&p

NEVADA TC58 5/8 WAVE
Using high grade aluminium and a low loss coil complete with small radials this antenna is our most popular amongst the 29MHz fraternity.
POWER:- 1kW
GAIN:- 3.5 dB
FREQ:- 28-30MHz
LENGTH:- 6.6 MTRS
£29.75 plus £4 p&p

SALIUT 3/4 WAVE
Using a unique base hoop this antenna offers exceptional ground wave coverage on 10 FM
POWER:- 2kW
GAIN:- 4.5 dB
FREQ:- 28-30MHz
LENGTH:- 9.1 MTRS
£59 plus £4 p&p

2 MTR EQUIPMENT

2 MTR HANDHELD

CT1600 A superbly sensitive new handheld covering 142-149MHz
- Repeater shift
- High/low power 1.5/0.5 Watt
- Thumbwheel selector

£179

Each set supplied C/W re-chargeable battery pack and free mains charger unit.

VHF MOBILE AMP

B110 144MHz 110 Watt W/Pre Amp.	£169
B42 144MHz 40 Watt	£64.66
LA05435 144MHz 45 Watt	£69.75

Full range of 144 MHz mobile amplifiers in stock see our Ham Catalogue.

RF AMPLIFIERS

All amplifiers except broadband models are tuned for 29.6MHz centre freq. Should you require a lower freq. i.e. 28.5MHz please state when ordering. Export models available for 26-30MHz.

MOBILE AMPLIFIERS

C.T.E. MOD 767 £49.90
76 Watts FM
INPUT:- 0.5-10 Watts
SWITCHABLE:- Class AB, Class C
SUPPLY:- 13.8 Volt
REMOTE CONTROL FACILITY

C.T.E. MOD 737 50W FM AM/SSB/CW	£44.76
C.T.E. MOD 767 80W FM AM/SSB/CW	£49.90
C.T.E. MOD 757 150W FM Broadband	£116.87
ZETAGI B35 25W FM 26-30MHz	£22.23
ZETAGI B150 70W FM 26-30MHz	£49.96
ZETAGI B300 150W FM (2-30MHz)	£136.00
NEVADA TC35 30W FM 26-30MHz	£23.75

MAINS OPERATED AMPLIFIERS

C.T.E. DC9 Solid State 150W FM (Broadband)	£199.31
ZETAGI B132 150W FM Solid State (Broadband)	£119.00

SCANNING RECEIVERS

C.T.E. DISCONE WIDEBAND ANTENNA £26

RECEIVE	70-700 MHz
TRANSMIT	70-500MHz
MAX POWER	500W
GAIN	3.5dB

WIDEBAND DISCONE RECEIVING ANTENNA
(3 Element) 70-500MHz

NEW BEARCAT H/HELD SCANNING RX. MODEL 100XL £24.95 £229
Receives 8 bands plus aircraft band. 16 Channels, priority keyboard lock and lighted display.
66-88 MHz 118-174 MHz 406-512 MHz

BEARCAT 175XL £209

Base receiver covers:-
66-88MHz
118-174MHz
406-512MHz
with 16 channel memory/scan

BEARCAT DX1000
COMMUNICATIONS RECEIVER

£379
Direct access communications 10KHz-30MHz with 10 channel micro-processor controlled memory

TEST EQUIPMENT

ZETAGI DL150 £85.19
RF DUMMY LOAD AND POWER METER
A very accurate unit for the service dept. or discerning enthusiast.
FREQ:- 0.5MHz-500MHz
POWER:- 150 Watt Max in 3 ranges 0-3, 0-15, 0-150W.

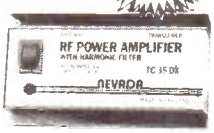
ZETAGI 500
SWR AND POWER METER
For the enthusiast who wants the very best. A twin meter unit with push button control for either 75 OHM or 50 OHM cable.
FREQ:- 3-200MHz
POWER:- Up to 2kW
£41.46

FD 1350 1.3GHz FREQUENCY COUNTER
FREQ:- 10Hz-1.35GHz
SENSITIVITY:- 43mV at 1GHz
DISPLAY:- 8 Digit
SUPPLY:- 9-12 Volt DC
£139.53

NEVADA

HIGH QUALITY BRITISH MADE 29MHz FM PRODUCTS

NEVADA TC35 DX £23.75
R.F. POWER AMP. WITH HARMONIC FILTER
INPUT:- 1-4 Watts
OUTPUT:- 25-30 Watts
SUPPLY:- 13.8V DC
FREQ:- 26-30 MHz



Can be centred on 29.6 MHz or 28.5 MHz (state which). A new top quality amp. which now features harmonic filter to reduce harmonic O/P.

NEVADA TC27 RX
RECEIVER PRE-AMP FOR 26-30MHz
A superior low noise pre-amplifier for 29MHz FM operation
Variable gain -6dB's to +18dB's suitable for use with transceivers up to 25 Watts output.
£22.34

TELECOMMS

HOTLINE (24 HOURS)
0705 662145
189 LONDON ROAD, PORTSMOUTH, HANTS, PO2 9AE.
TELEX 869107 TELCOM G

USE YOUR CREDIT CARD (AMERICAN EXPRESS ACCESS OR VISA) FOR IMMEDIATE DESPATCH

TRADE ENQUIRIES WELCOME.

WORLDWIDE DISTRIBUTORS OF AMATEUR & PERSONAL RADIO EQPT.

SAA5000A	£1.50
SAA5012A	£5.00
SAA5020	£3.50
SAA5030	£5.50
SAA5040	£3.50
SAA5040A	£5.50
SAA5050	£5.50
SAF1032p	£2.50
SAF1039	£2.00
SAS560	£2.00
SAS660	£1.00
SAS670	£1.00
SL901B	£4.50
SL918	£4.50
SAA 5052	£5.50
SAA 5043	£5.50
SAA 5051	£5.50
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	50p
TAA621	£2.00
TAA661	50p
TAA641	£1.50
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7607AP	40p
TA7609P	50p
TBA120A	40p
TBA120AS	50p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1441	£1.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00
TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA550Q	£1.75
TBA560CQ	£2.00
TBA570	£1.50
TBA625	50p
TBA641	£2.00
TBA651	£2.00
TBA673	£1.00
TBA720A	£1.50
TBA750Q	£1.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA890	£1.00
TBA900	£1.50
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.50
TBA990Q	£1.00
TMS1000NL	£2.00
TMS1943 clock chip	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS9716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2216	75p
SN29848	50p
SN29770BN	£1.00
SN29771BN	£1.00
SN29772BN	£1.00
SN7402N	£1.00
SN7472N	£1.00
SN74107	£1.00
SN74167	70p
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76013ND	£1.50
SN76018	£1.00
SN76008	£1.00
SN76023N	£1.50
SN76033	£1.50

Diodes

BY127	10p
BY133	10p
BY134	10p
BY164	50p
BY176	25p
BY179	40p
BY184	25p
BY187	10p
BY190	40p
BY196	30p
BY198	10p
BY204/4	8p
BY206	8p
BY208/800	8p
BY210/400	5p
BY210/800	10p
BY223	60p
BY224/600:4.8A/ 600v bridge	£1.00
BY226	15p
BY227	15p
BY228	20p
BY229/400	30p
BY237	5p
BY254	10p
BY255	30p
BY298	10p
BY299	10p
BY406	8p
BY527	20p
BY407a	10p
G11 470M/250V SP	£1.00ea
Min 12 volt relays	75p
R1038	40p
R1039	40p
R2009	80p
R2010b	£1.00
R2029	50p
R2210	60p
R2257	60p
R2265	50p
R2305	50p
R2306	50p
R2322/2323	pair 80p
R2323	15p
R2396	50p
R2461	60p
R2030	50p
R2443 BD124	40p
R2737	40p
R2738 TIP41	30p
R2775 TIP41c	40p
R3129 TIP47	40p
S2008b	80p
2SC940	£1.00
BU 105/04	80p
BU 108	£1.00
BU 124	50p
BU 126	80p
BU 180a	65p
BU 204	70p
BU 205	£1.00
BU 206	£1.00
BU 207	£1.00
BU 208	80p
BU 208 on heat sink	70p
BU 208A	£1.10
BU 208D	90p
BU 222	£1.00
BU 326	£1.00
BU 407	60p
BU409	60p
BU 426V	60p
BU 500	£1.10
BU 508A	£1.20
BU 526	75p
BU 705	£1.00
BU 807	£1.00
BU 824	£1.00
BU 826	£1.00
BUW 84	30p
BUY 71	£1.00
TIC 106A	30p
TIC116m	40p
TIC 116n/Y 1003	35p
TIC 126N	40p
TIC 206m	30p
TIC 225S	40p
TIC 226E	40p
TIC 226m	30p
TIC 236m	30p
TICV 106D (T092 case 2A/400V)	10p
TIP 29	20p
TIP 30	35p
TIP 30A	35p
TIP 30B	40p
TIP 30C	45p
TIP 31	30p
TIP 32	25p
TIP 33B	50p
TIP 33C	70p
TIP 34A	50p
TIP 34B	60p
TIP 34C	70p
TIP 35B	50p
TIP 35C	70p
TIP 35D	80p
TIP 36	50p
TIP 36C	70p
TIP 41B	40p
TIP 41D	70p
TIP 42/BRC 6109	30p
TIP 48	40p
TIP 49	30p
TIP 57	30p
TIP 100	30p
TIP 102	30p
TIP 112	30p
TIP 115	50p
TIP 117	50p
TIP 120	35p
TIP 125	35p
TIP 130	30p
TIP 131	25p
TIP 136	30p
TIP 140	50p
TIP 640	50p
TIP 2955	35p
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p
T 6052	40p
T 9004	40p
T 9005	40p
ZTX 102c	10p
ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
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8V/79M08c	30p
+6V/78M06c	30p
+10v/78LA10	20p
LM 337	30p
LM 342/18	30p
LM 340T 5.0	50p
+12V/LM 340T12	50p
+15V/78M15	15p
-18V/MC78M18	20p
-24V/78M24	30p
MC 7724cp	40p
MC 7824	40p
TIS 90	10p
TIS 91	20p
TIS 92	20p
TIS 93	20p
U 19885	40p
U 3832	15p
U 3845	15p
MR 508	10p
MR 501	10p
MR 502	10p
BCW 71R	30p
BYF 1202	10p
BYF 1204	10p
BYF 3126	40p
BYF 3214	40p
BYX 10	6p
BYX 36/600	35p
BYX 38/300	25p
BYX 49/600R	75p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYX 71/350	20p
BYX 71/600	50p
BYX 72/300	20p
BYX 36/600	50p
BYV 95B	10p
BVY 95C	12p
BYZ 106	10p
BPW 41	15p
BYW 56 2/A1000v G11	8p
BZU 15/24	54p
BZY 93c75	50p
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p
BZX 79 3v	10p
BC414	10p
BC416	10p
BC440	30p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	10p
BC559	10p
BC635	10p
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BCX32/36 pair	75p
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BD244	50p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD332	20p
BD373b	20p
BD416	25p
BD433	25p
BD437	25p
BD439	50p
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3C115	10p
3C116	10p
3C117	20p
3C119	20p
3C125	10p
3C126	10p
BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC183	10p
BC184	10p
BC204	10p
BC207	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC239	10p
BC250	8p
BC251	10p
BC252	10p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC328/338 pair	15p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
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AC138	15p
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BD562	30p
BD610	40p
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BF157	20p
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BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
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