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- Raycom RF Amplifiers 1-3W input

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- IC PM56B matches IC 735 £165.00

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  - HBCBCV 70centimetres £3.99
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- REVCO (British Made) £12.50

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**PRODUCT NEWS**

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

Readers, don’t forget to mention Radio & Electronics World when making enquiries.

---

**DIGITAL MULTIMETERS**

Levell Electronics Ltd have added two digital multimeters to their product range, the 540 and the 540T. These instruments permit accurate measurements to be made at low cost. Leading features are 2,000 hour battery life, and clear 3½-digit liquid crystal displays with 0.3in high characters.

The ranges covered are 200mV to 750V ac or 1,000V dc, 200μA to 10A ac and dc, and 20 ohms (or 200 ohms) to 20MΩ. The instruments also have a continuity buzzer test and a diode test range. The diode voltage accuracy is ±0.25% of reading ±1 digit and input impedance is 10MΩs. A transistor gain range is also incorporated in the 'T' version.

Cases are moulded in high impact ABS plastic, 170 × 87 × 42mm, weighing only 343gms. A tilting stand is provided for bench use.

The multimeters are priced at £37 + VAT for the 540 and £39 + VAT for the 540T.

Levell Electronics Ltd, Moxon Street, Barnet, Herts EN5 5SD.
Tel: (01) 449 5028.

---

**HIGH-RES MULTIMETER**

A new high-resolution 4½-digit multimeter from MS Components offers a basic accuracy of 0.03% and a total of 28 ranges: dc voltage and current up to ±1200V and 10A respectively, ac up to 750V and 10A, and resistance up to 321Ω cover the majority of application requirements.

Two additional functions provide frequency measurement, accurate to better than 0.008% from dc to 4kHz, and a diode testing facility.

Powered by six C-cells, the unit has an input impedance of 10MΩs, switchable to 100MΩs to reduce circuit loading below 32V.

Measurements are displayed on a 9mm high LC display with over-range and low battery warning indication and automatic zero and polarity functions.

MS Components Ltd, Zephyr House, Waring Street, West Norwood, London SE27 9LH.
Tel: (01) 670 4466.

---

**MEASUREMENT KIT**

Accurate and reliable electricity supply measurement has now been made possible using the new three-phase power measurement kit from the Response Company.

The kit comprises a three-phase solid state power meter, 3 clip-round 1000A current transformers and 4 quick-fit voltage leads. The Responder 3 meter, together with all fixing leads and operating manual, fits neatly into a specially designed shoulder-strap carrying case. The kit weighs barely 5.00kg.

The measurement kit provides comprehensive analysis display and registration of kW, kVA, kWHR, kVAR, kWh, kVVAR and kVARH, all to 1% resolution and with a range of 1000A down to 2A per phase.

The Response Company Limited, 77 Wates Street, Winchester, Hampshire SO23 BEY.
Tel: (0962) 67287.

---

**VDU-SCOPE**

Electronic & Computer Workshop Ltd claim that service engineers working with CCTV and a wide range of computerised equipment can significantly reduce the number of instruments and items of test equipment necessary by using a new combined instrument, the VDU-oscilloscope.

The Crotech 3339 combines a dual-trace 30MHz oscilloscope with a component tester and a fully 625-line compatible VDU.

The VDU function allows the test engineer to monitor all types of standard composite video lines (1V p-p) and its built-in zoom facility can be adjusted to give resolutions of up to 15 division horizontally and 20 division vertically. This gives a screen of up to 64 characters wide.

Using this capability the engineer can test a range of CCTV circuits and video output lines. Another application is with computerised equipment, where the 'scope can be used to test a range of digital and analogue lines.

The instrument offers two 30MHz channels, with a sensitivity of 5mV per division and sweep speeds to 0.2us per division. A range of display modes is available, including X-Y, and trigger facilities are sufficiently versatile for many types of measurement application.

The Crotech 3339 VDU-oscilloscope is available from ECW at a price of £669.30, including post-packaging.

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

---

**LOGIC PROBE**

The Thander TP1 logic probe and TP2 logic pulsar are tools for checking both TTL and CMOS circuits.

The TP1 can show fourteen different circuit conditions and can detect pulses down to typically 10ns.

The TP2 can inject a signal directly into a circuit without damaging sensitive components. Together they can stimulate and monitor responses of components in circuit, greatly aiding fault finding.

They retail at a price of £23.00 each plus VAT.

Thander Electronics Limited, London Road, St Ives, Huntingdon, Cambs PE17 4HJ.
Tel: (0490) 64646.

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MS Components Ltd, Zephyr House, Waring Street, West Norwood, London SE27 9LH.
Tel: (01) 670 4466.

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Electronic & Computer Workshop Ltd, 171 Broomfield Road, Chelmsford, Essex CM1 1RY.
Tel: (0245) 262149.
Both contact and non-contact measurements of rotational and linear speed can be taken with the new digital tachometer from MS Components. This compact, battery-powered, hand-held instrument covers speeds from 50 to 20,000 rpm in two switched ranges. Indication is by means of a 4½-digit LED display and is accurate to ±1 digit.

Non-contact readings can be taken at up to 1 metre using the basic instrument or the optional optical sensor where visual access is limited. Contact readings can be taken using an optional extension sensor, which can be fitted with an rpm cone or a choice of two linear speed conversion discs, giving readings in feet or metres per minute.

The instrument is supplied complete with reflective tape, batteries and carrying purse.

MS Components Ltd, Zephyr House, Waring Street, W Norwood, London SE27 9LH. Tel: (01) 670 4466.

An ac-to-ac power supply which enables simulation of power supplies anywhere in the world is the latest addition to the range of power conversion units offered by Systron Donner. The model ACTS 500 is an ac test station providing up to 500 VA of output power which may be infinitely varied in any combination of frequency and voltage over the ranges 40 Hz to 1500 Hz and 80 to 280 V.

The ACTS 500 will find many applications among design and production engineers needing to test products designed for military and export markets. It will also be invaluable for all electrical and electronic facilities needing to check line regulation and tolerances on ac line powered devices.

The unit is protected against overload, short circuit and inductive surges on the output, and also against over-temperature conditions and failure of supply rails.

Thorn EMI Measurement Ltd, Systron Donner Division, Archcliffe Road, Dover, Kent CT17 9EN. Tel: (0304) 202 2620.

A device designed to take the frustration out of positioning and using screws and nails, known as Handigrip, has been introduced by Display Tiling Services Ltd.

Handigrip is a small plastic handle which holds the nail or screw in a patented jaw. This allows the fastener to be accurately positioned before driving into any horizontal or vertical surface.

Handigrip is available in three sizes to suit a wide range of screws and nails, from the smallest panel pin through to heavy duty wood screws.

Handigrip is available through hardware stores, DIY outlets and garage shops. A pack containing a pair of each size and retailing at a recommended price of 69p including VAT will be the standard unit.

Display Tiling Services Ltd, Level Street, Brierley Hill, West Midlands DY5 1TZ. Tel: (0384) 263123/45.

A new data logger, Vela, from the Data Harvest Group can achieve a high degree of speed, accuracy and convenience in scientific measurements, while eliminating the need for numerous cumbersome instruments.

At the heart of Vela is a powerful microprocessor, equipped with fifteen permanently stored, EPROM-based programs which cover transient recording, data logging, timing, pulse counting and waveform generation. More than 60 additional programs for measurement and monitoring are also available. Vela also includes features such as: the analysis of stress in structural members; the logging of breaking point/plastic point; the monitoring of growth of fractures; the measurement of operational life of emergency lighting systems; the analysis of engine exhaust; and a host of other general monitoring and transient recording tasks.

The unit simply types the appropriate two-digit program number onto the integral keyboard, then enters a parameter and runs the program.

Vela can be used as a portable instrument (with the assistance of an external power source) as well as an 'intelligent' fixed interface to computers.

Vela can be powered from a wide range of supplies including rechargeable cells. Battery-backed CMOS memory ensures data retention in the event of power down. The introductory cost of the system is £375.00.

Data Harvest Group, 28 Lake Street, Leighton Buzzard, Beds LU7 6RX. Tel: (0525) 373666.

Most products based on standard Eurocard housings require a small degree of front panel customisation to house the system's controls and user interface. To facilitate the development of this, a new prototyping front panel is now available from BICC-Vero Electronics.

The prototyping front panels are from the KME range, and are supplied in a basic unfinished state with only the triple 'Dee' panel-fixing holes and the normal ident sight hole. The kit contains ten panels and a full complement of handles, idents and screws, together with drilling details for the normal handle positions.

BICC-Vero Electronics, Unit 5, Industrial Estate, Flanders Road, Hedge End, Southampton SO3 3LG. Tel: (04892) 5824.
### ECONOMIC DEVICES

**Tel:** 0902-712083 **Telex:** 338490

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**REGISTERED OFFICE:** THE COACH HOUSE, MUXTON LANE, TELFORD - NO CALLERS

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**ECONOMIC DEVICES. TEL: 0902-712083**

**Telex:** 338490

**All goods should be delivered within 4 working days.**
**PRODUCT NEWS**

**LINEAR AMP**
Now available from Walmore Advanced Components Limited is a new 1GHz linear amplifier/detector with a 500MHz bandwidth and a 15ns rise time.

Manufactured by RHG Electronics Laboratory Inc, the model ICE1000 is designed primarily for radar and other applications requiring high speed IF processing. This new device, which incorporates a built-in 20dB dynamic range ac coupled video detector, offers 60dB of gain. The video output is capable of driving 93 ohm loads to 2.2 volts nominal.

Walmore Electronics Ltd, Laser House, 132/140 Goswell Road, London EC1V 7LE. Tel: (01) 251 5115.

**AC DRIVEN RELAY**
A new miniature ac driven relay has been introduced by Italian manufacturer Feme and is available in the UK from Quiller.

The Feme relay is intended to provide a low cost alternative to the present dc driven devices, and eliminates the need for design and layout of rectifier circuits. Space saving without the dc power source is quite considerable.

Switching up to 16 amps, the ac relay can be supplied in c/o, n/o or n/c configuration and can operate over a voltage range of 6-240V ac.

Quiller Ltd, 85 Stanley Road, Bournemouth BH1 4SD. Tel: (0202) 303424.

**934MHZ GEAR**
Selectronic has now introduced a new 934MHz hand-held transceiver, the MT370, which features 20 channels, 10 memory channels, full scan facility, a high performance RF output, good audio quality, a high capacity battery pack and a half-wave whip antenna. It is available for £459 including VAT.

The company also has a new range of 934MHz accessories.

Selectronic, 203 High Street, Canvey Island, Essex. Tel: (0268) 691481.

**ANTENNA COUPLER**
The Amcomm 9000 antenna coupler is a development of the Amtech 300, now incorporating a 1:4 toroidal balun to permit connection of a transmitter to an antenna via 300 ohm balanced feeder.

The antenna coupler utilises a capacitively tuned T network for matching high impedance (300 - 600 ohms) or low impedance (50 - 75 ohms) antennas to low impedance transmitter outputs. It is general coverage and will tune over the range 1.7MHz to 30MHz. Selection of frequency range is by means of the inductor switch.

In operation the tune and load capacitors are adjusted to obtain minimum VSWR at the transmitter. The components in the antenna coupler are rated for operation with power outputs of 100 watts.

Low impedance connections are made via PL259 sockets. High impedance balanced feeder connections are made via insulated screw terminals (red and white).

Amcomm/ARE, 373 Uxbridge Road, Acton, London W3 9RN. Tel: (01) 992 5765/6.

**SWITCHED ON**
Tratec, the Dutch satellite product manufacturer, has introduced the TCS-10, a coaxial switch to be used in the 950-1750MHz satellite IF frequency.

The upgraded switch includes what the company call ‘spectacular features’. Specifications include a return loss of better than 20dB, an insertion loss of 0.3dB and isolation of 90dB.

Tratec BV, POB 385, 3900 AJ Veenendaal, Holland.

The price for the antenna bracket is £23.50 plus £6.50 postage and packing.

Brian Lee, 31 Marton Avenue, Farley, Pudsey, West Yorkshire LS28 5DX. Tel: (0532) 567642.
NEW KENPRO MODEL

Hi-Tech Worldwide Ltd have introduced a new Kenpro model to complement the KT200/400 series.

The unit has the following features built in as standard: 24 hour LCD clock, CTCSS sub-audible tone encode (decode optional) DTMF touch-tone with 2 autodial memories, battery economiser on receive (in standby mode), 4 scanning mode/functions, channel spacing steps programmable from 5kHz to 100kHz, 5 watts RF output with 12.8V Nicad, 10 memories with scanning and lockout facility, 144-148MHz coverage expandable for export versions, direct frequency access with programmable switch-on call channel.

The unit incorporates the latest receiver front-end JFET low noise devices with a good sensitivity and blocking performance, quality recovered audio, clear Tx audio from the built-in electret microphone and easy to fit optional accessories such as speaker mic. It also has a built in dc jack for operation without the Nicad pack.

The KT220EE costs £209 (prices may vary owing to fluctuating exchange rates).

Hi-Tech Worldwide Ltd, 584 Hagley Road West, Oldbury, Quinton, Birmingham B68 0BS.
Tel: (021) 421 8001.

RECEIVE SOFTWARE

Technical Software has announced that the RX-4 Multimode Receive Program, which can receive Morse, RTTY, Amtor and slow-scan TV without needing any expensive hardware, has now been completely improved, with improved performance and many new features added.

An advantage with this software is that all four modes are in the same program, only needing one key-press to change mode.

On CW there is a choice of software filters as well as a wideband decoder capable of reading at over 250wpm. The autotrack facility is controllable up to the maximum speed and can also be locked completely.

RTTY and Amtor have selectable unshift-on-space and switchable normal-reverse polarity. Tuning these signals is easy and accurate, as the on-screen frequency scale displays the tones directly. RTTY has four baud rates and decodes any shift automatically without switching. Amtor also reads many commercial TOR transmisions.

The SSTV can display 8, 16 or 32 second frames and good pictures are obtained even in the presence of some noise. The grey scale (picture brightness) can be adjusted from the keyboard and the picture storage allows you to over-write one stored frame with a better one, if required, thus making much more efficient use of the available memory space.

All received text is stored as well as printed on the screen. Stored text and pictures can be recalled to the screen, dumped to a printer or saved on tape or disc.

The Spectrum version needs no hardware at all, connecting directly to the Spectrum's Ear socket. The BCB-B, C6M64 and Vic 20 versions use the same interface as the RTTY/CW transceive program. For CW and RTTY they can also use a suitable terminal unit.

The program costs £25 on tape, £27 on BBC or CBM format disc, and the interface is £5 as a kit or £20 ready-made with all connections.

Technical Software, Fron, Upper Llandrorg, Caernarfon, Gwynedd LL54 7RF.
Tel: (0286) 881886.

LOWE-DOWN

New products from Lowe Electronics include the Trio TS440S HF transceiver (£350 inc VAT); the Trio TM2550E 2m FM mobile rig (£399 inc VAT); the Trio TR751E 2m multimode mobile transceiver; the JRC NRD525 general coverage receiver; and the Trio SWC3 remote head for the SW200 meter (£30.20 inc VAT).

Lowe Electronics Ltd, Chesterfield Road, Matlock, Derbyshire DE4 5LE.
Tel: (0629) 2817.

MOBILE TRANSCEIVER

ICS Electronics Ltd have announced the new ALR-206E 25.5 watt mobile transceiver.

This compact unit has an easy to read back-lit LCD frequency and S-meter readout with the same programmable features as the company's ALM-203E handheld transceiver introduced at the end of 1985. These are accessible from a keypad on the rear of the microphone.

Programmable features include: band scan; 10 memory channels; and memory scan. Frequency selection is by means of a large front panel knob or from the microphone up/down buttons. A mobile mount is included as standard.

The price of the ALR-206E is £229.00 including VAT plus £3 post and packing.

Also available from ICS is a complete 30W 2m hand-held system, consisting of the ALM-203E and a separate 30W FM amplifier with a 100dB gain GaasFET pre-amp. The price, including connecting cable, is £249.95 including VAT, plus £4 postage and packing.

ICS has also announced that the ISO144 2m isopole antenna is again available at a price of £39.95 including VAT, plus £2.50 postage and packing.

ICS Electronics Ltd, PO Box 2, Arundel, West Sussex BN18 ONX.
Tel: (0243) 912688.

RX MODIFICATION

RWC Ltd have announced a modification for the Yaesu FRG9600 scanning receiver.

The standard frequency range of 60-905MHz has been extended to cover up to 945MHz (940MHz guaranteed) with adequate sensitivity to cover the 934MHz range.

The modification also includes improved receiver sensitivity and 'S' meter recalibration.

Customers who purchase the FRG9600 at RWC can have the modification fitted at no cost, (including existing customers). Owners of the FRG9600 can have the modification and the other improvements fitted for £25 including VAT and return post. They are warned, however, that the warranty will be affected on sets not supplied by RWC.

Further developments are in progress, with a low frequency option under way to enable operation below 60MHz. It may also be possible to include additional bands to be fitted in 20MHz increments.

R Withers Communications Ltd, 584 Hagley Road West, Oldbury, Quinton, Birmingham B68 0BS.
Tel: (021) 421 8201.
from the software package computer, the dongle is interrogated under instructions from the software package and transmits a decryption key, which can be millions of bits long, into the computer to enable the software to be decrypted. Unless the correct key is used the package will not run.

The serial port can still be used in the normal way, the dongle acting merely as a passive connection, once the software has been authorised.

The SSS is available for £22.50.

Data Encryption Systems Ltd.

**DONGLE DESIGN**

**WILD VISION**

Wild Vision, the Newcastle based electronic vision company, has launched the Hawk V8, a low cost, high performance real-time image processing system for the BBC microcomputer.

The Hawk V8 consists of a single PCB mounted inside the BBC micro and an image processing software package. Video images from a camera are digitised in real-time and stored directly into the graphics display memory of the computer.

The direct memory access method used provides a system with a performance comparable to high-speed framestores, yet at a fraction of the cost. Moreover, the use of the computer's internal memory means that much higher processing speeds can be achieved.

Wild Vision, Mari House, 20-22 Jesmond Road, Newcastle-upon-Tyne NE2 4PO.
Tel: (091) 281 7861.

**SPECTRUM 128**

As expected, Sinclair launched the new Spectrum 128 onto the UK market during February (a similar machine has been available in Spain since before Christmas). It features, of course, 128K of RAM, with 32K of ROM, and will retail at £179.99.

The most notable features of the Spectrum 128's hardware, apart from the added memory, are the RS232/MIDI-out port and the keypad interface (both software driven), and the RGB/composite video output. It retains the earlier Spectrum's cassette port, TV output and expansion bus. There is, somewhat surprisingly, no joystick port.

There is also a 3-channel sound chip, which means no more weedy beeping, and a RAM disc file system usable from Basic. This latter means that some of the on-chip memory can be used for data storage in the same way as a disc is used. Access to such data is virtually instantaneous (and therefore much faster than disc).

The built-in software ('firmware') includes 48 Basic for those who want it, but has in addition a new 128 Basic with a full screen editor and on-entry syntax checker. 'Tape Loader' and 'Tape Tester' facilities will help with loading programs from cassette.

The new Spectrum 128 is claimed to be fully compatible with earlier Spectrum software, so there is already a massive amount of software available for it.

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**ICS presents the brilliant ALINCO**

**2 METRE TRANSCEIVERS**

**ALR-206E** 25 WATTS 2 METRE MOBILE

- 144-146 MHz FM
- 25 watts output
- 10 memory channels, band scan
- All programming from keypad on microphone
- Back lit LCD frequency display with LCD S meter
- Frequency selection from front panel or microphone
- Mobile mount included

The ALR-206E features micro processor controlled versatility and programming from the microphone in a compact package.

ALR-206E Price £285 inc VAT. (p p £2.50)
Isople 144 omni-directional antenna: Price £39.95 (p p £2.50)

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**ALM-203E 3/5 WATTS 2 METRE HANDHELD**

- 144-146 MHz FM
- 3 watts with NiCad, 5 watts with DDC converter
- 10 memory channels
- Programmable band scan
- Switchable 150-160 MHz Rx (marine band)
- S meter
- Toneburst
- NiCad charger

ALM203E Price: £239 inc VAT (p £2.50)

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OLIVETTI PCs

Olivetti is demonstrating an increased commitment to the business computer market with plans for the introduction of three new IBM-compatible computers. The M19, M22 and M28 are being launched during April, with availability being forecast for the second quarter (M19, M28) and the end of the third quarter (M22). P

Over the last two years Olivetti has seen its share of the European PC market double, so that it now stands at an estimated 11.7%, and the company is the foremost competitor to IBM in international terms, other companies competing only in their home markets.

The new machines will complement Olivetti's current range of M24 series models, which have gained an excellent reputation since they were introduced. When designing the M24 Olivetti sought to compete with the IBM PC on the grounds of performance, giving a higher specification for a roughly comparable price (not difficult, some would say, given the IBM PC's lacklustre design, its success in becoming a de facto standard being a result more of IBM's sheer size). Some other companies have taken a same performance, lower price' attitude, with Epson, for example, offering a basic IBM-compatible PC for £777. Lately such competition has resulted in companies like Olivetti reducing their prices as well.

Of the new machines, the M28 has the highest specification. Based on an 8086 processor running at 8MHz, it is claimed to be 30% faster and 25% smaller than the IBM PC AT. It is equipped with 512K of RAM as standard, expandable to 1MB on-board and to 7MB using the expansion slots, and uses a 20MB hard disc drive.

The M28 also caters for those requiring a multi-user system. A serial multiprotocal board can be fitted, allowing the machine to support four extra workstations, and Olivetti has announced full

SATELLITE SYSTEMS

Now available in the UK through Skidmore 4WD Ltd are the Superwinch satellite antenna control systems. Superwinch are known in the States for their good quality vehicle-mounted electric winches, and have applied this experience in building a robust actuator for satellite dishes.

The actuator employs a ½ horsepower motor to provide a 2000lb thrust rating through solid steel motor gears. Much attention has been given to weatherproofing.

Two indoor control systems are offered. The manual version provides a 3-digit read-out of dish position, with two buttons to control movement.

The programmable controller also has the 3-digit display and a manual facility, but also offers 16 preset positions. Both consoles have lock and key security so that the dish may be left pointing at a particular satellite or between satellites.

The outdoor actuator unit is available separately for those who might have requirements other than for a total system.
Racing ahead

The RACE project (Research in Advanced Communications for Europe) has entered its Definition Phase, the first part of a major programme to establish a pan-European advanced wideband telecommunications network by 1995. RACE is the second major project to be launched by the Information Technologies and Telecommunications Task Force, which was set up by the Commission of the European Communities in 1983, when ESPRIT was agreed. ESPRIT (European Strategic Programme of Research and Development in Information Technology) is a five year co-operative project in basic research involving industry, universities and research organisations.

The RACE Definition Phase involves the issuing of research contracts to a total of 109 different organisations, including telecommunications administrations, manufacturers, broadcasters and universities, who will work together through the Task Force and organisations such as ECTEL, the manufacturers' body, and CEPT.

Since the call for proposals last September the Task Force has moved at a break-neck pace, and all the contracts had been negotiated by the first week of March. Some had even been signed by the New Year, with work by now well under way.

The Definition Phase will run for 18 months, by which time the requirements of the Europe-wide telecommunications infrastructure will be established. The areas to be covered include the transmission of text, graphics and video as well as voice, and the digital technology involved means that control software will play a major part in the project. The ultimate goals include such services as videocovering and high quality flat screen television.

The speed and degree of co-operation achieved result from the appreciation by all concerned that only such a united effort can compete with the economic muscle available to the Americans and Japanese. A standardised European network would offer a home market of comparable size to that available to these foreign competitors, thus giving the cost benefits of community scale production.

New videotex standard

Prestel, British Telecom's public videotex service, is backing a new European protocol for data transfer on videotex systems.

The proposed standard has been developed by the European telecommunications technical standards organisation, CEPT, for inclusion in the new European videotex terminal standards.

While enabling information to be displayed on a videotex terminal, the new standard will allow data to be used for other purposes, for example the remote control of computer peripheral systems such as printers, and downloading of telesoftware with automatic error detection and correction.

The biter bit

It is unfortunately the case that advertisers sometimes cause offence or indignation because of their wording, although this is usually unintentional. Hence the following extract from a letter sent in by J S Paton G6RAZ of B &J Telecommunications of Thornbury, near Bristol, referring to Scarab Systems' ad in the February issue:

"The opening paragraph of this reads 'Have you had your appetite whetted on cheap ineffective programs from part-time software writers?...' I must defend my own part-time interest in B &J Telecommunications and point out that all software marketed by ourselves is written by professional software writers, eg Ham Tel, Grosvenor Software and Pearsons Computing, and that these programs were selected by ourselves as being the best available for each of the computers concerned.

'B &J Telecommunications manufacture hardware to support these programs and were forerunners in the use of the XR2211 IC in the receive side of RTTY terminal units. As far as the Spectrum computer is concerned with audio input, our audio tone processor not only filters both tones but also buffers and amplifies to give up to 5V output from signals as low as 100mV. This has been designed around the G1F1TU program but will greatly enhance the performance of any audio input system and must not be confused with cheap single tone filters. The logic of this (pun intended) is that you do not need 599 signals and can run audio inputsystems from the record output of many receivers.'

I must agree with Mr Paton that 'part-time' does not necessarily mean 'unprofessional', and the software companies he mentions are known for the quality of their products. However, to be fair to Scarab Systems it must be pointed out that their criticism was directed at those purveyors of 'cheap and cheerful' software who offer utility programs which have not been thoroughly debugged or are rather inelegantly written.

While the quality of such offerings can vary from excellent to laughable, a prospective buyer has little chance of determining the quality before purchase. It is probably wise to rely on an established reputation (ie a company such as B &J Telecommunications or Scarab Systems), but, as the saying goes, you pays your money and you takes your choice.

Mobile radio

The DTI has announced that licences for nationwide private mobile radio networks in Band III will go to GEC and

A flexi-rigid circuit board produced by Flexible technology, a company recently acquired as part of further expansion by Cambridge Electronic Industries
the consortium led by Pye Telecom. The two other contenders were Motorola and National Radiophone. The Pye consortium intends to form a company to operate the network which will be jointly owned by Pye, Racal, Securicor. Investors in industry (3i) and Digital Mobile Communications. It is interesting to note that Racal and Securicor are rivals in the field of cellular radio (Racal operate the Vodafone service and Securicor, in conjunction with BT, operate Cellnet).

A common technical standard has yet to be agreed, but the provisional start-up is given as January 1987. The networks will use the technique of trunking (essentially, automatic allocation of channels) to give users quicker access than would otherwise be available.

The prime users of the networks will be truckers, coach and taxi firms, etc. In addition to the two nationwide networks there will also be a number of regional networks, and in this area the relative lightweight National Radiophone will operate services in London, Birmingham, Merseyside and Scotland.

It seems to have attracted a lot of interest, and Maplin are consequently devoting greater resources to this area.

The MPS quarterly price list is sent free of charge to all customers, and is also available at the five Maplin retail stores. Further details are available from Doug Simmons on (0702) 552961.

**Digitally assisted television**

Digitally assisted television (DATV) is a new concept proposed by BBC research engineers. DATV involves the transmission of analogue picture signals together with high data rate digital signals carrying control or supplementary information about the picture. One application of DATV might be to reduce the bandwidth of a high-definition television (HDTV) signal so that it can be accommodated within a single DBS channel, previously planned for 625-line television services.

DATV is a bandwidth compression technique intended for use with high quality television signals. The essential role of the digital component in DATV is to provide the receiver with control information to assist in reconstruction of the picture without significant degradation in quality compared with the original.

One example of the use of the digital component of DATV is to carry information about which parts of the picture are moving and which are stationary; several bandwidth reduction techniques rely upon such information being available in the receiver. Another example is to carry data to help in the reconstruction of a sequentially scanned picture where, to save bandwidth in transmission, the signal has been converted from sequential scanning to interlaced scanning.

Early results from the experiments at the BBC’s research department at Kingswood Warren indicate that the DATV concept can offer HDTV picture quality in the home, even when the bandwidth of the signal has been reduced by a factor of between two and four.

DATV can also be used to improve the performance of 625-line television systems which have associated digital capacity, such as the MAC/packet family of transmission standards. However, when used to improve 625-line systems, there would be less freedom to exploit the DATV technique compared with its use to facilitate the transmission of HDTV systems using more than 1000 lines.

**More Maplin**

More news from Maplin concerns their wholesale operation, Maplin Professional Supplies, set up in 1985 to cater for the professional, trade, industry and educational customer.
ANY for driving an external speaker, to simply plug in and convert your previously dedicated computer. Made by a major UK company for only £4.95, it consists of a HIGH QUALITY COLOUR TV SET with two line choice, moulded case, containing ALL electronics (input, power supply etc.) firmly plugged into a HIGH QUALITY COLOUR TV SET, giving a netted audio sound. The central processor (the ALEPH) has an integrated 4 Watt amplifier for full sound. The operation is guaranteed by a 75p BOC! cheapest colour monitor ever. Price £9.95.

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COLOUR & MONOCHROME MONITOR SPECIALS

SYSTEM ALPHA 14 'COLOUR MULTI INPUT MONITOR' Made by a major UK company for only £9.95, this professional computer monitor offers a wide range of future requirements. Two video inputs, R/G/R and PAL Composite Video allow direct connection to a VCR or RCA jack, including our very own TELEBOX. An internal speaker and audio amp may be connected (not supplied). Dimensions: 675 x 275 x 300. B.C. colour, 100% contrast and audio controls for Composite Video input. Price £9.95. Included in price is full 90 day guarantee. Used units are supplied in excellent condition. Guaranteed.

DECCA 16 'COLOUR monitor. R/G/R input. The central processor allows us to offer this special price for a colour monitor at such a low price. Our input, including all electronics (input, power supply etc.) are firmly plugged into DECCA 80 series colour monitor. R/G/R input. The new DECCA 80 series colour monitor allows us to offer this special price for a colour monitor at such a low price.

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GOLDFeld of 140 monitors. Made by S.E. Labs for BT this two part system. Manufactured to RECOMMENDED quality for the market, this unit features quality construction with dual cassette system, R.S.232 interface and printer port.

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Don't forget, ALL TYPES and QUANTITIES of electronic surplus purchased for CASH
By the end of 1985, the four country Scandinavian NMT-450 cellular network had a total of 218,000 subscribers. The country breakdown was Sweden 76,000, Norway 63,000, Denmark 46,000 and Finland 33,000. With a total population of only 22 million, the average number of cellular subscribers per 1,000 Scandinavians is now 9.7 (or just under 1%).

The highest cellular penetration is in Norway, where in December '85 there were 15.4 cellular subscribers for every 1,000 Norwegians (1.5% of the population).

The NMT-450 network first came into service in Norway and Sweden in late 1981. The annual sales growth for all four countries combined was: 1981 - 3,000; 1982 - 29,000; 1983 - 43,000; 1984 - 59,000; 1985 - 84,000.

Today's Scandinavian NMT network uses 6,900 channels, 903 cells and 9 mobile switches. Subscribers can roam freely within any of the four Scandinavian countries. A 900MHz expansion is being planned. This will relieve congestion in the major city areas. The first NMT-900 cells are scheduled to be operational by late 1986 in Helsinki, Stockholm and Oslo.

Cellular services will be extended to Greenland and the Faroe Islands during 1986/87.

No to 900MHz

The UK's two cellular network operators, Cellnet and Vodafone, have both been experiencing overload problems in the densely packed central London area. The UK's 900MHz TACS cellular network has been operational for just over a year and the subscriber total is now just on 55,000, many of these being in the London area.

The success of cellular radio has resulted in an overcrowding of the spectrum in London. At busy times of day it can be difficult to obtain a line and users can be cut off during calls.

More channels

The DTI were asked for an additional 400 channels in the 900MHz band. Each network operator currently has 300 25kHz duplex channels, which together occupy 890-905MHz and 935-950MHz. The remaining unallocated 400 channels (905-915MHz and 950-960MHz) have been reserved for the Pan-European digital network. The UK government is reluctant to allocate extra 900MHz frequencies because this would weaken efforts to involve the UK in the Pan-European digital cellular system.

Cellular subscriber growth (in percentage of population terms) has been faster in the UK than anywhere else. After just over one year's operation, the subscriber bases of the two operators are for 31,000 Cellnet and for 24,000 Vodafone.

Vodafone, which claims to cover over 50% of the UK population, has 4 mobile exchanges (London, Birmingham, Manchester and Glasgow) in operation, 125 sites, 250 cells and 1,500 voice channels.

New service

The DTI has reportedly issued a draft specification for trunked Personal Radio Services (PRS) to operate in a 1MHz slot alongside the current 934MHz CB allocation. The UK's 934MHz CB segment is tucked in just below the 935-960MHz cellular base-station band. The 40 channels of the proposed trunked PRS would lie between 933 and 934MHz. This frequency means that communication is automatically set up on a clean channel. Frequency selection is dynamic (by the use of a calling frequency and a signalling procedure) and is not under the control of the user.

Switzerland already has operational PRS using the whole of the 933-935MHz band. PRS is seen by many as a reliable short range business communications medium for small local businesses that do not require and cannot afford the services offered by other mobile services. Being both trunked and at 900MHz, PRS is noise-free when compared to the clutter of 27MHz!

French revolution

Up until last year, TV broadcasting in France was relatively simple and easy to understand. There were three state-owned channels (TF1, Antenne 2 and FR3) which, after the closure of France's old 819-line VHF channels, reached their audiences via an entirely UHF transmission network, consisting of over 400 transmitters and 6,000 repeaters.

France's fourth channel, Canal Plus, is an over-the-air pay TV service. The French government has a major stake in Canal Plus through the state-owned publicity giant, Havas.

Canal Plus started transmissions in late 1984 on a mixed VHF and UHF network. Unlike the UK, where four channels could be squeezed into the UHF band, in France this did not prove possible, so Canal Plus has had to make do with a hybrid VHF/UHF network.

Canal Plus VHF transmissions use Band III frequencies liberated by the close down of the old 819-line black and white network. During its early months of operation, Canal Plus suffered a slower than projected subscriber take-up rate, but recently announced the signing up of its 800,000th subscriber. Canal Plus transmissions are encrypted.

Channels 5 and 6

However, apart from the four TV channels already in operation in France, there are now two other new national TV channels which planned to come on air in late February. There is also a project for a new cultural channel. All this is in addition to the forty new local TV stations.
planned as part of the liberalisation of broadcasting in France.

It was just over a year ago that President Mitterand gave the green light for France's two national private TV channels. The announcement last November that the fifth channel, the first fully private channel after TF1, A2, FR3 and Canal Plus, was to be given to a group of investors which included the Italian private TV entrepreneur, Silvio Berlusconi, provoked a major political storm in France, with the opposition threatening to disband the new commercial channel if, as is widely expected, it gains a majority in the National Assembly in the March general elections.

The go-ahead for the second private channel (France's sixth TV channel) was given in late January. The sixth TV channel will concentrate on music programmes and, like the fifth channel, was due to come on air before the end of February.

Eiffel Tower dispute

The political controversy surrounding the new TV channels is spilling over into broadcast engineering. The two new channels wanted to install transmitters on the Eiffel Tower to cover the Paris area. The four existing TV programmes each use Paris' famous landmark as their main transmitter site for the city (TF1 Ch25, Antenne 2 Ch22, FR3 Ch28, each with 700kW ERP at UHF and Canal Plus on VHF Ch06), but the bill that would allow the new channels to use the Eiffel Tower site was ruled as 'unconstitutional' by France's Constitutional Council.

Bitter arguments were still raging only weeks before the new channels were due to open. The operators of the new TV channels were complaining that if they were forced to use a site other than the Eiffel Tower, then their potential audience in the Paris area would be drastically reduced. TV antennas in the central Paris area all point towards the Eiffel Tower.

Channel Sept

Final decisions on how France's seventh (state-run) TV channel will be organised have still to be announced. A start up budget allocation of 300m francs has already been made. The seventh TV channel, which will be cultural, will use one of the four transponders on TDF-1, France's DBS satellite now scheduled for launch in November. The new seventh channel will also be transmitted over the FR3 terrestrial network while awaiting the launch of TDF-1.

France's DBS bird, TDF-1, has suffered further delays. Arianespace has again had to put back the launch date. The failure of Ariane flight V15 last September (which included the loss of what was to be Europe's third Eutelsat communications satellite) has delayed the launch by three to four months.

Within the last 18 months there have been many major and controversial changes to the whole framework of TV broadcasting in France. How broadcasting further develops, or even if it continues to develop in the same direction, will only become clearer after the elections in March.

Another chance

The Home Office, which is responsible for the broadcasting policy in the UK, plans to ask the IBA to advertise for operators for three new high-power DBS TV channels for the UK.

The IBA, which would be the regulatory body for the DBS project, is expected to advertise the franchises in the national press soon.

The UK's previous attempt to launch a DBS project collapsed last June, when the consortium (Club of 21) formed by the BBC, the Independent TV companies and five non-broadcasting bodies decided that the risks were too great. One reason then given for the collapse was the UK government's insistence on the use of a British satellite.

UK Home Secretary Douglas Hurd said in Parliament at the end of February that contractors planning to offer DBS services would not be precluded from buying a foreign satellite, if necessary. Then we'll have a foreign satellite sending us foreign programmes interspersed, no doubt, with adverts for foreign goods. But at least it will still be called UK-DBS!
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AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

In our January contribution to this feature we drew attention to the efforts being made by David Dodds GM4WLL to get more activity going on the 4 metre band. It was proposed that Wednesday evening be made a special 70MHz activity night. This has now been changed to Tuesday evening to fit in with 70MHz activity organised by G4SEU.

Throughout 1986, the callsign GB4MTR will be used for operations from thirteen different stations, each in a different county. The callsign will be used on most amateur bands, depending on the equipment available at the operating station. It is hoped that these operations will include 70MHz operation and that 4 metre operators will make either two-way contacts, crossband contacts or send in SWL reports. An award will be available, details of which can be obtained by contacting G4SEU, 49 Lincoln Avenue, Nuneaton, Warks CV12 0HR (see please).

So far the callsign has been operated from G4VOZ in Leicestershire in January, G4ENA in Gloucestershire during February, GW4H7K in Gwent during March and G4ENB in Bedfordshire during April. Further volunteers are required for the project and anyone interested should contact G4SEU.

Oscar 10

Having reached its most southerly orbital position at the beginning of March, the slow precession of Oscar 10's orbital plane is now bringing its apogee back to the north, when it will reach its most northerly latitude early in 1988. Its south to north passage takes about 22 months. It crosses the equator in January 1987.

The aurora

About a year ago we reported a dramatic 'fade-out' of radio signals which affected pretty well all of the HF amateur bands. At the time we commented that such sudden fade-outs are quite frequently associated with solar cycle minimum times - a state which we are experiencing at present.

Another such fade-out occurred over the first weekend in February. On the Sunday, there was an almost total blackout of the HF amateur bands. The ionospheric disturbance was accompanied by outstanding auroral displays and excellent auroral propagation conditions. The latter gave the VHF DX enthusiasts a real field-day!

Contacts were made from this country with most other European countries on the two metre band and the new 50MHz (six metre) band provided some good DX conditions, producing much excitement among those who have just got going on this band.

Auroral propagation is an interesting form of VHF propagation, occurring when the ionosphere above the polar regions of the Earth becomes highly ionised through unusual solar activity. Streams of electrified particles are injected into space from the sun and travel towards the Earth, where they encounter the Earth's magnetic field. This deflects the stream of particles towards the north and south poles.

In equatorial regions the Earth's magnetic fields run parallel to the surface of the planet, whereas at the magnetic poles they come down toward the poles and are thus vertical to the surface. Hence they have more influence on the ionospheric layers, and if severe enough produce such effects as the aurora.

There are two types of solar phenomena which produce these streams of particles. There are the so-called 'flares', which are related to sunspots, and 'coronal holes', which are areas of diminished solar magnetic field from which electrically charged particles escape in the form of jet streams. Both sunspots and coronal holes rotate with the sun, so their effects have a cyclic periodicity, provided of course they do not cease to exist before they are due to appear again, having done all the way around the sun.

After major ionospheric storms it often takes about three weeks or so for conditions to improve, which is about the time it takes for the 27 day cycle of the sun's rotation. If the sunspots or coronal holes are still in existence then poor propagation conditions will re-occur.

Beacons

Amateur radio beacons have been in existence for quite a long time now. The original idea was to provide a means, in the days of home-built receiving equipment for VHF use, for checking such gear out. Later on, with the advent of commercially produced VHF/UHF receiving equipment this requirement ceased, so they became a means for checking propagation conditions and for carrying out propagation research studies, particularly in the fields of sporadic-E, tropospheric and auroral propagation.

They were very useful too when provided for bands such as 10 metres, which became little used due to the vagaries of their characteristics, as indicators of whether the band was open or not.

The first beacon to be established was GB3IGY, which as its callsign suggests was operated for radio propagation studies during the International Geophysical Year, 1957/8. This was established for 144MHz band studies and was located in Kent.

As the value of these beacons became apparent more were established, both in this country and elsewhere. Those in this country are controlled by the RSGB and new ones will only be licensed if a genuine need and proof of their value to a sound scientific project can be put forward. An example of such a need was for investigations into the 50MHz band characteristics before it was released for amateur use.

Phase 3C

The next amateur radio satellite in the Phase 3 series is nearing completion, as teams in West Germany and the United States progress with the project. The anticipated launch is in August this year from an Ariane 4 launcher. However, slips in the Ariane 6 launch last January may push the actual launch of Phase 3C into September.

At the Phase 3C integration facility in Golden, Colorado, AMSAT technicians have carried out the all important thermal/vacuum tests. These tests are crucial in determining if the spacecraft is flight ready, the combination of heat and vacuum duplicating the environment in space in which the satellite will operate. Components in the spacecraft will thus be under as much pressure as they will be in space, and any suspect component can thus be replaced.

The two back-up battery packs have been mounted and the primary battery pack has been fitted with its cells. The individual cells in the main battery pack

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have yet to be wired together.

The helmet bottle mounting bracket gave some problems. A couple of dimensional errors in the components of this bracket made it necessary to re-machine parts and move mounting holes, which had to be done without disturbing other spacecraft systems.

The ionospheric 'F' layer

Long distance radio communication using frequencies below about 28 to 30MHz occurs as a result of bending of the radio waves in the ionosphere, a layer between about 50 to 200 miles above the Earth's surface, where free ions and electrons exist in numbers sufficient to affect the direction in which radio waves entering it will travel. This layer of ionisation is produced by the ultra-violet radiation from the sun.

In fact there are several layers, designated the 'E' layer, the 'D' layer and so on, but the one of most significance to radio amateurs is the 'F' layer. It is about 175 miles high at night, at which height the air is so thin that the recombination of the ions only takes place slowly.

During daytime the layer splits in two, designated the 'F1' and the 'F2' layers at heights of 140 and 200 miles respectively. The maximum distance for single-hop propagation via the 'F' layer is around 2500 miles.

It is interesting to recall how these ionised layers became designated by letters of the alphabet in the way they are. Soon after Marconi had managed to send radio signals across the Atlantic in 1901, attempts were made to explain how it was that these electromagnetic waves, which were known to travel in straight lines like light waves, could have been bent round the surface of the Earth in their travels from one side of the Atlantic to the other.

A physicist named Heaviside in England and another in America named Kennelly almost simultaneously suggested that there must be some sort of reflector in the upper atmosphere which reflected the waves downward. Heaviside's name is usually given to this hypothetical reflector rather than Kennelly's for the reason that Heaviside wrote an article for the scientific journal The Electrician, but it was rejected! Later on, in 1912, a radio physicist called Eccles wrote a paper on the effects of the ionised upper atmospheric layer on radio signals, and knowing of Heaviside's rejected article went out of his way to call the layer the Heaviside Layer, the name which is still used today.

Still later, as knowledge of the structure of this reflecting layer developed, it was realised that there was not only one reflecting layer, but several. One of the investigators whose name became associated with the work was Appleton.

He discovered that there was in fact another layer above the Heaviside Layer, and this layer became known as the Appleton Layer to start with.

A more objective way

However, supposing there were other layers? Would it be sensible to go on calling them by the name of the person who discovered them? It was decided to adopt a more objective way of naming them. The part of the atmosphere responsible for reflecting radio waves would be called the ionosphere, and the layers within it would be designated by letters of the alphabet, starting from the bottom. To leave room for possible undiscovered layers above and below the known ones, Appleton called the Heaviside Layer the 'E' layer and the one he had discovered the 'F1' layer.

So far, apart from a vague region below the 'E' layer called the 'D' region, and dividing Appleton's layer into two layers, viz the 'F1' and the 'F2' layers, no further layers have been so designated.

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OS79 May 1986
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Surveys show that the vast majority of video recorders are used mainly for 'time-shift' programmes that are recorded off-air, for playback at a more convenient time. The one thing that the new owner of a video recorder soon learns, however, is that it won't provide more hours in the day for TV watching, and I wonder how many of these timed recordings are in fact subsequently watched.

Also, how many people can actually understand the instructions that come with their recorders? Modern recorders offer very sophisticated timed-recording facilities, often allowing the viewer to record many different programmes at different times over a period of up to a fortnight, or to have individual episodes of a favourite soap opera recorded every night for a week.

Understand how it works

Unfortunately, most viewers never take the trouble to learn how to make full use of the timer facilities and restrict themselves to being able to record just one programme, finding this sufficient for their everyday purposes. Installation engineers say that the only people who make use of the full range of the timer facilities are teenage children, and many a return call to a customer with a new VCR can be avoided if the installer makes sure that the children of the family understand how it all works!

Another problem with timed recordings is that the broadcasters don't always keep to their published schedules, which can lead to great disappointment when the film doesn't start until later than the published time, and you find that you have recorded all but the last ten minutes of it and will never know who dummied it. These problems are not restricted to our own backward shores, and to help overcome them the Germans have designed a much simpler system of controlling timed recording sessions. The VPS (Video Programme System) switching system has been developed by the West German broadcasting organisations, in conjunction with their version of BREMA, the ZVEI, and has been operational since the autumn of last year.

With VPS each programme carries a teletext-like coded label on line 16 of each picture, and when the information on the transmitted label matches the information that has previously been put into the recorder, and not before, the programme will be recorded. At the end of the programme the recorder will switch off until it recognises another label for a programme which it has been asked to record. Therefore, the actual time at which the programme is transmitted is unimportant, since the VCR will not start until it recognises the label at the beginning of the required transmission.

If the broadcasters would co-operate by putting 'off' and 'on' labels at the start and finish of advertisements, the VPS system could even allow films to be recorded without recording the so-called 'natural breaks', but I guess that sound commercial reasons will be found for preventing this!

For some years now the West German broadcasters have been carrying bi-phase coded data at a rate of 2.5Mbit/s on line 16 of each TV picture, one of the so-called Insertion Data lines. This data is used to provide source identification, remote control of the network, identification of stereophonic sound channels, and for the transmission of test measurement results. The VPS labels for each programme item are carried in four bytes of the data transmitted on line 16, which have up until recently been spare, these being bytes 11-14. The comparator in the home video recorder continuously checks to see if the label information decoded from bytes 11-14 of line 16 matches the information that has previously been programmed into it by the viewer.

Automatic selection

The system allows for the automatic selection of label-controlled or timer-controlled operation of the VCR, so as to cope with programmes that haven't been labelled. The use of the timer can allow the recorder to wait for a label only during a particular time slot, perhaps half an hour before and an hour after the expected transmission time, thus minimising power consumption.

The actual inputting of instructions telling the recorder which programmes to record and when can be done in several ways. Since the labels contain the month, date, hour and minute of the programme's starting time, plus the code for the programme source, it is easy to use the remote control handset to insert the required information when prompted by a message on the television screen.

Even easier is to wipe a simple 'light-pen' over the bar-codes that are printed in the programme journals. Merely passing this pen over the codes for all the programmes you would like to record sets up the required labels without any further action on the viewer's part, and this is bound to make life much easier for the non-technical.

Many engineers will wonder why the Germans are not making use of the standard teletext transmissions for tape recorder switching purposes, since the IBA demonstrated that such a scheme was practicable back in the late 1970s. At that time the intention was to use
automatic teletext-controlled switching to allow UK schools' broadcasts to be transmitted during the night. The UK teletext standard, on which the German teletext system is based, actually contains a pseudo row address in magazine 8 specifically for this purpose. When challenged with this, the German engineers say that the lower data rate of VPS, 2.5Mbit/s compared with 6.9375Mbit/s for teletext, leads to a better error rate, with simpler error detection and clock regeneration, resulting in a more reliable system.

Reliable transmissions

This all sounds theoretically fine until you remember that the teletext system was not adopted until large numbers of tests had shown that the 6.9Mbit/s transmissions was reliable over a whole range of different terrains, including that of Bavaria. It also seems strange to introduce yet another decoder circuit into the receiver, now that teletext is available on millions of receivers.

A more plausible reason for not adopting a teletext-based system, if you disregard commercial reasons of the 'not invented here' variety, is that the federalist structure of West Germany's broadcasting system has led to a system where each region has its own programming, but not necessarily its own teletext service. The Germans claim that if teletext signals from a centrally generated service had to be multiplexed with locally generated video-recorder switching signals, this would prove extremely expensive. All regions already make use of the existing data transmissions on line 16, and it would therefore be fairly simple to introduce the extra video recorder switching bytes in each region. UK broadcasters currently make use of line 16 for standard teletext transmissions.

Grundig are actually making recorders with VPS at the moment, several German networks are transmitting the labels, and Austria and Switzerland have announced that they too intend to introduce VPS shortly.

It looks as though this West German initiative is set for considerable success, thanks to manufacturers and broadcasters having worked hand in hand. Having seen what happened when the Germans introduced stereo sound with TV and how the UK has had to rush to catch up, a speedy agreement between UK manufacturers and broadcasters would seem to be required if the VPS system is not to become a fait accompli throughout Europe.

The forecast for the introduction of an alternative, teletext-based switching system doesn't look too good when you remember that the earlier IBA ideas were never taken up. The bar-code system of programming was demonstrated by the BBC for use in conjunction with radio recorders several years ago, but it was claimed that the printers couldn't print accurate bar codes on the paper used for the Radio Times!
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MAY 1986
Every home constructor has learned from bitter experience that the cost of the power unit used for any project frequently exceeds the cost of the project itself, and very often the most expensive component in the power unit is the mains transformer.

For some projects — such as valve linear amplifiers — suitable new transformers are extremely difficult to obtain at reasonable cost, and in consequence recourse has to be made to those available from club junk sales, stalls at rallies, etc.

Unfortunately, the connections of these transformers are frequently unmarked and even when they are, except on ex-government transformers, the power ratings are rarely given. Of course, it is possible to make a 'guessimation' of the rating from the physical appearance of the transformer, but its inability to cope with the intended load may not be found out until too late, and replacement requires a complete rebuild of the power unit.

This program has been written to overcome this problem; by taking a few simple physical and electrical measurements and then applying these in the program, it is possible to calculate the capability of the transformer.

Within the program a number of assumptions have been made; but as these are based on standard design practice we feel they are acceptable.

Unfortunately, the program is only appropriate to conventional transformers and will not cope with high-power (over 5kVA), ferrite cored or toroidal transformers, or with variacs or auto-transformers. Despite the length of this list, most surplus transformers will fall within the scope of the program.

As with all our previous programs, this is written in standard Microsoft Basic and has been tested on both Sanyo and BBC B (32k) machines. It should also run with little or no modification on many other machines such as the Dragon or TR865, although we have not tested the program on these.

**Using the program**

The power capability of any conventional transformer depends on several factors, the first of which is the cross-sectional area of the core. The first requirement is therefore to measure the width and height of the centre core lamination stack (d1, d2).

This complete, the dc resistance of each winding should be carefully measured, and it should then be possible to determine which is the primary winding. If this is not possible, choose one of the higher resistance windings as primary, because if the wrong selection has been made it does not matter at this stage as the error will become evident later.

It is likely that the resistance of the low voltage secondary windings will be too low to be accurately determined by most multimeters. If this is the case, resort to passing a current from a low voltage source through the winding, measuring the current through, and the voltage drop across the winding and calculate the resistance by Ohm's law. The more accurate the resistance measurements can be made, the more accurate will be the final result.

Many transformers have tapped secondary windings. Treat each tap as the beginning of another winding, unless you are confident that the taped winding uses the same wire gauge throughout.

It is now time to apply some voltage to the primary winding of the transformer. The value of this voltage is not important provided that it is sufficient for the transformer to give adequate output from its low voltage secondary windings for reasonably accurate measurement. For this, bearing safety in mind, probably 24-48 volts ac (not dc) would be suitable, although mains voltage could be applied if the primary winding is marked as such. If mains voltage is used, a low value fuse (not exceeding 3 amps) should be placed in series with the supply.

Wire a resistor of suitable value (typically 10 to 15 ohms) in series with the selected primary winding and apply the test voltage. Measure the voltage across the resistor and across the primary winding. It should be noted that the sum of the voltage across the resistor and that across the winding will not equal the supply voltage, for the inductance of the winding will cause a phase difference. Finally, measure the output voltage for each secondary winding in turn.

It then only remains to run the program, inserting the measured figures as requested. The program will then print out a set of operating conditions, together with power losses, for which the transformer may have been originally designed. These figures are a valuable guide to the capabilities of the device, but nevertheless will rarely coincide with the intended application. For example, the calculated output may be 20 volts at 5 amps, but 6 amps is required and a slightly lower output voltage acceptable. Equally, the estimated input voltage may vary considerably from that supplied.

At the end of the printed table, therefore, the user is invited to insert the desired primary input voltage and the anticipated load on each secondary winding.

The table is then reprinted with due allowance for the differing operating conditions. Should the anticipated primary voltage be excessive and lead to core saturation, this will be indicated to allow the requirements to be modified — or alternatively another transformer to be located in the station operational stores department (ie junk box).

**Assumptions**

In order to derive the characteristics from the physical and electrical measurements described, certain assumptions must be made. These, however, are based on standard design practice and in consequence may be assumed to be in agreement with the figures used in the original design of the transformer.

The first of these is that the transformer is designed for 50Hz operation. Almost certainly all mains transformers of European origin meet this criterion, while most American transformers with a
**COMPUTING - TRANSFORMERS**

240 volt primary are also suitable for this frequency. Care has to be taken with American transformers with 110 volt primaries, for these are usually designed for domestic use on their 60Hz mains.

**Take care**

Care should also be taken if the transformer originated in wartime airborne or shipborne equipment, for many of these were designed for 400 or 500Hz operation and are not suitable for use on 50Hz. Being ex-government, these are normally marked with both the output voltages and the frequency of operation. More modern high frequency transformers normally use a ferrite core and thus can be readily identified.

Signal transformers, such as valve audio output types, will give unexpected results, but these may still be applicable provided that the insulation is adequate for the voltages concerned.

The second assumption is that the design flux for the transformer is 0.55 Tesla (50,000 lines/square inch) while the flux level at core saturation is 0.825 Tesla (75,000 lines/square inch). It has also been assumed that the iron loss at design flux will be 0.75 watts/kg (0.34 watts/lb) and that the copper loss in the secondary windings at design flux will be 4%.

The third assumption is that the load on the transformer will be resistive. If a capacitively smoothed rectified output is required, then the surge current must be used to find the actual output voltages.

A 'rule of thumb' has been used in the calculation of the total load on the transformer. This is that the square root of the input power (volts x amps) divided by 5.6 equals the area of the core in square inches.

**The program**

As may be expected, the early part of the program is devoted to the insertion of the static (lines 50 to 70) and ac (lines 80 to 260) measurements. Thereafter the program may be divided into four parts.

The first of these is devoted to estimating the internal construction, i.e. the turns ratio of the transformer. For this, it is first necessary to calculate the magnetising voltage. This may be thought to be the measured voltage across the primary winding. However, correction must be made to allow for the internal resistance of the winding (R1 in Figure 3.) and as inductive effects cause the current and voltage to be out of phase, recourse must be made to vector arithmetic. This figure (Bo) is calculated in lines 270-310.

Since the secondary windings are not loaded in the test, the induced is equal to the measured voltage and in consequence the turns ratio for all secondary windings is equal to the voltage ratio Vn/Bo (lines 330 to 360).

The second part of the program is devoted to estimating the original design operating voltages and currents. Here the rule of thumb formula referred to previously, which derives the total input load of the transformer from the central core area, has been used. Knowing that 4% of this will be dissipated in resistance, the design load on each secondary winding can be calculated (lines 390 to 410) and, from this, the design primary magnetising voltage (lines 420 to 450).

As the iron losses are almost entirely due to eddy currents, these have been represented by an additional secondary load Re (line 370).

From these derived figures it is now possible to calculate the voltage drop across the internal resistance of the primary winding (R1) to the magnetising current, and from this derive the design primary voltage, V1. At lines 460 and 470 and calculate the output voltages of the secondary windings (V2...Vn) at lines 480 to 500.

The third part of the program is concerned with estimating losses, this being a summation of those from all individual sources. At line 550 the input power is calculated by adding the power losses in the real and imaginary phases, while copper losses due to the resist-

---

10 REM TRANSFORMER ANALYSER
20 REM J.M.HOLLIDAY JULY 1985
30 CLS
40 PRINT
50 PRINT "CORE CENTRE LEG WIDTH AND STACK HEIGHT (INCHES):";
60 INPUT DI,D2
70 IF DI<0 OR D2<0 OR DI*D2>100 THEN GOTO 40
80 PRINT
90 PRINT "HOW MANY WINDINGS (INC. PRIMARY):";
100 INPUT N
110 IF N<1 OR N>12 THEN GOTO 80
120 DIM W(N),R(N),T(N),V(N)
130 PRINT
140 PRINT "ENTER DC RESISTANCES (ohms) AND MEASURED AC VOLTAGES:";
150 PRINT
160 REFORE
170 FOR I=0 TO N
180 IF I<3 THEN READ AS
190 PRINT AS
200 IF I<1 THEN PRINT I-1;
210 PRINT TAB(30);"=";
220 INPUT R(I),V(I)
230 NEXT I
240 DATA "PRIMARY SERIES RESISTOR"
250 DATA "PRIMARY WINDING"
260 DATA "SECONDARY WINDING NUMBER"
270 DATA=(1)"-V(I)/R(I)(R(O)"*2
280 IF R>0 THEN 310
290 PRINT "ERROR IN PRIMARY CIRCUIT DATA"
300 GOTO 110
310 =SQRT(BO)
320 X=0
330 FOR I=2 TO N
340 T(I)=V(I)/BO
350 X=X+T(I)^2/R(I)
360 NEXT I
370 KE=0.0096*X/D2
380 B=2*SQRT(D2*SQRT(R(X))
390 FOR I=2 TO N
400 A(I)=-0.4*R(I)/T(I)
410 NEXT I
420 BSAT=B/1.5
430 PRINT "BSAT=",BO
440 H=3+ALPHA
450 IP=B*0.4*KE
460 V(I)=SQRT(B*(I)*IP^2+H*(I)^2)
470 A(I)=SQRT(R(I)^2/IP^2)
480 FOR I=2 TO N
490 V(I)=V(I)*A(I)
500 NEXT I
510 CLS
520 PRINT
530 PRINT "OPERATING CONDITIONS"
540 PRINT
550 IF B-1/2*IP+H^2*R(I)
560 PRINT "POWER="B^2-KE
570 FOR I=1 TO N
580 P(I)=A(I)^2*RI
590 PRINT "TOTAL="P(I)
600 NEXT I
610 PRINT "VINDING","VOLTAGE","TAB(30)","CURRENT"
620 PRINT "PRIMARY","V1","TAB(30)A(I)
630 FOR I=2 TO N
640 PRINT "SEC","I-1","TAB(15)="V(I)-A(I)
650 NEXT I
660 PRINT
670 PRINT "IRON/COPPER LOSS WATTS % INPUT"
680 PRINT "PRIMARY","TAB(20)P(I)TAB(30)A(I)
690 PRINT "IRON CORE","TAB(20)F"K"KE","TAB(30)B^2KE*100/P(In)
700 FOR I=2 TO N
710 PRINT "SEC","I-1","TAB(20)P(I)TAB(30)A(I)
720 NEXT I
730 PRINT "TOTAL="TAB(20)P(ITAB(30)A(I)
740 PRINT
750 PRINT "ENTER DESIRED PRIMARY VOLTAGE ";
760 INPUT V(1)
770 FOR I=2 TO N
780 PRINT "CURRENT DRAWS FROM SEC. ";1-1"TAB(31)
790 PRINT A(I)
800 NEXT I
810 IF V(1)<.95BSAT THEN 840
820 PRINT "CORE SATURATION IS","V(I)/BSAT*100%; PERCENT"
830 GOTO 740
840 X=0
850 FOR I=2 TO N
860 X=X+T(I)^2/A(I)
870 NEXT I
880 IF X>.4*(V(1)/R(I) THEN GOTO 910
890 PRINT "SECONDARY CURRENT TOO HIGH"
900 GOTO 740
910 H=0
920 FOR I=1 TO 3
930 P(ISQRT(V(I)^2-(H*R(I))^2-K^2))
940 H=B/ALPHA/(1-B/BSAT)
950 NEXT I
960 IF P>KE*X
970 GOTO 470
Operating conditions

Winding Voltage Current
primary 240 1.10227
sec. 1 284.925 0
sec. 2 285.031 0
sec. 3 6.9109 2.5

Iron/Copper Loss Watts % Input
primary 5.26206 0.362
iron core 6.55862 4.65582
sec. 1 0 0
sec. 2 0 0
sec. 3 1.562 7.65468
Total 3.30899 14.872

Enter desired primary voltage?

Break in 760

in opposite half cycle to 1 (30%). 3. Neither rectifier is conducting and the only load is the current drain on LT secondary 3 (60%).

With these conditions, the rms voltages seen by the conducting rectifiers (which will determine the smoothed dc voltage) have been calculated. The total power dissipation is the sum of the dissipation in each part of the mains cycle, ie (16.17 × (20/100)) + (16.8 × (20/100)) + (3.03 × (60/100)) = 8.412V

MAY 1986

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ICOM are proud to launch their new flagship. The IC-751 was good, the new ICOM IC-751A is even better. With a general coverage receiver 100KHz – 30MHz it is a full featured all-mode solid state transceiver that covers all the WARC bands. The IC-751A has excellent 105db dynamic range and features pass band tuning, notch filter, adjustable AGC, noise blanker and RIT. A receiver pre-amp provides additional sensitivity when required. On C.W. the electronic keyer is standard and 40 w.p.m at full break-in is possible. The FL32 500Hz C.W. filter is fitted as is sidetone on receive mode. On SSB the new FL80 2.4KHz high shape factor filter is fitted.

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**SMALL FIRES IN JAM JARS!**

Until recently the humble, antiquated valve was a much neglected beast. Recently, however, even the big boys are heavily into vacuum tubes (protection from the EMP, don’t you know)

Roger Alban gives the low-down on those funny little light bulb thingies

The teaching of valve theory is no longer included in the syllabus for the Radio Amateurs Examination. However, the new amateur is likely to encounter new and secondhand equipment which contains valves, and to be confident in the use of the equipment he should have a reasonable understanding of the theory behind the operation of a valve. This article is intended to resolve the problem.

**The Edison Effect**

In 1883 the American scientist and inventor Thomas Alva Edison was experimenting with an electric filament lamp which contained a second filament. Apparently during these early days of the electric lamp the life of a filament was very short, and one way of extending the operational life was to insert a second filament into the glass envelope of the lamp to be used when the first filament had failed.

Thomas Edison discovered, Figure 1, that when the first filament was giving light, if he connected a battery and galvanometer between the first and second filament, a small current flowed through the galvanometer if the second filament was positive with respect to the first. If the battery was reversed, so that the second filament was negative with respect to the first filament, no current flow took place. This was called the Edison Effect, and remained nothing more than a scientific curiosity for many years until an explanation was forthcoming from OW Richardson.

Early in the twentieth century Richardson, who was for a time Professor of Physics at Princeton University, carried out investigations of the emission of electrons from the surface of hot metals. He explained the Edison Effect by assuming that electrons evaporate from the hot filament in much the same way as vapour molecules leave a hot liquid such as water in the form of steam. But what is actually happening?

Richardson explained the Edison Effect by assuming that negatively charged electrons evaporate from the hot filament and eventually return to the filament.

However, if another piece of positively charged metal is introduced into the lamp’s glass envelope then the negatively charged electrons will be attracted to the positively charged piece of metal (second filament), and electric current flow will take place.

**Thermionic emission**

Electron emission produced by raising the temperature of a material is called thermionic emission. With many metals the temperature necessary for electron emission to occur is so high that the material completely evaporates before the desired temperature is attained. Tungsten is a suitable metal, as a useful electron emission is produced at a temperature of 2,200°C, which is well below the melting point of 3,300°C.

However, if the material is surrounded by air at atmospheric temperature and pressure, the motion of the escaping electrons is restricted by collisions with the heavy air gas molecules. It is therefore essential to ensure that the emitting material is surrounded by either a vacuum or an inert gas at minimum pressure. Electrons will be freely emitted when the tungsten filament is brought to a state of incandescence by a small electrical current being passed through the filament to cause it to glow. The number of electrons released will increase with temperature.

**Negatively charged**

The electrons leaving the filament are negatively charged, Figure 2. As each electron leaves the filament it makes the filament take up a positive charge, producing an attractive force urging the electrons to return to the filament.

However, because each electron has an equal negative charge, there also exists a force of mutual repulsion between the electrons themselves. Many of the electrons are prevented from returning to the filament because of the repulsion of other electrons leaving the filament. These electrons also repel...
other electrons which are attempting to leave the filament.

The net result is that on attaining the critical temperature the filament is quickly surrounded by a cloud of electrons setting up a region of negative charge known as the space charge. Stability is reached when the number of electrons leaving the filament is balanced by those returning to it.

The cathode

One of the most important factors on which the electron emission depends is the 'electron affinity' of the surface of the material. It is a measure of the work which an electron must do in order to escape from the surface. Another important factor is the surface temperature of the material. The higher the temperature the higher the electron activity, and consequently a larger number of electrons will escape to form the space charge. The material from which the electrons escape is called the cathode, and in valves this can take the form of two different types of construction, the directly heated and the indirectly heated cathode.

The directly heated cathode consists of a wire of platinum, nickel or tungsten upon which is deposited a coating of barium oxide or strontium oxide. These materials will readily emit electrons at a temperature of about 1,000°C. Directly heated filaments may take the form of a letter I.V. or W, Figure 3a, to obtain the desired length and surface area. Spring suspension units are employed to keep the filament taut as it expands with heat, Figure 3b.

The indirectly heated cathode consists of a metal tube, Figure 4, usually of nickel, coated upon the outside with barium or strontium oxide. The heater filament is a tungsten wire loop placed inside the tube, the loop being coated with an insulating material such as aluminium oxide which is not affected by heat.

Large mass

The tungsten filament is heated by the passage of current, typically 0.3 amps at 6.3 volts. Owing to the relatively large mass of the cathode it takes an appreciable time to warm up, and there is a slight delay after switching on the heater wire before the electron emission commences.

**The anode**

If a positively charged piece of metal is brought near to the cathode, Figure 5, some of the electrons will be attracted to this piece of metal (the anode), thus reducing the space charge and permitting further electrons to leave the cathode. As the positive anode potential is increased the space charge will be gradually reduced until all the electrons which are leaving the cathode are attracted to the anode.

Any further increase in anode voltage will have no further effect on the flow of electrons, and the valve is said to be at 'saturation'. A greater flow of electrons can only be obtained by raising the temperature or increasing the size of the cathode surface.

The diode valve

The phenomenon described above was first explained by J.A. Fleming in 1904 using the principle of thermionic emission in a radio detector valve called the diode. The diode valve comprises two electrodes, the cathode and the anode, enclosed within a glass envelope from which gas has been excluded. The reason for removing the air from within the glass envelope is to ensure the free passage of electrons between cathode and anode. The lack of air also prevents oxidation of the filament and consequently extends its operational life.

The air is removed from the glass envelope by using an air pump during manufacture. Any remaining air is removed by burning a small amount of magnesium which sits within the gettering pan inside the glass envelope and is ignited by eddy current heating. The burnt magnesium leaves a mirror deposit on the inside of the glass envelope, and is a good indicator as to the amount of air remaining inside the valve. If a large quantity of air should find its way inside the glass envelope then the deposit of magnesium will turn a milky colour.

The anode may be in the form of a flat plate, which gives the alternative American name for it, plate. It is usual for the anode to be of a cylindrical or oval shape surrounding the cathode.

With no voltage applied to the anode, the potential in the region of the heated cathode is due to the space charge. The potential gradient between cathode and anode may be represented by the graph of Figure 6a. When the anode is made positive, if the cathode is cold the potential will fall uniformly from anode to cathode.

With the cathode heated, the potential at any point is due to the sum of the positive anode charge and the negative space charge; the potential gradient between anode and cathode takes the form illustrated in Figure 6b. As the electrons move away from the cathode, with increasing distance the potential becomes increasingly negative until a distance Xmm from the cathode is reached.

In this region the electrons experience a force drawing them back towards the cathode, whilst at a greater distance from the cathode the electrons are attracted towards the anode on account of the positive potential.

As a result of the space charge, only those electrons which leave the cathode with sufficient initial velocity to travel beyond the region of the negative potential will reach the anode. All the other electrons will return to the cathode. It can be seen that the region of the space charge plays a vital role in the operation of the electronic valve.

To be continued

---

**Fig 4** Indirectly heated cathode

**Fig 5** Electrons are attracted to the positive charged anode

**Fig 6** Potential gradient between anode and cathode
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MAY 1986
In the last two editions of *Data File* we have given an introductory outline of the discrete bipolar transistor and its basic characteristics, a general round-up of popular applications configurations, and have also taken a detailed look at the common-collector transistor amplifier and its derivatives. In the present edition of 'The File' we continue the transistor theme by examining common-emitter and common-base 'voltage amplifier' circuits.

To refresh the reader's memory, Figures 1 and 2 show the circuits of the three basic transistor amplifier configurations that have already been discussed and detail the comparative performances of these three amplifiers. Note in particular that the common-collector amplifier gives near-unity over-all voltage gain but features a high input impedance and low output impedance. This circuit is thus used primarily as a unity-gain voltage follower and impedance converter.

The common-emitter and common-base circuits, on the other hand, each provide substantial voltage gain, and are thus used primarily as voltage amplifier circuits. The common-base circuit gives near-unity current gain and is used mainly in wideband or high frequency voltage amplifier applications. The common-emitter circuit provides both voltage and current gain, and is thus of particular value as a high gain power amplifier.

The common-emitter amplifier (also known as the common-earth or grounded-emitter circuit) can be used in a wide variety of digital and analogue amplifier applications. Let's begin by looking at some 'digital' circuits.

**Digital circuits**

*Figure 3* shows the practical circuit of a simple npn common-emitter digital amplifier/inverter or switch, in which the input signal is either at zero volts or at a substantial positive value. Here, when the input is at zero volts the transistor is fully cut off, and the output is thus at full positive supply rail voltage.

When the input switches to a positive value greater than 600mV (the nominal voltage needed to forward bias the base-emitter junction of the transistor), the transistor turns on and causes a collector current to flow in R1, thus pulling the output voltage towards zero. If the input voltage is sufficiently large the transistor is driven to saturation (ie, fully on), and the output voltage falls to a saturation value of only two or three hundred millivolts. Thus the output signal is an amplified and inverted version of the original input signal.

**Safety resistor**

In *Figure 3*, R5 acts mainly as a safety resistor that limits the base-drive current to a safe value; the input impedance of the circuit is slightly greater than the R6 value. It should be noted that R5 influences the rise and fall times of the output signal: the greater the R6 value, the worse these times are.

This snag can be overcome by shunting R5 with a 'speed-up' capacitor (typical value about 1nF), as shown dotted in the diagram. In practice, R5 should have as low a value as possible consistent with safety and input impedance requirements, and should never be greater than R6 × hFE.

*Figure 4* shows a pnp version of the digital inverter/switch circuit. In this case the transistor is switched fully on when the input is at zero volts, and the output thus takes up a value roughly 200mV less than the positive supply rail value. The transistor only turns off when the input rises to within less than 600mV of the supply rail value, and under this condition the output falls to zero volts.

It should be noted that the sensitivity of the *Figure 3* and *Figure 4* circuits can be greatly increased by simply replacing Tr1 with a pair of transistors wired in the Darlington or Super-Alpha configuration. A very high gain non-inverting digital amplifier/switch can be made by using a pair of transistors in either of the configurations shown in *Figures 5* or 6.

The *Figure 5* circuit, which uses a pair of pnp transistors, operates as follows:

When the input signal is zero volts, Tr1 is cut off and is thus effectively removed from the circuit. Under this condition, Tr2 is driven to saturation via R2, and the output signal has a value of a few hundred millivolts. When, on the other hand, the input signal is significantly greater than 600mV, Tr1 is driven to saturation and pulls Tr2 base down to only 200mV or so above zero. Under this condition, Tr2 is cut off, and the output is at full supply voltage value.

The *Figure 6* circuit, which uses one npn and one pnp transistor, works in a slightly different manner from that described above. Here, when the input is at zero volts, Tr1 is cut off, so Tr2 is also cut off via R2-R3 and the output signal is...
thus at zero volts. When the input signal is high (above 600mV), on the other hand, Tr1 is driven on and derives most of its collector current from Tr2 base via R3, thus driving Tr2 to saturation. Under this condition, the output takes up a value 200mV or so less than the positive supply rail value.

Finally, to complete this look at 'digital' common-emitter amplifier circuits, Figure 7 shows (in basic form) how a complementary pair of the Figure 6 circuits can be used to make a dc-motor direction-control network using a dual power supply.

**Operation**

The circuit operates as follows:

When SW1 is in the forward position, Tr1 is driven on via R1 and Tr2 is driven on via R3 and Tr1, but Tr3 is cut off via R4 and Tr4 is cut off via R5 and R6. Thus, the 'live' side of the motor is connected (via Tr2) to the positive supply rail under this condition and the motor runs in a forward direction.

When SW1 is in the off position, Tr1 is cut off via R1 and Tr2 is cut off via R2-R3, and simultaneously Tr3 is cut off via R4 and Tr4 is cut off via R5-R6. The 'live' side of the motor is thus effectively open circuit under this condition, and the motor is inoperative.

Finally, when SW1 is in the reverse position, Tr3 is biased on via R4, and Tr4 is driven on via R6 and Tr3. Tr1, however, is cut off via R1 and Tr2 is cut off via R2-R3. Thus, the live side of the motor is connected (via Tr4) to the negative supply rail under this condition, and the motor runs in the reverse direction.

The basic digital circuits of Figures 4 to 6 can be used to drive a variety of resistive loads, including lamps and LED-resistor combinations etc., without modification. If they are used to drive inductive loads, such as relay coils etc., the circuits must be provided with simple diode protection networks, to limit inductive switch-off back-emfs to a safe value. Common-emitter amplifiers make far more sensitive relay drivers than do common-collector amplifier circuits (described last month), and Figures 8 to 10 show some practical examples of relay driving common-emitter circuits.

Figure 8 shows the circuit of a simple but versatile 1-transistor relay driver, which increases the relay's operating current sensitivity by a factor of about 200 (the nominal hfe value of Tr1). Resistor R1 gives base drive protection, and can have a larger value than 1kΩ if required.

The relay can be turned on either by applying a dc voltage greater than 700mV to the input, or via switch SW1 (shown dotted). The basic Figure 8 circuit gives non-latching operation, but can be made self-latching by wiring a spare set of relay contacts (RLA/2) between the collector and emitter of Tr1, as shown dotted.

The current sensitivity of the Figure 8 circuit is limited by the current gain of Tr1: the sensitivity can be greatly increased (to a factor of about 20,000) by replacing Tr1 with a Darlington-connected pair of transistors. Figure 9 shows how this principle can be used to make a relay driving circuit that can be activated by placing a resistance of less than a couple of megohms across a pair of stainless metal probes. Water, steam and skin contacts have resistances below this value, so this simple little circuit can be used as a water, steam or touch-operated relay switch.

Finally, Figure 10 shows the circuit of another ultra-sensitive 2-transistor relay driver. This particular design needs an input of about 700mV at 40µA to activate the relay, and is based on the Figure 6 design. Resistor R2 is wired between the base and emitter of Tr1 to ensure that this transistor (and also Tr2) is fully cut off if the input terminals are open circuit.

**Linear biasing circuits**

A common-emitter circuit can be made to function as a linear ac amplifier by applying a dc bias current to its base, so that the collector takes up a quiescent value of roughly half-supply volts (to accommodate maximal undistorted output signal swings) and by then feeding the ac input signal to the base and taking
The first step in designing a circuit of the Figure 11 type is to decide on the value of load resistor R2. The lower this value, the higher will be the amplifier’s upper cut-off signal frequency (due to the smaller shunting effects of stray output capacitance on the effective impedance of the load), but the higher will be the quiescent operating current of Tr1.

In the diagram, R2 has a compromise value of 5kΩ, which gives an upper ‘3dB down’ frequency of about 120kHz and a quiescent current consumption of 1mA from a 12 volt supply. To bias the output to half-supply volts, R1 must be given a value of R2 x 2/hfe, and (assuming a nominal hfe value of 200) this works out at about 2M2 in the example shown.

The matters of input impedance and voltage gain of the Figure 11 circuit are fairly easy to work out, and are both determined by the forward biased impedance of the internal base-emitter junction of Tr1. This junction has an impedance of about 25/β, where Ic is the collector current value in mA, eg this impedance is 25Ω at 1mA, 12.5Ω at 2mA, or 5Ω at 0.5mA. The input impedance into the transistor base equals this impedance multiplied by the hfe value of Tr1. Thus, in Figure 11 the input impedance equals roughly 5kΩ, shunted by R1.

The voltage gain of the Figure 11 circuit equals the R2 collector-load resistor value divided by the base-emitter junction impedance value and works out at about 46dB, or x200. Note that, in theory, this gain figure also determines the maximum attainable upper 3dB point of the frequency response, which equals F5 / A5. The F5 of the 2N3904 is about 300MHz, so the maximum attainable 3dB point of the Figure 11 circuit (ignoring the effects of stray capacitance) is 1.5MHz.

### Weakness

A major weakness of the simple Figure 11 circuit is that its quiescent biasing point is highly dependent on the current gain (hfe) of the individual transistor used. This problem can be overcome by modifying the circuit as shown in Figure 12. Here, biasing resistor R1 is wired in a dc feedback mode between the base and collector, and is given a value of R2 x hfe. The ‘feedback’ action is such that any shift in the output biasing point (due to variations in hfe, temperature or component values) automatically causes a counter-change in the base-current biasing level, thus tending to cancel the original shift.

The Figure 12 circuit provides the same values of bandwidth and voltage gain as the Figure 11 design, but has a lower total value of input impedance. This is because the ac feedback action of Figure 12 causes the apparent impedance of R1 (which shunts the 5kΩ base impedance of Tr1) to be reduced by a factor of 200 (A5), thus giving a total input impedance of 2kΩ. If desired, the shunting effects of the biasing network can be eliminated by using two feedback resistors and ac-decoupling them, as shown in Figure 13.

Finally, if the ultimate in biasing stability is required, this can be obtained by using the potential-divider biasing technique shown in Figure 14. Here, potential divider R1-R2 sets a quiescent voltage slightly greater than V+3 on the base of Tr1, and ‘voltage follower’ action causes 600mV less than this to appear on Tr1 emitter. Thus, V+3 is developed across 5kΩ emitter resistor R3, and (since the emitter and collector currents of Tr1 are almost identical) a similar voltage is dropped across R4, which also has a value of 5kΩ, thus setting the collector at a quiescent value of 2V+3. Note that the R3 emitter resistor is ac-decoupled via C1, enabling the circuit to give a voltage gain of 46dB to ac signals.

### Circuit Variations

Figures 15 to 18 show some simple but very useful variations of the basic Figure 12 and Figure 14 common-emitter designs. Figure 15 shows how the Figure 14 design can be modified to give a fixed voltage gain of about x10. These designs rely on the fact that the common-emitter voltage gain equals the collector load impedance value (R4) divided by the effective ‘emitter’ impedance value. In Figure 14, the effective emitter impedance is that of the internal base-emitter
function, and equals 25Ω at 1mA. This circuit thus gives a voltage gain of ×200. In Figure 15, on the other hand, resistor \( R_3 \) is decoupled by series-connected \( C_2-R_5 \), and the emitter impedance (at ac signal frequencies) thus equals the internal junction value in series with the paralleled values of \( R_3 \) and \( R_5 \). This works out at roughly 560Ω, thus giving a final voltage gain of about ×10. Alternative gain values can be obtained by altering the \( R_5 \) value.

Figure 16 shows a simple variation of the above design. In this case \( R_3 \) is not decoupled, its impedance thus equaling the \( R_4 \) value, and the circuit gives unity voltage gain. Note, however, that this circuit provides two unity-gain output signals, with the emitter output in phase with the input and the collector signal in anti-phase. This circuit thus acts as a unity-gain phase splitter.

Figure 17 shows an alternative way of varying the circuit gain. This design is a variation of Figure 12: it still gives 46dB of voltage gain between \( T_r_1 \) base and collector but feedback biasing resistor \( R_3 \) is ac-shunted by \( R_2 \), thus giving the Figure 17 circuit a base impedance of about 500Ω. \( R_1 \) is wired in series between the input signal and \( T_r_1 \) base, and thus (in conjunction with the 500Ω base impedance) gives a signal attenuation action between the input and base. The overall voltage gain of the circuit thus works out at roughly ×10, or \( R_2/R_1 \). Alternative gain values can be obtained by altering the values of either \( R_1 \) or \( R_2 \).

Finally, Figure 18 shows how the Figure 12 design can be modified to give a wideband performance by simply wiring a direct-coupled emitter follower stage \(( T_r_2 )\) between \( T_r_1 \) collector and the output terminal.

It was pointed out earlier that Figure 12 has a maximum potential bandwidth of 1.5MHz but in practice the shunting effects on \( R_2 \) of stray output capacitance reduce the actual bandwidth to about 120kHz. By buffering the output via \( T_r_2 \) these shunting effects are reduced and the bandwidth is extended to several hundred kHz.

### High-gain circuits

A 1-transistor common-emitter amplifier circuit cannot give a voltage gain significantly greater than 46dB when using a resistive collector load. If a voltage gain greater than 46dB is needed, a multitransistor circuit must be used. Figures 19 to 21 show three useful high-gain 2-transistor voltage amplifier circuits.

The Figure 19 circuit acts like a direct-coupled pair of common-emitter amplifiers, with the output of \( T_r_1 \) feeding directly into the base of \( T_r_2 \). It gives an overall voltage gain of 76dB, or about \( \times 8 \), 150, but has an upper -3dB frequency point of only 35kHz.

Note that feedback biasing resistor \( R_4 \) is fed from \( T_r_2 \)'s ac-decoupled emitter (which 'follows' the quiescent collector voltage of \( T_r_1 \)) rather than directly from \( T_r_1 \) collector so that the bias circuit is thus effectively ac-decoupled. Figure 20 shows an alternative version of the above design, using a npn output stage; the performance of this circuit is the same as that of Figure 19.

The Figure 21 circuit uses a very different way of giving a high voltage gain (about 66dB, or \( \times 2000 \)). In this case \( T_r_1 \) is wired as a common-emitter amplifier with a split collector load \(( R_2-R_3 )\), and \( T_r_2 \) is wired as a common-collector amplifier or emitter follower, and feeds the ac output signal (derived from \( T_r_1 \) collector) back to the \( R_2-R_3 \) junction via \( C_3 \), thus 'boostering' the value of \( R_3 \) (as described last month) so that \( R_3 \) acts as a near-infinite impedance to ac signals and \( T_r_1 \) gives up its high voltage gain. The bandwidth of this circuit extends up to about 32kHz, but the design gives an input impedance of only 330Ω.

### Other designs

To conclude this edition of Data File, Figures 22 to 24 show the basic circuits of some other types of linear voltage amplifiers. Figure 22 shows an example of a common-base amplifier, which gives a good wideband response. This circuit is biased in the same way as Figure 14.

Note, however, that in Figure 22 the base is ac-decoupled via \( C_1 \), and the input signal is applied to the emitter via \( C_3 \). The circuit has a very low input impedance (equal to that of the forward biased internal base-emitter junction), gives the same voltage gain as the common-emitter amplifier (about 46dB), and gives zero phase shift between input and output.

Figure 23 shows the circuit of a so-called 'differential' amplifier or long-tailed pair. The two transistors share a common emitter resistor (the 'tail'), and the circuit bias point is adjusted via \( R_1 \) so that the two transistors pass identical collector currents (giving zero difference between the collector voltages) under quiescent conditions.

The two transistors interact via the emitter tail, and the circuit action is such that the output signals (available from either collector) are proportional to the difference (the differential voltage) between the two input signals. If identical signals are applied to the two inputs, the circuit will (ideally) give zero output.

Finally, Figure 24 shows how the above circuit can be modified for use as a phase splitter, which provides two anti-phase outputs from a single-ended input signal. In this case the base of \( T_r_1 \) is simply ac-grounded via \( C_1 \) and the input signal is applied to the base of \( T_r_2 \).

In the next edition of Data File we'll take a look at transistor oscillators and multivibrator circuits.
Do you recall the article on aerial design I had published in the April 1985 issue of Radio & Electronics World? You do? Great! That saves me talking to myself. Well, now that you’ve cut up your mum’s bread board to make the wooden blocks I wrote about, I’ll give you something to do with them. I’m going to describe a small 2m quad that you can build using the wooden blocks and a few other bits and pieces. It will only cost a couple of pounds to build, an amount I’m sure all of you can afford.

The nuts and bolts of the matter
To build the quad you will need:
Five of the aforementioned wooden blocks, drilled.
A wooden broom handle (straight, please unless you’re interested in moon bounce).
Twenty 16in lengths of ¼in dowel.
A small reel of 26swg enamelled copper wire.
A strip of 5 amp rated connector block (we need one double and four single units, remove the metal inmards of the four singles.)
A small tin of weather varnish plus a brush.
Five wood screws to lock blocks to boom.
Twenty panel pins and four press tacks.
A wooden pole to mount the antenna, long enough to clear the elements.
A clamp to affix the pole to the boom.
Co-ax cable as required.
Got all that? If not, off you go to Woolies and get it. I’ll have none of that ‘I didn’t know’ business in this project.

The antenna, simple to construct, is small, light and, if you so desire, portable.

Construction details
Firstly give all the parts to be used in the project, including the connectors, a good coat of varnish. This will protect them from the elements, and give the wood a nice shine to boot. When that’s done, and the wool from your sleeve removed from the varnish, allow the bits to dry.
To obtain the correct spacing for the elements, measure and mark the boom from what will be the reflector end. First make a mark for the centre of the reflector’s block, then from that mark measure the following: 16, 29, 37 and 45 inches.

Thus the space between the reflector and the driven element will be 16 inches; between the driven element and the first director 13 inches; between the first and second director 8 inches; and between the third and fourth director also 8 inches.
If your pencil broke during that operation, don’t worry, you won’t be needing it again.
Next cut the 26swg wire to the following lengths:
Reflector length = 87 inches
Driven element length = 83 inches
Director lengths = 77 inches.
When the wire is cut, scrape the coating from the ends of the wires: about 1/4 inch is needed. This allows continuity when the wire ends are screwed down in the connector block.
The arms for the quad are 16 inch lengths of ¼ inch dowel, and you will need to make 20 such arms.

Getting it together
Making the elements isn’t a difficult job, as you will see. Firstly, lay a wooden block flat on the workbench and push four dowel rods into the holes drilled in the quad configuration. Use the four press pins to temporarily position the wire on the arms, making sure that all sides are equal. When this has been done to your satisfaction, drill a small hole in each arm at those points and thread the 26swg wire through. Scrape the coating from the ends of the wire, and join it together using a single connector.

Be gentle
When the elements are built, gently pull each arm away from the centre to make the wire taut, and secure the arm with a panel pin through the block. Don’t overdo the pulling, otherwise you may bend the dowel rods.
Now the elements are built, they can be slid onto their marks on the boom. When satisfied that all is correct, secure the blocks with the wood screws.

{Figure 4 shows how to position the coax cable on the driven element. The}
antenna is fed at a point approximately 1 inch along from the lower left-hand dowel rod, when looking through the reflector. Note that the co-ax cable comes into the block from the top. Tape the cable along the arm and down, in a fairly loose loop, to the support pole where it is taped. This eliminates any stress on the arm itself, and prevents one tripping over loose co-ax.

Mounting the quad on the rotator

A length of all tube can be joined to the support pole, to address the rotator. Remember the support pole must be made of wood or plastic. It has been my experience with this type of quad that they don’t like metal poles passing between their elements... say no more.

The antenna shouldn’t need to be tuned as the SWR is quite flat, not above 1.4:1. Moving the feed point slightly either way will affect the SWR reading, if adjustment is needed.

This is a good project for those among us who do not have a lot of QRK to throw around. It is cheap to make, simple to construct and it works well. When I first built this antenna, I set it up in my shack and I couldn’t even hear Dover with the Yagi I was using at the time, this seems most acceptable. Once the quad was up on the rotator, it got me into Germany, France, Holland and the Netherlands on SSB, and into Birmingham on FM, among other places. It proved its worth more than once.

Remember it can break down and be packed away in the car boot, which makes it a handy implement for the average camper. The only complaint I have is that I can’t pack it away in the saddle bag of my bike!
**INTEGRATED CIRCUITS**

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**POTENTIOMETERS**

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**NEW BRANDED CATHODE RAY TUBES**

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**TELEX**

966371 TOS PM
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Additional values and descriptions may be available in the full document.
DAMP DETECTOR

If your bidet’s bubbling over, you’ll want to know before it starts dripping into your cornflakes

Terry Pinnell has the answer

Domestic disasters are mercifully few and far between in our household. One was that time the ceiling fell in. Well, not the entire ceiling, one corner of it, but by the time we had paid for replastering and repainting, I recall regarding it as definitely worthy of the ‘disaster’ label.

The cause was distinctly out of proportion to the effect. A simple matter of water seeping through the sealing around the edge of a bath and through the other kind of ceiling down below. Anyway, repairs complete, my mind turned to future avoidance. Ideally I wanted a more helpful warning of trouble than the appearance of another ominous stain.

At last, a real motive to make an electronic water sensor!

The first step was to do a little research and dig up some suitable designs from the available literature. Altogether I found 13 circuits, 6 from books and 7 from old magazines. These fell into two reasonably distinct categories, as follows.

Rain or water alarms

These typically detected water present in substantial volume. Applications included a bath reaching a certain level, rain falling on an outdoor strip of Veroboard, an overflowing washing machine, a flooded bilge in a boat, and so on.

With one exception, all ten of the circuits in this category were based on the principle shown as a block diagram in Figure 1.

In the presence of water or any other liquid which conducts adequately, the sensor, usually just a pair of wires or other suitable probes, passes sufficient current to bias a transistor into the ‘on’ state, or enable a CMOS or TTL gate, thereby activating an oscillator circuit. This drives a suitable loudspeaker, typically of around 64 to 80 ohms.

Variations on this theme were mainly in the type of oscillator circuit, the most popular being the complementary stable, using one npn and one pnp transistor. Some circuits activated a relay rather than an audio oscillator, allowing bells, buzzers or lights to become the output signal.

An exception

The exception I mentioned was interesting because it was the only one which acknowledged a possible snag with the usual type of circuit. This is the tendency for probes using direct current to become corroded over a longish period. This means that the circuit may fail, which its author claimed drastically reduced corrosion due to the electrolytic effect.

It employed a 4093, which I did not have in my stock of ICs, so I redesigned it for the more popular 4011 or 4001, so that I could experiment a little with it. The circuit is shown in Figure 2.

As you see I have only shown the first part of the circuit, ie up to the point at which an output is produced which can be used to activate either a simple low power oscillator or a relay as before.

Operation is straightforward. The first two gates, IC1a and IC1b, are used as inverters (ie their inputs are connected directly together) and with R1, R2 and C1 form a simple oscillator. The frequency of this did not appear at all critical; I used components at hand and these gave about 3kHz. This, our ac signal, is passed via an isolating capacitor to one ‘side’ of the sensor, eg one of two wires immersed in the container or whatever.

If there is a sufficiently conductive path due to the presence of liquid, this signal is passed on to the next circuit element, a doubler/rectifier. This produces a dc signal from the ac one. So if the amplitude of the ac signal passing through is large enough, a high voltage (ie close to the 9V supply) will be passed on to the next element, a Schmitt trigger.

Briefly, all this does is produce a ‘snap-into’ effect, so that as soon as the dc voltage at its input (the left-hand side of R4) reaches a certain level, say 4 or 5V, its output (pin 10 of IC1) will suddenly change from 0V to 9V. This high output of the Schmitt can then be used in precisely the same way as before to activate an audio oscillator or relay, etc.

Moisture detectors

The three examples of these were all concerned with testing indoor or outdoor soil conditions. This category was potentially of most interest for my own application, as I wanted to spring into action when things got damp, not wet.

However, none of them at first sight did all that I wanted. This prompted me to list
the functions I required in my own design:

Battery operated - bathroom!
Negligible quiescent current consumption - so that I could forget about changing the battery for a year or so.
No action required - ie able to leave it switched on. I expected this to be easy to achieve if consumption was negligible. Note that this doesn't mean that an on/off switch was unnecessary, because it still needs switching off after the alarm has sounded.

Audible alarm - should be loud enough to be heard downstairs in reasonably quiet conditions (which I assumed would occur for a few seconds or so at some time before the battery ran out).

Reliable switching - one characteristic of most of the circuits I had seen was their inability to deal properly with the 'intermediate' condition I wanted, when the bathroom floor was neither flooded nor bone dry. What I did not want was for it to switch on and off irritatingly when conditions were in this half and half stage, but to give a nice positive indication at the first sign of damp. Clearly a case for a Schmitt trigger.

Simple and cheap - these usually go together (although common exceptions are specialised easy to use ICs, which tend to be pricey).

A happy state

The circuit evolved to meet my requirements is shown in Figure 3. When a happy state of dryness prevails under the bath, the resistance across the sensor is very high, ie many megohms, and as the sensor and R1 are arranged as a potential divider across the 9V supply, the input voltage at the left of R2 is close to zero.

IC1a and IC1b are two gates of a 4011 CMOS IC arranged as a Schmitt trigger.

Any Schmitt trigger has the important characteristic that its output changes abruptly from low to high when its input increases above a certain voltage, usually called the upper trip level. The output changes abruptly back to low again if the input voltage is reduced below a lower trip level.

The key point is that this lower trip level is lower than the upper trip level, so that if the circuit swings high at, say, 8volts input, it will only swing low again if the input voltage goes below, say, 5V. This difference, 1V in this imaginary example, is called hysteresis.

It is a kind of backlash effect, and in our damper detector ensures that if the input voltage gradually increases from close to zero up to the trigger point, ie up to the upper trip level, due to the insidious leakage of water round the edge of the bath, then the alarm will go on and stay on until someone does something about it, rather than go on and off intermittently as it dries out a little then gets damper and so on.

Schmitts can be made out of discrete transistors (bipolar or FETs), TTL logic ICs, 555 timer ICs or 741 op amps. In my damper detector the specification for negligible quiescent current consumption prompted me to choose CMOS.

The hysteresis, H, of a simple CMOS Schmitt trigger is very easy to calculate:

\[ H = V_{\text{supply}} \times \frac{1}{R_{\text{input}}} + \frac{1}{R_{\text{feedback}}} \]

In our circuit \( R_{\text{input}} \) is 1M and \( R_{\text{feedback}} \) is 12M, so

\[ H = 9 \times 1 \div 12 = 0.75V \]

The upper and lower trip levels would then be evenly spaced above and below the gate transition voltage which is roughly half the supply voltage.

In the specific case of our damper detector we could therefore expect the output of the Schmitt to swing high when the input was approximately 4.5 - 0.4, ie 4.9V, and to swing low again if the input goes below 4.5 - 0.4, ie 4.1V.

Some variation

Actually the transition voltages of individual IC chips varies a bit, depending on manufacturing tolerances etc, so don't expect a precise correspondence of theory and practice.

When testing the finished circuit the actual values I measured were as follows:

Upper trip level = 5.74V
Lower trip level = 4.77V

So the actual hysteresis was a little higher than the 0.75V calculated (but I recently measured the actual supply voltage of the PP9 battery, which has been installed for nearly two years, as 9.5V, and my 12M resistor proves to be 11.85M).

Feeding these values into the formula above yields a result of 0.8V hysteresis, which is a bit closer).

Incidentally, remember to use a high impedance meter (10M or more) when taking such voltage readings, as the results will otherwise be misleading.

To test the circuit before entrusting it to its lonely vigil in the bathroom, kitchen, garage or wherever, you can simply use a high value potentiometer in place of the final sensor. I used a 1.5M pot, and by carefully increasing it I measured the two 'trip points' as:

Upper trip point = 650k (output goes high and alarm sounds).
Lower trip point = 1M (output goes low and alarm stops).

Remember to remove at least one side of the test pot to measure its resistance after detecting the switch of output.

The Schmitt output is used to enable or disable (ie to start or stop) the oscillator.
made out of the other two gates of our 4011 chip.

**CMOS gated oscillator**

If you look back at Figure 2, the CMOS oscillator there was a simple, ungated version; when power was applied it oscillated. In Figure 3, on the other hand, pin 8 is used as the enabling pin. When this is low, the oscillator is inactive; when pin 8 is high, however, oscillation occurs. Its frequency is determined by the values of R4, R5 and C1, and in my damp detector was about 1kHz, chosen after experiment.

When inactive it is of course important that the oscillator output from pin 11 is low. If it was high then a dc current would flow through the speaker, as Tr1 would be on.

One other difference between this CMOS oscillator and that in Figure 2 is that pin 13 goes to V+. Actually this is immaterial; I could equally well have connected pins 12 and 13 together ... I seem to recall wiring it like this out of curiosity.

**Output stage**

It probably seems generous to call the five remaining components a 'stage', but logically what is that they constitute. Tr1 is switched on and off by the CMOS oscillator output, via the potential divider R6 and R7, which provides additional current limiting as well as ensuring that Tr1 goes fully off when pin 11 is low, thus achieving our design aim of a negligible standby current.

Tr1 drives the speaker, which has a sufficiently high resistance to limit the collector current through the transistor to its permissible level (when Tr1 is on most of V+ appears across the speaker, so the maximum current at those times would be about 9 ÷ 75, around 120mA).

Diode D1 protects Tr1 against high switching voltages induced in the speaker windings. I've seen many circuits which do not include this feature, so I remain uncertain just how necessary it really is; better safe than sorry, anyway, and a 1N4148 or similar costs next to nothing.

There is nothing critical about any of these components and you could cheerfully use any reasonably similar values you may have to hand. If you want to try low impedance speaker, however, I say an 8 ohm miniature, then you should use a small power transistor for Tr1, with an adequate current and power dissipation rating (you may then find that it gets insufficient base current through R6, so experimenting may be necessary).

**Conclusions**

The case I used was a little unusual, being a piece of plastic drain-pipe with press-fit ends. I bought quite a length of this from a local DIY shop, together with a dozen end pieces, and used it on several projects. At the time it was pretty economical, but I'm not sure about current prices. The end pieces are the constraining factor, because although insignificant at the ends of a 20 foot length of guttering, they start to look pricey on an 8 inch case.

A really nice feature of this Marley section is that it is a perfect fit for PP9 batteries, as you can see from the photograph on the previous page. Although the word 'sensor' is used in the circuit diagram, in practice of course there can be any number of them wired in parallel. I used five. Four were placed at various strategic points under the bath, and the other was a last minute decision to build in a couple of wires to the underside of the case, so that obvious 'local' flooding would not be overlooked. A couple of my sensors were just lengths of bare wire laid close together on top of the plasterboard. The others were pieces of Veroboard a few inches square, with alternate rows wired together. These were placed copper side down in spots likely to get the first of any future leaks.

Two wires lead from each sensor, one being connected in common at a convenient point under the enclosed bath. All five resulting wires were then connected inside the case, together with the pair from the in-built probe, and taken to the Veroboard, as shown in Figure 5.

The reason for keeping one of each of the pair of wires separate until they are all eventually connected inside the unit itself was so that the resistance of each one could be measured conveniently, without having to take the side panel off the bath, in the event of the alarm being triggered. This has proved useful in practice, because short of an out and out flood it is by no means always clear where the damp spot is. A quick check with the ohmmeter soon narrows it down.

The damp detector has been in place for about four years now and has probably been activated in anger about three times during that period, i.e. excluding spillages from the wash basin or direct hits from the shower. On each of those three occasions close examination indicated worn sealant, precisely the original cause, and it was promptly renewed (usually by my wife, I have to admit; my only attempt proved messy to say the least). So I think it can be claimed to have justified its existence.

Very recently it gave its first false alarm, ultimately traced to a probe becoming a bit corroded. The next model will be an ac version!
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MAY 1986

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January was, in general, an inactive month for DX-TV, a fact reflected by the log reports. Like most months during the winter, there were one or two highlights, the most notable being sporadic-E opening on the 22nd. It started during the afternoon and sustained signals were reported as lasting for well over an hour.

Reception was from the south-east, with test transmissions from Yugoslavia on channel E3 and cartoons from Italy on channel IA. Signals were also present on channels R1 and R2 from 1545, but unfortunately programmes were in progress, making station identification virtually impossible. The most likely source was Hungary, from the high power transmitters at Budapest and Pecs.

The Quadrantids meteor shower produced intense activity during the month on Band I frequencies. The best days were the 3rd and 4th. Unfortunately, most of the programme material was from the same source and was of relatively low quality. Reception via meteors was of short duration and some activity lasted for twenty seconds or more, creating the effect of messy and patchy sporadic-E propagation.

Reception via enhanced tropospheric conditions was virtually non-existent for most of the month. It would appear that a couple of French stations did penetrate as far north as Leeds on the 9th!

DX-TV log for January

The following rather sparse log shows reception conditions noted by the author in December. It seems typical of most other enthusiasts’ results elsewhere in the UK.

2/1/86: CST (Czechoslovakia) on channel E2 with the ‘EZO’ electronically generated test pattern bearing the ‘RS-KH’ identification and an unidentified transmission on R1 consisting of a female announcer.

3/1/86: Frantic activity via meteor shower but only on programmes.

4/1/86: Further meteor shower but again, only programmes were noted, making positive station identification difficult.

7/1/86: Unidentified feature film noted on channel R1 via short duration meteor shower activity.

10/1/86: Danmarks Radio (DR-Denmark) on channel E3 from the Fyn transmitter showing the PM5534 test card and the identification ‘DR DANMARK’, CST on R2 with the ‘RS-KH’ test card.

12/1/86: SR-1 (Sweden) on channel E2 radiating the ‘TV1 SVERIGE’ PM5534 test card. Unidentified programme noted on channel R2.

13/1/86: Unidentified caption on channels E3 and E4 consisting of a figure or head in the centre of the screen with two fairly wide dark stripes either side. This could have been a leftover form of opening caption. Did anyone else see this?

19/1/86: Unidentified cartoon received at 0954 on channels E2 and E3.

21/1/86: Unidentified female announcer (not from TSS-Russia) on R1 and R2. The signal faded before the appearance of an identification caption or programme credits. JRT (Yugoslavia) on E3 with no less than three test cards. RAI (Italy) on IA with cartoons, including Popeye. JRT on E4 showing a ‘Studio Zagreb’ caption. This was followed by Sportsko Sporti which featured a basketball match.

Watch those test cards

The start of the 1986 sporadic-E season is only a few weeks away. A close watch on any test card identification should be maintained, as it may provide a clue to the transmitter of origin. Unfortunately some countries carry a national identification. For example, Sweden radiates the ‘TV1 SVERIGE’ inscription on their PM5534 test card from all transmitters in Band I, thus making it practically impossible to ascertain the exact source of reception.

The Yugoslavian reception noted on January 22nd provided a good example of how useful regional identifications can be. The first JRT test card to be received bore the inscription ‘JRT BGRD’ in the lower black rectangle of the PM5544. This indicated that the studios at Beograd (Belgrade) were responsible for its origination. The nearest channel E3 transmitter to Beograd is Kapanonik with an ERP of 50kW. A co-channel test card appeared carrying the identification ‘RTV LJLL’; this later switched to ‘RTV at the top and ‘LJUBLJANA’ at the bottom. The nearest E3 outlet to Ljubljana is at Kum in the far north of the country. Its ERP is also 50kW.

Possibly the best form of identification is used by NRK in Norway. The name of the actual transmitter is normally included on the PM5534 and thus provides positive identification. It reminds us of an old article in the UK when the ITA, as it was then called, included details of the transmitter site at the bottom of test card ‘D’ during the mid-sixties.

Reception reports

Andy Webster of Billinge, near Wigan, telephoned to say that January had been the bleakest month for TV DX. The reason is quite simple; his aerials came down during severe gales earlier in the year. Andy reported that the 1½ inch diameter mast carrying the aerials had snapped just above the rotator, bringing the whole lot down onto the roof. His Band I beam was clamped approximately six inches above the rotator, with the Band III and UHF arrays above this. We feel that the Band I clamp would have been in a better position immediately above the rotator. This may have helped to prevent sway in the beam from exerting strain on the mast. We have adopted this idea on several systems, so far without any problems.

Lunchtime loggings

Several lunchtime test cards have been logged by Simon Hamer of New Radnor in Powys during the month. The Telfunken TO5 monoscopic test card appeared from Austria on channel E2a on the 5th. This particular monochrome test card has been used for many years and carries the identification ‘ORF PS1’. The FuBK test pattern from the West German channel E2 transmitter at Grünert was received on the 9th. This outlet radiates programmes from the BR service.

An interesting pattern from the south on channel E2 was logged by Simon on the 12th. It was a chessboard pattern, similar to the one used by TVE in Spain. This pattern hasn’t been seen very much in recent times. Perhaps the colour bar pattern generator had packed in!

Ian Manzius of Aberdeen also saw lots of DX via meteor shower on the 3rd. The following day, while playing with his tuner, he heard a very strong vision buzz on the French L3 channel in Band I at 1305GMT.

Auroral activity was present on the 6th (an aurora was in evidence 27 days earlier) resulting in signals from Norway on channels E2 and E3, and Russia on R2. The 11th proved interesting, with performing bears on push bikes at 1630 on R1 and R2. The programme is thought to have originated in Hungary.

Norway on E2 and Russia on R1 were logged via sporadic-E on the 21st at 1900 while on the 22nd Ian noted programmes from RAI-Italy on channel IA with a carrier frequency of 53.745MHz. Presumably he was using a scanner to be aware of this offset.

Rijn Muntjewerf of Beemster in the Netherlands has forwarded his impressive log which covers the tropospheric opening noted last October. The entries seem endless, with many Russian Band III and UHF transmissions. One of the recently opened Danish local stations came through on channel E54, fortunately on test card. Rijn’s sporadic-E

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Test card radiated by one of the regional TV services in Denmark on channel ES4

An unusual test card used by Italian pirate station L'Antenna

FuBK test card used by the 2nd network in Czechoslovakia (CST-2) with 'ODK 2' ident

Opening caption transmitted by the TV service in Egypt

PM544 test card from Yugoslavia showing the use of regional ident from Ljubljana

Identification caption radiated by the new Danish TV service, 'Kanal 2'
successes during January include Russia on R1 and R2, Norway on E2 and E3, Spain (2nd network on channel E2) and RTP-Portugal from the channel E3 outlet at Lisbon.

Finally, Brian Cole G1DXC would like to know if there is a supplier of tuners with an IF of 10.7MHz covering the Eastern-bloc OIRT FM radio band which operates roughly between 63MHz and 73MHz. For initial help, please write to Brian at 32 Catkerton, Stichy, Telford, Shropshire TF3 1YT, or to the authors via Radio and Electronics World.

Italian pirate mystery solved

Kevin Jackson of Leeds has forwarded details of the new Italian private/pirate station which appeared on many DXers’ screens during the latter part of the 1985 sporadic-E season. It is called ‘Radio Tele Uno’ and it is located at Tarvisio on the border with Austria, near Udine. The station operates on channel IA but, at the moment, the ERP is not known.

It is interesting to note that the other private station ‘Nord Center Television’, shares this channel in the same area of Italy. The test card used by Radio Tele Uno is very similar to that radiated by the relatively new Danish service, Aarhus Lokal TV.

How to become a DXer – part 2

Last month we gave details about sporadic-E propagation in relation to DX-TV reception. Although this is possibly the most interesting form of TV DX, the easiest method is via enhanced tropospheric conditions. Provided that the enthusiast is not too interested about receiving sound channels, a domestic UHF TV aerial could be suitable for DX reception. This mode of propagation is often available from countries such as Belgium, West Germany and the Netherlands. Occasionally signals at UHF from further afield may be seen.

The troposphere extends to about 7,500 metres above the surface of the Earth. Slow moving areas of high pressure can affect television reception at irregular intervals. This type of weather pattern, often referred to as ‘anticyclonic’, produces clear blue skies by day and clear but cold nights. The Earth warms up during the day due to the lack of cloud cover but at night the accumulated heat is allowed to escape quickly. This heating and cooling process inevitably leads to inversions of temperature. The troposphere then acts as a waveguide, directing TV signals of above approximately 60MHz back to the Earth.

This type of propagation has the advantage that signals tend to suffer less from rapid fading and phase distortion. The opposite is generally the case with sporadic-E propagation.

For enthusiasts wishing to experiment with tropospheric reception, we recommend that they tune into the BBC weather forecasts in order to keep a check on the Atlantic chart for the appearance of high pressure systems. During prolonged openings it is quite likely that the local TV programmes will suffer from co-channel interference, thus alerting the prospective DXer to possible signals from the Continent.

Aerials for Band I TV

For initial experiments with SpE propagation, a dipole with each element cut to fifty inches will suffice. This roughly corresponds to the centre of the band. The dipole is best mounted horizontally, since most transmissions encountered are horizontally polarised.

Where possible the dipole should be erected externally. The height isn’t too important since signals propagated in this way arrive at an angle. Some method of realignment will be possible to achieve maximum signal pick-up, but a second or even third dipole could be installed with simple switching arrangements to select the most productive aerial.

The more serious enthusiast generally progresses to the luxury of a beam in order to receive the weaker signals. A second benefit is improved discrimination between co-channel transmissions arriving from different directions. 3 or 4-element wideband arrays are popular. For a more ambitious system a wideband array plus a couple of single channel aerials for channels E3 and E4, for instance, can be employed.

Aerial availability

Protel, of 295 Ballards Lane, London N12, carry a wide range of aerials suitable for DX reception. Their Band I range consists of fixed dipoles which they will supply cut to any required channel. A 4-element wideband array is available which will suit the needs of the more ambitious DXer. There is also a 4-element channelised design.

The aerials in stock are cut to channel E4, although Protel will construct systems for other Band I channels at no extra cost. For tropospheric reception at UHF, various wideband or grouped arrays are available. For trop DXing in Band III they can supply their own 5-element wideband design or the popular 13-element wideband Triax array.

Complete satellite TVRO systems, which include a multi-standard receiver, can be supplied with dish sizes from 1.2m upwards for really hardened telly addicts! Full details of all these receiving systems plus details about mast, brackets and accessories, can be obtained from Steve Stilwell on (01) 446 4441.

Multiband TV receivers

Various receivers (mainly colour) are now available within the UK without too many problems. However this was not the case a few years ago when enthusiasts had to go to great lengths to obtain multiband systems.

The French TV company Thomson can supply a 10-inch colour TV/monitor, model TF2502PI. It caters for Bands I/III and UHF, PAL or SECAM colour transmissions can be resolved and the set will operate Western European systems B, G and I (5.5MHz) and 6.0MHz intercarrier sound systems. It does not cover the Eastern European systems D and K (5.5MHz sound), although it will display the picture.

The TF2502PI will receive French system L transmissions and the different standards can be memorised on any of the programme selectors.

A brochure is available from the following UK distributor: Heron Electronics Limited, 1st Floor, Lawford House, 493 Harrow Road, London W10 4RE. Tel: (01) 968 4488.

Service information

Netherlands: The FuBK electronic test card is once again in use by NOS from three transmitters. The test card is radiated prior to the normal test transmission opening time of 0900 local time and identification includes ‘LOPIK’, ‘GOES’ and ‘MARKELO’. The latter only broadcasts the FuBK via NOS-1 on channel E7.

It is anticipated that some low power transmitters will come into service for Dutch army personnel stationed in West Germany. An NOS-2 test card has been received on channel E41 from the general direction of West Germany.

Belgium and West Germany: The Belgian BRT transmitter at Bensberg in West Germany is now using channel E25. Previously BRT programmes for Belgian army personnel were on channel E39, but regional transmissions from the WDR-3 outlet at Düsseldorf now occupy this channel.

Belgium: The BRT (Flemish language service) and RTBF (French language service) UHF transmitters at Wavre have been taken out of use on a permanent basis. The reasons are high operational costs and the extensive cable TV systems in the country.

West Germany: New identifications are in use with the FuBK test card radiated by the first network of Norddeutscher Rundfunk (NDR-1). The details are as follows: Hamburg – HMBBC and channel HMBG; Schleswig-Holstein – NDR-1 KIEL; all other NDR regions – NDR-1 HANNOVER.

NDR’s third network (NDR-3) is also using a new identification on the FuBK test card. It is radiated daily from all three network stations. The inscription is ‘FUBK’ and HMBG’ and is originates from Hamburg. A digital clock is incorporated.

The above information was kindly supplied by Gösta van der Linden of Rotterdam, Netherlands.

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MAY 1986
This article is being written in what is described as the coldest February since 1947 - all I can say is that I hope the sun has thawed the time it appears in print!

Sometimes a cold, bright spell gives us an opening on VHF and UHF, but this year there has not even been that to cheer us up. Never mind: I have received a tidy bunch of letters - and promises of more. First, however, I will just mention that the chairman of the Swiss ATV club USAT, Fritz HB9RWD, came to London recently on a rapidly arranged visit. I had the pleasure of meeting him and presenting him with some BAYC publications. We spent an interesting afternoon and evening discussing ATV operations in our two countries and agreed on the need to co-operate through the European ATV Working Group.

An interesting point is that in Switzerland ATV is officially banned on 70cm. Banned not by the licensing authorities, but by USKA, the national radio society! They have interpreted literally the IARU evening discussion on ATV operations in.

...over the weekend.

On the 30th he worked PE1AAQ and PE1H2R. Both stations were AM, which meant they had to slope detect Ron’s signals, but despite this he had P5 reports from ‘AAQ and P3 from ‘H2R. Both stations were received P5 in AM at Westgate and Ron managed to work them both again on 30 September.

Another kind of 24cm test has been going on in Northamptonshire recently. Charlie Suckling G3WGD, well known for his moonbounce and other 23cm SSB activity, has lately equipped for satellite TV using equipment with an IF of 850 - 1450MHz. He hit on the excellent idea of trying a 23cm receiving aerial connected to the tunable IF downconverter, and asked me to send him some colour and sound signals. I am pleased to say this was a total success. Colour vision and audio signals on 1255MHz were received on 9 February with 10 to 11 carrier to noise margin, despite the slightly unusual receive set-up.

Repeater news

Some repeater news now. GB3UD, near Stoke-on-Trent, is in operation as a manned relay station. Output is just 200mW, and the best DX report to date is G5KS, who is receiving it at P3 strength. It is hoped to raise the power to 8W.

Another machine operating as a beacon and manned relay is Durham, although it is on a temporary site. It uses a pre-production DC-to-Light transmitter generating 2 Watts. As soon as the licence is issued the repeater will swing into full action. There are also whispers abroad that the Bath repeater may enter service during March.

I have received a nice long letter on smart-looking Bristol FM TV Group paper. It comes from Shaun O'Sullivan G8UWE, who also enclosed a call-up letter addressed to the FM fraternity in and around Bristol. They are very keen to build aTV repeater (FM only) for Bristol and are actively generating local support. Roger Worth G4ZOF and Shaun act as chairman/treasurer and secretary/chief engineer respectively.

Their intention is for a fairly simple repeater (initially), without all the bells and whistles such as teletext pages but with good RF engineering. ATV activity in Bristol is running at a high level now, with several newcomers joining the scene. Besides the usual Wednesdays and Sundays local TV nets activity is often seen on other nights. Certainly a call on 144.750 will usually produce a response.

Bottom end

Roger G4ZOF, Chris G8GLQ and Shaun G8VPG carry out most of their exchanges on 24cm FM towards the bottom end of the band. Shaun and Roger are both fully equipped with Wood and Douglas gear, complete with pre/de-emphasis and subcarrier audio. They both use 23-element Tonna antennas.

Chris G8GLQ has mainly home-brew gear, including a 2C39 amplifier. He also has a corner reflector antenna. Len G8LUE is receive only at present but is building Allan Latham's transmitter. He has a Sandpiper helical antenna. Pete G0DRX is equipped with Wood and Douglas gear. Viv G1XE and Ivor G1XF are active viewers with Wood and Douglas equipment and a JVL 4 element loop yagi. They are awaiting the DC-to-Light transmitter.

Shaun is starting to dabble with 10GHz but has not had time to progress much. He and Roger have found that on 24cm the addition of Wood and Douglas's pre/de-emphasis modules have produced a staggering improvement in picture quality. Over their obstructed 14km path reports have gone from P2 to P3.5 to P4, with additional improvement in picture stability. So these modules are highly recommended, even if sound is still a bit scratchy (some more development work to be done!).

Another welcome letter has come from Andy Goy G4HJD in the city of Kingston upon Hull. After a great summer fun contest using BCD's call, G6CCV, they decided to carry out some more 1255MHz FM tests. The equipment was working but there was no-one to work during the contest! Andy had more luck in his summer holidays when he worked three of the Worthing stations on 1255MHz on their home ground.

In January Ron was successful in working a number of Dutch stations on 24cm. On 27 September he got a P5 report from PE1HLR (after a P5 link-up on 70cm) and on the 30th he worked PE1AAQ and PE1H2R. Both stations were AM, which meant they had to slope detect Ron's signals, but despite this he had P5 reports from 'AAQ and P3 from 'H2R. Both stations were received P5 in AM at Westgate and Ron managed to work them both again on 30 September.

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ATV ON THE AIR

Andy's transmitter is constructed using Wood and Douglas modules and G8KOE's design of audio modules. His receiver is the Fortop TVC1300 and BATC FM demodulator. Andy has had some problems with the intercarrier sound but a circuit by Martin G8KOE cured the problem. He also had problems of interaction between sound and vision, but the November CO-TV video strip should solve this. The tunable sound demodulator is already built and works well.

Getting out and about he and Nick G8PSE have been operating IP from a field six miles from Andy's QTH. Picture quality was P5 but colour eluded them. Dave G4WCD has also assisted in these tests. They are hoping to attract more people up to 24cm and intend to apply for a repeater next year. In the mean time they will take portable ATV systems to some public special events.

SSTV

Finally the slower scanners - and writers. Once again, despite promises to the contrary, the only letter is from Richard G3WW. What an idle lot you slow-scanners are! But back to the plot.

Firstly, commiserations to Grant Dixon, who suffered a fall in his shack while looking up some data for another amateur! He should be well by the time you read this, so here's hoping all is now to rights.

G3WW tells me he is still receiving phone calls asking him to compare the Wrasse SC-1 with the Robot 1200C in terms of their operation. The answer is that they are compatible for black and white but not for colour. The most recent enquiry was from E45FIN on 20 metres, who proceeded to give Richard a lengthy lecture on the 1200's capabilities - based on the literature alone.

A new station worked was 5SHHE on 20 metres using a Commodore 64: he wanted a QSL card direct just to show his friends who said it wasn't possible.

A local 144.5 FM net has sprung up using BBCs and Spectrums. It comprises G6YYQ (Littleport, Cambridgeshire), G6BDD (Ramsey St Mary, Cambridgeshire), G1ACB (Brinkley, Suffolk), G6OHH (Wimblington, Cambridgeshire), G4YVG (Tofts, Cambridgeshire), G4UVU (Newmarket, Suffolk), G8XOC (Stoke Ferry, Norfolk), G1MIA (Southery, Norfolk), G1ACO (Wirton, Norfolk), and G1EMW (Wareham, Dorset). They are known as the 'Fenland Net' and aim to meet at 1930 on Monday evenings (to give night shift workers a chance before they disappear to work), although most of these operators seem to be on nightly.

Richard is making two-way contacts to EU and the USA (when 20 metres is open) in black and white and colour using the SC-1 and the 1200C. The Ferguson Movie Star TV is working well as a colour monitor 'after 12+' has been taken off IFs'. G3WW suggests SSTV might live up 29.6MHz FM.

Moving house

Never think of moving house after 43 years; Richard is in the process of doing just this and the preparation is ghastly, even though the house is not yet sold. Discards from the junkbox will apparently fill several dustbins!

Finally, a couple of SSTV snippets. G4YVG (mentioned above) has made a very good job of a G9WCY transmit and receive converter and has also made a 24 second single-frame colour adapter. G3CDK has made an excellent 1200C tape of the shuttle flight in colour.

That's it for now. We could do with a few more letters for the next round-up, so don't keep all the news to yourselves. Drop me a line at 71 Falcutt Way, Northampton NN2 8PH or leave a 3 minute message on the answering machine: (0604) 844130.

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THURLBY DMMs 1503/1503HA/1604 £189/185/199
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MAY 1986

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MEDIUM WAVE

DXING

by Steve Whitt

I

nothing else, this winter has seen one of the most varied DX seasons for many years. On the MW band conditions have ranged from the excellent to the downright appalling!

On one hand some excellent DX from North and South America as well as the Far East was reported at the end of November '85 and around January 20th '86. In contrast, radio conditions took a steep downturn (at least for those of us listening to the bands below 30MHz) around the start of February.

In fact, one of the strongest geomagnetic storms since 1976 struck on February 8th, disrupting world-wide communications. This storm, which lasted approximately 24 hours, was the result of a series of powerful solar flares observed in the previous week. During such a storm a surge of high energy particles from the sun enters the Earth's magnetic field, leading to a concentration of intense ionisation in the polar regions. This led to the aurora that was reported to be visible in much of Britain, much further south than is usually the case. Geomagnetic storms disrupt power distribution, satellite and long distance cable communications, and sky wave radio communications.

The UK-based MW DXer will have noticed a complete absence of DX for about 10 days, so if at the time you suspected a faulty receiver or aerial now you know what was really going on.

Long waves

Although not really medium wave, the long wave band (150kHz – 290kHz) is often lumped together with the former under the term medium frequencies. Two things have prompted this item about this rather neglected band. Firstly, in the April issue of R&E there was an article by Richard Marris describing a loop antenna specially for the LW band and, secondly a number of significant frequency changes have recently taken place.

The 1979 World Administrative Radio Conference (WARC) decided that the arrangement of channels in the LF band should be standardised along the same lines as those on MF; that is all channels should be harmonic multiples of 9kHz. It was decided that the first five LF channels (currently 155, 164, 173, 182 and 191) would move on 1/2/88 to 153, 162, 171, 180 and 189kHz. The next five channels are due to shift on 1/2/88 and the last five on 1/2/90.

So far Deutschfunk has moved to 153, France Inter remains on 163.84, Moscow Home Service – on 171, Stimme der DDR is now on 177 (ex 179), Europe No 1 is on 183 (ex 185), and Sweden is now on 189kHz.

Desirable

Although a loop aerial would be a desirable accessory for listening to LW, it is perfectly possible to get good reception from a portable radio using the directional properties of the internal ferrite rod aerial to optimise reception from a particular direction.

Well, what can you hear? In addition to the stations listed above, a selection of stations from Europe, the USSR and North Africa are easily heard. Outside this area the LW band is not generally used for broadcasting. As a guide to what you'll hear I've included Figure 1.

Signals on the LW band behave much like their counterparts on the MW band. During daylight hours propagation is via the ground wave, which is augmented by such a sky wave signal at night. If you recall the item on MW propagation in this column last month you'll remember that the lower the frequency the greater the range of the ground wave signal. It is for this reason that the BBC can provide coverage of most of the UK with its 200kHz Radio 4 service from just one transmitter.

In addition, propagation via the sky wave is subject to less fluctuation than for MW signals. Consequently it is possible to provide good reception over large areas throughout the day and night.

The principle drawbacks associated with LW broadcasting are two-fold. Firstly there is only a limited amount of radio spectrum available – in fact only 15 channels which restricts the number of users, and secondly the long wavelengths involved (1000-2000 metres) require the use of either massive (and expensive) aerials or smaller, less efficient aerials and very powerful (and expensive) transmitters.

It's back to the medium waves for the next item, which was prompted by a letter from John Cooper of Hull, who wrote seeking some advice regarding the interconnection of aerials and receivers.

John seemed to be having problems getting the best performance from an external aerial when used with a National Panasonic R2000 multiband portable fitted with an internal MW aerial. Often a portable radio will have such an internal ferrite rod aerial as well as a socket for an external aerial. The problems usually arise because the internal aerial is not disabled when the external one is connected and the two signals interact.

Theoretically, in these circumstances it would be possible to delve inside the radio and disable the internal aerial, but this would probably make reception even worse due to receiver overload, since the internal aerial is tuned to provide the front-end selectivity of the radio.

One possible solution is the use of an aerial tuning unit between the external aerial and the radio to provide a better match between the two. Another solution is to use an external MW loop aerial instead of a long wire and to use a technique known as inductive coupling to get the signal from the aerial into the radio.

Inductive coupling relies on the transformer principle whereby the windings of the loop aerial and the ferrite aerial form the primary and secondary of an aircored transformer. With a normal communications-type receiver some sort of electrical interconnection between loop

Fig 1 Long wave band scan
and receiver is needed, but for inductive coupling to a portable radio there is no need for any cables or indeed for a loop amplifier. All that is required is a loop with its tuning capacitor to be located physically close to the ferrite rod of the portable radio (say 1-4 feet) and for it to be tuned to the same frequency as the radio.

With the loop so positioned and tuned, a marked increase in signal strength should be noted. For optimum performance and to make best use of the directional property of the aerials both the loop and the ferrite rod aerial should be correctly orientated so that their directional nulls coincide (Figure 2). To null out interference, both the loop and the radio need to be rotated as a pair together.

DX File
This month we welcome a relative newcomer to the MW band, 14 year old Darrell Rostron from Rochdale, who reports an interesting selection of European DX using his Trio R600 plus wire antenna. Darrell received good early evening signals from R Caroline in the N Sea (963kHz), Deutschlandfunk from Cologne (1269kHz), R Sweden International (1179kHz), Sud Radio Andorra (819kHz), Trans World R Monte Carlo (1467kHz).

Another dial-twiddler to report this month is Paul Barton, who hails from Harrogate. Paul is a keen MW-DXer and in his letter he describes his home-made receiver which, together with a 75-foot wire aerial, enabled him to hear the following mix of stations:

585kHz Madrid, Spain at 2330
891kHz RTA Algiers, Algeria, Arabic music at 2037
930kHz CJYQ St Johns, NF, Canada, pop music at 2325
981kHz RTA Algiers, Algeria, English programme at 2030
981kHz Athens, Greece, local pop music at 2050
1010kHz WINS New York, USA, news at 0010
1470kHz R Vibracion, Curapano, Venezuela, identification at 2400
1510kHz WMRE Boston, MA, USA, adverts at 2335

Finally before I close I’d like to say thanks for all the correspondence last month, and if you have any suggestions, problems or DX listening tips feel free to drop me a line c/o R&EW. So 73s till next month.

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LATEST LITERATURE

Pride of place in this month’s LATEST LITERATURE must go to the World Radio TV Handbook. This year is the 40th anniversary of this most illustrious tome, and the 1986 edition has seen some changes in design aimed at making the book easier to use.

For those unfamiliar with the DXer’s bible, WRTH provides details of the world’s radio and TV broadcasters. Frequencies and times, contact addresses, languages and powers are all given, along with brief details of programming. In addition, broadcasts are listed by time, and long, medium and short wave stations are listed by frequency.

Further reference sections cover solar activity, most suitable bands, clubs for DXers and so on, and there are excellent reviews of new equipment. Indeed, these reviews would be worth a book of their own, collated from past issues of WRTH.

Obviously, WRTH is essentially a series of lists, but don’t think it is inherently unreadable as a result, and there is a wealth of general features to enjoy. It forms an invaluable source of info for the serious DXer and the novice alike. WRTH is produced in Denmark by Billboard A G, and the official cover price is $19.95 (ISBN 0 902285 11 44). It is distributed in the UK by Pitman Publishing, 128 Long Acre, London WC2E 9AN. The agent for New Zealand is Arthur Cusden, 212 Earm Street, Invercargill, and for the USA and Canada is Watson Guittill, 1515 Broadway, New York NY10036. Rush out and order your copy now!

On the subject of guides and lists, the fourth edition of Dial-Search has just been published. This appears every two years, and is an A5 booklet of 46 pages designed as a quick reference guide for European listeners. Where WRTH could be regarded as an encyclopedia to be referred to as required, Dial-Search is a handy pocket book to be kept close at hand when listening in.

It contains such information as the broadcast band frequencies, a list of European medium and long wave stations likely to be heard using a domestic receiver without special aerials, a list of British stations, English broadcasts, etc. Maps of Europe and the British Isles give details of transmitter sites and high ground, and for the musically inclined there is a brief list of regular classical and jazz transmissions.

Dial-Search (ISBN 0 9508575 2 1) costs £3.30 including postage in the UK, or £3.50 (or 15 IRCs) in Europe, from George Wilcox, 9 Thurrock Close, Eastbourne, East Sussex BN20 9NF. It is also available through bookshops.

From one handy reference book to another: the 16th edition of Newnes’ Radio and Electronic Engineer’s Pocket Book, by Keith Brindley. This contains an amazing amount of information including its size, from abbreviations and formulae to aerial dimensions and UK radio stations.

Apparently, this edition has been ‘completely revised, reset and redesigned in an easier-to-use format.’ It will certainly prove immensely useful, and, even if it isn’t fully comprehensive, it cannot be rivalled at the price (£2.50, ISBN 0 408 00720 6). Newnes Technical Books are at 84-88 The Centre, Feltham, Middlesex TW13 4BH.

The next book we come to is a real gem for computer-literate short wave listeners and RTTY enthusiasts. George Sassoon’s The Radio Hacker’s Code Book is a detailed introductory guide to the reception of radioteleprint transmissions, especially those of non-amateur origins. These come from meteorological offices, international news agencies, embassies, oil rigs, even homesick Russian sailors!

Judging from its tone, this book is aimed at computer enthusiasts who seek new avenues to explore with their precious number crunchers. It is not primarily a book for radio amateurs who want to delve further into data transmission (it is worth noting that George Sassoon is evidently a radio amateur).

As a result, there is an obvious assumption that the reader has a certain degree of familiarity with a computer, and the basics of receiving RTTY are outlined for the uninitiated (and it is an excellent history of Baudot et al).

Sassoon takes the reader from setting up a station through an outline of what RTTY is, to the hardware and software requirements. There are numerous Basic and Z80 machine code listings, and a full description of a terminal unit (with circuits in the appendices).

With such basics established, we are introduced to the prospect of decoding encrypted transmissions. I must admit, the idea of cracking the codes of, for example, the Soviet Navy appeals to me immensely (but then I always wanted to be James Bond). Sassoon describes various encrypting systems used and the reader is shown how to write programs using a computer to decipher them. Perhaps of equal importance here is the admirable bibliography included at the end of the book, since the limited space in a book of 240 pages could not do justice to such an intricate topic.

Even if you’re only mildly interested in RTTY, I believe you’ll find The Radio Hackers Code Book fascinating. A word of warning, though: it is a book to be read thewhet appetite, so don’t blame me if you get badly bitten by the code-cracking bug.

It is published by Duckworth and Company Ltd, The Old Piano Factory, 48 Gloucester Crescent, London NW1 7DY. Tel: (01) 485 3484. The price is £6.95 (ISBN 0 7156 2068 1).

More bits and bytes in the next publication: An Introduction to Computer Communications, by that prolific writer RA Penfold.

This book is exactly what it claims to be, an introduction, so don’t regard it as a manual for use in serious applications: the reader is expected to be a curious home micro user, not a businessman thirsting for hi-tech.

The text is divided into three chapters: these being modems, local networks (strictly home micros), and radio communications. The principles of data transmission are covered first in a very competent manner, and then the intricacies of communicating via a modem are unravelled. The network section is brief as this area is somewhat limited for home micros, but some interesting possibilities are pointed out, and some useful general information is covered.

The radio communications chapter is similarly brief (after all, the whole book is only 120 pages), and outlines RTTY, CW, AMTOR and packet systems. It is a chapter to awaken the computer user to the possibilities of radio communications, not a detailed and highly technical account of this form of communications.
LATEST LITERATURE

Datel UK
The new 128-page DPM and calibrator catalogue from Datel provides information on the company’s broad product range, together with an easy to follow guide to selection. Also included is a comprehensive tutorial section on the fundamentals of DPM design and a glossary of terms. The book is arranged in nine sections. Section 1 discusses the features and functions to be looked for in a DPM, and provides a tabulated quick selection guide. Section 2 comprises 50 pages of concise information on Datel’s DPM product range, and includes details on several new families of instruments. This is followed by a 10-page section on specialised panel instruments (bar meters and programmable counter-timers) and by a 7-page section on voltage calibrators (hand-held, bench and panel-mounted). A section on accessories lists connectors, ac-to-dc power converters and newly-developed temperature sensors which are completely compatible with Datel instruments. Further sections provide product and panel cut-out dimensions, circuit diagrams of typical DPM applications, functional pin-out descriptions and an explanation of the theory of DPM operation. Finally, there is a 3-page glossary of terms.

Datel (UK) Ltd, Belgrave House, Basing View, Basingstoke, Hants RG21 2YS. Tel: (0256) 469085.

Aerial Techniques
Aerial Techniques’ 1986 catalogue is now available. It comprises a representative cross-section of equipment available from the aerial industry and should fulfil most receiving needs. However, if a customer is unable to find a specific requirement in the catalogue he should contact Aerial Techniques, who have access to all major suppliers and manufacturers. The catalogue is available, together with a separate price list, by return of post for 65p.

Aerial Techniques, 11 Kent Road, Parkstone, Poole. Dorset BH12 2EH. Tel: (0202) 738232.

Fulcrum
Fulcrum’s latest product catalogue incorporates the S100/696 computer board products which the company supplies, including the VME, IBM, Apple computer board products and single PCBs which it has recently become the distributors of. The catalogue details the specifications and price of every product and there is a section on extra services and products which the company can supply.

Fulcrum (Europe) Ltd, Valley House, Purleigh, Essex CM3 6QH. Tel: (0621) 828763.

Papst
The Papst Motors’ 1986 price list for Fan Products is now available. Despite pressure from the German deutschmark against sterling, many items listed last year have been either reduced in price or held in check. In addition thirty-one new units have been added to the 1986 list.

Copies are available on request.

Papst Motors Ltd, East Portway, Andover, Hampshire SP10 3RT. Tel: (0264) 53655.

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MAY 1986
In this issue, the out of band Far Eastern station review continues by listing those currently operating between the limits 4500 to 4735.

Xinjiang
On 4500 Xinjiang PBS (People’s Broadcasting Station) operates at Urumqi, China. With a power of 50kW it radiates programme in the Home Service from 2300 to 0200, from 0330 to 0730 and from 1030 to 1730 in Chinese. From 1800 to 1855, from 1900 to 1955 and from 2000 to 2055 it relays the Radio Beijing Foreign Service in Russian which is, needless to say, jammed. Nei Menggu PBS, Hohhot carries the Home Service in Mongolian from 2120 to 0600 and from 0900 to 1515, the power being 10/50kW on 4525. This one, unlike that listed above, is seldom logged here in the UK, although the chance of a DX ‘catch’ always exists for the invertebrate out of band searcher.

Clandestine
Next in ascending frequency order is the seldom heard clandestine Voice of the Revolutionary Party for Reunification, located in Haeju, North Korea on 4557. Except for an English transmission from 1400 to 1430, it programmes in Korean from 2000 to 2230, from 0300 to 0400, from 1000 to 1400 and from 1500 to 1700 with a power of 100kW.

Mainly intended for South Korean exiles, the programmes are pro-communist in content, the policy favouring the reunification of Korea on communist terms. This clandestine identifies in Korean as Tongil Hyongmyeong Mongsol Pangsongnimda.

China, Laos and Vietnam
Another station rarely reported by European DXers is Radio Beijing on 4650. It operates with a power of 50/120kW presenting programmes in Korean from 1100 to 1500 and in Russian from 1500 to an indeterminate sign-off time. The entire transmissions are jammed, of course.

Super DX exists, if only one could log it, on 4700 in the shape of Houa Phan in Laos. With a power of 1kW it serves the local community from 2300 to 0100, from 0330 to 0530, from 1000 to 1155 and from 1235 to 1435. The frequency is likely to vary slightly on occasions.

Two rarely heard Vietnamese transmitters are those based at Son La and Gia Lai-Kon Tum. The former occupies the 4700 channel, the latter 4701. Both are apt to vary in frequency slightly. Son La is in operation from 2230 to 2300 and from 1140 to 1400. This schedule includes programmes in Montagnard from 1200 to 1300 and from 1330 to 1400, and in Vietnamese for the remainder of the time. The latter station features programmes in Vietnamese and other local languages and is on the air from 2300 to 2330, from 0300 to 0430 and from 1030 to 1400. The powers are not known.

Burma
On 4725 may be found the oft reported BBS Rangoon. At 50kW, it is scheduled with local programmes from 1030 to 1455 (Saturday and Sunday until 1545) during January, February, March, April, May, June, September and October, and from 1030 to 1545 (Saturday and Sunday until 1445) during March, April, July, August, November and December.

For those addicted to tape recording, the local-style music is well worth taping — it is not every day that one can savour the sounds of crashing cymbals and sonorous gongs.

Identifying in Uigher
Adjusting the receiver to 4735 will almost certainly result in the signals of Xinjiang PBS. Urumqi, China being heard. Among other programmes it features the Home Service in Uigher and identifies as Xinjiang Khalk Radio Istansisi.

It is scheduled on the air from 2300 to 0230, from 0330 to 0730 and from 1030 to 1730, this including relays of the Radio Beijing Minority Language Service in Uigher from 1100 to 1126 and from 1330 to 1356. From 1900 to 1955 and from 2000 to 2055 it relays the Radio Beijing Foreign Service in Russian.

When seated comfortably at the receiver operating position, study this section, note the times herein, adjust the receiver to the frequencies specified, and listen. Hopefully you will receive similar results.

AFRICA
Ascension Island
BBC Relay on 11820 at 1919, OMs and YLS with a discussion about the British economy during an English programme for South Africa, timed from 1800 to 2030.

Cameroon
Radio Garoua on 5010 at 0430, the National Anthem at 0917, OM with a talk in the Arabic transmission and YL with a discussion in the General Arabic Programme for the Arabic world, scheduled from 0700 through to 2345.

Galon
Radio Japan (Gabon Relay) on 15210 at 1540, light orchestral music then OM with a talk about Japanese trees during an English transmission for Europe and the Middle East, timed from 1500 up until 1600.

Ghana
Accra on 4915 at 0600, OM with the station identification followed by a newcast mostly about local events and affairs. This is GBC at 10kW radiating in vernaculars and English from 0545 to 0800 (Sunday until 2200) and from 1200 to 2200.

Mali
Bamako on 4835 at 1927, OM with a talk in vernacular. This one is on the air from 0600 (Sunday from 0700) to 0800, and from 1800 to 2400.

Mozambique
Maputo on 3335 at 0309, OM choir, then OM with announcements in Portuguese.

Radio Mozambique is scheduled from 0300 to 0530 and from 1500 to 2215 with a power of 10kW in Portuguese and vernaculars. The frequency is variable. Maputo, formerly Lourenco Marques, is the seaport capital at the head of Delagoa Bay on the East African coast.

Nigeria
FRCN Kaduna on 4770 at 1950, OMs with a pop song in English, a pipes’ time-check at 2000UTC then OM with the station identification and a newcast in English, mostly about local affairs.

Seychelles
FBEA (Far Eastern Broadcasting Association), Mahé on 11755 at 0443, OM with a talk in the Arabic transmission beamed to Africa from 0345 to 0445. Carrier off at 0446.

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SHORT WAVE NEWS

Togo
Togbokiepe on 5047 at 0532, congregation with hymns followed by OM with a sermon in vernacular. The Home Service in French and vernacular is on this frequency from 0530 to 0803 and from 1703 to 0005, but there is an English news bulletin at 2000. The power is 100KW.

CENTRAL AMERICA
Antigua
BBC Relay on 11775 at 1110, OM with the news in English, OM with the identification at 1115 during the English presentation to Australasia and the Pacific Islands scheduled from 1100 to 1130.

Cuba
Radio Havana on 6165 at 2245, OM with comments on current affairs between recordings of Spanish pops during the English programme to Northern Europe, timed from 2200 to 2300. Seven chimes at 2254 then YL with the station identification in English.

NORTH AMERICA
Canada
Montreal on 11915 at 1538, YL with the station identification, OM with world news in the English programme for Eastern Europe, scheduled from 1538 to 1545.

USA
World Harvest Radio, Indiana on 7355 at 1040, OM with a religious talk in English during a programme for Europe timed from 0800 to 1100. Sign-off without the National Anthem at 1056 after announcing an address in South Bend, Indiana.

SOUTH AMERICA
Argentina
Buenos Aires on 11710 at 2300, OM with the station identification and a newscast in Spanish during a programme in that language timed from 2200 to 0100, intended for South American listeners.

Dominican Republic
Radio Clarin, Santo Domingo on 11700 at 2139, YLs with some folk songs complete with a backing of guitars. Radio Clarin programmes in Spanish to Central America from 1100 to 0500.

ASIA
China
Zhejiang PBS (People's Broadcasting Station) on 2475 and 2326, OM with a talk in Chinese. Voice of the Strait, Fuzhou on 2800 at 1536, YL with a talk in Chinese.
CPBS (Central People's Broadcasting Station) Beijing on 1512, YL with songs in Chinese. Xizang (Lhasa) PBS on 4035 at 1517, YL with a talk in Tibetan. Voice of the Strait, Fuzhou on 4045 at 1528, YL in Chinese, OM with announcements at 1530 then some local-style orchestral music.
Xinjiang PBS on 4220 at 1515, OM with announcements in Mongolian then OM with a song. Voice of the Strait, Fuzhou on 4330 at 1520, OM with a song, OM with announcements in Chinese. Xinjiang PBS on 4735 at 1428, OM's with a discussion in Uighur.
Xizang PBS on 4750 at 0042, YL in Chinese. Yunnan PBS on 4760 at 1512, violin music Chinese style. Xinjiang PBS on 4800 at 2335, OM in Chinese. Radio Beijing on 4815 at 1553, OM announcements in Mongolian at the end of a Foreign Service programme, 'East is Red' on chimes at 1600.
Xinjiang PBS on 5060 at 1510, Chinese orchestral music. CPBS Beijing on 5075 at 2220, OM with a talk in Chinese in a Home Service 2 programme.

South Korea
SBS on 7550 at 1557, YL and OM with a talk in the Korean programme for Europe and the Middle East, timed from 1530 to 1600.

Sri Lanka
Colombo on 11800 at 1450, YL with a song. Indian-type music then OM with some announcements in the Hindi transmission of the All Asia Service, scheduled on this channel from 1330 to 1730. The west coast city of Colombo is the capital of the republic, the artificial harbour being built by the British.

Pakistan
PBC Karachi on 4815 at 1534, OM with a talk in vernacular during a Regional Service programme. With a power of 10kW, this one is on the air from 0230 to 0600 and from 1200 to 1900.
Islamabad on 11995 at 1407, YL with a talk in Bengali to South and South-East Asia with many mentions of Pakistan. The schedule is from 1230 to 1445.

SOUTH-EAST ASIA
Philippines
FEBC (Far East Broadcasting Company) Manila on 11850 at 0950, OM with a religious talk and announcements in an English transmission for Australia, New Zealand and New Guinea, scheduled from 0700 to 1000.
FEBC Manila on 11890 at 1057, OM with a talk in the Chinese programme to Asia, timed from 1000 to 1100. OM with the station identification in English at 1059, OM in vernacular and off at 1100.

Vietnam
Hanoi on 12020 at 1332, OM with a newscast mainly composed of local events with some Asian items at the commencement of the English transmission to Asia, scheduled from 1330 to 1400.

NEAR AND MIDDLE EAST
Cyprus
BBC Relay, Limassol on 3990 at 0318, OM with a talk about the Turkish army in an English World Service programme timed from 0300 to 0530 on this channel.

Iraq
Baghdad on 11720 at 0518, OM with a song amid some Arabic music in the programme for the Middle East. This Arabic transmission starts at 0230 and ends at 1300 on this frequency.
Baghdad on 11750 at 0440, OM with the news in English followed by the station identification at 0445, the schedule being from 0300 to 0400 and directed to North America.

Lebanon
Radio Voice of Lebanon, Beirut on 6550 at 2235, light orchestral music Euro-style, YL with announcements in Arabic. The schedule is from 0415 to 2120, mainly in Arabic with some programmes in French and a few minute newscasts in English.

Oman
BBC Relay Masirah Island on 11955 at 0220, OM with a talk all about the short waves in an English programme for Iran and South Asia, scheduled from 2330 to 0530.

Qatar
Doha on 9905 at 2100, six 'pips', OM with the station identification and a newscast in the Arabic presentation to Africa, from 0245 to 0700.

NOW HEAR THESE
Kalaallisit Nunaat radio, Godthab, Greenland on 3995 at 1022, OM in Icelandic then a 6-note interval signal repeated at 1030. The Home Service is on the air from 1000 to 0300 weekdays and on Sunday from 1100 to 0205 with a power of 1kW (diode).

Choibalsan, Eastern Mongolia on 4995 at 1544, Chinese-style orchestral music, OM with a song just audible on peaks. This 12kW transmitter carries the Home Service 1 from 2200 to 1600. This schedule includes slots of the Moscow Foreign Service in Mongolian daily, and in Russian and Chinese on Tuesday and Friday. The frequency can vary from 4994 to 4996.

NOW LOG THESE
For newcomers to the hobby, try some of the Brazilians on the 25 metre (11650 to 12050) band.
Radio Nacional da Amazonia, Brasilia on 11780 at 2322, OM with a talk in Portuguese then OMs with local-style songs and guitars. Radio Guaira, Porto Alegre on 11785 at 2225, OM with a newscast in Portuguese, OM with the station identification and a trumpet fanfare.
Radio Globo, Rio de Janeiro on 11805 at 0132, OM and YL with some commercials in Portuguese. Radio Brasil Central, Goiania on 11815 at 2150, OM with a talk in Portuguese with mentions of Brazil in the capital. Radio Bandeirantes, Sao Paulo on 11925 at 0138, OM with pops in Portuguese.

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59
WA Sparks G8FBX

We were very sorry to hear of the death of Bill Sparks G8FBX, a regular contributor to our sister magazine Amateur Radio and co-author of the excellent CB conversion articles in R&EW, November '84 and March '85, on 6 January this year.

A keen SWL in his youth, Bill became an electro-chemist working for a number of years for Salford Electrical Instruments and latterly as a principal in several electro-plating companies, until ill-health forced an early retirement.

The printing of the certificates has been financed by the council and any money left over after the costs of administering the award have been met will be distributed between the Radio Amateur Invalid and Blind Club (RAIBC) and Hebdon Green School for Handicapped Children in Winsford, Cheshire.

There are two classes of award: class A for single band, multimode, and class B for multiband, multimode. To qualify for the award amateur stations must have achieved either of the following:

1. Worked nine stations who are situated in the district of Vale Royal or who are members of the Mid-Cheshire Amateur Radio Society, plus one Mid-Cheshire Amateur Radio Society station (G3ZTT, G8ZTT).

2. Worked both Mid-Cheshire Amateur Radio Society stations plus the Delamere Forest Microwave Activity Group station (G4ZTT) and the Vale Royal Contest Group station (G6ZTT).

Applications should be sent to Hans M Field, Awards Manager, Mid-Cheshire Amateur Radio Society, 6 Llanedepen Close, Winsford, Cheshire CW7 1NA, together with an extract of their log showing the details of the contacts claimed, signed by themselves and one other licensed radio amateur to confirm that the extract is a true copy of the applicant's log. Also enclose a cheque or postal order, made payable to the Mid-Cheshire Amateur Radio Society, for the sum of £1.00 (sterling) or 5 IRCs for applicants outside the United Kingdom, and an A4 sized sae (UK only).

For any further information about the Vale Royal Award contact Dr E J Loader G8HXU on Runcorn (0209) 513944 during the day or phone Northwich (0606) 75660 in the evening.

Mobile radio rally

The Mid-Ulster Amateur Radio Club is holding its annual mobile radio rally on Sunday 18 May in the grounds of Parkkaur House, which is situated approximately six miles from Dungannon on the main Ballygally Road.

The event starts at 12.00 noon. There will be the usual trade stands and a bring-and-buy stall as well as talk-in on 144.550MHz.

Monthly meetings of the Mid-Ulster Radio Club are held on the second Sunday of each month at 3.00pm in the Guide Hall, Castle Hill, Guildford. There is usually a talk or demonstration of interest to radio amateurs and everybody is welcome. For details about either the rally or the meetings contact the club secretary, Sam White, tel: (0762) 22855.

Hobby fair

The Wembley Conference Centre in London will host the Amateur Radio and Electronics Hobby Fair on 5 and 6 July. This is apparently the first two-day fair of its type to be held in the south of England, and is a major new event on the rally calendar.

A wide variety of retailers and manufacturers will be present offering a range of goodies: RTTY, satellite TV and communications, micro-

ERRATA

Readers should note the following errors and omissions published in S Dean's article, RTTY decoding using the Spectrum - Part II, in the March issue.

In the Basic part of the program, line 420 should read: 420 LET MSB=INT (ADD/256); LET LSB=ADD-256*MSB

In the Transmit M/C routine the 9th line from the top should have a label:
AGAIN: 3A 08 5C  LD A, (5C08)

We apologise for any inconvenience caused by these errors, although most of them will not affect normal operation of the program.
waves, hobby components and amateur TV will all be included at the fair.

If you are interested in attending as an exhibitor, contact: Amateur Radio Promotions, Woodthorpe House, Clapgate Lane, Birmingham B32 3BU.

**Binstead ARS**
The Binstead Amateur Radio Society meets every Wednesday at the Scout Headquarters, Drill Hall Lane, Binstead. Morse lessons and instructions on the RAEE are given where required, and AMTOR and ATV are demonstrated on certain dates according to requirements.
The society has its own radio shack built into the Scout buildings and runs a variety of activities, including exercises with the Scout group.
The club also has its own award: The Binstead Amateur Radio Society Island of Wight Award. To qualify for this you must meet the following requirements: VHF—work ten Isle of Wight stations which must include the G0BAR club station; HF—work five Isle of Wight stations, again including the G0BAR club call.
The award is printed in four colours and costs £2.50.
For further details contact: D F Barnes G4VJF, 2 Shorbourne Avenue, Binstead, Ryde, Isle of Wight PO3 PX.

**Wireless revival**
This popular annual mobile rally for radio amateurs is being held on Sunday 25 May at the Civil Service Sports Ground, Straight Road, Bucklesham, Ipswich, Suffolk.

With features such as traders, a car boot sale, an aerial testing range and a vintage radio display, plus non-radio stalls, children's play area, a model flying display and other attractions, this rally provides a happy day out for the whole family. The admission price is 80p.
Further details are available from: Jack Tootill G41FF.

---

**Southgate ARC**
The Southgate Amateur Radio Club meets at 7.30pm for an 8.00pm start on the second Thursday of each month at the Holy Trinity Church Hall, Green Lanes, Winchmore Hill, London N21. On 8 May there is a talk by Stan Wood, the Marconi Company historian.
For further details contact: R F Sandy G4OBE, 12 Borden Avenue, Enfield, Middlesex EN1 2BZ.

**May Day microwave**
There is a BATC contest day on 5 May. The May Day Microwave, 23cm and 3cm fast scan, takes place between 0001 and 2359 hours.
For entry forms, log sheets and information about contest rules send an s.a.e to: Mike Wooding G6IQM, 3 Perkins Grove, Rugby CV21 4HU.

---

**COMPETITION RESULTS**
The winning limerick in our competition to win the new TT/9003 transistor tester from Repro Electronic Systems (featured in the February issue) is from R E Mackenzie of Herne Bay, Kent:

> A radar technician one day
> Of a magnetron got in the way
> Twas the radial scan
> That spiralled the man
> To an "ohm" in the Milky Way!

Congratulations, Mr Mackenzie. Your transistor tester is on its way! Well done everybody for your efforts, especially those of you who actually know what a limerick is (and it's amazing how many people don't...)

---

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**MAY 1986**

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a n y  9 3 4 t r a n s c e i v e r , p r e f e r  b a s e u n i t b u t n o
S h u r e  b a s e  m i c ,  K e n w o o d  h a n d  m i c .  E x c h a n g e  f o r
S l a l e y ,  N o r t h u m b e r l a n d  N E 4 7 O B S .  T e l :  ( 0 4 3 4 7 3 )
o f f e r .  T e l :  S o u t h a m p t o n  4 6 3 0 4 4 .
T e l :  ( 0 5 0 2 )  6 5 7 2 6 .
s i d e d , d r i l l e d , £ 1 . 5 0 . W o b b u l a t o r 7 MH z - 7 0MH z ,
•  P C B  f o r  P W  M e o n  5 0MH z  t r v t  1 0m  i n p u t ,  d o u b l e
t y p e  n o  S L V 1 4  ( 4 5 0 b e a d  t a n t a l u m  c a p s  4 71 S F 3 5V W ,
r e c h a r g e a b l e  s e a l e d  b a t t e r i e s ,  £ 4 5 . 0 0 .  N o  o f f e r s ,
W  W o o d w a r d ,  4 F e l l o w s  R o a d ,  S p a r k b r o o k ,  B ' h am
•  D a t o n g A D 3 7 0 M PU  n e w , D a t o n g D C 1 4 4 / 2 8
S l i m  J i m  w a v e m e t e r ,  n e w ,  4 w a t t  P S U  d c  v a r i o u s  S S
3 9 5 7 2 0 .
i n ,  1 0 0 W  o u t ,  £ 9 5 . D r a e  1 3 . 8V  1 2 a m p  p ow e r  s u p p l y
•  H a l l i c r a f t e r s  S k y  C h i e f ,  O s r a m  M u s i c  M a g n e t ,
A C 7 1 ,  E k c o  A 2 3 M a r c o n i  2 6 2 ,  M a r c o n i  5 5 9 ,  V i d o r
1 9 M k I l l  t a n k  r a d i o ,  E k c o  A 2 1 ,  M u r p h y  D 3 4 ,  B u s h
r e c o n d i t i o n e d  1 9 8 5 ,  £ 8 0 0 n o .  1 A  B r i d g e  G a r d e n s ,
N u n n e r y  S t r e e t ,  C a s t l e  H e d i n g h a m ,  E s s e x .
6 2
Send to: Radio & Electronics World Classified Ads
Sovereign House, Brentwood, Essex CM14 4SE
Classification: (tick appropriate box) If you want to insert ads under more than one classification use separate sheets for second and subsequent ads
For Sale .................................. ☐ Wanted.................................. ☐

USE BLOCK CAPITALS (One word per box)
To avoid mistakes please write clearly and punctuate your ad

Name/Address
Postcode/Telephone

USE SEPARATE SHEET FOR MORE WORDS
Ensure that you have included your name and address, and/or telephone number

CONDITIONS: Your ad will be published in the first available issue. We will not accept trade advertisements. We reserve the right to exclude any advertisement.

MAY 1986
please mention RADIO & ELECTRONICS WORLD when replying to any advertisement

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SMALL ADS

THE SCIENTIFIC WIRE COMPANY
11 Forest Road, London E17. Telephone 01-541 1055
ENAMELED COPPER WIRE
Size     Colour     AWG     450'     1000'     2500'
0.03     0.50        2.5      1.05      0.98
0.03     0.51        2.5      1.15      1.03
0.04     0.51        2.5      1.37      1.30
0.04     0.52        2.5      1.37      1.30
0.04     0.53        2.5      1.45      1.40
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Best quality Mitsubishi Rayon 0.5mm cut to length - 25p per metre. Add 75p for postage, packing and data.

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BAS 485 Aerial booster tripe the gain
of weak television price £3.70 p + p 50p
B485HG video beam from your video recorder

Electronic Mallord
62 Bridge Street, Ramsbottom
Lancs BLO 9AG
DIAL-A-FREE LEAFLET
(24hr) 070 682-3036

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Test Equipment
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linearity with our two-tone test
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Access Barlcaycard (VISA) welcome.
62 Lawes Avenue, Newhaven
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Tel: (0273) 514465.

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Dragn/RFEX is a wide range of high quality radio
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RTTY Tape £15, Morse Tape £6.95 CW Transceivers £10.75
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SCART/VGA Tape £10
ADPM-RTTY Utility ROM £15
All programs feature split-screen type-ahead operation
Maidenhead Locator (Dragon & CBM64) Tape £3
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resonance curves. Put component values into
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FOR A PERIOD OF ___________ issues ___________ issues ___________ issues ___________ issues
COPY enclosed ___________ to follow ___________
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CHARGE TO MY ACCOUNT ___________

COMPANY ___________
ADDRESS ___________
SIGNATURE ___________
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12v DC to 230v 50 cycle 200 watt £85.
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CRYSSTALS Made to order for any purpose and large stocks of standard frequencies for computers, modems, etc. Amateur CW (QRP) freqs £4.00 and CB conversion crystals at £4.50.
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M57713/SAV8 VHF/SSB 15W £39.00
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Tel: (0253) 885107

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Closed Wed & Sun.
Electronic Component Specialists.
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JOHN GM3OEP
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40mm x 59mm double
Total
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6 issues
12 issues
Single
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£88.00
£158.00
Double
£94.00
£176.00
£316.00

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0277 219876

for details

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<th>ad space</th>
<th>1 issue</th>
<th>2 issues</th>
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### Colour Ad Rates

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<td>£840.00</td>
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<th>Issue</th>
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<th>Mono artwork</th>
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<td>12 Jun 86</td>
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**SERIES RATES**

Series rates also apply when larger or additional space is taken that initially booked. A 10% discount is given if series rates are not taken in any single insertion. The minimum space must appear in all issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received.

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