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NEXT MONTH

54 What's in Store for You

☐ Next Issue
Cover date October 1986 on sale Thursday, 11 September

☐ Publication Date
Second Thursday of the month preceding cover date

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Radio & Electronics World Magazines

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

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

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

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Cover Photographs
Top — a low cost bench TV and video PAL pattern generator (p8)
Bottom — a new colour graphics card by Wild Vision (p12)
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.

Clinical<br>

The Meteor 600 frequency counter, available ex-stock from Thurlby Electronics, features an input sensitivity of better than 5mV up to 100MHz, better than 10mV up to 50MHz, and better than 25mV up to 600MHz.

It has a full 8-digit display, two levels of prescaling and three gate times between 100ms and 10s. Using the longest gate time, a resolution of 0.1Hz can be obtained.

The standard crystal reference oscillator has a typical temperature stability of better than 2.5ppm from 10°C to 40°C and an ageing rate below 1ppm per year.

The Meteor 600 has dual inputs with impedances of 1MΩ and 50Ω respectively. A switchable low-pass filter is incorporated for the removal of unwanted high frequency noise when measuring low frequency signals, and a variable threshold trigger level control is also provided.

The Meteor 600 can be operated from an ac line or from rechargeable batteries. Its dimensions are 220 x 240 x 100mm and it weighs 1kg. The UK price is £99 + VAT.

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

Electronic & Computer Workshop Ltd has announced the availability of high voltage probes for the Crotech range of oscilloscopes. The universal design also allows the probes to be used with many other instruments that utilise a standard BNC input connector.

The P100 is a light-weight probe that gives x100 voltage sensing and permits voltages of up to 1kV to be measured easily.

This is well suited to many equipment testing applications where HT supplies are to 40°C and an ageing rate below 1ppm per year.

The P100 has dual inputs with impedances of 1MΩ and 50Ω respectively. A switchable low-pass filter is incorporated for the removal of unwanted high frequency noise when measuring low frequency signals, and a variable threshold trigger level control is also provided.

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

FEATURED OPTIONS

Electronic & Computer Workshop Ltd has announced the availability of high voltage probes for the Crotech range of oscilloscopes. The universal design also allows the probes to be used with many other instruments that utilise a standard BNC input connector.

The P100 is a light-weight probe that gives x100 voltage sensing and permits voltages of up to 1kV to be measured easily.

This is well suited to many equipment testing applications where HT supplies are present.

For voltages of up 40kV, such as those present in TV receivers and other UHV rails, the HV40 provides a x2000 voltage multiplication ratio.

The probes are available from ECW at all-in prices of £28.18 for the P100 and £34.93 for the HV40.

Prices include VAT and post/packaging.

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

LOW COST DSO

Hameg Limited have launched “the world’s lowest cost” dual channel digital storage oscilloscope, the HM205, which costs £448.00 plus VAT (including probes).

This 20MHz real-time oscilloscope permits storage and display of slow-occurring signals and events (from 50s to 0.1ms). None of the usual problems associated with long-persistence screens, such as trace flicker, streaking and relatively short view time (max 10s in single-shot mode) due to unavoidable loss of brightness are present in the HM205.

With a maximum sampling rate of 100kHz, the resolution of 1024 x 256 points for the X and Y axes is great enough to register and display even the most minute waveform.
details. In the 'refresh' mode waveforms, amplitude and frequency changes are visible immediately. Signals recorded in the 'single-shot' mode can be stored until the instrument is switched off, even if it is operated in any of its real-time modes.

With an optional add-on, the memory contents can be retrieved as hard copy using a chart or X-Y recorder. In many applications, when slow phenomena below 10kHz are involved, the HM205 can perform the functions of much more expensive digital storage scopes.

The HM205 also offers ease of operation in the real-time or analogue mode. It features a component tester which operates at the push of a single button, and a specially designed active video trigger that permits stable triggering of distorted TV signals.

There are three rear panel BNC sockets for vertical signal out, sweep out, and Z modulation input. The instrument also features 2-level graticule illumination and a switch-selectable 1kHz/1MHz calibrator.

Hameg Oscilloscopes Ltd, 74-78 Collingdon Street, Luton, Bedfordshire LU1 1RX. Tel: (0582) 413174.

**LOGIC ANALYSER**

New from Gould Electronics Ltd is the K20 logic analyser, a low cost, easily portable instrument that offers up to twenty-four channels of logic analysis, with both state and timing mode capabilities.

Features include a memory depth of 2K samples/channel, a maximum clock rate of 100MHz, and a glitch capture mode. Hex and binary formats can be displayed simultaneously, and the K20 also incorporates a triggering facility whereby three user-defined patterns may be used sequentially or in combination.

The instrument has an internal clock with a 25Hz-100MHz frequency. Set-up is assisted by on-screen messages which can be accessed by pressing the Help key.

Weighing only 4.1kg and with dimensions of 135 x 254 x 294mm, the K20 is easily portable and ideal for a wide range of service applications. The instrument has input voltages of 110/120V ac 60Hz and 220/240V ac 50Hz, and is supplied with a state probe, timing probe, test lead set, and user manual. Available as an optional extra is a nylon carrying case.

Gould Electronics Ltd, Instrument Systems, Roebuck Road, Hainault, Ilford, Essex IG6 3UE. Tel: (01) 500 1000.

**FIELDMETER**

John Chubb instrumentation has developed a fast response electrostatic fieldmeter, the JCI 111F, for measuring both truly static as well as rapidly varying electric fields. The fast response capability enables rapidly changing electrostatic conditions to be followed in manufacturing operations - such as, for example, in production handling of components sliding in contact with insulating surfaces. 50 and 60kHz electric fields can also be reliably monitored.

The JCI 111F sensitivity ranges are 5, 20, 200 and 2000 kV/m fed with both manual and automatic range selection. Static and slowly varying electric field observations are displayed in a 3½-digit liquid crystal display. This provides a resolution of a few volts per metre and the ability to measure surface potentials to a volt at 90mm separation. Fast changing electric fields are monitored via the analogue signal output with a response time within 3ms. The instrument includes both battery and mains power supply operation and has integral battery charging facilities.

The fast response capability of the JCI 111F can be combined with options for a user-settable alarm circuit or an RS423 communications interface. A bayonet pin arrangement is provided around the sensing aperture for mounting units which expand the range of application of the instrument. Charge may be measured using the JCI 151 Faraday Pail, and the JCI 156 and 158 voltmeter adaptors enable the fieldmeter to be used as a sensitive and stable electrostatic voltmeter. With the JCI 155 charge relaxation test unit it will be possible to study fast static charge dissipation effects.

John Chubb Instrumentation, Unit 30, Landsdown Industrial Estate, Gloucester Road, Cheltenham, Glos GL51 8PL. Tel: (0242) 573347.

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**COLOUR & MONOCHROME MONITOR SPECIALS**

**SYSTEM ALPHA 14 COLOUR MULTI INPUT MONITOR**

Made in Japan, the most advanced mini computer TV system on the market. This system comes complete with a high quality colour TV set, a colour monitor and all accessories. Effects include: 5cc Transistor, 3 colour mix, 16 intensity, 3 2/3m, 25000 ways, 3 1/2 way, 3 1/2 way, 3 1/2 way. A fantastic deal with a 3 year warranty. Only £259.95.

**DECCA 80 18 COLOUR MONITOR, RGB input**

Through dedicated research and development, DECCA have created a brand new unique RGB input system. This system is a must for anyone wishing to have a truly high quality TV and monitor system. It comes complete with a quality monitor, high quality video input, RGB port, and all accessories. Effects include: 5cc Transistor, 3 colour mix, 16 intensity, 3 2/3m, 25000 ways, 3 1/2 way, 3 1/2 way, 3 1/2 way. A fantastic deal with a 3 year warranty. Only £259.95.

**DECCA 80 18 COLOUR MONITOR, Composite video input**

Through dedicated research and development, DECCA have created a brand new unique RGB input system. This system is a must for anyone wishing to have a truly high quality TV and monitor system. It comes complete with a quality monitor, high quality video input, RGB port, and all accessories. Effects include: 5cc Transistor, 3 colour mix, 16 intensity, 3 2/3m, 25000 ways, 3 1/2 way, 3 1/2 way, 3 1/2 way. A fantastic deal with a 3 year warranty. Only £259.95.

**BUDGET RANGE EX EQUIPMENT MONOCHROME video monitors**

All units are fully tested and are made to high standards. There is a wide range of models to choose from. We have a selection of budget range video monitors. They are all tested and are fully guaranteed. Only £59.95.

**GOLDFQ43 enclosed, compact switch mode supply with DC regulated output.**

This unit is a compact switch mode power supply. It is ideal for use with small microprocessor based systems. It has a DC output of 24V, 500mA. It is perfect for use with the IBM PC or any other PC compatible system. Only £29.95.

**GOLDFQ43-4 5V 4.5amp switch mode supply.**

This unit is a compact switch mode power supply. It is ideal for use with small microprocessor based systems. It has a DC output of 5V, 4.5A. It is perfect for use with the IBM PC or any other PC compatible system. Only £29.95.

**FULL RANGE OF ACCESSORIES**

We have a full range of accessories available. These include: keyboard, mouse, printer, modem, hard disk, etc.

**KEYBOARDS**

Manufacturers Brand NEW surtury with 67 keys. There are 4 x 16 keys, 3 x Y, 1 x X, 1 x W, 1 x V, 1 x U, 1 x J, 1 x K, 1 x L. The keyboard is designed for use with all IBM compatible systems. It is fully compatible with all IBM compatible systems. Only £29.95.

**DATA LINKS WIRELESS SURTURY**

We have a full range of data links wireless surtury. These include: 67 keys, 1 x Y, 1 x X, 1 x W, 1 x V, 1 x U, 1 x J, 1 x K, 1 x L. The keyboard is designed for use with all IBM compatible systems. It is fully compatible with all IBM compatible systems. Only £29.95.

**MACHINE SPECIFICATIONS**

- **CPU:** 8088/8086
- **RAM:** 64K
- **ROM:** 64K
- **HD:** 360K
- **CRTC:** 1024 x 800
- **Monitor:** 1280 x 1024
- **Display:** 16 colours
- **Keyboard:** 110 keys
- **Mouse:** One button
- **Printer:** Raster dot matrix printer
- **Modem:** 300 bps
- **Network:** Ethernet
- **Power Supply:** 180W

**SOFTWARE**

We have a full range of software available. These include: IBMPC DOS, IBMPC PCK, IBMPC TEC, etc.

**BUDGET RANGE**

We have a full range of budget range systems available. These include: IBMPC 8088, IBMPC 8086, etc.

**HIGH QUALITY COLOUR TV SET**

The fabulous TELEBOX TV set comes complete with a colour monitor and all accessories. Effects include: 5cc Transistor, 3 colour mix, 16 intensity, 3 2/3m, 25000 ways, 3 1/2 way, 3 1/2 way, 3 1/2 way. A fantastic deal with a 3 year warranty. Only £259.95.

**REDIFFUSSION MARK III, 20” COLOUR monitor.**

This system is a high quality colour monitor. It comes complete with a high quality monitor, all accessories, and a 3 year warranty. Only £259.95.

**MICRO COMPUTER DECCA 8016 20” COLOUR monitor.**

This system is a high quality colour monitor. It comes complete with a high quality monitor, all accessories, and a 3 year warranty. Only £259.95.

**CONTAST AND BRIGHTNESS - even in PIL tube, Matching including our very own TEL BOX A and internal speaker and audio amp may be rugged ALLOY chassis to continually supply fully regulated DC outputs of +5V for driving an external speaker, sound-THE ONLY.**

**ONL� ONLY £24.95 OR £19.95 warranty. Post and packing £3.50 when used with colour CRT.**

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**DECCAPAX VP1 complete Professional system is a significant improvement over the PRESTEL system. It is supplied complete with a full range of accessories. Effects include: 5cc Transistor, 3 colour mix, 16 intensity, 3 2/3m, 25000 ways, 3 1/2 way, 3 1/2 way, 3 1/2 way. A fantastic deal with a 3 year warranty. Only £259.95.

**ALPHATEL, very compact unit with integral FULL ALPHABETIC keyboard. Just add a domestic TV monitor and you have a PRESTEL system ready to go. Post and packing FREE.arts. Effects include: 5cc Transistor, 3 colour mix, 16 intensity, 3 2/3m, 25000 ways, 3 1/2 way, 3 1/2 way, 3 1/2 way. A fantastic deal with a 3 year warranty. Only £259.95.

**BUDGET RANGE**

We have a full range of budget range systems available. These include: IBMPC 8088, IBMPC 8086, etc.

**SPECIAL OFFER**

MODEL 20-1 72-200, compact. Cost unit for use as subscriber card to PRESTEL PRESTEL GOLD, MONOBAND 20-2 1200-75 Same as 20-1 but for viewing of colour pictures. Both units are fully loaded and include a full range of accessories. Only £299.95.

**MITSUBISHI M2894-638” BRAND NEW metal case, Mahogany finish, 12” monitor, 25mm wide, 25mm high, 35mm deep, INTEGRAL MODEM, etc., for direct connection to TELEX system, recently on sale at £499.95, now only £149.95.**

**HOOBBY IUSER SPECIAL OFFER**

MODEL TG2423 80” to 1200, full duplex, 4 way or 6 way, duplex. Only £149.95.

**DISH PRINTERS**

**SPECIAL BULK PURCHASE of these compact, high quality digital printer systems.**

IBMPC COSYTER 114, IBMPC FAX 114, IBMPC EXPANDER 114, IBMPC FAX 114. The unit is a state-of-the-art product. Only £299.95.

**SPECIAL OFFER**

MODEL G201 75-200, compact, Cost unit for use as subscriber card to PRESTEL PRESTEL GOLD, MONOBAND 20-2 1200-75 Same as 20-1 but for viewing of colour pictures. Both units are fully loaded and include a full range of accessories. Only £299.95.

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SEPTEMBER 1986
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FR1300-02 features a very heavy duty die cast chassis and DASSIDLO type print mechanism giving superb registration and print quality. Microprocessor electronics offer full DIP/20 pin CPM command compatibility and full control via CPM WORDSTAR etc. Many other features include bi-directional printing, switchable 10 or 12 pitch, full width 381mm paper handling with up to 163 characters per line, friction feed rollers for single sheet or continuous paper, internal buffer, standard RS232 serial interface and built in Mongeau interface. Supplied absolutely BRAND NEW with 90 day guarantee and FREE daisy wheel and dust cover. Order NOW or contact sales office for more information. Optional extras $232 data cable $10.00 Tech manual $7.50 Tractor Feed $140.00 Spare daisy wheel $3.50. Carriage & Ins. $15.00.

- **EX NEW SERVICE PRICES**

Compact ultra reliable quality built unit made by the USA EXTEL Corporation. Often seen in major hotels printing up to the minute News and Financial information, the unit operates on 5 UNIT BAUDDY CODE from a Current loop, RS232 or TTL serial terminal. May be connected to your micro as a low cost printer or via a simple interface and filter to any communications receiver to enable printing of worldwide Newspapers, etc. SUPPLIED in either interface.

Sold BRAND NEW at a fraction of cost only $49.50 + pp $4.50.

**SUMMER OFFER ONLY $399.99!!**

DIY PRINTER MECH

Brand New surplus of this professional printer chassis gives an outstanding opportunity for the Student, Hobbyist or Robotics constructor to build a printer - plotter - digitiser etc. entirely to their own specification. The printer mechanism is supplied ready built, all connecting wires are tested but WITHOUT electronics. Many features include all metal chassis, phosphorus bronze bearings, 132 character optical shaft position encoder, NEEDLE head 2 x two phase 12 V direct drive with carriage and paper control, 0.5 Paper Duster etc. Even a manufacturer's print sample to show the unit's capabilities. Overall dimensions are 12 x 12 x 10cm.

Order NOW or contact sales office for more information. Optional extras $232 data cable $10.00 Tech manual $7.50 Tractor Feed $140.00 Spare daisy wheel $3.50. Carriage & Ins. $15.00.

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**DEC CORNER**

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Many EX STOCK computer tape drives and spares by PERTEC, CIPHER, WANGO, DIGIDATA, KENNEDY etc. Special offer this month on DEI Cartridge tape drives only $450.00 each.

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All in one quality computer cabinet with integral switched mode PSU, mains filtering, and twin fan cooling. Originally made for the famous DEC PDP8 computer system costing thousands of pounds. Made to run 24 hours per day the PSU is fully enclosed in a removable top lid, fusing, trip switch, power and run led mounted on all front panel, rear cable entries, etc. etc Units are in good but used condition - supplied for 240v operation complete with full circuit and tech man. Give your system that professional finish only $49.50 + carr. 19" wide 16" deep 10.5" high. Useable area inside 11.5 x 11.5 x 10.5. Also available less PSU, with fans etc. Internal dim. 19" w, 16" d, 10.5" h. £19.95. Carryage £7.75.

**66% DISCOUNT ELECTRONIC ON COMPONENTS EQUIPMENT**

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2xk $5.25 pp $1.25
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**SEMICONDUCTOR ‘GRAB BAGS’**

Mixed Semis amazing value contents include transistors, diodes, logic, ICS, triacs, diodes, bridge rect, etc etc. All devices guaranteed brand new. $10 each spec with manufacturer's markings, fully guaranteed.

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TTL 74 Series. A fantastic purchase of an "across the board" range of 74 TTL series IC's. $1 each. All 100+ fixed "mostly TTL" grab bags at a price which few if any competitive dealers in the bag have normally cost to buy. Fully guaranteed all IC's for this price. Valuated monthly.

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TTL 74 Series. A fantastic purchase of an "across the board" range of 74 TTL series IC's. $1 each. All 100+ fixed "mostly TTL" grab bags at a price which few if any competitive dealers in the bag have normally cost to buy. Fully guaranteed all IC's for this price. Valuated monthly.

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**CENTRONICS 710 PRINTERS**

- **EX RENTAL Heavy duty full width carryage printer up to 132 columns on fan fold sprocket feed paper. 80 column 20 char x 20 dot matrix 1280 x 720 dot resolution. 40 MA interface supplied in tested condition brand new fully tested with manufacturers markings, fully guaranteed.**

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Further series of 74 TTL series IC's.

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**EPROM COPIERS**

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Same specs as above but with additional RS232 serial interface port and RS232 printer port as standard. Great for computers etc. £445.00 + pp £3.00

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**DIARY 1986**

- **SEPTEMBER 1986**

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**PRINTERS - PRINTERS - PRINTERS**

- **GE TERMIPRINTER**

A massive purchase of these desk top printer terminals enables us to offer you these quality 30 or 50 cps printers at a SUPER LOW PRICE against their original cost of over £100. Unit comprises of all QWERTY electronic keyboard and printer mech with print face similar to correspondence quality typewriter variable forms tractor unit enables full width - up to 13.5 x 120 column paper, upper - lower case, standard RS232 serial interface, internal vertical and horizontal tab settings, standard ribbon, adjustable baud rates, quiet operation plus many other features. Supplied complete with manual. Guaranteed working at £130.00.

- **GE1200 120 cps £175.00**

- **GE1200A 2000 PLUS £130.00**

- **GE1200B 1000 terminal £10.50 Car & Ins £10.00**

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**100's of other EX STOCK items including POWER SUPPLIES, RACKS, RELAYS, TRANSFORMERS, TEST EQUIPMENT, CABLE, CONNECTORS, HARDWARE, MODEMS, TELEPHONES, VARIOUS, VUPS, PRINTERS, POWER SUPPLIES, OPTICS, KEYBOARDS etc etc. Give us a call for your spare part requirements. Stock changes almost daily.**

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- **GE1200 120 cps £175.00**

- **GE1200A 2000 PLUS £130.00**

- **GE1200B 1000 terminal £10.50 Car & Ins £10.00**
VOLTAGE MEASUREMENT
A precision voltage measurement module (DMM 204) is now available with CIL’s new Jay series of measurement instrumentation. The Jay range allows different modules to be inserted into the front of the units to perform many measurement tasks, e.g. temperature, DMM, strain, calibration and simulation.

The Jay basically consists of a Z80-based microcomputer circuit with RS232 option, housed in a bench-mounted case. The front panel has a 2 x 16 dot matrix LCD display, switches for control functions and access for the modules.

The microprocessor program is stored in PROM within the module. Each module therefore has a different program to perform its particular task. This means that after the instrument is purchased, for say, temperature measurement, other modules can be purchased to perform almost all measurement tasks.

The third module released by CIL, the DMM 204, is specifically designed for precision low level dc measurement. Basic accuracy is ±0.01% of reading with sensitivity 100 nanovolts.

CIL Electronics Ltd.
Decoy Road,
Worthing.
Sussex BN14 8ND.
Tel: (0903) 204646.

PATTERN GENERATOR
A low cost, rugged, mains operated bench instrument, the Orion TV and Video PAL Pattern Generator, has been developed by Black Star.

Features include separate RF and composite video output ports with level control, tunable RF carrier, internal or external sound modulation, switchable sound carriers (5.5, 6.0, 6.5MHz), and positive or negative video modulation. A front panel source of frame and line sync pulses is provided for scope triggering.

The Orion Pattern Generator, covering VHF and UHF channels, is compatible with PAL systems B, D, G, H, I and K and provides a full range of colour and monochrome test patterns including colour bars, focus and grating.

Additionally the Orion offers comprehensive rear panel outputs of RGB and sync signals with switchable signal levels and sync conditions to ensure compatibility with the majority of video and computer monitors.

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

COMMUNICATION TESTERS
Thorn EMI Instruments has announced a new range of Megger instruments for testing fibre optic communication networks, comprising three new instruments to complement their existing range of 850nm test and inspection equipment.

The two power meters in the range, the OTP610 and OTP620, are capable of measuring light output at 850nm, 1300nm and 1550nm, giving the instruments the ability to test the complete range of fibre networks in use today. The use of a processor to compute the output on the clear liquid crystal display allows for the automatic compensation of thermal errors.

In this application the power meters are complemented by a new 1300nm light source, the OLS610. This exhibits the same features of selectable output power and output stability shown on earlier Megger light sources.

Thorn EMI Instruments Ltd.
Archcliffe Road,
Dover.
Kent CT17 9EN.
Tel: (0304) 202620.

MULTIMETER
A built-in signal generator allows the high performance PAN3000 multimeter many new possible applications including radio and TV circuit testing.

Available from Electronic and Computer Workshop Ltd, the PAN3000 has 58 measurement ranges, all of which are protected against misconnection and most other faults by a patented triac system and quick-blow fuse.

Sensitivity is 20kΩ/V dc and ac. The parameters that can be measured include dc voltages from 0.15 to 1500V, ac voltages from 5 to 1500V, dc current from 50μA to 5A, ac current from 5mA to 5A and resistance down to 0.5 ohms.

The PAN3000 costs £267.00, including VAT, post/packing, and a shock-proof case.

Electronic and Computer Workshop Ltd,
171 Broomfield Road,
Chelmsford,
Essex CM1 1RY.
Tel: (0245) 262149.
SEPTEMBER 1986

PRODUCT NEWS

SENSOR MODULE

PEP Modular Computers has introduced a position velocity sensor module in single-height Eurocard format to extend the line of products which interface to the VMEbus.

It has been designed for measuring current operating parameters of digitally controlled machines, e.g. robotics. Using the THCP 2000 chip it has four basic operating modes:

- direction discriminator
- frequency measurements
- pulse width measurements up/down counting

which are jumper selectable.

The module features 6 independent channels with 16-bit resolution each. All channels may be cascaded to achieve more resolution (32, 48, 64 or 96 bits). Synchronisation of different channels is possible as well.

Each channel has two optically isolated input ports for initiator signals. Each pair of inputs provides the capability to perform direction determination through a comparison of two signals.

PEP GmbH, Am Klosterwald 4, 8850 Kaufbeuren/Allgau, West Germany.
Tel: (08341) 89 74.

TEMP/VOLTAGE CONVERTER

A temperature/voltage converter which, used with a multimeter, allows temperatures from -60°C to +950°C to be measured quickly and accurately has been introduced by Beckman Industrial. Designated the TP850 it has three interchangeable probes, each fitted with K type thermocouples: an immersion probe, a surface probe and a thermocouple wire. The price is £46. A self-zeroing amplifier ensures excellent stability of measurements, both with time and with variations of environment temperature. The circuit provides cold junction compensation and linearisation of the signal transmitted by the thermocouple probe.

The instrument is powered by an ordinary 9V battery, the state of charge of the battery being indicated by a red LED.

The instrument will turn itself off automatically after three minutes in order to save battery life.

Beckman Industrial Ltd.
Temple House,
43/48 New Street,
Birmingham B2 4LJ.
Tel: (021) 645 8899.

ATUS UK

Cap Co Electronics have announced two new products to add to their range of high quality aerial tuning units and associated equipment. The SPC-300D and SPC-3000D feature a safety device for protection against lightning strikes (although not against a direct strike). Switching via relays and control switches means that when the supply is turned off all antennas connected to the ATU are automatically grounded, obviating the need to uncouple all the aerials upon leaving the shack.

The new units also have provision for connecting three aerials, a 'direct' and 'through' switch and a 1kW balun for balanced or unbalanced operation.

The established Cap Co range includes the SPC-300C, 4 to 1 and 1 to 1 kW baluns and the G40GP quick-fit aerial kit, all using 'good old-fashioned low loss British engineering.

Cap Co Electronics Ltd.
63 Hallcroft,
Birch Green,
Skelmersdale.
Lancs WN8 6OB.
Tel: (0695) 27948.

SHACK PROTECTION

The probability of shock or earth leakage currents having a dc content is particularly high in the radio shack and this could be dangerous, say Dormam Smith Switchgear Limited.

Electronic circuitry may modify the ac voltage waveform, resulting in a complex ac/dc or pure dc leakage current, and the need for the close shock protection afforded by rcds is widely appreciated.

However, many people are not aware that the majority of rcds are incapable of sensing shock currents with a dc content, nor is it generally appreciated that many rcds will become less sensitive, slow, or even fail to operate completely if not periodically exercised using their test button.

To overcome the shortcomings of traditional rcds, Dormam Smith Switchgear have recently introduced their Safeline range of miniature circuit breakers/rcds and isolator/rcds.

Capable of sensing ac, dc or complex ac/dc shock or leakage currents and, in the case of the mcb/rcd, additionally detecting overload currents, Safeline will probably be of interest to safety conscious operators.

Dormam Smith
Switchgear Ltd.
Blackpool Road,
Preston PR2 2DQ.
Tel: (0772) 728271.
PRODUCT NEWS

MARINE-HAND-HELD

As an addition to the range of Sealine VHF radio-telephones Shipmate has announced the launch of its new MC-56 hand-held, which incorporates the following features: all 55 international channels fully synthesised; UK marine channel as standard; dual watch facility; channel 16 quick access button; switchable 3W/1W output power; 220V ac charger unit; the ability to add Coastguard channel 00 for authorised users.

Channel selection is by a rotary switch and channel position is viewed through a magnifier prism. All components are contained and protected within a tough plastic case which incorporates a metal belt clip, nylon wrist strap and a convenient slide-on nicad battery pack which can be recharged overnight.

Optional accessories include a carrying case and a flat microphone/speaker unit.

Available from most marine electronics dealers and good chandlers, the MC-56 has an rrp of £250.00 + VAT.

Shipmate Marine Electronics Ltd.
Unit 5, Elm Court, Crystal Drive, Smethwick, West Midlands B66 1RB.
Tel: (021) 552 1718.

LOW PROFILE PSU

A new low profile 120W switched mode power supply, the model 19B, has been introduced by Greendale Power.

Just 45mm tall, the model 19B is designed for use in microprocessor-based systems such as personal computers, peripherals such as Winchester and floppy disc drives, AT&T systems and scientific instruments.

This new PSU achieves its diminutive size by virtue of a comparatively high switching frequency ~70kHz and has a considerably lower profile than directly competing units. Dimensions are 220 × 100 × 45mm in the open frame (Eurocard rack mountable) version and 223 × 103 × 50mm in the optional cased version.

Five dc outputs are provided, two of which (+5V and ±24V) are fully floating. Standard output voltage combinations are: +5V at 12A (main output), with auxiliary outputs of either +12V/2A, ±12V/2A, 5V/2A and ±24V/2A or +15V/1.6A, −15V/1.6A, 5V/2A and 24V/2A. Other output voltage combinations are available to special order.

All outputs are regulated to ±0.5% for a 195 – 264V ac line swing when operating at 100% rated load and all outputs remain within specification for a minimum of 20ms after loss of ac power. The auxiliary outputs are short circuit protected, while the main output has current limiting protection against overload and continuous short circuits.

The ac voltage input ranges are 98/132V and 195/264V and efficiency is a minimum of 70%. In-rush surge current at switch-on is limited by special soft-start circuitry; over-voltage protection on the main +5V dc output is set between 5.5V and 6.5V. The model 19B is also protected against ac under-voltage operation.

Standard features of the 19B include common mode input filtering and logic inhibit (logic high, TTL compatible); all units are supplied 100% burn-in. A power failure signal output is optional. The operating temperature range is 0°C to +50°C at full rated load.

Greendale Power Ltd,
Unit 1, Cobnar Wood Close, Chesterfield Trading Estate, Sheepbridge, Chesterfield S41 9RQ.
Tel: (0246) 455417.

RFP PROTECTION

Roxburgh Suppressor’s FL110/110M filters have been developed to protect industrial and consumer electronic products from radio interference.

The FL110 range is divided into five basic models with rated current from 3-30A, developed to protect against differential and common mode interference. The FL110M units have linear inductance on the load side which results in an increase in the output impedance, making them particularly suitable for use where there are low impedance loads — in brush dc motors, for instance.

Both versions are in metal cases and wire lead, faston or screw terminals are fitted, depending on the model.

Roxburgh Suppressors Ltd, Haywood Way, Iivyhouse Lane, Hastings, E Sussex TN35 4PL.
Tel: (0424) 442160.

SM TRANSFORMERS

Avel-Lindberg have now added what they believe to be the first surface mounted power supply transformers to the ever growing choice of SMDs. The Avel type OB/SM flat-pack transformers span a range from 1.8 to 24VA (1.8, 3.5, 5, 8, 9, 12, 15, 19, 24VA). These small, rectangular, flat transformers are tested with a one minute 5000V ac hipot test.

Dual 50/60Hz primary windings can be series or parallel connected for 120V or 240V operation, and dual secondary windings give 5, 6, 8, 9, 12, 15 and 18V rms in parallel and 10, 12, 16, 18, 24, 30 and 36V rms when series connected. The non-concentric twin primary and secondary windings are wound on separate bobbins to give maximum isolation and low inter-winding capacitance. The core construction and winding configuration achieves a near toroidal characteristic with low radiated noise, high efficiency and low temperature rise.

Although the eight soldered points provide a secure mounting for OB/SM transformers, the mechanical fixing can be supplemented by four holes moulded into the corners of the case.

Avel-Lindberg Ltd, South Ockendon, Essex RM15 5TD.
Tel: (0708) 853444.
**VIDEO CONTROLLER**

ITT Semiconductors has announced a one-chip video memory controller which adds several attractive features to a digital TV set. These include a flicker-free picture, still picture, multi-picture-in-picture, zoom, and background storage for a teletext processor.

Flicker-free television is possible by doubling the vertical deflection frequency. The VMC 2260 video memory controller does this with a memory which is able to store one field and can handle the very high transfer rate requirements of single-speed input data and simultaneous double-speed output. The controller accesses five standard 256K DRAMs, data being transferred between the VMC and RAMs via a bidirectional 20-bit data bus with a speed of 11.8 megawords per second.

The additional TV features are realised by exploiting the read and write facility of the RAMs. Still picture, for example, simply results from inhibiting writing.

For the multi picture-in-picture mode, the television screen is divided into nine small pictures of equal size, each displaying either a section of a large picture or a complete (but compressed) picture.

Snapshots of up to nine different input signals can be displayed simultaneously. Zooming is achieved by displaying only part of the RAM content: enlargement factors of two and three times are possible.

**GRAPHICS KIT**

Texas Instruments' new low cost graphics design kit, a complete package which brings simple and comprehensive full colour bit-mapped graphics to the designers' fingertips, is now available from VSI.

Operating with any 8, 16 or 32-bit CPU, this video graphics kit will support systems with screen resolutions from 256 x 256 to 4096 x 4096 pixels and any number of colours.

A new concept with integrated circuits to match has reduced the active device count to six. A video system controller (TMS 34061) for video RAMs eliminates separate text and graphics sub-systems, a versatile video palette provides all the circuitry normally contained in a substantial PCB, and two multi-port video RAMs not only provide virtually unlimited memory bandwidth but also eliminate the usual problems between display, refresh and update.

The complete design kit comprises six chips, one 68-pin socket and a package of supporting literature which includes six separate publications. It costs £99 + VAT.

**PEN PLOTTER**

Advance Bryans Instruments has announced the 6300 series Colorwriter, a new high-performance digital plotting system.

The 6300 Colorwriter combines functional design with multi-colour plotting, 7 and 10 pen models being available with a variety of pen colours and of pen types and thicknesses, as well as adapters for liquid ink drafting or Pentel pens.

Offering graphics resolution of 0.025mm (0.001 inches), the 6300 series can be used for plotting on A4 (model 6310) or A3 (model 6320) charts in a variety of media including coated or bonded papers, or transparencies. Other functions include an optional roll chart advance capability and easily used multi-function front panel controls, giving a wide range of features such as self-test, scaling for changing plot dimensions or orientations and a pause control.

The system is compatible with most presentation, analytic and drafting programs, such as Lotus 1-2-3, Symphony, Chartmaster and SuperCalc, and its built-in intelligence includes over 65 commands. The writing speed is programmable in 1cm steps to a maximum of 40cm/s to accommodate different writing media.

Using a standard RS232C or IEEE-488 interface, the 6300 series can communicate with external computer systems for full automated on-command digital plotting. High speed transfer of complex plots can be achieved using the system's 16K memory.

**LAN CHIPS-SETS**

A new chip set resulting from a joint development programme between Texas Instruments and IBM is now available from VSI Electronics.

Designated TMS 380, the set provides standardised interfaces for connecting external equipment to the recently announced IBM Token-Ring network.

The set comprises five integrated circuits containing local area network (LAN) management services. Providing a data rate of 4Mbits/s using existing telephone twisted-pair, shielded twisted-pair and fibre optics, the set is designed for LAN connection to personal computers, advanced technology PCs and 32-bit professional workstations. The internal system architecture is also designed for easy upgrading, as higher speed standards are developed.

VSI Electronics (UK) Ltd, Roydonbury Industrial Park, Horsecroft Road, Harlow, Essex CM19 5BY. Tel: (0279) 29666.
PRODUCT NEWS

CONNECTOR SYSTEM

New from Amphenol is a 0.025 inch pitch cable and connector system designed to meet the ever growing demand for interconnect miniaturisation. Up to 50% savings on size and weight over conventional 0.05 inch pitch can be realised with this cost-effective solution, which is based on Allied Amphenol's Spectra Strip IDC flat cable. The 0.025 inch pitch cable features IDC termination and UL recognition, using PVC dielectric and 30awg solid copper core. Five cable widths accommodate from 26 to 80 conductors. The cable is 0.025 inches thick and is double-contoured for precise location into connectors. The range of connectors now available includes D-type connectors, offering 16 to 74-way contact configurations for PCB and cable mounting. Connector shells are steel, yellow chromated over zinc. Nickel-plated contacts are selectively gold-plated in contact and termination areas. D-type connectors can be supplied with metalised hoods.

Also available are transition connectors for PCB-to-cable interconnection, offering from 10 to 84 contacts arranged in four staggered rows, and sockets and PCB headers, either right-angled or straight, featuring polarity keying in 10 to 80-way sizes.

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

ORYX PSU

The range of Oryx Micro soldering irons now has a universal power supply unit suitable for all the Micro range. This PSU can be supplied wired for 6, 12 or 24V and is capable of providing 25W. Working direct from a 240V supply, the double insulated transformer offers maximum safety to the operator using a low voltage iron. Output voltage is designated when ordering, although the internal circuits are still intact and can be changed if necessary.

The 13 light-weight Micro irons available for this unit, with the choice of some 23 tip styles, make this product very useful for micro-miniature work such as surface mount devices.

Greenwood Electronics
Portman Road,
Reading RG3 1NE.
Tel: (0734) 595843.

PALETTEMATE

A new colour graphics card which greatly enhances the display capabilities of the BBC microcomputer has just been unveiled by Wild Vision. The Palettamate allows 16 different colours to be selected from a palette of 4096 to be displayed simultaneously on an RGB monitor in mode 2.

The Palettamate is intended for anyone wishing to exploit the graphics capability of the BBC micro. Uses include producing dramatic effects for games programs, adding a professional finish to video presentations, and many other applications such as CAD packages or colour coding data from scientific experiments.

The card plugs inside the BBC with no soldering required, and the output to an RGB colour monitor is taken from the normal RGB socket at the rear of the computer so that no extra sockets are required.

The displayed colours are set up using separate palettes for red, green and blue which can be individually programmed using the VDU 19 statement. This way existing programs can be readily amended to take advantage of the new device.

The Palettamate is supplied complete with a package of ROM-based utilities software to enhance its use and provide special effects. It costs £127.50 + VAT.

Wild Vision,
Mari House,
20-22 Jesmond Road,
Newcastle upon Tyne
NE2 4PQ.
Tel: (091) 281 0481.

ANTI-SLIP MATS

Cobonic Limited seems to have the answer to all those slippery problems that can occur in the workshop, lab, office and home. It's a mat called StopSlip.

Due to its inherent tackiness, any item placed upon its surface will stick there as if glued without leaving any traces either on the table or on the object. Stop-Slip is available in various sizes with thicknesses of either 2 or 3mm. It can also be cut to required sizes with scissors.

Cobonic Ltd,
32 Ludlow Road,
Guildford,
Surrey GU2 5NW.
Tel: (0483) 205 280.

TVRO EXTRA

In last month's article, TVRO Receiver, we forgot to mention that when ordering the kit from Comex Systems Ltd it is necessary to add £2.50 P&P. We apologise for any inconvenience caused by this omission.

Readers are asked to note that the two Astec modules featured in the article are not included in the kit.

To recap, prices are as follows: TVRO receiver - motherboard and kit - £35.00; board only - £11.75; AT-1020 tuner module - £35.10; AT-3010 IF/demodulator - £54.65; F type plug for AT-1020 - 50p; Mitsubishi heterodyne 10GHz receiver - £47.00; scalar horn - £42.00; 60-1700MHz wideband low-noise preamp kit - £35.00.

Comex Systems Ltd,
Comet House,
Unit 4,
Bath Lane,
Leicester.
Tel: (0533) 25084.

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SEPTEMBER 1986
Penetrate the four corners of the earth with the

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1 VATWOW "I have recently installed a DX33 beam and I would like to advise you that I am extremely satisfied with it. It certainly outperforms the TH2UNR which I previously used and the VSBR is lower."

2 G3XWE "The last thing is to tell you how pleased I am with the DX33 antenna. On unpackaging the DX33 I was immediately impressed with the quality of the hardware and in operation it is just as impressive. I have used it on all three bands and have been obtaining excellent reports from DX stations all over the world. I have conducted tests with other stations and these show the electrical elements included in the DX33 specification are fully met in practice."

Conclusion on the product:

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EMOTO 110MXA Circular dish for 8M beams £460.50
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R-200

The R-200 provides outstanding performance through use of microprocessor controlled operating functions, allowing maximum flexibility and ease of operation throughout its operating range. All mode receiver, it covers 150 kHz - 30 MHz in 20 bands, on SSB, CW, AM, FM, SSB. Key features to include: digital VFO for memories that store frequency, band and mode information, memory scan, programmable band scan, digital display with 24 hour dual clock plus timer and a host of other features to enhance the excitement of listening stations around the world. PRICE £480.

Western Your 'ONE-STEP' SOURCE FOR TOWERS, ANTENNAS AND YAESU OR KENWOOD

PAYMENT BY TELEPHONE ACCEPTED WITH ACCESS AND BARCLAYCARD

Enjoy the pleasures of home brew equipment with a project from C M HOWES COMMUNICATIONS: All our kits have clear instructions, a fibreglass circuit board that has the parts locations screen printed on it for easy, accurate assembling, plus all board mounted components. Whether you are an experienced operator planning to build a transmitter or GRP transceiver from kit, by following our first receiver, we have interesting designs to suit. With our kits, you don't have to be an old hand at construction to enjoy the satisfaction of building your own equipment.

If you have considered building yourself a small rig for portable and holiday use this summer?

HC230 and HC230 TRANSMITTERS - use your 3M rig on 20 and 80M!

The HOWES HC230 and HC230 offer an excellent alternative to an HF transmitter. At the present price of the output cycle, there is no sense in spending a small fortune on a band HF rig? The two most active HF bands can be worked using your existing 2M SSB/CW rig and our transmitters - and at a considerable saving in cost too!

An exciting possibility offered by these new HOWES transmitters is HF mobile operation. This becomes much more practical with the combination of a compact 2M rig, and a neat little transmitter tucked out of the way.

Both the HC220 and HC230 offer a good 10W RF output from mismatch proof transistors. The 2M drive has been reduced is adjustable between 5 and 20W, but it can be easily modified to accept direct input or 20W. The use of a high proportion of fixed value filter components keeps alignment simple, and the output spectrum clean. Any fancy equipment is not needed to align your kit.

On receive, the balanced mixer offers both sensitivity, and a good dynamic range. The 10 element bandpass filtering which is used here of the mixer requires no alignment at all - simply wing the right number of turns on the toroids! If you are competent with a soldering iron, you should be able to build a HOWES transmitter. The full documentation and the component locations printed on the double sided, solder masked PCB make a construction a pleasure.

EMOTO 10PSX£55.20
EMOTO 110MXA £226.75
EMOTO 110MXA Extra large £227.75
EMOTO 110MXA Extra large but great tuning power £233.00
EMOTO 110MXA Circular dish for 8M beam £458.85
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ME 200 £100.00
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1080 DX-6V 10MHz Multi and Vertical plus 80 £116.00
1081 DX-31 Dipoles 10/15/20 3x3p £87.75
1082 DX-31 2 elements 10/15/20 dipole £161.00
1083 DX-30 3 element 16/20 50W dipole £324.25
1084 DX-30 4 element 80 £340.50
1085 DX-333 Conversion kit £89.00
1086 DX-333 Conversion kit £89.00
1087 DX-344 Conversion kit £89.00
1088 DX-343 5 element 20M £143.75
1089 DX-345 5 element 10M-Yagi £92.00
1090 DX-345 5 element 10M-Yagi £92.00
1091 DX-345 5 element 10M-Yagi £92.00
1092 DX-345 5 element 10M-Yagi £92.00
1093 DX-345 5 element 10M-Yagi £92.00
1094 DX-20/31 Rotary dipole for 2MHz £87.75
1095 DX-341 5 element 20M £143.75
1096 DX-341 5 element 10M-Yagi £92.00
1097 DX-341 5 element 10M-Yagi £92.00
1098 DX-341 5 element 10M-Yagi £92.00
1099 DX-204/26 8 element 40/60 £80.00
1100 DX-204/26 8 element 40/60 £80.00

T R F 3 SHORTWAVE BROADCAST RECEIVER

Listen to the news, sport, music, political comment from around the world on the new HOWES TRF3 shortwave receiver. The design features switchable input impedance so that it can be used with a variety of antennas, and there is an input attenuator for strong signal conditions. Up to 2W of audio output are available, but the low quiescent current consumption means that it can easily be battery powered, if you wish. Frequency coverage is 1.5 to 12.0 MHz in three bands using a 300pF tuning capacitor (available at £1.50). This simple TRF design may be firmly rooted in the solid age, but the old thrill of old radio stations heard on a crackling set is still strong! Great fun to build and use - educational too!

HOWES TRF3 kit £13.90
HOWES TRF3 kit £13.90
HOWES TRF3 kit £13.90
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EASY TO BUILD KITS BY MAIL ORDER

Become a skilled operator in constructing your own portable kit. Each kit comes complete with instructions, a fibreglass circuit board plus all mounted components. A straightforward kit, you will be an operator in a week.

Enjoy the pleasures of home brew equipment with a project from C M HOWES COMMUNICATIONS: All our kits have clear instructions, a fibreglass circuit board that has the parts locations screen printed on it for easy, accurate assembling, plus all board mounted components. Whether you are an experienced operator planning to build a transmitter or GRP transceiver from kit, by following our first receiver, we have interesting designs to suit. With our kits, you don't have to be an old hand at construction to enjoy the satisfaction of building your own equipment.

If you are a DX operator planning to build a transmitter or GRP transceiver from kit, by following our first receiver, we have interesting designs to suit. With our kits, you don't have to be an old hand at construction to enjoy the satisfaction of building your own equipment.

If you would like further information on any item, simply drop us a line, enclosing a SAE. We have a full page of information on each kit, plus a general catalogue.

SEPTEMBER 1986

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13
Let's get together

European co-operation is definitely all the rage these days, and quite rightly so. Lately, every other press release to land on my desk seems to come from the Commission of the European Community about the RACE, ESPIRIT, EUREKA, DELTA "initiatives" etc, or from various European companies getting together to develop more shiny toys to benefit mankind — it almost makes you forget what their real motive is (profit, of course, although I wouldn't want you to get the impression I'm knocking it).

Anyway, some of the latest such info comes from Renault. For the last few years they've been working on Project ATLAS with Telediffusion de France (TDF) and SAGEM (the Société d'Applications Générales D'Electricité et de Mécanique). ATLAS stands for Acquisition through Telediffusion of Automobile Logistics for Services, and whoever contrived that particular acronym ought to be forced to sit through every session of the European Parliament for the next ten years.

The project's aim is to present a car driver with useful information through the medium of a touch-sensitive screen. This will include details of the car's mechanical condition, pre-recorded information such as extracts from the car's handbook, and external info on traffic and weather, etc (which is where TDF comes in).

Renault subsequently "put in hand a dossier within the framework of the EUREKA project" (bloody Européak!), which was christened MINERVE (Media Intelligent pour l'Environnement Routier du Véhicule Européen — as acronyms go, pretty sensible).

Meanwhile, over in windmill land, Philips were working on CARIN (Car Information and Navigation), a project to develop an "electronic co-driver" to give route information, the vehicle's position, and details of the weather or the destination, all centred on the use of a compact disc (Philips pioneered the development of CD, after all).

Sounds a little bit like ATLAS, eh? Well, SAGEM, who control the MINERVE project, approached Philips with a view to working on a pan-European scale. The outcome? Yet another acronym (ho hum, this is getting tedious), with efforts and experience all pooled in a common project, CARMINAT. Since both the ATLAS and CARIN projects have produced vitf working demonstration vehicles, I don't suppose it'll be long before our cars are not only telling us how to get there, but where we ought to be going.

As an aside, you might be amused by another co-operative effort of Renault's, this time with Daimler-Benz. It goes under the name of PROMETHIUS, which stands for Programme for a European traffic with Highest Efficiency and Unprecedented Safety (i kid you not). If anyone can come up with a better (worse?) acronym for an actual project/organisation, I'm sure we can sort out a suitable prize . . .

Let's get together - part 2

With their sights firmly fixed on cutting a slice of the projected $500 million due to be spent on VLSI (Very Large Scale Integration) ICs for ISDN interfacing by 1990, Philips and Siemens have standardised an ISDN-oriented modular architecture (IOM) for these ICs. Such chips will be used to connect the voice, data and video communication services of 10 million subscribers to the integrated services digital network.

The modularity of the IOM architecture, it is claimed, minimises the number of carrier card/LSI/circuitry required and reduces their individual complexity.

A partnership between Philips and Siemens is certainly nothing to be sniffed at. According to the European Electronics Companies File 1985/6, recently published by Benn Electronics Publications, these two rank second and third respectively in European electronics sales. First was IBM (surprise, surprise) with sales of $11,741 million. After Siemens came Thomson, GEC, ITT and a host of other big names.

It's reported on such weighty matters sounds to you like good bed-time reading, give BEP a ring on (0582) 421981. It'll cost a mere £170/3425 (well, it's a drop in the ocean to IBM).

Let's not get together!

The Small Business Bureau deserves a prize for this year's most alarmist and over the top press release so far. I quote from "If GEC takes over Plessey, 66 small or medium size high technology firms would fail or be seriously at risk, another 116 would be in difficulties, and up to 24,000 jobs could ultimately be in jeopardy".

These figures are described as minimum estimates, and came from a report prepared by Tidek Management Consultants. They form one more blow in the stroke/counterstroke battle between GEC and Plessey, with Plessey trying to stave off a take-over bid. It probably be old news by the time you read this, but I'd put money on Plessey winning (if only because that's where my sympathies lie).

Ground probing radar

ERA Technology, the British research and development company, has taken a leading role in the development of ground probing radar for the detection of buried plastic discs and pipes.

Antenna design and signal processing technologies are now at the stage where hidden objects can be located and identified quickly and reliably despite the clutter of other, much stronger signals from unwanted 'targets'.

The ERA Technology ground probing system uses a 'diffuseless' radar to illuminate the ground through novel 'dispersionless' antenna elements. A detection 'map' can be produced, showing the position in a searched area of the targets both in plan view and in cross-section if depth information is needed. Further characteristics of the targets may be used for recognition, typically using a visual interpretation of the radar image, or identification of electrical parameters relating to the target, such as target body resonances.

This technology can be applied to a variety of civil and military tasks.
ment contract for the supply of fifty FM/AM-1200 communication service monitors and ten FM/AM-1500 communication service monitors. The contract value is approximately £500,000.

Both the FM/AM-1200 and FM/AM-1500 monitors were first super high frequency aircraft satellite communications terminal.

The terminal, designated MASTER (an acronym for Military Aircraft Satcoms Terminal), will operate in the 7/8GHz SHF military band and will be employed to demonstrate designed and manufactured by the American company IFR Inc. The FM/AM-1500 integrates the functions of several different test instruments, such as FM/AM signal generators; duplex offset generator; and an audio spectrum analyser. The instrument features a keyboard entry system and menu functions, an LCD display for programmed frequency readout, processor-controlled memory functions and a CRT capable of alphanumeric or waveform displays.

The FM/AM-1200 features: 1-1000MHz spectrum analyser with 10 selectable dispersions from 10MHz to 1kHz; audio frequency function generator; duplex generator, off-set selectable in 10kHz steps to 49.99MHz; average and peak RF power measurement from 100mW to 150W; analogue and digital display of all received and generated parameters; vacuum fluorescent display; RS232 interface as standard; RF generator output variable to +10dBm.

**Marconi aim high**

Marconi Defence Systems Ltd have secured a contract from the UK Ministry of Defence to build Europe’s trate secure communications links via the UK’s Skynet 4 military communications satellite.

Marconi believe that the contract offers the prospect of swift, reliable, fully-secure and jam-resistant communications for long range aircraft. The MASTER terminal will harness the potential of space communications to establish a significant advance in performance and availability over the high frequency radio links on which fixed and rotary wing aircraft currently depend for their beyond-line-of-sight contact.

**Business via satellite**

Marconi Defence Systems Limited of Stanmore, Middlesex, has announced a £3 million deal with the European Space Agency to supply three advanced transportable earth stations. These stations, designated TDS-6, will operate in the new 30/20GHz communications band and will be employed to test and demonstrate teleconference links and other business services available via the ESA’s Olympus communications satellite. Olympus is being developed as the forerunner for the commercial satellites of the 1990s. The Marconi design for TDS-6 employs a land/air transportable radio cabin and trailer-mounted 2.5m diameter offset feed antenna which is capable of satisfying the most stringent CCIR side-lobe requirements. The two 30GHz uplink channels to Olympus are powered by 300W travelling wave tube amplifiers, while the 20GHz receiver employs solid-state low noise amplifiers.

Examples of Marconi’s other work in the area of Kband satellite communications equipment include filters for the ESA Eureka recoverable spacecraft inter-orbital communications payload, manufacture of a 45GHz receiver for the Skynet 4 military communications satellites, and studies of inter-satellite links for the future European Columbus space programme and data relay satellites.

**Large-screen monitor**

Mitsubishi Electric Corporation, following the introduction of its 35-inch colour TV in September of last year, has now developed a 40-inch direct view picture tube (the world's largest) and a 40-inch colour monitor/receiver for business use. The monitor/receiver is equipped with the newly developed deflection frequency automatic synchronizing circuit installed in the new display unit enables it to automatically tune the frequency horizontally and vertically when connected with business machines (personal computers and word processors).

**Multi-media CD**

Philips and Sony have published the provisional CD-Multimedia Designers Group (CD-I) specifications, also known as the provisional ‘Green Book’, providing a complete format for the interactive use of CD ROM. The two companies, who did not review the CD-I specifications with their licensees in Tokyo on 23 June and in New York on 26 June. The final specification is expected by the end of this year.

In 1980 Philips and Sony jointly developed the compact disc digital audio system and subsequently marketed compact disc digital audio products in 1982. Since that time consumer acceptance of compact audio discs and players has grown dramatically.

The two companies reached agreements for CD ROM (read only memory) applications in 1983. In May 1985 they announced the 'Yellow Book' or physical format specification for CD-ROM, which laid the groundwork for storing character and graphic information on optical discs.

With the 'Yellow Book' specification, a CD ROM drive can act as a computer peripheral for business use. Information stored on the CD ROM disc can be retrieved with the use of a personal computer. The CD-I system does not require the support of a floppy disc, and the CD-I player, which contains its own intelligence, will be a stand-alone unit suitable for audio and video as well as text and data applications.

CD-I specifies how various types of information on a compact disc are identified, how each type of information is encoded, and how tracks, files, and records are laid out on the disc.

To generate a clear understanding and avoid confusion in the marketplace caused by non-compatible systems, Philips and Sony participated in the High Sierra Group with 12 other corporations active in CD ROM development. The purpose of this participation was to agree on a logical format standard which allows applications to access data from a CD ROM system independent of the particular hardware and operating system.

In harmonising the file system of CD ROM and CD-I, Philips and Sony completed a CD-I specification which incorporates the joint efforts of the High Sierra Group and the CD-I Group to ensure that a CD ROM disc will be playable on a CD-I player.
**SPECTRUM WATCH**

**NIGEL CATHORNE G3TXF**

The UK's Joint Radio Committee (JRC) of the electricity, gas and coal supply industries is undertaking a VHF ACSB pilot study in the Bristol area. The JRC will be using Amplitude Comamped SSB techniques on channels in the new JRC frequency band (138/149MHz). ACSB with 5kHz channel spacing is claimed to be spectrally more efficient than FM. The trials, which are scheduled to commence in the late summer, are planned to last about a year.

The communications engineering department at Bristol University, under Professor Joe McGeehan, will be making engineering assessments during the trials. Bristol is also currently undertaking a study on behalf of the DTI to look into channel protection ratios for ACSB on VHF. The JRC ACSB trials will be followed with interest by the mobile industry.

**Radio telemetry deregulation**

Nearly two years ago the DTI published a Green Paper (consultative document) with proposals for the exemption from licensing of different types of low power radio devices. The proposal was to exempt low power telemetry operating either inductively in the bands 0–185kHz and 240–315kHz or free radiating at 173.2–173.35MHz (1mW) and 458.5–458.8MHz (500mW ERP).

It was also planned to exempt telemetry and teletcontrol devices operating in the band 26.96–27.28MHz (other than model control equipment, which was already exempt) with a power of up to 1mW.

Although the original consultative document was published two years ago, there have not been any announcements of final decisions on deregulation in these areas.

The latest word is that the DTI's finalized proposals are being prepared for presentation to Parliament and that deregulation in this area may possibly come into effect before the end of the year.

**International broadcast shows**

There are four major international professional broadcast equipment exhibitions. In the US there is the annual NAB show, which attracts some 40,000 visitors from all over the world to see the latest (predominantly NTSC) products.

Far away in Japan there is the annual InterBEE show, which draws many broadcast visitors from Asia and the Pacific rim countries.

Here in Europe there are two major broadcasting exhibitions. In the UK there is the International Broadcast Convention (IBC), which will be held next month (September) in Brighton and which is a biannual event, held in 'even' years.

Over in Montreux, Switzerland, there is the International TV Symposium, which also takes place every other year, but in 'opposite' years to the IBC. The Montreux technical show should not be confused with the Montreux programme festival. The two Montreux shows (technical and programme) have common origins but are now separate events.

Thus, up until this year at least, every year in Europe there has been just one major broadcasting show.

**Newcomer: Broadcast '86**

This year a newcomer to the European broadcast show scene made its debut. Broadcast '86 was held in Frankfurt in June. The organizers of 'Broadcast' made no bones about it: they want their show to become the NAB of Europe (ie the largest and most significant European broadcast show, in direct competition with the existing IBC and Montreux shows).

The first Broadcast show was a feeble affair. Many of the big names in broadcast equipment (Amex, Bosch, Grass Valley, Marconi, Philips, Sony, Thomson) were conspicuous by their absence. The show organisers said that they had announced the show too late for these major companies to include it in their exhibition budgets.

Broadcast '86 was more a German show dealing with German broadcasting themes than a major international broadcasting event. However, the Broadcast show organisers are already planning the 1988 event. By then the major broadcast manufacturers may have been persuaded by the excellent exhibition facilities that the Frankfurt trade fair operation has to offer to take part in Europe's newest broadcast show.

**Private radio Germany**

The advent of private commercial radio broadcasting is a topic of intense debate within Germany. Germany is a federation of states, each of which makes its own decisions in media matters.

Each of the eleven German states is going in a different direction when it comes to commercial broadcasting. Bavaria, a southern farming state, has already has a number of local radio stations including Radio Gong, Radio 92.4 and Radio Eins.

Private commercial broadcasting started on 30 April 1986 at 103.6MHz with 5kW. Four companies operate the same station on a time-share basis. Rheinland-Pfalz, unlike Bavaria where there will be numerous independent stations, has opted for a single private commercial station that will operate across the entire state. As there are four owners the station has been called Radio 4.

A curious feature of the limited amount of private local broadcasting that exists so far in Germany is that the transmitters and antenna facilities are provided directly by the German Post Office.

UK built Redifusion PT2100 transmitters are being used at the heart of the recently opened VHF wide-area paging system in French-speaking Switzerland.

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The station organisers have nothing to do at all with the transmission side. The programme originators feed their programme down a telephone line to the DBP's transmitter station and that is the last they see of it.

This is a similar arrangement to that used by the IBA for the ILR network in the UK. It is totally different from the RF free-for-all that marked the early days of private commercial broadcasting in France, Italy and, to a lesser extent, Spain.

UK Community Radio shelved

The UK government is being severely criticised for shelving plans for a network of experimental community radio stations. It was in mid-1985 that the government invited applications from groups wishing to establish community radio stations. The original intention was to licence, on an experimental basis, a mix of low power 'community of interest' and 'neighbourhood' stations. Nearly 280 interested groups submitted tenders to the Home Office in the belief that a first round of licences would be issued before the end of the year.

Nine months later the government has announced that it is abandoning these plans, pending a complete review of the future of radio broadcasting in the UK.

The government department concerned with administering the new stations, the Home Office, had reportedly recommended that the broadcasting experiment should go ahead, but they were overruled in early July by Cabinet colleagues apparently worried about 'unregulated' stations broadcasting material critical of the government in the run-up to the next election.

As a result of the government's u-turn around and the anger this has caused among applicants who had invested time and money in preparing detailed business and engineering plans for their applications, there is now a danger of a rapid rise in the number of pirate radio stations, many of which went off the air to bid for an experimental community radio licence.

New UHF Txs for IBA

The IBA placed a £7.5 million order in June with Marconi for the supply of fourteen pairs of UHF TV transmitters, marking the beginning of the replacement programme for the first generation of IBA UHF TV transmitters that were installed in the late '60s and early '70s.

The new Marconi UHF klystron transmitters will commence operation in 1988 at the rate of six per year. The high power 15kW, 25kW and 40kW transmitters will replace transmitters in fourteen of the IBA's main UHF transmitter sites.

The IBA's UHF TV transmitter re-engineering programme will cost some £40 million at today's prices and is expected to take ten years to complete.

Transmitters being supplied in the first phase will cover the major centres of population. London's Crystal Palace transmitter alone serves over 12 million people.

The new external cavity klystron transmitters will be capable of broadcasting in stereo sound. The IBA currently maintains 1,936 TV transmitters and transposers for both ITV and Channel 4 networks. The IBA is also responsible for the radio transmitter network used by the Independent Local Radio (ILR) stations. The IBA-run radio transmitters (a mix of MW and VHF-FM) now total 125.

New European satellite: Astra

The Luxembourg-based organisation SES has placed an order for a 16-channel DBS RCA satellite which it plans to launch on Ariane Flight 26 in May next year (Ariane flight launch dates are still only tentative following the recent Ariane launch failure - a revised launch schedule has yet to be announced). SES say that £200M has been invested in the multinational satellite project. This includes the purchase of the satellite, launch fees, insurance and the construction of an Earth station in Luxembourg. The chateau of Betzdorf, once the residence of Luxembourg's Grand Duke, is being converted into the Astra control station and uplink point.

SES are now busy looking for customers for their 16 programme channels (and if a second satellite is launched as a working spare there will be 32 programme channels on offer). The first firm client is a Scandinavian consortium, Scanstat, which will be making full use of the multi-channel sound facilities by broadcasting in several Scandinavian languages at the same time.

Astra's footprint will cover most of Europe, and using 45W transponders will be receivable with 85cm dishes. The 50dBW contour will cover an area containing 92% of European consumer purchasing power. However, differences between SES and Eutelsat, the European satellite communications organisation, still have to be ironed out.

The fourteen IBA stations that will be equipped with UK UHF transmitters:

<table>
<thead>
<tr>
<th>Station</th>
<th>Transmitter power</th>
<th>ITV channel</th>
<th>UHF colour service began</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystal Palace, London</td>
<td>2 x 40kW</td>
<td>23</td>
<td>November 1969</td>
</tr>
<tr>
<td>Mendip, Avon</td>
<td>2 x 15kW</td>
<td>61</td>
<td>May 1970</td>
</tr>
<tr>
<td>Wenvoe, near Cardiff</td>
<td>2 x 15kW</td>
<td>41</td>
<td>April 1970</td>
</tr>
<tr>
<td>Winter Hill, Bolton</td>
<td>2 x 15kW</td>
<td>59</td>
<td>November 1969</td>
</tr>
<tr>
<td>Pontop Pike, Newcastle</td>
<td>2 x 10kW</td>
<td>61</td>
<td>July 1970</td>
</tr>
<tr>
<td>Emley Moor, Huddersfield</td>
<td>2 x 10kW</td>
<td>47</td>
<td>November 1969</td>
</tr>
<tr>
<td>Durras, near Aberdeen</td>
<td>2 x 10kW</td>
<td>47</td>
<td>July 1971</td>
</tr>
<tr>
<td>Sutton Coldfield, Birmingham</td>
<td>2 x 10kW</td>
<td>43</td>
<td>November 1969</td>
</tr>
<tr>
<td>Black Hill, Glasgow</td>
<td>2 x 10kW</td>
<td>43</td>
<td>December 1969</td>
</tr>
<tr>
<td>Divis, Belfast</td>
<td>2 x 10kW</td>
<td>24</td>
<td>September 1970</td>
</tr>
<tr>
<td>Blisdale, North Yorkshire</td>
<td>2 x 10kW</td>
<td>29</td>
<td>March 1971</td>
</tr>
<tr>
<td>Caradon Hill</td>
<td>2 x 10kW</td>
<td>25</td>
<td>May 1971</td>
</tr>
<tr>
<td>Goldbeck, near Carlisle</td>
<td>2 x 10kW</td>
<td>28</td>
<td>September 1971</td>
</tr>
<tr>
<td>Sandy Heath, near Bedford</td>
<td>2 x 10kW</td>
<td>24</td>
<td>January 1971</td>
</tr>
</tbody>
</table>

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The AMSAT-UK/Satellite Colloquium, held at the University of Surrey over the weekend July 5/6, was an outstanding success. This event brought together over 160 amateur space enthusiasts from 14 countries. The staff of the university’s electronics department, under the leadership of Dr Martin Sweeting, produced a series of lectures varying from future plans for new amateur radio satellites to considerations of the future of AMSAT-UK and its position vis-à-vis the various other organizations now entering this field.

The University of Surrey is an attractive establishment located in a most pleasant part of Surrey. The accommodation provided, the weather and the company all helped to make the event most enjoyable, with requests from those present for a similar event in the not too distant future.

The planned lectures covered such subjects as the UoSAT on-board computers, the telemetry and experimental data formats, the digital communications experiment, the radiation detectors, particle wave experiment and the CCD camera, satellite tracking and orbits, Oscar 10 and Phase 3C satellites and much more. Informal meetings added considerably to the variety of topics discussed. There were also some interesting trade stands and demonstrations on view. The new UoSAT Control Centre was available for inspection and the occasion was honoured by the presence of the RSGB’s Mrs Joan Heathershaw.

Oscar 10 — still in trouble

The orbit of Oscar 10 takes it out into space as far as some of the highly charged areas of the outer atmosphere such as the Van Allan Belt. Electrically charged particles in this area are thought to be responsible for the problems recently experienced in the control of this satellite, which have necessitated a shut-down of its transponders.

High energy particles are thought to be responsible for faults which have occurred in the memory system. These faults are not so much due to damage sustained by the actual hardware as to static discharges interfering with the software programs which have been loaded into the memory systems. An attempt was made to erase the existing program in the satellite and reprogram it — not an easy task. In the mean time the battery is being discharged, as controls for its recharging are not being received correctly, and word was passed around to all possible Oscar 10 users not to use the satellite even though at times they might find the transponders working apparently normally. Hopes are high that if the battery can be kept up to a sufficiently high voltage to enable control of the satellite to be maintained, it should be possible in time to bring it back into full operational use.

Special event stations

This time of year sees a proliferation of what are termed 'special event stations' operating on the various bands. They are specially licensed stations operating temporarily from the site of some fete or similar celebration, staged to demonstrate amateur radio to the attending public. The callsign issued by the Licensing Authority has the prefix GB followed by the usual figure and letters. These special event stations are popular both with the public attending the event, as it gives them a practical demonstration of a real live amateur radio station, and with the radio amateur fraternity, as it gives them something challenging to do in setting up the station and offers the chance of operating with an unusual callsign.

An interesting 'licensing peculiarity' turned up over the question of using the new 50MHz band for special event station events. Apparently the terms of the licence under which 50MHz operates at the moment preclude this.

A remarkable old-timer

Ken Alford G2DX died earlier this year. In a personal tribute to him another remarkable old-timer, Dud Charman G6CJ, in the May Radio Communication, gave some details of his life.

Born in 1893, he grew up in Kendal and showed an early interest in 'things scientific'. In 1912 he obtained an experimental transmitting licence, with the call TXK. He purchased a 'wireless station' from the famous London store Gamages, which cost all of £5.00! It consisted of a spark transmitter and a crystal detector.

With a friend who had an aeroplane — a pretty rare possession in those days — they flew the wireless station over Lake Windermere and its signals were received on the ground.

Mr Gamage, the owner of the store, was very keen on the new 'wireless', and he provided a room in his store where those also interested in this new science could meet to discuss their results and experiments. Ken had met Leslie McMichael, another wireless pioneer, and they went to these meetings at Gamages. They formed the Wireless Society of London, which later became the Radio Society of Great Britain.

Ken’s first job was as a draughtsman at Vickers in Barrow, where he designed the tail-finn of an early airship. From there he went as an aerodynamicist to the Royal Aircraft Factory at Farnborough. There he learnt a lot more about wireless and during the First World War he designed the Army No 2 Wireless Set.

From 1921-3 he was active in the transatlantic tests carried out to see if wireless communication could be established from this country to America. He learnt about the superhet receiver whilst engaged in these tests and was foremost in establishing their use among the amateur radio fraternity in this country. He spent many years on the council of the RSGB and leaves behind him a great quantity of records and material which will be preserved for posterity.

Dud Charman G6CJ is himself a famous old-timer. He acquired a reputation as an 'aerial wizard', design-

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**Compiled by Arthur C Gee G2UK**

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**AMATEUR RADIO WORLD**

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ing aerial systems for commercial use as well as for amateurs. He was famous for the working model used to test his aerial designs and demonstrate their characteristics.

This model consisted of a baseboard several feet square and covered with copper sheet. He constructed miniature versions of his aerials exactly to scale and mounted them on this 'earth', feeding them with RF around 3000MHz in frequency. A 'pick-up loop' fed a receiver where the signals were demodulated into a sound signal, and he could then move the loop around the aerials giving an audio signal of varying strength.

Dud used to demonstrate this model to radio clubs many years ago, a demonstration which was very popular. Advancing years have curtailed his activity in this direction, but he was persuaded to resurrect the equipment again for 'just one more demonstration' at the recent AMSAT-UK Colloquium, referred to previously. Those present who saw this demonstration were as fascinated with it as his earlier audiences years ago!

Honour for Japanese amateur

From the current issue of the IARU Region 1 Region News, we read that Mr Shozo Hara JA1AN, a very well-known Japanese radio amateur, has been awarded a 'Ranjuhosho', — the Japanese 'Blue Ribbon Medal' — in recognition of his distinguished service in the telecommunications world, particularly for his promotion of amateur radio in Japan during the past three decades. In Japan, a Blue Ribbon Medal is awarded by the State for distinguished social work, scientific achievement or invention, or some other meritorious service or achievement. There are not many such awards made, and to receive one is the highest honour for a private citizen. Those medal winners in the Japanese telecommunication world have been mostly presidents or high-ranking executives of public telecommunication corporations such as NTT, KDD and NHK, or of commercial broadcasters or major electronics enterprises.

Shozo Hara's interest in amateur radio goes back to 1939 and has continued unabated ever since. After the Second World War he was the prime promoter of the re-establishment of amateur radio in Japan, which he secured in 1952. At the same time his best efforts were dedicated to reorganising the national amateur radio society in Japan, JARL, not only so that the organisation ran profitably but that it should fulfil the needs of its members. Thanks to his efforts, JARL succeeded in readjusting to these requirements and received government approval in 1959.

He has been President of JARL without a break since 1970, and has worked steadily for attaining their goals both domestically and internationally.

RSGB's next president

Mrs Joan Heathershaw is to be the RSGB's president again next year. A very popular president when she filled the position a year or so ago, she was unanimously elected to fill the post again during 1987. This will be a particularly busy year for the RSGB, as it is the society's 75th anniversary in 1988, so preparations for celebrating the occasion will be necessary.

Computer congress

For the first time, a congress on the state-of-the-art of computer use by the radio amateur is being organised. The congress is to be held in Florence in November. Applications must be submitted by August 31st. Entitled 'Hambit '86', it is being hosted by the Italian Amateur Radio Association (ARI). Details from Carlo L Ciapetti ISLCL, Via Trieste, 36-50139 Florence, Italy.

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PACK 9 10mm LED: 4 red, 2 yellow.

PACK 8 20mm LED: 4 red, 2 yellow.

PACK 7 15mm LED: 4 red, 2 yellow.

PACK 6 20mm LED: 4 red, 2 yellow.

PACK 5 10mm LED: 4 red, 2 yellow.

PACK 4 15mm LED: 4 red, 2 yellow.

PACK 3 20mm LED: 4 red, 2 yellow.

PACK 2 30mm LED: 4 red, 2 yellow.

PACK 1 40mm LED: 4 red, 2 yellow.

POWERFUL AIR IONISER KIT

These have been described as 'miracles' by many in the hobbyist magazines, and have been credited with everything from curing hay fever and asthma to reducing high blood pressure and improving concentration. Increasing visibility, cooling insect nuisance and even speeding up the healing of burns! Although some of the benefits may be exaggerated, there is no doubt that the ioniser is much cheaper and easier to use and much more effective than a simple air freshener.

Use of the powerful benefits of ionisers is that it is distal liquid and smoke particles become charged, and are precipitated at the air's surface, where they will be swept up disturbing normal household cleaning. You can test this by scanning through your house with the small ioniser. Be sure to scan above the ceiling and below the floor. The smoke disappears in seconds. Just what you need if you have an office with smokers (or if you are a smoker with no sympathetic colleagues!). The action of precipitating particles from the air is a natural benefit to asthma and hay fever sufferers, of course, no matter how bad the airs themselves may be.

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**DIGITAL FILTERS**

**Bringing the computer closer to the analogue world**

by Mary Dick

- **RC filters or op-amps to simulate inductors of large value.**
- **Technology has changed though. Crystal filters, ceramic resonators and surface acoustic wave (SAW) devices are common items in many catalogues—they have improved the sharpness of filter passbands and made the passband characteristics more invariant to the manufacturing process.**
- **The computer has helped, too. Sophisticated circuit analysis programs allow designers to optimise their design long before it is built. But the computer and its digital techniques have made advances into filter technology and enable filtering operations to be performed that would have been nearly impossible with analogue designs. Digital filters are becoming one of the day-to-day workhorses of modern electronics. Let us take an introductory tour of this important field and try our hand at a simple design.**

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**Enter the computer**

Why is the introduction of the computer such an important step? What are the advantages to be gained?

Perhaps the most obvious advantage is one of long term stability. Traditional filters suffer from drifting of their characteristics owing to circuit warm-up and the changing of component values as the device ages. Because a digital filter uses numbers stored in a read only memory (ROM), the characteristics are much more stable; the effects of vibration, shock and temperature change also disappear.

The cost of volume production is less with the digital system – ROMs can be produced much more easily than precision inductors, for instance. Size, too, tends to be smaller.

However, the adaptability of digital filters is probably their strongest point: a few simple changes to the computer’s program and the filter characteristics can be changed. This adaptability can even be made to alter the filter’s characteristics according to the nature of the input signal – giving a sort of intelligence to the filter.

**Preparing analogue signals**

The first problem encountered when using a computer is the preparation of the analogue signal so that it may be read by the computer. This is done by an analogue-to-digital converter. Before the converter digitises the input voltage, the voltage is sampled. **Figure 2 shows a very simple sampler.** The sequence of operation is as follows: with **S** open, **S2** closes and discharges **C**; **S2** opens and **S2** closes; the input voltage then appears on **C**. and when **S2** opens at the end of the sample is available as a stable voltage at the output of the voltage follower.

The two main assumptions are that the high impedance of the follower (perhaps a MOSFET device) will not discharge **C** significantly between successive samples and that the sample time (when **S2** is closed) is sufficiently short that the input voltage does not vary during it. The action of the sampler is shown in **Figure 3.** Note how the holding function of the sampler works.

Although there are several techniques for analogue-to-digital conversion (ADC), only one is described here to illustrate the ADC step in the digital filtering process. Single-slope conversion is one of the oldest methods; it is simple in concept and easy to understand. **Figure 4 shows the circuit of a single-slope ADC.** In its reset state, **S1** has discharged **C**; the flip-flop output (Q) is zero and the counter is zeroed.

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**Fig 1 Filtering in a superheterodyne receiver**

**Fig 2 Sample and hold circuit**

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SEPTEMBER 1986
To begin the conversion $S_0$ is opened and a pulse is sent to the set input of the flip-flop. Because the flip-flop output is high, pulses from an oscillator are clocked into the counter. With $S_0$ open, the constant-current source charges $C_1$ and the non-inverting input of the comparator sees a linear, rising ramp of voltage.

When the voltage on $C_1$ rises above that of the input $(V_{in})$, the comparator output goes high, resetting the flip-flop and so stopping the counter. As the value of the counter is directly proportional to the input voltage, the computer may read the (digital) counter and scale the value to obtain a reading of the true (analog) input voltage.

**Digitisation process**

The digitisation process is not without its problems, however. The ADC tends to have errors caused by manufacturing tolerances and temperature drifts; the first may be cured by tighter quality control, but this raises the price. The resolution of the ADC, while not an error, does limit its ability to see small voltage variations. For example, an 8-bit ADC has 256 discrete levels between its two reference voltages. If the total range is 1 volt, then the ADC will be blind to changes of less than around 2mV and the most accurate that ADC answers can be quoted to is 4mV. For many purposes this sort of resolution will be quite adequate; the actual accuracy of the device depends on the accuracy of the voltage reference and, in the above example, the stability of the oscillator.

A much more fundamental problem occurs within the sampling process and is not a fault. Sampling any waveform will, unless preventative steps are taken, introduce 'aliasing'. The result of this is that a signal of one frequency will appear as another after sampling — and disrupt any attempt at filtering.

Figure 5a shows a signal being sampled ten times during one cycle. Figure 5b shows the result of applying the same sampling to a signal of much higher frequency — it can be seen that, after sampling, the signal appears at a quite low frequency. If care is not taken, aliasing like this could cause a high frequency signal to creep through a low-pass filter, for example.

**'Anti-aliasing'**

Unfortunately, there is no 'magic-wand' cure for aliasing; a conventional, analogue low-pass filter has to be used before the sampler to ensure that the alias-causing signals are blocked out. Such a filter is known as an 'anti-alias' filter and is designed to start attenuating frequencies at about one third of the sampling frequency.

Now that the signal has been digitised the computer can read it in from the ADC, which is normally handled as a 'memory-mapped' peripheral. Once the signal is in memory there are a few simple manipulations which can be done, and these are briefly described below.

Two signals can be added (audio mixer) or subtracted (differential amplifier) by simple addition or subtraction operations; multiplication and division can also be done. The signal can be clipped: if its (digitised) value exceeds the clipping threshold, the signal's value is set equal to the threshold's value. A variation on this would be soft-clipping where, perhaps, a signal in excess of the threshold might be clipped to:

$$V_{out} = \sqrt{V_{in} - V_{threshold}} + V_{threshold}$$

In order to treat two signals like this, their sampling rates and the range of the ADC used must have been the same.
DIGITAL FILTERS

**Filtering – the digital way**

Analogue filters are so common in communications circuits that little thought is given to them by the user. When confronted with the design of a filter – perhaps for a homebrew receiver – a previously designed version is usually to be found in the literature. Changing its centre frequency or pass-band characteristics may be accomplished by scaling the values of a few components.

This apparently rule-of-thumb system works very well, but actually hides a vast amount of complex mathematics which ‘governs’ filter design and characteristics. To describe these mathematics here would be the next logical step in considering the transition from analogue to digital filters, but if a certain amount can be taken in trust by the reader, it is much simpler to try a short, non-mathematical treatment. Those who understand the mathematical techniques might gain even more of an insight into the problem; certainly the author did.

Before starting, it is as well to remember that not all signals are being considered: the anti-alias filter has only left those with a frequency range from dc to (approximately) one third of the sampling frequency.

If we wanted to represent the frequencies coming into the filter, we might decide to draw them on some kind of graph. Without worrying too much about why, let us plot them on a circle – rather like a polar diagram. Figure 6 shows such a plot: dc levels are placed at the intersection of the circle with the positive x-axis and, as we move round the circle anti-clockwise, signals of increasing frequency are represented until we return to our start point at a frequency equal to the sampling frequency.

**Sampling frequencies**

Since the frequency at any given point on the circle is linearly proportional to the angle traced through from the start point, a frequency of half the sampling frequency is represented by the point at the intersection of the negative x-axis and the circle. If we were sampling 2,000 times per second, the circle would have the corresponding frequencies as marked in Figure 6.

Different sampling rates would cause the frequencies to be linearly scaled as the sampling is to 2,000. While there is a mathematical reason for drawing such a graph, the reader should not feel that it is an unreasonable way of representing signals. Figure 7 shows the same graph with two signals plotted, one a 660Hz Morse code signal and the other a 100Hz ‘unwanted’ noise signal that might come from mains interference.

The design of a suitable digital filter to remove the unwanted signal is our next step. If we leave our two signals in their graphical form we could design a mask to fit over Figure 7. In doing so, we shall multiply the mask with the original signals – so a simple mask might consist of a value of 1 everywhere except at the position of the unwanted signal, where it should have a value of zero.

**Signal amplification**

If we wanted a particular signal to be amplified, a value exceeding 1 might be used in the mask. Now, at this point, the mathematics which have been put to one side force us to limit what is available for the mask. The zero value is allowed and this is mathematically described as a ‘zero’. The other component that may be used is infinity; we can place an infinity (known as a ‘pole’) in our mask. Zeros and poles are allowed to be placed anywhere in the mask – but some care is needed if the result of multiplying the mask and the signals is to produce a meaningful result. After all, if we place a pole on a signal the computer will suffer from an arithmetic overflow and probably crash.

How is the effect of the mask on the signals present calculated? This is a fairly simple operation and is vital if we are to be able to predict the action of our filter. If we first consider a point on the circle, the effect of the mask on the amplitude of a signal with a frequency corresponding to that point is the quotient of the product of the point-to-zero distances and the product of the point-to-pole distances.

**Figure 8** shows an arbitrary point, two poles and two zeros. The amplitude of the resulting output will be:

\[ A_{\text{out}} = \frac{Z_0 \cdot Z_2}{P_1 \cdot P_2} \]

To determine the characteristics of the filter over the filter’s range (from dc to \( f_s/2 \)) this calculation is performed all round the top semicircle with as many points being chosen as are necessary to specify the characteristic with the desired accuracy. Because this is fairly difficult to visualise several examples are included to show the effect of different pole-zero configurations.

**Figure 8** shows a simple zero located at the dc point on the circle, and the associated filter characteristic. Note how there is a smooth roll-off towards dc just as though a dc-blocking capacitor had been placed in an analogue circuit. The frequency scale is not fixed in value.
the graph goes from dc to f/2; if f₂ is varied then the upper limit and the roll-off breakpoint, f₁, also change. Using the equation given above, the response becomes:

\[ A(\text{out}) = A(\text{in}) \frac{Z_1}{P_1} \]

At the dc point, Z₁ is zero but rises to \( \sqrt{2} \) at \( f_1/4 \) and to 2 at \( f_1/2 \).

The smooth roll-off is not always what is wanted - a steeper rejection slope which allows more low frequencies to pass might be more applicable in many cases. If we think about this requirement, it is obvious that we need to keep the zero at the dc point because that is where the rejection is required. However, a short distance round the circle from the dc point the filter is required to have a unity response, i.e. it passes frequencies unattenuated.

Because the above equation is only governed by Z₁, a change will need to be implemented. If a pole is added near the dc point, say at \( (y=0, x=0.9) \), then the characteristic becomes:

\[ A(\text{out}) = A(\text{in}) \frac{Z_1}{P_1} \]

Near the dc point the distance Z₁ is very small, and so dominates the response. However, as we move anti-clockwise round the circle Z₁ and P₁ become nearly equal and the input and output amplitudes become equal. The effect on the filter's characteristic is quite pronounced: the -3dB point has moved from \( f_1/4 \) to \( f_1/500 \). Hence, if \( f_1 \) is 1 kilohertz, the filter's roll-off has gone from 250Hz to around 20Hz.

By moving the pole closer to the zero this could be improved, although, as noted later, there are problems encountered (see Figure 10).

**A simple bandpass filter**

The last example in this section is that of a simple bandpass filter designed to amplify signals around \( f_1/4 \) while totally rejecting both dc and \( f_1/2 \) signals. Here, two zeros are required and are placed at the intersections of the unit-radius circle and the x-axis, as shown in Figure 11. Since we want \( A(\text{out}) \) to be much larger than \( A(\text{in}) \) at \( f_1/4 \), we include a pole near the \( f_1/4 \) point; another pole is also placed near the \( 3f_1/4 \) point for mathematical symmetry and a 'real' implementation.

Now, if we calculate the distances \( Z_1, Z_2 \), and \( P_2 \) and then use our simple rule:

\[ A(\text{out}) = A(\text{in}) \frac{Z_1Z_2}{P_1P_2} \]

we can see that \( A(\text{out}) \) is zero where wanted and will be \( 2 \sqrt{2/3} P_1P_2 \) at the \( f_1/4 \) point. Choosing \( P_1 \) and \( P_2 \) to be 0.8 of a radius from the centre gives a gain at the centre frequency of 5.6. Figure 11 also shows the frequency response - a rather mediocre bandpass filter.

While no mathematics have been used, the reader should be able to have an intuitive feel for the relationship between the position of zeros and poles and the frequency response. Of course, these illustrations have been simple - most digital filters have a large number of coefficients and can have very complicated characteristics. In such cases computer programs aid the filter designer.
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AN 18 TO 28MHz PREAMPLIFIER

A simple construction project for a real performer

Ken Williams

The performance of many older, and some not so old receivers tends to tail off above 14MHz, and this was brought home to me only a few days ago when I heard a local station working DX on 21MHz which did not even appear above the noise level of the shack receiver.

Thoughts of modifications to the rig immediately came to mind, but after consideration it was decided to construct a preamplifier which could be used in conjunction with any HF equipment in the shack.

Designing a preamp

When designing a preamplifier for VHF high sensitivity is paramount, but on HF the atmospheric noise level limits the usable sensitivity. However, the extremely strong broadcast signals to be found right across the HF spectrum make good cross modulation characteristics essential.

With these parameters in mind, some thought was given to the actual circuit. Firstly, there would be little difficulty in obtaining the necessary sensitivity, for almost any reasonable HF or VHF RF transistor would produce the desired performance.

Secondly, to give improved protection against cross modulation a band-pass input circuit should be employed.

Thirdly, as the preamplifier would be feeding into a low impedance receiver input, matching in the form of an emitter follower output stage should be included.

Fourthly, in order to avoid overloading the receiver, an attenuator should be incorporated in the output circuit.

The next move was to the workshop in order to investigate the contents of the components store (ie junk box).

Removing a kilo of fluff, dozens of open circuit resistors and a tatty, ten year old copy of Playboy revealed a BF180, sundry small unmarked transistors, a two-gang 50pF variable capacitor, an Eddystone diecast box and various pieces of single sided copper-clad board.

From the latter a piece 7 x 4.5cm was cut, and following my normal practice the pattern in the PCB was cut using a dental burr in a miniature electric drill.

The circuit was wired as indicated, with the exception that for initial testing the band-pass input was replaced by a single tuned circuit.

The only component which the reader may have difficulty in obtaining is the RF choke in the collector circuit of the BF180. This had been removed from a defunct Pye Ranger VHF RT equipment. Should a similar component not be available, it is probable that a 1000 ohm resistor would form a viable substitute with little detriment to the performance of the unit.

Component values

The component values used are not, in general, critical, and if those quoted are not available the preferred value above or below will probably make little difference to the final performance. Some care should be taken in the bias arrangements for the BF180, R1 being selected to give the device a standing current of about 1mA. Should a BF180 not be available, a 2N706 or similar would probably make an adequate substitute.

The emitter follower stage uses an unmarked npn JFET which other evidence suggests may be a 2N706. The circuit values used allow almost any small signal transistor to be used in this position.

An attenuator (R8, R10, R11) is located between the emitter follower and the output. This is intended to reduce the overall gain of the preamplifier so that the first stage of the succeeding receiver will not be overloaded by strong signals, and also to provide a measure of impedance matching between preampli-
18-28MHz PREAMP

**Fig 2** PCB layout. Pattern should be cut on single-sided board

Fier and receiver. For initial testing, however, attenuation was not really required and the value indicated for R11 was temporarily inserted.

When the wiring of the PCB was complete, rather than immediately mount it in the box it was decided to carry out the preliminary performance tests. These were carried out using a single input tuned circuit.

Using the preamplifier in conjunction with a Drake 2B switched to 2.1kHz bandwidth, a system noise figure of better than 3dB was obtained on 21MHz. A gain figure of about 22dB was measured by comparing the input necessary to provide a selected S meter reading on the receiver with and without the preamplifier in circuit.

When, however, the input of the preamplifier was connected to a non-resonant aerial, severe cross modulation was evident.

The band-pass input circuit was then constructed, with the inductors wired directly between the stator plates and frame of the capacitor. This enabled their relative position to be easily adjusted for optimum performance. By trial and error, and balancing overall gain against cross modulation performance, a spacing of 1 inch centre to centre was finally chosen.

**Performance figures**

Finally, the preamplifier was mounted in the Eddystone box and the final performance figures determined.

Compared with the earlier tests with a single input circuit the sensitivity was somewhat degraded, with an indicated noise figure of 4dB on 28MHz and about 1dB worse on 21MHz. The gain also was slightly less at about 20dB. This reduction in performance caused no concern, for it still remained far better than required.

At this point it was considered that the preamplifier met the requirement, and it only remained to increase the value of R11 to reduce the gain to a level whereby the addition of the amplifier to the input of the receiver caused only a slight increase in background noise. The final value selected will therefore vary in each individual case.

**Thumbs up**

I make no claim that this preamplifier is the ultimate, it certainly is not. But it will give a considerable improvement in performance to older or less sensitive receivers. Furthermore it is simple to construct and has only one component (the 2 x 50pF ganged capacitor) which may be difficult to obtain.

If only one band is required the ganged capacitor could be replaced by preset trimmers, although if that band required is at the lower end of the range it may be desirable to add a turn or two on the inductors.

At one point in the development of this preamplifier trimmer capacitors were added across the inductors, but after a little experimentation it was decided that they were not necessary.

**Fig 4** Preamp in box sockets can be moved to rear

---

**COMPONENT LIST**

**Resistors**
- R1: 6k8
- R2,6: 33k
- R3: 470R
- R4: 680R
- R5: 15k
- R7,6: 1k
- R9,10: 68R
- R11: 68R initially, then adjust (see text)

**Capacitors**
- C1,2: 25pF
- C3,4,5,6,7: 10nF
- C8,9: 2 x 50pF ganged variable

**Inductors**
- (all wound on ½ inch former)
  - L1: 3 turns over 'cold' end of L2
  - L2: 15½ turns close-wound 22g enamelled wire
  - L3: As L2
  - L4: 5 turns over 'cold' end of L3

**RFC**
- Choke from Pye Ranger (see text)

**Semiconductors**
- Tr1: BF180 or similar
- Tr2: 2N706 or similar (see text)
Readers who have used the test program published with the Spectrum RTTY terminal (Feb-Mar '86) will by now have realized its limitations for 'on air' use.

This is not surprising, since the program's main use was simply to set up the terminal and confirm operation. The program described below, however, possesses all the facilities which have come to be expected of any self respecting RTTY terminal, such as:

• Five 255 character memories, to store commonly used messages such as station details etc.

• A 1023 character keyboard buffer to allow messages to be handled while receiving.

• Fast machine code routines allowing the proposed higher baud rates to be handled easily.

Program I – Basic program

<table>
<thead>
<tr>
<th>Line</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>00</td>
<td>PAPER 7, 1K &amp; BORDER 0</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>F 2555.0</td>
</tr>
<tr>
<td>25</td>
<td>05</td>
<td>RUN AT 0:00, HEN AT 2:5</td>
</tr>
<tr>
<td>29</td>
<td>19</td>
<td>WND, MEM01=500, PAUSE MEM01 HEN 1=1</td>
</tr>
<tr>
<td>40</td>
<td>10</td>
<td>PRINT 0:100, 'UNICOD', PA</td>
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<tr>
<td>50</td>
<td>10</td>
<td>LET K3=3000</td>
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<tr>
<td>60</td>
<td>10</td>
<td>IF I THEN GOTO 100</td>
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<tr>
<td>70</td>
<td>00</td>
<td>IF I THEN GOTO 20</td>
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<td>80</td>
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<td>IF I THEN GOTO 20</td>
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<tr>
<td>450</td>
<td>00</td>
<td>IF I THEN GOTO 20</td>
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</tbody>
</table>

Control of the transmitter push-to-talk switch.

Note that this new program does not provide the filter calibration tones and the baud rate check facility, since these are not normally required once the unit has been set up. It is therefore advisable to keep a copy of the original test program in case recalibration is necessary (unless of course test equipment is available).

Program description

The main portion of the program is written in machine code for speed reasons: Program I is the assembly listing. The first part of the program performs initialisation (lines 460-520). This includes zeroing the keyboard buffer length SIOLL + SIOLH, setting both cursors to the left-hand side, clearing the keyboard byte KBD, clearing the screen and setting the terminal in receive mode.

Whilst in the receive mode, the UART status, the keyboard, and the mode control byte are polled continuously. If a character is received by the UART, its code is used as an offset pointer in the look-up table to convert the 5-bit ASCII to 7-bit ASCII which the computer requires to print.

The Spectrum keyboard is scanned every 20 milliseconds by the operating system, and if a key is pressed its code is placed into location KBD (23560). Lines 540-1170 check if this key is one of the controlling characters, in the following order: figure shift, lines 700-750; letter shift, lines 760-800; return to menu, lines 810-830; transmit mode, lines 840-940; receive mode, lines 950-1170.

Lines 1180-1270 check the keypress against the look-up table entries to see if it is sendable: if so it is placed on the 'top' of the keyboard buffer (unless the buffer is full, in which case the character is ignored).

If the character is not sendable, lines 1620-1910 check if it is a request to load the contents of one of the memories into the keyboard buffer. Since the memory can be up to 256 characters long, the receiver register is sampled after each memory character transfer so as not to miss any received characters.

The current mode (receive, transmit, or send RYS) is held in the MODE byte, which will contain 0, 1 or 2 respectively.

Lines 1920-2020 jump to the appropriate routine, depending on the current mode, then loop back to the beginning of the keyboard routine.

In transmit mode, if the UART is ready to send, the bottom-most character of the keyboard buffer (SIOLBT) is read out and the whole buffer contents moved down by one character (lines 3470-3670). If the buffer is empty the program returns to the keyboard routine to wait for a keypress.

Lines 3680-3710 check if the character read out is sendable, and if so its shift state is checked against the current state (lines 3760-3900). If a change of shift is detected the appropriate shift code is transmitted before sending the character itself. The character is printed in the top window by line 3730.

A continuous stream of RYS is sent by lines 4020-4060, which will continue until the mode is changed. These characters are not printed in the window.

The two text windows each have their own print routines (PR1 and PR2), enabling them to work independently.

Each window prints on a fixed line, and a scroll is forced when the cursor reaches the RHS of the screen or if a line feed character is received by the print routine. The scroll itself is simply a Z80 block move instruction applied to the relevant screen address area.

The easy way

Channel 2 is opened before each printing operation to ensure that the main screen is used. RST16 is the easy way to the Spectrum 'print character routine'. Apart from printing characters on the screen, this routine allows the cursor to be positioned in a way similar to the PRINT AT n, m in Basic. Extensive use is made of this to control the position of both cursors.

Program I is the Basic program, which is used to load the machine code initially, and to display and set the five memories. Note that the machine code loader is at the end of the program, which means that if the program is stopped and re-run, it is not necessary to reload the code (damn clever!)

Line 20 sets caps lock on, because lower case letters are not included in the 5-bit ASCII table. Note that if caps lock key (caps shift 2) is pressed while not in the machine code part of the program, caps lock is turned off and must be returned to the on state, or the keys a-z will not be recognized by the keyboard routine (unless shift is used).

The memory contents are displayed and changed by lines 109-430. Each memory is allocated 256 bytes irrespec-

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Program II: Assembly Listing

The memory map at the end of the listing indicates that the program is stored in the Spectrum's memory. The address of each block of memory is shown, and the bytes stored in each block are listed. The listing itself is a detailed view of the program's assembly code, which can be compiled and run on the Spectrum computer.
Program III — Basic loader

available the machine code can be entered from Program III, otherwise the loader (Program III) can be used. This program makes the machine code from the data statements and verifies that the data is correct by adding all the numbers and checking the total against the checksum values obtained from the prototype program.

If an error is detected by the program, the numbers in the DATA lines should be checked carefully. This is almost certainly the hardest part of typing in the program, but the data must be exactly incidentally, don’t delete the checksum lines in the hope that it might just work. Take it from me — it won’t.

Once the code has been generated successfully (shown by DATA READ OK) we ‘have it’ to occupy CODE 29000-3600, after the Basic which was saved earlier.

Testing the program

With the terminal connected (turn off the terminal before loading and run the program in the normal manner using LOAD*). If all is well the menu will appear, and operation can be confirmed.

Operating instructions

When running, the following options are available from the menu (note: don’t use the ‘Enter’ key when selecting from the menu).

Set Memories: This option allows the operator to examine and change the contents of the five memories. The operator is asked which of the memories to alter, and the contents of the selected memory are displayed along with its length and the ‘alter Y/N’ prompt.

To change the contents, answer Y to type in the new contents. If most of the original contents are correct, or if text needs to be added at the end of a memory, the cursor key right key (caps shift 8) will copy characters from the old contents to the new up to the desired position. To correct typing errors, use the cursor left key (caps shift 5) to delete the text one character at a time.

For example, to correct the omission of ‘i’ in details, press left arrow twice to delete the ‘i’ and then continue typing its to complete the word.

To terminate a memory entry, use the ‘£’ key (symbol shift 3). This is used rather than the more usual Enter to allow the latter to be employed to insert carriage return/line feeds into the memory as required. The program will issue a warning beep when the memory is almost full (more than 245 characters), and any text entered after the 255th will be ignored.

Run Program: This option starts the terminal in the receive mode with the received text appearing in the top window. Text to be transmitted may then be compiled in the bottom window (the terminal is immediately switched to transmit if required).

Memories may be added to the buffer by using caps shift 1-5. Each keypress is checked to see if it is a valid 5-bit ASCII character, invalid keys being ignored. To transmit the completed message press caps shift 0; each character will appear as it is sent, in the top window. Text may still be added while sending, even to the point when the keyboard buffer is empty. A short delay is provided when switching to transmit to allow any relays in the transmitter to operate. A continuous stream of ROYs may be sent by pressing caps shift 9. This will continue until another mode is selected. Note that the ROYs are not displayed in the window.

To return to the menu, press caps shift and symbol shift.

Caps shift 1 Put memory 1 into transmit buffer
 Caps shift 2 Put memory 2 into transmit buffer
 Caps shift 3 Put memory 3 into transmit buffer
 Caps shift 4 Put memory 4 into transmit buffer
 Caps shift 5 Put memory 5 into transmit buffer
 Caps shift 6 Letter shift (receive only)
 Caps shift 7 Figure shift (receive only)
 Caps shift 8 Receive mode
 Caps shift 9 Send ROYs
 Caps shift 0 Transmit mode

Caps shift + symbol shift Return to menu

Enter Issue a carriage return/line feed

Save Memories: This option need only be used if the contents of a memory have been altered, and permanent record is required. Before saving memories, rewind the tape to the beginning and follow the usual prompts. What’s that about, except to remind the more idle of readers that a tape containing the program can be obtained from the author for a mere £4.50 including postage (make cheques payable to S Dean and send them to the editorial offices).

READER OFFER

For those of you interested in building a RTTY terminal for the Spectrum, Radio and Electronics World now has a stock of PCBs for the unit designed by S Dean, as published in the February issue of the magazine.

The board measures 14.5 x 11cms and costs £9.20 including postage and packing.

To order your board please send a cheque or postal order made payable to Radio and Electronics World to: Radio and Electronics World Magazine, Sovereign House, Brentwood, Essex CM14 3SE. Allow 28 days for delivery.
If you want a handheld with exceptional features, quality built to last and a wide variety of interchangeable accessories, take a look at the ICOM range of FM transceivers. All ICOM handhelds come with an IC-BP3 nicad battery pack, flexible antenna, AC wall charger, belt clip, wrist strap and personal earpiece as standard.

**IC-2E/4E, 2 metre and 70cm thumbwheel handportable.**

These popular handhelds from ICOM are still available. For those Amateurs who require a simple but effective FM transceiver the IC-2E and 4E take some beating. Frequency selection is by means of thumbwheel switches (with 5kHz up-switch) and duplex or simplex facility. Power output is 1.5 watts or 150 milliwatts (2.5 watts is possible with IC-BP5A battery pack).

**IC-02E/04E 2 metre and 70cm keypad handportable.**

These direct-entry CPU controlled handhelds utilize a 16-button keypad allowing easy access to frequencies, memories and scanning. Ten memories store frequency and offset. Three scanning systems, priority, memory and programmable band scan, (the IC-02E now with an improved CPU retains duplex offset). These handhelds have an LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions. Power output is 3 watts or 0.5 watt in low power position for the IC-02E and 2.5 watts or 0.5 watt for the IC-04E. (5 watts is possible with the IC-BP7 battery pack or external 13.8V DC.)

**STOP PRESS. New handheld available.** Just released is the **IC-12E** 23cm keypad handportable, this new transceiver has direct keypad entry for frequency, memories and scanning systems. Ten memories store operating frequency simplex or duplex. An internal power module provides 1 watt or 100 milliwatts of RF power. Five tuning speeds including 12.5kHz and 25kHz.

Also available for ICOM handhelds are a large range of optional extras including a variety of rechargeable nicad power packs, dry-cell battery pack, desk charger, headset and boom mic, speaker mic, leatherette cases and mobile mounting brackets.

For more information on these portables and other ICOM Amateur equipment contact your local authorised ICOM dealer or Thanet Electronics Ltd.
ICOM

IC-28E 2m. FM mini-mobile.

Rx Range 138-174 MHz.

This new 2 metre band transceiver is just 140mm (W) x 50mm (H) x 133mm (D) and will fit nearly anywhere in your vehicle or shack. Power output is 55 watts or 5 watts low power and is supplied complete with an internal loudspeaker.

The large front panel LCD readout is designed for wide angle viewing with an automatic dimmer circuit to control the back lighting of the display for day or night operation.

The front layout is very simple, all the controls are easy to select making mobile operation safe. The IC-28E contains 21 memory channels with duplex and memory skip functions. All memories and frequencies can be scanned by using the HM-15 microphone provided. Also available is the IC-28H with the same features but with a 45 watt output power.

Options include IC-PS45 13 By 8A power supply, SP8 and SP10 external speakers. HS15 flexible mobile microphone and PTT switchbox.

IC271 & 471 Multimode
Base stations

ICOM can introduce you to a whole new world via the world-communication satellite OSCAR. Did you know that you can Tx to OSCAR on the 430-440 MHz IC-471 and Rx on the 2m IC-271.

By making simple modifications, you can track the VFO’s of the Rx and Tx either normally or reverse. This is unique to these ICOM rigs and therefore very useful for OSCAR 10 communications. Digital A.F.C can also be provided for UOSAT etc. This will give automatic tracking of the receiver with digital readout of the doppler shift. The easy modifications needed to give you this unique communications opportunity are published in the December ’84 issue of OSCAR NEWS. Back issues of OSCAR NEWS can be obtained from AMSAT (UK), LONDON E12 5EQ. This range includes the IC-271E-10W, IC-271E-25W, 271H-100W and the 70cm versions IC-471E-25W and 471H-75W r.f. output. The 271E has an optional switchable front-end pre-amp. The 271H can use the pre-amp AG-25, with the 471E and 471H using the AG35 mast-head pre-amp. Other options include internal switch-mode PSUs; the 271E and 471E use the PS25 and the 271H and 471H use the PS35.

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SEPTEMBER 1986
THE TRIODE VALVE

As you probably know from the earlier article on valves (R&EW May and June '86), the ability of the diode valve to pass current flow in one direction was demonstrated by J A Fleming in 1904 and is the fundamental property of the electronic valve.

Experiments were subsequently carried out in an attempt to externally control the flow rate of electrons from cathode to anode. It was not until 1908 that it could be successfully demonstrated that the introduction of a mesh of wire positioned between the cathode and anode would influence the flow of electrons, the influence exerted depending upon the potential difference between this grid of wire and the cathode.

Principles
The space charge surrounding the cathode plays an important part in the movement of electrons. The potential of the space charge will determine whether electrons travel on to the anode or return to the cathode.

If a grid of wire is positioned so that it encloses the cathode in the space charge region, its potential with respect to the cathode will influence the flow of electrons. This mesh of wire is known as the control grid (abbreviated to grid), and is of open mesh or spiral construction so as not to impede electron flow.

It is apparent that the potential applied to the grid will have a much greater relative influence on the space charge than the anode will have for the same applied potential, since the grid is much closer. The control grid therefore provides a very effective way of regulating the electron flow from cathode to anode. For a given cathode temperature, the electron flow or anode current I_a will now depend not only upon the anode potential V_a, but also upon the grid potential V_g.

Valve parameters
As mentioned earlier, the anode current I_a can be influenced by three possible variables: filament temperature, anode voltage V_a, and grid voltage V_g. In practice the valve must be designed to give sufficient emission of electrons for the particular purpose for which it is intended. The cathode is arranged to be operated at a fixed temperature which will provide the required electron emission and ensure long life.

When the characteristic performance of the triode valve is measured, the cathode is heated under a specified fixed condition, and either the anode voltage V_a or the voltage applied to the grid is varied while the resulting anode current is recorded. These variations may also affect the flow of grid current.

Test circuit
A test circuit suitable for measuring the static valve characteristics is shown in Figure 2. The filament is connected to a constant voltage source of 6V, which heats the cathode to the required temperature. In the anode circuit a potentiometer is connected across the high tension anode battery supply to permit the anode voltage to be finely adjusted. The anode current is read by the ammeter inserted in the anode supply circuit. A voltmeter is connected across the triode between anode and cathode to measure anode voltage. The battery in the grid circuit is centretapped and shunted by a potentiometer.

By using this circuit configuration the voltage applied to the grid can be continuously varied over a wide range of positive and negative values, recorded on a voltmeter connected between the grid and cathode. These measurements will give the 'static' characteristics of the triode valve, since they are measured
with fixed values of voltage applied to the various electrodes and not with the varying or dynamic potentials of normal operation.

It is not possible to represent the behaviour of a triode by a single characteristic curve, as could be done for the diode. This is because the anode current is controlled by both the anode and grid voltages. It is therefore necessary to devise graphs to show the effect of both voltages at once.

The usual practice is to present two sets of characteristic curves, with one set showing anode current against anode voltage for various fixed values of grid voltage. Another characteristic curve is plotted showing anode current against grid voltage for various fixed values of anode voltage.

If we plot anode current against anode voltage for various fixed values of grid voltage, we obtain the characteristic curve shown in Figure 3. As there is no fundamental difference in principle of operation between a diode and a triode, we can consider initially what happens if the grid is connected directly to the cathode, i.e., if the grid voltage $V_g$ is zero. Under this condition, the triode behaves in much the same way as a diode, and its characteristic curve is like curve 1 in Figure 3.

To observe the effect of varying the value of $V_g$ the test circuit shown in Figure 2 is used and the potentiometer in the grid bias supply varied to obtain various fixed values of grid voltage. For each grid voltage, individual curves of anode voltage against anode current are plotted.

For example, suppose the grid is made less than $-5V$. If the anode voltage $V_a$ is zero, the electrostatic field surrounding the grid will prevent any electrons from passing through the grid and thus $I_a$ will be zero. Anode current will only flow if the anode is made sufficiently positive to overcome the effect of the negative charge on the grid. This occurs at point $X$ on the graph shown in Figure 3 at the foot of curve 2.

For values of $V_a$ less than this, the anode current will remain cut off, while for values greater than this the current arises when $V_a$ is increased, giving a characteristic resembling that of a diode.

Curve 2 in Figure 3 shows a similar graph shape to that of curve 1, but is displaced to the right of the diagram. Curves 3, 4, 5, and 6 are again similar in shape. Every increase in negative grid bias causes a further displacement to the right requiring higher values of $V_a$ to encourage anode current to flow.

This set of curves is called the static anode characteristics. Any convenient value of $V_a$ can be chosen for the individual curves, but $V_g$ must be held constant for any one curve. It can be seen that the distance between the curves is almost equal, showing that for this
particular valve every 5V increase in negative grid bias requires about 100V increase in positive anode voltage to counteract the influence of the grid.

Mutual conductance
Another set of characteristic curves can be plotted when the anode voltage is held constant and the grid voltage is varied, with the anode current being measured. The resulting graphs are shown in Figure 4.

It will be observed that these graphs have a considerable linear portion which for the three curves plotted are parallel and equally spaced. It can be seen from Figure 4 that the anode current decreases as the grid bias is increased, until eventually the cut-off point is reached. The higher the value of \( V_a \) the greater the bias required to achieve cut-off.

The slope of the straight portion of the graph is the ratio of current to voltage or conductance. The values of current and voltage are obtained from separate circuits comprising the anode and grid. Therefore the slope of the graph is known as the control grid to anode transconductance, more usually known as the mutual conductance. This is a measure of the control exercised by the grid over the anode current and is defined as the ratio of small change in anode current to the change in grid voltage which causes it. Mutual conductance is denoted by the symbol \( g_m \) and is measured not in mhos but in milliamperes per volt.

It is customary for valve manufacturers to provide both the anode characteristics and the mutual conductance characteristics, although it is possible to obtain one from the other. Sometimes the third possible set is also given, showing \( V \) plotted against the grid voltage, \( V_g \), each curve being plotted for a fixed value of \( I_a \).

Triode coefficients
Having obtained the anode and mutual conductance characteristics for the triode it is now possible to predict how it will behave when used in a circuit. However, it is possible to simplify the design work required by considering only the part of the characteristics where the curves are roughly straight and parallel. The three quantities \( I_a \), \( V_a \), and \( V_g \) are then taken two at a time, and for each pair the change in one quantity caused by a small change in the other is found.

Valve resistance
With the grid potential held at a constant value, the anode characteristic curve is obtained for various fixed values of grid voltage. The linear portion of these curves for various fixed values of grid voltage measures the ratio of anode current to anode voltage, and is called the internal conductance of the valve.

The reciprocal of this is the voltage to current ratio, which is known as the ac resistance or the inherent impedance, or alternatively the slope resistance for the triode. This is defined as the ratio of a small change in anode potential to the change in anode current which results, the grid potential remaining constant. It is measured in ohms and is denoted by the symbol \( r_a \).

Over the linear portion of the curve for the grid voltage held at 5 volts, Figure 5; if \( I_a \) is the small change in anode current resulting from a small change \( V_a \) in anode voltage, then:

\[
r_a = \frac{V_a}{I_a}
\]

In the graph shown in Figure 5, the ac resistance is:

\[
r_a = \frac{200 - 150}{(15 - 11) \times 10^{-3}} = 50 \times 10^2
\]

\[
= 12,500 \text{ ohms}
\]

The ac resistance may also be determined from a pair of graphs showing the mutual characteristic. If we extend the mutual characteristic graph shown in Figure 4 to obtain the graph shown in Figure 6, we can see that if we hold the grid voltage constant at -6V and draw a dotted vertical line which will cut the linear portion of the curves for \( V_a \) at 200V and \( V_a \) at 300V, the change in anode voltage will produce a rise in anode current from 8mA up to 23mA. Therefore the ac resistance is:

\[
= \frac{300 - 200}{(23 - 8) \times 10^{-3}} = 100 \times 10^2
\]

\[
= 6,700 \text{ ohms}
\]

Amplification factor
When the grid voltage is varied it results in a change of anode current. The amplification factor of the triode is the ratio of the change in anode current to the change in anode voltage, with \( I_a \) being held constant. Therefore if we are to obtain the amplification factor we must hold \( I_a \) constant after \( V_a \) has been varied. It will be necessary to readjust the value of \( V_a \) to obtain the original value of \( I_a \).

A set of characteristic curves can be plotted to obtain the ratio, or it can be obtained from the anode characteristic curve as shown in Figure 7. If \( I_a \) is held constant at, say, 10mA, then a change in grid voltage will result in a change in anode voltage. As both \( V_a \) and \( V_g \) are measured in volts, \( \mu \) has no units and is merely a number, typical values ranging from 10 to 100.

In the example shown in Figure 7, the value of the amplification factor will be:

\[
\mu = \frac{V_a}{I_a} = \frac{120 - 80}{6 - 4} = \frac{40}{2} = 20
\]

This procedure can be applied to any triode by measuring the horizontal distance between the chosen curves for \( V_a \) to obtain the change in \( V_a \) along the horizontal axis of the graph. It is wise whenever possible to take a measurement of the rate of change either side of the proposed operating point of the valve to obtain the average value.

Mutual conductance
The amplification factor shown in Figure 4 is the mutual conductance, which has already been calculated from the mutual characteristic curve shown in Figure 6.

The mutual conductance of the triode can be calculated by holding the anode voltage constant at, say, 200V and determining the change in \( I_a \) when \( V_a \) is varied. Thus:

\[
9m = \frac{I_a}{V_a} \text{ } 15 - 10
\]

\[
V_a = 7 - 4 \text{ } 3
\]

\[
= 3.3mA/V
\]

Typical values range from 1 to 10mA/V. A knowledge of the valve parameters enables the most suitable type of triode to be selected for a particular purpose from the wide range of valves available. A simple relationship exists between the various parameters. As previously derived, the amplification factor \( \mu = V_a / V_g \). If we now multiply numerator and denominator of \( I_a \) and rearrange the equation we obtain:

\[
\mu = \frac{V_a}{I_a} \text{ } \frac{V_g}{V_a}
\]

which can be rewritten as:

\[
\mu = r_a \times g_m
\]

This equation is always true provided the three coefficients are always measured near the same operating point.

Under certain conditions grid current will flow: if the grid is positive with respect to the cathode, some of the electrons on their way to the anode will be attracted towards the grid.

Up to a certain limit this grid current is practically independent of the voltage applied to the anode. If the anode voltage is high, the electron velocity will also be high. Electrons will then collide with the grid with such force as to knock off other electrons, which will then be attracted to the anode. This is a form of secondary emission and will result in the grid current being reduced.

If air has found its way into the valve glass envelope and the valve has become "soft", some of the positive ions formed by collision between electrons and gas molecules will be attracted to the grid, even when the grid voltage is negative with respect to the cathode. This will be equivalent to a negative grid current and is sometimes referred to as "backlash" or reversed grid current. Absence of reversed grid current is an indication that the valve vacuum has not been contaminated with air.

SEPTEMBER 1986
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In recent editions of Data File we have taken a look at the operating principles and applications of the discrete bipolar transistor, including practical low power amplifier circuits and different types of multivibrator and oscillator design. Last month we concentrated on audio preamplifier and tone control circuits, etc. In the present edition of 'The File' we continue the audio theme by looking at the operating principles of low frequency power amplifier circuits.

Power amplifier basics

Basically, a transistor audio power amplifier's job is that of converting the medium level, medium impedance ac output voltage of a preamplifier stage (described last month) into a high level power-amplified state suitable for driving a low impedance device such as a loudspeaker or pair of headphones etc., and to do so with the minimum of signal distortion.

This action can be achieved by operating the transistor(s) in either of two basic modes, known as 'class A' or 'class B' Figures 1 and 2 outline the basic principles of these two operating modes.

A basic class A amplifier normally consists of a single transistor wired in the common emitter mode with the speaker acting as its collector load, as shown in Figure 1a. The essential feature of this type of amplifier is that its input (base) is biased so that the collector current takes up a quiescent value roughly half-way between the desired maximum and minimum swings of output current, as shown in Figure 1b, so that maximal undistorted output signal swings can be obtained. From this description it can be seen that if the ac and dc impedances of the speaker load are the same, the transistor collector voltage takes up a quiescent value of roughly half-supply volts.

Excellent signals

The class A amplifier is simple and produces excellent low distortion audio signals. Its major disadvantages are that it consumes a high quiescent current and is relatively inefficient. Amplifier 'efficiency' can be regarded as the ratio of ac power feeding into the load to the dc power consumed by the circuit. At maximum output power the efficiency of the class A amplifier is typically about 40% (the theoretical maximum is 50%), falling to about 4% at one tenth of maximum output and to near-zero at very low output power levels.

A basic class B amplifier normally consists of a pair of transistors driven in anti-phase but driving a common output load, as shown in Figure 2a. In this particular design the two transistors are wired in the common emitter mode and drive the speaker via push-pull transformer T2, and the anti-phase input drive is obtained via phase-splitting transformer T1. The essential features of this type of amplifier, however, are that neither transistor is biased on until quiescent conditions and that one transistor is driven on when the other is driven off, and vice versa.

The major advantages of the class B amplifier are that it consumes near-zero quiescent current and has a very high efficiency (theoretically up to 78.5%) under all operating conditions. Its major disadvantage is that it produces high levels of signal distortion, as is made clear by the graph of Figure 2b. The basic action of the Figure 2a circuit is such that both transistors are cut off under quiescent conditions, since both transistors are operated with zero base bias. Consequently neither transistor conducts until the input drive signal exceeds the base-emitter 'knee' voltage (about 600mV) of the transistor. This factor results in severe cross-over distortion in the output signal of the amplifier, as shown in Figure 2b. Cross-over distortion is highly objectionable to the audio listener, so in practice the basic class B circuit must be modified if it is to be used as a practical audio power amplifier. The modified circuit is known as a 'class AB' amplifier.

The major advantage of the class B amplifier is that it consumes very little quiescent current. Its major disadvantage is that it generates severe cross-over distortion. In practice the cross-
over distortion can be virtually eliminated by applying slight forward bias to the base of each transistor, as shown in Figure 3, so that each transistor passes a modest amount of quiescent current. Such a circuit is known as a class AB amplifier.

The basic class AB amplifier circuit of Figure 3 was widely used in many early transistor power amplifier systems, but can now be regarded as obsolete. One of its main disadvantages is that it requires the use of transformers for input phase splitting and output speaker driving. Another disadvantage is that its two transistors must have closely matched electrical characteristics; if they do not, they will give unequal values of signal amplification and a good low distortion performance will not be obtained.

Figure 4 shows the basic circuit of a class AB amplifier that suffers from none of the snags mentioned above. It uses a complementary pair of transistors (one pnp and one npn) wired in the emitter follower mode, and uses a split (dual) power supply. The two emitter followers are biased (via R1-R2) so that their outputs are at zero volts, and zero current flows in the speaker load under quiescent conditions, but they have slight forward bias applied (via RV1) so that they pass modest quiescent currents and thus do not suffer from cross-over distortion problems. Identical input signals are applied (via C1 and C2) to the bases of the emitter followers, which do not require the use of a ‘split-phase’ drive system.

The circuit operates as follows. When an input signal is applied to the Figure 4 circuit, the positive parts drive Tr2 off and drive Tr1 on. Tr1 is an npn transistor, and acts as a current source with a very low output (emitter) impedance: it feeds a faithful unity-voltage-gain copy of the signal directly to the speaker under this condition, almost irrespective of the actual parameter values of Tr2.

Thus the basic Figure 4 circuit does not require the use of transistors with closely matched electrical characteristics, and does not call for the use of input or output transformers. The design can be modified for use with a single-ended power supply by simply connecting one end of the speaker to either the zero or the positive supply rail and connecting the other end to the amplifier output via a high value blocking capacitor, as shown in Figure 5.

The basic Figure 4/5 circuit forms the basis of virtually all modern hi-fi audio power amplifier designs, including those in integrated circuit form. Let’s look at some of the many modifications that can be made to the basic circuit.

**Circuit variations**

The basic Figure 4 circuit gives zero overall voltage gain, so the most obvious circuit modification is to provide it with a voltage-amplifying driver stage, as shown in Figure 6. Here, Tr1 is wired as a common emitter amplifier and drives the two emitter followers via collector load resistor R1. Note that Tr1 base bias is derived from the circuit’s output via R2-R3, thus providing dc feedback to stabilise the circuit’s operating points and ac feedback to minimise signal distortion.

Figure 6 also shows how a form of auto-bias can be applied to Tr2 and Tr3 via silicon diodes D1 and D2. If simple potential-divider biasing is applied to the circuit as in Figure 4 it will be found that the circuit’s quiescent current will increase when the ambient temperature rises (because of the thermal characteristics of the transistor base-emitter junctions) and decrease as the temperature falls. Figure 6 also shows the biasing derived from the forward voltage drop of the D1-D2 silicon diodes, which inevitably have thermal characteristics that are almost identical to those of the Tr2-Tr3 base-emitter junctions, thus giving the circuit near-perfect thermal compensation.

In practice a small preset pot is usually wired in series with D1-D2 to allow the bias voltage to be adjusted over a limited range, and low value resistors R4 and R5 are wired in series with Tr2 and Tr3 emitters to provide a degree of dc negative feedback.

**Fig 5** Alternative versions of the class AB amplifier with single-ended power supply

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The input impedance of the basic Figure 4 circuit equals the product of the speaker load impedance and the current gain of Tr1 or Tr2. An obvious circuit improvement is to replace the individual Tr1 and Tr2 transistors with 'super-alpha' connected pairs of transistors, thereby greatly increasing the input impedance of the circuit and enabling the amplifier to be used with a driver with a large value collector load. Figures 7 to 9 show three alternative ways of modifying the Figure 6 circuit in this way.

In Figure 7 Tr2-Tr3 are wired as a Darlington-connected npn pair, and Tr3-Tr4 are wired as a Darlington-connected pnp pair of transistors. Note in this circuit that four base-emitter junctions exist between Tr2 base and Tr4 base, so the output circuit must be biased via a chain of four silicon diodes.

In Figure 8 Tr2-Tr3 are wired as a Darlington-connected npn pair of transistors, but Tr3-Tr4 are wired as a complementary pair of common emitter amplifiers that operate with 100% negative feedback and provide unity voltage gain and a very high input impedance. The Figure 8 circuit configuration is known as a 'quasi-complementary' output stage, and is probably the most popular of all class AB amplifier configurations. Note that this circuit calls for the use of three biasing diodes.

Finally, in Figure 9 both Tr2-Tr3 and Tr4-Tr5 are wired as complementary pairs of unity-gain common emitter amplifiers with 100% negative feedback, but are virtual 'mirror images' of each other. The circuit thus has a complementary output stage. This circuit calls for the use of only two biasing diodes.

**Amplified diode**

The circuits of Figures 6 to 9 all call for the use of a chain of silicon 'biasing' diodes. If desired, each of these chains can be replaced by a single transistor and two resistors wired in the 'amplified diode' configuration shown in Figure 10.

Looking at this diagram, it can be seen that if R1 is replaced by a short, the circuit output will equal the base-emitter junction 'diode' voltage of Tr1, and will have the thermal characteristics of a single diode. If R1 equals R2 the circuit will act like two series-connected diodes, and if R1 equals 3 x R2 it will act like four series-connected diodes, and so on. Thus the Figure 10 circuit can, by adjusting the R1/R2 ratios, be made to simulate any desired whole or fractional number of series-connected diodes.

Figure 11 shows how the circuit can be modified so that it acts as a fully adjustable 'amplified diode', with an output variable from 1 to 5.7 x the base-emitter junction voltage.

**Bootstrapping**

In the basic complementary amplifier circuit of Figure 6, the main purpose of the Tr1 driver stage is to provide significant overall voltage gain to the amplifier. At any given Tr1 collector current value this voltage gain is directly proportional to the effective Tr1 collector load value, so it seems obvious that (for maximum voltage gain) R1 should be given as large a value as possible. There are, however, a couple of snags that complicate this simple theory, as follows.

The first problem is that the effective or ac value of R1 equals the actual R1 value shunted by the input impedance of the Tr2-Tr3 power amplifier stage. Thus if R1 has a high value, the power amplifier input impedance must be even greater. This requirement can usually be met by simply replacing Tr2 and Tr3 with high gain 'pairs' of transistors, as in the circuits of Figures 7 to 9. Let's assume that this is done.

The second snag is that to provide maximal output signal swings Tr1 must be biased so that its collector takes up a quiescent half-supply voltage value, as determined by the collector current of Tr1 and by the resistive value of R1. The actual value of R1 is thus predetermined by biasing requirements. To get high voltage gain, therefore, a way must be found of making the ac impedance of R1 much greater than its dc value. This can be done by using the 'bootstrapping' technique shown in Figures 12 and 13.

Note in Figure 12 that Tr1 collector load comprises R1 and R2 in series, and that the circuit output signal (which also appears across the speaker) is fed back to the R1-R2 junction via C2. This output signal is a near-unity-voltage-gain copy of that appearing on Tr1 collector.

Let's assume that R1 has an actual value of 1k and that the Tr2-Tr3 stage gives a voltage gain of 0.9. It can be seen that under actual amplifying conditions 'X' signal voltage at the top end of R2 and 0.9 'X' volts appear at the top end of R2, is only one tenth of 'X' signal volts are developed across R2, which thus passes only one tenth of the signal current that would be expected from a 1k resistor. In other words, the ac signal impedance value of R2 is ten times greater (10k) than its dc value, and the signal voltage gain is similarly increased.

In practice, the above-mentioned bootstrapping technique enables the effective voltage gain and collector load impedance of Tr1 to be increased by a factor of about x 20. Figure 13 shows an alternative version of the circuit which
saves two components. In this case the speaker forms part of Tr1's collector load, and is bootstrapped via C2.

Note that an alternative to the bootstrapping technique is that of replacing the load resistor with a simple transistor constant-current generator. This technique is used in many integrated circuit (IC) types of power amplifier.

**Alternative drivers**

In the basic Figure 6 circuit the Tr1 driver stage uses parallel dc and ac voltage feedback via potential divider network R2-R3. This circuit is simple and stable, but suffers from fairly low gain and very low input resistance, and can be used over only a very limited range of power supply voltages.

A simple variation of this circuit is shown in Figure 14. It uses current feedback via series resistors R1-R2, thus enabling the circuit to be used over a wide range of supply voltages. The feedback resistors can be ac decoupled (as shown) via C2, if desired, to give increased gain and input impedance, at the expense of increased signal distortion. Tr1 can be a Darlington type if a very high input impedance is required.

Figure 15 shows an alternative configuration of driver stage. This design uses series dc and ac feedback, and gives greater gain and input impedance than the basic Figure 6 circuit, but uses two transistors of opposite polarities.

Finally, Figure 16 shows a driver circuit that is specifically intended for use in amplifiers that use dual (split) power supplies and have direct-coupled ground-referenced input and output stages. It uses a long-tailed pair input stage, and the input and output will both centre on dc earth potential if R1 and R4 have equal values. The circuit can be used with a single-ended power supply by simply grounding one of its supply lines and using ac coupling of the input and the output signals. The basic Figure 16 circuit forms the basis of many practical IC power amplifier designs.

**An IC power amplifier**

An integrated circuit consists, in essence, of little more than a lot of transistors and resistors all formed or 'integrated' on the same slice of silicon 'chip'. The techniques used in designing the actual circuit are very similar to those used in designing an ordinary transistor circuit. This is particularly true in the case of IC power amplifier designs, and to illustrate this point Figure 17 shows (in basic form) the internal circuit of the well-known LM380 2 watt audio power amplifier IC, which can be used with single-ended power supplies.

In the LM380, Tr1 and Tr2 are wired as npn emitter followers that drive the Tr3-Tr4 differential amplifier pair of transistors: npn transistors are used in these stages so that input signals can be dc referenced to the ground line, thus enabling input transducers to be directly connected between the ground and input lines.

The output of the differential amplifier stage is direct-coupled into the base of Tr12, which is wired as a simple common emitter amplifier with Tr11 acting as its high impedance (constant-current) collector load, and the collector signal of Tr12 is fed to the output pin of the IC via the Tr7-Tr8-Tr9 quasi-complementary emitter follower set of output transistors. The output currents of Tr7 and Tr9 are rated at 1.3A peak.

Bias-determining and gain-controlling resistor networks are built into the LM380 IC. Feedback resistor R2 is wired between the output terminal of the IC and one emitter side of the differential amplifier stage, and has half the value of R1; the action of these two resistors is such that the amplifier output automatically balances at a quiescent potential of about half supply-line voltage. The voltage gain of the IC is internally fixed at ×50 (34dB) by the ratios of R2 and R3, but can easily be altered by using external feedback or decoupling networks. The LM380 is a very versatile and easy to use IC.

**Next month**

In next month's edition of 'The File' we will conclude this transistor mini-series by looking at a few practical power amplifier circuits, plus a variety of useful and not-so-useful gadgets and miscellaneous circuits.
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September 1986
M ay was an incredible month for sporadic E openings, with practically every Band I transmitter in Europe being received. One enthusiast reported opening to all with the PM554 on the 30th, which can't be bad for the start of the season. Unfortunately, exotics haven't been widely received although some reports suggest that USA or Canadian signals may have been spotted.

During an opening from the southeast, Arabic pictures were logged together with a station broadcasting in English some two hours ahead of BST. The latter is thought to have been the SW transmitter at Dharhan in Saudi Arabia. Much of this month's activity centres around semi-exotics and mystery signals; we hope these will ultimately be identified.

**Featured fortunes**

This month we are featuring William Maries' DX-TV log noted at Studley in Warwickshire. All the times are BST and reception is via sporadic-E except NOS-1 from the Netherlands and Canal Plus from Spain.

1/5/86: Canal Plus on test with the PM554 on channels L5 and L8. The L8 signal was perfect except for the negative vision. Signals were received from 0800 via tropospheric; unidentified French TV on L25 with colour bars at 0910 via tropo.

2/5/86: Canal Plus at 0708 with a very weak signal on L8 via tropo; NOS 1 with the PM554 on E4.

5/5/86: NOS 1 with the PM554 on E4; CST with the EZO on R2 received via MS at 1143.

6/5/86: NOS 1 with the PM554 on E4; NRK on test with the PM5534 and 'BREMANGER' identification via MS on E4.

11/5/86: NOS 1 with the PM554 on E4; RAI with programmes on IA from 1527. Received in PAL colour at times.

15/5/86: TSS with an animated programme on R1 and R2 at 1436 followed by a news programme; TVR with programme details at 1558 and then a logo and clock on R2. RAI with a sports programme on IA and IB from 1545; MTV with a clock at 2014 (white background), announcer, programme at 2015. Received on R1.

16/5/86: RAI on IA with the PM554 on E4. Also seen later with programmes at 1609; TSS on R1 with the 0249 at 0815 (floating with the UEIT), R2 with the UEIT at 0831, R3 with the UEIT at 1021 (with UT0167 identification), and R4 with the UEIT at 1055. While R1 and R2 showed 'HOBOCN' at 1255, R3 radiated the UEIT; MTV on R1 with the clock (white background) at 0959 and then programmes at 0856; SWT with the PM5534 on E2, E3 and E4. Received in colour at times from 1020; DDR 1 with a film and then a hobby programme. Received on E4 and identified by the anti-pirate identification on all but one day during the month and E3 and E4 received from 1052; CST with the EZO seen briefly at 1117 on R1; TVP with the PM5544 on R1, R2 and R3. Received from 1135; NRK with the PM5534 on E2 with 'GULEN' and 'GAMLEN' on E3. Received from 1437; TVE with horse racing from 1735 on E4.

17/5/86: YLE on test with the FuBK on E3 and E4. Programme details were shown at 1317 and programmes began at 1330; TSS with programmes on R1 at 1130. Also later with programmes on R1 and possibly with a test card floating, although it could not be identified; NRK on test with the PM5534 with 'STEIGEN' (received in PAL colour at times) and 'MELHUS' floating on E2. Reception from 1155; RUV with the PM5544 on E4 at 1640, in colour at times.

18/5/86: RUV with the PM5544 on E4 from 1055.

21/5/86: RAI on channels IA and IB with a concert. Received at 1650; BR with a film and identified by the anti-pirate ident; ORF with the news on E2a; JRT with a programme - 'TVÖ'. MTV with the clock at 1828 (black background) and 'TV HIRADO' at 1830. Received on R1 and R2; French sound (unidentified) was received on R1 vision at 1912. No picture was resolved but could possibly be Canal Plus on L2.

22/5/86: TVE with a bullfight in colour.

26/5/86: RAI with programmes on IA and IB at 1633; RTS with the PM5534 and 'RT SH SHOIPART' identification on IC, received at 1638; MTV on R1 with the clock (black background) at 1900; ORF with a sports report on E2a at 1905; TVE with programmes at 1930; JRT with adverts at 1930 on E4.

30/5/86: TSS with the UEIT on channel R1 at 1047 and R2 at 1042. 0249 on R1 at 1050. Also seen at various times during the day with programmes. SWT with the PM5534 on E2 at 1045 and E3 at 1126. Writing was received with the E2 signal but could not be compared with the E3 signal as they were not received at the same time. The writing was not always present on E2. Received up until 1341; RAI with programmes on IA and IB at 1126. Also seen later with TG 1 at 1916; JRT with the PM5544 and clock 'JRT BGRD' identification on E3, received at 1130. Later at 1456 the 'RTV LJNA' PM5544 was received, changing to 'RTV 1 LJUBLJANA' at 1459; ORF with the PM5544 on E2a changing with the TOS - received from 1218 until 1523. Also on E4 at 1505. Both in colour at times; TVE with teletest (sort of I) from Galicia and then programmes at 1230, received on E4. Also seen later with general programmes at 2020 on E2, E3 and E4 - adverts on E2 were different to those on E4; CST with the EZO on R1 at 1232 changing to FuBK. Programmes first seen at 1450. Received up to 1505 with the PM5534 and 'MELHUS' ident. Received at 1243 on E2; RTP with adverts on E3 at 1251; TVP with the PM5544 on R1 at 1429; RUV with the PM5544 on E4 at 1433; Radio Tele Uno with their FuBK on IA at 1451, unidentified vertical bars on E2 until 1330; unidentified multi-burst on R1 at 1438.

A good start to the season

May 16th and 30th were two remarkably brilliant days for DX-TV reception, with increased activity throughout Band I and even Band II (TV). DX from virtually all points of the compass came through on the 30th. During the afternoon there were sightings of an Italian private TV test card blasting its way through over transmissions from RAI on channel IA. This station was Radio Tele Uno, which started using channel IA last year. The electronic test card resembles the FuBK but it includes an additional chequered band towards the top.

During the same opening another Italian private station was noted on IA, namely Nord Center Television (NCT). This appeared radiating a chequeboard pattern with the logo superimposed in the lower corner. A different private/pirate Italian network was logged by Ray Savocs of Huddersfield, North Yorkshire. An 'older type' test card was seen with the identification 'CARELLETO' at the bottom.

Very high MUFs were recorded on May 16th when Russian transmitters were resolved as high as channel 'HUS' on E4. The East German service (DDR.F1) was logged by many DXers on channel E4 from the Cottbus outlet. A film was being shown, followed by a programme about various hobbies. William Maries of Studley noticed an anti-pirate 'DDR' logo superimposed in small lettering.

Kevin Jackson of Leeds logged Finland using the FuBK test card with the identification 'YLE TV1' for most of the morning on May 17th prior to programme commencement on channels E3 and E4. At 1155 BST, sample teletext pages were shown with the identification 'YLE-TEKST-TV' at the top. It would appear that the dreaded Ceefax-style sample pages of text have caught on even in Finland! Vince Richardson of Dolgarrog

**DX-TV RECEPTION REPORTS**

Compiled by Keith Hamer and Garry Smith

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Fuß test card radiated by NDR in West Germany

Sample teletext page by British Forces in Germany — note BBC ident

Identification used by the French Forces TV network in West Berlin

Main news programme in Arabic from the Egyptian TV service

Identification caption radiated by JTV in Jordan and received on E3

Identification

Ph5534 test card transmitted from the JTV outlet at Suwileh

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in Wales even spotted the YLE test card on channel E2.YLE ceased using this channel a few years ago for their TV-1 and TV-2 transmissions, but this is the second report of its reception within a year. Chris Howles of Lichfield noted a YLE test pattern on E2 during last year's season.

Another mystery concerning a defunct transmitter cropped up on May 7th. Tony Pryor of Bryn Gwyt, Llanfihangel, was surprised to find the D:R1:clock caption present on channel E3 at 0800. The Helperberg E3 outlet supposedly closed down a few years ago, although Andy Webster of Billinge near Wigan caught sight of the D:R1:electronic test card on this channel last year.

Icelandic channel E3 and E4 transmissions from RUV presented themselves on several days during the month. RUV is often regarded as an early or late evening source of reception, but recent reports indicate that morning transmissions do, in fact, take place. Iain Menzies of Aberdeen saw the 'RUV-ISLAND' PM5544 at 0200 on May 3rd with a co-channel 525-line picture (system M) during auroral-E activity. The system M signal couldn't be identified but it must have been from a Canadian or USA station.

Albania (RTS) has appeared on channel IC at least twice during the month. Simon Hamer of New Radnor in Powys saw it on the 30th with programmes while William Maries noted the PM5534 test card complete with the identification 'RTSH SHQIPTAR' on the 26th.

Reception reports

There's an abundance of Scandinavian DX in Simon Hamer's log for May. He reported Finland displaying the 'YLE TV1' FuBK test card on the 6th. A caption from NRK in Norway appeared during several openings which read 'Dagsreven': We assume this referred to programme schedules. The 16th was a typical day for Scandinavian DX, when SR/SVT (Sweden) came through on the colour PM5534 pattern on channels E2, E3 and E4. Test cards from Norway were also noted bearing transmitter identification including 'GREENSTAD' on channel E2 and 'HEMNES' on E3. He also noted on E3 the 10kW Danish transmitter at Fyn.

Simon has reminded us that during the early sixties transmitter details were incorporated on the monochrome test card. It was similar to the BBC's Test Card 'C' but had an additional outer circle and was designated Test Card 'G'. The transmitter location and 'DANMARKS RADIO' appeared in two white segments at the top and bottom. Later versions were of the standard test card G variety in which the familiar 'letterbox' was added. At one time, Danmarks Radio also used the Philips PM5540 (NOS-type) monochrome test card. With the introduction of colour TV the old favourites were replaced by the ubiquitous PM5544. The digital clock insert was incorporated test card 'G'. The station list showed the 'ESTE TELEVISION' on the FuBK-type test card. It is worth remembering that programmes from the USSR TV network 'TSS' are also aired over the network. This might be a little confusing since captions in both the Cyturlc and Roman alphabet may be seen at times. The news programme from Estonian TV is identified by the letters 'AK', which means 'Aktuelle Kamera'. This test card was also used by the East German TV service.

The letters 'MTV' occasionally cause confusion when seen by enthusiasts on channels E3 and E4. Hungarian TV (Magyar Televizio) always springs to mind when DXers see an 'MTV' caption. However, when received on an 'E' channel it is a sure sign that signals are arriving from YLE in Finland. The caption is shown between commercials.

Despite having less time for DXing, Iain Menzies has managed to log a few unusual signals during May. Apart from the system M reception on the 3rd, he was surprised to see the West German FuBK pattern on channel E2 carrying SWF (Südwestfunk) identification. There is nothing listed for SWF on E2, but Chris Howles has a video recording made last year showing the 'GRUNten', 'SaARl RUNDF' and 'SWF RBG' FuBKs all floating with one another.

Mark Dent and Kevin Jackson (both of Leeds) have sent logs detailing sporadic-E openings noted during May. An Italian private station was seen on the 9th showing the identification 'RADIO-TELE-UNO'. To round off the month, signals from TVR in Rumania were noted on channel R2 from the outlet at Bukaresti. A colour-bar pattern was resolved at 1537 before going on to the FuBK test card at 1544. Mark has commented that TVR seems to be rare this year. The station was a lucky catch on the 7th because the transmitter was only switched on to show Bucharest win the European Cup.

Allen Hawkess of Poole in South Scotland has contacted us to describe recent DX conditions north of the border. Using a D-100 DX-TV converter fed from a 5-element wideband array, Allen noted a mystery when the letters 'RTC' appeared between commercials shown on channel E3. A number of other readers have also seen this. Can anyone help identify this station?

Service information

Denmark: A second TV network is due to come into service during 1988 via 12 stations. Facilities will be provided to allow regional broadcasts from each site. TV-2 will be totally independent of the existing Danmarks Radio network and revenue will be raised from advertising. With the proposed introduction of this new service, Denmark should become an interesting country from the point of view of DX-TV enthusiasts.

Due to problems with reception from the DR outlet at Sønderjylland/Rangstrup (channel E7 with 60kW ERP), a new power transmitter has been brought into service at the same site on channel E9.

Netherlands: Despite rumours to the contrary, the Dutch PTT do not have any plans to introduce a low power TV network in West Germany. It was anticipated that NOS programmes would be relayed to Dutch army personnel stationed in Germany.

The FuBK test card, with regional identification, is gradually being introduced at every main NOS transmitter. At present, however, the outlet at Smilde still relayed the old monochrome Philips PM5540 pattern prior to the regular PM5544 transmissions.

USSR: The UJEI electronic test card radiated by the Lithuanian TV service includes the identification 'LRRTPC'. This is an abbreviation for 'Lietuvos Respublikinis Radijo ir Televizijos Peredavimo Centras' which means the 'Lithuanian Republican Radio and TV Transmitting Centre'. This is located at Vilnius.

Poland: Sample pages of teletext are now transmitted from TVP-2 outlets. Unlike the BBC's crack-pot decision to replace test card transmissions with Ceefax, the Polish authorities have seen sense by broadcasting teletext for about ten minutes after each close.

At present, TVP-2 shows around 25 pages of text.

France: The following transmitters are due to come into service for the TV 5 network during December: Brest/Roc Tredudon on channel 34; Cherbourg on 35; Rennes 34; Beauvais/St Just 49; Chartres 47; Reims 53; Troyes 29.

The following outlets are due to commence between September and December and will be used for the TV 6 service: Rennes on channel 31; Rouen 62; St Etienne 62; Avignon 44; Angers 53; Lorient 55; Valenciennes 37; Dunkerque 62; Caen 60; Angouleme 34; Bourg-en-Bresse 32.

TV 6 programmes are also radiated in Band I from the channel L4 outlet situated at Lilie-Lambertsart.

Our thanks to Kristian van der Linden, the GENEX DX Club (Netherlands) for supplying this month's service information.

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Hi, I'm a helpful assistant and I can help you with this document. Please let me know if you need any specific information or if you have any questions.
A nice bulging file of letters means you have been busy sending in news and photos of activity on the air – thanks! Please keep it up, too much is most certainly better than not enough. In fact the slow-scanners among you seem to have taken my past remarks to heart, because this time your news far out-weighs the remainder. Excellent – but that means there's so much news I have had to split it down the middle. So, slow-scanners, your news comes next month!

70cm and all that

Down to business, and we start with a detailed letter from Steve G4DVN in Werrington, Stoke-on-Trent. He says quite a few new ATV stations have sprung up over the last couple of years and some nights are quite busy with ATV pictures flying all over the place. Stations active most nights include G6IUH, G1DDA, G1OLX, G6UKP, G1DJP, G3OGD and G8KUZ. Steve has recently got back on 70cm and runs 100 watts PSP to an 18-element parabean. Best DX with this set-up was a P3/P4 two-way with F3XY back in December 1983.

From the most northerly tip of Nottinghamshire, on the borders of Lincolnshire and Yorkshire, comes a letter from Dave Higgison G8JET. He is on the air "at last" and has a Fortop transceiver and a 48-element Multibeam. Stations worked so far include Ted G6HMS (North Hykeham), Dave G4DUB (Clowne) and Frank G3OS in Burton-by-Street. All these contacts were P3, over 20 miles or more.

Further afield there's José ON7TP in Liege – or Luik if you prefer. He has been involved with ATV since 1979 and in 1984 "had the bright idea of joining the BATC, giving me a lot of good material and info." In fact showing the magazine to others in his local ATV group led to their joining up as well. They are building a number of BATC colour test cards and note that the circle is better than anything produced by a home computer.

TV down under

Another long distance letter comes from Michael ZL1ABS in Albany, Auckland, New Zealand. Alwyn ZL1TZV is (re-)building for 70cm ATV – and converting from 405 to 625 lines in the process! Nice to hear that some people can still transmit 405 lines – can anyone else?

In all there are eight new stations under construction in Auckland using the TV for Amateurs/CQ-TV122 transmitter and an EPROM-based call-sign generator. PCIs are provided by ZL1TVW (TV Wayne!), a leading ATV man in New Zealand.

Ian ZL1TOQ is in charge of the appeal to fund a TV repeater in Auckland, which is now nearly paid for. Its proposed site is the Klondyke Road Tower.

Still on repeaters, the Wellington ATV repeater has just had its RF equipment renewed (all solid-state) in time for the national VHF Convention. The output, incidentally, is on 614MHz and viewers need converters since most domestic TVs are fitted only with VHF tuners. When not in use the repeater sends an electronic ident, with a seven minute text bulletin of ham radio, ATV and propagation news every half hour. Longer monthly bulletins also go out over the repeater, as well as on 3.9MHz LSB.

The G6HH/P team 'live'! Mike G11GM (front left), chief mast errector Paul GBOXD (front right), Nick G42XI (back right) and Derek G4KKJ (rear left). See text for details of their (soggy) achievements.

Wet funday

From St Leonards, Sussex, Tim Anderson G1JWR writes with news of the local Fun Day. Since most people were working on April 1st they postponed their activity until the following Bank Holiday Monday and used the customary contest site, Fairlight Helipad. This is 160m asl, just east of Hastings and right on the coast.

Thanks to prior publicity they had plenty of contacts, of which 22 were two-way TV (all on 70cm). Best DX was Welwyn Garden City: the French could not be raised on .750 or .170.

For a fun day the weather was appalling – torrential rain, snow, and three inches of hailstones at close of play. And then the van wouldn't start! The G6HH/P team will be at it again from the same site during the September contest, and let's hope they have more luck next time.

Higher things

Back up to Staffordshire, and activity on 24cm is gradually increasing thanks to GB3UD, which is in beacon mode at present. Several stations are either building or buying equipment, with activity already seen from G1DDA, G1OLX, G6UKP and G4DVN. Steve's equipment is 10W from a triplo into a Jaybeam (1296) 15/15 antenna; he intends to supplement the latter with the 1240-1290MHz version for the bottom end of the band as soon as possible.

Steve has also been busy constructing a twin 2C93 PA and is just waiting for a video QSO to prove it can pass vision. Currently it is producing 70W out for 10W in, but Steve expects to improve on this. He will then look for a little more DX: at the moment semi-DX regulars include G3DFL, G8MTF and G6EJH, all around P3/P4.

The 'other Steve' G8MJ should be situated in his new mountainside location above Malvern by the time you read this, and he looks forward to working the world from there. He – like Garry G4CRJ in High Wycombe and Jeff G3CPP in Mildenhall – is getting very interested in 10GHz FM video. Steve seeks suggestions for a good frequency to settle on – he is thinking of building a simple fixed-frequency transmitter and receiver. Drop me a line with any ideas.

Garry says it's about time we knew where all the 3cm operators are – that way they might get to work each other! I'll willingly produce a map if you write in and identify yourselves.

New stations

Keith Miles G1OTO is a newish station in Mapperley, Nottingham, and is keen to make contacts. His equipment includes a Solent 1W transmitter, Wood & Douglas complete receive system and a 20-turn helical antenna. 10W PA is under construction. There is not much activity locally and even GB3GV is not

Andy Emmerson G8PTH puts you in the picture.
visible. However, G6YKC and G4ROB are constructing transmitters so things are looking up.

During April he went /P at Dorkett's Head to work Richard GBBWC. This was his first 24cm TV contact and he was rewarded with P5 reports in both directions. The power was just 1.2W and G6YKC assisted, making recordings and playing them back on 70cm. Another new station is Dave McCue G4NJD in Bletchley; he is receiving the Dunstable repeater.

Participation in the May Day microwave contest was a little patchy, but one person who got out and about was Ivor G1XE from Bristol. He took his 24cm gear to a high spot in the Quantocks near Minehead. Best DX was Roger G4ZQF back in Bristol, with a P4 report over the 62km path.

Repeater news now from G1JWR. The Sussex TV repeater is to be called GB3VI, as GB3SX is still in use for the Crowborough beacon. The transmitter is virtually complete, while work will shortly start on the rest. G4BGQ is doing the hardware and G4BCO doing the software. As soon as the licence is received they hope to have the repeater in beacon mode.

That's it for this time. Next month all the news is slow-scan, but more reports are welcome, so don't keep all the news to yourselves. Drop me a line care of the editor.

Our prayers were answered — well, some of them! People like me who had been complaining that they hadn't seen a decent lift for ages were rewarded throughout the second half of June with some excellent conditions for tropospheric DX. Since this was largely coupled with good weather in general, I dare say nobody had any complaints.

I say 'in general' advisedly, because some of the openings did not fit the textbook pre-conditions of a warm, bright day followed by a much cooler, still evening. I know this is oversimplifying anyway, but I suppose you could say that the good conditions were not always obvious from the weather.

Those who made the effort were rewarded with the DX, which for us in central England included north and south Wales, Kent, Tyneside, Jersey and north Yorkshire.

Effort and its rewards

Working the DX does, of course, involve a bit of effort. Just listening to the band often gives no clue that there is any opening at all. So it is worth giving CQ calls now and again — then you may work the rare DX! You will rapidly observe that the successful DXers are not the alligators (huge mouths and tiny ears); when they call they leave plenty of gaps for people to react and possibly turn their beams.

If you have a sensitive set-up it is worth disabling the squelch to hear any weak stations coming back to you; unfortunately some operators get out far better than they can receive (no preamp perhaps), and you end up hearing them but never working them because they don't hear you. Sometimes they are in a semi-local net with their squelch turned up, and don't even realise how far their signals are travelling. Ah, well, this is the very meat of DXing and forces you to use your skill in winking out the rarities.

Operating standards during the lifts were extremely good; none of the 'woosh, over the top...' we sometimes hear on other bands. Stations who were the centres of attention worked patiently through the pile-ups they were causing. My only gripe — and it's not just a personal one — is about these peculiar people who ask if you QSL; you say yes, and they say that they too QSL 100%. They insist on a card direct, so you take down their details, spend a small fortune on stamps and wait for the cards in return. Ha ha ha! I think I had a 25% success rate in June and I don't believe the Post Office lost all those cards. So from now on I don't send a card until I have received one... but I do QSL 100%!

Club news

There seems to be some turnover in the club membership scene. The original 934 Club has passed the 1000 mark in membership numbers but the total of current members is closer to 750.

I gather that some members felt they only needed a PO box facility, and they could get this cheaper from a local club or dealer. This is understandable, but these folk are forgetting the representation that the club has with the Radio Regulatory Division and the negotiations which go on behind the scenes. The more members the national bodies have, the better they can claim to represent the majority of 934MHz band users.

I said bodies in the plural, since there is now an alternative 934 club. This is the Personal Radio Club of Great Britain, based in Southampton and run by James Finch. Just like the original 934 Club, it is fiercely independent of any sponsorship or commercial relationship with any dealers. Inevitably the leading lights of each club have connections with the trade, but in my opinion this does not disqualify them; in fact their knowledge of the commercial world befits them for these roles.

Anyway, you can join PRCGB by sending £5 and your name and address to 41 Twyford Avenue, Shirley, Southamption SO1 5NZ.

The first newsletter is full of useful technical background and attractively produced. The club intends to hold regional demonstrations and meetings and has had the clever idea of issuing five-digit membership numbers which could be used as call signs if Swiss-style PRC ever takes off in this country.

I have joined, and would recommend the club from first impressions. Of course I support the original 934 Club as well, but I hope we don't get any more breakaway groups, since this will diminish our credibility with the people at Waterloo Bridge House.

Out and about

Rallies exclusively for 934 enthusiasts have not taken off in a large way yet, though there have been some well-supported local meetings such as the one at Epsom Downs earlier in the year.

I shall be pleased to plug any event if you let me know in good time — write care of the Editor at least two months in advance. Do tell your friends about this magazine, too... it may be the only regular monthly 934 spot!

Several amateur radio mobile rallies have had 934MHz get-togethers, usually informal gatherings around the stands of enlightened dealers who have brought 934MHz gear for sale. In this way, I have, had the pleasure of putting a face to several voices and names, too numerous to mention here.

Hardware news

Marksman Products from Milton Keynes have brought out a new design of delta-feed yagi, in 4 and 12-element sizes. I hope to bring you a user test report next month.

Telecomms of Portsmouth have added two items to their roster of useful test gear. Priced at £29.95 is a dummy load for use on all frequencies up to 3GHz (ideal for all amateur, CB and commercial use). There is also a low cost SWR and power meter aimed at the lower end of the 934MHz and cellular market: it costs £49.95 and I hope to check one out soon.

Sign-off

That's it for this month, except to hope that the RRD may permit the use of antennas with more than 4 elements. Mike TC1 tells me there was some hesitation early on due to fears of health and safety hazards, but these may soon be overcome. If we are successful it will be because of representation, not by magic, so join a club if you haven't already done so! Stand up and be counted...
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**September 1986**

Please mention RADIO & ELECTRONICS WORLD when replying to any advertisement
As a result of some interesting feedback, this month's column features a selection of news items as well as some more tips for the DXer wishing to keep up with what's happening in the radio world. Having a radio and an aerial is really only half of the problem; the other half is knowing when and where to tune-in, and so this month I'm including details of both printed and computerised sources of information.

IBA round-up

According to the IBA, independent local radio now has the following coverage figures for the UK. The table shows the percentage of the population able to receive ILR stations at normal listening quality.

Unfortunately, despite the number of ILR stations operating, I cannot help but feel that wherever you go they tend to sound the same, with similar music formats, sound-alike commercials and jingles, and almost identical news; it is indeed rare to find a station with genuine character or style.

One exception to the rule is a new DX radio show called Red Dragon DX, being aired on Red Dragon Radio in the Newport and Cardiff area. The show is being hosted by Al Dupre, an active radio listener himself, and it can be heard on 1305 and 1398KHz at 0015 UTC every Saturday morning. It is not often that DXing gets this level of exposure in the UK, so tune in to Al and give him your support.

A couple of months ago I highlighted the activities of Festival Radio Stoke, a special event station being operated by Signal Radio throughout the summer on 1017KHz. This station may be the forerunner of others in a similar vein, since the Home Office has expressed an intention to licence a number of such stations each year.

Unfortunately, information on these stations seems to be hard to come by, and details are announced at fairly short notice. One example that came to my notice is Showground Radio, which as I write is due to be operated by Hereward Radio especially for the East of England Show from 15-17 July. This station will be operating on 1602KHz but sadly it will have packed its bags and left by the time you read this column.

Computer corner

Information databases for home computers are widely available these days. I have, however, received information about one with a difference which is intended for the DXer (particularly for those with an interest in 'soft' radio). 'Radiobase' is a computer database capable of holding records of radio stations from anywhere in the world. It has a capacity of 550 files, but to get the user started it is supplied with up to the minute information on around 220 Irish stations (MW, FM and SW).

To use Radiobase you'll need access to a 48K Sinclair ZX Spectrum or Spectrum+ computer. Naturally it offers full search and sort facilities as well as appropriate printing commands. The program, which comes on a cassette tape, is supplied with complete instructions and is available for just £5.50. For further information, or to place orders, write to Brian Buckley, 29 Coalsiland Road, Lurgaboy, Dungannon, Co Tyrone, N Ireland BT71 6LA.

Computers can also be excellent sources of information, and if you are lucky enough to have access to BT's Prestel system there are a couple of areas of interest to the MW DXer. Firstly, keying *5588* will get you into Waveguide 258, which is a large section of weekly updated info on radio, TV and amateur radio. This makes very interesting reading. Secondly, you'll occasionally find information about broadcasting and radio regulatory affairs in the section edited by the DTI; key *2040# for this one.

Community Radio

The Home Office announced in early July that all Community Radio plans had been shelved because the government, citing the example of anti-indian propaganda aired by some Asian-run stations, felt that stations might fall into the hands of 'extremists'. There is a possibility that Community Radio may be revived as part of the predicted radio shake-up due as a result of the Green Paper to be published before the end of the year, but in the interim some disillusioned applicants are likely to sue the government over their costs whilst others will undoubtedly appear as pirate operators. Note: to keep in touch with the latest news on the London pirate scene phone the 'TX' magazine recorded message on 01-400 8282.

Spain on Medium Wave

This is the title of a new 88-page (21 x 15cm) book. It comprises three sections; the first is a record of all MW stations in frequency order, including the main details about each one; the second part contains info on station networks; and lastly there is a quick reference index. A 42 x 30cm map of Spain is also included. To order send an International Money Order for 550 pesetas or 9 IRCs to: Fransisco Martinez y Martinez, Apartado 4031, 28080 Madrid, Spain.

'Now Radio Newsletter'

This is a new fortnightly radio newsletter edited by Jay Jackson (formerly of Radio Caroline) aimed at both the broadcaster and the listener. It covers all aspects of radio in and around the UK and Eire.

A sample copy (costing £1.00) and full subscription details are available from NOW Radio Newsletter, PO Box 45, Kettering, Northants NN16 0NW.

DX FILE

Summer not really being the DX season, I thought I'd highlight some of last winter's DX. I recently heard from a keen Norwegian DXer, Geir Stokkeland, who wrote to report some fabulous DX heard last winter from his location near the North Cape in Norway. He reports the very first logging of Fiji (884KHz) in Europe and the first logging of New Zealand for over a decade (on 1008, 1035 and 1098KHz). He adds two Chinese stations to the list of 'firsts' as well as KIPA Hawaii. And to round things off Geir added around 150 stations from the USA to his personal log. Well, all I can do is turn green with envy!

On the subject of last winter's DX, the Medium Wave Circle has available a publication detailing every American station heard in the UK during the 85/86 winter DX season. It covers North, Central and South America as well as the Caribbean. A copy is available (ask for Reprint no 7) from Harold Emblem at 55 Halsall Road, Southport, Merseyside PR8 3DB for 50 pence plus a stamped SAE.

That's it for another month, so until we meet again I look forward to your correspondence on any aspects of MW radio.
In the first part of Lighting ATV, aspects of lighting techniques, illumination levels and the qualities required of the light itself were introduced. This brief introduction concludes with a look at lighting equipment and its use.

Many variations exist in lighting equipment. There are general purpose and special purpose sources, in a considerable range of powers. Some have lens systems, others do not. Some of these types are adjustable, allowing the position of the lamp to be varied in relation to either the reflector or the lens, or both. This is known as ‘racking’. It adjusts the area of illumination by widening (‘flood-ing’), or narrowing (‘spotting’) the beam of light emitted.

Racking can be used to adjust light levels from each source. This balancing of levels between one light and another is subjective, but in colour television the general preference is for a close ratio between ‘key’ and ‘fill’.

Balancing levels

A convenient method of balancing light levels is to use spun fibreglass in front of the source. It is mounted in a frame or clipped slightly away from the lantern to avoid its heat. Spun fibreglass is a more efficient method than using ‘neutral density’ filters for lowering intensity, as it diffuses the light. It is cheap and easier to obtain, although it is not as good as an Opal (‘frost’) filter as a diffuser. Its use has the advantage of helping to tone out any patchy illumination from a poor quality source.

The ‘Fresnel’ type of lantern is a good all-rounder to have, where racking is provided. It has a special lens of concentric prisms, which is intended to even out the ‘hot spot’ in the centre of the beam, making it a controllable flood. It can be used to key and fill and also light specific areas. Second-hand theatre Fresnels may be available quite cheaply and it may be possible to ‘uprate’ some to quite high intensity (ask the manufacturer).

Checking equipment regularly is very important for safety. These same checks are recommended on second-hand equipment before you purchase. Correctly rated heat resistant cable should always be used near the heat source. Check the terminals and the plug (if fitted). Professional equipment is often remotely fused, and it’s not uncommon for wires to work loose in constant use. Check this cable inside the lantern for insulation wear.

Where racking is provided check its full travel, noting that the cable does not get trapped. Mechanical fixtures must be secure and independently earthed, to protect against a lantern becoming live. A second link to the fixing for overhead lanterns is recommended, such as a safety chain looped around.

To maintain the light output, dust the lens, lamp and reflector, but do not wipe the highly polished (‘frost’ silvered) mirror type, just blow the dust off. The state of such a reflector should be checked when purchasing. Normally any used lamp with this type of reflector is of little or no value, although the amount of tarnish on it should give an idea of its age.

The main lighting feed should be through an accessible isolator switch. Never use any combustible material either to construct units, or in close proximity to them; always use the proper lighting filters.

There are two main drawbacks in using dimmers: there are potential RF interference problems, and the ‘colour temperature’ varies dramatically with level adjustment. Dimmers do, however, prolong the life expectancy of the lamps. Intensity can also be varied (without colour temperature change) by using multiple lanced sources, whose lamps are switchable in parallel to the supply.

Do it yourself

Finally, it is possible for a competent home constructor to make some of the lighting equipment, if all the normal safety rules are followed. This brief article cannot give any detailed account, but may give an idea of the possibilities and problems involved.

Lamps often have a very narrow working temperature range: the lamp housing should be designed to dissipate the heat at a rate which maintains this temperature.

Multiple lanced units can use less powerful lamps to overcome this problem. Fluorescent strip lighting makes an extremely good ‘soft light’ source for filling with a diffuser filter, and spot bulbs with integral reflectors can also be safely constructed.

Reflector design requires a high output with even illumination within the directional angle of beam required. Unevenness shows up (as if lighting through trees) with patchy dips in level. Cooking foil is too uncontrollable to use. A reflector from an old electric bar fire might provide an answer for short ‘hot burning’ tubes. Old car spot lights can provide other shapes for bulb type lamps. Cool burning lamps, such as the fluorescent tubes, can simply have a white laminate or paint reflector. Double skinned construction is recommended for the hotter burning lamps.

Adapting ready-made lighting is recommended for directional and controllable units. Junk shops may provide old projectors, which, with a wide angle lens, in a small studio, may make an ideal key source. Photographic flood lighting units would make convenient fill sources once adapted.

By Norman E Ash

Lighting ATV

Part Two

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SEPTEMBER 1986

Please mention RADIO & ELECTRONICS WORLD when replying to any advertisement.
The 'lightweight' units might be suspended from a home-made 'lighting grid' made from gas pipe for a small studio and from scaffolding poles for heavy units with large spans.

If a pole is erected floor to ceiling in each corner of the studio and paired together by bars, clamped firmly, so that the room walls support these without any movement, then lateral bars can be clamped across the top in the desired position for lighting. A short bar can be clamped vertically downwards off the grid, to vary the height of the lanterns. Safety 'coach bolts' prevent the bar from dropping.

Adjustment
The lanterns need to be able to tilt and turn. A bolt through the pivot point can be clamped against the body of the unit using wing nuts and large washers, although in the turn movement this can be dangerous unless a restraining method (such as safety chains) is used.

Frames to hold filters can be made of flat metal bar. Overlapped ends can be bolted through and into a loop of stiff wire (made from an old coat hanger), the other end being attached using self-tapping screws or bolts to the body of the unit. Allow an air gap behind the frame, and for a unit intended as a soft light diffuser a large frame 30-60mm away should work better. Use small Bulldog clips to hold the filters in position. Opal (frost) diffuser is recommended for fill lighting, where affordable.

The looped stiff wire can also be used as a metal mask plate ('flag') holder. Lanterns often have these attached ('barn doors') and they can mask off the light to illuminate specific areas. These are normally matt black, but silver finished flags can also be used as reflector panels.

Parts for constructional work, such as C clamps, should be available as spares for theatre lighting. Numerous books on lighting are available; a particular series on television includes a popular volume on lighting for TV.
This month we feature just a few of the Latin American transmitters currently operating on the 90 metre band (3200 to 3400). A more complete review will be undertaken at a later date, including the low powered transmitters seldom heard in the UK. Our last update of some of the South American stations on the band appeared in the June 1984 issue.

Brazil
Newcomers to the hobby should note that Portuguese is the programme language used by Brazilian stations, whereas Spanish is used by most South American countries. Original native languages such as Aymara and Quechua are also sometimes heard on the band. French is radiated by RFO Cayenne (10kW) in French Guiana on 5055 variable, whilst Radio Apinie, Paramaribo, Surinam on 5005.6 at 0.35kW uses Dutch, Hindustani and Javanese.

Radio Bandeirantes, Cachoeira Paulista is on 3285 from 0800 to 0300 with a power of 2.5kW. It rarely appears in the logs of European DXers but is often heard by those nearer Brazil.

On 3325 there are two Brazilians, the first being the 2.5kW Radio Difusora Universitaria, Guarulhos working from 0800 to 0300 or sometimes 0330. It is seldom heard outside the country, probably because the 5kW Radio Liberal in Belém, working around the clock, effectively blankets their transmissions. Whatever the actual cause, the latter is regularly reported worldwide.

Radio Alvorada in Londrina is on the air from 0800 to 0300 (Sunday from 0830 to 0200) on 3335 at 5kW. Not often heard in Europe, it is frequently heard by USA DXers.

Radio Nacional, a Radiobras station, occupies 3374.5, at which frequency it radiates from 0800 to 0300 at 5kW. Although like many other Latin American stations it is rarely heard in Europe, that is no reason why UK broadcast band enthusiasts should not not endeavour to log this or indeed any other South American transmitter notable for its absence from European logsbooks. The short wave bands can often be full of surprises — there is always the likelihood of that long sought-after station being audible on channel when least expected — a last despairing effort does sometimes produce results!

Ecuador
Radio Federacion Shuar, Sucua, reactivated in August 1985 after a period off the air, is on 3210.7 reportedly closing at 0159. The power is 10kW. Regularly logged here is HCJB in Quito on 3220. At 10kW it programmes in Quechua from 0800 to 1400, from 2100 to 0200 and from 0200 to 0500 in Spanish. A good one for the 90 metre band newcomer to try.

La Voz de Rio Carrizal, Calcuta operates from 0430 to 1100 with a variable closing around 0400 on 3260.6. At 3kW, it identifies as 'Radio Carrizal' but is rarely heard in the outside world.

La Voz de Napo, Tena programmes in Quechua and Spanish from 1000 to 1215 and from 2200 to close-down around 0230. The power is 2.5kW and the frequency is 3380. Move newer to Ecuador to hear this one!

Often heard and reported throughout the world is Radio Iris, Esmeraldas on 3381. With a power of 5kW it is scheduled from 1100 (variable) to 1300 and from 2100 to 0400 varying to 0500.

Most reported of all the Ecuadorians on the band is undoubtedly Radio Zaracay in Santo Domingo de los Colorados, at 25kW it is on the air from 1000 to 1400 and from 1900 to 0500 on a slightly variable 3395.

Guatemala
Radio Cultural in Guatemala City on 3300 at 10kW radiates in local languages, English and Spanish. The schedule is from 1200 (Sunday from 1100) to 0830. The English programmes are timed from 0300 to 0430 and on Sunday from 0900 to 0430. Regrettably it is infrequently heard in Europe.

In Coban, Radio Tezulutilan is on the air from 1000 to 1500 and from 2100 to 0230 with a power of 5kW on 3370.1. Seldom heard on this frequency by Europeans, it's frequently noted on the parallel 4835 channel.

Peru
Radio La Voz de Oxapampa, Oxapampa on 3260 is scheduled from 1100 to 1300 and from 2300 to around 0400 with a power of 5kW. It identifies as 'La Vox de la Selva Central', but is seldom logged outside Peru = grrrr.

None at 1kW
It will be noted that 90 metre band Latin American transmitters rated at 1kW or less have been omitted from the above. Such a low power rating does not preclude reception here in the UK: in fact some such stations are heard more frequently than many listed here. Power ratings in themselves are no guarantee of reception in Europe. Other factors such as co-channel interference, station equipment efficiency and location all contribute to the final result.

An update of lower powered 90 metre band LA stations will appear in due course.

AROUND THE DIAL

We hope the following will help readers obtain similar results to those reported here.

AFRICA

Benin
Cotonou on 4870 at 2135. OM (OM = male announcer or speaker) with a talk in French. Cotonou is on the air carrying the Home Service in French and local languages — all eighteen of them — at the following times: from 0400 (Sunday from 0600) to 0800 (Saturday until 1100, Sunday until 2300) and from 1300 to 2000 with a power of 30kW. Station identification will be made easier for English speaking listeners by tuning in to the English news bulletin radiated at 2000 every Wednesday.

Chad
N’djamena on 4904 at 2202, OM with songs in vernacular, OM with announcements in French. Radiodiffusion Nationale Tchadienne operates from 0455 to 0730 (Sunday until 0700) and from 1555 (Sunday from 1445) to 2100 (Saturday and Sunday until 2200) with a power of 100kW. The frequency is apt to vary from 4903 to 4906 on occasions. French and Arabic together with Sara and some other local languages are used in broadcasts from N’djamena.

Egypt
Cairo on 9755 at 2037, OM with recitations from the Holy Quran in a transmission for the Middle East timed daily from 0200 to 0730 and from 1100 to 2100.

Ghana
GBC (Ghana Broadcasting Corporation) Accra on 3366 at 2238, jazz music European style then some vocal 'oldies'. GBC2 features programmes in English and is scheduled from 0545 to 0800 (Sunday until 0900) and from 1530 to 2200 with a power of 10kW.

Kenya
The Voice of Kenya, Nairobi on 4915 at 0455. YL (young lady = female) with pop songs in
Swahili, OM announcer. The National Service is entirely in Swahili and is radiated from 0300 (Sunday from 0330) to 0830 and from 1330 to 2110 with a power of 100kW. The frequency varies from that above to 1560.

Dominating the frequency, Nairobi is co-channel with the 10kW Accra operating from 0245 to 0800 (Sunday until 2200) and from 1200 to 2200 in local vernaculars and English. To log the latter station listen after Nairobi closes.

Morocco
VOA Tangier on 5995 at 0723, OM with a programme about recent South-East Asian events during the English transmission for Europe timed from 0400 to 0800.

South Africa
RSA Johannesburg on 3330 at 1750, OM with a talk about sport in English, organ music, the RSA interval signal at 1756 then sign-off without the National Anthem at 1758. This 250kW transmitter operates an irregular special sports service in English on this frequency from 1600.

SABC Johannesbourg on 3320 at 2010, jazz music on a piano then YL with announcements in Afrikaans. At 100kW, this one is on the air with the Home Service entirely in Afrikaans from 0350 (Saturday from 0355, Sunday from 0400) to 0510 and from 1635 to 2200.

Togo
Radiodiffusion TV Togo, Togbokiepe on 5047 at 0532, congregation with hymns, OM sermon in a vernacular. The Home Service in French and vernaculars is scheduled here from 0830 to 0803 and from 1703 to 0005. An easy identification of this one can be made by listening for the newscast in English, which is radiated daily at 2000. The power is 100kW.

Zambia
ZBS (Zambia Broadcasting Services) Lusaka on 4910 at 0354, OM with a news bulletin in a vernacular with several mentions of Zambia, then YLs with a programme of local songs. The Home Service in vernaculars and English is broadcast on this channel from 0350 to 0530 and from 1530 to 2105 (Friday until 2205). There are newscasts in English at 0500 weekdays and at 1800 daily. The power is 50kW.

South America
Bolivia
Radio Nueva America, La Paz on a measured 4756.5 at 0219, OM with a harangue in Spanish interspersed by audience applause: still very forcefully speaking at 0227 retune until 0240 switch-off. Radio Nueva America is scheduled from 1000 to 1430 and from 2200 to a variable sign-off time of 0400 (Sunday from 1030 to close-down between 2245 and 2300). The power is 1kW, but because the channel is a clear one it is frequently logged in Europe. Founded in 1948, La Paz lies in a valley at a height of 12,000 feet.

Brazil
Radio Difusora do Maranhao, Sao Luis on 4755 at 0207, OM with ballads in Portuguese. RD do Maranhao operates irregularly and reportedly closes at 0330. The power is 2kW.

Radio Difusora Acreana, Rio Branco on 4880 at 0224, YL with folk songs complete with local style musical backing. The signals from Rio Branco are radiated from 0900 to 0400 and the power is 5kW.

Ecuador
HCGJ (Herald Christ Jesus Blessing) Quito on 6130 at 0710, OM with a religious talk in the English transmission for Australia and New Zealand, timed from 0700 to 1130.

Honduras
La Voz Evangelica, Tegucigalpa on 4820 at 0436, OM with a talk in Spanish and OM with a hymn. LV Evangelica operates in Spanish from 1030 to 0600 but with an English transmission on Monday timed from 0300 to 0600. The power is 5kW.

Venezuela
Radio Mundial Bolivar, Ciudad Bolivar on 4770 at 0200, OM with the station identification, promos (promotions) in Spanish then suddenly off at 0304—presumably no breakfast. A 1kW, Radio Mundial Bolivar is scheduled from 0900 to 0400.

ASIA
China
Radio Beijing on 9945 at 1320, Chinese style orchestral music during the Vietnamese programme for Asia, timed from 1100 to 1555.

Radio Beijing on 9965 at 1950, YL with announcements during the Albanian programme for Europe, scheduled from 1900 to 1955. Carrier off at 1957 then 'East is Red' on chimes at 2000, YL and OM with the station identification and the Esperanto offering to Europe, from 2000 to 2030.

South-East Asia
North Korea
Pyongyang on 9977 at 1937, OM with songs then OM with announcements in the Korean transmission for Europe, Near and Middle East and Africa, scheduled from 1900 to 1950.

Vietnam
Hanoi on 10040 at 1606, OM and YL alternating with news items in an English program directed to Africa and timed from 1600 to 1630.

Australia
Melbourne on 7205 at 1750, YL with announcements, YL with a pop song in an English programme for Asia scheduled from 1430 to 2040.

Guam
TWR (Trans World Radio) Agana on 9870 at 1327, OM with a religious talk and address of the organisation concerned then OM with the station identification, all in an English programme for Asia, scheduled from 1300 to 1400.

Bangladesh
Dhaka on 6240 at 1920, YL with the station identification and a newscast in Bengali with mentions of country names such as Japan etc, in the Bengali slot timed from 1900 to 1930.

India
AIR Delhi on 9945 at 1434, OM and YL with songs in Hindi then some local style music in the General Overseas Service English program for eastern and South-East Asia, scheduled from 1330 to 1500.

Delhi on 17875 at 1000, YL with the station identification, frequencies and times of English broadcasts, then YL with a news bulletin all in an English transmission for Australia and New Zealand scheduled from 1000 to 1100 and also logged in parallel on 17387.

Iraq
Baghdad on 13700 at 0832, OM and YL with announcements then some Arabic music in an Arabic presentation to Europe, timed from 0400 to 1000.

Pakistan
Karachi on 15595 at 1556, OM with the station identification, frequencies and times of English broadcasts, OM with the news in English at slow speed to the Middle East, scheduled from 1600 to 1615.

Islamabad on 15605 at 1005, OM with the station identification, English, YLs with songs then OM with the station identification in Urdu and English, local and UTC time-check, then news of national affairs in English at slow speed timed from 1100 to 1115, all during the Urdu/English program for Europe scheduled from 0715 to 1115.

NOW HEAR THESE
Omdurman, Sudan on a measured 5038.5 at 2114, OM with announcements in Arabic, OM with a song complete with Arabic type musical backing in the Voice of the Sudanese Nation service on this channel from 1900 to 2200 with a power of 20kW.

ZBC Gweru on a measured 3395.7 at 1851, OM with announcements in English then YLs with songs and OM with the station identification in English, on YLs with songs. Power is 500kW.

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

934MHz Club
Two years ago, five 934MHz enthusiasts got together to form the 934MHz Club UK. From such humble beginnings the club has flourished, and to date has some 750 paid-up members. Not bad when you consider that membership was originally only expected to hit the 200 mark!

The club has gone from strength to strength, having now established what is described as a 'good' relationship with the DTI. Discussions with the department have apparently included the idea of expansion of the band and the possibility of lifting the current antenna restrictions and setting up repeaters.

Further details can be obtained from the newsletter editor and club chairman, Vic Anthony UK.01, PO Box 424 Althorne, Chelmsford, Essex.

RSGB convention
The RSGB has once again chosen the Belfry Hotel, on the A40 near Oxford, as the venue for this year's National HF Convention.

It costs just £2 to get in and attractions include a 1.8MHz get-together, a Worked All Britain stand, RNARS ORQ CW tests, and a DX quiz, to mention but a few. There will also be a supervised construction area where you're invited to build a simple direction-conversion Rx.

A provisional lecture programme starts at 10.30am with Don Field G3XTT, who writes for our sister magazine, Amateur Radio, discussing HF antennas for small gardens. Between 1545-1645 there will be a DX forum.

As you can see, it will be quite an eventful day - so don't miss it.

For further details contact D Field G3XTT, 105 Shiplake Bottom, Peppard Common, Henley-on-Thames RG9 5HJ, or telephone (0734) 501359.

Midlands VHF
The RSGB Midlands VHF Convention is being held on Saturday 11th October at Madeley Court Centre, Telford, Shropshire from 1900hrs.

The convention programme includes lectures on cellular radio, 10GHz amateur television and meteor scatter. The forum will be followed by an evening buffet until 2200hrs.

As well as a small trade show, bring and buy and book stall, there will be a measurements facility providing most required measurements up to 18GHz.

A 'how to get there' map and further information is available from J Burden G3UBX, 18 Langley Road, Merry Hill, Wolverhampton for an SAE.

28th Harlow rally
The twenty-eighth Harlow Amateur Radio Rally will take place on Sunday 21st September at the Harlow Sports Centre, Hammarskjold Road, Harlow, Essex. Doors open at 10.00am.

Features of the rally include a giant bring and buy, exhibits by special interest groups and morse tests (must be pre-booked with the RSGB).

Parking is free and a licensed bar will be available for the essential tipple and other refreshments. Access to the venue is via the M11 (junction 7) or the A414, but talk-in on S22 and G6UT will be available for the confused.

Further information is available from David Goulart G3UEG on (0279) 22365 (day) and (0279) 27788 (evenings and weekends).

Peterborough rally
The Peterborough Radio and Electronic Society Mobile Rally will take place on Sunday 21st September at the Wrrina Sports Stadium, Bishops Road, Peterborough.

The venue is situated on the river Banksmen and offers free parking and delicious meals in the adjacent Tropicana Restaurant. With a little ingenuity it should be possible to appease the missus with a slap-up meal and the romantic setting, while you get down to the serious business of radio junk, etc.

Further details are available from Peter Wilson G4PNW at 221 Tydesdale, Bletton, Peterborough PE3 6ZX.

ELOHEx '86
The Hornsea Amateur Radio Club are holding a Computer and Electronics Exhibition on 19th October at the Floral Hall, Hornsea.

The exhibition will include local club and trade stands in addition to the statutory junk and bring and buy stands.

Cafe and bar facilities will be available and talk-in will be on S22 and G4EKDT. Doors open from 1000 to 1700hrs.

The club meets every Wednesday at 1930 for 2000hrs at The Mill, Atwick road, Hornsea, North Humberside for a full programme of talks, videos and slides on a variety of subjects. Visitors and guests are always welcome.

Details on the exhibition and club meetings are available from Richard Guttridge G4YTV, tel: (0401) 62498.

More Junk
The Aberdeen ARS plans to hold one of its frequent junk sales on 5th September, followed on the 12th by a Raynet presentation and slide show, on the 19th by Sid Will's morse keyer project, and a lecture, "Computers in amateur radio", on the 26th.

The society is currently running the WASR (Worked All Scottish Regions) Award. Full details are available from GM4BVK at 67 Greenfern Road, Mastrick, Aberdeen.

Regular society meetings are held on Fridays at 7.30pm at 35 Thistle Lane, Aberdeen and information can be obtained from Don GM4GXD on (04676) 251.
Any old iron?

Once again, the Dunstable Downs Radio Club will be holding the National Amateur Radio Car Boot Sale at the Shuttleworth Collection Old Warden Aerodrome, Nr Biggleswade, Bedfordshire, on Sunday 21st September. There will be over 100 stalls selling equipment and components, both new and old. Admission to the sale, which takes place from 10am until 5pm, is just 50p.

For further details contact Phil Morris G6EES, 10 Seamons Close, Dunstable, Beds LU6 3EQ. Tel: (0562) 607623.

Speed freaks

Richard Branson may not have succeeded on his first attempt, but he and his Virgin Atlantic Challenger II grabbed the headlines recently when he finally broke the existing speed record for crossing the Atlantic.

A special event station, G8ZAC, was set up to mark the occasion by the Wimborne and District Radio Society. Members involved were G1SHV, G4SBK, G4XLM and G8NGT.

The equipment used by the society included Meteorosat weather picture receivers, low speed audio recorders and amateur band SSB transmitters and receivers.

For details of the club contact TW Mansfield G3ESH, 16 Fir Grove, New Maiden, Surrey KT3 6RH, Tel: 01-942 1418.

G8EOLD

The Thoraby and District Amateur Radio Club will be operating the above special event station over the weekend of 13th/14th September.

The station will be operating during the open days of the Oldbury-on-Severn nuclear power station, and will be operational on HF, 2 metres and 70 centimetres.

Special QSL cards will be issued to contacts. Further information is available from Alan Jones G8AZT, c/o 9 Queen’s Walk, Thornbury, Nr Bristol BS12 1SR. Tel: (0454) 416381.

Botswana independence

To celebrate Botswana’s 20th anniversary of independ- ence, Botswana amateurs have been allowed to use a special callign facility during the Independence celebrations throughout September and October.

Full licence holders will use the prefix 802 and novice licence holders will use the prefix 800.

BARS members, including SWLs and other Botswana active radio amateurs are being issued with QSL cards. Please note that BARS does not operate a running QSL bureau and incoming cards are distributed only to BARS members.

Further information is available from the Botswana Amateur Radio Society, PO Box 1873, Gaborone, Republic of Botswana, Southern Africa.

Going, going, gone!

On 16th September the Rugby Amateur Transmitting Society is holding an auction of radio goodies.

To keep all you hungry hams happy there will also be a barbeque to provide sustenance, as well as trade and club stands.

The doors open at 7.30pm and admission is free. The venue is the Cricket Pavilion, 'B' Building Entrance, BTI Radio Station, A5 Trunk Road, Hillmorton, Rugby, Warwickshire CV23 0AS.

For more information contact Kevin Marriot G8TWH on (0788) 77998.

College quest

The London Electronics College, which celebrates its 80th anniversary this year, intends to mark the event by setting out on an internation- nal quest to find its oldest former student.

The college, formerly known as the British School of Telegraphy and founded in 1906, trained early marine radio officers using the original Marconi wireless telegraph, some 300 of its students being at sea in 1912. Harold Bridge, wireless operator on the SS Titanic at the time of the tragic iceberg disaster, and Thomas Cottam on the SS Carpathia, the first ship to acknowledge the radio distress messages which saved so many lives, were both trained at the college.

Nowadays, the college specialises in professional electronics technician education, having ceased radio officer training in 1980. The nautical connection was maintained to the end as the college was amongst the sponsors of the Trans-Globe Polar Expedition, lead by Sir Ranulph TW Fiennes under the patronage of the Prince of Wales, during 1979-82. Lady Virginia Fiennes, the expedition radio operator, trained at the college during one of the last marine courses.

Since its foundation the college reckons it has trained some 5,000 students, many of whom will still be scattered over the remote parts of the world, both on land and at sea. In honour of the college’s 80th birthday, a general signal ‘QSO’ is being sent out to all former students asking them to get in touch again. It’s just possible that some of those original 1906 Marconi wireless telegraph operators will respond to the call.

Present-day staff and students look forward to welcoming such visitors on a tour of inspection - just to see how much electronics has changed in the era of microcomputers and new technology.

An apple a day . . .

The Communications and Electronics Museum was presented with an Apple computer by the Rank Xerox Information Technology Centre (Slough) on 1st July. The computer was accepted on behalf of the CEM by the Lord Mayor of Portsmouth City, Councillor Miss Marie Seaman, at a special presentation ceremony at Fort Widley in Portsmouth where the Museum’s collection of historic equipment is being recorded and restored. The Apple computer will assist with the administration and archive activity required to establish the museum.

The CEM is building upon the collection of civil and military equipment which has been gathered by Dr Graham Winbolt and Mr Douglas Byrne. In time the museum aims to establish a permanent home for the collection.

Food for thought

The latest issue of the Bury Radio Society’s journal, Feedback, features an interesting article by Bob Hayter G4OAC about operating VHF/UHF on the routes to the West Country (guess who took his rig on holiday?).

There are many other news items and features worthy of mention, including a review of a Morse tutor program by NW Webster G2DWR, which will interest prospective Class A licencees.

Two events the club has lined up are a talk by Peter Smith on ultrasonics and Doppler shift on 9th September, while on 14th October there is a construction competition.

Meetings are held every Tuesday at 8pm at the Mosses Youth and Community Centre, Cecil Street, Bury.

For further details on the club contact M Swierc G4ZTB, 47 Ramsay Avenue, Bacup.

Spilling the beans

The British Amateur Radio Teleprinter Group (BARTG) recently released the sum-
Color from a "no colour" shack.
Membership costs £5.00 per year and forms are available from Dave Lawton GOANO, "Grenethurst", Pinewood Rd, High Wycombe, Bucks HP12 4DQ, on receipt of an SAE.

Top cat
ACCumulator, the Amateur Computer Club's newsletter, has a new editor, Bazyle Butcher. The club caters for the more technically minded and this is reflected in the newsletter, which carries articles on the construction and use of computers and add-ons, in the latest issue. Leon Heller explains how to build a simple microprocessor controlled PLL frequency synthesizer, and there is also information on the RS232 interface and radio data systems.
To join the ACC, send £6.00 to Andy Leeder, Church Farm, Stratton St Michael, Norwich NR15 2QB.

Lough Erne AGM
On 17th September the Lough Erne Amateur Radio Club plans to hold its AGM. The venue will be the Railway Hotel, Enniskillen, Northern Ireland at 8.00pm.
Further information is available from W A Ward G14WRE on (0365) 24905.

Quick and painless?
On Thursday 11th September Steve Wight G3ZVW, of the Southgate ARC, will be discussing 'The Quick and Painless Way to Learn CW'. It all goes down at the Holy Trinity Church Hall (Upper), Green Lanes, Winchmore Hill, London N21, at 7.45pm.
For further details contact Dave Elson G4YLL, 200 Churchgate Road, Cheshunt, Herts EN8 9EL. Tel: (0992) 30051.

Pay attention
SWLs wishing to take the RAE in May 1987 may wish to attend a course running at the Avondale Evening Centre in Southport on Tuesdays. Enrolment will take place on the week commencing 15th September.
For further details contact the Evening Centre Head or Rick Whittaker G4WAU on (061) 427 4730.

South Cheshire ARC
The South Cheshire ARC has sent us details about some forthcoming events, including a talk on Operation Raleigh on 8th September.
The club's AGM on 13th October will be followed by a lecture on railway workings. All meetings take place at the Crewe LMR Sports Club, Godward Street, at 8pm.
For further details contact Chris G1PUV on (07816) 73185.

NOTES FROM THE PAST
Old Wives' Tales
Contrary to a widespread belief, all modern inventions are not the work of teams of professionals working for big organisations. A steady proportion are purely amateur, particularly those of everyday devices rather than abstract ideas. The safety razor was just such an invention, and Kodachrome was initiated by two amateurs. Nearer at home, Bakelite was - so at least started off with independent backing.
Inventors, too, appear to be born rather than made. Once a man has invented something he is eagerly snapped up for institutionalised research. Here he gets a chance to show his wares with big financial backing. Perhaps for this reason the spreading of a wide filter for all sorts of ideas still untired) institutional research pays off dividends and is so widely thought to be responsible for the introduction of all new inventions.
Usually, whenever I get a lot of correspondence on a particular point, and especially when the writers seem a little hazy on a subject, I try it out on my circle of friends and acquaintances. It invariably provides a useful clue to what people popularly suppose and what they really know.
I did just this on the topic of inventions, and to my astonishment I found quite a lot of people who were firmly convinced that 'big businesses' buy up and suppress inventions so as not to ruin their existing market. This, of course, is just nonsense, in Britain at any rate. If a patent is not worked for three years after the grant, any bona fide applicant can apply for the issue of a compulsory licence to do so.
One writer finds they all end with independent new inventions. 'Old wives' tales die hard. One or two friends I spoke to obviously still harboured a suspicion that there was a catch in it somewhere, even after I tried to disillusion them. Perhaps there is something in the romantic fiction that bright ideas are regularly bought up and 'killed' that makes them prefer to believe it's true?

South Bristol ARC
We recently received the latest update of the South Bristol ARC's event calendar. Notable events include a VHF activity night on the 27th August, whilst on 10th September there will be a lecture and demonstration of cellular radio. This will be followed on the 17th by a computer bring and buy evening.
For further details contact Ian Brothwell G4EAN, 56 Arnot Hill Road, Arnold, Nottingham NG5 6LQ. Tel: (0602) 263350.

South Cheshire ARC
The South Cheshire ARC has sent us details about some forthcoming events, including a talk on Operation Raleigh on 8th September.
The club's AGM on 13th October will be followed by a lecture on railway workings. All meetings take place at the Crewe LMR Sports Club, Godward Street, at 8pm.
For further details contact Chris G1PUV on (07816) 73185.

Happy hunting
Crawley ARC's latest newsletter features some helpful advice on antennas by G3UUV.
One event mentioned in the club's programme summary sounds particularly interesting and takes place on 27th August - a pub hunt...

For further details contact Dave Hill G14QM, 14 The Garrones, Worth, Crawley, West Sussex RH10 4Y7.

QSO
FOR SALE

- National HR0 plug-in coil packs, 900kHz to 30MHz. Cover ranges 900kHz-2.5MHz/1.7MHz-4MHz, 4.5MHz-14MHz, 14MHz-25MHz, £20. Can have receiver, power supply and speaker for nothing (been modified to partly miniature valves). Would prefer swap for useful military kit. Why? Tony Howard. Tel: (0334) 66595 (work hours, inc Sat).

- Two TS160S HF transceivers, two PS30 20A PSUs, two AT230 tuning units, VFO180, SP180 with built-in filters. Also SM220 monitor scope module, MC50 station mic, microdot RTTY terminal (video module requires attention). All good condition. Reason for sale: other uses. £250. Tel: (0905) 561561.

- Exchange camera compatible photography outfits, including Olympus OM40 pro, OM30 cameras with 28mm, 60mm, lenses, filters, bag etc, and colour darkroom with enlargers, pfktak, chemicals, paper, trays, plus lots more. All 2 months old. In vgc, £200, will exchange for good HF trans, ferris, £F300 not QTHR. Carefully considered, WHY? Or sell for £550. Tel: Chris (02407) 5036.

- YAESU FR101S comm reciever, mint cond, no mods. £120 ono. Tel: (0117) 321222.

- YAESU FT-290R, immaculate, in box, £350. 6 amp PSU, £15. Save £15 buy the lot for £330. Halicrafters SX140 ham band Rx, £x0. Realistic DX101XL Rx, £30. Buyers to collect. Datong D70 Morse Tutor, £35. Mike G1HGD. Tel: (0989) 516461 (work hours).

- YAESU FT202R transceiver, 9 months old, warranty, in manual boxed, 5W/25W HW ds and disc system used in shack, only £250 not QTHR. Tel: Cuffley 872772.

- Realistic DX1000 comm receiver, general coverage, 150kHz to 30MHz in five bands, excellent condition, good working order for beginner in short wave radio with some standby rec. Buyer collects, £50 ono. Tel: Goole 776910. For Andy.

- Leak throughline FM tuner (mono), 88-108MHz ideal for conversion, £10. Tel: Bristol 778991 evenings or weekends.

- Ferraghost 44N mono open reel tape recorder, speeds 3+7, complete with manual, micophones and assorted tape cartidges, £10, W4765110, YEO:

- Yaesu FT1100E 2.5 metre, 50W, repeatable 6.30pm.

- YAESU FT102, IC740, IC720A, FT902D, TS430, CW/RTTY reader. £199.

- John Wreath. Tel: (0923) 541234. Amsat CPC6128 colour monitor, built-in disc drive, 2 months old, boxed, sell for £30 or swap for YAESU FRG6800. Tel: Hull 614996 after 16 hours 40pm.

- YAESU 25RD, immac cond, no mods. £250. Tel: (0922) 612811.

- YAESU TS430R, virtually unused, hence £600, with original packing and manual. Icom tcvr IC701, 100W, solid-state, 10m to 160m (pre-WARC), complete with PSU/PSU, IC701 PS and desk mic, SM2, no extras to buy, all original packing and manual. Prefer buyer to inspect and collect or carriage. Very interesting in C2000D with aircraft as p/x. VR57 valve wanted.

- YAESU FT102R transceiver, 19 to 165MHz, in six footed, KXV Yesa TX, £30, RTTY type tuning indicator, £10. Tel: (0808) 811102.

- Scanning receiver, Bearcat110, coverage 50-50, 450-512MHz, with service manual, boxed, mint, £115 ono. Realistic PRO2001 scanner, coverage 30-50, 144-174, 430-512MHz, service manual available, in good condition, £150 ono. Shogun set sell unit new, £295, original spares £72, boxed. £350 not QTHR. YAESU FT2200 transceiver, £150.

- Yaesu TS430R transceiver, hand-held, 10MHz coverage, good cond, boxed with speaker mike and alignment charger, £140. 100W trans, good cond, boxed, £140. G1E886 not QTHR. Tel: Waltham Cross (0922) 32114 after 7pm.

- YAESU TS211E 2.5 metre, £170. Transceivers, 9 months old warranty, in manual boxed, 5W/25W HW ds and disc used in shack, only £250 not QTHR. Tel: Cuffley 872772.

- Yaesu 225RD in excellent condition, general coverage, 150kHz to 30MHz in five bands, excellent condition, good working order for beginner in short wave radio with some standby rec. Buyer collects, £50 ono. Tel: Goole 776910. For Andy.

- Yaesu TR7028G 2 metres, transceiver, £105, only cond, £150 ono. Tel: Bristol 778991 evenings or weekends.

- Yaesu TS430R, virtually unused, hence £600, with original packing and manual. Icom tcvr IC701, 100W, solid-state, 10m to 160m (pre-WARC), complete with PSU/PSU, IC701 PS and desk mic, SM2, no extras to buy, all original packing and manual. Prefer buyer to inspect and collect or carriage. Very interesting in C2000D with aircraft as p/x. VR57 valve wanted.

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- Spectrum 48K, Interface One, 2 microdrives, card reader, printer, 6 rolls paper, datacord, joystick + interface, Spectac back-up interface, keylogger, 2 microdrives, Modem, Interface One, software, literature, lots of software, books, adventure maps, game hints, magazines, in fact complete computer set up. Terry, tel: (0275) 34783 after 1800.

- Dave, Bourne End 24529 evenings.

- S P E C T R U M 4 8 K , I N T E R F A C E O N E , 2 m i c r o d r i v e s , g a m e h i n t s , m a g a z i n e s , i n f a c t c o m p l e t e c o m p u t e r £ 5 0 . A l l w i t h d a t a . T e r r y , t e l : ( 0 2 7 6 ) 3 4 7 8 3 a f t e r 1 8 0 0 .

- D a v e , B o u r n e E n d 2 4 5 2 9 e v e n i n g s .

- Keyboard, every issue.

- F R E E C L A S S I F I E D A D S would build one (how much please?) K A Evans, t u r e , v a l v e d a t a s h e e t s a n d c h a r a c t e r i s t i c s , £ 0 . 5 0 p e r w e e k e n d s .

- Copy, all plus post and packing. Tel: (0843) 587243 ECC84, £0.50. ECC83, £1. ECC81, £1. EL84, £0.50.

- (bands 1, 3, 4 & 5) system B/G. Sharp selectivity and Tokyo Power 2m linear, HL82U, 80W. Phone Paul WDV400/1200 varactor, £50. 50MHz IF processor, Europea countries, one year’s use only - 40MHZ + scope or sell for £550. Klay Lund, 9 G4X HF on (0293) 515201.

- Some sets round bAKElos, £1155 RX, AR88 or Edystone sets, working or not, by private collector. Other communications receivers considered. Also wanted: circuit board manual for USA Signal Corps receiver type BC342P. Please phone Clacton 475340.

- Vintage wireless sets: round bakelos Ekco, £1155 RX, AR88 or Edystone sets, working or not, by private collector. Other communications receivers considered. Also wanted: circuit board manual for USA Signal Corps receiver type BC342P. Please phone Clacton 475340.

- Linear amplifier for 26-30MHz AM, FM and SW, 100W, 100W. David Mitchell, ‘Westfield’, Rillington Fields, Scagghetmore, Malton, N Yorks Y017 5EB.

- Video cassette recorders in any condition, working or not, not concerned about mechanisms/heads etc. Will collect. Tel: D Head on Stevenage (0430) 62179.

- Manual, service sheets, or any information on Russian made dual trace oscillograph type CI-16, dated 1973. Also any details or information on equivalent for Russian valve 6C1917. Simon Barnes, 9 Yeats Close, Newport Pagnell, Milton Keynes MK16 8RD.

- Yaesu FRG7 receiver or Yaesu 7700 general coverage receiver, 0-30MHz, or Icom, with AM/SSB. All letters will be answered, details of price and condition please, distance no object. Mr H Richards, 7 Grange Road, Thurmoby, Cleveland TS17 6LT.

- Portable record players – late ’50s, early ’60s valve models, particularly Dianette Autocine using UL41 amplifier and 6½ inch round speaker, also Pilot with UCL83 amplifier. Other models required are Philco, EAR twin-speaker models, Pye black box, HMV. Can possibly collect. E W Huggins, The Malt House, Laxfield, Woodbridge, Suffolk IP13 EDZ. Tel: (086) 683 600.

- Edystone RX686, RX 800 or RX 500, 77, 220, or Drake 2B. All letters answered. B Smith, Hirsts Cottage, Spa Lane, Lathom, Ormskirk, Lancs L40 6JG. Tel: (0993) 21218.

- Swap full kit for £90 or 30MHz transceiver or 100MHz + scope or VW151. I C R 7 0 0 , £ 1 3 0 0 e a c h , c o n v e r t e r f o r A R 2 0 0 2 , F RG 9 6 0 0 o r s i m i l a r , a b o u t £ 1 0 0 0 , £ 1 3 0 0 .

- Need to purchase at reasonable price, six diode rectifiers type 5642. D E Fisher, 48 Taynton Drive, Marsham, Surrey RH1 9PS. Tel: Marsham 4972.

- CB rigs, not working, up to £2 each paid, but you must deliver. PF1 Txs wanted, must be cheap (about £3-£4 each). Mr C J Barker, 52 Spode Street, West End, Stoke-on-Trent, Staffs ST4 4DY. Tel: (0785) 456705.

- Need to purchase at reasonable price, six diode rectifiers type 5642. D E Fisher, 48 Taynton Drive, Marsham, Surrey RH1 9PS. Tel: Marsham 4972.

- Betamax video cr, about £50. SEM 0.1-0.3MHz converter for AR2002, FRG9600 or similar, about £50. Icom ICRT8, 100MHz. David, PO Box 129, 70600 Yavne, Israel. Tel: (0348) 87147.

- ICOM IC-940 users look! Book in the making: do you run a scanner, often anywhere in the UK? Do you collect freqs? Do you use it with a computer using RS232c port? Would you like a reward? Then why not write to50 Tandridge, Reigate, in strict confidence and tell me about your scanner. All letters answered. Also wanted: instructions for Texas TS30, service manual for ACR2001 and K L Clayton, 38 Stoke Hills Estate, Farnham, Surrey GU9 7TF. Tel: 710254.

- Collins R 960/UR or radio 621T 8E. P Swiatek DDS6G, Buncliever St 5, K elein 40, W Germany. Tel: (2234) 47976.

- Swap Practika L camera with damaged 55mm, F4.5 lens. Also 50mm telephoto, 135mm, and range doubler. Also macro close-up lenses and Ever Ready case. Swap full kit for £70 or 2m pocket transistor or 100MHz + scope or VW151. I C R 7 0 0 , £ 1 3 0 0 e a c h , c o n v e r t e r f o r A R 2 0 0 2 , F RG 9 6 0 0 o r s i m i l a r , a b o u t £ 1 0 0 0 , £ 1 3 0 0 .

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- Good switch mode computer PSU, computers, 8 inch disk drives, frequency counter, many other items. Swap or buy, WHY? Mel Saunders. 7 Drumcliff Road, Thornaby, Stockton-on-Tees.

- Betamax video cr, about £50. SEM 0.1-0.3MHz converter for AR2002, FRG9600 or similar, about £50. Icom ICRT8, 100MHz. David, PO Box 129, 70600 Yavne, Israel. Tel: (0348) 87147.

- Super gaging oscillator model 343. Manual for radar CRT reactuator model 202. Wireless World August 1984 to December inclusive and January 1985, for completing my volumes. Cambridge mutual inductance bridge, Marconi 1936 9-valve LW/MW radiogram or chassis model 222 or...
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• FR7700 for FRG7700, must be in good condition. Any information on software for Spectrum computers or Amstrad computers regarding Fe/Te, radio modes etc. Bernard, 99 Rothfarnham Road, Dublin 14, Ireland. Tel: 905786
• Bound volumes of RSG bulletin from 1952 to 1967. Can collect from Midlands or south of England. G6JNS OTH. Tel: (0905) 620041, 24 hours
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<td>2N4208A PCB battery</td>
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<td>1.50</td>
</tr>
<tr>
<td>6000</td>
<td>1.30</td>
<td>1.30</td>
</tr>
</tbody>
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**FREE SHIPPING**
5% off orders of £5 or more.

**SPECIAL OFFERS**
Automatic Car Immobiliser £1.99
Automatic Key Pad Car Immobiliser £2.99
B.C. sockets £2.99
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6000A HA52 60W £1.45
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**WHY PAY HIGH PRICES FOR COMPONENTS**

<table>
<thead>
<tr>
<th>Component</th>
<th>Minimum</th>
<th>Usual</th>
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<tr>
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<tr>
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</tr>
<tr>
<td>LM5080PS</td>
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<td>NCH4127P</td>
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<tr>
<td>6 way dip switch</td>
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<tr>
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<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>4084 Hx2</td>
<td>3.40</td>
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<td>1.30</td>
<td>1.30</td>
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</tbody>
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11 SEPTEMBER 1986

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- Full range of Components, Motors and Servos
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COLOUR AD RATES

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PRINTED — web-offset

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FOR FURTHER INFORMATION CONTACT

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(0277) 216787

SEPTMEB 1986

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2 MTR FM Handheld Transceiver
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3/4 wave ultra-high gain base antenna
Adjustable 26-30mhz power max 2 KW gain 6.5 db. The ultimate base antenna for long distance work.
Height: 9.1 mtr.

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F911
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Supply: – 13.8 Volts
Input PWR: – 0–10 Watts

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Adjustable 26-30mhz power max 2 KW gain 6.5 db. The ultimate base antenna for long distance work.
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For the Amateur Radio Enthusiast.

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