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Radio & Electronics

The communications and electronics magazine

World

**THE BASICS:
AN INTRODUCTION
TO ELECTRONICS**

**VALVES:
BEYOND THE
TRIODE**

**CAT INTERFACE:
COMPUTER
AIDED DXING**

**JAPAN RADIO:
NRD-525 HF
RX REVIEWED**



**SPECTRUM WATCH:
NEW DEVELOPMENTS**

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SCANNING RECEIVERS

Heard about our modified Yaesu FRG9600 with HF? Or our Bearcat handhelds? Call now for details!

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For a very limited period we offer these two fine transceivers at special prices while present stocks last.

Now everybody can afford to own an excellent 2 mtr and 70cm Hand-Portable! And as usual, it's first come first served, so don't delay if you do not want to be disappointed!

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Editor
Jane Berry

Assistant Editor
Anita Ley

Advertisement Manager
Marian Vidler

Advertisement Executive
Karen Turner

Publisher
Peter Williams

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Safety in the shack

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

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

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

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

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

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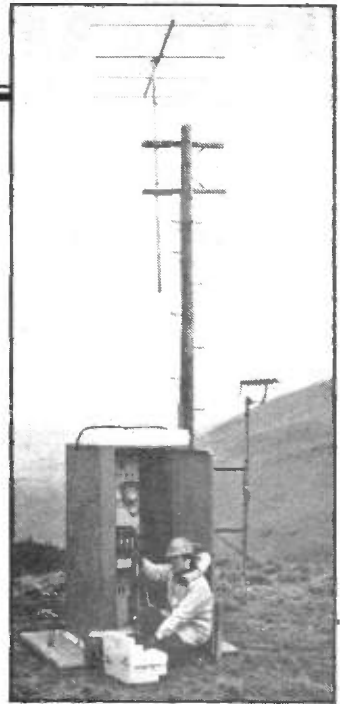
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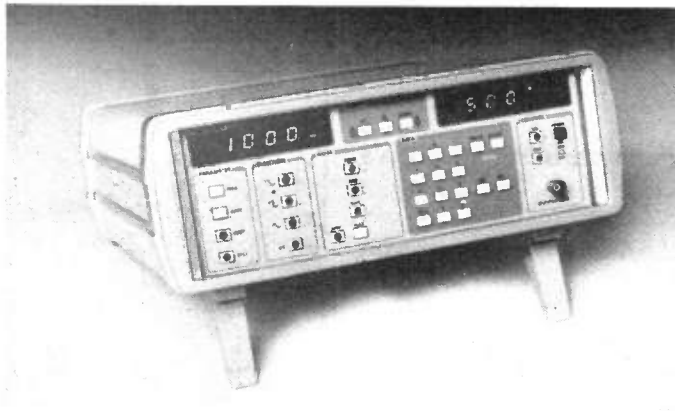


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PRODUCT NEWS

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

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



FUNCTION GENERATOR

Thandar Electronics have announced the introduction of a high performance, fully programmable function

generator priced at £1,290 plus VAT.

Designated the TG401, it produces sine, square and triangle waveforms over a

frequency range of 0.004Hz to 4MHz with an output amplitude from 10mV to 10V peak to peak.

The TG401 features triggered and gated modes with manual or external trigger. A TTL sync output and VCO input are also provided and are fully protected. The TG401 is claimed to be an ideal instrument for a wide range of applications where it can be operated via the front panel or remotely by the IEEE 488 interface.

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

POCKET PYROMETER

The Oryx pocket-sized pyrometer ODP1, for specific use with soldering irons, ensures against poor quality soldering. Users can be certain that tip temperatures are at a safe level for the product being soldered.

A non-flammable insulated lead feeds a thermocouple probe, which is detachable. By placing the iron tip in the thermocouple loop, temperatures between 200°C to 450°C will be displayed.

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

NEW MULTIMETERS



Two new Hung-Chang multimeters, model numbers HC5010 EC (£52.50 exc VAT) and HC775 (£33.50), are available from Cirkit Distribution, who have just introduced the products into the United Kingdom.

The model HC5010 EC offers a range of facilities matching those of much more expensive digital multimeters. It is equipped with a continuity tester giving both audible and visual indications as well as diode and transistor testers, which enable accurate capacitance, conductance and temperature measurements to be taken.

Capacitance measurement

is provided in three ranges: 200pF with resolution of 1pF and accuracy of \pm (1.5 per cent full scale + 5 digits); 2 μ F with 0.001 μ F resolution and \pm (2 per cent FS + 5 digit) accuracy; 20 μ F with 0.01 μ F resolution, accurate to \pm (2 per cent FS + 5 digit). Conductance is measured in the 200ns range with a resolution of 0.1ns and an accuracy of \pm (1.5 per cent reading + 10 digits). The temperature range is -20°C to +137°C with a resolution of 1°C and accuracy of \pm 3°C + 1 digit.

The model HC775 is a pocket-sized auto-ranging voltmeter with many extra features including low and high power resistance and

ac/dc current measurement. It also has a memory mode, which can be set manually, and overload protection.

Other features of the HC775 include 3½-digit 10mm high LCD, auto-polarity and mode display, and Lo Batt indication.

The dc voltage range is 200mV, 2V, 20V, 200V, 1000V with 100 μ V resolution, while the ac voltage range is 2V, 20V, 200V, 750V with 1mV resolution. Accuracy is to \pm (0.75 per cent + 1 digit).

*Cirkit Distribution,
Park Lane,
Broxbourne,
Herts EN10 7NQ.
Tel: (0992) 444111.*

CABLE CONTINUITY

A new range of digital insulation and cable continuity testers has been announced by David Bisset Ltd, specialists in communications test equipment. Robust and battery-operated, they will check wiring and cable runs for telephones, telecommunications equipment, modems, computer systems and their electrical supply circuits. Damaged or rotting insulation, poor conductors and broken wires in communications networks can be located.

Two measurements are required on cables and twisted pairs: *high* insulation resistance to detect insulation breakdown, and *low* continuity resistance ('out and back' resistance) measured when a cable pair is shorted at the far end.

The insulation testers announced include the DMS range and model 9D digital insulation and cable continuity tester. The new 9D provides insulation resistance measurement to 200 megohms, continuity up to 200 ohms, 500V dc test vol-

tage, 0 to 500V ac measurement, and has the advantage of a 'latch' switch for hands free operation.

The model DMS-251 multi-range digital insulation tester has a choice of test voltages - 250, 500 or 100 volts - for general purpose work. The model DMS-100 digital insulation and continuity tester features a low test voltage of 100V dc specially for communications wiring, with 200 ohms continuity resistance and 200 megohms insulation resistance measurements.

Designed for field work, the

instruments are rugged and come complete with carrying cases and leads. They are intended for use by modem and computer terminal installers, LAN (local area network) wiring in buildings or large sites, telephone installers, data communications contractors, third party maintenance companies and telecommunications engineers.

*David Bisset Ltd,
65 High Street,
Redbourn,
Herts AL3 7LW.
Tel: (058285) 2637.*

STORAGE OSCILLOSCOPE

The newly expanded range of Hitachi digital storage oscilloscopes, now available from Thurlby Electronics, features GPIB (IEEE-488) interfaces as standard on every model.

The range starts with the low cost VC-6020, which has a real time bandwidth of 20MHz and includes two 1MHz A/D converters to provide simultaneous, dual-channel storage of single-shot or repetitive waveforms. For very low speed events a 'roll' mode is provided, which makes the screen act like a chart recorder, with the new data being written onto the screen on the right-hand side as the old data disappears from the left-hand side. An analogue plotter output allows stored data to be plotted as hard copy using either an X-Y or Y-T pen plotter. The GPIB interface enables waveform data to be transferred to or from a computer, thus making the VC-6020 suitable for use in ATE systems.

The new VC-6041Z is a high performance DSO with a maximum sampling speed of 40MHz and a memory length of 4K words per channel. For single-shot events the VC-6041Z can capture waveforms up to 10MHz (at 4 samples per cycle), whilst repetitive waveforms of up to 40MHz can be captured with a resolution of 0.25ns (100 samples per cycle). Two separate 4K word stores are available as reference memories independently of the acquisition memories, enabling four waveforms to be held simultaneously. Other features include fully variable pre-trigger, digital averaging, and waveform magnification up to one hundred times.

The new VC-6050 has all the features of the VC-6041Z as well as full dual timebases and a sophisticated cursor measurement system with on-screen readout of voltage, time and equivalent frequency. Repetitive waveforms of up to 60MHz can be captured via the ultra high

speed sample and hold digitisers which provides an equivalent sampling speed of 8GHz.

The prices range from £1,395 for the VC-6020 up to £3,250 for the VC-6050. All models are available ex-stock from Thurlby Electronics.

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

LOW COST TEST GEAR

Scopes, function generators, multimeters and power supplies are among a new range of test and measurement equipment available from Flight Electronics. The units are around 20 per cent cheaper than the same 'branded' units available from traditional sources.

A sole distribution deal with Taiwanese manufacturer GW Instrumentation now allows Flight to directly market

these instruments in the UK and Eire. Other equipment includes intelligent frequency counters, audio/RF generators, a distortion meter, ac millivoltmeter, curve tracer, auto IC-tester, and a wide range of accessories, test leads and probes.

The range will be of interest to anyone who has the need for reliable test instrumentation in electronics and electrical production, QA, prototyping, service and education. A range of 26 bench power supplies covers most user applications, ranging from 18 to 200W, with either single, dual or quadruple outlets. Seven oscilloscope types offer capabilities up to 40MHz dual-beam delayed sweep. Seven function generators are stocked, from basic types to a double-function model with a 0.1Hz to 14MHz range.

*Flight Electronics,
Ascupart Street,
Southampton SO1 1LU.
Tel: (0703) 227721.*



MICROCOM RANGE

MNP Sales Ltd, part of Microcom Inc, has announced the availability, through appointed distributors Data Translation Ltd and Feshon Systems Ltd, of the first of their modem ranges with BABT approval. Four modems, the AX/1210, AX/1210C, AX/2410 and AX/2410C, all feature Microcom's MNP communications protocol, which conforms to OSI standards and provides 100% error-free data transfer.

*Data Translation Ltd,
The Business Centre,
Molly Millar's Lane,*

*Wokingham,
Berks RG11 2QZ.
Tel: (0734) 793838.*

*Feshon Systems Ltd,
Resicon House,
London Road,
Riverhead,
Sevenoaks,
Kent TN13 2DH.
Tel: (0732) 460088.*

COMMUNICATIONS LINK

The Interconnect Switch-Box from Olympia offers the ability to create a low cost communications link between typewriters, telex and computers without the

need for supplementary software or presetting of protocols.

Communications links can be either within a building, linking typewriter to typewriter and typewriter to personal computer/word processor, or from building to building or country to country via a modem to electronic mail or via a telex box to the international telex network.

Up to six devices can access one modem or telex box via the switch-box, and switch-boxes can be interconnected to create large daisychain networks.

*Olympia Business
Machines Ltd,
Olympia House,
199/205 Old Marylebone Rd,
London NW1 5QS.
Tel: 01-262 6788.*



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FREE

Your monitor from its computer!! For only £29.95 it becomes a SUPERB HIGH QUALITY - COLOUR - TV SET

The fabulous TELEBOX, an INVALUABLE MUST for the owner of ANY video monitor with a composite input, colour or monochrome. Made by a major UK Co. as a TOP QUALITY, stand alone UHF tuner and costing OVER £75 to manufacture, this opportunity to give your monitor a DUAL FUNCTION must not be missed! The TELEBOX consists of a compact stylish two tone charcoal moulded case containing ALL electronics tuner, power supply etc to simply plug in and convert your previously dedicated computer monitor into a HIGH QUALITY COLOUR TV SET, giving a real benefit to ALL the family! Don't worry if your set, doesn't have sound - THE TELEBOX even has an integral 4 watt audio amplifier for driving an external speaker, PLUS an auxiliary output for superb quality television sound via your headphones or HI FI system etc. Other features include: Compact dimensions of only 15.75" w x 7.5" d x 3.5" h, latest technology, BRITISH manufacture, fully tuneable 7 channel push button tuner, Auto AGC circuit, SAW filter, LED status indicator, fully isolated 240v AC power supply for total safety. Mains ON-OFF switch etc. Many other uses.

LIMITED QUANTITY - DON'T MISS THIS OFFER!!!

ONLY £29.95 OR £24.95 if purchased with ANY of our video monitors. Supplied BRAND NEW with full instructions and 2 YEAR warranty. Post and packing £3.50 *When used with colour crt.

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

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

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GOULD OF443 enclosed, compact switch mode supply with DC regulated outputs of +5v @ 5A, +12v @ 0.5A, -12v @ 0.1A and -23v @ 0.02A. Dim 18 x 11 x 6 cm 110 or 240v input. BRAND NEW only £16.95

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AC-DC Linear PSU for DISK drive and SYSTEM applications. Constructed on a rugged ALLOY chassis to continuously supply fully regulated DC outputs of +5v @ 3 amps, -5v @ 0.6 amps and +24v @ 5 amps. Short circuit and overvoltage protected 100 or 240v AC input. Dim 28 x 12.5 x 7 cm NEW £49.94
Carriage on all PSU's £3.00

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The FABULOUS CPM TATUNG PC2000 Professional Business System

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

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

The central processor plinth contains the 84K, Z80A processor, DUAL TEAC 55F 5 1/4" CENTRONICS and system expansion ports, and if that's not enough a ready to plug into STANDARD 'DRIVE port for up to FOUR 8" disk drives, either in double density or IBM format. The ultra slim 92 key, detachable keyboard features 32 user definable keys, numeric keypad and text editing keys, even its own integral microprocessor which allows the main Z80A to devote ALL its time to USER programs, eliminating 'lost character' problems found on other machines. The attractive, detachable 12" monitor combines a green, anti-glare etched screen, with full swivel and tilt movement for maximum user comfort. Supplied BRAND NEW with CPM 2.2, user manuals and full 90 day guarantee. Full data sheet and info on request.

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EX BRITISH TELECOM full spec, CCITT, ruggedised, bargain offers. Sold TESTED with data. Will work on any MICRO or system with RS232C interface.
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MODEM 20-1 75-1200 baud. Compact unit for use as subscriber end to PRESTEL, TELECOM GOLD, MICRONET etc. £39.95 + pp £6.50
MODEM 20-2 1200-75 baud. Same as 20-1 but for computer end. £65.00 + pp £6.50
DATL 2412. Made by SE Labs for BT this two part unit is for synchronous data links at 1200 or 2400 baud using 2780/3780 protocol etc. Many features include 2 or 4 wire working, self test, auto answer etc. COST OVER £800. Our price ONLY £199 + pp £8.00
DATL 4800, RACAL MPS4800 baud modem, EX BT good working order. ONLY £295.00 + pp £8.00

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Standard VDU data entry terminals at give away prices!!
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DECCA FAX VP1 complete Professional PRESTEL system in slimline desk top unit containing Modem, Numeric keypad, CPU, PSU etc. Connects direct to standard RGB colour monitor. Many other features include: Printer output, Full keyboard input, Cassette port etc. BRAND NEW with DATA A FRACTION OF COST only £55.00

ALPHATANTEL. Very compact unit with integral FULL ALPHA NUMERIC keyboard. Just add a domestic TV receiver and you have a superb PRESTEL system and via PRESTEL the cheapest TELEX service to be found!! Many features: CENTRONICS Printer output, Memory dialing etc. Supplied complete with data and DIY mod for RGB or Composite video outputs. AS NEW only £125.00
Post and packing on all PRESTEL units £8.50

EX-STOCK INTEGRATED CIRCUITS

4164 200 ns D RAMS 9 for £11 4116 ns £1.50 2112 £1.00 2114 £2.50 2102 £2.00 6116 £2.50 EPROMS 2716 £4.50 2732 £3.00 2764 £4.95 2712B £5.50 6800 £2.50 6821 £1 68A09 £8 68B09 £10 8085A £5.50 8086 £15 8088 £8 NEC765 £8 W20793 £28 8202A £22 8251 £7 8748 £15 Z80A DART £6.50 Z80A CPU £2.00. Thousands of IC's EX STOCK send SAE for list.

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Japanese 5 1/4" half height 80 track double sided disk drives by TEAC, CANON, TOSHIBA etc.
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SIEMENS FD100 SS FH 40 TRK £65.00
Carriage on 5 1/4" drives £5.50

Brand NEW metal 5 1/4" DISK CASES with internal PSU.
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8" IBM format TESTED EX EQUIPMENT.
SHUGART 800/801 SS £175.00 + pp £8.50
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Various disk drive PSU's Ex Stock SEE PSU section.
HARD DISK DRIVES
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Exchangeable version £295.00, ME3029 PSU £95.00
DIABLO 44/DRE4000A, 8.5 + 5 Mb from £750.00
CDC HAWKS 5 + 5 Mb £795.00. CDC 9762 80 Mb RMO3 etc. £2500.00.
PERTEC D3422 5 + 5 Mb £495.00

RODIME 5 1/4" Winchester ex-stock from £150 CALL Clearance Items - Sold as seen - No guarantee.
ICL 2314 BRAND NEW 14" Mb Removable pack hard disk drive, cost over £2000 with data ONLY £399.00
BASF 6172 8" 23Mb Winchester £199.00

Unless stated all drives are refurbished with 90 day guarantee. Many other drives and spares in stock - call sales office for details.

All prices quoted are for UK. Mainland, paid cash with order in Pounds Sterling PLUS VAT Minimum order value £2.00. Minimum Credit Card order £10.00 Minimum BONA FIDE account orders from Government Depts., Schools, Universities and established companies £20.00. Where post and packing not indicated please ADD £1.00 + VAT. Warehouse open Mon-Fri 9.30-5.30. Sat 10.30-5.30. We reserve the right to change prices and specifications without notice. Trade, Bulk and Export

RADIO ELECTRONICS

32 Biggin Way, Upper Norwood, London SE19 3XF
Telephone 01-679 4414 Telex 894502 Data 01-679 1888



ERS — PRINTERS — PRINTERS — PRINTERS

SUPER DEAL? NO — SUPER STEAL THE FABULOUS 25 CPS "TEC STARWRITER"

Made to the very highest spec the **TEC STARWRITER FP1500-25** features a very heavy duty die cast chassis and **DIABLO** type print mechanism giving superb registration and print quality. Micro-processor electronics offer full **DIABLO/QUIME** 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 with handshake. 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 **RS232** data cable £10.00. Tech manual £7.50. Tractor Feed £140.00 Spare daisy wheel £3.50. Carriage & Ins. (UK Mainland) £10.00.



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, aligned and pre tested but **WITHOUT** electronics. Many features include all metal chassis, phosphor bronze bearings, **132** character optical shaft position encoder, **NINE** needle head, 2 x two phase 12V stepper motors for carriage and paper control, 9.5" Paper platen etc, etc. Even a manufacturer's print sample to show the unit's capabilities!! Overall dimensions 40 cm x 12 cm x 21 cm.

Sold **BRAND NEW** at a **FRACTION** of cost **ONLY £49.50 + pp £4.50.**

TELETYPE ASR33 DATA I/O TERMINALS

Industry standard, combined ASCII 110 baud printer, keyboard and 8 hole paper tape punch and reader. Standard **RS232** serial interface. Ideal as cheap hard copy unit or tape prep. for CNC and NC machines. **TESTED** and in good condition. Only **£235.00** floor stand **£10.00**. Carr & Ins. **£15.00.**

EX NEWS SERVICE PRINTERS

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 BAUDOT CODE** from a Current loop, **RS232** or **TTL** serial interface. 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 **NEWS, TELEX** and **RTTY** services.

Supplied **TESTED** in second hand condition complete with **DATA, 50** and **75** baud xtals and large paper roll.

TYPE AE11
50 Column **ONLY £49.95**
Spare paper roll for AE11 **£4.50**
TYPE AF11R 72 Col.
+ Ribbon **£65.00**
TYPE AH11R 80 Col.
ASCII/BAUDOT **£185.00**
Carriage and Insurance **£7.50**

GE TERMIPRINTER



A massive purchase of these desk top printer terminals enables us to offer you these quality **30** or **120** cps printers at a **SUPER LOW PRICE** against their original cost of over **£1000**. Unit comprises of full **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" 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 **GE30 £130.00**, **GE1200 120 cps £175.00**. Untested **GE30 £65.00** Optional floor stand **£12.50** Carr & Ins. **£10.00.**

SEMICONDUCTOR 'GRAB BAGS'

Mixed Semis amazing value contents include transistors digital, linear, ICs, Triacs, diodes, bridge recs, etc. etc. All devices guaranteed brand new full spec with manufacturer's markings, fully guaranteed

50+ £2.95 100+ £5.15
TTL 74 Series. A gigantic purchase of an "across the board" range of **74 TTL** series IC's enables us to offer **100+** mixed "mostly TTL" grab bags at a price which two or three chips in the bag would normally cost to buy. Fully guaranteed all IC's full spec. **100+ £6.90**, **200+ £12.30**, **300+ £19.50**

20,000 FEET OF ELECTRONIC AND COMPUTER GOODIES

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PDP 1140 System comprising of CPU, 124k memory & MMU 15 line **RS232** interface. **MP02** 40 MB hard disk drive
TU10 9 track 800 BPI Mag tape drive, dual track system. **VT52** VDU, etc. etc. Tested and running **£3,750.00**
BA11-MB 3.5" Box, PSU, LTC **£395.00**
DH11-AD 16" x **RS232** DMA interface **£1,900.00**
DLV11-J4 x EIA interface **£350.00**
DLV11-E Serial, Modem support **£190.00**
DUP11 Synch. Serial data i/o **£650.00**
DQ200 Dialog — multi RK controller **£495.00**
DZ11-B 8 line **RS232** mux board **£650.00**
KDF11-B M8189 PDP 1123 PLUS **£1,100.00**
LA30 Printer and Keyboard **£80.00**
LA36 Decwriter EIA or 20 mA loop **£270.00**
MS11-JP Unibus 32kb Ram **£80.00**
MS11-LB Unibus 128kb Ram **£450.00**
MS11-LD Unibus 256kb Ram **£850.00**
PDP11/05 Cpu Ram, i/o etc **£450.00**
PDP11/40 Cpu, 124k MMU **£1,850.00**
RT11 ver 3B documentation kit **£70.00**
RK05-J 2.5 Mb disk drives **£650.00**
KL8 JA PDP 8 async i/o **£175.00**
M18E PDP 8 Bootstrap option **£75.00**
VT50 VDU and Keyboard — 20 mA **£175.00**
VT52 VDU and **RS232** interface **£250.00**

Give your **VT100** a Birthday!!!
Brand New **VT100** Keyboards
only **£85.00**

1000's of **EX STOCK** spares for **DEC PDP8, PDP8A, PDP11** systems & peripherals. Call for details. All types of Computer equipment and spares wanted for **PROMPT CASH PAYMENT**

MAG TAPE DRIVES

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.

CALL FOR DETAILS

COMPUTER/SYSTEM CABINET & PSU

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 screened and will deliver a massive **+5v DC** at 17 amps, **+15v DC** at 1 amp and **-15v DC** at 5 amps. The complete unit is fully enclosed with removable top lid, filtering, trip switch, power and run leds 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 for only **£49.95 + carr.** 19" wide 16" deep 10.5" high. Useable area 16" w 10.5" h 11.5" d.

Also available less psu, with fans etc. Internal dim. 19" w, 16" d, 10.5" h. **£19.95. Carriage £8.75**

66% DISCOUNT ON ELECTRONIC COMPONENTS

Due to our massive bulk purchasing programme, which enables us to bring you the best possible bargains, we have thousands of ICs, Transistors, Relays, Caps, PCBs, Sub-assemblies, Switches etc. etc. surplus to OUR requirements. Because we don't have sufficient stocks of any one item to include in our ads we are packing all these items into the **BARGAIN OF A LIFETIME**. Thousands of components at giveaway prices. Guaranteed to be worth at least 3 times what you pay. Unbeatable value and perhaps one of the most consistently useful items you will ever buy!!! Sold by weight.

2.5kls **£5.25 + pp £1.25**
10kls **£11.25 + pp £2.25**

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CURE those unnerving hang ups and data glitches caused by mains interference with professional quality filters **SD5A** match-box size up to **1000 watt 240 V** Load **ONLY £5.95**. **L12127** compact completely cased unit with 3 pin fitted socket up to **750 watts ONLY £9.99.**

EPROM COPIERS

The amazing **SOFTY 2** The "Complete Toolkit" for copying, writing, modifying and listing **EPROMS** of the **2516, 2716, 2532, 2732** range. Many other functions include integral keyboard, cassette interface, serial and parallel i/o UHF modulator ZIF socket etc **ONLY £195.00 + pp £2.50**
"GANG OF EIGHT" intelligent **Z80** controlled 8 gang programmer for ALL single 5v rail **EPROMS** up to **27128**. Will copy **8** 27128 in **ONLY 3 MINUTES** Internal LCD display and checking routines for **IDIOT PROOF** operation. Only **£395.00 + pp £3.00.**

"GANG OF EIGHT PLUS" Same spec. as above but with additional **RS232** serial interface for down line loading data from computer etc **ONLY £445.00 + pp £3.00**

Data sheets on request

1000's of other EX STOCK items including POWER SUPPLIES, RACKS, RELAYS, TRANSFORMERS, TEST EQUIPMENT, CABLE, CONNECTORS, HARDWARE, MODEMS, TELEPHONES, VARIACS, VDU'S, PRINTERS, POWER SUPPLIES, OPTICS, KEYBOARDS etc. etc. Give us a call for your spare part requirements. Stock changes almost daily.

Don't forget, **ALL TYPES and QUANTITIES** of electronic surplus purchased for **CASH**





IN WITH A BANG

Canon has added to its A200 personal computer range with the new A200 EX, a high power, high performance machine with built-in expandability that is not only highly compatible with the IBM AT, but faster.

This is due to the machine's 16-bit 80286 microprocessor with switchable clock rates of 6 or 8MHz, which allow large amounts of data to be processed in much less time.

With a 640Kbit RAM and 1.2Mbit floppy disc drive, the standard A200 EX configuration is more than capable for most needs. However, this can be expanded to 15.5Mbits with optional memory expansion boards, and either one or

two 40Mbit hard disc units can be installed, enabling a maximum of 81.2Mbits storage capacity.

In addition to ports for Centronics parallel and RS-232C interfaces, there are eight built-in expansion slots for system expandability, including six with 16-bit IBM AT compatibility and two with 8-bit PC compatibility.

Available with either a monochrome or colour monitor, the A200 EX HD40 with one 40Mbit hard disc is priced from £4,250.

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

2-WAY CONVERSATIONS

Two-way data conversations, communicating with two remote computers at the same time, are now possible with a unique new feature of Omnimux 2000, Racal-Milgo's dual-role data PABX and switching multiplexer.

The dual session feature allows users to be linked to two communications channels at the same time, switching from one to the other at the press of a key. Omnimux 2000 is alone in the data PABX field in permitting this.

Now users involved in long sessions with mainframe computers, who may have to wait for replies from one host, can fill in with secondary communications tasks, like reading or answering electronic mail, during pauses.

Alternatively, data coming down the line from one host can be manipulated or vetted then sent on to a second host during the same session.

The key to this new capability is Omnimux 2000's software program based construction. Plug-in software modules and slot-in hardware cards allow simple additions and enhancements to basic operation. A specialist team at Racal-Milgo is working constantly on new developments which will be made available to users at much lower cost than similar extras for hardware-only systems.

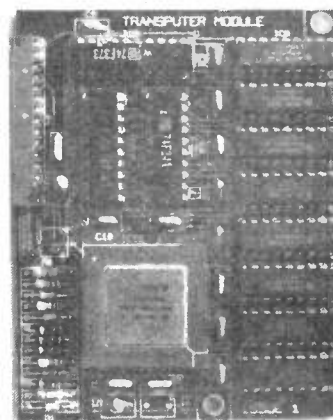
*Racal-Milgo Ltd,
Landata House,
Station Road,
Hook,
Hants RG27 9JF.*

TRANSPUTER MODULE

The Concurrent Technology TM1 transputer module offers OEMs, educational establishments and hobbyists the opportunity to use the revolutionary Inmos T414 transputer for a relatively small outlay.

The TM1 consists of a four-layer PCB, approximately 95mm by 74mm, on which is mounted an Inmos T414-15 transputer capable of up to 7.5 MIPS and 256K of high-speed DRAM. The module may be mounted vertically or horizontally on a suitable interface board, which may be a conventional double-sided PCB, or even a wire-wrap board, via a 15-way female connector.

The TM1 may be used on its own as a low cost transputer evaluation system; a PC interface card and a resident assembler will soon be available. OEMs wishing to enhance the performance of an existing product will also find it of interest because of its small size. It may also be used as the basis for a very powerful, compact, parallel-processing system; up to eight TM1s may be mounted



on a single eurocard, with support circuitry, giving up to 60 MIPS from a system that can be held in one hand.

The TM1 can be supplied with a 10 MIPS IMS T414-20 or the new IMS T800 (when available) as options. The latter (which includes an on-chip maths co-processor) will deliver up to 2.25 megaflops/sec.

Prices are as follows: 1-2 - £600.00; 3-5 - £500.00; 6-10 - £475.00.

*Concurrent Technology,
30 Baldslow Road,
East Sussex TN34 2EY.
Tel: (0424) 714790.*

THERMAL PRINTER

Rapid have announced the immediate availability from stock of IBM's compact personal printer, the Quietwriter.

The £1,160 machine employs non-impact thermal printing technology and produces letter quality text at speeds up to 60cps. The noise level of only 51dBA means that the printer is barely audible in normal office environments. It provides a wide choice of fonts and allows two different font styles to be mixed on the same document without stopping the printer.

Cut sheet paper from 76 to 381mm wide is handled by the Quietwriter's push-button controlled single sheet feed, while an automatic cut sheet feed or continuous stationery feed (for forms up to 368mm wide) are both available as options.

*Rapid Terminals,
Denmark Street,
High Wycombe,
Bucks HP11 2ER.*

PC PORTABLE

Olivetti has announced the UK launch of the M15, a new PC-compatible portable computer. Priced at £1,295, the M15 is a complete PC system configured to meet the market's demand for true portability, compatibility and functionality.

Weighing just 11lbs, including the integral rechargeable battery, the M15 is configured with an 80C88 processor running at 4.77MHz, 512K RAM, twin 720K 3.5in floppy disc drives, 80 x 25 character LCD display and 78-key detachable keyboard. Serial and parallel interfaces and a clock/calendar with battery back-up are standard M15 equipment. The price also includes a carrying case, the mains supply/battery recharge unit and tutorial software entitled *Getting to know the M15*.

*British Olivetti Ltd,
PO Box 89,
86/88 Upper Richmond Road,
London SW15 2UR.*

BETTER MORSE

Technical Software have recently released an improved version of their successful Morse Tutor program.

The program introduces the alphabet in easy stages and has comprehensive facilities for the student to learn the characters by ear. The pitch of tone used for sending can be varied from the keyboard and, with most computers, also the volume.

Random characters are used for initial learning and new groups of letters are introduced quickly to allow the student to become fluent in the whole alphabet as soon as possible. The program can send any amount the student wishes at any speed from 1 to 40wpm.

It is quite common for students to have problems with certain individual characters. To help with this, difficult characters can be typed in and the program will send them more frequently.

After each sending run, the copy can be checked so that any problems can be quickly identified and corrected. As speed increases, the characters are broken up into random length words, to train the student to recognise the inter-word gaps.

In order to preserve the rhythm of the Morse, when sending at slow speeds the program sends the character at 12wpm and follows it with a pause of the correct length to achieve the desired overall speed.

When the alphabet has been learnt, the figures are introduced and, if required, common punctuation marks. Again, these are learnt by ear and practiced using random characters, though for these the 'word' length is fixed at 5 characters.

When the student has reached test speed on random characters, he or she can prepare for the plain language test by having the program send the 40 pre-recorded texts supplied with it. It is also possible to have someone type in a text for sending. The program deliberately does not provide any facility for the student to send. Computer programs do not teach this well and

BELLS AND WHISTLES

Icom's latest HF transceiver, the IC-761, is now available from Thanet Electronics. It is an all-mode transceiver which features an internal aerial tuning unit and ac power supply. The ATU boasts a 3 second band selection and tune up with a VSWR matching of less than 1.3:1.

DX hunters will be attracted to the 100kHz-30MHz general coverage receiver and 105dB dynamic range. Frequency selection is by the main VFO or via the front panel direct access keypad.

Other features include passband tuning, IF shift, notch filter, noise blanker, preamp and attenuator.

For the CW operator there is an electronic keyer, 500Hz filter and full break-in (40wpm).

The IC-CR64 high stability crystal is standard, as is the



CI-V communications interface for computer control. Twin VFOs and split mode for crossband contacts are provided, and the IC-761 features program scanning, memory scan and mode select scan, and the 32 memories can store frequency and mode.

The transceiver's operating system is held permanently in ROM and is not dependent upon the lithium battery. The

cell is used for memory back-up only. A meter gives PO, ALC, IC, VC, COMP and SWR readings.

The IC-761 HF transceiver with ATU/PSU retails at £1,999 inclusive.

*Thanet Electronics Ltd,
Sea Street,
Herne Bay,
Kent CT6 8LD.
Tel: (0227) 363859.*

unchecked keying is likely to produce bad sending habits difficult to correct later. Using a friend to check sending is very much to be preferred.

The program is available for BBC-B, Electron, Spectrum, CBM64 and VIC-20 (plus at least 8k), at £6 on tape and £8 on BBC or CBM64 disc. Owners of the previous program can get a 50% discount by sending their old program as part exchange.

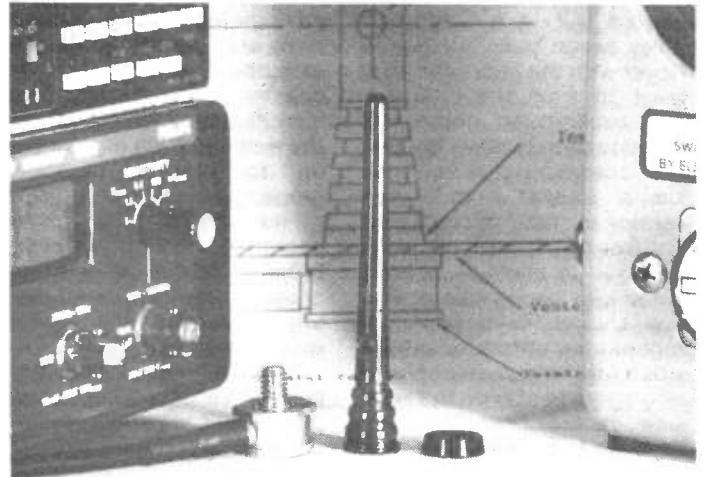
*Technical Software,
Fron,
Upper Llandwrog,
Caernarfon,
Gwynedd LL54 7RF.
Tel: (0286) 881886.*

ANTENNA AWARD

Cellmaster, a roof-mounted cellular carphone antenna, has won Les Wallen Manufacturing Ltd of Ramsgate, Kent a 1987 British Design Award.

Because of its dramatic reduction in size, the Cellmaster is very discreet. The 3½ inch high mast will not resonate in the wind and can be left in position during car washes. It is also vandal-proof as it is difficult to get a firm enough grip to bend or dislodge it.

Shape and size were con-



sidered a high priority by the Design Council. Size is related to frequency – the higher the frequency, the smaller the antenna. The increased diameter gives a greater bandwidth than conventional antennas (a 70MHz range from 890 to 960) and no matter what channel is in use,

the performance will not vary. The shape is not only aesthetically pleasing but also lends itself to good bandwidth.

*Les Wallen Manufacturing,
Unit 1, Trinity Place,
Ramsgate,
Kent CT11 7HJ.
Tel: (0843) 582864.*

HANDS FREE

Few can doubt the danger of driving along in a vehicle with one hand on the steering wheel and the other clutching a microphone. The popularity of cellular radio has resulted in new clauses within the Highway Code forbidding hand-held microphone oper-

ation whilst on the move.

For some months Waters and Stanton have been experimenting with various microphones in an effort to find one that was neither attached to the driver's body nor an obstruction to his vision. As a result they have introduced the Adonis FX-8.

PRODUCT NEWS

This microphone has the unique feature of being mounted several feet away from the operator on the dashboard or sun visor. The unit comprises a highly directional microphone unit fitted with back to back electret capsules, and comes with all the necessary hardware for mounting. Unlike normal noise cancelling microphones, the output of each capsule is fed into separate amplifiers that are driven back to back and only the difference signal, ie the operator's voice, is fed to the transceiver.

The ambient noise level is virtually eliminated. A control box with up/down buttons that fits to the gear stick completes the line-up and has an output level control to match the transceiver. The only extra needed is a suitable microphone plug for the transceiver in use.

Extensive tests have been carried out in a somewhat noisy seven year old Range Rover with the microphone at least 3ft from the operator. The background noise was found to be extremely low and the received signal sounded similar to that from a conventional fist microphone. The freedom from flying leads attached to one's body combined with 'hands free' operation should make this microphone an attractive proposition for the mobile operator who wants to stay on the right side of the law. The microphone is priced at £69.95.

*Waters and Stanton,
18-20 Main Road,
Hockley,
Essex SS5 4QS.
Tel: (0702) 206835.*

ASTRID RETURNS

Eighteen months ago a revolutionary satellite Earth station, ASTRID (Automatic Satellite Telemetry Receiver and Information Decoder), was launched, at an all in price of £149.

The system enabled BBC B and Spectrum 48K computer owners to automatically access the educational scientific satellites UoSAT 1 and UoSAT 2, and display the masses of scientific news and data. ASTRID now works with

all the Spectrum computers (48K upwards), all the BBC range (model B upwards) and costs £129.57 + VAT. It also works with the Amstrad range of computers when the correct Amstrad serial port and extra software is used.

Extra software is available for BBC and Spectrum computers. Graphs can be produced from the 'whole orbit data', the telemetry can be fully decoded without using look-up tables, satellite orbits can be predicted and displayed over maps, and on Spectrums even the UoSAT 1 pictures can be displayed.

*SRW Communications Ltd,
ASTRID House,
The Green,
Swinton, Malton,
North Yorkshire YO17 0SN.
Tel: (0653) 697513.*

COILS AND CAPACITORS

Telecomms, specialists in communications equipment, have announced the release of a new British made roller coaster coil. It has been manufactured in response to the demand for a high quality unit to cover the 1.8-30MHz range.

The RC26 has been designed to sit between 250pF and 500pF capacitors to make a low cost 1 kilowatt all band antenna tuning unit.

Also available are two high power variable capacitors, the TC500, 13pF-500pF, and

AUDIOKITS

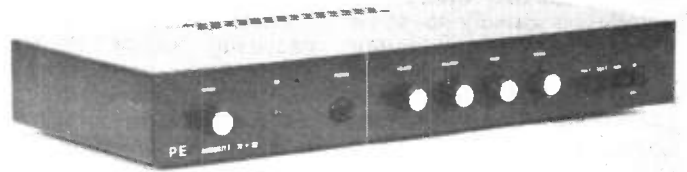
Audiokits have introduced two new audio amplifier kits to their range.

The PE 30+30 is a slimline integrated amplifier which incorporates tone controls, two tapes with dubbing both ways and a switched mike socket. The kit is available for £140.

The Everyday Electronics Apex preamp and power project is expected to be available shortly.

Audiokits have also introduced a range of bulk foil resistors which are manufactured to high standards of accuracy with low internal capacitance and inductance and a very low temperature coefficient.

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



NEW-LOOK SOCKET

The universal Combicon/filter from Feller of Switzerland is now available from Rendar. This new product combines a filter and IEC 320/CEE 223-pin plug connector, and also houses fuses of either European or North American dimensions, allowing connection of a cordset and fuse.

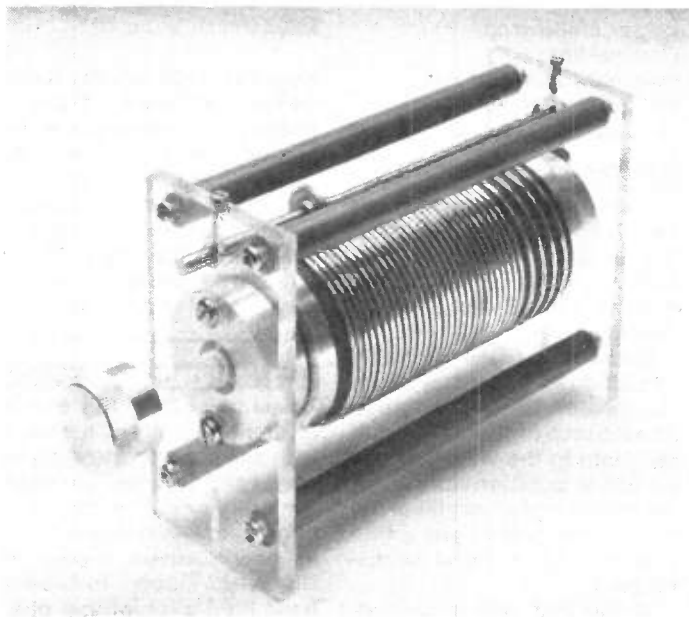
Additional flexibility is afforded by a new construction with spring lugs, which provides a snap fitting into the equipment housing, eliminating the need for securing screws.

Approved to SEV, VDE, SEMKO, UL and CSA specifications, the unit incorporates a broadband filter rated for 1, 3, 6 or 10A for effective protection against supply-borne interference and radio interference suppression.

Connection to the unit, which is housed in a metal enclosure with climatic classification to DIN 40040:HPF, is provided by quick-disconnect contacts. Screw mounting is available as an option.

A version of the Combicon socket is available without filter if required.

*Rendar Ltd,
Durban Road,
South Bersted,
Bognor Regis,
West Sussex PO22 9RL.
Tel: (0243) 825811.*



STOP SNORING!

The world's first anti-snoring device has been launched in the UK. The product, known as Snoozer, claims 90% success in stopping snorers snoring.

Snoozer, which has been developed in collaboration with researchers throughout Sweden, is a high technology based 'snoring alarm' for

those for whom snoring is a social or medical problem. Over 20,000 Snoozers have been sold in Sweden since its launch there at the beginning of the year.

It is estimated that there are 16,000,000 individuals who snore in the UK and of that number at least 2,000,000 are chronic snorers.

The device consists of a

canister the size of a card pack into which is sealed a microphone, an electronic controller and vibrator. The device is placed under the pillow of a bed and three to five consecutive snores sets it off. Snoozer then starts vibrating for one or two seconds and, as a result, the snorer turns over on his side and hence he stops snoring. Initially, the snorer tends to wake up before changing his sleeping position, but this quickly becomes a subconscious action. The Snoozer then becomes part of a good night's sleep in peace.

Snoozer costs £49.95 including VAT.

Prodatec Division,
Robotechnic Ltd,
19 Queen Street,
London W1X 7JP.
Tel: 01-499 9746.

SUCTION NOZZLE

Colo is a new and improved de-soldering tool which has

been specifically developed for working with highly sensitive components such as those found on printed circuits.

The introduction of a flexible suction nozzle at the point of contact with the component offers several distinct advantages, as it adapts to the profile of the solder point, protects against mechanical overload by absorbing the solder remover's recoil, and screens the intake of air. The melted tin is thereby removed quickly and effectively whilst reducing the thermal overload of the component.

The new Colo nozzle is economic in use, the only part which ever requires replacement being the suction tube, which may be carried out quickly and easily without the use of any tools.

KW Communications Ltd,
Vanguard Works,
Jenkins Dale, Chatham,
Kent ME4 5RT.
Tel: (0634) 815173.



DM 105 - Pocket DVM from

A meter to literally suit all pockets - including the one that holds the wallet!

Cirkit

Its small size offers easy one hand operation, with large, clear, wide-angle display. But small does not mean delicate: the DM105 can withstand a 12 inch drop without damage, due to its glass epoxy PC boards, shock mounted display and through thermoplastic case. Overloads are handled with similar certainty; the resistance range is protected up to 500 dc, AC voltage range to 800V rms and DC voltage ranges up to 1000V.

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Size: 130 x 75 x 28mm
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Accessories: Battery, test leads and manual.

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NEWS DESK

Winners in Fremantle

TV coverage of the recent America's Cup Race has revolutionised the popular image of yacht racing. Live action TV pictures, transmitted from on board the American yacht in the final, were transmitted to homes all over the world. This is the first time that such a broadcasting technique has been used on a yacht, adding a new dimension to spectator enjoyment of this skilled sport.

The camera system, Yacht-Cam, was designed by Northampton television company,

TV-2 Communications. It incorporates a dome antenna, developed and supplied by Marconi Communication Systems. TV-2 installed the camera on the 12 metre yacht, *Stars & Stripes*, at the request of Australian broadcaster, Channel 9, and American cable sports channel, ESPN.

A camera was mounted on the yacht's mast, facing aft, beneath the main sheet boom where it could capture the crew at work. Pictures were sent from the camera by cable to a microwave transmitter which was mounted on the

underside of the transom. The signals were then fed into Marconi's dome antenna and transmitted up to a helicopter circling overhead. Using a second microwave transmitter on a different frequency, the signals were re-transmitted from the helicopter to the America's Cup studios of Channel 9 and ESPN in Fremantle, Western Australia, from where live TV pictures were sent, via satellite, to all major broadcasters world-wide.

Because of the great demand for microwave frequencies, broadcasters did not learn which ones they would be using until two weeks before leaving for Fremantle. Marconi Communication Systems was therefore left very little time to develop an antenna to operate in the 2GHz band.

BT and satellite TV

British Telecom recently announced two major agreements to distribute UK television programmes by satellite into Europe.

British Telecom has signed an agreement with Eutelsat, the European satellite consortium, for up to eight of the transponders on the Eutelsat 2 medium-powered satellite due to be launched in late 1989.

British Telecom has also signed an agreement with Société Européenne des Satellites (SES) of Luxembourg for up to eleven of the transponders on their 'Astra' satellite due to be launched in 1988. These transponders would be accessed from the UK and carry a mix of English and other language programmes.

Both of these second generation satellites offer higher power, permitting reception on smaller antennas and substantially improving market prospects for companies producing TV programmes for distribution.

Reception is presently limited to about 10 million homes across Europe accessible via relatively large (3.7 metre diameter) antennas and local cable networks. The higher power of the new satellites would enable the TV companies to target community systems and indivi-

duals more effectively.

The greater power of the Eutelsat 2 and 'Astra' satellites should permit reception using dishes as small as 60cm in diameter in an area bounded by Edinburgh, Stockholm, Milan and Bordeaux.

Big Brother's watching

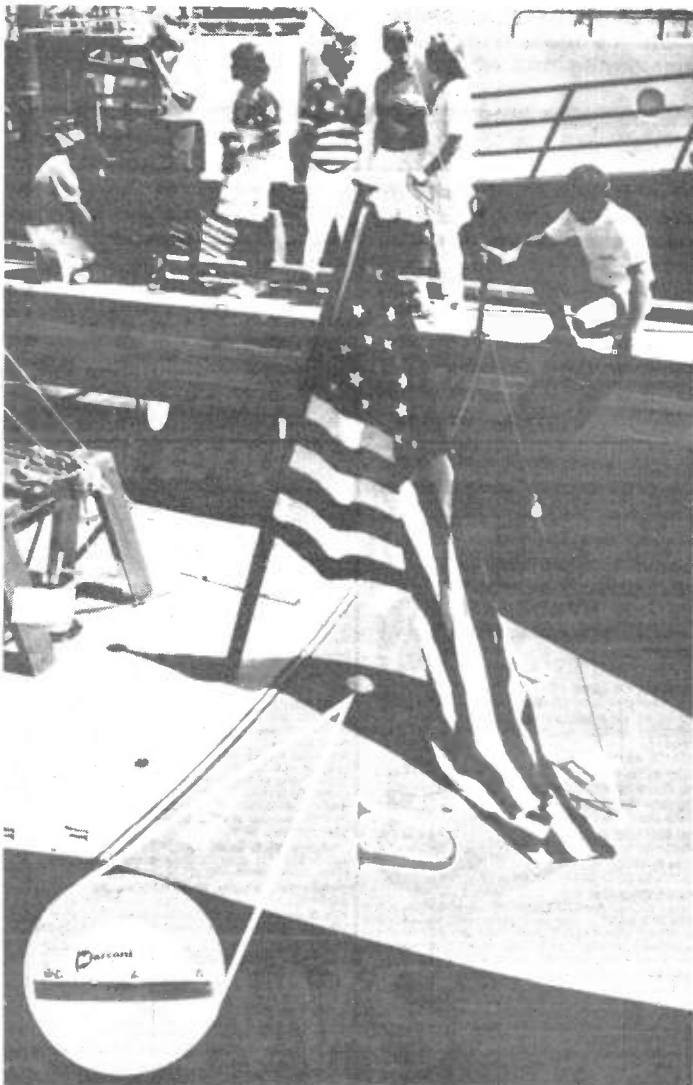
In 1986 the Department of Trade and Industry's Radio Investigation Service (RIS) contacted some 60,000 radio users about the licensing requirements of their radio transmitters and problems concerning reception and interference.

Much of the RIS's time is taken up inspecting stations and advising users on their operation. In 1986 over 10,000 new and established private mobile radio transmitter base stations were checked. Many installations were found to deviate in some respect from the licence conditions imposed to prevent users causing each other interference. Most of these problems were solved by the licensees responding to RIS advice and without disrupting services.

Under the Wireless Telegraphy Act 1949, unlicensed radio users can face fines of up to £2,000 and/or three months' imprisonment. The courts can also order forfeiture of the equipment used in the offence. During the year the RIS issued 2,800 formal warnings about unlicensed radio use, mainly to users of Citizens' Band radio, illegal cordless telephones, private mobile radio and marine radio. Continued unlicensed use resulted in 727 convictions, of which 601 were for CB misuse, 18 for the illegal use of mobile radio and 16 for the use of unapproved cordless telephones.

The RIS carried out 209 raids on 70 unlicensed 'pirate' broadcast stations and during the year 74 people were convicted for illegal broadcasting.

In addition to ongoing work, the RIS carried out two nationwide campaigns to counter licence evasion and abuse of marine radio and Citizens' Band, during which a total of 19,200 users were contacted.



Almost 5,000 reports from householders concerning television and radio interference and reception problems were dealt with during the year – a £21 charge is made to diagnose individual reception problems. Some 2,600 reports of interference and reception problems from business radio users were also handled by the RIS, the latter on a consultancy basis.

CableSat TV 87

The 1987 CableSat TV show takes place from 2nd-4th June at the Metropole Hotel, Brighton.

The exhibition will cover the complete range of antennas, cable and fibre optics, head-end equipment, testing and measuring equipment, on-screen services, programmes, satellite receivers and switching equipment, along with many other services. The popular 'Dish Farm' just along the promenade from the exhibition will feature the very latest in satellite dishes and, as in previous years, will supply live feed to the show.

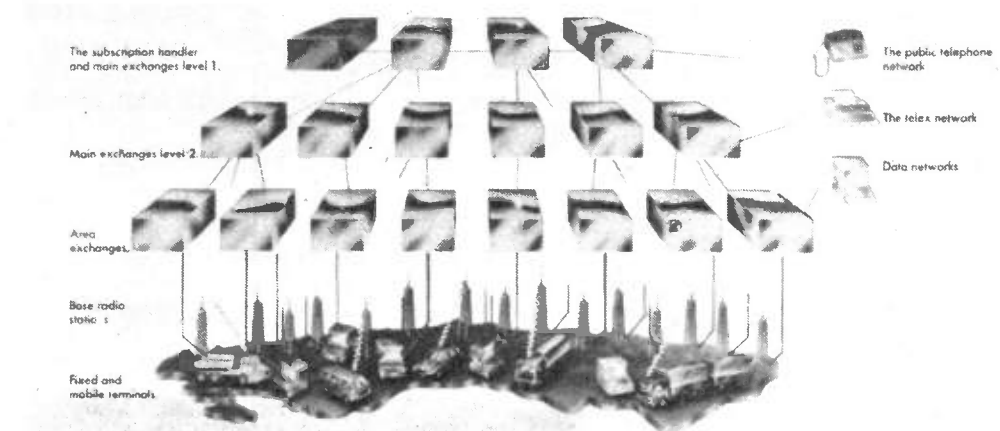
CableSat TV 87 is set to provide a meeting place for those involved in cable and satellite ventures to review their progress and to plan for the future. The growth of the show reflects the continuing mood of optimism in the industry as the potential rewards continue to outweigh initial investment costs. There is now intense competition within the industry between equipment manufacturers and suppliers, and between companies for customers and audiences. As concerted effort is also needed to compete with domestic television, emphasis is being placed on programming expertise and development.

For further details on the exhibition and seminars, contact Pam Howard at Online on 01-868 4466.

Swedish development

Sweden has launched the world's first public radio telecommunication network for text, speech and data.

The new network, called Mobitex, commenced commercial operation in October 1986. It began with communication between fixed



The Swedish public radio telecommunication network

and mobile terminals, and will later be extended to link with the existing telephone, telex and data networks.

Among the advantages offered by the new network are an improved frequency allocation system and reliable alarm procedures.

The main difference between Mobitex and other mobile telephone systems is its orientation towards text and data transmission. The packet method of digital communication used makes eavesdropping very difficult and, if necessary, it is easy to add encryption.

The service is expected to cover most of Sweden within two years.

Tele-X system approved

The EUTELSAT Assembly of Parties meeting in extraordinary session in Paris has approved the use of the Tele-X satellite network by Sweden and Norway. The assembly has thus endorsed the favourable findings of the Board of Signatories which, under the terms of the EUTELSAT Convention, had given prior consideration to the request for co-ordination presented by Sweden and Norway.

The board concluded that the public telecommunications services which would be provided to these two countries by the Tele-X satellite would not cause serious harm to the organisation.

First videophone

The first European videophone is about to be launched world-wide. The equipment has been

developed by the Finnish company Vistacom Industries Oy, and is able to compress a motion colour image to such an extent that it can be transmitted on a single digital telephone line at a speed of 64k bits per second. As a result, the biggest obstacle to the successful commercialisation of the videophone – high network cost – has been eliminated.

Vistacom's videophone consists of an image transmission unit called Video Codec-64 and a videophone terminal with built-in video camera and monitor. The Codec unit compresses the

motion colour image so that the information transmitted on the telephone line is 1/1500th of the picture's original content. This means that the system registers only the moving parts of the image, which it then transmits to the receiver's terminal.

Compared to equipment previously developed by a number of American companies, Vistacom Industries has succeeded in reducing the size of the equipment by one third. In addition, power consumption for the Finnish version is only 50W while the American videophones use approximately 1000W.



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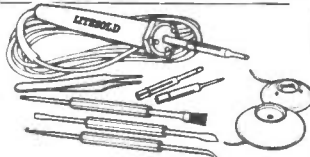


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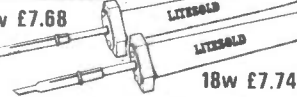
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Stainless steel element shafts. Screw-connected elements. Slip-on bits available from 1.6 to 4.7mm. LA12



model, 12w, 2.4mm bit. LC 18 Model, 18w, 3.2mm bit. 240v Std - 12v available. Presentation wallet.

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| LA12 | £1.00 | £1.71 |
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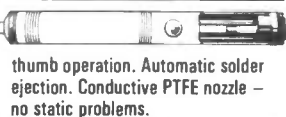


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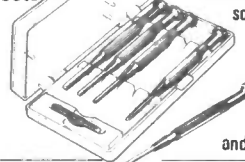
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SPECTRUM WATCH

by John Andrews

The title of a recent newspaper report, *Hunt for TV sex pirates*, came after late night transmissions of an unusual nature occurred in the Plymouth area. Viewers were treated to the sight of the 1982 BBC 'Christmas tape' featuring well-known broadcasters fluffing their lines, the banned 'Girls on film' mud wrestling video, Prince Andrew with naked Koo Stark and other delicacies not normally seen by a bored viewing public. The blame (or credit?) for these transmissions was first pointed at broadcast technicians, but was then transferred to a pirate 'using a home-made transmitter to feed the signal into a relay station used by Television South West'.

TV transmitter 'capture'

The broadcasts went out in the interval between TSW's regular close down and the shut-down of the transmitter, which normally occurs ten minutes after losing the carrier from the main station. In the past it was relatively easy to 'capture' a TV transmitter in this way - some funsters took over Hannington once and said they were from another (friendly) planet and had taken over the Earth. Nowadays, most relay stations look for a special code in the vertical interval (and strip it off) before allowing a signal to be retransmitted, but perhaps this technology is not used at Plymouth. Don't get any ideas, though; the penalties are a £2,000 fine and up to six months' imprisonment. On the other hand, a judge might welcome brighter programmes.

In case you have not heard of Christmas tapes before, these are entertainment programmes made by TV technicians out of all the blops, fluffs and other foul-ups recorded during the production of programmes. A trophy is awarded annually for the best tape made by the various ITV companies. Unfortunately these tapes do not normally hit the airwaves and the BBC has been banned by an over-sensitive management from participating in the last few years.

Marconi's major order

Marconi has won an order worth US\$60 million as subcontractor to Ericsson Radio Systems of Sweden. They will supply the Scimitar V combat net radio to the entire Swedish army and part of the navy. This will be a second generation frequency-hopping VHF combat net radio system, incorporating both voice and data communications.

Frequency hopping is a technique often used in advanced military systems, in which all transmitters and receivers change frequency rapidly. The changes follow a quasi-random sequence, which is in fact predetermined but impossible for the enemy to follow, thwarting any

attempt at eavesdropping. Ericsson now plans to export the complete system under the name Starcom.

War on illegal CPs hots up

CPs (cordless telephones to you and me) have never been more popular than at present, nor cheaper, but some of the really cheap ones are not a bargain. Tough new regulations have made it an offence to use any but the approved models, and as a result the ones using illegal frequencies are being dumped at silly prices. Unfortunately they are being bought by silly people who do not realise that the radio investigation teams are on their trail.

Taxi operator Michael Johnson of Kirby Cross, Essex was recently fined £160 with £65 costs for using an illegal cordless phone, which indicates to me

that his original cash saving was not worthwhile. Johnson did, in fact, make it easy for the RIS boys by forgetting to turn off the transmitter after demonstrating it to a potential buyer.

Many other users give themselves away by the very distinctive 49 and 70MHz dipole aerial array supplied with many of these phones. It looks like an old television 'H' antenna, only one leg is longer than the other - rather gives the game away!

Also, the phone calls interfere with the 70MHz amateur and military band and can be traced easily by listening to the names mentioned. Incidentally, up to now it was legal to buy and sell these illegal CPs, though unlawful to use them. Very shortly it will be against the law to import and sell them, thus ending a rather stupid situation.

No it isn't a tardis, but a British Telecom VHF radio-telephone station on a Welsh mountainside. The station was erected to supply telephone links to those off the beaten track in the vicinity, and is connected by cable to the main network. This solution is used in many remote situations, including off-shore islands



SPECTRUM WATCH

Cellnet extends to offshore islands

These days you can count the number of cars which *don't* have a cellular aerial, or so it seems. Anyway, the independent telephone operators in the states of Jersey and Guernsey, as well as Manx Telecom, have chosen Cellnet as the only cellular radio system on their islands. The service will be operated on a partnership basis, combining local knowledge with technical expertise from Cellnet, which is owned jointly by Securicor and British Telecom. Cellnet subscribers from the mainland will now be able to use their mobiles when visiting the islands or sailing in coastal waters.

You can in fact use cellular radio for long distances offshore – the sets work all the way to Calais and Boulogne – and some trawlers use them from miles out at sea. Indeed, a Cellnet user in the south of France saw the 'in service' light come on last autumn (it was during a tropo opening). He was so pleased that he rang home to tell the good news.

Stateside clever dicks

In order to claw back some revenue, most of the American satellite TV channels now employ scrambling to lock out freeloaders. The system most widely employed is the seemingly uncrackable 'Videocypher II', which employs the DES encryption system. Since it is an uncrackable system, the only way 'enthusiasts' (read 'cheats') have been able to make pirate descramblers has been to clone the software in existing, paid-for decoders. This was then incorporated into boxes sold commercially in Latin America and British Columbia, but not in the USA for fear of tough legal penalties.

Recently, satellite TV guru Bob Cooper held a weekend conference/rally for hobbyists at an offshore location. He announced in advance that he would have on sale EEPROMs with the magic software and this attracted enthusiasts like wasps to a honeypot. Much money changed hands at the early February event and then, would you believe it,

those enthusiasts were asked to turn out their pockets by customs officials on their re-entry to the USA.

General Instrument, who claim their software copyright is violated by these chips, had tipped off the US Customs, and rendered this weekend excursion distinctly unfruitful and even more expensive than anticipated for the participants! If your sympathies (and interests) lie with the hobbyists, you can dial USA area code (305) 771 0575 to listen to a three minute tape called Scramble-Fax. The prefix for the USA from Britain is 0101.

More bad lads

Why does everyone want something for nothing these days? Former *Spectrum Watch* scribe Nigel Cawthorne notes in his 'European Mobile Comms Report' that serious problems have developed on Holland's mobile phone system. The authorities are battling with crooks who are running up huge bills on stolen car phones and on equipment fitted with bogus numbers. This has reached such a proportion that the Dutch PTT has had to bar all calls outside Europe. This not only curbs the usefulness of the phones but also cuts off valuable potential revenue from legal users who wish to call the States and elsewhere.

Around 500 pirate sets are believed to be in use and the crooks are making recordings with scanners and then analysing the tone sequences to work out valid user codes. 'Naughty' car phones are then fitted with working numbers.

Airphones soon?

Racal Avionics have announced that technical tests of their satellite-based telephone service are scheduled for this spring. Commercial trials will follow during the summer on British Airways' Boeing 747s. Passengers will then be able to dial directly into public telephone networks on transatlantic flights, a development that is expected to have a

major impact on aeronautical telecommunications. Using a geosynchronous INMARSAT 'bird' and British Telecom's Earth station at Goonhilly, Cornwall, the system will extend both voice and data links to near world-wide coverage.

The airborne voice communications equipment is being developed by Racal-Decca at Walton-on-Thames and will use credit card payphones. It meets international standards and will also include data facilities for air traffic control, company communications and passenger facilities.

New satcoms for soldiers

British armed forces are to deploy a new satellite Earth station which can be carried and operated by one person. The MANSAT system, which operates in the 7 to 8GHz band, has been developed by Ferranti Electronics Microwave division and the Royal Signals and Radar Establishment. It will provide long-range patrols with a duplex satcom link to a base station or other MANSAT terminals and, since these use a narrow beamwidth and can be used almost anywhere, detection by an enemy will be difficult. The portable station weighs just 17kg and comprises two-way radio, data terminal, batteries and 46cm dish. A solid-state amplifier delivers power up to 2.5 watts.

REW

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AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

If you are fairly active on the 'local' amateur bands, such as Top Band, 80 or 40 metres, etc, you will no doubt have been asked for your WAB reference data. If you are not aware of the WAB scheme, you will be somewhat puzzled as to what this may be. The following information will enlighten you. The Worked All Britain Awards Group was founded by the late John Morris G3ABG, to promote a greater interest in amateur radio in Britain. The group promotes an awards programme, activity weekends, nets and so on. The award programme is based on the geographical and administrative divisions of Britain and the award scheme is open to both licensed amateurs and short wave listeners.

Great Britain and Northern Ireland are divided geographically into a grid system. In Great Britain this is referred to as the National Grid Reference (NGR) and in Northern Ireland as the Irish Grid. Both systems divide the countries into 100km by 100km grid squares, which are referred to as 'large squares'. On the NGR, these squares are given a two letter reference, eg HP, SP, TL, etc, and on the Irish Grid a single letter reference, C, D, G, H and J. The large squares are then broken down into 10km by 10km squares, which are given a two number reference, 00, 01, 02, etc. The large squares and the two number reference then gives the WAB area, eg SP38, TL00, J04, G82, etc. Great Britain and Northern Ireland are broken down for administrative purposes into counties. The boundaries of these counties are drawn up arbitrarily. The WAB area is then linked with the county, eg HP61 Shetland Isles, SP38 West Midlands, SS98 Mid Glamorgan, C82 Antrim, and so on. There are altogether more than 4000 WAB areas.

There are various WAB Awards available. The WAB Areas Award, for instance, is given for working WAB areas and there are six classes of this award, designated Bronze, Silver, Gold and so on. To win one of these awards, European stations must work 300, 500, 750, 1000, 1500 and 2000 areas. Non-European stations have lower requirements at 100, 200, 400, 600, 800 and 1000 areas. Then there is the WAB Counties Award, a Large Square Award and a WAB Overseas Award, as well as numerous others.

In order to help keep track of how one's

awards status is progressing, a WAB Record Book is available which lists each WAB area, county by county, together with a list of towns and villages in each area, into which one's contacts can be entered. Claim sheets for the awards are supplied with the Record Book. WAB QSL cards and stickers and available and a regular newsletter is produced. Further information is available from Brian Morris G4KSQ, Burdell Avenue, Sandhills Estate, Headington, Oxford OX3 8ED.

Old-timers' association

We mentioned the Radio Amateur Old-Timers' Association a few months or so ago, reporting that it was originally called the British Old-Timers' Association and that it was founded in 1959, but had in recent years somewhat declined in activity. It was formally re-established in April 1985 and is now affiliated to the RSGB and to the Australian Old-Timers' Association.

Sylvia Havard G4USN is now its Hon Secretary/Treasurer. Membership is open to all persons who have been actively interested in amateur radio for over twenty-five years, either as a licensed amateur or as a short wave listener. A QSL card or a recommendation from another member is all that is required as proof of eligibility.

A journal, *OT News*, is now published quarterly, and is also available on tape on receipt of two 90 minute tapes. Its editor, Stuart Dodson G3PPD, would be very appreciative of any interesting articles for inclusion in future editions of *OT News*. Weekly nets are held on Thursdays at 11.00 and 19.00 clock time on 3765kHz plus/minus QRM under the callsign G2OT. The annual subscription is £4.00, running from 1st April each year, with a registration fee for new applicants of £2.00 which includes the badge. Applications should be directed to G4USN, Altonwood, 1 Merricks Lane, Bewdley, Worcs DY12 2PA.

The International Short Wave League

We also mentioned the re-establishment of the ISWL a short while ago, and we are glad to report that it is now going ahead well. Two issues of its journal, *Monitor*, have so far been produced and they make good reading. From the February issue, the last available at the

time of writing, we learn from the feature 'Amateur Bands Review', by John Fitzgerald G8XTJ that conditions on the amateur bands have been as follows: 1.8MHz produced a good crop of DX CW signals, viz, VE1ZZ, W1PL, W3GM and W4KQ, RB5ZB and RQ2GG, TK5VN and a good few near and middle Europeans. 3.5MHz produced FM5BH, HC5EA, KT5F, VE2JV, YB0DPZ and YV5IVI, all on SSB. 7MHz produced some really good SSB signals from such DX countries as JH, R10, UA9, VS6, VK and ZL, and even 21MHz has produced some decent SSB DX with J28DN, VU2GJ, ZS6BKK/P and 5H3RB.

The satellites

The Russian satellite RS1 continues to put in an appearance from time to time, not functioning as intended of course, but still sending the CW group '5015' when the sun and its solar panels are in the right position. It is six years since it was fully operational and it is interesting to note that even after this length of time it is still in a condition to be at least partly operational.

RS5 and 7 are still occasionally operational, even though their batteries appear to be quite useless now and they have to rely solely on current from their solar panels.

RS9 and 10 are reported to be ready for launching, but await a suitable opportunity.

Oscar 10 still has its transponder functioning, but as its controlling computer has ceased to function it cannot be controlled to conserve its power. Ground control stations have again requested that it should be used with the minimum ERP and should not be used during March and April, due to the sun angle giving insufficient illumination to the solar panels. They have also specified certain sections of its orbit during which it should not be used for transponder QSOs, again due to unfavourable solar panel illumination on these sections of the orbit. Some concern was caused at one stage when two high power ground stations, one in Germany and the other in Italy, took it upon themselves to 'police' the use of Oscar 10 by telling any station they heard to cease operation, which included your scribe! Whilst their motive was no doubt well intentioned, subsequent investigation showed that the

power they were using was so high that their activities were likely to do more damage to the satellite than good.

An interesting communiqué was received from one of the control stations which gives some idea of what appears to be happening on Oscar 10. On Tuesday 10th February, signals from Oscar 10 were excellent with the general beacon giving a steady tone. On the 11th, the GB was on but was sending a frequency modulated tone. This was the same on the 12th. The next day, both the general beacon and the engineering beacon were on and running a PSK memory dump, which was not the result of any command signals from the controlling ground station, but appeared to be the result of lowering of the battery voltage under the current negative power budget with Mode B operation. On sending a *reset* command to Oscar 10, to the surprise of the controller it worked first go! The following day, voice communication was operative, but very distorted due again to lowering of the battery voltage as a result of the transponder loading. So, it seems to be a question of completely uncontrolled operation at present, with forebodings of it coming to the end of its useful life. What is particularly worrying is that at the

time of writing Oscar 10 has not been heard for three days!

AMSAT Phase 3C is ready for launching. This satellite is very similar in design and operation to Oscar 10, but has radiation hardened chips in its computers and improved screening.

News is beginning to come to hand about the French amateur satellite project ARSENE, of which little information has been forthcoming so far. It will have a linear transponder permitting multiple access by stations using transmissions including SSB, CW, RTTY and SSTV. Its design incorporates an original idea of partitioning the transponder passband into 25kHz segments so as to limit the effects caused by those stations who continue to use excessive power to access the satellite. The transponder is equipped with an independent AGC on each 25kHz segment. Modes B and F will be used alternately. Mode B has an uplink of 435MHz and a downlink of 145MHz. Mode F has 435 uplink and 2446MHz downlink. Mode B and Mode F beacons will be carried. Discussions with Arianespace have taken place about launching possibilities. Either an Ariane 3 or 4 can be used as a launch vehicle.

UoSAT 1 has been off at times when its schedule would have indicated other-

wise, due to some intermittent faults on the control transmitter. Its 21MHz beacon has been operational. UoSAT 2 now has its digitalker operational on Wednesdays, and reports on this would be appreciated. Its 70cm beacon is on Sundays between midnight and 1200hrs.

JAS-1, or Oscar 12, is reported by some to be performing excellently, but by others as presenting numerous problems. It appears to require good ground station equipment to provide acceptable results - particularly a good receiving antenna system. Experiments being carried out by the control station in Japan also make its signals over in this part of the world erratic. It is said to be switched on only when it is in one of the Japanese sectors of its orbit at times, due to these experiments. So, if you cannot hear it, don't get too upset!

Rockall Island again

An expedition to this well-known rock was to have taken place last summer, but due to lack of transport it had to be called off. This was a pity, as such an expedition would have provided not only a new WAB square but also counted towards the 'Islands on the Air' Award. It is hoped to make another attempt during August 1987.

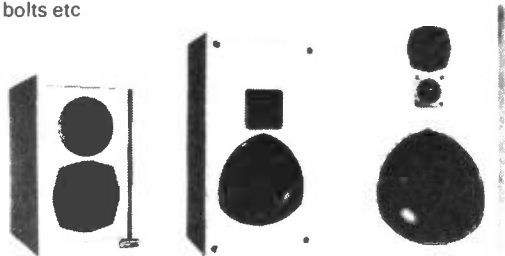
REW



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Considerable attention has been given to the circuit layout, which uses a double-sided pcb with extensive earth plane, star supply and ground feeds. The psu is regulated, even to the TO3 complementary output darlingtons, with secondary reservoir capacitors for each channel. All driver and pre-amp stages are de-coupled. All low level signals to the selector switch are kept in coax, not sprawled across the pcb as in many other designs. The only power wiring is from the rectifier to the pcb and directly from the output stage to the heavy duty speaker sockets.

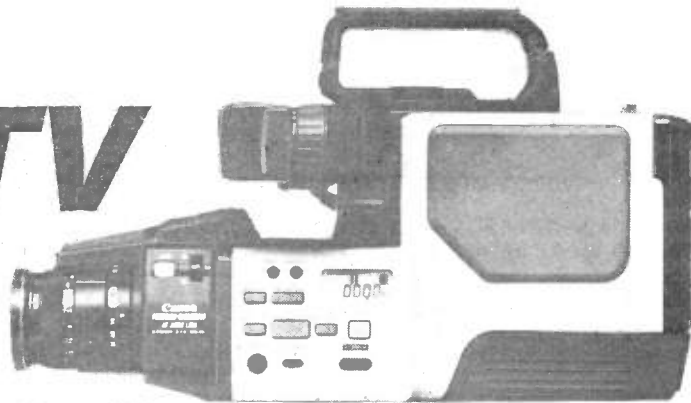
The design uses passive RIAA equalisation and tone controls with a tone cancel and subsonic filter facility. You can even introduce a subtle bass boost to compensate for loudspeaker deficiency. All inputs other than the MM or MC input bypass the front end pre-amp. The volume control is placed directly in front of the main amp, where the output overload fuse is included in the feedback loop. The MM input sensitivity is 2mV with a 29dB overload margin and 80dB S/N ratio ref full output, which is 40 watts per channel.

The case and pcb are manufactured to professional standard. The GATE ONE kit is £139.61 inc. but from 1st May this has to go up to £161.00. A fully built and tested GATE ONE is currently £179.86. Send for further details. PS The is not just a well engineered design, it sounds superb as well and offers unbeatable value for money.

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ATV



ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Two readers' letters this time, and both from abroad. Starting with D Dobricic YU1AW from the Yugoslavian amateur radio club, we learn that ATV is very much the flavour of the month there: 'Suddenly, we have a very interesting and exciting opportunity for our future ATV activity. Every few weeks we are getting permission to broadcast programmes devoted to amateur radio and other technically inclined programmes, on one of the commercial channels (usually UHF 43).' He goes on to say that they use non-professional tape formats, in other words VHS and Beta, and really they could do with a time base corrector. It all sounds great fun.

From even further away, in Warsaw, Stanislav Pazur brings us up to date on ATV activities in Poland. There are just two magazines for hams, *Radioelektronik* which everyone can buy, and *PZK Bulletin* which is only for members of PRV, the national radio club. Neither magazine publishes much on ATV (to date there have been just three articles, all on SSTV).

At the end of 1985 the Polish radio amateurs union, PZK, recorded 6,462 licensed amateurs, 1,817 SWLs and 560 club stations (80 being RTTY stations). An ATV club was founded in May 1985 called Polski Związek Radiowideografii, the Polish Radiowideographers Union. Founding members were SP2JPG, SP3CMX and SPLRS, with Wojciech Cwojdzinski SP2JPG as president.

The first ever station authorised for SSTV was SP3ZHC from Zielona Gora, and using the special event callsign SP0PIR she hooked up with OZ3WP on March 3rd 1980. Since then SSTV operation has expanded and between 15 and 20 stations are active (one is a club station). There are no fast-scan stations and the shortage of RF valves and semiconductors is the reason for this.

The second meeting of the Radiowideograph club was held in Leszno on May 10/11th last year; around 100 amateurs attended. Jurgen Y23NE was also present as a guest from Germany. A special event station, SP0RVG, operated during the meeting. On Polish TV's second channel there is

now a monthly programme for radio enthusiasts. Its main goal is to popularise HF and VHF activity, and special station SP6TVP operates during the programme. SP6ARR, who works for TV Poland, is the presenter. What a shame we have no regular programmes for radio and TV enthusiasts on British TV.

Technical matters

Not everyone who reads this column is a member of the British Amateur Television Club (BATC). Indeed, I know there are a lot of folk whose interest is mainly in DX-TV or RTTY or whatever, but who still like to keep up to date with the ATV scene. So, I make no apology for including some BATC news from time to time. A promising development is the formation of a technical committee, which will promote new advances as well as formulating technical specifications and policy.

The fact that we ATVers have managed to do without such a body up to now seems to me to indicate that ATV is without the bureaucracy which affects (or infects) some other branches of the hobby - thank goodness! All the same, we are now reaching the stage where, like it or not, our hobby is getting more and more technical, and some agreed standards are essential. Just sticking with the standards originally laid down by the pioneers may not be the best solution (I think everyone now realises that FM is far superior to AM for microwave TV), and for an example of organised technical chaos just look at the various so-called standards for colour SSTV.

The aims of the new BATC technical committee will include:

- Devising a television transmission technique compatible with the present state of the 70cm band (think about it!)
- Establishing bandplans for all amateur bands up to 24GHz for television repeaters, simplex and links usage
- Investigating the optimal antenna and polarisation requirements for TV repeaters (some folk are having second thoughts)
- Investigating the need for higher power limits for ATV repeaters and

beacons

- Standardising the use of the vertical blanking interval for such uses as low-speed data, callsign identification and remote control

- Promoting the practice and policies of non-interfering operation

I think all this is good stuff and we can all look forward to the results of this work.

New product

In recent months, Microwave Modules have extended their range of microwave television equipment with a model operating in the 13GHz band. No, it's not for ATV use but intended for surveillance TV operations. However, the techniques employed are of interest.

The video transmitter consists of an oscillator producing a signal on approximately 1.625GHz (ie one eighth of the output frequency) which is frequency modulated by the video waveform. This oscillator is followed by two stages of amplification, after which the output is divided into two separate parts.

The first of these passes to a three stage multiplier to the 13GHz output frequency, which is then applied to a two stage GaAsFET amplifier to give an output power of 200mW. The second oscillator output is applied to a series of high speed dividers from which a square wave of 128 milliseconds period is derived. A further square wave of 128ms period is obtained from another series of dividers driven by a crystal oscillator operating in the 8MHz region. The phase of the two square waves is compared, any divergence producing an offset voltage which is applied to correct drift in the 1.625GHz oscillator (this same technique is also used in some 23cm ATV transmitter designs, and doubtless in much other microwave equipment).

The receiver comprises a two stage RF amplifier at 13GHz followed by a hot carrier diode mixer, the local oscillator being applied via a multiplier chain and deriving from a crystal oscillator in the 74-82MHz range.

The IF output signal at 1.5GHz is subsequently converted to 123MHz, and finally to 36.5MHz, where it is applied to a phase locked loop demodulator. The resulting video signal is then amplified to a level of 1V peak-to-peak. Further details can be obtained from Microwave Modules in Liverpool.

Colour transcoding on the cheap

For many moons it has been the desire of some video enthusiasts to transcode from PAL to SECAM or vice versa, but the cost of this operation has put them off. In France Sony produced a budget transcoder which took PAL or NTSC in and produced from this SECAM 50 or 60Hz, but this cost nearly £1,000. Other devices, such as the ones produced by Michael Cox, were much more expensive...

ATV ON THE AIR

All this has changed now and a glance in the advertisements of, say, *Television* or the professional video production magazines will turn up several PAL to SECAM (and vice versa) machines for well below £200. What has caused the drop and what can ATVers do with them?

Price crash

The price crash is due to a combination of greater demand and the degree of integration now possible in solid-state circuitry. The old Sony gadget I mentioned is a large box full of discrete components and preset controls; nowadays you can do this all on one chip assembly! Both methods work just as well, but there is less to go wrong with the single chip approach.

An example is the Philips TDA3592A integrated SECAM to PAL transcoder. This produces a true PAL signal so it can

be used with all types of PAL decoders. It can therefore be used in monitors, VCRs and TV receivers. The complete module is a board about two inches square, containing the integrated circuit, a crystal, two presets, a few capacitors and a delay line.

The workings

Horizontal and vertical SECAM signals are identified by an on-board identification circuit. If PAL signals are received they are passed directly to the chroma output, while if SECAM signals are received the PAL path is automatically switched off and the SECAM signals are fed via a limiter/amplifier to a SECAM demodulator. After demodulation and clamping the signal proceeds through de-emphasis, blanking and re-insertion circuits to the PAL modulator, which produces the required PAL signal.

A power-saving feature operates when the supply voltage falls below 5 volts; in this mode the SECAM processing shuts down but the non-SECAM (PAL and black and white) signal path remains active. The 24 pin module operates from a 12 volt supply, consuming 90mA current typically.

Some transcoder applications for amateurs are receiving SECAM DX and amateur transmissions with a PAL-only monitor, also producing, say, SECAM colour pictures to send to France when you have only a PAL source.

The gadgets are also useful if you have two VCRs (one being multi-standard) and you wish to make SECAM copies of a PAL recording.

More ideas?

Any other ideas? If so, write and tell me! I'll see you next month ...

RAW

Three large parcels recently arrived from Canvey Island, and when I opened them guess what? They were full of 934 goodies. I thought it was my birthday a month early until I had a phone call from Mike 'Selectronic' Machin saying that they all had to come back (if I could resist the temptation to buy them!).

The point of this little exercise was to acquaint me (and thus you) with some interesting new products just in at the Essex emporium. The products are listed below and a review of each follows.

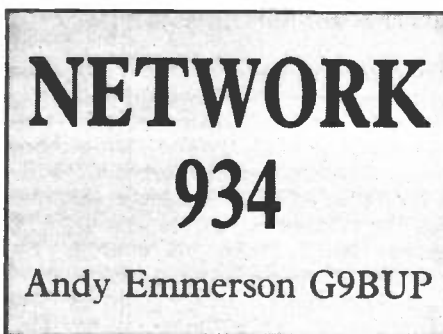
- Selectronic/Jacom PA11 base station collinear antenna.
- Corona SWR903 VSWR and power meter.
- Welz SP930 VSWR and power meter.
- Puma Sky Fly low noise preamplifier.
- Tandy PRO2004 scanner receiver.

All of these products are new on the UK market, so let's run down the list.

Big stick

The PA11 is one of a range of collinear antennas intended for base station operators who are looking for all-round DX operation. Because of the very high gain of these antennas, close-in performance is traded for the best DX, but you may well not notice any drop-off. The PA11 has 11 half wave dipoles which achieve 9dB gain over a dipole and it costs £73.50. The PA18 has 18 elements for 12dB gain (£96.50), while the PA28 uses (you guessed it) 28 elements (15dB gain) and costs £135.00.

Construction of the sample antenna looks very sound and is the normal black rod with an orange cap. The finish of the metal parts was absolutely superb and the only disappointment is the use of an SO239 (UHF series) connector. An N-type would have been better from an SWR viewpoint and is entirely waterproof. In this case you will have to get hold of a very good quality PL259 (try the Greenpar or Radiospares examples) and



bind it tightly with co-ax seal tape afterwards.

Little boxes

I have already remarked on the finish on this Japanese equipment – it is up to instrument quality, almost like jewellery. The delightfully named Sky Fly preamp is superbly turned out with its neat lettering and little LEDs. Anyway, it is intended as a mobile preamplifier and could also be used in the shack where a masthead unit is inconvenient. Gain is specified as 20dB maximum, which I don't understand; this figure is a little more than is desirable, but it would certainly perk up a deaf receiver. It reverts to straight-through mode if the power fails. I think that's what the Japano-English 'instructions' mean! Puma also make amateur equipment and have a good reputation in this field. The price of the preamp is £99.95.

Two meters

Yes, I did intend two meters, not two metres. They are in fact two power/VSWR meters and it is interesting to compare two manufacturers' attempts at the same product.

Corona's product is all in one brushed aluminium box and measures power in two ranges, 8 watts and 40 watts, as well as VSWR. Female N-type connectors on

the rear of the case connect to the transceiver and the antenna feedline.

Welz chose the alternative approach of separating meter movement and measuring head, allowing the latter to be 'remoted', as the Americans say. This may be much more convenient in a mobile situation and in many shacks, since it may not be convenient to route thick antenna feeder back to the dashboard or front shelf of the shack. All you need on view is the meter dial and switches, with the rest tucked away out of sight (and reach, probably).

Power ranges

The Welz meter again has a VSWR scale and two power ranges (10 and 50 watts this time). It also has a nifty dc volts function to check the car battery or shack supply. You can also illuminate these scales. Smart, huh?

Both meters have their plus points: the Welz is much more versatile but looks a bit plastic, while the Corona looks much smarter and has the advantage of being solid and heavy. You pay your money and make your choice – the Corona costs £59.95 while the Welz costs an extra £10, but is still excellent value for money.

Super scanner

Many scanner enthusiasts have up to now ignored the offerings from Tandy. The early models were nothing to write home about, but starting with the little hand-held, their specification has improved to match the best. The new PRO2004 will make a lot of people very happy and save them money too.

Most people consider that a new scanner nowadays requires a full-range machine, covering from around 50MHz to the top end of cellular radio. Above this the microwaves begin, and unless you especially enjoy decoding the Morse code idents of TACAN and VORTAC

beacons, or tracking down rare amateur activity through 23cm repeaters, you are probably not fussed about having coverage right up to 1300MHz. That said, there were only four scanners around to satisfy the full-range enthusiast – now there are five!

The price is something else!

The AR2002 and MX8000 both cover 25-550 and 800-1300MHz in AM/FM (around £490), the FRG9600 covers 60-950MHz with SSB as well (about £500 for this version), while the R7000 goes all the way to 2000MHz (but costs £919). Against these the new Tandy offers 25-520 and 760-1300MHz with AM and wide and narrow FM modes (not SSB though). The price is something else as well at £399 (not £325 as in the Tandy catalogue – this is incorrect).

So, here we have a scanning receiver almost £100 cheaper than the nearest competition – and it's great! Let's dispose of its only two weaknesses compared with the AR2002/MX8000 straight away – it does not have a tuning dial nor a press button keypad. Instead you have just a membrane keypad, but it's a good one as these go. There is a proper positive tactile 'click' feel as you touch a key.

Unlike any other scanner, you have an amazing 300 channels for storing listening frequencies you have already chosen. These are in ten scan banks of which any or all banks can be scanned. Ten frequencies located during search can be stored in channels on the monitor bank, while a direct search function enables you to start a search from the displayed frequency on the scanner.

Good looks . . .

The PRO2004 is neatly styled in matt black plastic, with a sloping front panel. The display is black LCD numbers on a blue fluorescent panel, and is the clearest I have yet seen on a scanner. The readout can be dimmed when desired. There is a built-in 220-240 volt ac power supply (very handy) and you can



The Realistic PRO2004 scanner

also run it off a 13.8V dc supply. There is scope for battery back-up of memory and a battery alarm beep.

Rear panel connections comprise antenna (BNC), external speaker, and high impedance output for tape recorder and power supply. There is also a 10dB attenuator which can be switched in. On the front panel is a 3.5mm jack for optional headphones.

. . . and performance

A telescopic antenna is supplied and I tested the review sample both with this and with a roof-top gain antenna. Checking 934MHz and cellular, I was surprised how much came in, even with the little whip indoors. With a proper aerial system results were very creditable . . .

'It's just about as sensitive as a Delta 1', said Mike on the phone, 'which is not bad going. Many scanners tail off above 900MHz.' So I had to check this out, because many 934MHz enthusiasts would like a scanner for quickly monitoring the band without tying up the main transceiver.

I found the PRO2004 to be slightly down on my Delta 1, though any difference in

performance is noticeable mostly on really weak signals. The PRO2004 did also 'invent' some spurious cellular signals in the middle of 934MHz, but of course it does not have the same filtering as a custom 934MHz transceiver.

However, it outperforms the FRG9600, which often stops one 12.5kHz channel either side of a strong 934 or cellular signal, so one up to the PRO2004.

User functions

When it comes to memory facilities and other user functions this receiver is in a class of its own, and if you take into consideration the price it's superb. Tandy undoubtedly has a winner on its hands and I imagine there will be long queues for it once the word gets around. Remember, you read it here first, and if your local Tandy shop cannot help, remember that Selectronic also stocks these.

No more handsets

What they don't stock is the hand-held rig for 934MHz – not any more. All stocks have sold out and I hear that secondhand examples are selling at premium prices. Well, well . . .

REW

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INTRODUCING PRACTICAL ELECTRONICS

by Alan Pickard

Electronics is in itself a vast and complex branch of electrical engineering which may be studied up to degree level and beyond, using lots of very involved mathematics. For our purpose we will look at electronics at the least complex level possible and confine any maths to simple explanatory arithmetical calculations. Any further study requirements must be sought in specialist electronics books.

The difference between microelectronics and electronics is that the former term is associated with integrated circuit devices such as microprocessors and their associated peripheral devices. Microelectronics is a term generally used to describe the behaviour of digital systems which make extensive use of the IC devices comprising a microcomputer system. Microelectronics deals with the hardware (and micro-hardware) and also the software (programming) which drives it.

Electronics is concerned with electronic circuit behaviour in detail and includes digital and analogue devices. These devices, for example a single transistor, are referred to as discrete (not discreet!) components as opposed

to those circuit elements which are integrated, or collected in an IC package.

An appreciation of some basic electronics is essential to anyone contemplating, for example, interfacing even the simplest device to a microcomputer, such as a switch or LED (light-emitting diode).

An understanding of the behaviour of components such as resistors, diodes and transistors is invaluable, as is the ability to make calculations from a simple formula.

Ohm's law

As well as being a basic principle of electrical engineering and physics, Ohm's law is a fundamental 'tool' of electronic theory at any level.

Ohm's law provides a simple relationship between voltage (or electromotive force) across a circuit or circuit element, the current (electron flow) through a component and the resistance property of the component or circuit to the flow of current.

The Ohm's law equation is simply:

$$\frac{V}{I} = R$$

where V is in volts (V), I is in amperes or amps (A) and R is in ohms (Ω). Thus the ratio of the voltage to current is directly related to the resistance. For convenience, it follows that $V=IR$ and also $I=V/R$, providing an individual expression for each quantity.

Before taking a look at resistance and resistors, it is useful to clarify the following:

- Voltage occurs across a component.
- Current passes through a component.
- Resistance is a fixed quantity which determines current flow for a given voltage.

Resistors

Figure 1 shows the circuit symbol for a resistor which is connected across a supply voltage of 5 volts dc. The polarity of the supply may be denoted as positive (+) and negative (-) but the less positive side is usually referred to as zero volts (0V). In other words, the voltage (sometimes called potential difference) is connected across the resistor. This is sometimes also referred to as a 'volts

drop' across the resistor.

If the resistor had a resistance value of 10 ohms and a volts drop of 5V occurred across it, we could calculate the current flowing using Ohm's law. Using $V/I = R$ and $V/R = I$, then $I = 5/10 = 0.5$ ampere = 0.5A. If the resistor had a much higher value, which is more usual, for example 10,000 ohms or 10k Ω , then the current through it would be less for the same voltage across it (5V). As $I = V/R = 5/10000$, then $I = 0.0005A = 5mA$ (1mA = 1 milliampere = one thousandth of an amp).

Resistors required for construction purposes will usually be supplied in packets with the resistance value marked on them. The resistors themselves are not usually marked with numbers, but use a system of colour-coded bands to denote their value. Details of this system are given in the appendix.

Resistors are widely used in simple circuits and interfaces and provide the means of setting voltages (producing volt drops) and also limiting the flow of current in a circuit.

The potential divider circuit

In Figure 2, circuit (a) duplicates the basic principle of Figure 1a, but includes a simple current calculation circuit. Circuit (b), however, consists of two resistors in series. Calculation shows that the same current flows through each resistor, which should be expected in a

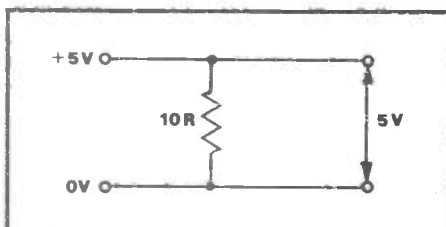


Fig 1a A resistor connected across a supply and drawing current

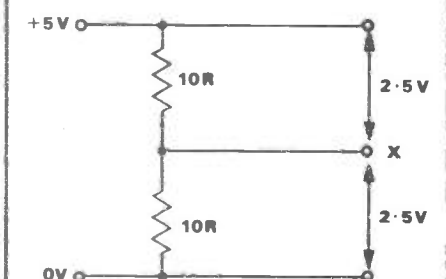


Fig 1b Two resistors acting as a potential divider to produce a portion of the supply voltage

Appendix - Identification of resistors

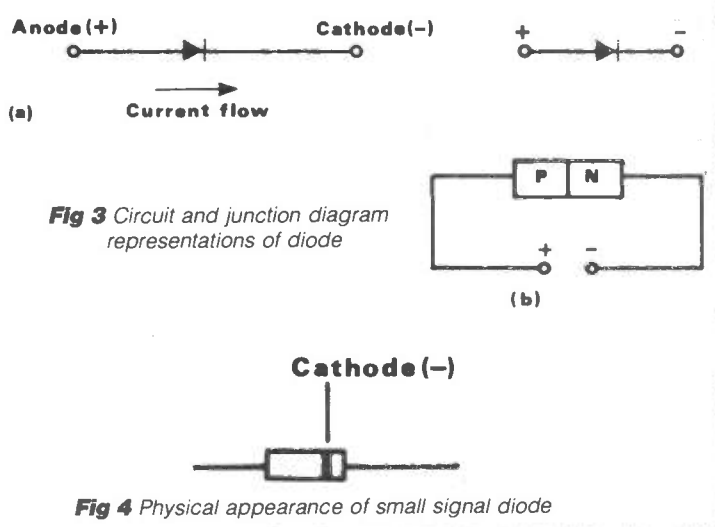
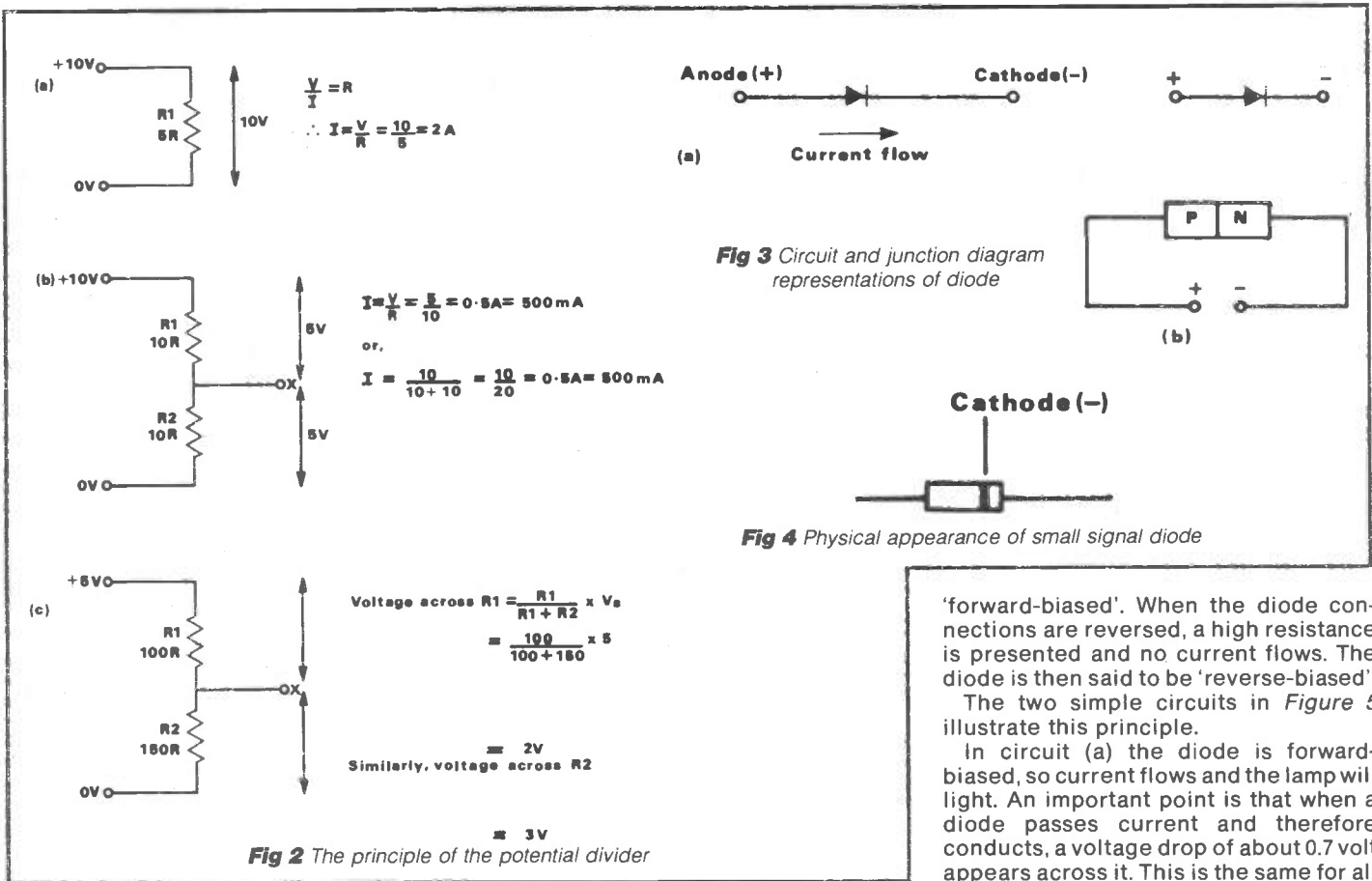
Resistors are usually colour coded as follows:

| | | | | | |
|--------|---|--------|---|-------------|------------|
| Black | 0 | Green | 5 | Tolerances: | |
| Brown | 1 | Blue | 6 | Brown | $\pm 1\%$ |
| Red | 2 | Violet | 7 | Red | $\pm 2\%$ |
| Orange | 3 | Grey | 8 | Gold | $\pm 5\%$ |
| Yellow | 4 | White | 9 | Silver | $\pm 10\%$ |

A typical resistor can be seen in Figure 16. The resistance value would be $27 \times 10^3 = 27,000\Omega = 27k\Omega$ or 27k

Note: Resistors usually have 'preferred' values in a series such as 27, 33, 39, 47, 56, etc

Also, 2.7 Ω may be written 2R7
 1 Ω may be written 1R0
 47 Ω may be written 47R
 3.3k may be written 3K3
 5.6M may be written 5M6
 (M = megohm = $10^6\Omega$)



'forward-biased'. When the diode connections are reversed, a high resistance is presented and no current flows. The diode is then said to be 'reverse-biased'. The two simple circuits in Figure 5 illustrate this principle.

In circuit (a) the diode is forward-biased, so current flows and the lamp will light. An important point is that when a diode passes current and therefore conducts, a voltage drop of about 0.7 volt appears across it. This is the same for all silicon diodes, and is known as the forward volt drop.

In circuit (b) the diode is reverse-biased and therefore does not conduct. If no current flows, then the volts drop across the diode is virtually the whole of the supply voltage, 6V. This is because the diode has a very high resistance compared with the lamp resistance which is very low.

We can now look at a simple circuit consisting of a resistor and a diode and make use of the principle of the potential divider shown in Figure 2.

In this circuit (Figure 6), the diode is forward-biased and therefore has 0.7 volt dropped across it. It follows, then, that as the sum of the voltage (or volt drop) in a series circuit must add up to the total supply voltage across the circuit, the volt

series circuit. Perhaps more importantly, it should be realised that the volts drop across each resistor of the same value is the same, and is half of the total supply voltage. The volts drop could in fact be calculated as a proportion (half) across each resistor.

This principle is then used for circuit (c), where this time the two resistors do not have the same value. The ratio of resistance is 100:150: or 2:3. Therefore, the voltage will be proportionally dropped across each resistor, in accordance with Ohm's law. The larger the resistance, the larger the volts drop. Thus 2V appears across R1 and 3V across R2. This can be checked by doing current calculations as in (b).

Diodes and LEDs

Following our instant introduction to and mastery of voltage, current and resistance we can now press on to semiconductor diodes.

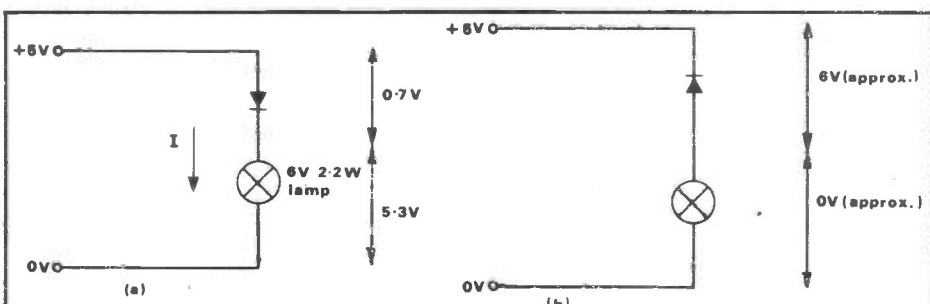
Unlike a resistor, which is a passive device, the diode performs a function, depending on how it is connected in a circuit. The diode is a polarised device and also an active component. Another way of describing the diode is as a semiconductor two-terminal device formed by creating a junction between two types of semiconductor, namely p-type and n-type silicon. This device will pass current easily in one direction, but

hardly at all in the reverse direction.

The diode can be represented as shown in Figure 3, with its physical construction as in Figure 4. The arrow-head points in the direction of easy current flow. This is a general rule for the circuit symbols of all semiconductor devices.

In the absence of polarity markings, the diode polarity may be tested using a multimeter set to the ohms range. A low resistance should be measured in one direction and a high resistance in the other.

If a diode is connected with its anode (+) to the positive terminal of a dc supply and its cathode (-) to the negative terminal, this presents a low resistance path and current will flow through the diode. The diode is then said to be



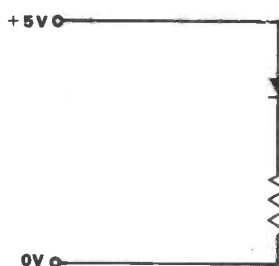


Fig 6 Diode resistor circuit

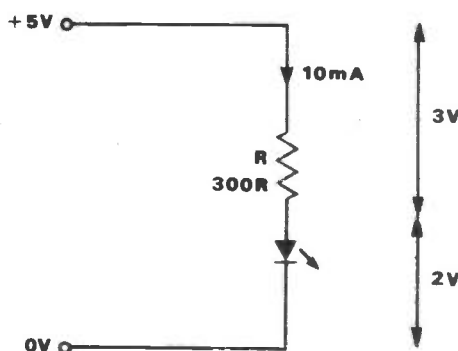


Fig 8 LED in circuit

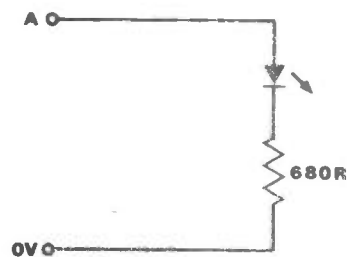


Fig 9 Sourcing LED current

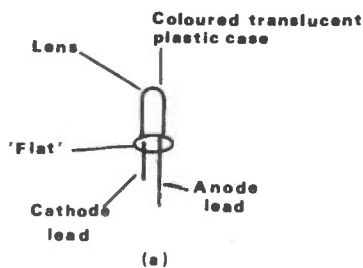


Fig 7 LED physical appearance and circuit symbol

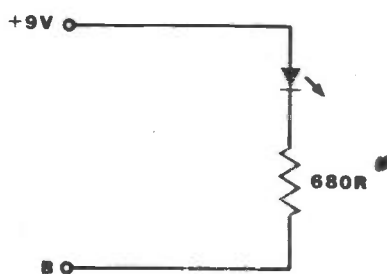


Fig 10 Sinking LED current

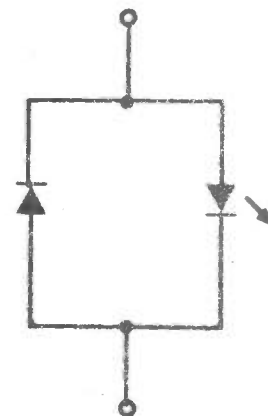


Fig 11 ac operation of LED

drop across the resistor must be $5 - 0.7 = 4.3$ volts.

The current through the circuit can be calculated if the resistor value is known, in this case it being $1k\Omega$ or 1000 ohms.
 $V/I = R \quad I = V/R = 4.3/1000 = 0.0043 = 4.3mA$.

Thus if 4.3mA flows through the resistor, then the same current is flowing through the diode. The volts drop across the diode is fixed at 0.7V, so the current is determined by the value of the resistor. If the resistor value is changed, current through it and the diode will be altered. A given diode has a maximum current rating and so the resistor value must be chosen to ensure that this value is not exceeded, otherwise the diode will be damaged.

These points are particularly relevant when using LEDs (light-emitting diodes) in a circuit, but before examining LED circuits, we will look briefly at the LED itself.

The light-emitting diode

An LED is a junction diode made from the semiconductor gallium arsenide phosphide (GaAsP). When forward-biased it conducts and emits red, yellow or green light, depending on its composition. No light emission occurs on reverse-bias, which, if it exceeds 5V, may damage the LED.

The common LED must have an external resistor connected to it in series to limit the forward current. The

voltage drop V_f across a conducting LED is greater than that across an ordinary diode and is about 2V. A typical LED current is 10mA.

For a given supply voltage, R must be calculated as follows:

$$R = \frac{(\text{Supply voltage} - 2.0) \text{ V}}{0.01 \text{ A}} = \frac{V_s - V_f}{I_f}$$

For example, if $V_s = 5V$, $R = (5 - 2)/0.01 = 300$ ohms.

LEDs are used as indicators, especially in digital electronic circuits, to show whether outputs are 'high' or 'low'. In Figure 9, the LED lights when 'high' output (eg +9V) is applied to A (output is source of LED current). In Figure 10, the LED lights when 'low' output (eg 0V) is applied to B (output accepts or sinks LED current).

The advantages of LEDs are their small size, reliability, long life and high operating speed.

- Red - adequate light output at 5-25mA (I_f).
- Green/yellow - adequate light output at 10-40mA (I_f).

For ac operation, an LED must have a diode connected (inversely) across it in parallel (inverse parallel). This provides protection from reverse voltages $> 5V$. It must be approximately doubled (within its limits) by reducing the value of R.

Transistors as amplifiers

A basic understanding of transistor operation is also essential for simple

interfacing work. Again, detailed theory and mathematical treatment will be avoided, the aim being always to provide enough information to prevent the blowing up of transistors and possibly computer circuits!

The transistor is a semiconductor device which can act as an amplifier as well as a switch.

Although the interface circuits in this article use the transistor as a switch, it would give an incomplete impression of the usefulness of transistors if we did not look quickly at its function as an amplifier.

First of all, let us examine the basic properties of a transistor. A transistor consists of three layers of semiconductor material which are usually silicon doped with p-type or n-type material. There are two basic types of transistor. The npn is made up of a 'sandwich' of two layers of n-type semiconductor material with p-type material in the middle. The other type is the pnp.

The npn type is shown in Figure 12.

Although a transistor is similar to a diode it has three layers and therefore three terminals. These are called base, collector and emitter. Figure 12a shows the transistor's three layers and their connections, 12b shows the standard circuit symbol and 12c is a representation of the transistor as two diodes connected back-to-back. This is valid for the purposes of illustration and also indicates the different resistance values

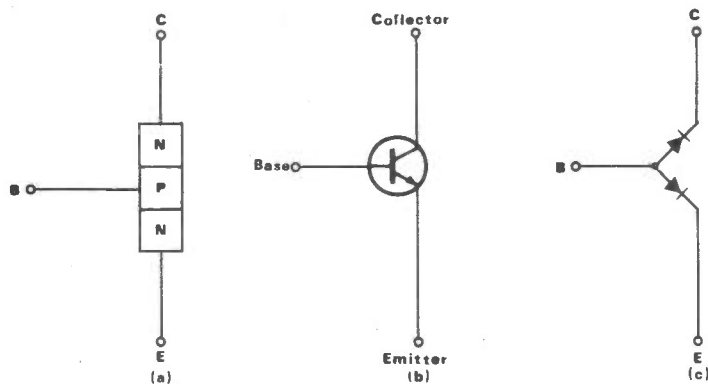


Fig 12 Junction, circuit and diode representation diagrams of npn transistor

which would be measured with a multi-meter on the ohms range.

As already stated, it is useful to look at the transistor as a simple amplifier and *Figure 13* illustrates this. This circuit shows an npn transistor connected in common emitter mode. This simply means that the emitter terminal is common to both input and output sections of the circuit. A voltage of 0.7V is connected across the base-emitter junction of the transistor, and this (pn) junction is described as being forward-biased, like the diode discussed earlier. Similarly, the collector-base junction is reverse-biased, the collector (n) at +6V and base (p) at +0.7V. Thus, the base is less positive than the collector.

Because the base-emitter is forward-biased, current will flow from base to emitter. This current is very small, say 0.05mA (0.00005A), and is usually designated I_b .

A fundamental action of a transistor is that when a base current flows, then a larger collector to emitter current flows. Thus a tiny base current of 0.05mA can produce a collector current of around 5mA, which is 100 times greater. This provides a very useful method of accurately controlling larger currents with smaller ones.

If no base current flows, then no collector current flows.

Transistors as switches

Digital circuits (those found in computers and switching systems) have inputs and outputs which are either of two voltage levels, referred to as 'high' and 'low'. In most cases the supply voltage is +5V and a 'high' is therefore +5V. A low is 0V. These voltage levels are also described as logic 1 (+5V) and logic 0 (0V). Thus all digital circuits work on the system of:

- +V and 0V
- +5V and 0V
- logic 1 and logic 0
- 1 and 0
- on and off

- high frequency and low frequency
- pulse and no pulse, etc

Perhaps confusingly, inverse logic is also encountered, where +5V may represent logic 0 and 0V logic 1, although this will be indicated for a given application.

We can now consider another simple circuit (*Figure 14*) to demonstrate the switching action of a transistor. The transistor is connected in the common-emitter mode as before. R_b is the base resistor which prevents excessive current flowing into the base (in other words, it limits the base current by a predetermined amount set by the value of the resistor). R_L is the load resistor, which in practice could be a motor or a relay coil.

The transistor is usually considered as a current operated device, but of course voltage levels exist in the circuit also. Switching circuits are concerned with voltages which represent logic levels or states.

In this circuit, if the required base current flows then the transistor is said to be saturated. At this point the transistor is conducting, or is turned ON. Perhaps surprisingly, if the transistor is ON this means that there is virtually no voltage drop across the collector-emitter junction. Therefore, at the output the voltage is zero (~0.1V). This means that when an input level causes base current flow, the transistor is turned on and the output level is logic 0. Conversely, with no input, and therefore no base current, no collector current flows and the transistor is OFF.

If the transistor is off, a voltage drop of

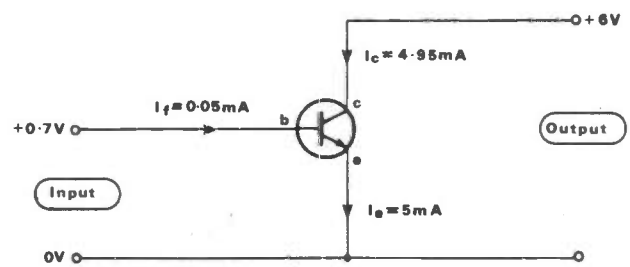


Fig 13 The transistor as an amplifier (current)

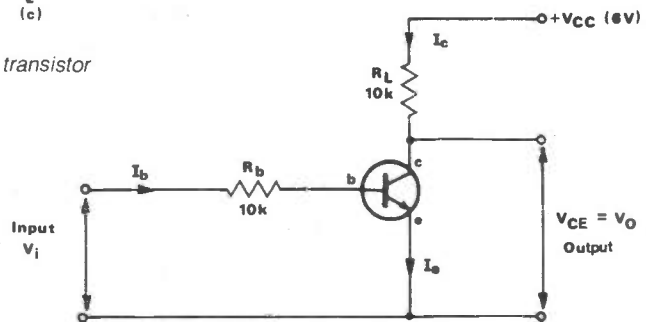


Fig 14 The transistor as a switch (voltage)

approximately 6V (less, actually, due to R_L) appears across the ce junction. Therefore the output is a logic 1. In a nutshell, an input logic 1 produces an output logic 0 and an input logic 0 an output logic 1.

This may not be what one might have expected, but it introduces another fundamental digital electronics principle, that of stage inversion.

Figure 14 shows the transistor in the common-emitter configuration or mode. This circuit produces an inversion of the input signal and is known as an inverter. A single transistor can therefore be utilised if it is necessary to change a logic level in a system.

Figure 15 provides a summary of transistor switching for both logic states.

Transducers

A transducer is a device which converts one form of energy into another. Although not always strictly an electronic device, it features largely in, or is connected to, many electronic circuits. An example would be a loudspeaker, which converts electrical energy into sound vibrations.

Other examples are the LED (electrical energy to light energy) and the electric motor (electrical energy to mechanical energy).

Digital logic

As we have already seen, digital circuits have only two levels, or states, represented by logic 0 and logic 1, open and closed switches, etc. Digital signals are different from analogue signals or

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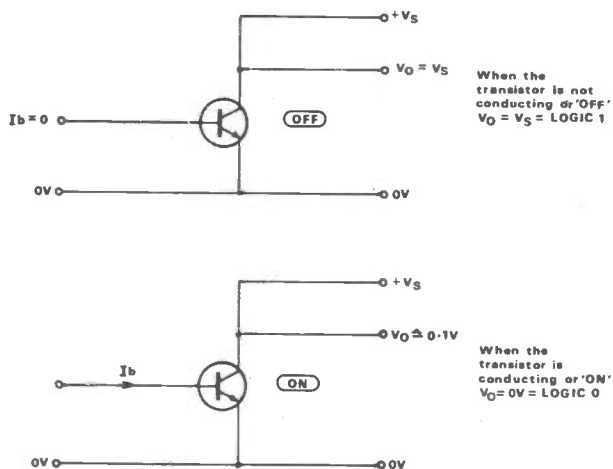


Fig 15 Summary of transistor switching

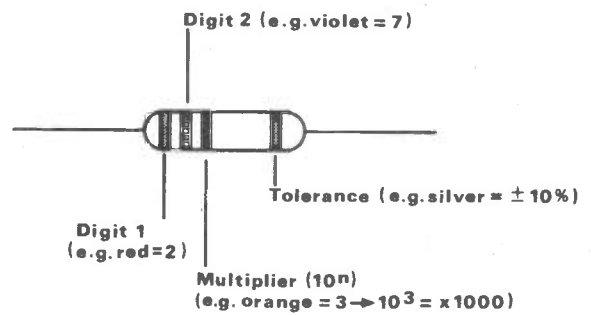


Fig 16

The next stage

In this article we have covered the basics of electrical and electronic theory, using Ohm's law as applied to resistors, diodes and transistors. To be able to build electronic circuits successfully, it is essential to understand these basics. In addition, other components such as capacitors and inductors need to be covered as well as digital circuits. A logical progression would then be the study of microprocessors and interfacing, which utilise the principles already covered. **REW**

quantities such as temperature, sound, etc. Analogue signals are continuously variable quantities.

In electronics, circuits which operate by switching from one state to another are called digital circuits and are said to use digital logic. In other words, electro-

nic logic is digital logic applied to electronic switching circuits.

Digital logic uses a special mathematical system known as Boolean logic.

Digital circuits in integrated circuit form will be considered separately in a future article.

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PRODUCTS FOR SATELLITE TELEVISION, AMATEUR RADIO AND PROFESSIONAL USE

DATA FILE . . .

Ray Marston looks at the Siemens 'IR60' infra-red remote control system

In last month's edition of *Data File* we outlined the basic operating principles of infra-red (IR) remote control systems and looked at applications of the range of ICs used in the Plessey 490/922 32-channel remote control system. In the present edition of 'The File' we continue the theme by looking at the range of devices used in the Siemens 'IR60' 60-channel remote control system.

System basics

The basic Siemens system is designed to give up to 60 channels of non-simultaneous remote control via a 6-bit code transmitted along an IR beam. The system comprises one 60-channel transmitter IC (the SAB3210), one infra-red preamplifier IC (the TDA4050) and one general purpose receiver/decoder IC (the SAB3209) that provides three analogue and three digital outputs plus a 4-bit parallel output and a 6-bit serial output.

Additional ICs include the SAB3211, which can convert the 4-bit parallel output into a 'channel number' display via a 9-segment (7 plus 2 segments) LED display, and the SAB3271, which is a complete receiver/decoder IC but gives (among other things) a 6-bit parallel output.

The SAB3210 transmitter IC

Figures 1 and 2 show the outline and block diagram of the SAB3210, an IC which is specifically designed to transmit a carrier-modulated pulse-coded IR signal. Figure 3 shows a basic application circuit in which this IC receives input instructions via an 8-row (inputs 1 to 8) by 4-column (inputs a to d) keyboard switch matrix: each key can thus be allocated a unique instruction number related to the matrix numbers (2d, 8a, etc).

Whenever a key is operated the IC detects the action and generates a start bit plus a unique 6-bit serial code word that is transmitted via the IR output stage. Note that the IC's negative supply line is connected via external transistor Tr1, which is activated via turn-on control pin 7.

To input an instruction to the SAB3210 a column input must be connected to a row input, thereby turning the IC on via pin 7 and Tr1 and causing a corresponding carrier-modulated pulse code signal to be transmitted via pin 8 and Tr2. Carrier modulation occurs at half of the clock oscillator frequency (typically about 60kHz) set by C2-L1-C3. The pulse code signal continues to be transmitted as long as an input switch is closed. When the switch is released this state is detected, and a unique end command (code 111 110) is transmitted.

When the IC is used in the simple manner shown in Figure 3, in which each code word corresponds to a 1-row/1-column matrix combination, a total of 32 basic code words (000 000 to 011 111)

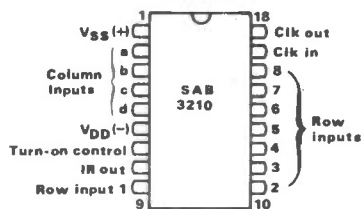


Fig 1 Outline and pin connections of the SAB3210 transmitter IC

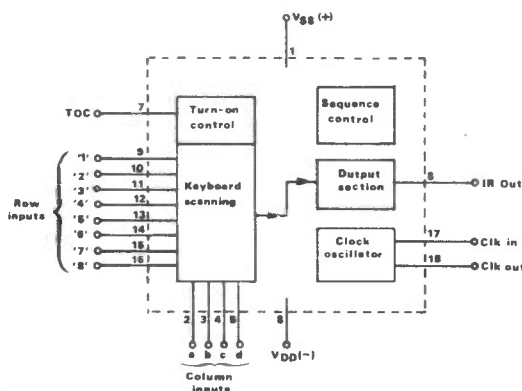


Fig 2 SAB3210 transmitter IC block diagram

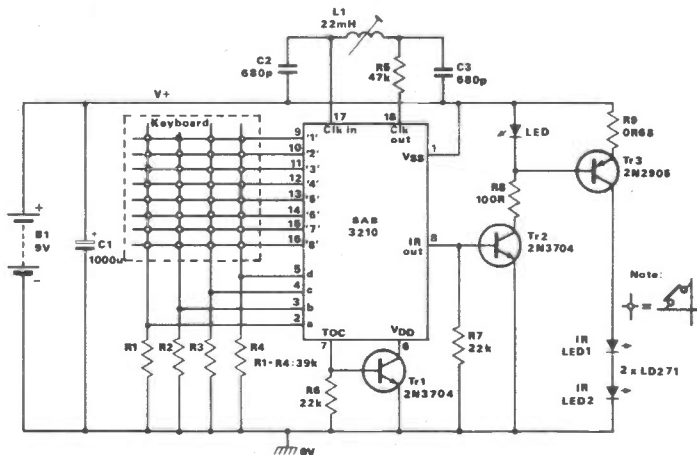


Fig 3 Simple 32 channel IR transmitter circuit

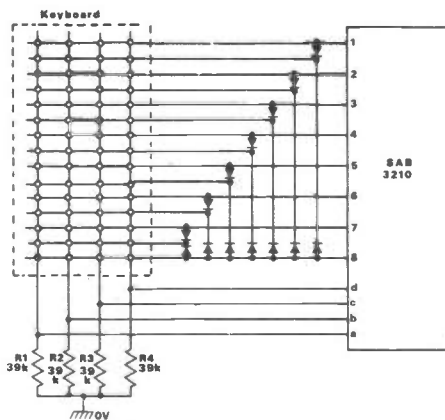


Fig 4 Modification to give 60 channel transmitter operation

DATA FILE

| Inst no | Key code | Serial code fed CBA | Function | Receiver output action |
|---------|----------|---------------------|--------------------|--|
| 0 | 1a | 000 000 | Normal position/on | Volume sets on 1/3, analogue 1 and 2 set to 1/2 RLA on |
| 1 | 1b | 001 | Quicktone | Volume sets rapidly to zero |
| 2 | 1c | 010 | Standby | Turns RLA off |
| 3 | 1d | 011 | Reserve 1 | RSV1 output switches alternately high or low |
| 4 | 2a | 100 | Program step +/on | Increments binary channel-select output by one step: turns RLA on |
| 5 | 2b | 101 | Program step -/on | Decrement binary channel-select output by one step: turns RLA on |
| 6 | 2c | 110 | On | Turns RLA on |
| 7 | 2d | 111 | Reserve 2/on | RSV2 output switches alternately high or low: turns RLA on |
| 8 | 3a | 001 000 | — | Not evaluated by SAB3209 receiver, but read out at its serial interface |
| 9 | 3b | 001 | — | |
| 10 | 3c | 010 | — | |
| 11 | 3d | 011 | — | |
| 12 | 4a | 100 | — | |
| 13 | 4b | 101 | — | |
| 14 | 4c | 110 | — | |
| 15 | 4d | 111 | — | |
| 16 | 5a | 010 000 | Channel 1/on | Sets binary output to 0000: RLA on Sets binary output to 0001: RLA on Sets binary output to 0010: RLA on Sets binary output to 0011: RLA on |
| 17 | 5b | 001 | Channel 2/on | |
| 18 | 5c | 010 | Channel 3/on | |
| 19 | 5d | 011 | Channel 4/on | |
| 20 | 6a | 100 | Channel 5/on | Sets binary output to 0100: RLA on Sets binary output to 0101: RLA on Sets binary output to 0110: RLA on Sets binary output to 0111: RLA on |
| 21 | 6b | 101 | Channel 6/on | |
| 22 | 6c | 110 | Channel 7/on | |
| 23 | 6d | 111 | Channel 8/on | |
| 24 | 7a | 011 000 | Channel 9/on | Sets binary output to 1000: RLA on Sets binary output to 1001: RLA on Sets binary output to 1010: RLA on Sets binary output to 1011: RLA on |
| 25 | 7b | 001 | Channel 10/on | |
| 26 | 7c | 010 | Channel 11/on | |
| 27 | 7d | 011 | Channel 12/on | |
| 28 | 8a | 100 | Channel 13/on | Sets binary output to 1100: RLA on Sets binary output to 1101: RLA on Sets binary output to 1110: RLA on Sets binary output to 1111: RLA on |
| 29 | 8b | 101 | Channel 14/on | |
| 30 | 8c | 110 | Channel 15/on | |
| 31 | 8d | 111 | Channel 16/on | |

Fig 5 Relationship between Tx key codes and Rx actions on the 32 basic instructions

can be generated. An additional 28 words (100 000 to 111 011) can be generated by using (with the aid of steering diodes) a 2-row/1-column key combination in which '8' always forms one of the two rows, as shown in the 60-key circuit of *Figure 4*. Here, two diodes are needed for every 4 additional instructions, with each diode pair connected to one other row and a set of column switches, so that actuation of a key connects two rows to one column. In practice, circuit reliability can be enhanced by externally biasing row 8 (and all other used rows) high via a 220k resistor wired directly between the positive supply line and the relevant row pin.

The SAB3210 transmitter IC is specifically intended to be used in conjunction with the SAB3209 receiver IC, and the table of *Figure 5* shows the relationship between the transmitter key codes and the receiver actions, using the basic 32-channel instruction set. *Figure 6* shows the 28 additional actions that can be obtained by using the 60-channel instruction set of *Figure 4*. Note that the SAB3210 IC can, in fact, generate a total of 64 different serial codes, but that four of these codes (instruction numbers 60 to 63) cannot normally be used.

Transmitter waveforms

The SAB3210 transmitter IC is a very sophisticated device and generates a fairly complex output signal, with the general form shown in *Figure 7*. Whenever a keyboard switch is operated the IC checks that only a single switch has been closed and then, after a 20ms 'debounce' delay, transmits a suitably coded command signal. This signal has a typical duration of 10ms and is repeated at 120ms intervals so long as the keyboard switch is closed. When the switch is released a final 'end' command signal (code 111 110) is generated, and all transmission then ceases.

Figure 8 shows the general details that apply to each command signal (assuming the use of a 60kHz clock oscillator frequency), but with specific details related to the 6-bit code word '100110' (reading from F to A). The command starts with a 0.5ms 'pre-signal' pulse, which simply advises the receiver circuitry that a code signal is about to be transmitted. Roughly 3.5ms later a 0.5ms 'start bit' pulse is transmitted, and is followed by six 0.5ms pulses which form the 6-bit code word by using a so-called 'biphase' modulation technique. What happens here is that the transmitted code signal carries imaginary 'markers' at 1ms intervals: a 0.5ms pulse immediately following a marker repre-

Fig 6 Relationship between Tx key codes and Rx actions on the extension instructions

| Inst no | Key code | Serial code fed CBA | Function | Receiver output action |
|---------|----------|---------------------|-------------|--|
| 32 | 81a | 100 000 | — | Not evaluated by SAB3209 receiver, but read out at its serial interface |
| 33 | 81b | 001 | — | |
| 34 | 81c | 010 | — | |
| 35 | 81d | 011 | — | |
| 36 | 82a | 100 | — | |
| 37 | 82b | 101 | — | |
| 38 | 82c | 110 | — | |
| 39 | 82d | 111 | — | |
| 40 | 83a | 101 000 | Volume + | Increases volume output level Decreases volume output level Increases analogue 1 output level Decreases analogue 1 output level |
| 41 | 83b | 001 | Volume - | |
| 42 | 83c | 101 | Analogue 1+ | |
| 43 | 83d | 011 | Analogue 1- | |
| 44 | 84a | 100 | Analogue 2+ | Increases analogue 2 output level Decreases analogue 2 output level Not evaluated by SAB3209, but available on SAB 4209 receiver |
| 45 | 84b | 101 | Analogue 2- | |
| 46 | 84c | 110 | Analogue 3+ | |
| 47 | 84d | 111 | Analogue 3- | |
| 48 | 85a | 110 000 | — | Not evaluated by SAB3209 receiver, but read out at its serial interface |
| 49 | 85b | 001 | — | |
| 50 | 85c | 010 | — | |
| 51 | 85d | 111 | — | |
| 52 | 86a | 100 | — | |
| 53 | 86b | 101 | — | |
| 54 | 86c | 110 | — | |
| 55 | 86d | 111 | — | |
| 56 | 87a | 111 000 | — | Not used Not used 'End' instruction Not permitted due to ambiguity |
| 57 | 87b | 001 | — | |
| 58 | 87c | 101 | — | |
| 59 | 87d | 111 | — | |
| 60 | — | 100 | — | Not used Not used 'End' instruction Not permitted due to ambiguity |
| 61 | — | 101 | — | |
| 62 | — | 110 | — | |
| 63 | — | 111 | — | |

sents a logic 1 bit, but a 0.5ms pulse starting 0.5ms after a marker represents a logic 0 bit. Thus, the biphasic signal shown in Figure 8 equals (reading from F to A) code word 100110.

Note from Figure 8 that each transmitted 0.5ms pulse signal is modulated at 30kHz (half of the clock oscillator frequency), with a 1/4 duty cycle, ie so that the pulse is switched high for one quarter and is switched low for three quarters of each 30kHz cycle period. Thus, since each command signal comprises eight 0.5ms pulses (giving a total command pulse period of 4ms) and a 1/4 duty cycle is used, each command signal is switched high for a total of only 1ms. Also, since each command is repeated at intervals of 120ms, it can be seen that the *mean* current consumption of the IR transmitter output stage equals only 1/120th of the *peak* transmitter output current. This IR transmitter system is thus highly efficient.

Preamplifiers

In the IR receiver unit, the transmitted IR signal must first be detected and amplified via a suitable preamplifier circuit before being fed to the input of the SAB3209 receiver/decoder IC. This preamplifier circuit must be a fairly sophisticated design; it must be frequency selective (to specifically respond to the IR code signal tone) and must provide very high signal gain (to give good long-range operation), but must not saturate when the transmitter is held very close to the receiver.

Figures 9 to 11 show the practical circuits of three suitable designs. Note that each of these preamplifiers must be mounted within a screened case, to minimise interference from unwanted electromagnetic signals.

The Figure 9 design is based on a CA3140 op-amp and a number of readily available discrete components. Here the basic IR signal is detected via infra-red diode IRD1 and is then selectively amplified via Tr1, the op-amp, and Tr2. To protect the circuit against signal saturation R1-R2-D1 and C2 prevent the Tr1 bias point from shifting under heavy drive conditions, and D2-D3 clip the levels of the op-amp output signals to prevent overdriving of following stages. The values of C2-C3-C4-C5 and C7 are chosen to make the preamplifier reasonably frequency selective (to 30kHz), thereby ensuring a good low-noise figure.

The Figure 10 and 11 designs are based on the TDA4050, an 8-pin dedicated IC that provides high overall signal gain (up to 100dB) combined with an integral AGC system that is automatically activated (to eliminate saturation problems) by the 'pre-signal' pulse in each transmitted command signal. In use, the TDA4050 is made frequency selective by wiring an external twin-T R-C network between

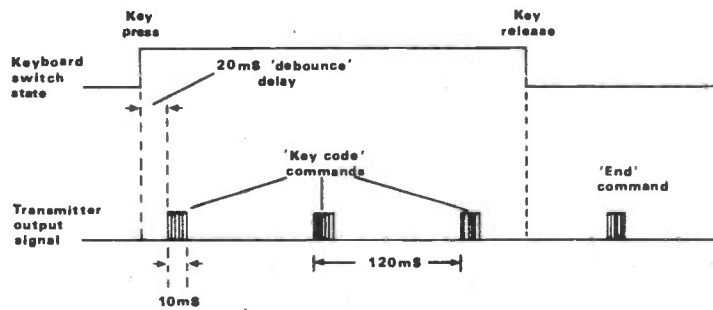


Fig 7 General form of the SAB3210 transmitter signals

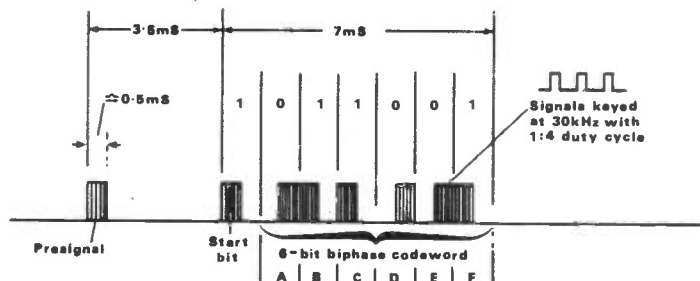


Fig 8 Details of command signal with 6-bit codeword '100110' and '1' start bit

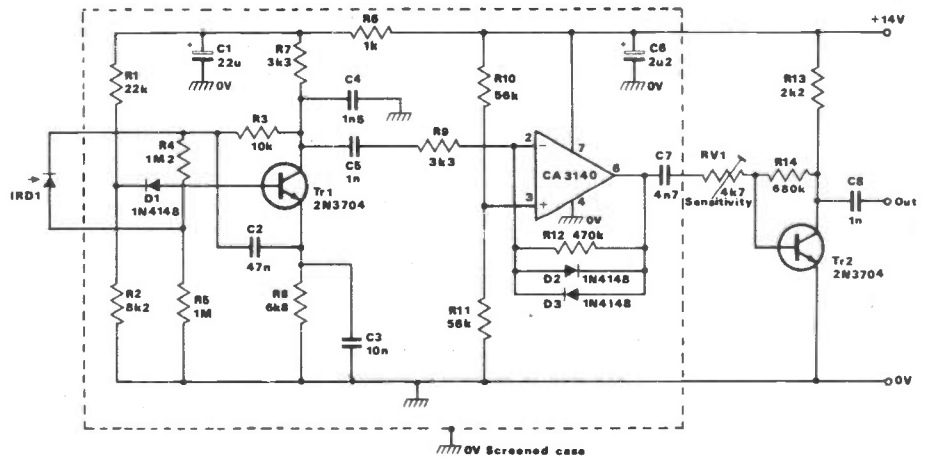


Fig 9 IR receiver pre-amp circuit

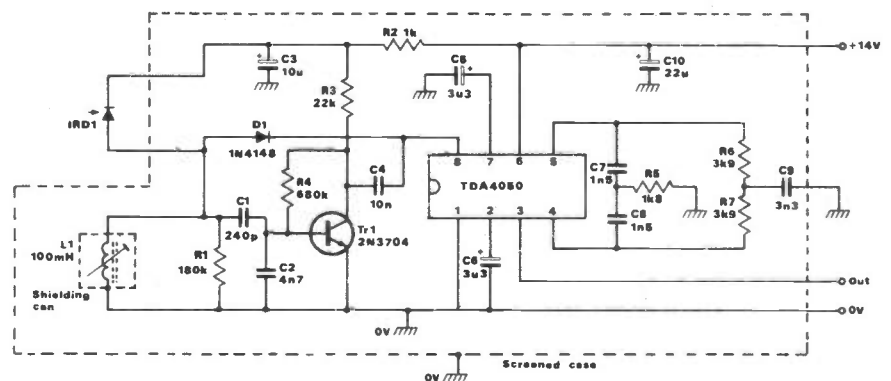


Fig 10 TDA4050 IR receiver preamp circuit with L-C tuning

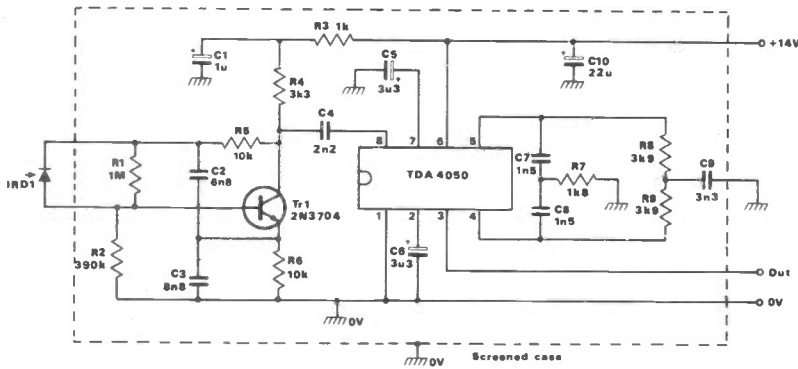


Fig 11 TDA4050 IR receiver preamp circuit without L-C tuning

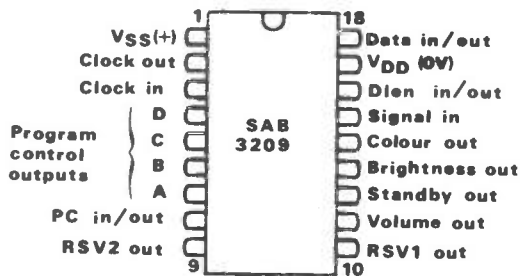


Fig 12 Outline and pin designations of the SAB3209 receiver IC

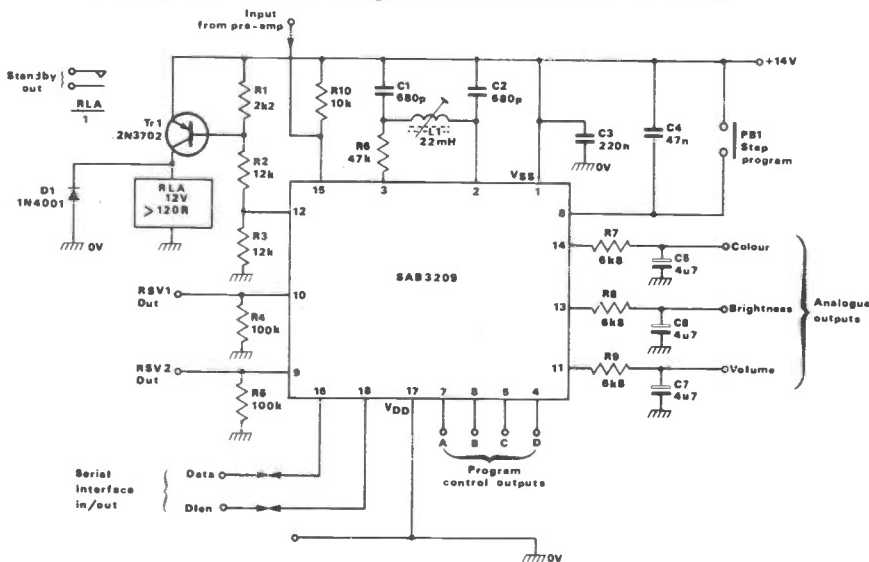


Fig 13 Practical SAB3209 application circuit

pins 4 and 5, as shown.

In the *Figure 10* preamplifier circuit the IR signals are first detected via IRD1 and amplified via frequency selective stage Tr1 (which is tuned via L1-C1-C2) before being fed to the pin 8 input terminal of the TDA4050. In the *Figure 11* design the IR signal is detected via IRD1 and fed non-selectively to the TDA4050 via the Tr1 stage.

The SAB3209

The SAB3209 acts as a general purpose receiver/decoder IC in the IR60 remote control system. It provides three analogue and three digital outputs plus a 4-bit parallel output and a 6-bit serial output, all activated via the IR transmitter system. *Figure 12* shows the outline

and pin notations of the IC (which is housed in an 18-pin DIL package), and *Figure 13* shows a practical application circuit of the device.

Input signals to the SAB3209 are fed to pin 15 via a suitable preamplifier stage. The IC is provided with a clock oscillator (L1-C1-R6-C2) which must be tuned to the transmitter clock frequency (double the serial code frequency). The chip checks the input code signal for sense (correct number of bits, bit duration etc), processes it and then both 'dumps' the resulting code signal at the serial interface (pins 16 and 18) and simultaneously passes it on to a register, from where it is then converted into a useful output action.

The outputs from pins 4 to 7 of the IC

form a 4-bit binary code that can be used to select (via suitable external decoder circuitry) any one of 16 external channels. The binary code number can either be set via the transmitter signal or can be directly shifted one step at a time via push-button switch PB1 (connected to pin 8).

The outputs from pins 9, 10 and 12 are single-bit signals that can be set high or low via transmitter commands. In *Figure 13* the pin 12 output is used to activate relay RLA via Tr1 and the contacts of this relay can be used to switch power to external circuitry.

The SAB3209 provides three analogue output signals (at pins 11, 13 and 14). In *Figure 12* these outputs are notated 'volume', 'brightness' and 'colour' respectively, but in practice they can be used to control (via suitable external circuitry) any analogue functions. Each of these analogue outputs takes the form of a 1kHz (approx) square wave that can have its mark/space ratio (and thus its mean level) varied over a full span in 64 discrete steps via the transmitter command signals. These variable mark/space signals are converted to dc analogue voltages via low pass filters R7-C5, R8-C6 and R9-C7, and can be used to control external voltage-controlled attenuators, amplifiers and filters, etc.

It should be noted that the SAB3209 receiver IC can be activated both via remote control signals fed into input pin 15 and by command signals fed directly into the serial interface (pins 16 and 18) terminals. If both types of signal are input simultaneously, those at the serial interface are automatically given priority by the chip logic.

Special support chips

Siemens produce a number of 'special' (for professional use) support chips for use with the IR60 system. One of these is the SAB3211 display decoder/drier chip, which gives a visual read-out of the selected binary-coded 'channel' number on a multi-segment LED display. This IC simply converts the 4-bit output code from pins 4 to 7 of the SAB3209 into a form suitable for driving a 9-segment numeric display.

Another 'special' IC is the SAB3271, a self-contained receiver/decoder chip which specifically decodes the transmitted 6-bit serial command code signal into the form of six parallel outputs, which can be decoded by additional circuitry to make all 60 command 'instructions' available for external use.

Note: Readers wishing to experiment with the IR60 remote control system should note that all of the ICs mentioned here are available from Electrovalue Ltd, 28E St Jude's Rd, Englefield Green, Egham, Surrey TW20 0HB.

In next month's edition of *Data File* we'll look at applications of the LM10 'micropower' operational amplifier. **REW**

MEDIUM WAVE



DXING

by Steve Whitt

Welcome to the May issue of *Radio and Electronics World*. This month I'll be looking again at a subject that affects not just the MW-DXer, but just about every radio listener – namely, that unwelcome occupant of the radio spectrum, interference. But first this month I'll be taking a peek at two very useful new publications.

Review

For many years Radio Nederland has been a prolific source of information for the DXer and short wave listener via its Media Network programme, which is currently hosted by Jonathan Marks. To supplement this weekly programme a number of valuable publications are produced for the enthusiast. Indeed, two excellent booklets have just been published by Radio Nederland. Firstly, of general interest, is the ninth edition of the *Receiver Shopping List* which attempts the difficult task of reviewing the pros and cons of receivers currently on the market. The latest edition runs to 36 pages and includes 12 new receivers added since the previous version in August 1985. So, if you are in the market for a new receiver, this booklet could be a good starting point.

More specifically directed towards the budding MW-DXer is the second booklet, called *Looking at Loops – An Introductory Guide to MW Listening*. This is a new publication and in its 12 pages includes a constructional design for an MW loop, information on interference, a bibliography of relevant books and articles as well as introductions to Medium Wave radio clubs. Both of these booklets are available free from Radio Nederlands, English Section, Postbus 222, Hilversum 1200 JG, The Netherlands. If you do write, please mention *Radio and Electronics World*.

Media Network

Should you wish to hear Media Network, it is aired on various short wave frequencies at several times each Thursday (try 5955kHz at 1148hrs). Additionally, reader Richard Gedye informs me that Radio 210, the ILR station for Reading, relays a syndicated version of Media Network as part of its weekly electronics and radio programmes. Listen for programmes called 'Silicon Valley' and 'Radioactivity' at 1930hrs every Tuesday on 1431kHz and 97MHz VHF.

Interference

Interference is any unwanted signal (or noise) that, by adding to the desired signal, degrades reception of the wanted information. It is usually the case that the interference most often encountered on Medium Wave is man-made in origin.

Whereas there is very little one can do about naturally occurring interference, it is possible, theoretically at least, to

eliminate man-made sources of interference. The first step to suppressing interference is, in fact, recognising it and then finding out where it is coming from. Having identified a source of interference, it is an unfortunate fact of life that it may prove impossible to do anything about it. The following are the most common forms of man-made interference to affect MW reception.

Co-channel interference

Since the MW band is channelled, and because there is only 1080kHz (120 channels) of spectrum available, there are inevitably several stations transmitting simultaneously on each channel. Normally the powers and locations of stations allocated to a particular frequency are chosen to ensure that co-channel interference does not occur within the respective target areas during hours of daylight.

However, listeners outside the primary target area will often suffer interference, and even reception in the primary target area can be disrupted by co-channel interference arriving via the skywave path at night.

Modulation splash

Modulation splash or adjacent channel interference can be a particularly irritating form of interference since, unless it is a receiver-generated effect, there is not much the listener can do about it. Modulation splash, strictly speaking, is a transmitter effect and can be caused by a station not limiting the bandwidth of its transmitted audio, resulting in components of the transmitted sidebands interfering with signals on adjacent channels. This form of splash can also result from a poorly maintained or over-modulated transmitter.

A second form of adjacent channel interference can be generated within a receiver with insufficient front end selectivity when receiving very strong signals. To test whether adjacent channel interference is in fact receiver generated, an aerial attenuator should

be used to reduce the strength of the incoming signal. If the relative degree of interference reduces, a receiver effect should be suspected, but if no change is observed, then it is likely that the interference is actually being transmitted. To look for an example of modulation splash one need go no further than the Radio Caroline signal on 963kHz which often spreads over a total of 30-40kHz.

Heterodyne interference

A heterodyne is an audible beat note or whistle that is generated in a receiver when two signals on slightly different frequencies are received simultaneously.

In a perfect world where all MW stations operated exactly on their allocated channels, heterodyne interference would not be a problem. Although heterodynes are a form of interference, they can in fact be of use to the MW-DXer, since they can reveal the presence of a weak off-channel station long before its modulation becomes audible.

Jamming

This is a deliberate attempt to interfere with reception and is usually a transmission of man-made noise intended to blanket another programme to make it unintelligible. The amount of jamming present tends to reflect the degree of political unrest in the world, and at present there is relatively little to bother the MW listener. One very prominent and well established jammer can be heard during the evening on 720kHz designed to prevent reception of Radio Free Europe.

Electrical interference

This title covers a multitude of interference sources which will tend to affect listeners living in built-up areas, particularly near industrial zones. Man-made electrical interference comes in all shapes and sizes, but can be classified as intermittent or long term. It can be difficult to track down intermittent

MEDIUM WAVE DXING

sources of interference, but fortunately their nuisance value is not long lasting. Common examples are engine interference from the poorly suppressed spark plugs of passing cars, and arcing of electrical contacts in thermostats and switches. If the source is identified, it is generally not too difficult to suppress this sort of interference. Other examples are caused by faulty street lights and faulty insulators on overhead power lines, and in both these cases the solution is to inform the relevant authority.

The longer lasting variety is commonly due to harmonic radiation from television timebases. This is audible (only if a nearby TV is operating) as a rough buzzing located at intervals of 15.625kHz across the medium wave band. Unfortunately, this form of interference often restricts any serious DXing to outside television hours.

Electrical invasion

Generally, as more and more electrical equipment enters the home and office, the greater the level of interference and the less chance there is of suppressing it. Among the more recent sources of (very potent) interference are VDUs, computers, electronic telephones and

office exchanges. Regrettably there is usually little a DXer can do to cure this affliction unless they own the offending piece of equipment.

Even if one lived in a world without any man-made interference, one would still notice a whole range of noises limiting reception of very weak signals. Of these the least significant (for the MW listener) is the noise actually generated within the receiver, because the level of other naturally occurring noise sources picked up by the receiver's aerial is many times greater.

Common examples of these types of interference are atmospheric

static, which manifests itself as continuous crackling, and lightning discharges which are heard as a loud crashing noise. The distinguishing feature of these signals is their broadband nature; namely the noise will be heard at all frequencies in the MW band at roughly the same intensity. It is interesting to note that the radio wave emitted by a lightning flash behaves like any other radio wave and, therefore, can propagate over considerable distance. In fact, one of the greatest sources of interference world-wide is that generated by the large numbers of daytime tropical thunderstorms.

STARTING POINT


This month in place of the DX file I've decided to include some listening tips for the newcomer to the MW band. If you have never explored the MW band before I'm sure you'll be surprised how many distant stations can be heard, even on a quite basic portable radio. Try for the following English language broadcasts:

RTE Dublin, Eire on 612kHz, 0530-0050hrs.
American Forces Network, Frankfurt, Germany on 873kHz 24hrs a day.

Radio Sweden Int, Stockholm, Sweden on 1179kHz at 2300-2330hrs.

Trans-World Radio, Monte Carlo, Monaco on 1467kHz at 2200-2300hrs.

Reception should not be too difficult, but remember that all times are GMT/UTC.

Before I sign off for another month, let me remind you that all your logs, reception tips and any queries will be most welcome if you care to drop me a line c/o R&EW. 73s and good DX. 

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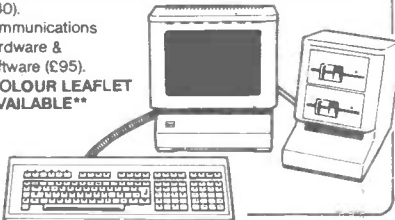
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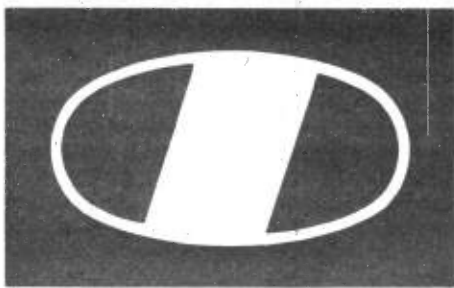
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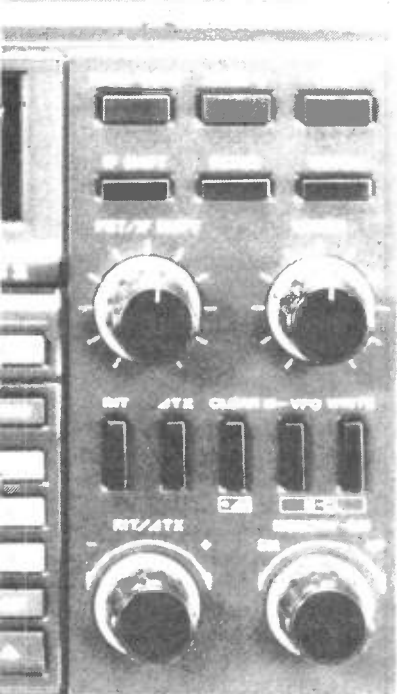
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BEYOND THE TRIODE

The invention of the triode valve in 1908 was a big step forward for mankind and represents a milestone in the development of electronics.

The triode valve works well at amplifying audio signals, but for some reason fails to amplify signals of higher frequency. It was discovered that the electrodes of the valve behave like the plates of a capacitor and that at high frequencies the capacitance reactance is low.

Miller demonstrated that the valve capacitance between the anode and grid will appear as a capacitance of value $C_{ag} \times (A+1)$ which in effect is shunted across the input terminals of the valve amplifier. At radio frequencies the reactance of this capacitor is very small and effectively short circuits the input and output of the valve amplifier, reducing the amplifier gain. At higher frequencies the amplifier is likely to become unstable, because the capacitance between anode and grid provides a relatively low resistance path over which the amplified signal can be fed back to the input of the amplifier in the correct phase, which causes the amplifier to become unstable and start to oscillate.

A solution

The hopes and aspirations of the valve manufacturers and circuit designers

were dampened for a time, whilst a solution was sought. One idea to solve the problem was to introduce a second grid between the anode and the control grid to break up the natural capacitance. This second grid is known as the screen grid, since it screens the control grid from the anode. The screen grid behaves as an electrostatic shield and therefore reduces the natural capacitance between the anode and grid. This result is accomplished by ensuring that the screen grid is at ground potential at RF by connecting a capacitor between the screen grid and earth. The grid anode capacitance will be reduced to such a level that the problems of feedback and instability will no longer exist.

In addition to the shielding effect, the screen grid serves another very useful purpose. It is kept at a positive potential with respect to the cathode. The presence of this positive second grid will influence the flow of electrons between the anode and cathode. What effect will this grid have on the characteristics of the valve?

Characteristic change

The anode voltage/anode current characteristic of a screen grid valve, now known as a tetrode, is shown in *Figure 1*. At low anode voltages a large number of electrons will be drawn from the cathode

to the screen grid which is maintained at a fixed positive voltage. The anode current will be very small. As the anode voltage is increased, electrons will be attracted to the anode, and consequently the anode current will commence to rise. As the anode voltage is increased further, the electrons approaching the anode will be accelerated and will reach the anode at high speed. On hitting the anode surface the electrons will dislodge other electrons from the anode. If the screen grid is at a higher positive potential than the anode, these secondary electrons will be attracted to the screen grid. The anode current will therefore fall until the anode voltage is increased still further to equal the screen grid voltage.

Anode voltage

Over this range of anode voltages, the anode current will actually decline and the slope of the characteristic curve will indicate a negative resistance. When the anode voltage is increased still further, and exceeds the value of voltage applied to the screen, the secondary electrons will be attracted back to the anode and the anode current will again start to increase as the anode voltage is increased. In practice the value of voltage applied to the screen grid is usually fixed at between 50 and 60 per cent of the anode voltage.

The screen grid is constructed of a wide spaced wire mesh and consequently only attracts a small proportion of the total electron flow. Most of the electrons will be accelerated in the screen grid region, as a result of the positive voltage on the screen and the speed at which the electrons are travelling as they pass through the wire mesh forming the screen. As the anode voltage is increased still further above the voltage of the screen, the anode current will not increase as steadily and the anode voltage will have less dependence on the anode current. Therefore, it would appear that the valve has a very high internal resistance and consequently a greater amplification factor.

Amplification factor

In any amplifier circuit, the anode voltage will vary because the anode current varies as a result of a varying voltage signal being applied to the control grid. In a triode amplifier the varying anode voltage produced by the signal applied to the control grid will also influence the anode current. This is because the anode current is greatly influenced by the anode voltage, and the resulting anode current will be less than for a triode. This means that the full

Fig 1 The anode voltage/anode current characteristic of the tetrode valve

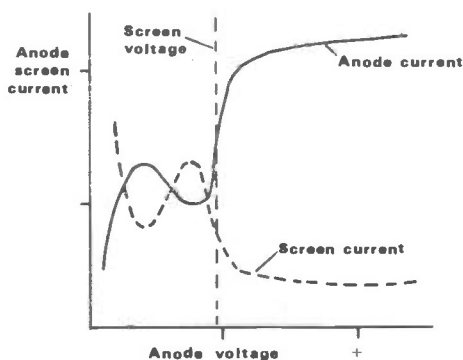


Fig 2 Typical anode characteristic graph for a pentode valve

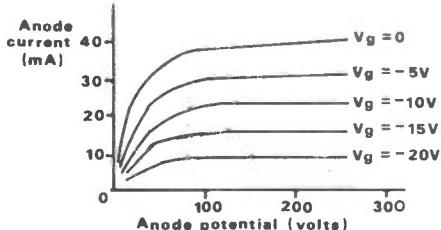
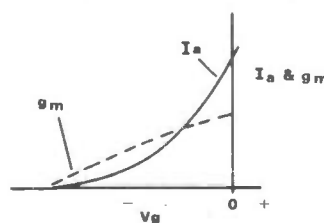


Fig 3 Mutual conductance characteristic curve for variable μ pentode valve



amplification of the triode valve cannot be achieved and this is one disadvantage of using a triode. The introduction of the screen grid almost entirely eliminates the effect of the anode voltage on the anode current, and the amplification obtained is therefore much higher than for a triode valve.

The mutual characteristic graph for the tetrode is similar in shape to that of the triode valve, the curves for various values of anode voltage being closer together on account of the high internal resistance. However, there are disadvantages in using a tetrode valve. If the valve is to function as a stable amplifier it is essential to operate it in such a way that the negative resistance portion of the graph is not used, otherwise instability is likely to occur. When the tetrode valve is used as an amplifier there will be an RF component present on the screen voltage similar to the RF component on the anode. To prevent the RF component from appearing on the screen and varying the screen voltage, a large capacitor must be connected between screen and ground to ensure that the screen grid is at ground potential with respect to RF. It should be noted that the total cathode current in a tetrode valve is equal to the sum of the screen and anode currents.

The tetrode valve

The tetrode valve has the main disadvantage that part of the characteristic curve cannot be used because of the negative resistance produced by a secondary emission from the anode being collected by the screen grid. The valve manufacturers continued their research and came up with the idea of introducing another grid between the screen grid and the anode to collect the secondary emission and return the secondary electrons back to the cathode.

The pentode valve

The pentode valve is similar in construction to the tetrode but has been fitted with a fifth electrode. An additional grid called the suppressor grid is inserted between the screen grid and anode. This is electrically connected internally to the cathode. The function of this additional grid is to repel any secondary electrons and return them to the anode. This has the effect of eliminating the dip or kink present in the anode characteristic of the tetrode valve, and making the pentode valve suitable for use as a power amplifier, while retaining the essential properties of the tetrode valve, namely high mutual conductance and amplification factor.

A typical anode characteristic curve for a pentode is shown in *Figure 2*. The anode current rises steeply for low values of anode voltage and at an early stage reaches a state where the anode current is only affected slightly by the anode voltage. The pentode is more suitable for use as a voltage amplifier.

Variable μ valves

A particular form of pentode is the variable μ valve. This has the same arrangements of electrodes as the normal pentode, but the control grid has a specially designed mesh. The pitch or spacing of the mesh varies progressively from the centre of the grid towards the edges. As a result of the construction, the control of the anode current by the grid is no longer a linear relationship, and the application of a large negative voltage to the control grid is required to cut off the anode current completely.

The effect of this non-linear grid construction is to give the valve an adjustable amplification factor and, therefore, a corresponding variation in mutual conductance, depending upon where on the mutual characteristic curve, *Figure 3*, the control grid is biased. The mutual characteristic curve has a continuous and gradual change of curvature for different values of grid voltage. The mutual conductance and amplification factor will vary with grid voltage by an almost linear law with the normal pentode, and so the mutual conductance and therefore the amplification factor will remain almost constant, except towards the cut off point of the mutual characteristic curve.

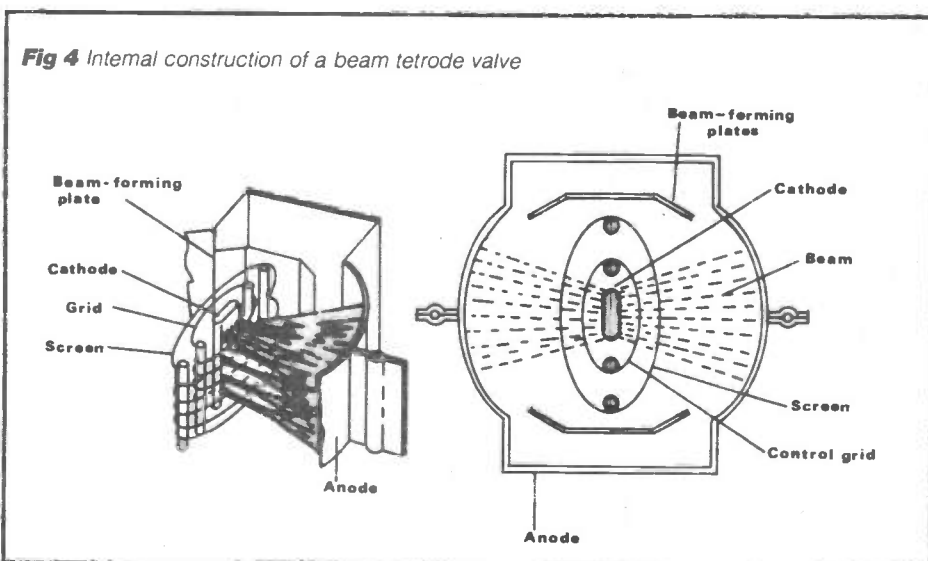
The function of a variable μ valve is to enable the stage gain of an amplifier to be adjusted automatically according to

the level of bias applied to the grid. A typical example of the use of a variable μ pentode would be in a communications receiver for automatic control of the gain of the RF and IF stages. If a portion of the amplified signal is rectified and is fed back to the control grid of the variable μ amplifier valve, then weak signals can be given an increased gain, while stronger signals will reduce the gain. The net result is that the output signal, irrespective of the signal strength of the incoming signal, will be maintained at a fairly constant level. This principle in a receiver is known as automatic gain control, or AGC.

Beam tetrodes

Another method of suppressing secondary emission is used in a beam tetrode valve. This valve is constructed with four electrodes, comprising the cathode, control grid, a screen grid and an anode. The electrodes are so placed that secondary emission from the anode is suppressed and this also increases the overall efficiency of the valve. The electrons which travel to the anode are beamed by two forming plates which are electrically connected to the cathode. The density of the beam is such that secondary emission is repelled. The secondary electrons form a cloud which surrounds the inside beamed surface area of the anode.

Another feature of the beam tetrode valve is the low current drawn by the screen. The screen and grid are constructed from spiral wires wound so that each turn in the screen is shaded from the cathode by the grid turn. This alignment of the screen and the grid causes the electrons to travel in concentrated bands of electrons between the



BEYOND THE TRIODE

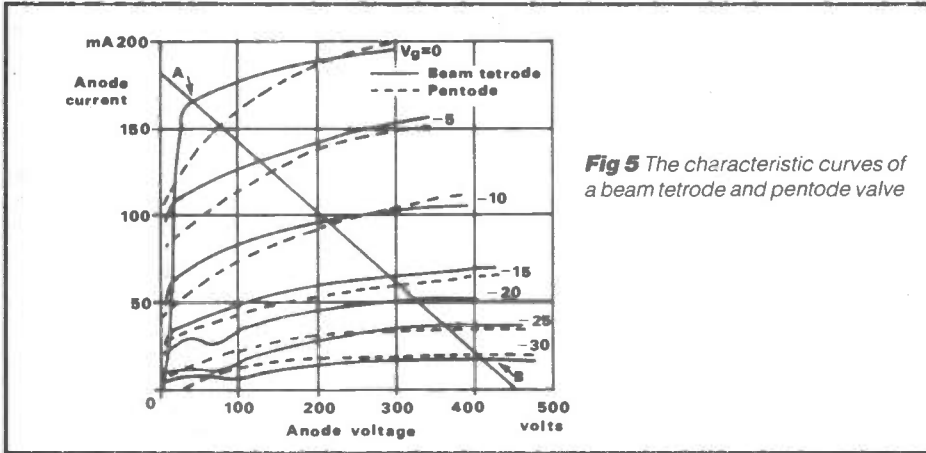


Fig 5 The characteristic curves of a beam tetrode and pentode valve

turns of the screen, such that only a few electrons actually come into contact with the screen. As a result of the effective suppressor action provided by the cloud of electrons close to the anode, and the low current drawn by the screen, the beam tetrode valve has the advantage of producing high power outputs with minimum losses.

One of the well-known early beam tetrode valves was better known as the 6L6. The electrode arrangement of a beam tetrode valve is illustrated in

Figure 4.

The distinctive feature of this type of valve is that the control and screen grid helixes are of the same pitch with the wires so aligned that the screen wires lie in the shadow of the control grid wires, a flat cathode, side deflecting plates and a relatively large screen plate distance. The side deflecting plates are connected to the cathode and, in conjunction with the flat cathode, form the electrons into a beam with small lateral spread, as shown.

The characteristic curve of the beam

tetrode valve will be slightly different to the characteristic curve of the pentode valve. Figure 5 shows the characteristic curve of a beam tetrode and pentode valve superimposed upon each other. A load line, AB, has been drawn on the characteristic curve to illustrate the difference under operational conditions. The line AB extends farther to the left before it cuts the zero grid volts curve for the beam tetrode. Therefore, the beam tetrode valve is capable of providing a greater output power than the pentode valve. Remember that power output is proportional to the product of the change in anode voltage between points A and B on the horizontal axis, and the change of anode current between points A and B on the vertical axis.

Next Month

In the second part of his three part series Roger Alban GW3SPA describes the theory behind the valve amplifier



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Crossing the Pond

Stan Crabtree presents the story of Marconi's remarkable contribution to early long distance wireless communication

Bridging the Atlantic had been the dream of Guglielmo Marconi since the latter years of the nineteenth century had seen his system of wireless telegraphy produce greater and still greater ranges of communication over water. The feat was achieved barely 6 years after the Italian inventor had obtained a distance of 1½ miles during experiments on his father's estate near Bologna. But although one-way contact was made in December 1901, it was a further 6 years before a reliable, commercial W/T service was introduced between the two continents.

Six months after the inaugural contact, Marconi was using 1100 metres (272kHz) for distance tests. This was considerably more than the first wavelength used. The original transmitting channel was reputed to be 366 metres (820kHz), but at the time many felt that this was totally unrealistic considering the distance and the time of day. However, further tests were made some 3 months later on the

Philadelphia. Marconi installed a receiving package consisting of a coherer detector, a telephone earpiece and an ink recorder and sailed with the ship to New York. Results obtained went some way to substantiate his earlier claims when signals from his Cornish station at Poldhu were monitored at 700 miles in daylight and some 2000 miles at night. Morse signals on tape, endorsed with the ship's position, bore proof of the distance achieved.

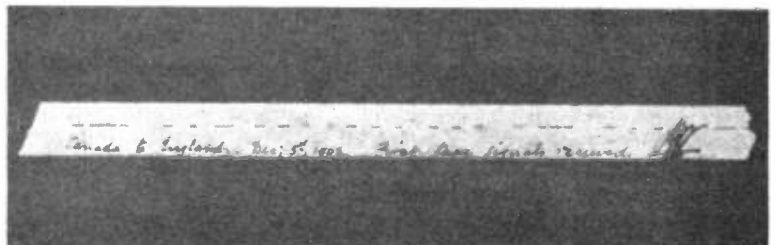
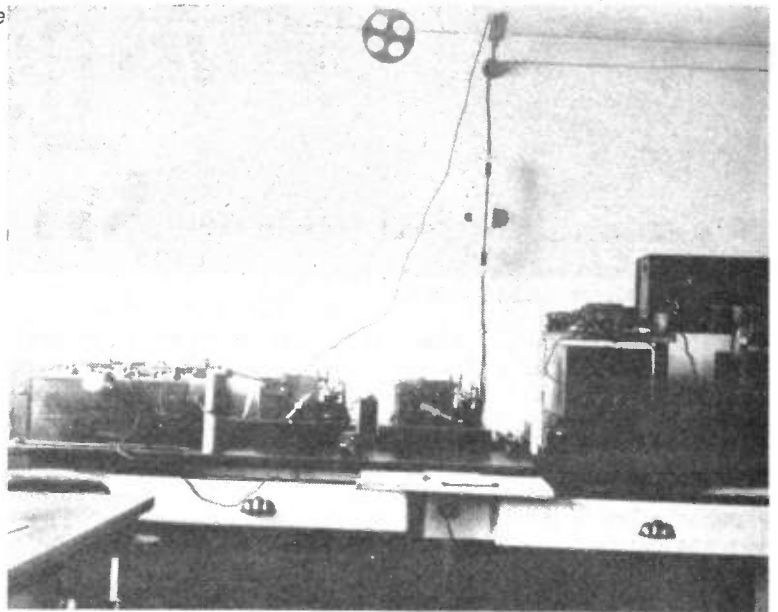
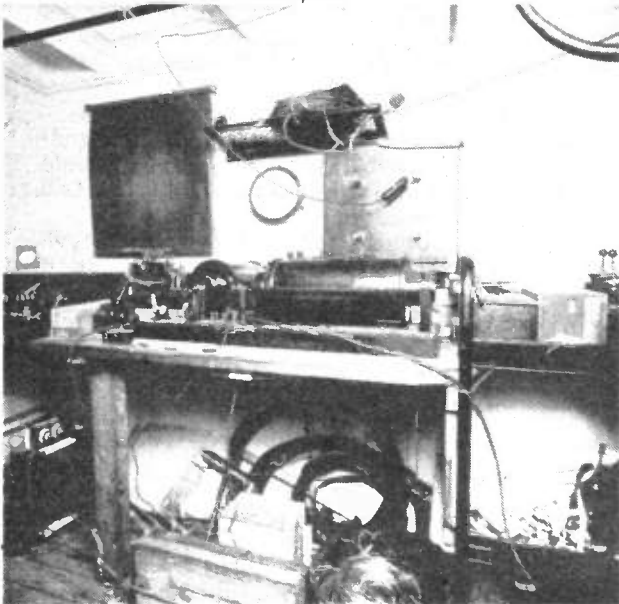
The North American station had been established at Glace Bay on the most eastern tip of Nova Scotia. An impressive

aerial array consisted of 400 copper wires suspended from lines strung between a square of four 200ft wooden masts. The wires met at the base feeder point to form an inverted cone. Tests were continued throughout 1902 but were inconclusive. Two-way contact was obtained for a few hours at a time but this was not good enough for a commercial service.

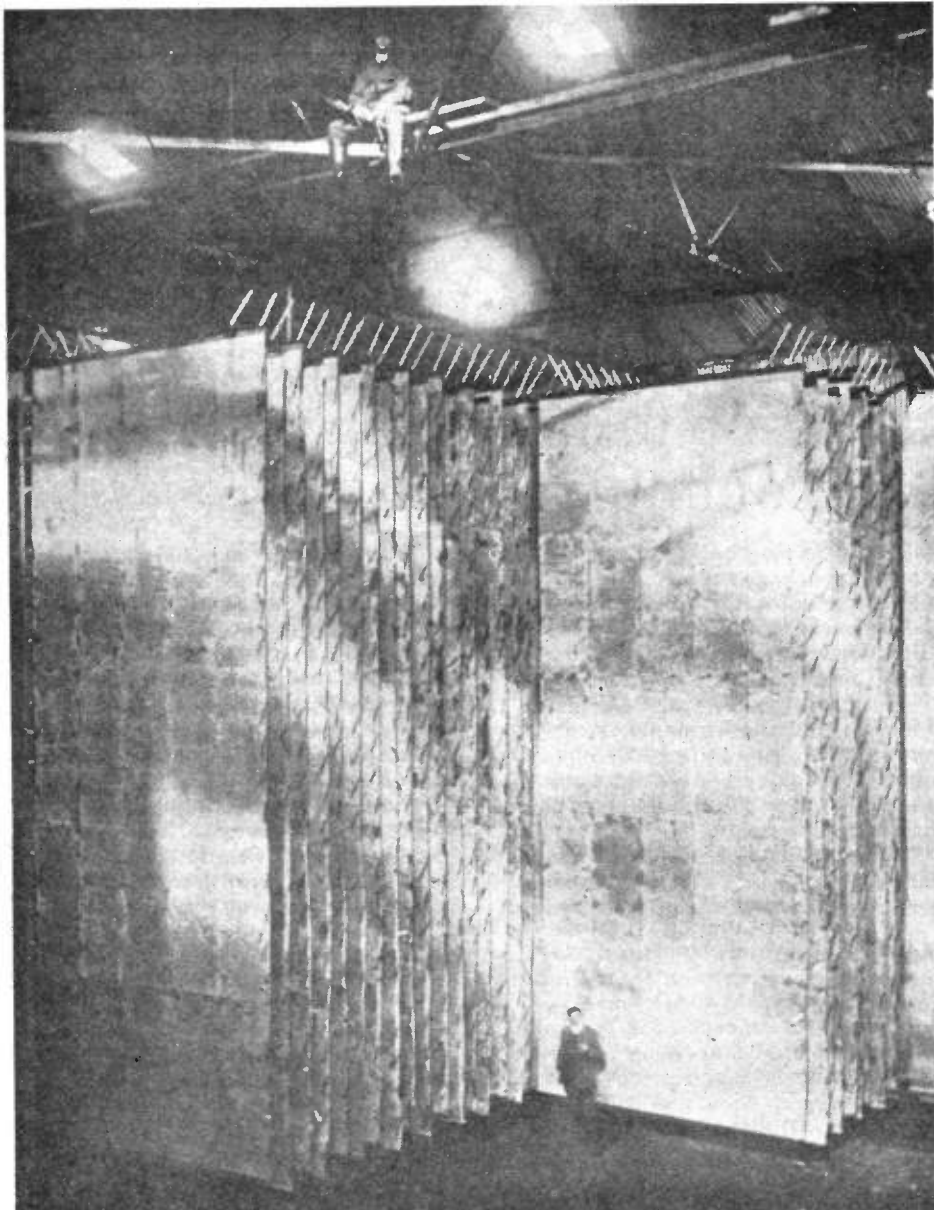
Conditions improved slightly during the autumn months and after moving the Poldhu operating wavelength up to 1650 metres (181kHz) on 5th December, a limited two-way service was introduced.

The first readable transatlantic message was received on the 'Philadelphia' from Poldhu. The equipment and tape are shown right

Marconi's cabin on the 'Philadelphia'



CROSSING THE POND



The Clifden condenser under construction

On 21st December telegrams were sent from Glace Bay to Poldhu, addressed to King Edward VII and also the Italian Senate. Traffic handling continued but a backlog had to be cleared during the hours of darkness.

Early in the New Year a new transmitter at Cape Cod was completed. The original plan was that traffic from the United States would be relayed via Glace Bay to Poldhu, thus easing any load on the landline between Glace Bay and New York. The two East Coast stations were to be tuned to 2000 metres (150kHz), a further move upward. On January 18th 1903, the Cape Cod transmitter came on the air with a message from President Theodore Roosevelt to King Edward VII. After being received at Glace Bay, Poldhu came unexpectedly on the air with an acknowledgement. The Cornish station had copied the signal direct – the

first time a telegram sent from the United States had been received direct in the UK.

However, the service was anything but consistent. At some periods, during daylight hours, there was no communication at all. Even when contact was possible, much time was spent in repeating traffic to confirm authenticity. Weak signals were affected by atmospheric conditions, and even though the new magnetic detector was now in use as the receiving instrument, its sensitivity was only marginally better than the coherer. The actual throughput of wordage per hour was too low to be considered a commercial proposition. The service was thus 'temporarily abandoned' and the 3 stations officially closed down on 22nd January 1903.

Marconi was obviously disappointed. However, the company's resources at

this stage were insufficient to provide further funding. Marconi, of necessity, turned to other fields. Occasional Atlantic tests were conducted during the year at Poldhu with vessels being used to monitor the signals. In the middle of 1903 the wavelength was increased to 2000 metres (150kHz).

Early in 1904 Marconi was again able to turn his attention to a North Atlantic service. With a 'T' aerial, Poldhu was refitted to operate on 4250 metres (70.5kHz); the longest wavelength used in this type of communication so far. Additionally, a receiving station was established in the North East of Scotland at the fishing village of Fraserburgh. On a Great Circle projection this was nearer to Glace Bay, but further tests showed little overall improvement. The final ranges obtained were still only 1200 miles by day – insufficient for a reliable service between Europe and the USA.

An improved 'umbrella' aerial system was installed at Glace Bay early in 1905. The station had been moved a short distance and the opportunity was taken to effect changes to the aerial and earth system. Results of tests undertaken were promising: 1800 miles during daylight. A few months later Marconi raised the operating wavelength to 3660 (82kHz) and finally attained what had eluded him for so long – two-way contact with Poldhu in daylight hours.

Another important revelation had come to light the previous year at Poldhu. It was noticed by accident that increased signal strength was apparent in the receiver when the horizontal section of the aerial was lying in a direction towards the transmitter. When tried with a transmitter a further improvement was noticed. This was the birth of the Marconi inverted 'L' aerial, which subsequently replaced the large complicated arrays that had been used up to this time.

Marconi came to the conclusion that the Poldhu site was insufficient for his needs, especially with the directional aerials he was planning. After a preliminary survey he chose a new location on the West Coast of Ireland at Clifden, in County Galway. This would also be some 200 miles nearer the Glace Bay station.

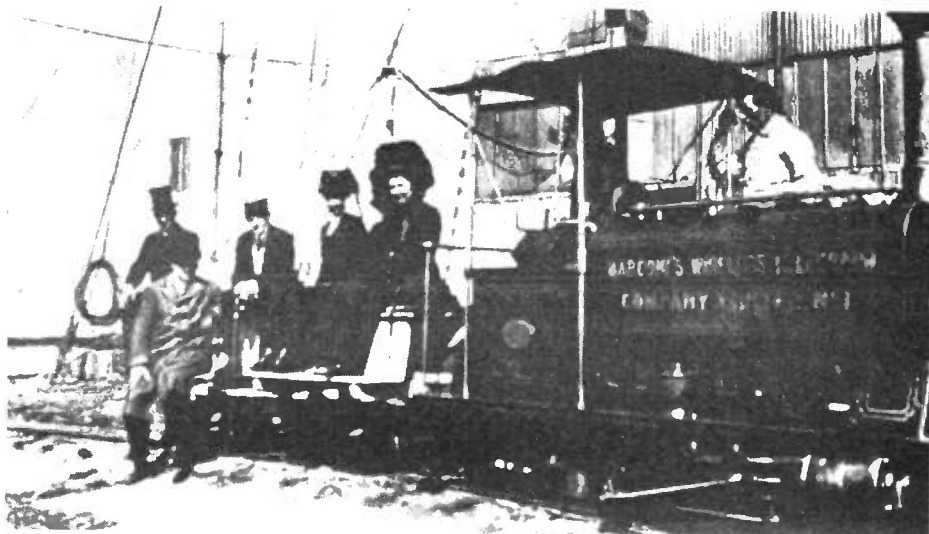
Construction work at Clifden began in early 1906. It was Marconi's idea that this would be the 'big one', and indeed it was. It incorporated all the latest circuitry and techniques devised over the previous years. The site itself was so remote and inaccessible that no motor vehicle could tackle the rocky terrain. A miniature railway track was thus constructed to transport personnel and equipment from the nearest road. The small steam engine carried the name 'Marconi Wireless Telegraphy Limited No 1' painted on its boiler.

The turbo-driven dc generators were

powered by steam boilers heated by the burning of peat. After the station was opened the light railway was utilised to carry piles of peat from the bogs located a few miles away. The 300kW generating plant provided a dc voltage of 20,000 volts which supplied sufficient current to charge 6000 secondary cells, each of 40 AHC. Connected in series a dc voltage of 12,000 was available. With the generator connected this could be increased to 15,000V.

The capacitor in the aerial circuit was of an entirely new design. The plates were constructed of galvanised steel and were some 40ft in height. The 12 inch air space between the plates was designed to withstand 80,000 volts. Due to the size of the dielectric, 1,800 plates were required to provide the capacity of 1.16 microfarads. The whole unit was suspended from the roof and enclosed, along with the aerial inductance, in a specially constructed building one hundred metres long.

The source of the radiated signal was also an innovation. Although in essence a spark transmitter, rotating discs in the charging circuit took the place of the earlier spark gap. When the discs were stationary the discharge was the usual spark. But with the discs spinning rapidly it was, in effect, a continuously oscillating circuit. Marconi had produced what he felt was the first continuous wave transmitter. The radiated pattern was unique in that it occupied only a very narrow band. These were no longer 'damped waves'. Gone were the ubiquitous side bands usually associated with the spark transmitter. The transmission was so clean that it no longer produced a note in the receiving station earphones—simply a click. A modification was introduced by fixing a given amount of studs on the smooth surface of one of the discs. Thus the continuous wave was interrupted regularly and the overall effect was a system of modulation. This eventually appeared as a pleasing tone at the receiving end for the length of time the key was pressed. A directional, long wire



The railway used to transport personnel and equipment at the Clifden site

aerial system aligned on the Glace Bay bearing completed the installation.

Inauguration day was 15th October 1907, with the Clifden transmitter working on a nominal wavelength of 6666 metres (45kHz). No snags appeared and the operator initially exchanged congratulatory traffic with the Glace Bay station. This was followed by routine messages on hand. With both stations working more or less continuously, 10,000 words were exchanged between noon and 2200 hours GMT. The upgrading of the radiated signal resulted in increased keying speeds and receiving operators found the distinctive musical note easy to copy against a background of atmospherics. The only limitation to the system was the delay in the landline from Glace Bay to New York. Marconi had expected this. It was obvious from traffic statistics that a large proportion of messages would originate from and be destined for the USA. It was one of the reasons that he had installed the Cape Cod transmitter. Early in 1908 the Clifden site received a direct cable line to London and eventually the outlet from Glace Bay to other North American destinations was expanded.

The transatlantic service between these two stations continued successfully for 22 years. Glace Bay lost its transmitter and receivers during a fire in the autumn of 1909 and was off the air for 6 months. After renovation the station was upgraded. In 1911 a duplex system was introduced.

The Clifden station was completely destroyed in July 1922 by Irish irregulars in their bid for self government. It was never rebuilt. There were sufficient systems and other services in operation at this time to effectively absorb the traffic currently being handled by the pioneer station. Being in so remote a location, salvage was neither feasible nor attempted. After more than half a century of being lashed by Atlantic winds much of the durable wreckage still remains as a memorial to a truly significant contribution to early long distance wireless communication.

References

A History of the Marconi Company, W J Baker, Methuen 1970.

Guglielmo Marconi, 1874-1937, Keith Geddes, HMSO 1974.

Photos courtesy Marconi

REW

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CAT INTERFACE

How to obtain a computer-aided transceiver to make your DXing efforts even more worthwhile

By R A Penfold

When computer controlled electronic devices first came along there was much humorous speculation about radio receivers that would do all the DXing, leaving the owner to get on with something more worthwhile. This may have seemed a little far-fetched at the time, but many modern communications receivers have sophisticated built-in scanning facilities and there is a trend towards the inclusion of an interface which permits external control using a home computer. The receiving set-up that does all your DXing for you is probably quite feasible now, but a more sensible approach to using the power of modern communications equipment is to have the controlling computer aid more effective DXing with the operator supervising things.

There must be endless ways in which computer control can be used as a DXing aid, but these are generally more applicable to broadcast band listening than to amateur band reception. The problem with amateur band reception is that it is rather random in nature, with stations not going on the air to any form

of timetable. Simple scanning down a band in search of stations can work well enough, but more sophisticated forms of automatic reception are unlikely to be successful.

With broadcast band reception the DXer often lays in wait for a specific station on a particular frequency. This opens up possibilities such as having the computer preprogrammed to tune to the appropriate frequencies at the correct times, or if two stations of interest will be transmitting at the same time, the system could be set up to switch from one to the other periodically. If one of the stations came through, manual control could then be used to hold the receiver on that station until it had been positively identified. In fact, this technique could be used to monitor several channels and, although not as good as having separate receivers tuned to each channel, it would be very much better than having to manually channel hop.

There are other possibilities, such as a computer controlled receiver with a sort of built-in *International Radio Times*. The idea here is to program the computer

with details of the broadcast times and frequencies of all the stations that are of interest. Then, in order to tune to a particular station at some later date, it is merely necessary to tell the computer which particular station is required. The computer then checks the current day/time against the broadcasting schedule of the station in question, and tunes to any frequencies that should be in use at that time.

Many DXers already use computer databases to store broadcasting schedules in a form that is quickly and easily interrogated, and this just takes things a step further with the computer directly controlling the receiver rather than the user having to extract information and then tune the receiver.

Although some may feel that this type of thing is rather getting away from the true spirit of radio DXing, it represents an interesting technical challenge, and that is surely very much what DXing is all about.

CAT

There is no standard form of computer interface for communications equipment, but the most popular type for amateur equipment is probably the Yaesu CAT (computer aided transceiver) type. This was originally designed for use with transceivers, but is implemented in slightly cut-down form on the FRG9600 and FRG8800 receivers (the latter being the receiver used by myself). It is a form

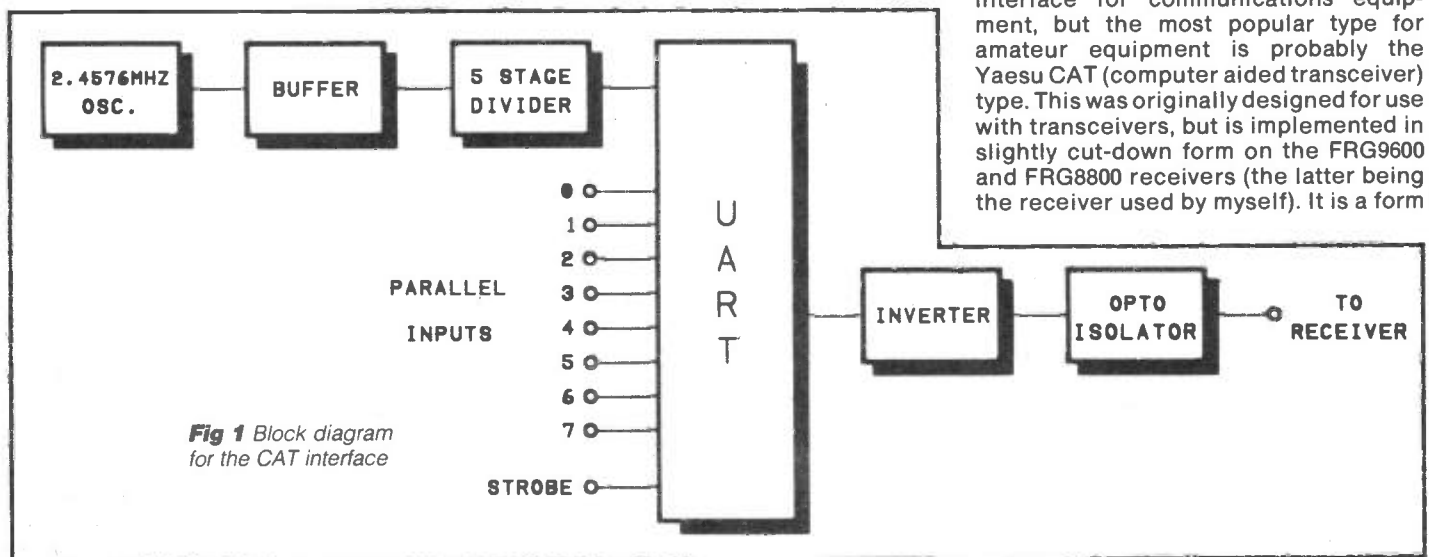


Fig 1 Block diagram for the CAT interface

of serial interface, and it is almost compatible with a standard RS232C interface. The word format is a standard one start bit, eight data bit, two stop bits and no parity type, operating at a baud rate of 4800. Many RS232C serial interfaces can handle this format and baud rate, but there is a slight problem in that the signal via an opto-isolator and it is not compatible with standard RS232C signal levels.

The current levels available from an RS232C output should actually be sufficient to drive an opto-isolator, and interfacing a CAT input to an ordinary serial output should require no more than an inexpensive opto-isolator plus a few passive components. However, even if feasible, this method could only be implemented if the computer has a serial output capable of operating at the right baud rate and with the correct word format. Also, any serial interface fitted to the computer might already be tied up for operation with a modem, printer or whatever.

This leads to the development of this simple CAT interface which can be driven from any eight bit parallel computer output port which can also provide a suitable handshake output. The unit can operate from the user ports of the BBC Model B (including the B+, B+128 and Master 128 machines), the Commodore VIC-20 and the Commodore 64/128. It should also operate properly with computers such as the Sinclair Spectrum and Amstrad machines if driven via an add-on PIA board. It should also be possible to drive it from a Centronics style parallel printer port, but this must be a type that

provides all eight data bits (with some the MSB is simply tied to ground).

The unit may seem pointless for the Commodore computers as these have built-in software which enables the user port to generate serial signals. However, this software does not support a baud rate of 4800, and is of no use in the present application.

The interface includes an opto-isolator, and I would strongly advise against trying any form of direct connection to the CAT interface of the receiver. There may be no obvious need for any isolation between the computer and the receiver, but in practice problems with high voltages between the chassis of the two items of equipment can occur. This voltage should only be at a fairly high impedance, but this could be sufficient to prevent a proper signal transfer from occurring and can even result in semiconductor devices in either the computer or the receiver being damaged. Problems are most likely to occur with computers that do not have an earthed chassis, especially if the receiver should also be used with no earth connection (which is not advisable). This is not just a lot of theory which is of no practical importance, and I have a defunct 6526 interface chip from my Commodore 64 computer which testifies to this fact.

System requirements

Although a lot of circuitry is needed in a serial interface, by using a special serial interface chip to do all the hard work the component count can be kept quite low. The block diagram of *Figure 1* shows the stages used in this CAT interface.

A UART (universal asynchronous receiver/transmitter) is at the heart of the unit. This is capable of parallel to serial and serial to parallel conversion, but in this case only the former is required and the receiver section is left totally unused. The UART can handle any standard word format, including five, six, seven and eight bit word formats. In this case an eight bit word format is required, and all eight parallel inputs must be driven from the output lines of the computer. The required word format is selected by connecting control inputs of the UART to the appropriate supply rails, and not under software control (as is the case with most types of serial interface device). The strobe input must be pulsed low each time fresh data is sent to the device, as it is this that initiates the data transmission process.

The baud rate is controlled by an external clock generator circuit. The UART requires a clock signal at sixteen times the required baud rate, of 76800Hz (76.8kHz) in other words. This is obtained from a 2.4576MHz crystal oscillator via a buffer stage and five stage binary divider chain.

The serial output signal is inverted to give a signal of the correct polarity to drive the opto-isolator. The latter does not need to be a high efficiency or high speed type, and a standard inexpensive component is adequate for this application where a fairly high drive current is available. Although a baud rate of 4800 is a fairly high one, it represents a maximum frequency of only 2400Hz (with alternate marks and spaces sent), and this is well within the capabilities of an ordinary opto-isolator.

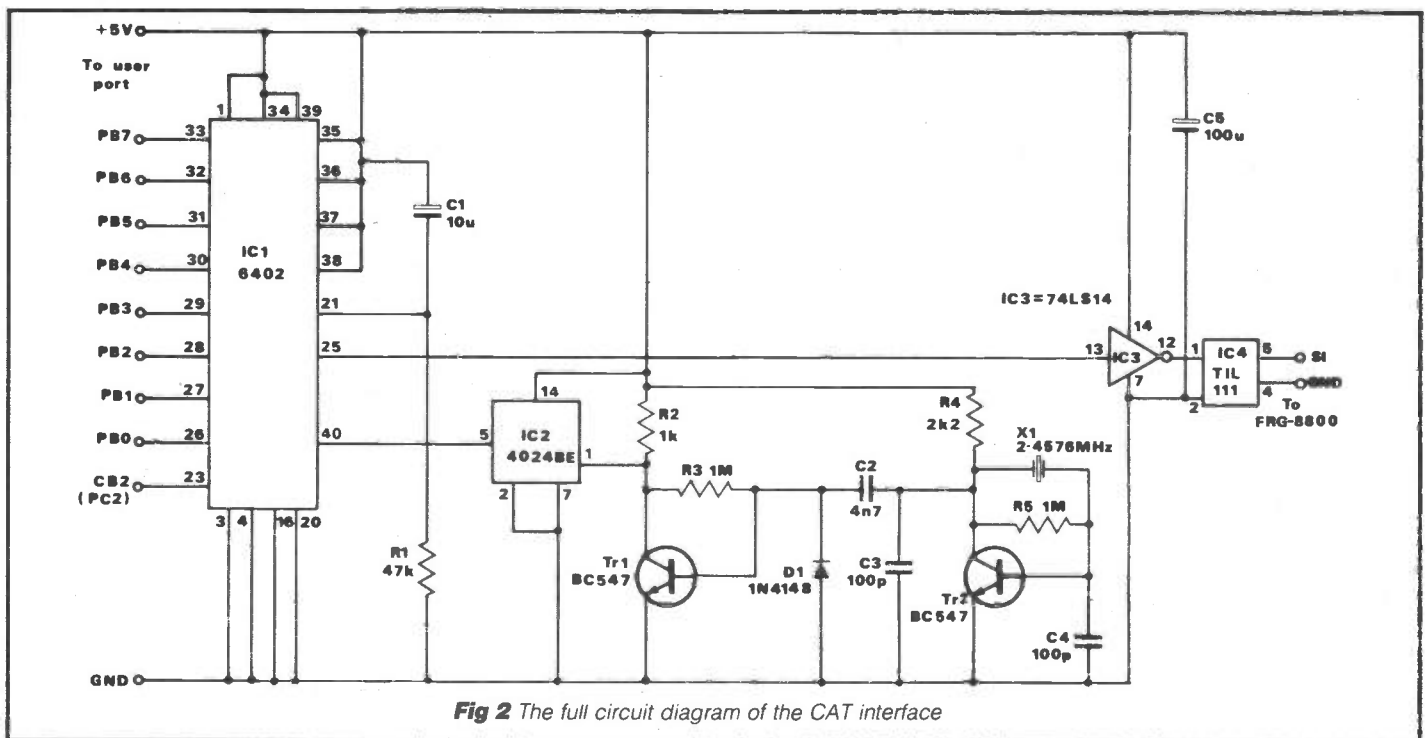
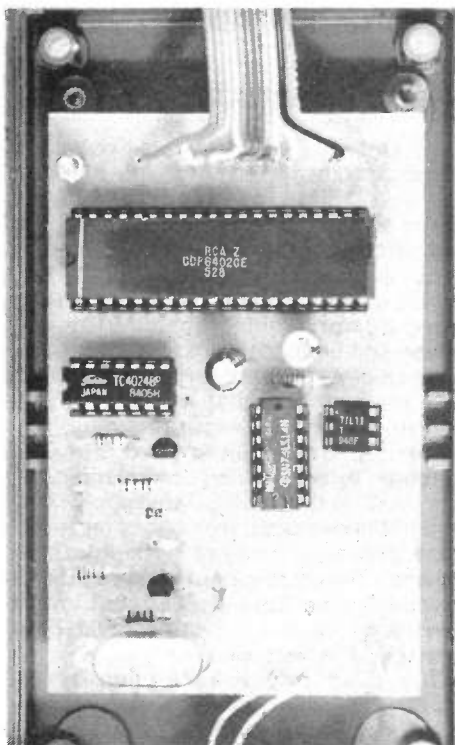


Fig 2 The full circuit diagram of the CAT interface



Circuit operation

The full circuit diagram of the CAT interface appears in *Figure 2*. IC1 is the UART, and this is the industry standard 6402 type. Its eight parallel inputs are fed from the data lines of the computer's user port, and the strobe input is fed from

line CB2 (VIC-20 and BBC Model B) or line PC2 (Commodore 64). Line CB2 has several modes of operation, and one of these automatically provides the required high to low transition each time data is written to the user port. Line PC2 only has a single mode of operation, and in this it also provides the required strobe pulse automatically after data has been written to the user port.

IC1 requires a positive reset pulse at switch-on, and this is generated by C1 and R1. Pins 35 to 39 are used to program the required word format, and the table shows how this system operates.

In this case a word format of eight data bits, two stop bits and no parity is required, which requires all five inputs to be tied to the +5 volt supply rail. Pin 34 is the control word load input, and this is tied to the high state in order to load the data on pins 35 to 39 into IC1's control register.

Tr2 operates in a conventional crystal oscillator mode, and Tr1 operates as the buffer amplifier which ensures that an output having suitable characteristics to drive a CMOS logic device is obtained. D1 prevents over-driving of Tr1, which could lead to waveform distortion and an unsatisfactory output signal. The binary divider is a CMOS 4024BE seven stage

type, but in this case the signal is tapped off prior to the last two stages.

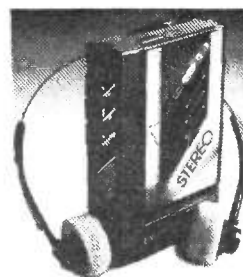
IC3a is an inverting Schmitt trigger which inverts the serial output signal and provides a suitable drive current for the opto-isolator. The latter is a standard infra-red LED/npn photo-transistor type. The output is taken from across the emitter and collector terminals and no connection is made to the base terminal of the transistor. The emitter connects to the earth rail of the receiver and the collector connects to the serial input terminal. A collector load resistor is required, but a suitable (680R) component is included at the serial input of the receiver.

The circuit requires a single +5 volt supply, and the current consumption is only a few milliamps. The computer should be able to supply this without any difficulty. REW

Next month, R A Penfold concludes his article by dealing with the PCB construction and the CAT interface in use, and looking at some demonstration software

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FEATURED IN ETI, SEPTEMBER 1986

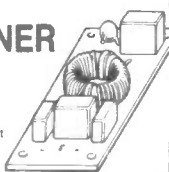
It is astonishing how many people buy or build top-flight hi-fi equipment, and then connect it to a noisy, spiky mains supply. Rather like buying a Ferrari and trying to run it on paraffin, you might think. Expecting crystal clear sound, the poor music enthusiast ends up with a muddy, confused mush,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

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TACHOMETER AND DWELL METER

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

Do you

- Fit a £500 Pie-in-ear in-car stereo with digital flex-woolers and 24-band ramification?
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- Tune your engine.

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MAINS CONTROLLER

FEATURED IN ETI, JANUARY 1987

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

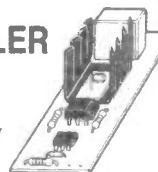
The ETI Mains Controller is a logic to mains interface which allows you to control loads of up to 500W from your computer or logic circuits. An opto-coupler gives isolation of at least 2,500V, so the controller can be connected to experimental circuits, computers and control projects in complete safety. Follow your computer interface with a mains controller, and you're really in business with automatic control!

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Your mains controller parts set contains: high quality roller lined PCB, MOC3021 opto coupler, power trace with heatsink, mounting hardware and heatsink compound, all components, including snubber components for switching inductive loads, transistor and resistors for CMOS interface, full instructions.

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The NRD-525 Communication Receiver from JRC

Andreas Piróg peers into one of JRC's latest boxes of tricks and is not disappointed

The NRD-525 HF general coverage communication receiver, which replaces the NRD-515, is the third model of the semi-professional grade series manufactured by the Japan Radio Company Ltd.

Specifications

Let us first have a brief look at some technical data, as specified by the manufacturer. The NRD-525 covers the frequency range from 90kHz to 34MHz (*note*: these are the manufacturer's specifications only; in actual fact it is possible to tune from below 30kHz). An optional VHF/UHF converter extending frequency coverage to 60MHz, 114-174MHz and 423-456MHz is available. The receiver utilises an up-conversion double superheterodyne system with a 1st IF of 70.453MHz and a 2nd IF of 455kHz. Modes covered as standard are: AM, SSB (LSB/USB), CW and FM. An optional plug-in RTTY demodulator is available.

Up to 4 bandwidths, selectable independent of mode, are included:

Wide: >4kHz @ -6dB <10kHz @ -60dB

Inter: >2kHz @ -6dB <6kHz @ -60dB

Narrow: >1kHz @ -6dB <3kHz @ -60dB

Aux: Optional CW/RTTY filters are available

FM: 12kHz @ -6dB

Other specifications are as follows: frequency stability ± 3 PPM, image and IF rejection >70dB, dynamic range >100dB, PBS variation range ± 1 kHz, notch attenuation >30dB, BFO variation range ± 2 kHz, RIT variation range 5kHz or more. Power supply requirements 100/120/220/240V ac and 12-16 dc. Dimensions 330 x 130 x 280mm (WHD). Weight 8.5kg.

Description

The receiver is housed in a silver-grey finish metal case with plastic front panel. Inside the cabinet everything is entirely

modular in design with plug-in PC boards. On the front panel, control knobs and push-buttons are conveniently spaced and laid out in rows.

The NRD-525 comes standard with a large variety of features and controls. Internal speaker, RF gain, noise blanker, single step-down attenuator (20dB), variable AGC, BFO, passband shift in all modes, RIT, monitor, lock, dimmer, numeric keypad for frequency entry and up/down slewing pads are all included.

The NRD-525 incorporates audio tone control, squelch and a clock/timer arrangement. A built-in memory unit has a large capacity of 200 channels. Each channel stores data on frequency, bandwidth, mode, AGC speed and attenuator settings. Memory scan and frequency sweep of a selected band are both featured, including a control of speed and of the sensitivity of the auto-stop circuit.

The NRD-525 tunes in 10Hz increments. The light blue 7 digit VFD (vacuum fluorescent display) also indicates carrier frequency of the RIT off-set, when RIT is switched on. A number of auxiliary displays on the same panel indicate: S-meter, mode, bandwidth, AGC time constant, squelch, attenuator, scan/sweep and clock/timer status and memory channel selected.

The receiver utilises the automatic tuning system, consisting of a double-tuning circuit with capacitor diodes controlled by a microprocessor. A personal computer can also be connected to the NRD-525 by means of the RS-232C interface (option).

Rounding off VHF/UHF and LF/HF (low and high impedance) antenna connectors are provided on the back panel of the NRD-525.

Your scribe borrowed a sample of the NRD-525 and operated it for nearly a

week - long enough to get really familiar with the rig and to form an opinion of its quality and performance standards.

The model tested (serial no BR36919) incorporated two standard factory IF filters, ie the 6.0kHz wide and the 2.0kHz inter. An optional narrow - the 1.0kHz xtal - was installed.

On-the-air

The tests were performed side by side with the NRD-515 equipped with the 6.0, 2.4, 0.6 and 1.0kHz BW IF filters and used as a reference receiver. Certain comparisons with the TR7 transceiver from R L Drake Co have also been made. The aerial used was a 45m long-wire antenna with 50 Ω co-ax down connection.

A quick tune around on the NRD-525 model demonstrated that the receiver has class. Its precision, versatility and, in many respects, its operating comfort could not remain unnoticed.

Tuning can be accomplished by means of a rotary flywheel-weighted tuning knob, keypad, slewing, scanning and memory. In practice, such a variety of choices make rapid QSY remarkably comfortable.

The silky-smooth single-speed VFO is a delight to operate. Circuitry appears to be clean and quiet. Background noise is below average and no 'birdies' have been found. However, a strange buzz on several frequencies within the LF/MF spectrum was observed, especially when detuning the VFO approximately 1kHz up or downwards away from the transmitted carrier frequency. By the way, a quick check of the previous model, the '515 did not confirm the existence of any buzz on those frequencies at that time. After closer investigation, it appeared that the nuisance was generated by the ac/dc converter T16LUJD00017 on the VFD panel of the NRD-525.

The set provides clear and distinct audio when an outboard speaker unit – in this case the SP-230 from Trio – is used. Unfortunately, no sample of the matching speaker, the JRC NVA-88, was available for testing. With the '515's accessory speaker – the NVA-515 – the audio did not provide complete satisfaction. Equally, the NRD-525's top-mounted internal loudspeaker left a lot to be desired in this respect. No wonder, as it is simply intended for some auxiliary, 'emergency', applications rather than regular use.

Exciting exploration

Exploring 60m on the new NRD-525 at around 2115 UTC, I was pleased to hear a variety of interesting signals coming from Africa, Asia and Latin America. Although the 2.0kHz IF filter performed very well, I found the 2.4kHz one installed on the '515 generally to be preferable, because of its slightly wider bandwidth and, as a result, better audio. Nonetheless, for 120 and 90m Tropical Band DX, the NRD-525's 2.0kHz IF BW seemed to be nearly the ideal value. In the case of critical CW/RTTY QRM, the narrow 1.0kHz xtal can be selected as an alternative to solve most of the problem.

Also at about 2115 UTC, high frequency Latin American DX has been an exciting area for research. Accordingly, I have made regular checks on the high-powered outlets of Radio Nacional da Amazônia, Brazil, on 11780 and 15200kHz. Conditions were good on these bands. A very clear and strong signal with no interference or fading from Radio Nacional de Chile was noted on 15140kHz, so I switched over to the wide 6.0kHz IF BW in order to enjoy 'improved fidelity' DX programme listening. The filter performed very well indeed, on short wave as well, a strong and interference-free signal being received.

Another day, just after midnight, I spent most of the time on 60m and was once again searching the band for DX. In fact, I was amazed at the number of stations I could receive. Indeed, the NRD-525 demonstrated excellent DX capabilities in the Tropical Bands, as did the parallel performing '515. Reception in SSB (LSB/USB) turned out to be in a class of its own when scanning the 80 and 20m amateur bands and monitoring a variety of distant QSOs.

With regard to the high-powered international SW broadcasting bands both models performed similarly, providing very good reception of weak signals in the presence of powerful nearby stations. Neither intermodulation nor overloadings were observed.

Reception of long and medium wave signals is satisfactory. The NRD-525's sensitivity is quite adequate in this regard, even making some LW/MW DXing possible. Still, the '515 with its internal, manually tunable preselector

performed unquestionably better on medium wave than did the NRD-525.

The NRD-525's use of a synchronous AM detector noticeably improves the overall readability of received signals. Also the built-in IF notch operates excellently in terms of eliminating heterodynes and QRM from CW and RTTY stations. However, a separate on/off switch would have been more convenient than the existing 'soft' off position.

The NRD-525's digital frequency readout, although enabling the operator to tune to the nearest 10Hz, is, in my opinion, not 'user-friendly'. During long-term operation, excessive fatigue and even some dizziness can occur, because of its tiny, visually-irritating digits. By way of comparison, the '515's LED readout with its large, discrete numerals, is a pleasure to work with.

As previously indicated, the reception in SSB and ECSS modes is very good. Also, tuning in SSB/ECSS is straightforward, thanks to the efficiently operating RIT (fine tune) which alters the frequency display to read out to the nearest 10Hz. Any occasional mismatch by as much as 5Hz is of practically no concern at all, even for music programmes.

The dual-width noise blanker turned out to be effective in reducing ignition pulse noise, including, of course, that of the indefatigable Soviet 'Woodpecker' radar transmissions.

Auxiliary functions/features such as direct access tuning, frequency sweeping, memory scanning, clock/timer, etc work perfectly. Equally, the operating controls are solid and reliable on both models. The sole difference is that the NRD-525's rotary knobs (except for the main tuning knob) scrape the fingers during operation, whereas those of the '515 seem to have an exceptionally pleasurable 'feel'. This also applies to the somewhat spartan Δf , even if its operation is not quite up to the standards of the NRD-525's RIT control.

Evaluations

The set features what is possibly the largest number of channel memories of any semi-professional model available. Memory scanning and frequency sweeping are both included as well.

A real surprise is the NRD-525's external styling, substantially different from that of earlier models from JRC. The layout of the front panel and the overall finish are similar in style to certain eye-catching 'super sets' from Yaesu and Icom (FRG-8800 and IC-R71). In fact, a large number of fashionable push-buttons, in combination with a crowd of miniaturised vacuum fluorescent displays, turn the operation of the NRD-525 into – to put it mildly – a bizarre exercise. Particularly clumsy, in my opinion, is the mode/bandwidth selection via respective switch pads with non-standard labelling (left/right white arrows). In practice, I found the system used to be considerably annoying, in contrast to that encountered in other commercial grade receivers from JRC.

Now, as regards HF performance itself, the reception of AM mode signals is noticeably enhanced by the NRD-525's use of a synchronous AM detector. Further welcome features are an IF notch and the passband shift operating in all modes. In addition to the defeatable AGC, the NRD-525 now offers the possibility of bypassing the existing input RF filters – a clever technique when hunting super-weak DX signals.

Selectivity is very good indeed. A combination of ceramic (NTK), mechanical (Kokusai) and crystal (NOK) IF filters ensures remarkable operating flexibility and allows for serious SWL/SWDX applications, even in the most congested signal interference environment.

Dynamic range is excellent. Reportedly, the NRD-525's ICP₃ (third order intercept point, 20kHz) is equal to +5, +10, resp +14dBm, depending upon the sources from which such assessments emanated. In addition, the set is



NRD-525

very sensitive. As with the Drake TR7, the NRD-525 provides excellent performance in flushing out marginal DX signals under difficult conditions.

Long and medium wave reception is generally good. The overall quality of construction is well above average. The set is capable of 12-16 dc operation, which makes it suitable for mobile applications, too.

Overall, the NRD-525 revealed the following features:

- excellent usable sensitivity (SW only)
- excellent dynamic range
- excellent AGC
- superb frequency stability
- hi-fi-level ECSS reception
- tunes and displays frequencies to the nearest 10Hz
- utilises synchronous AM detector
- incorporates excellent IF notch
- includes commendably performing noise blander

The NRD-525 v the NRD-515

When compared with the '515, the NRD-525 arrives fully self-contained, with a built-in loudspeaker, memory channels, keypad for frequency entry and memory selection, scanning/sweeping unit, and a clock/timer and 'beep-beep' arrangement.

With regard to IF selectivity, the configuration of bandwidth filters on both receivers is different except for the stock CLF-D68 hand-selected ceramic (6.0kHz @ 6dB down) wide from NTK. For example:

Inter: the stock MF-455-10AZ 121 (2.4kHz @ 6dB down) mechanical from Kokusai is on the '515, whereas the NRD-525 features the stock MF-IC 31 455 (2.0kHz @ 6dB down) from the same manufacturer (Kokusai).

Narrow: the optional MF-455-03AZ 121 (0.6kHz @ 6dB down) [CFL-260] mechanical from Kokusai is on the '515, in contrast to the YF-455 DE (1.0kHz @ 6dB down) [CFL-233] xtal from NOK on the NRD-525.

Aux: the optional YF-455 DPB (0.3kHz @ 6dB down) [CFL-230] CW narrow xtal filter from NOK is on the '515, whereas the YF-455 FM (0.3kHz @ 6dB down) [CFL-231] CW narrow, resp the YF-455 DQ (0.5kHz @ 6dB down) [CFL-232] SSB narrow xtal, both from NOK, are recommended by the manufacturer (JRC) for the NRD-525.

Moreover, the following xtal IF filters (NOK) may alternatively be installed in an aux position on the NRD-525, resp NRD-515 receivers:

YF-455 DE (1.0kHz @ 6dB down) [CFL-233]

YF-455 DG (1.8kHz @ 6dB down) [CFL-218]

YF-455 EB (3.0kHz @ 6dB down)

Technically, the NRD-525 has shown itself to have many improvements over its predecessor. The inclusion of a synchronous AM detector, electronic preselection, all-mode passband shift, IF notch and audio tone control, absent on the '515, are obvious advantages. Further advantages of the NRD-525 are as follows:

- entirely modular construction of the circuit
- synthesizer tunes in 10Hz increments
- frequency counter reads out to the nearest 10Hz
- built-in loudspeaker
- favourable retail price (£1,195 inc VAT)

In terms of AM SWL/Tropical Band DX, both sets are high-class performers. So far, I have found the robot-like NRD-525 to perform above the '515's standards, especially as regards SSB/ECSS reception. However, the latter model appears to be better suited to MWL/MW-DX applications, thanks to its internal, manually-peaked preselector.

The main distributor or JRC equipment in the UK is Lowe Electronics Ltd of Derbyshire. Tel: (0629) 2817 for further information.

REW

NEXT ISSUE

Radio & Electronics

The communications and electronics magazine **World**

DESIGNING POWER SUPPLIES

The PSU is the most highly stressed item in any project, says David Sylvester, so adequate attention must be given in its design. Here, he reveals how it's done

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Meteor shower DX produced by the Quadrantids created an enthusiastic start to the New Year. Intense activity occurred on January 3rd and 4th with many European stations being noted throughout Band I. From then on, however, DX-TV reception was minimal. Perhaps 'non-existent' would be a more accurate description.

Fortunately, there were a couple of mini sporadic-E openings on the 18th and 25th, but these lasted for only a few minutes.

Towards the end of the month there was a flourish of tropospheric activity which brought January to an interesting conclusion.

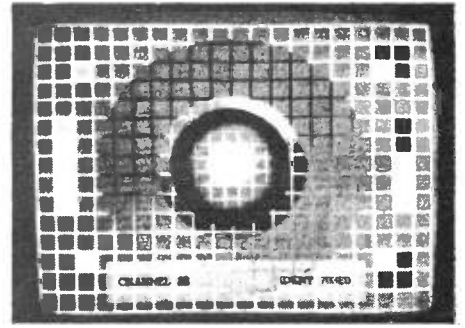
Tropospheric DX round-up

A large area of high pressure over Europe at the end of January meant lots of tropospheric DX in Band III and at UHF. Reception also occurred in Band I but to a lesser degree. Many parts of the UK were affected by the conditions so most enthusiasts managed to catch a whiff of something!

Simon Hamer of New Radnor in Powys noted East German programmes on channels E5 and E6 in Band III on January 31st. Perhaps this will give some idea of how good the conditions were, especially considering how far inland Simon's location is. His reception was even more impressive because he lives in a valley and normally tends to be shielded from tropospheric signals. Simon also managed to log the Danmarks Radio transmitters situated at Soenderjylland (channel E7) and Vestjylland (channel E10).

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith



Meanwhile in Leeds, the ever-faithful 500W relay at Brussels operated by RTBF-1 was noted on the 31st. A couple of 525-line system M transmissions were also present. These originated from American Forces Network transmitters operating in Belgium and the Netherlands. The signals were spotted by Kevin Jackson.

DX-TV logs for January

This month we are featuring two reception logs. The first is from Simon Hamer and shows his successes via sporadic-E propagation:

3/1/87: Danish PM5534 test card from Danmarks Radio on channel E3; Russia on channel R2 with a documentary programme from TSS. This was followed by the 'BPEMR' news bulletin; Sweden (SVT) on channel E4 with a subtitled programme and an identification caption; feature film from TVE-2 in Spain

including the 'tve' anti-pirate identification in the corner.

4/1/87: PM5544 test card with a dark background from TVP in Poland on channel R1; Czechoslovakian 'EZO' type electronic test card from CST on channel R1; Austrian PM5544 test card on channel E2a carrying the identification 'ORFFS1'; Italian programmes on channel IA with the anti-pirate 'RAI' identification in the corner of the picture.

5/1/87: BPEMR news programme from TSS on channel R1.

23/1/87: SVT on channel E3 with their clock caption showing 1350 prior to the station opening sequence.

26/1/87: FuBK electronic test card from Bayerischer Rundfunk (BR-1) in West Germany. The test card, received on channel E2, included the identification 'GRÜNTEN' and was co-channel with the Swiss '+PTT SRG-1' FuBK; Polish PM5544 test card from TVP on R2.

PHOTO FILE ● PHOTO FILE ● PHOTO



Fig 1 Close down caption from Bayerischer Rundfunk, West Germany

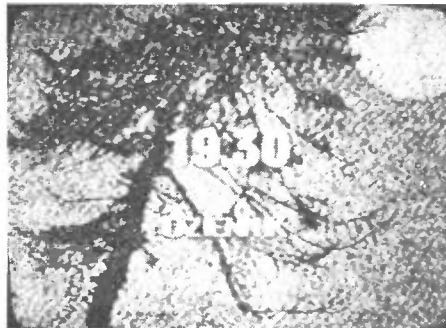


Fig 2 Caption announcing the Polish TV news programme, 'Dziennik'



Fig 3 Russian current affairs identification programme

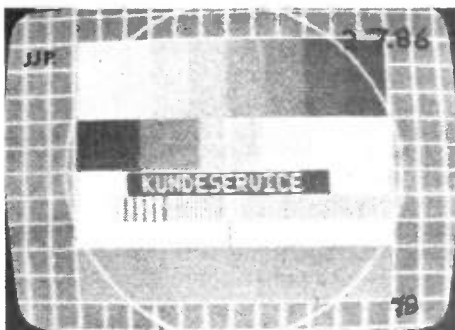


Fig 4 FuBK test card used by Kanal 2 in Copenhagen, Denmark on E56



Fig 5 Identification caption from a local TV station in Denmark

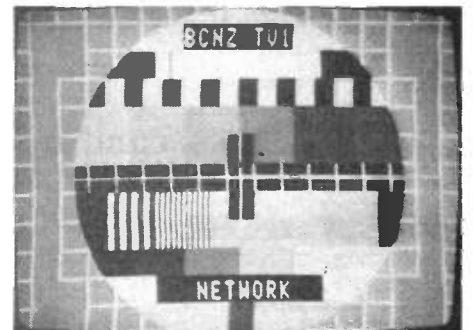


Fig 6 PM5544 test card radiated by the TV service in New Zealand

DX-TV RECEPTION REPORTS



Kevin Jackson's UHF aerial system

The other log comes from Kevin Jackson of Leeds and shows his reception for the 31st via enhanced tropospheric conditions:

31/1/87: French TV signals from Télédiffusion de France (TDF) with TF1 (first network) on channels E27, E42, E43 and E63. The second network (A2) was noted on E21, E34, E39, E46, E48 and E57. FR-3 (third network) transmissions were noted on E37, E40, E45 and E60. Meanwhile, 'Canal Plus' signals (also from France) were received on channels L5, L6, L7, L8, L9 and L10. Still in France, signals from the 'La Cinq' service were logged on channel E49. Kevin also noted the following services: RTBF-1 (French language service in Belgium) on channels E8, E52 and E57; RTBF-2 on E45 (500W outlet), E60 and E42; BRT-1 (Flemish language service in Belgium) on E10, E43 and E49; BRT-2 on E46 and E62; NOS-1 on channels E5, E6, E7, E29 and E50; NOS-2 on E31, E32, E45, E53 and E54; ZDF (second network from West Germany) on E21, E24, E26, E33, E34, E35, E37 (from two transmitters) and E43; WDR-1 (West Germany) on E9, E30, E43 and E46; WDR-3 on E39, E42, E48, E49, E50, E55, E57 and E60; SWF-3 (Südwestfunk, West Germany) on E44 and E56; HR-3 (Hessischer Rundfunk, West Germany) on E52; AFN (American Forces Network)

on channel A80 from the Camp New Amsterdam transmitter in the Netherlands. AFN-TV was also received by Kevin on channel E34 from the Belgian base at 'SHAPE'.

Our thanks to Simon and Kevin for sending in details of their impressive logs.

Reception reports

Iain Menzies of Aberdeen has just splashed out on a receiver system for monitoring the 50MHz amateur band. During the Quadrantids meteor shower peak on January 3rd, he heard around a dozen UK stations. Iain also received Continental TV services including Russia, Italy and Spain.

Auroral DX was noted on the 7th, 10th, 16th, 17th and 25th with NRK present from Norway on channel E2 and Russia (TSS) on R1. Iain also saw a dash of sporadic-E activity on the 18th with his favourite station, TVE! Perhaps 'favourite' isn't quite the word. Reading between the lines (and the expletives) in his letter it would appear that the very mention of Spain brings on a similar effect to waving a red rag at a bull. Incidentally, he would be grateful if anyone could advise him of a cheap source of the 1987 *World Radio & TV Handbook*. He feels that £18 is far too expensive. Don't we all!

John Kimberley of Solihull in the West Midlands has been receiving Belgian transmissions in Band III on channels E8 and E10 on a regular basis from the Wavre outlet. He has now acquired a D-100 DX-TV converter. On the narrow band IF setting he can now separate the French 'Canal Plus' service originating from the channel L5 outlet at Lille from all the rubbish caused by cross-modulation from the nearby Sutton Coldfield mast.

William Maries of Studley in Warwickshire managed to log the Dudelange channel E7 outlet in Luxembourg on January 8th. This transmitter radiates RTL Plus programmes. A couple of French transmissions were also present at UHF with t1 on channel 22 and FR-3 after close down on channel 28.

The 31st was more spectacular for

William as there were many West German stations in evidence. Several FuBK test cards with individual identifications were noted from Westdeutsches Fernsehen. These included 'WDR 1 LA9' on channel E9 from Langenberg, 'WDR 1 NH30' on E30 from Nordhelle and 'WDR 1 KL46' from Kleve.

The new identification on the French PM5544 test card was noticed by William on the 31st. The inscription was 'CENACO ROMAINVILLE' and he saw it on channels 28, 42 and 60 via the FR-3 network.

At the moment, William is in the process of compiling a data sheet system covering the various television services operating throughout Western Europe. The aim is to produce a handy reference source which should be easy to update. It will be invaluable to both established DXers and newcomers to the hobby. We will be reporting its progress in the near future.

Kevin Jackson and Mark Dent (both of Leeds) noted excellent trop DX from West Germany and the Low Countries on January 30th and 31st. A mystery occurred during the enhanced conditions in the form of a transmission on channel 49 from France. It was the 'La Cinq' service which should have closed down on January 1st.

Kevin witnessed a small sporadic-E opening on the 9th when Czechoslovakia appeared on channel R1 together with a 'floating' and unidentified PM5544 test card.

Kevin's indoor aerial system consists of a Triax 44-element wideband UHF array attached to a stub mast which is set in a bucket of concrete. This makes life much easier when the aerial has to be repositioned... on the lounge carpet; this room houses all of Kevin's aerials. His Band I system comprises a wire dipole which is taped to the window frame. A 3 element wideband array is used for Band III. The system works well as his logs always testify. It also helps living several floors up in a tower block with an unobstructed take-off to Europe.

Bob Brooks of Great Sutton in South Wirral has sent his log for the month. Stations received include NRK (Norway), CST with the 'RS-KH' electronic test card, SVT (Sweden), TVP, RTBF, BRT and Canal Plus. Bob also noted RTE from Eire on the 17th with programmes until close down at 0023.

Multi-standard TV

John Bray of St Neots tells us that JVC have recently released a multi-system colour receiver, model C140KM. It will resolve PAL and SECAM colour transmissions on systems B,G,H,D,I,K and K' which means that it is ideal for picking up signals from Russia, Western Europe and the UK. In keeping with many so-called 'multi-standard' receivers, it won't work on the French system 'L', but it will

Band I
Type 'VHF 1220-1'
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NF = 1.8dB
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Flatness = ±1dB
Output DIN 45004 100mV

VHF wide-band
Type 'VHF 1220-WB'
40-230MHz
NF = 1.8dB
Gain = 20dB
Flatness = ±1dB
Output DIN 45004 100mV

respond to the 525-line system 'M' standard as used in the USA where the NTSC colour system is employed. It will also resolve 4.43MHz NTSC.

The model number quoted refers to the 14-inch version, but John informs us that a 20-inch set is also available.

New VHF preamplifiers

Fringe Electronics Ltd are now producing their 'standard VHF range' preamplifiers with an updated specification. The preamplifiers in the table are available and should be of interest to DXers. These specifications are those quoted by Fringe Electronics Ltd. The preamplifiers are available direct at a cost of £10.41 inclusive of postage and packing (VAT is extra). A mains power unit (type P1215 to power the amplifiers) is available at £9.43 inclusive (VAT extra). Further details are available by writing to the company at 50 Mansfield Road, Clipstone, Mansfield, Notts NG21 9EQ.

Breakfast TV comes to Italy

The programme is called 'Uno Mattino' ('Uno Morning', taken from the name of Italy's state-owned first network, RAI Uno) and features 'Telegiornale' (TG-1) news bulletins at 0800, 0900 and 0930. Our thanks to David Bocca Corsico Piccolino

(Vigevano, Italy) for passing on this information.

Service Information

Sweden/Finland: There are two relay stations operating near Södertälje (south of Stockholm) which are re-broadcasting programmes from the Finnish TV service, YLE. The stations are Södertälje/Blombacka on channel E49 with 100W ERP and Södertälje/Ragnhildsberg on channel E47 with 500W ERP.

The main YLE transmitter to operate in Sweden is located at Stockholm/Nacka. It uses channel E39 with an ERP of 1000kW. The Philips PM5534 test card is radiated with the identification 'YLE' at the top and 'STOCKHOLM' at the bottom.

Finnish transmissions are carried by radio link between Helsinki, Abo, Hammarland, Väddö, Käknäs and Nacka.

Czechoslovakia: The identification 'ODK' used on the CST FuBK test card is an abbreviation for 'Odbavovací Komplex'. This is the control complex from where TV programmes originate.

There are plans to increase the effective radiated power (ERP) of the CST-1 relay in Prague. The channel R41 outlet is expected to radiate with 100kW.

Denmark: A new UHF transmitter has come into service at Vejle which is

situated on the east coast of Jylland some 40km south west of Aarhus. It operates on channel E30 but at present there are no details about its ERP. The Vejle outlet radiates the TV-Syd service.

Netherlands: The familiar EBU bar pattern and the PM5540 test card have been discontinued in favour of the FuBK. This test card is radiated via both networks from about 0830 local time, although occasionally it is transmitted at 0815 or from 0845. It includes a circle and the identification 'AVVC-HVS'.

Between approximately 0855 and 0900 local time the FuBK test card is radiated without the circle but with individual main transmitter identification. From 0900, the usual PM5544 test card is broadcast with either 'PTT-NED 1' or 'PTT-NED 2' identification. Approximately ten minutes before the start of programmes the inscription changes to either 'NEDERLAND 1' or 'NEDERLAND 2'. Occasionally, the FuBK test card with transmitter identification is shown after close down, but usually transmitters are switched off immediately after the last programme.

This month's service information was kindly supplied by Michael Summers Larsen (Denmark) and Gösta van der Linden (Netherlands). 



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IN4004 or IN4006 Diodes 300 for £6.50

KBS005/01/02 3 amp 50 V/100 V/200 V/bridge rectifiers, 35p/36p/40p. 10 off £3.20/£3.40/£3.70. 100 off £30/£31/£34

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Mullard 5mm LED, 40 red, 30 green, 30 yellow = 100 mixed £7

'HARVI' Hardware packs (nuts-bolts-screws-self tappers, etc) marked 35p retail, 100 mixed packs for £11.

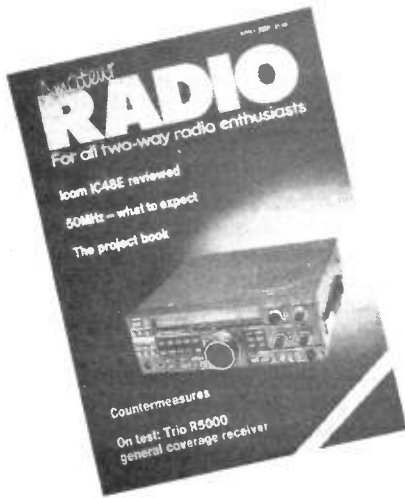
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Suffolk annual rally

The East Suffolk Wireless Revival will be holding the 11th annual mobile rally for radio amateurs on Sunday 24th May at the Civil Service Sportsground, Straight Road, Bucklesham, Ipswich.

There will be all the usual features such as traders' stands, a car boot sale, aerial testing range, a transceiver clinic and a bring-and-buy and vintage radio display. There will also be non-radio stalls, a children's play area, model flying display and other attractions to make the rally a happy day out for all the family.

Admission to the rally will be £1, and talk-in will be provided by the Felixstowe DARS on S22, GB3PO and GB3IH.

Further details can be obtained from Jack Toothill G4IFF, 76 Fircroft Road, Ipswich IP1 6PX. Tel: (0473) 464047.

Swansea rally

The Swansea ARC is organising a rally to be held on Sunday 3rd May in the Patti Pavilion, adjacent to the County Cricket Ground, on the Swansea to Mumbles coast road (A4067). Trade stands, bring-and-buy, CW test (pre-book with the RSGB), bar and full catering will be provided, and there will be free lucky programme prizes. The rally is open from 10.30am to 5.00pm. Full details are available from the rally secretary, Roger Williams GW4HSH, on (0792) 404422.

Out in the field

The Burnham Beeches Radio Club (G3WIR/G6WIR) is anticipating fine weather this month, with a spring holiday 'picnic' on 2nd, 3rd and 4th May. This is a twice yearly event when the club station is set up and there is much activity both on and off the air. There will be a barbeque and camping, and both QRP and DX activity.

It's all back to the club house on the 18th, though, for a talk on satellites by Neill Taylor G4HLX, who is region 6 representative for the RSGB.

The BBRC meets at the Haymill Youth and Community Centre, Burnham Lane, Slough, at 8.00pm on the first

and third Mondays of each month.

For further details contact Eileen Chislett on Maidenhead 25720.

The Emerald Isle

The most recent newsletter from the IRTS, the Irish Radio Transmitters Society, reminds members that, with the AGM imminent, those who wish to enter for the various IRTS Awards should 'start getting their act together'. We thought we'd better pass the message on...

Glen Ross G8MWR, who is a regular contributor to our sister publication *Amateur Radio*, has an article in this newsletter about getting started on 10GHz. All in all, it makes interesting reading.

Further details are available from the Irish Radio Transmitters Society, PO Box 462, Dublin 9.

Charity event

Still in Ireland, the annual rally of the Mid-Ulster Radio Club is scheduled for Sunday 17th May this year at Parkanour House near Dungannon on the Ballygawley Road.

The doors open at 12.00 noon and the entrance fee is £1. There will be the usual trade stands, a bring-and-buy stall, the RSGB bookstall, a QSL bureau and more. Talk-in will be on S22 FM, 145.550.

The club is hoping for a

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

good turn-out, as all the proceeds from this event will go to the Stanley Eakins Memorial Fund.

Further details are available by contacting Sam White G1BIW on (076) 22 22855.

Swindon rally

The Swindon and District Amateur Radio Club is holding an Electronics Rally on Sunday 10th May. As in previous years, the rally will be held at the Oakfield School, Marlowe Avenue, Swindon, and doors will open at 10.00am.

In addition to the rally, a film show and other amusements will be available for children and parking is free. Talk-in will be provided on S22 and SU8, GB3TD on 70cm.

Further information is available from the rally organiser, G8SFM on (066689) 307.

Scarborough rally

Sunday 26th July is a day to mark in your diary if you live in the area of Scarborough, for it is the day of the annual rally

held by the Scarborough Amateur Radio Society.

Doors open for 11.00am at The Spa, Scarborough, and talk-in will be available on 144MHz (S22) and 432MHz (SU8 and RB0-GB3NY).

Further details on what's happening are available from the rally secretary, Ian Hunter G4UQP (QTHR), on (0723) 376847.

Losing your head?

The Mid Lanark Amateur Radio Society stages a monthly lecture. On 29th May, Fausto Ferrari of the Glasgow College is giving a talk on 'Mary Queen of Scots - as seen by the rest of Europe', to mark the 400th anniversary of her beheading (*I didn't know she was a radio ham - Ed*).

Club meetings are held in the Wrangholm Hall, New Stevenston, Motherwell, for 7.30pm and all visitors and prospective members are welcome.

A 35p admission charge is made to help pay for the club's use of the hall.

Further information on the club is available from the secretary, Mid Lanark Amateur Radio Society, 32/34 Carfin Street, New Stevenston, Motherwell ML1 4JL.

Hamigos en le sol

The Association of foreign radio amateurs on the Costa del Sol was the idea of Richard Robinson EA7DGA (ex G2ANX) who has been living in Spain since 1971. The objective behind the operation was to help visiting and resident foreign amateurs to make contact with others in the area.

The group meets at the Restaurante Hawaii, in Torremolinos, for brunch on Sundays between 12.00 and 3.00pm local time.

The restaurant is owned by Carlos EA7ASI and his wife Christine who offer an excel-

Calling all club secretaries!

We are always pleased to receive news and details of interesting meetings from clubs and individuals. However, to help us to promote your organisation or event, please note the following:

- 1) Typed press releases on A4 paper are much more legible than scrawled notes on loo paper, and are less prone to misinterpretation.
- 2) Check that all the relevant information concerning an event is included, such as venue (with full address and directions if necessary), time and date.
- 3) A contact address, such as that of the club secretary, is essential. Please give a full postal address and phone number if possible.
- 4) Please bear in mind that we work two months in advance, so items for publication in a specific issue should be submitted at least three months before the event is due to take place.

Notes from the past

An opinion expressed nearly forty years ago

Knocked 'em in the Edgware Road

During my long association with our hobby it has been interesting to watch how the centres of the retail trade for the constructor have waxed and waned in popularity. It is not that any particular district has ever attained an even near-monopoly, but many of them have had turns in holding the dominant position.

Way back in '23, Lisle Street staked out its claim – not with ex-WD stuff, but with cut price components, and even today many old-timers still tell of 'Mother' Raymond's shop which largely helped in putting Lisle Street on the radio map.

Bishopsgate, Farringdon Street, Holborn, Tottenham Court Road and later Fleet Street districts have all at times been considered to have the distinction of being the centre to which constructors gravitated and where both suburban and provincial visitors made their regular pilgrimages.

The Edgware Road district has for some time been a minor centre of its own and in recent years has been in the ascendancy where constructors from all parts flock on a Saturday. Anyone doubting the extent of interest in constructional radio should take a look round that way any Saturday afternoon, and the enthusiasts who foregather have come from miles around.

This area, easily accessible by all means of transport, with all classes of trade from the well-lined pocketbook to the schoolboy's hard saved coppers catered for, plus all the shops being open in the afternoon, has everything in its favour. A Saturday in Lisle Street is little different from a normal weekday. The neighbouring shops (Tottenham Court Road, Soho Street, etc) are closed, so if the visitor cannot get what he wants there he runs the risk of wasting the best part of the afternoon.

On form I guess I'll put my money on the Edgware Road taking the lead in the constructors' Mecca Stakes.

lent menu. Carlos also offers the use of his shack and HF rig with beam to visiting amateurs. Usually the group operate on 14,170 at 1.00pm GMT (12.00 noon GMT in summertime) looking for members who are not in Spain at the time.

A member's list including personal details and skeds is circulated within the association so that contact may be made.

Those requiring further information should contact Fred Pilkington G3IAG (EA7FSF), 24 High Street, Cheveley, Newmarket, Suffolk CB8 9DQ. Please enclose an SAE.

Spontaneous combustion

The Leiston Amateur Radio Club is a friendly and active club on the east coast of Suffolk. Members are currently involved in running an

RAE class in preparation for the May exam, and there are numerous activities and lectures held throughout the year.

The club meets on the first Tuesday of every month (except August when they are busy with special events) at the Sizewell Sports and Social Club, Sizewell Road, Leiston for 7.30pm. Bar facilities are available and there is ample car parking space.

Visitors are always welcome, but they must be signed in to conform with the fire regulations (apparently amateurs have a habit of bursting into flame every now and again).

Further information on the club and its activities are available from John G0CJX or Alan G3MYA (both QTHR) or by telephoning (0728) 830777.

Freebie

We hear that the DTI have produced a wall chart called a 'Frequency Allocation Chart', showing how the frequency spectrum is allocated. This is available free by phoning 01-275 3072.

The DTI are presently undertaking a major review of the amateur licence. If you have any contribution to make on this subject, contact Room 613, Waterloo Bridge House, Waterloo Road, London.

Errata

In the article entitled *The MF10 Filter Chip* in the February 1987 issue of *Radio & Electronics World*, readers should note the following correction:

In *Figure 4* pin 12 of the IC should be connected to *ground* and not to *-7 volts* as shown.

We are sorry for any inconvenience that this error may have caused.

Computing

AMRAC, the national Amateur Radio and Computer club, has just revised its membership subscriptions. With effect from 1st May the subscriptions will be £8 for the UK, £10 for Europe and £12 for the rest of the world.

AMRAC produces a bi-monthly 40-page newsletter, *AMRAC User*, which covers all the latest news, ideas and

technical items on packet radio, as well as coverage of Amtor and RTTY. In addition to the newsletter, the club also produces a *Hot-News Sheet* in the alternate months to ensure members are kept up to date.

AMRAC is keen to encourage the formation of local AMRAC groups, to hold regular meetings and promote digital communications at a 'grassroots' level. Such groups have already been formed in Hampshire, the Thames Valley and Essex and it is hoped that many more will be formed around the country.

Further details on the club may be obtained by sending an SAE to the secretary, Phil Bridges G6DLJ, AMRAC, PO Box 39, Hythe, Hants SO4 6WY, or on Prestel mailbox 703847754.

Sent to Coventry

Some dates for your diary during May from the Coventry ARS: On 1st May a 2 metre direction finding contest; on 8th May, Morse tuition and a night on the air; on 15th May a talk by G0AJB on 'The earliest days of radio'; on 22nd May another Morse tuition and night on the air; and on 29th May, the (indoor!) direction finding game.

All meetings are held at 8.00pm at Baden Powell House, 121 St Nicholas St, Radford, Coventry.

If you would like to find out more about the society, contact the secretary, Bill Hahn G3UOL, 91 The Chesils, Coventry CV5 9NA. Tel: (0203) 414684.

Felixstowe

Dates for meetings of the Felixstowe and District ARS during May, to be held at 8.00pm in the Scout Hut, Bath Road, Felixstowe, are a social evening on 4th May and on the 18th a construction contest.

Further information is available from Paul Whiting G4YQC on (0473) 642595.

Maths with Maurice

The Bury Radio Society will be meeting at the Mosses Youth & Community Centre, Cecil St, Bury on 12th May for a lecture by M Priestley G0BWN, entitled 'Maths with Maurice'.

Full details can be obtained from M L Hamil G1VQE, 29 Harrow Close, Blackford Bridge, Bury, Lancs BL9 9UD.

Meteors In Chelmsford

The Chelmsford Amateur Radio Society has arranged a lecture on 'How to work VHF-DX by meteor scatter' by Ken

Willis G8VR, to be held on 5th May at 7.30pm at the Marconi College, Chelmsford.

Further information about the Chelmsford ARS can be obtained from Roy and Ela, G3PMX and G6HKM, 1 High Houses, Mashbury Rd, Great Waltham CM3 1LE, tel: (0245) 360545.

Fareham ARS

The Fareham and District Amateur Radio Club meets every Wednesday for 7.30pm at the Porchester Community Centre, Westlands Grove, Fareham, Hants PO16 8RE. Morse classes precede club meetings at 6.30pm.

This month's lecture is enti-

led '6 to 10 metre operation' by G4JCC on the 6th May.

New members are always welcome at club meetings, further information on which is obtainable from the secretary, A S Chester G3CCB, 44 The Ridgeway, Down End, Fareham, Hants PO16 8RE. Tel: (0329) 288139.

PCB mods

S Dean has suggested the following modifications to his article *PCB Designer*, an on-screen draughting program published in the December 1986 issue.

The printed circuit board draughting utility was written for use with dot matrix printers which produce a horizontal dot density of 72 dots/inch, and which require the sequence ESC * 5 to enter this mode. If the printer is capable of 72 dots/inch, but requires the sequence ESC K to enter it (for example, Epson MX82), simply add the following line: 2545 POKE &508C, &4B:FOR

A=&5090 TO &5094: POKE A,0:NEXT

If the printer is *not* capable of 72 dots/inch, then add these two lines:

2545 POKE &508C,&4B:FOR A=&5090 TO &5094: POKE A,0:NEXT
2546 POKE &5013,&33:POKE &5018,19

Note that the number 19 poked into location &5018 above is a typical value for most common printers. The exact value can be derived using the expression $n = 1512 / (\text{dot density})$, where n is the number to be poked into &5018, rounded to nearest integer, and the dot density is

the number of dots/inch that the printer produces in normal bit image mode. For example, if the printer width is 8 inches, and produces 640 dots in bit image mode, then the dot density is $640 / 8 = 80$ dots/inch. If this figure is then entered into the above expression: $n = 1512 / 80 = 18.9$ which is rounded to 19

This modification makes the following assumptions:

- 1) That the printer will enter the normal bit image mode when the sequence ESCAPE K is received.
- 2) That the printer can be programmed to advance the paper in units of 1/216th of an

inch by the sequence ESCAPE 3 n, where n is derived as above.

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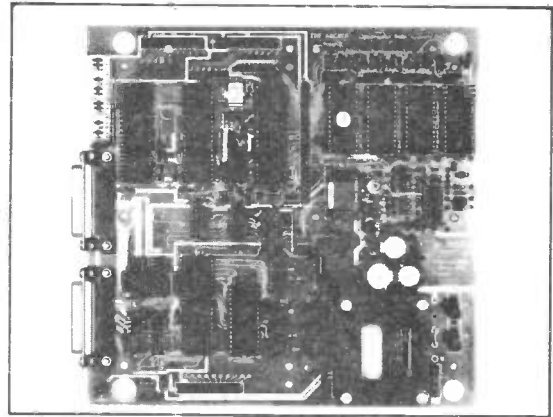
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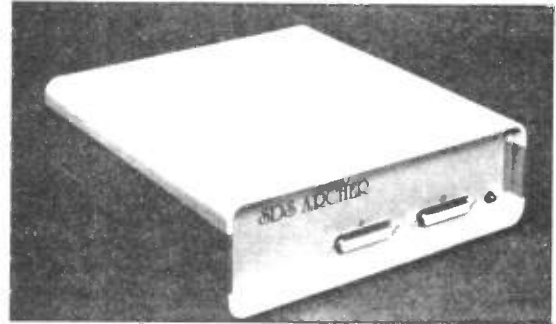
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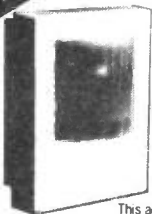
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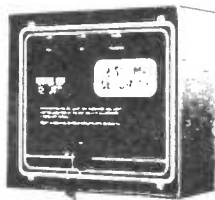


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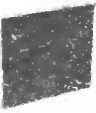
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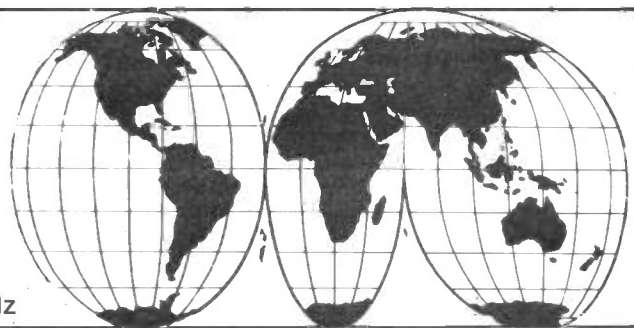
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SHORT WAVE NEWS FOR DX LISTENERS

By Frank A Baldwin

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



Continuing our review and update of some of the low powered Latin American transmitters currently in operation on the 90 metre band, those within the range **3316.2** to **3390.2** are now featured.

Radio Pastaza in El Puyo, Ecuador, operates on **3315** from 1100 (Sunday from 1200) through to 0400. With a power of 2kW, it is heard regularly by USA DXers but only occasionally by listeners in our part of the world.

Radiodifusora Sangay in Macas, Ecuador, is scheduled from 1100 through to 0400 on a nominal **3320**, but in fact is heard on **3322.4**, power unknown.

Evangelical station

Radio Maya de Barillas, Huehuetenango, Guatemala at 1kW transmits on **3324.8** from 1030 to 1500 and from 2230 to 0330. Should you hear and identify this evangelical station, founded in May 1962 by the Central American Benevolent Association, then count yourself fortunate indeed.

Two Brazilians

On **3325** are the signals from the Brazilian Radiodifusora Universitaria in Guaralhos. With a power of 2.5kW it transmits from 0900 to 0300.

The 5kW Radio Liberal in Belem, Brazil, is scheduled on the air around the clock on a reported **3325.5**. It is more often reported than the above mentioned stations.

A low powered Peruvian

Elusive, at least to Western European listeners, is the 0.5kW Ondas del Huallaga in Huanuca, Peru. It programmes to the local populace from 1000 to 0430. The nominal frequency is **3330** but in fact is reportedly subject to variation from **3329.5** up to **3331.5**, thereby making life difficult for Peruvian hunters.

Radio Alvorada located in Londrina, Brazil, entertains

the local citizenry from 0900 through to 0300 (Sunday until 0200). The power is 5kW and the frequency **3335**.

Bag a Bolivian

Once logged by the writer during the last peak period for Latin American reception, Radio 27 de Diciembre, Villamontes, Bolivia now on **3349.5** is scheduled from 2200 to 0200 (Sunday until 0030) with a power of 1kW. If you are lucky, this one may be in the bag!

Get a Guatemalan

Also heard during that period were the signals from La Voz de Nahuala, Nahuala, Guatemala on **3360**, at which point on the dial they serve the locals from 1100 to 1500 and from 2100 to a variable closing time around 0300. This one has been reported by European DXers, so get going!

Brazil again

More often reported in the SWL press are signals from the 5kW Brazilian Radio Cultura in Araraquara operating on **3365** with a 24 hour schedule.

Bag another

On or near this last mentioned channel (it varies slightly) is Radio 16 de Marzo in Centro Minero Bolivar, Bolivia. The power is 0.5kW and it operates from 1030 to 1200 and from 2200 to 0300.

Get one more

More often logged on the 60 metre band (**4835**), but listed in parallel on **3370** is Radio Tezulutlan in Coban, Guatemala, where it radiates from 1100 to a sign-off around 0215. The power is 5kW, it being only seldom heard in our part of the globe on this 90 metre band channel.

Yet more Brazilians

Another 5kW Brazilian is Radio Nacional, Sao Gabriel de Cachoeira, a Radiobras station. It is scheduled from

0800 to around 0100 on **3374.5** but is only occasionally logged by Western European DXers.

More often appearing in SWL press reports are loggings of Radio Dourados, Dourados, Brazil. At 5kW it programmes from 0800 through to 0400 on **3375**.

Co-channel with the above is another Brazilian in the shape of Radio Equatorial, Macapa operating from 0800 to around 0420.

Yet another co-channel Brazilian is Radio Educadora in Guajara Midim with a power of 5kW on the air from 0900 to 2200. Radio Chortis Jocatan, Chiquimula in Guatemala on **3380** has a power of 1kW and is active from 1100 to 1330 and from 2200 to 0300, this being an alternative frequency to **3365**.

A mixed bag

Radio Cumbre (Radio Summit) La Voz del Trabajador del Bismuto, in Tazna, Bolivia also on **3380** at 1kW, is on the air from 1100 (Sunday from 1200) to 1330 (Saturday to

0330) and from 2200 to a variable 0300 (Sunday until 0120). It rarely features in the SWL press.

La Voz de Los Campesinos (The Voice of the Rural Folk), Radio Iris in Esmeraldas, Ecuador is often heard by UK DXer insomniacs like myself on or around **3380**. It is listed from 1000 (Sunday from 1100) to around 0400. The frequency can vary from that shown up to **3381** on occasions.

Radio Educacao Rural, Tefe in Brazil on **3385** is seldom logged outside the vicinity, but for those who wish to try for this one, the power is 1kW and it is scheduled from 0900 to around 0200.

The 1kW Peruvian station Radio Cutervo, Cutervo, works around the clock, but alas its signals do not break through to us resident in these islands.

Another Bolivian, Radio Camargo, Camargo is on **3390.2** from 2230 to 0200 varying to 0230 with a power of 1kW. Needless to say, it is rarely logged here in our northern climes.

AROUND THE DIAL

In which a few of the monthly loggings are reported as a guide to those intending a tune to some of the frequencies mentioned below.

AFRICA

Botswana

Gaborone on **4820** at 1946, when radiating a programme of pop records complete with announcements in English. The published schedule of this 50kW transmitter is from 0400 to 2100 with the Home Service in Setswana but, as my report indicates, the English language is also used.

Angola

Radio Nacional, Luanda on **4952** at 2306, OM with a talk in Portuguese followed by songs and music in the local manner. This Angolan can be elusive in that the frequency

can vary from **4946** to around **4953**, a search around those frequencies being necessary before locating the signals from Luanda. A few evenings later, it was heard on a measured **4952.7**. Radio Nacional is on the air around the clock with a power of 10kW.

Cape Verde

Radio Nacional de Cabo Verde, Mindelo on **3928** at 2249, pop songs in Portuguese with music in the fast rhythmic manner of the locality. At 10kW, Radio Nacional de Cabo Verde operates in Portuguese and Creole from 1800 to 2400, although the closing time can vary up to 0100.

Djibouti

Radiodiffusion Television de Djibouti on **4780** at 0411,

music in the Arabic manner and songs in either Somali or Afar in the National Service which features both those languages and also Arabic. The schedule is from 0300 to 0800 and from 0900 to 1730 from Saturday to Thursday inclusive and from 0500 to 1900 on Friday. The power is 20kW. Unfortunately, the frequency is mostly dominated by the 50kW USSR transmitter at Petrozavodsk, an early morning foray providing the best chance of logging Djibouti.

Guinea

Radiodifusion Nationale, Conakry on **4900** at 2006, OM with a talk in French. The Home Service in French and vernaculars is on this channel from 0600 to 0800 and from 1230 to 2400 week days, but there is an English slot from 1830 to 1930 daily. The Sunday schedule is from 0800 through to 2400 and the power is 18kW.

Libya

Tripoli on **9600** at 0855, songs and music during an Arabic transmission for north-east Africa timed from 0400 to 2255 daily.

Mali

Bamako on **9635** at 0904, alternate male and female announcer with a news bulletin in a vernacular. The French language is used from 1100 to 1800.

Morocco

Rabat on **11920** at 2000, time pips, OM with the station identification then a newscast in Berber during a mainly Arabic programme for western Europe, scheduled from 1900 to 0100.

Mozambique

Radio Mozambique, Maputo on a measured **4866.5** at 1900, time pips, OM with the station identification followed by the news in Portuguese. With a power of 25kW, Radio Mozambique operates in Portuguese from 0255 to 0730 and from 1500 to 2205.

CENTRAL AMERICA

Cuba

Radio Rebelde, Havana on **5025** at 0409, OM with a talk in Spanish. This 50kW transmitter radiates programmes in

Spanish around the clock.

Honduras

HRRI Sani Radio, Porto Lempira on **4755** at 2229, OM with announcements in Spanish, the station identification then a talk with a mention of Nicaragua. Sani Radio first came on the air in late August last year and features bilingual Spanish/Meskito/Sumo educational and entertainment programmes for the Miskito and other Indians of Honduras. The power is 10kW and the schedule is from 1200 to 1600 and from 2100 to 0200.

SOUTH AMERICA

Paraguay

Radio Nacional, Asuncion on **9735** at 2213, OM with the station identification, announcements in Spanish followed by songs and local style music.

The city of Asuncion at the confluence of the rivers Paraguay and Pilcomayo, was founded in 1536 and is the capital of Paraguay, in and around which nearly a quarter of the total population of the country reside.

Peru

Radio San Martin, Tarapoto on **4810** at 0319, when radiating a ballad followed by an announcement and promotions in Spanish. With a power of 3kW this one operates from 1000 through to 0300. It identifies as Una Voz Peruana Para la Libertad which translates roughly as One Peruvian Voice for her Liberty.

Venezuela

Radio Rumbos, Villa de Cura on **4970** at 0403, announcements, station identification, promotions and more station identifications, all in Spanish. This one transmits from 0900 (Sunday from 1000) to 0600 (Sunday until 0400) and has a power of 10kW.

ASIA

Afghanistan

Kabul on **4920** at 1912, OM with a news bulletin followed by the station identification during an English programme scheduled at the time of writing from 1900 to 1930 daily and thought to be a relay from a USSR transmitter.

Bangladesh

Dhaka on **7505** at 1945, OM with some announcements in Bengali in a programme directed to Europe and timed from 1900 to 2000.

India

Delhi on **17387** at 1024, songs in Hindi together with the distinctive music of India during an English programme for east Asia scheduled from 1000 to 1100 daily.

Iran

Teheran on **9685** at 1339, OM with a talk mentioning various Ayatollahs, Iraq and America in the Arabic presentation to the Middle East scheduled from 1100 to 1730. The transmission was, it appears, subject to some ineffective jamming.

Oman

Muscat on **17735** at 1412, quotations from the Holy Quran in an Arabic programme aimed at the Middle East scheduled from 0800 to 1500.

Pakistan

Islamabad on **7365** at 1357, songs and music, followed by the station identification, 3 pips time check at 1400 and then a newscast in the Urdu programme for the Middle East scheduled from 1315 to 1530.

SOUTH-EAST ASIA

Japan

Radio Japan, Tokyo on **9645** at 2220, OM with the station identification then 'Japan Encyclopedia', all about the Japanese railway system. This English transmission directed to Africa, Europe and the Middle East is timed from 2200 to 2300.

Radio Japan, Tokyo on **11955** at 0859, musical box interval signal, OM with the station identification followed by a newscast in the English programme for east Oceania scheduled from 0900 to 1000. Also heard in parallel on **15235**.

Sri Lanka

SLBC Colombo on **9720** at 1545, OM with the station identification followed by pops in the English transmission to south Asia scheduled daily from 1230 to 1630.

PACIFIC

Marianas Islands

KTWY Agana, Guam on **9870** at 1328, OM with a religious talk in the announced 'Good Tidings Hour' followed by the Trans-World Radio Pacific identification, all in the English programme for south Asia timed from 1300 to 1430.

KYOI Saipan on **11900** at 1334, English announcements and recorded pops during the English programme for east Asia timed from 1000 to 1600.

New Zealand

Wellington on **9600** at 0900, clock chimes, time pips followed by the station identification in the English presentation to Australasia scheduled from 0855 to 1115.

CLANDESTINE

Voice of Democratic Kampuchea on **9920** at 0910, YL with a harangue in Cambodian followed by a short interlude of some music in the local style then OM with a talk. The transmission was subjected to jamming. The Voice of Democratic Kampuchea announces in Cambodian as Samleng Kampuchea Pracheathipatei, the policy being one of support for the former Pol Pot regime of Cambodia. The transmitter is thought to be located in the People's Republic of China. Significantly this channel is one regularly used during various schedules by Radio Beijing.

NOW HEAR THESE

Radio Rikisutvarpid, Reykjavik, Iceland on **9985** at 1917, OM and YL with a discussion in the Icelandic programme directed to northern Europe from 1855 to 1945.

Radio Thailand, Bangkok on **9655** at 1218, YL with a talk, some light music European style then OM with the station identification in English at 1221 followed by a newscast. This English transmission to south-east Asia is timed from 1130 to 1230. Officially named Krung Thep, Bangkok is the capital of Thailand and of Phra Nakhon province, succeeding Ayuthia as the Thai capital in 1782. Being in the south-west of the country on the Chao Phraya River near the Gulf of Siam, it is the chief port of Thailand. **REW**

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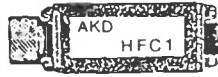
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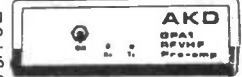


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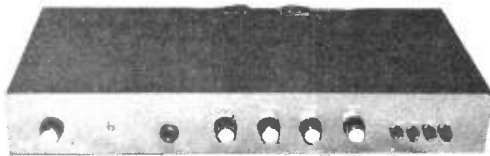
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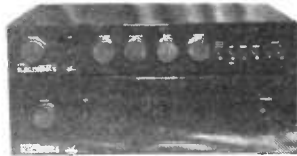
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- JVC radio, TV, cassette recorder FM, SW, MW, TV-VHF, TV-UHF, variable sound monitor mixing play system, in good cond, suitable for DX-TV. Exchange for Eddystone EC10 Mk 2 receiver, must be unmodified and in good cond, or will pay cash for EC10 Mk 2. Tel: (08357) 314

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Simply complete the order form at the end of these ads - feel free to use an extra sheet of paper if there is not enough space. We will accept ads not on our order form. Send to *Radio & Electronics World*, Classified Ads, Sovereign House, Brentwood, Essex CM14 4SE.

- NATO 2000 CB/radio H/M/L/LL AM/FM/LSB/USB/CW, with Sirtel CBE2004 power missile mic, also President Madison home base. H/M AM/FM/LSB/USB. Needs some tidying up, no mic or ext speaker, ALS Colt 1200 DX H/M/L/LL AM/FM/LSB/USB, also needs tidying up, no mic and needs PLL locked properly. Also Trio J99-59 receiver, 0-30MHz, needs new valve, for repair or spares. Colt 485 DX Black Shadow remains for spares. Also mic leads for spares, also 7ft Fire Stick antenna ½ wave and one small centre-loaded mobile, £220 ovno. Tel: Fowey 3548 (0272) 683)
- Breml BRL 200W linear, £30. Also binoculars Zenith Tempest 7x35mm, £20 ono, and Prinz 10x50mm, £25 ono. Contact Mr Martin Fuller, 37 Greenfield Close, Eccles, Nr Maidstone, Kent ME20 7HU, or telephone Maidstone 70485
- Electronic multimeter, similar to AVO but better, complete with 50 and 75 ohm RF probes, leads, etc, £40 ono. Similar for repair or rebuild, £17. Printer, serial or parallel input, basic but good, £40. Similar but parallel only, £35. DX-TV Rx with 5.5MHz sound, video and audio output, bands 1, 3, 5, £20. Several Apple boards, disc, printer, etc, £5 ea, cond unknown. Tel: Ben, Kidderminster 743253
- Racal RA17L receiver for sale. Superb sensitivity and selectivity in 6 bands, 0.5MHz to 30MHz. Excellent condition, £195 ono. Includes rack and LF adaptor, circuits. Tel: Luton (0582) 503806
- Crystals, 44MHz HC6U, suit Trio 2200GX etc. Receive, S21 (145.525) and S23 (145.575) only. I Newbold, 66 Crantock Road, Perry Barr, Birmingham B42 1RP. Tel: (021) 356 9899
- Trio R600 as new, hardly used, £250 or very near

- offer. Complete with all packaging, manual and receipts, 9 months old approx. This communications receiver has a range of 150kHz to 30MHz plus AM, SSB CW. Tel: Milton Keynes (0908) 564547 any time
- Icom IC-R71/E superior grade general coverage receiver, 100kHz-30MHz plus £350 extras incl external speaker, remote control, filters, voice synthesizer. Excellent condition £750 ono. Tel: (0452) 504596 (evenings)
- Sony ICF2001D multi-band radio, 5 year guarantee. Bought August 1986. Excellent condition £250. Tel: (0452) 504596 (evenings)
- Icom R71E receiver in mint cond, hardly used at all, possibly only 20 hrs use £650. No offers. Yaesu FRT7700 ATU £30 plus postage. Tel: 01-281 2493 any time
- Scanner users. I have photocopy of service manuals for the following: Tandy-Realistic Pro 30, Pro 31, Pro 32, and Pro 2021; Yaesu FRG9600, plus combined AOR-Regency manual, AOR 2001-2002 UK version and Regency MX5000-MX7000 USA version £5 each plus postage etc 50p. Tel: 01-743 0811
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- Yaesu FT290 vgc, muTek pre-amp, reverse repeater, inc batts, charger, c-case, mobile mount, ½ whip 25W linear £300. FT203 handheld ½ tele aerial, spare batt pack, batts, charger £130. GM6DVZ, 37 Kirkton Road, Fraserburgh, Aberdeen. Tel: (0346) 26601
- Commodore 64 programmers reference guide and user manual plus *Easy Programming on C64* £7 the three. 40ch FM CB rig PT40, gwo £10. 12 off CX14A Mullard Gunn effect diodes 12-18GHz 8mW brand new in envelopes £1 each. 2 foot dia dish with feed for 10GHz £20. Various other items of 10GHz eqpmnt for sale. Tel: Worthing (0903) 40072 evenings
- 128K Sinclair QL (JS), toolkit on EPROM, speech synthesizer, assembler, books, magazines, joystick, software, printer cable and lots more. Value £400, asking price £220. Chris (after 6pm weekdays or weekends). Tel: (0322) 75502
- JVC b/w TV/radio 2½in screen, Band I/III and UHF, receive DX-TV, radio tunes SW, MW, VHF. 12 volt or mains, in case £90. MM 144/433 UHF transverter 10W o/p, FM SSB, 12 volt £115. Atari software, new locator calculation £3, coil turns, line imp etc, £3 on tape, log book £3. New N type plugs, 5 for £8. Ben. Tel: Kidderminster 743253
- Wobulator 7MHz to 70MHz variable sweep range, new set valves £35. High voltage power supply suit medium linear £20. New N type plugs suit 934 use or good 70cms set-up, £2 ea or 5 at £9. Etched and drilled PCB to make VHF transverter with CCT £3.50. 2 stage helical filter 70cms 50 ohm in out, £3. MM 144/433 trvtr £120. Ben. Tel: Kidderminster 743253
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20mm x 59mm single
40mm x 59mm double

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

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

TO: Radio & Electronics World · Sovereign House · Brentwood · Essex
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print your copy here

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NUMBER OF INSERTIONS REQUIRED

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Double County Guide 3 £94.00... 6 £176.00... 12 £316.00...

PAYMENT ENCLOSED

£

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

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

Registered No 2307667 (England)

C P I

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| 128 x 90 or 61 x 186 | 1/4 page | £160.00 | £150.00 | £145.00 | £125.00 |
| 128 x 186 or 263 x 90 | 1/2 page | £305.00 | £290.00 | £275.00 | £245.00 |
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| 263 x 394 | double page | £1140.00 | £1070.00 | £1020.00 | £910.00 |

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| May 87 | 12 Mar 87 | 18 Mar 87 | 20 Mar 87 | 9 Apr 87 |
| Jun 87 | 16 Apr 87 | 22 Apr 87 | 24 Apr 87 | 14 May 87 |
| July 87 | 14 May 87 | 20 May 87 | 22 May 87 | 4 Jun 87 |
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| CONDITIONS & INFORMATION | | | |
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| <p>SERIES RATES Series rates also apply when larger or additional space to that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received. A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad series rate contracts are not interchangeable.</p> | <p>If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.</p> <p>COPY Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations.</p> | <p>Printed — web-offset PAYMENT Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by publication date.</p> <p>FOR FURTHER INFORMATION CONTACT Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE. (0277) 219876</p> | <p>Overseas payments by International Money Order. Commission to approved advertising agencies is 10%.</p> <p>CONDITIONS 10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p> |



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- 4 5-surface mounting
- 5 4-electrical switches, white flush mounting
- 7 4-in flex line switches with neons
- 9 2-mains transformers with 6V 1A secondaries
- 10 2-mains transformers with 12V A secondaries
- 11 1-extension speaker cabinet for 6" speaker
- 12 1-glass reed switches
- 17 2-ultrasonic transmitters and 2 receivers with circuit
- 19 2-light dependent resistors
- 25 4-wafer switches - 6p 2 way, 4p 3 way, 2p 6 way, 2p 5 way, 1p 12 way small one hold fixing and good length spindle your choice
- 28 1-6 digit counter mains voltage
- 30 2-Nicad battery chargers
- 31 1-key switch with key
- 32 2-aerosol cans of ICI Dry Lubricant
- 34 96-1 metre lengths colour-coded connecting wire
- 39 1-long and medium wave tuner kit
- 41 8-rocker switch 10 amp mains SPST
- 45 1-24 hour time switch mains operated (s h)
- 49 10-neon valves - make good night lights
- 50 2-12V DC at 24V AC, 3 CO relays
- 51 1-12V 2 CO miniature relay very sensitive
- 52 1-12V 4 CO miniature relay
- 54 10-rows of 32 gold plated IC sockets (total 320 sockets)
- 55 1-locking mechanism with 2 keys
- 56 1-miniature unselector with circuit for electric jigsaw puzzle
- 60 5-ferrite rods 4" x 5/16" diameter aerials
- 61 4-ferrite slab aerials with L & M wave coils
- 63 1-Mullard thyristor trigger module
- 66 1-magnetic brake - stops rotation instantly
- 67 1-low pressure 3 level switch can be mouth operated
- 69 2-25 watt pots 8 ohm
- 70 2-25 watt pots 1000 ohm
- 71 4-wire wound pots - 18, 33, 50 and 100 ohm your choice
- 77 1-time reminder adjustable 1-60 mins clockwork
- 85 1-mains shaded pole motor 1/2" stack - shaft
- 89 1-mains motor with gear box 1 rev per 24 hours
- 91 2-mains motors with gear box 16 rpm
- 96 1-thermostat for fridge
- 98 1-motorsised stud switch (s h)
- 101 1-2 hours delay switch
- 103 1-mains power supply unit - 6V DC
- 104 1-mains power supply unit - 4 V DC
- 107 1-5" speaker size radio cabinet with handle
- 112 1-heating pad 200 watts mains
- 114 1-1W amplifier Mullard 172
- 115 1-wall mounting thermostat 24V
- 118 1-teak effect extension 5" speaker cabinet
- 120 2-p.c. boards with 2 amp full wave and 17 other recs
- 121 4-push push switches for table lamps etc
- 122 10-mtrs twin screened flex white p/c outer
- 124 25-clear plastic lenses 1 1/2" diameter
- 127 4-gilot bulb lamp metal clip on p.c. outer
- 128 10-very fine drills for pcbs etc
- 129 4-extra thin screw drivers for instruments
- 132 2-plastic boxes with windows, ideal for interrupted beam switch
- 134 10-model aircraft motor - require no on/off switch, just spin to start
- 137 1-6" 4 ohm 10 watt speaker
- 142 10-4 BA spanners 1 end open, other end closed
- 145 2-4 reed relay kits 3V coil normally open or c/o if magnets added
- 146 20-pilot bulbs 6.5V 3A Philips
- 154 1-12V drip proof relay - ideal for car jobs
- 155 3-varicap push button tuners with knobs
- 169 4-short wave air spaced trimmers 2.30"
- 172 10-12V 6W bulbs Philips m/s
- 178 3-oblong amber indicators with lidlamps 12V
- 180 6-round amber indicators with neons 240V
- 181 100-p.v.c. grommets hole size
- 182 1-short wave tuning condenser 50 pf with spindle
- 184 1-three gang tuning condenser each section 500 pf with trimmers and good length spindle
- 188 1-plastic box sloping metal front, 16 x 95mm average depth 45mm
- 193 6 5 amp 3 pin fuses sockets brown
- 195 5 B.C. lampholders brown bakelite threaded entry
- 196 1 in flex silvermat for electric blank soldering iron etc
- 197 2 thermostats, spindle setting - adjustable range for ovens etc
- 199 1 mains operated solenoid with plunger 1" travel
- 200 1 10 digit switch pad for telephones etc
- 201 8 computer keyboard switches with knobs, pcb or vero mounting
- 206 20 mtrs 80 ohm standard type co ax off white
- 211 1 electric clock mains driven, always right time - not cased
- 216 1 stereo pre amp Mullard EP901
- 232 2 12V solenoids, small with plunger
- 236 1 mains transformer 9V 1 amp secondary C core construction
- 241 1 car door speaker (very flat) 6" 15 ohm made for Radiomobile
- 242 1 speakers 6" x 4" 4 ohm 5 watt made for Radiomobile
- 243 1 speakers 6" x 4" 16 ohm 5 watt made for Radiomobile
- 244 1 mains motor with gear box very small, toothed output 1 rpm
- 245 4 standard size pots, meg with dip switch
- 249 1 13A switched socket on double plate with fused spur
- 266 2 mains transformers 9V A secondary
- 267 1 mains transformers 15V 1A secondary p.c.b. mounting
- 291 1 ten turns 3 watt pot spindle 100 ohm
- 296 3 car cigar lighter socket plugs
- 298 2 15 amp round pin plugs brown bakelite
- 300 1 mains solenoid with plunger compact type
- 301 10 ceramic magnets Mullard 1" x 3/8 x 5/16
- 303 1 12 pole 3 way ceramic wave charge switch
- 305 1 tubular dynamic microphone with desk rest
- 308 1 T.V. turret tuner (black & white T.V.)
- 310 2 oven thermostats
- 313 2 sub miniature micro switches
- 314 1 12" 8 watt min fluorescent tube white
- 315 1 6" 4 watt min fluorescent tube white
- 316 1 round pin kettle plug with moulded on lead
- 453 2 2" 80ohm loudspeakers
- 454 2 2" 80ohm loudspeakers

FROZEN PIPES Can be avoided by winding our heating cable around them, 15 mtrs connected to mains cost only about 10p per week to run. Hundreds of other uses as it is waterproof and very flexible. Resistance 60ohms/metre. Price 28p/metre or 15m for £3.95.

CAR STARTER/CHARGER KIT

Flat Battery! Don't worry you will start your car in a few minutes with this unit - 250 watt transformer, 20 amp rectifiers, case and all parts with data £17.50 post £2

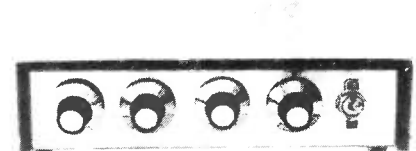


Ex-Electricity Board Guaranteed 12 months

VENNER TIME SWITCH

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

SOUND TO LIGHT UNIT



Complete kit of parts of a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by 3/4" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is £14.95 in kit form

12 volt MOTOR BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3.3" long by 3" dia. They have a good length of spindle - 1/10 hp £3.45 1/8 hp £5.75 1/6 hp £7.50

25A ELECTRICAL PROGRAMMER

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

THIS MONTH'S SNIP

BENCH ISOLATION TRANSFORMER. Toroidal wound 400 watt but very compact. Has a separate 10V winding which can be added or subtracted to give fine voltage control. Normally £40, our price £10 plus £2 post, ref 10P9.

TANGENTIAL BLOWER HEATERS

We can supply 1-2KW - quite definitely the smallest tangential blow heater we have ever had, measuring approx 6 x 6 x 4. This could be just the thing for a small bedroom or to fit under desk or table if you suffer from cold legs. In addition to normal heating functions if put into a simple enclosure this could be a pipe unfreezer (much safer than a blow lamp) possibly even a paint stripper, hair dryer or hand dryer. Price is £5, plus £1 post, ref 5P23. 2-5KW - width approx 8" (plus motor), elements made up of two 1-2kw sections, so with switch supplied you can have 2kw, 1kw or cold blow. Over heat cut-out eliminates fire risk should stop or air flow be impeded. Fan blades are metal. Price £5 plus £1.50 post, ref 5P62. 3KW - width approx 13" plus motor, element made up of 1kw and 2kw section, supplied with 4 section rocker switch, allowing 3kw, 2kw, 1kw and cold blow. Price £6.95 plus £2.00 post. 2KW D.I.Y. SPECIAL - if you want a really cheap tangential heater, this is your opportunity, made for 115v mains, to use on a 230v. Simply join elements in series, needs only simple on/off switch, as you will only have one heat level 2kw and no cold blow. Price £2 plus £1 post, ref 2P96. VERY LOW RUNNING COST - only a 300w element. So would cost only approx 1.2p per hour to run. Should be enough for an airing cupboard or a hot box for seed germination. Might even be enough to keep a damp corner dry. Normal construction approx 4" x 4" plus motor wide. Price £5 plus £1 post, ref 5P78. 500W - 115V TRANSFORMER to isolate you or yours from mains to earth shock dangers. We are able to offer these transformers at less than the price of an auto transformer. Our price for the 500w mains to 115v isolation transformer is £10 plus £5 post, ref 10P6. RESIN CURED FILLER/BUILDER/STICKER made by the famous Holts company, suitable for repairs, not only to car bodies but also to sinks and wash basins, water tanks, drain pipes and gutters, tiles, roofs, filling holes in walls and concrete, repairing cracks in gates, window frames etc. etc. It is weather resistant and adheres well to metals, wood, concrete and some plastics. Special bargain price 2 large tubes for £1, ref 8D464. STEPPER MOTOR By American Philips corporation. Step angle 7.5°. Coil resistance 27 ohms. Operating volts 10-14. Size approx 2 1/2" dia by 1 1/2" deep on a square mounting plate. This is in fact two bi-directional motors with P.M. rotors. Applying correct pulse causes a 7.5° step angle of spindle. Number of steps through which it rotates and a speed at which it rotates is determined by the applied impulses. Properly used this provides an ideal method of speed and position control. Brand new and unused price £5, ref 5P81. BIG GLASS FIBRE SHEETS. Virtually unbreakable, size 4' x 3' approx. Flat, approx 1/16" thick. Intended for pcb's but also ideal for roof repairs, car port, greenhouse etc. £2 each. Minimum quantity we can dispatch is 10. Carriage cost £6.50 per 10. £8.50 for 15.

IONISER KIT

Refresh your home, office, shop, work room, etc. with a negative ION generator. Makes you feel better and work harder - a complete mains operated kit, case included £11.95 plus £2.00 post

TELEPHONE BITS

Master socket (has surge arrester - ringing condenser etc) and Extension socket £3.95
Dual adaptors (2 from one socket) £3.95
Cord terminating with B.T. plug 3 metres £2.95
Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets £11.50
100 mtrs 4 core telephone cable £8.50

MINI MONO AMP

Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of £1.15 each, or 13 for £12.00

J & N BULL ELECTRICAL

Dept RE, 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT
MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B/C card orders accepted. Brighton 0273 734648. Bulk orders: write for quote

£2 POUNDERS*

- 2P2 -Wall mounting thermostat, high precision with mercury switch and thermometer
- 2P3 -Variable and reversible 8-12v psu for model control
- 2P4 -24 volt psu with separate channels for stereo made for Mullard UNILEX
- 2P6 -100W mains to 115V auto-transformer with voltage tapings
- 2P8 -Mains motor with gear box and variable speed selector. Series wound so suitable for further speed control
- 2P9 -Time set switch. Boxed glass fronted and with knobs. Controls up to 15 amps. Ideal to program electric heaters
- 2P10 -12 volt 5 amp mains transformer
- 2P12 -Disk or Tape precision motor - has balanced rotor and is reversible 230v mains operated 1500 rpm
- 2P14 -Mug Stop kit - when thrown emits piercing squawk
- 2P15 -Interrupted Beam kit for burglar alarms, counters, etc
- 2P17 -2 rev per minute mains driven motor, ideal to operate mirror ball
- 2P18 -Liquid/gas shut off valve mains solenoid operated
- 2P19 -Disco switch-motor drives 6 or more 10 amp change over micro switches
- 2P20 -20 metres extension lead, 2 core - ideal most Black and Decker garden tools etc
- 2P21 -10 watt amplifier, Mullard model reference 1173
- 2P22 -Motor driven switch 20 secs on or off after push
- 2P26 -Counter resettable mains operated 3 digit
- 2P27 -Goodmans Speaker 6 inch round 8ohm 12 watt
- 2P28 -Drill Pump - always useful couples to any make portable drill
- 2P31 -4 metres 98 way interconnecting wire easy to strip
- 2P32 -Hot Wire amp meter - 4; round surface mounting 0-10A - old but working and definitely a bit of history
- 2P34 -Solenoid Air Valve mains operated
- 2P38 -200 R.P.M. Geared Mains Motor 1" stack quite powerful, definitely large enough to drive a rotating aerial or a tumbler for polishing stones etc
- 2P43 -Small type blower or extractor fan, motor inset so very compact, 230V
- 2P46 -Our famous drill control kit complete and with prepared case
- 2P49 -Fire Alarm break glass switch in heavy cast case
- 2P51 -Stereo amplifier, 3w per channel
- 2P55 -Mains motor, extra powerful has 1 1/2" stack and good length of spindle
- 2P62 -1 pair Goodmans 15 ohm speakers for Unilex
- 2P64 -1 five bladed fan 6 1/2" with mains motor
- 2P66 -1 2Kw tangential heater 115v easily convertible for 230V
- 2P67 -1 12v-0-12v 2 amp mains transformer
- 2P68 -1 115v-0-15v 2 amp mains transformer
- 2P69 -1 250v-0-250v 60 mA & 86.3v 5A mains transformer + 50p post
- 2P70 -1 E.M.I. tape motor two speed and reversible
- 2P72 -1 115v Muffin fan 4" x 4" approx (s h)
- 2P75 -1 2 hour timer, plugs into 13A socket
- 2P82 -9v-0-9v 2 amp mains transformer
- 2P84 -Modem board with press keys for telephone redialler
- 2P85 -20v-0-20v A Mains transformer
- 2P88 -Sangamo 24 hr time switch 20 amp (s h)
- 2P89 -120 min time switch with knob
- 2P90 -90 min time switch with edgewise engraved controller
- 2P94 -Telephone handset for EE home telephone circuit
- 2P95 -13A socket on satin chrome plate
- 2P97 -mains transformer 24V 2A upright mounting
- 2P98 -20m 4 core telephone cable, white outer
- 2P99 -500 hardened pin type staples for telephone cable
- 2P101 -15V mains transformer 4A upright mounting
- 2P105 -capillary type thermostat for air temperature with c/o switch
- 2P108 -mains motor with gear box giving 110rpm
- 2P109 -5" wide black adhesive pvc tape 33m, add £1 post if not collecting

OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's dozen range and you become entitled to a free gift with each dozen pounds you spend on these packs.

A classified list of these packs and our latest "News Letter" will be enclosed with your goods, and you will automatically receive our next news letters.



£5 POUNDERS*

- 5P1 12 volt submersible pump complete with a tap and switch, an ideal caravan unit
- 5P2 Sound to light kit complete in case suitable for up to 750 watts
- 5P3 Silent sentinel ultra sonic transmitter and receive kit, complete
- 5P6 12V alarm bell with heavy 6" gong, suitable for outside if protected from direct rainfall. Ex GPO but in perfect order
- 5P12 Equipment cooling fan - min small type mains operated
- 5P13 Ping pong ball blower - or for any job that requires a powerful stream of air - ex computer. Collect or add £2 post
- 5P15 -Unselector 4 pole, 25 way 50 volt coil
- 5P18 -motor driven water pump as fitted to many washing machines
- 5P20 -2 kits, matchbox size, surveillance transmitter and FM receiver
- 5P23 -miniature (appr 2 1/2" wide) tangential blow heater, 1-2kw
- 5P24 -1/2 hp motor, ex computer, 230V, mains operation 1450rpm. If not collect add £3 post
- 5P25 -special effects lighting switch. Up to 6 channels of lamps can be on or off for varying time periods
- 5P27 -cartridge player 12V, has high quality stereo amplifier
- 5P28 -gear pump, mains motor driven with inlet and outlet pipe connectors
- 5P32 -large mains operated push or pull solenoid. Heavy so add £1.50 post
- 5P34 -24V 5A toroidal mains transformer
- 5P35 -modem board from telephone auto dialler, complete with keypad and all ICs
- 5P37 -24 hour time switch, 2 on/off's and clockwork reserve, ex Elec Board loading up to 50A. Add £1 post
- 5P41 -5" extractor fan, very quiet runner (s h), gnd 12 mths
- 5P48 -telephone extension bell in black case, ex GPO
- 5P61 -200W auto transformer 230V to 115V toroidal
- 5P62 -mains transformer 26V 10A upright mounting, add £2 post
- 5P64 -mains motor with gear box, final speed 5rpm
- 5P68 -Amstrad stereo tuner FM and LM and S.A.M
- 5P60 -DC Muffin type fan 18 to 27V, only 3W
- 5P61 -drill pump mounted on frame, coupled to mains motor
- 5P62 -2 1/2 kw tangential blow heater, add £1.50 post if not collecting
- 5P73C high pressure mains operated gas or water valve with tube connection suitable soldering
- 5P74 6rpm 60W mains motor and gearbox with instant stop
- 5P79 30rpm 80 watt mains driven motor with gearbox
- 5P82 1 25rpm mains 60w motor with gearbox
- 5P84 1 delay time switch, adjust 0-20 seconds
- 7P1 1 instant heat solder gun - mains with renewable tip and job light
- 10P10 1 9" extractor fan 115V so supplied with adaptor

LIGHT CHASER KIT motor driven switch bank with connection diagram, used in connection with 4 sets of xmas lights makes a very eye catching display for home, shop or disco, only £5 ref 5P56.

NEVADA 934 MHz EQUIPMENT

Packed full of CB, 934MHz & Amateur Equipment—plus useful info. **Only £2.00** Includes a £2 voucher

Have you tried this exciting new band yet? Available for private or business use, by simply purchasing a £10 licence from any post office. Range is from 10 - 250 miles according to your location and WX conditions.

DELTA 1 934 Mhz TRANSCEIVER



£365

THE DELTA 1 IS A STATE OF THE ART TRANSCEIVER AND NOW IN USE BY OVER 70% OF 934 MHz ENTHUSIASTS!

- FEATURES:
- Scan facility.
 - 16 channel memory/scan.
 - Sensitive RX.

ACCESSORIES

| | |
|------------------------------------|---------|
| P7M-E Mag Mount 7dB Antenna | £49.72 |
| P714R-E GTR Mount 7dB Antenna | £49.72 |
| PA7-E Base Colinear 7dB Antenna | £67.75 |
| PA15 Base Colinear 11dB Antenna | £79 |
| TC12L 12 Element Beam 18dB Antenna | £39 |
| HRA 934L in line Pre-amp | £139.95 |
| HRA 900 Masthead Pre-amp | £139.95 |
| PLUS MANY MORE ITEMS | |

Send £1 for our full 934 Mhz catalogue.

SCANNING RECEIVERS

£26

C.T.E. DISCONE WIDEBAND ANTENNA

| | |
|-----------|------------|
| RECEIVE | 70-700 MHz |
| TRANSMIT | 70-500MHz |
| MAX POWER | 500W |
| GAIN | 35dB |

WIDEBAND DISCONE RECEIVING ANTENNA

HANDHELD SCANNING RX BEARCAT 100XL

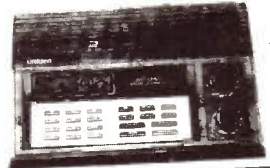
- A super sensitive low cost handheld which covers: 66-88MHz, 118-174MHz, 405-512MHz
- Includes Public Service, Aircraft, Marine, etc.
- ★ 16 Channels memory scan
 - ★ Priority keyboard lock
 - ★ Lighted display

£24.95

BASE SCANNING RX BEARCAT 175XL

For the enthusiast a sensitive base receiver which covers: 66-88MHz, 118-174MHz, 405-512MHz

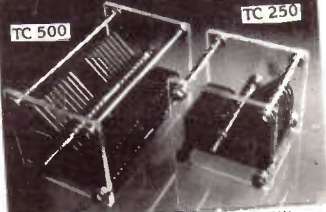
Same specifications as the popular 100XL handheld model



£209

NEVADA AMATEUR PRODUCTS

HIGH POWER VARIABLE CAPACITORS



IDEAL FOR ATU's OR AMPLIFIERS UP TO 3KW

| | |
|--------------------|------------------|
| TC 500 - 26-500 pF | £28 (£2 p.p.) |
| TC 250 - 13-250 pF | £19.95 (£1 p.p.) |

HIGH POWER "ROLLER COASTER" VARIABLE INDUCTOR



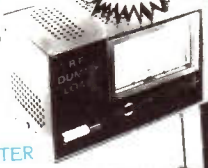
Suitable for 1 KW ATU
 Frequency: 1.8 - 30MHz
 IND: 26.5 uH
 SIZE: 5 1/2 x 10 1/2 x 14 1/2 cm

SPECIAL OFFER
 TC250, TC500, & ROLLER COASTER, COMPLETE FOR **£59** (£2 p.p.)

TEST EQUIPMENT

ZETAGI DL150 RF DUMMY LOAD AND POWER METER

A very accurate unit for the service dept. or discerning enthusiast
 FREQ:- 0.5MHz-500MHz
 POWER:- 150 Watt Max in 3 ranges 0-3, 0-15, 0-150W



£85.19

ZETAGI 500 SWR AND POWER METER

For the enthusiast who wants the very best. A twin meter unit with push button control for either 75 OHM or 50 OHM cable
 FREQ:- 3-200MHz
 POWER:- Up to 2KW



£41.46

FD 1350 1.3GHz FREQUENCY COUNTER

FREQ:- 10Hz-1.35GHz
 SENSITIVITY:- 43mV at 1GHz
 DISPLAY:- 8 Digit
 SUPPLY:- 9-12 Volt DC.



£139.53

NEW LOW PRICE

2 MTR HAND HELD CT1600

Through bulk buying we can now offer this superbly sensitive handheld at an all time low price. Unit covers 2 Mtr Ham Band Plus 142-149 Mhz (For Export)

- Repeater Shift
 - Hi/Low power 1/2 - 1 1/2 Watts
 - Thumbwheel Freq Selector
- Each set supplied C/W re-chargable battery pack and free mains charger unit.



£169

VHF MOBILE AMPLIFIERS

| | |
|---|--------|
| MOD. B110 144 MHz 110 Watt FM Plus Low Noise Pre-amplifier Switchable | £169 |
| MOD. B42 144 MHz 40 Watt FM Mobile AMP | £64.66 |

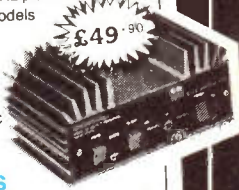
SEE OUR HAM CATALOGUE FOR FULL RANGE.

R.F. AMPLIFIERS

All amplifiers except broadband (2-30 MHz) models are tuned for 29.6 MHz centre freq. Should you require a lower freq. ie. 28.5 MHz please state when ordering. Export models available for 26-30 MHz.

C.T.E. MOD 767

76 Watts FM (150W P.E.P.)
 INPUT: 0.5-10 Watts
 SWITCHABLE:- Class AB, Class C
 SUPPLY:- 13.8 Volt
 REMOTE CONTROL FACILITY



£49.90

MOBILE AMPLIFIERS

| | |
|---|---------|
| C.T.E. MOD. 737 50W FM (80W P.E.P.) | £44.76 |
| C.T.E. MOD. 767 80W FM (150W P.E.P.) | £49.90 |
| C.T.E. MOD. 757 150W FM (300W P.E.P.) (3-30MHz) | £116.87 |

ABOVE MODELS HAVE REMOTE CONTROL FACILITY PLUS CLASS AB & CLASS C SWITCHING. (NOT MOD 737).

| | |
|--|--------|
| ZETAGI B35 25W FM (26-30MHz) | £23.72 |
| ZETAGI B150 70W FM (160W P.E.P.) | £49.96 |
| ZETAGI B300 200W FM (400W P.E.P.) 2-30 MHz | £136 |
| NEVADA TC35 DX 25W FM (W/LOW PASS FILTER) | £23.99 |

MAINS AMPLIFIER

ZETAGI B132 SOLID STATE (240W P.E.P.) 2-30 MHz... £119

NEVADA

HIGH QUALITY BRITISH MADE 29MHz FM PRODUCTS

NEVADA TC35 DX

R.F. POWER AMP. WITH HARMONIC FILTER

INPUT:- 1-4 Watts
 OUTPUT:- 25-30 Watts
 SUPPLY:- 13.8V DC
 FREQ:- 26-30 MHz

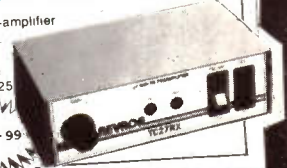


£23.99

Can be centred on 29.6 MHz or 28.5 MHz (state which). A new top quality amp, which now features harmonic filter to reduce harmonic O/P

NEVADA TC27 RX RECEIVER PRE-AMP FOR 26-30MHz

A superior low noise pre-amplifier for 29MHz FM operation. Variable gain -6dB's to -18dB's suitable for use with transceivers up to 25 Watts output.



£23.99

TELECOMMS

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 HANTS, PO2 9AE,
 TELEX 869107 TELCOM G

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