

# Radio & Electronics

The communications and electronics magazine **World**

**IN THE AIR:  
CONTROLLING  
THE TRAFFIC**

**IN THE CELLS:  
CHECKING  
FLAT BATTERIES**

**IN THE SHACK:  
LOW VALUE  
RESISTORS**

**IN A MINUTE:  
A SIMPLE  
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## NEW PRODUCTS

**NEW IC781**  
ICOM



Come and see the NEW ICOM IC781 HF Professional transceiver with built in Band Scope, Auto ATU and PSU, the new KENWOOD RZ1 Mobile Scanner, the new YAESU VHF Base Station and Mobile, and the new FOX mobile Scanner... because of our purchasing power and overseas contacts we get the new models first! And offer the best introductory prices!

## SPECIAL OFFERS

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YAESU YDB44A BASE STATION MIC 600 50K	£39.95	£19.95
YAESU FT777 5W-120W 1.6-30MHz PA UNIT	£149.00	£75.00
YAESU HORN RELAY ALARM UNIT WITH 555	£12.50	£4.50
ICOM ICA20 AIR BAND CAA APPROVED H H	£429.00	£379.00
ICOM ICA2 AIR BAND CAA APPROVED H H	£399.00	£279.00
KENPRO KT400EE 2W UHF H H C W CHARGER	£279.00	£199.00
COLOUR ROTA 40KG ROTATOR 3 CORE CABLE	£45.00	£37.50

Please ask for our SPECIAL OFFERS LIST, USED LIST, SCANNERS LIST, and LATEST PRODUCT NEWS. Please send a large SAE

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YAESU FT767GX RWC MK2 AS ABOVE C W 2 OR 6 METRES	£1590.00
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YAESU FT747GX NEW MULTIMODE 100W HF TRANSCEIVER	POA
NEW YAESU FT736R MULTIMODE BASE STATION C W 2 METRES	POA
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ICOM IC275 25W 2 METRE MULTI FEATURE SUPERB BASE STATION	£949.00
ICOM IC575 10W TO 8.5 METRE ALL MODE SUPER BASE STATION	£949.00

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## YAESU

**FT767GX RWC Mk2**



Raycom offer our own improved version of this fabulous HF-UHF transceiver, we fit a small SMD chip component mod board in the VCO to improve the RX dynamic range by up to 20dB, FOC when purchased new from us. If you are lucky enough to own the FT767 already, send your unit + £59.50 and we will fit it for you! (inc. return carriage). Also available at some Yaesu dealers. **SEE REVIEW FOR DETAILS OF THIS ACCLAIMED MODIFICATION.**

## ANTENNAS & ACCESSORIES

NOW AVAILABLE AT RAYCOM: CUSHCRAFT, BUTTERNUT, HY-GAIN ANTENNAS, JAYBEAM, TONNA, MET, HAM-M ROTATORS. Call for full details, prices, availability and delivery costs.

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GBKW TYPE 7 1MHz TRAP DIPOLE KIT SO239	£24.50
GBKW TYPE as above for use with 300 OHM	£23.50
GBKW TYPE 2X 7.1 TRAPS ONLY LESS CABLE	£9.95
RAYCOM AIRBAND-VHF SIX ELEMENT DISCONE	£12.50
RAYCOM DISCONE VHF 60-600MHz BE B0239	£29.50
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RAYCOM RWC HB9CV 2 METRE 2E MINI BEAM	£12.50
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The above popular products POST FREE (UK mainland only)

## SCANNERS

**BEARCAT by Uniden**

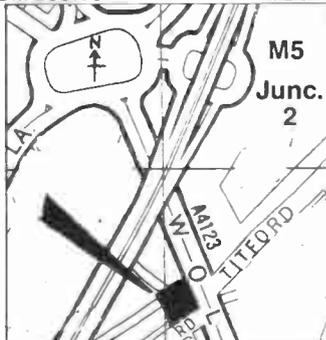
**UBC 175XL**



RAYCOM ARE TRADE AND RETAIL DISTRIBUTORS FOR THIS SUPERB RANGE OF QUALITY SCANNERS THE POPULAR UBC 100XL HAND HELD HAS SOLD IN THOUSANDS, BUT IS NOW COMPLEMENTED BY THE UBC 70XCL POCKET SIZED HANDHELD ALSO THE NEW COST EFFECTIVE UBC 50XL HANDHELD SEE THE NEW MODELS IN OUR SHOWROOMS OR SEND A SAE FOR DETAILS

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UBC 100XL



## SCANNERS

YAESU FRG9600 from the company who specialises in fitting extra options, as supplied to Government departments and professional bodies. We also upgrade existing models, please call for more details, prices, delivery and information.

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Yaesu FRG9600 RWC Mk2 60-950MHz N Connector Fitted	£495.00
Yaesu FRG9600 RWC MK3 HF 100KHz-950MHz plus Mk2 Spec	£595.00
Yaesu FRG9600 RWC Mk5 HF 50KHz-950MHz Active Mixer	£625.00
Package deal on above Mk3-5 FRG9600 c/w AH7000 discone, G5RV, PA4 AC PSU complete receiving station HF-UHF including delivery UK mainland	£1100.00 to above price
Icom ICR7000 25M-2GHz superb quality professional Rx	£859.00
Icom ICR7000 AH7000 receiver plus Matching Discone	£937.50
KENWOOD RZ1 New 25-950MHz Mobile	POA
Wide & Narrow AM/FM	POA
Fox VHF-UHF Multi-Function Mobile Scanner FM only	£139.00
UNDEN BEARCAT UBC 50XL VHF-UHF 10ch H/hold Scanner	£139.00
UNDEN BEARCAT UBC 70XL VHF-UHF 20ch Miniature H/hold	£199.00
Uniden-Bearcat UBC 100XL VHF-UHF-Airband H/hold Scanner	£189.00
Uniden-Bearcat UBC 175XL VHF-UHF-Airband Desk-Top	£175.00
BJ200 Mk2 VHF-UHF-Airband-Military Airband H/hold	£220.00
AOR 2002 25-550, 800-1300MHz Desk-Top Mobile AM, FM	£469.00
Sony Air 7 Top Quality VHF-Airband Handheld Scanner	£245.00

PACKAGE DEAL AVAILABLE ON ALL MAKES

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Icom ICR7 HF Top Grade Communications Receiver	£799.00
Sony PRO80 HF VHF Handheld Scanner c/w accessories	£345.00
Sony 2001D Short Wave Airband DEI IIXF RX with ANI kit	£395.00

Many more makes and models in stock, PLEASE CALL FOR PRICES DELIVERY COSTS and any advise or information, or send large SAE (insured post and packing £10.00 Carrier £12.50)

**SONY RAYCOM** now appointed official Sony dealers, full range of both professional and domestic models available to order. Worth waiting for!

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\* = Extended Receiver coverage available, call for details  
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 \*YAESU FT23R FN810 2.5W (5W) 2MTRS C/W CHARGER £249.00  
 \*YAESU FT73R/FN810 2.5W (5W) 70CMS C/W CHARGER £259.00  
 \*ICOM MICRO 2E 2.5W 2MTR HANDHELD WITH CHARGER £209.00  
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FT 290RMK2/FL2025 (STD) WITH 25W LINEAR AMPLIFIER	£489.00
FT690RMK2 6MTR 2.5W MULTIMODE STANDARD ACCES	£399.00
FT690RMK2 6MTR 2.5W M/M AS ABOVE C/W NICADS CH	£425.00
FT790RMK2 NEW 70CM 2.5W MULTIMODE DUE OUT SOON	£499.00

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YAESU FT211RH 45W 2MTR MOBILE WITH FREE 1.4 WAVE ANT	£299.00
YAESU FT212RH NEW 45W 2MTR MOBILE DVS FEATURE OPT	£349.00
*ICOM IC28E 2MTR 25W MOBILE WITH FREE 5/8 ANTENNA	£359.00
ALINCO Dual Bander ALD-24E	£445.00
ICOM IC-48e 70cm 25W	£429.00
ICOM IC-3200 Dual Band 25W	£499.00

Many other types and makes stocked, please enquire

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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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CSA's 'Carymast' can be erected by one man in less than ten minutes, see p9.

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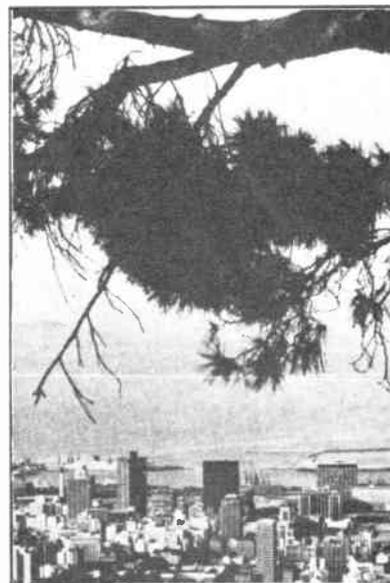
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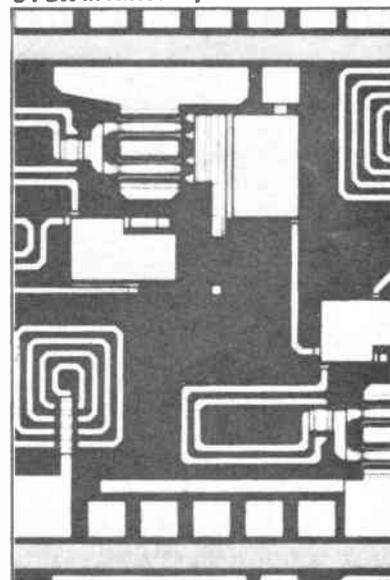
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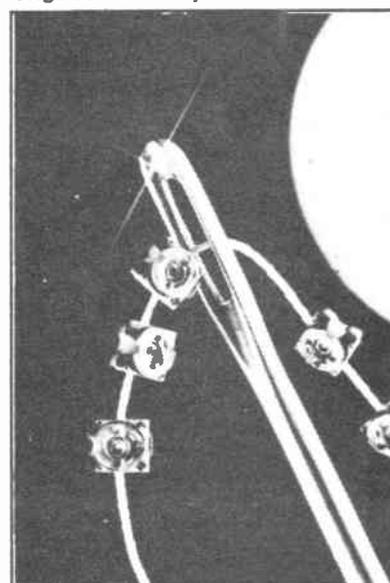
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# PRODUCT NEWS

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

## LOW COST LOGIC ANALYSIS

Thandar Electronics has introduced the TA1000 logic analyser with comprehensive microprocessor disassembler support for development, production, training and field service. It can capture data 1k deep across 32 channels at up to 25MHz, internally or externally clocked, and display the information in timing or list formats on the integral 7in CRT.

The TA1000 features multi-level triggering with restart, plus event and delay count. There are three external clocks, with a total of five qualifiers, and all clock and data inputs are high impedance (1M/5pF) to minimise circuit loading. All functions are accessed through soft-key controlled displays.

In timing mode any 17 channels or scale can be displayed simultaneously and

each channel can be uniquely labelled. The complete 1k store depth can be displayed with expansions of  $\times 2$ ,  $\times 4$ ,  $\times 8$  and  $\times 16$  and a search can be made for any word.

In list mode up to 32 channels can be grouped together and given a single character label and user-defined name; up to 16 groups can be specified. Display formats include binary, octal, hex, decimal and ASCII. Search, compare, and find difference are also standard.

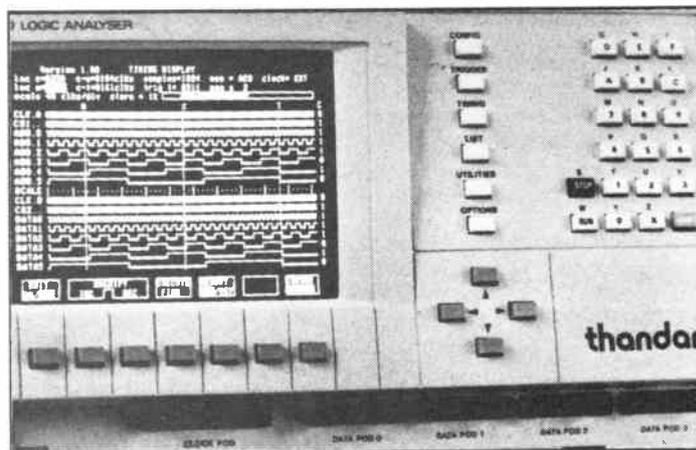
Two cursors and a fixed trigger marker allow direct readout of absolute and relative store positions. Full IEEE-488, RS232 and Centronics interfaces are standard, as in non-volatile storage (battery-backed CMOS RAM) of current data and reference memories together with up to four further acquisitions and 16 set-ups. As well as provid-

ing full operational remote-control the IEEE-488 and RS232 interfaces can be used to load/download data and set-ups.

The TA1000 is available in two formats. A version with TTL-level threshold pods costs £1,790.00 + VAT and a

version offering variable threshold pods costs £2,250.00.

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



## AC CURRENT PROBE

New from Thurlby Electronics is the compact lightweight Kenwood PC-80 high-sensitivity ac probe for use with oscilloscopes.

Its three ranges are 2mA/mV, 10mA/mV and 100mA/mV. The -3dB frequency response is 100Hz to 100kHz on the 2mA/mV range and 50Hz to 100kHz on the other ranges. Maximum voltage allowable at a circuit under measurement is 500V (dc and ac peak when the core is closed).

The maximum measurable current varies with the frequency and the range. 5A rms (14A peak-to-peak) can be measured on the 2mA/mV range above 1kHz; 60A rms (168A peak-to-peak) can be measured on the 10mA/mV range above 1kHz; and using the 100mA/mV range allows 120A rms (560A peak-to-peak) to be measured above 100Hz. The maximum superimposed dc current also varies with the range and measurement frequency.

The PC-80 current probe utilises a differential coil in the detection circuit to pro-

vide a wide current measuring range and to minimise effects from external magnetic fields. The output coaxial cable is 1.5m long and has a BNC connector on the end.

The Kenwood PC-80 ac probes costs £375 plus VAT and are available exclusively in the UK from Thurlby Electronics.

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

## BETTER BERT

David Bisset Ltd has four new test instruments and a new range of rugged digital multimeters. The new instruments are for V35 datalink testing, acoustic testing of telephone handsets, dial testing, modem testing, V24 interface monitoring, and subscriber line fault location.

The new V35 BERT adaptor model AD-1 is designed for testing high speed V35 data transmission equipment with data rates up to 2.133Mb/s. It

extends the capabilities of the hand-held programmable data communications test set CTS-3 by providing a V35 (34 pin) interface with fast BERT/BLERT testing (bit and block error rate testing).

BERT tests are essential for assessing quality of the new V35 national and international links now being installed. New protocol analysis software plug-ins for the CTS-3 will also be shown to demonstrate data capture and dump-to-printer.

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

## SCOPE SEPARATES TV

The Hameg HM806 80MHz multi-function oscilloscope from STC Instrument Services incorporates an active TV-sync separator for easier triggering on noisy or distorted video signals.

A 3-channel measurement amplifier and a true second timebase allow expansion and detailed analysis of

extremely small waveform sections. Using the alternating time base mode, the normal and expanded signals are displayed together, resulting in a 6-trace display if all three channels are used.

For stable jitter-free representation of asynchronous signal components, the HM806 provides a separate second trigger facility with an independent slope and level selection. Other notable features include dc to 120MHz triggering; a maximum sensitivity of 1mV/div; and  $\times 10$  magnification which extends the maximum sweep range to 5ns/div.

The HM806 provides a built-in switchable 1kHz/1MHz calibrator with an approximate risetime of 3ns. In addition to LF and HF compensation of wideband probes, it can be used for instant self-tests of the instrument's transient response from the probe to the CRT screen.

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

## VANDAL PROOF

A F Bulgin's new MP33 switch, developed from the MP13 security switch, features integral sealing to make it resistant to the ingress of water and dust.

Featuring a stainless steel button, housed in a robust chromium-plated brass body, the switch is designed to stand up to aggressive use and is particularly suitable for applications such as security call systems in areas with a high incidence of vandalism. Operational between the temperatures  $-20^{\circ}\text{C}$  and  $+85^{\circ}\text{C}$ , the MP33 switch has a glass-filled nylon moulding, silver-plated brass contacts and silver-plated brass termination.

The switch is 36mm in length, has a bezel diameter of 22mm and is rated at 1 amp 50 volts. Both the MP33 and MP13 are based on A F Bulgin's MP12 meter push.

*A F Bulgin and Co PLC,  
Bypass Road,  
Barking IG11 0AZ.  
Tel: 01-594 5588.*

## DIGITAL THERMOMETER

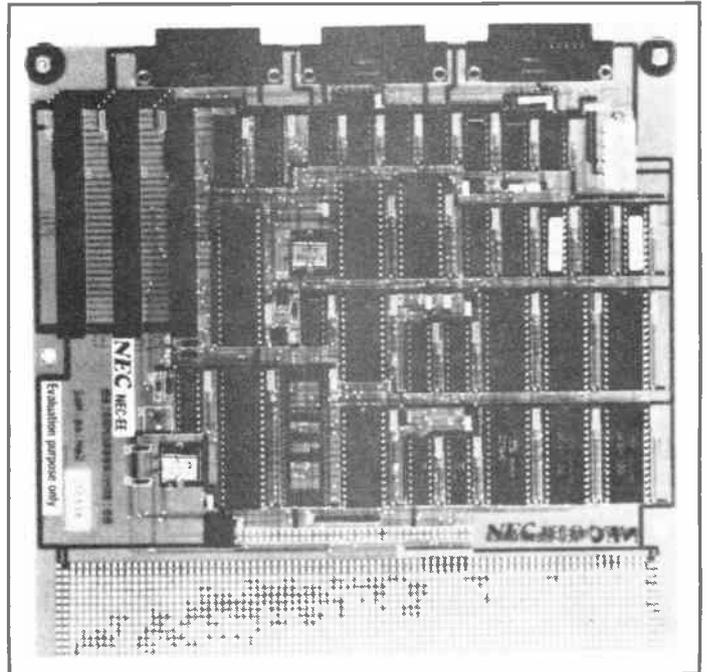
Levell Electronics now stock a new digital thermometer, type DT303K. This low cost  $3\frac{1}{2}$  digit LCD thermometer is calibrated to BS4937 for type K (NiCr/NiAl) sensors, with flat blade miniature thermocouple connectors.

Temperatures from  $-50^{\circ}\text{C}$  to  $1300^{\circ}\text{C}$  or  $-58^{\circ}\text{F}$  to  $2000^{\circ}\text{F}$  may be measured to an accuracy of  $\pm 0.2\%$   $\pm 1^{\circ}\text{C}$ .  $1^{\circ}$  or  $0.1^{\circ}$  resolution may be selected with a measurement rate of 3 per second. Power is supplied by a PP3 type battery with 200 hours of life and a low battery indication is provided on the display.

Thermocouple probes available include a naked bead probe, and rigid stainless steel sheathed surface and immersion probes.

The size of the DT303K is  $128 \times 72 \times 33\text{mm}$ , its weight is 200g and it is priced at £49 plus VAT.

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



## COMPUTER DESIGN

Designed to simplify the development of V20/V30 microcomputer-based systems, NEC's new EBIBM 70108/70116 design kit has all the necessary facilities in a single board. On-board monitoring is provided with debugging features including instruction trace and breakpoint control. It also provides register and memory control in both native and 8080 emulation modes. Disassembly is supported in either mode.

Two integral serial interfaces allow downloading of executable programs from the host PC as well as com-

munication with a terminal. The board also incorporates 128k of RAM which can be Pused for interrupt vector table, data and op-code storage. Three IBM-bus slots are provided for system expansion, and a large wire-wrap area allows hardware prototyping for either V20 or V30 systems.

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

## MICROSOFT MOUSE

MEDL's latest addition to its range of fingertip-control trackerball cursor positioners is the IBM plus Microsoft<sup>®</sup> compatible RB2/CAD-6 version.

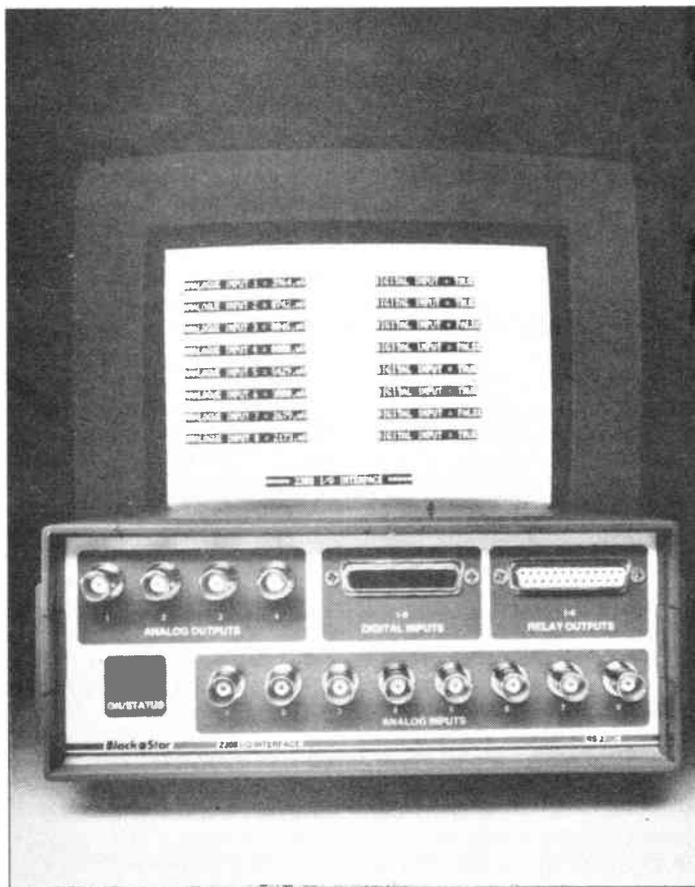
Designed primarily for use with OEMs and desktop computers the unit incorporates all necessary software and hardware to ensure full interchangeability with the Microsoft<sup>®</sup> Mouse and the Mouse Systems Corporation PC Mouse.

Thus, for the first time, all mouse users can now have the benefits of trackerball control for graphics programs, CAD/CAM and CAE, wordprocessing, menu-

driven programs, positional control and robotics. The fixed-position trackerball needs minimum operating space, gives freedom for very fast or slow operation, does not require regular cleaning and has zero drift.

The Marconi RB2/CAD-6 trackerball cursor positioner is available from Instagraphics, Bradford. Tel: (0274) 626027 or Riva Terminals, Woking. Tel: (04862) 71001.

*Power Semiconductor Division,  
Marconi Electronic Devices Ltd,  
Carholme Road,  
Lincoln LN1 1SG.  
Tel: (0522) 29992.*



## PRODUCT NEWS

### EPROM WRITER

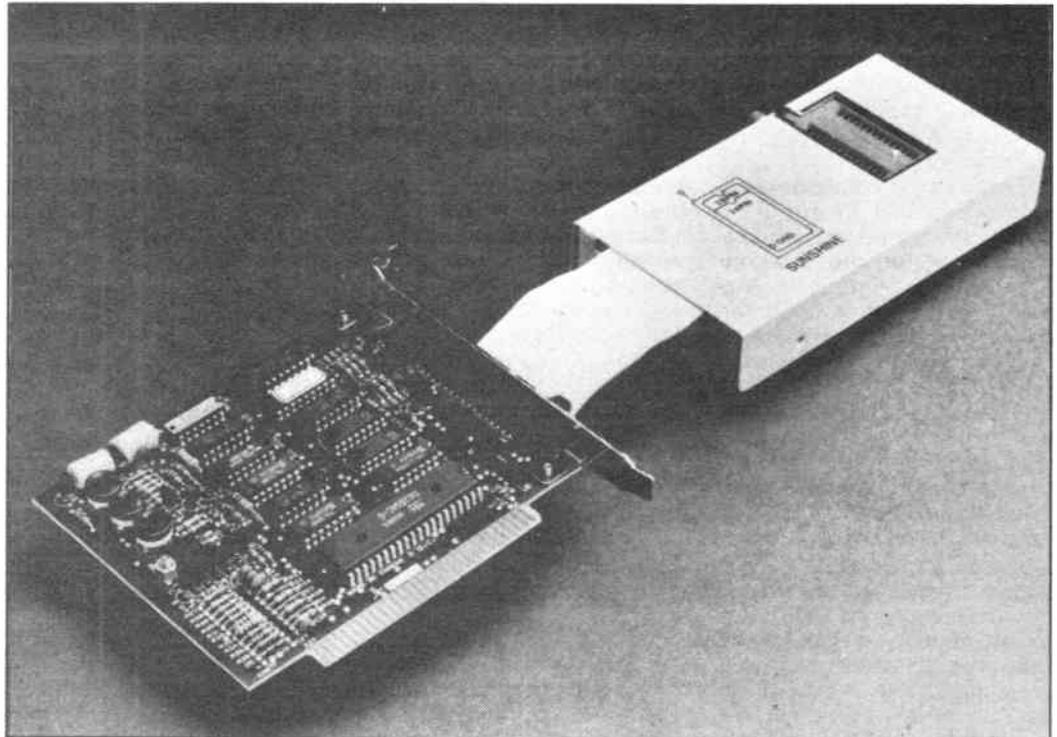
Dram Electronics Ltd offers three eprom writers for the PC XT/AT to program one, four or ten eproms at a time. They are priced at £141, £190 and £299.

Operation is quick and simple: ten 2764 EPROMs take only 64 seconds to program.

Eprom type and programming voltage are software-controlled. The I/O address of the writer card is selectable. The programming data length and starting address are settable.

Other PC-compatible programmer cards from Dram Electronics include a PAL programmer, an 8748/49 8742/41 programmer card and an IC identity tester card.

*Dram Electronics Ltd,  
Unit 12, Kingston Mill,  
Chestergate,  
Stockport SK3 0AL.  
Tel: (061) 429 0626.*



### DISPLAY MODULE

A new fluorescent indicator panel (FIP) module from NEC features a 48 x 180 dot matrix configuration.

Designated FM180GX48BA-A, the module features an uncommitted 8640-dot display, designed to provide a great deal of flexibility with both graphics and textual characters.

Operating from a single 5V dc supply, the module is programmed by 8-bit parallel TTL level inputs and can be driven directly from the CPU data bus. Memory is provided for one frame of the display.

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

### COLOUR GRAPHICS

The demand for low-cost, easy-to-use colouring software has led to the development of Illustrator Paintbox from Nidd Valley. Originally designed to complement the Illustrator graphics package, Paintbox includes a good selection of standard drawing and text functions which

allow it to be used independently of Illustrator as a stand-alone mouse-operated graphics design package.

Both Illustrator and Paintbox are disc based, but they provide the power and flexibility of higher priced ROM based packages. The result is a progressive graphics system suitable for age five upwards.

Operating Paintbox is simple; the mouse is used to select options from the colour and brush menu and from five pull-down windows. Careful attention has been given to the protection of screen designs by including several automatic safety features, plus dual-speed mouse movement – fast for menu selection and normal speed for accurate pixel alignment.

A four-colour palette on the screen can be instantly reset to any combination of the eight BBC colours. Paint and Fill options provide a total of 22 colour shades and a random spray feature enables attractive colouring effects to be created.

Available for the BBC B/B+/Master 128 and Compact, the package is priced at £44.90 including the Nidd Valley Digimouse, or £14.95 for the software only. Paint-

box can also be supplied packaged with Illustrator software for £29.90, and £59.90 for the full package with Digimouse. Prices all include VAT. Licences are available to Local Authorities.

*Nidd Valley Micro Products Ltd,  
Thorp Arch Trading Estate,  
Wetherby,  
West Yorkshire LS23 7BJ.  
Tel: (0937) 844661.*

### PCB PACKAGE

At CAD/CAM '88, Number One Systems launched their printed circuit board design and schematic draughting package – Easy PC.

Number One Systems is not trying to compete with the big boys who provide full auto-routing, connectivity lists and schematic capture, but intends to set alight the low cost market where auto-routing algorithms can still leave the user to do the tricky tracks, and where a comprehensive range of layout features, drawing functions and speed are of more practical value than the frills.

Easy PC is fast – it zooms, pans and redraws at considerable speed, on a single key-press. It is priced at £275 plus VAT.

*Number One Systems Ltd,  
Harding Way,  
Somersham Road,  
St Ives,  
Huntingdon,  
Cambs PE17 4WR.  
Tel: (0480) 61778.*

### GRAPHICS EDITOR

The Canon Express desktop publisher has been enhanced by new modified Expression software capable of supporting ReadRight optical character recognition and a unique Graphics Editor package, as well as additional typestyles from Bitstream's 'Fontware' library.

The mouse-driven Graphics Editor is a specially commissioned version of the powerful Halo DPE editor and uses tools such as Airbrush, Paintcan, Scissors etc.

The Express desktop publisher containing the new 1.05 version of Expression software remains at £8,950, consisting of the A200 EX computer, LBP-8 SX laser beam printer and the IX-12 image scanner.

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

## IEC-320 FILTERS

Rendar has announced two new ranges of IEC-320 inlet filters. The inlets feature a moulded construction and provide a good price/performance ratio. They are UL, CSA, VDE, SEV and SEMCO approved.

Manufactured in Switzerland by Feller, the IEC-connector power line filters feature low leakage currents and provide good protection against mainsborne transients. The 5100 series filters are 59mm long and the 5110 series filters are 50mm long. Snap-in options reduce installation costs, and solid connector pins enhance signal integrity.

Both ranges offer leakage currents of less than 0.5mA. For more demanding applications, versions with leakage currents of less than  $5\mu\text{A}$  can be supplied.

Current ratings are 1, 2, 3, 4, 6, and 10A at 250V ac. Frequency range is 0 to 400Hz.

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

## POWER MOSFETS

Two new 500V power MOSFETs from International Rectifier feature an on-resistance of only 0.6 ohm and current handling up to 11A continuously, and 44A pulsed. They offer a cost-effective solution to applications requiring lower  $R_{ds(on)}$  than that currently offered by the Hex 4 die size, without the need to move to Hex 5 die.

Packaged respectively in TO-3 hermetic and TO-3P (TO-247) formats, IRF448 and IRFP448 feature an intrinsic diode recovery  $dV/dt$  of 3.5V/ns.

Fabricated using IR's Hexfet III technology, the new MOSFET devices also feature high transconductance and superior reverse energy handling.

*International Rectifier Co  
(GB) Ltd,  
Hurst Green,  
Oxted,  
Surrey RH8 9BB.  
Tel: (0883) 713215.*

## CHIP POTENTIOMETERS

Now available in the UK from House of Power are the Kyocera CVR-32 chip potentiometers, measuring only 3mm x 3.7mm and believed to be the world's smallest.

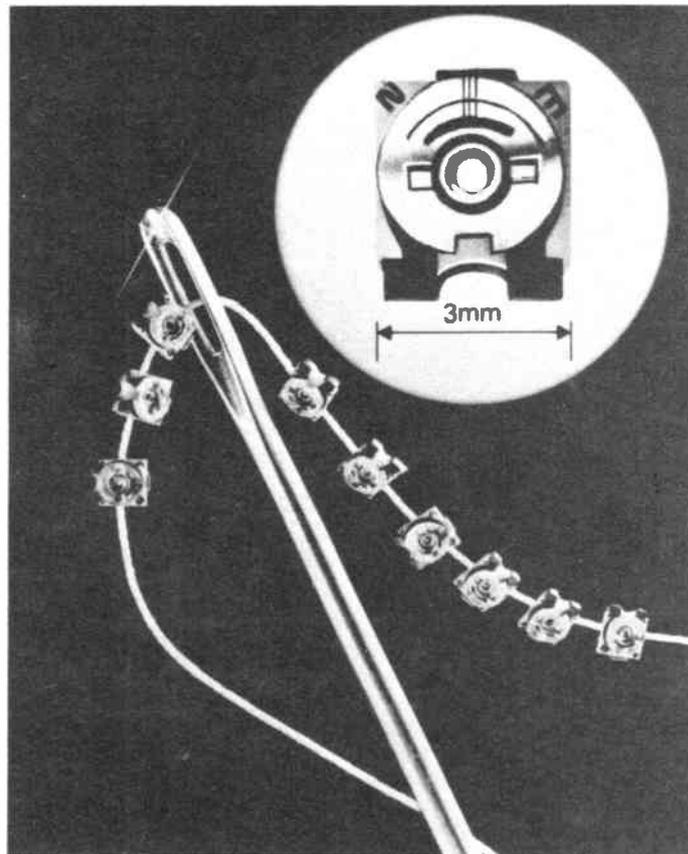
The CVR-32 series offers resistances from 100R to 2.2M, is available on 8mm tape and reel, and is compatible with all industry-standard soldering processes.

The potentiometer rotor has been designed to eliminate air leakage and give

maximum contact pressure for linearity to the industry 'B' standard. Its temperature coefficient is within  $\pm 250\text{ppm}/^\circ\text{C}$ .

Resistances are standardised to E6, and legibly identified on each component. Rated power is 0.1W at 70°C, and the operating temperature range is  $-40^\circ\text{C}$  to  $+100^\circ\text{C}$ .

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



## ATTENUATOR/MODULATOR

The AMC AGH Series of current-controlled attenuator/modulators covers a very wide frequency range, from 1 to 18GHz. There are seven models in the range, each covering a bandwidth of greater than an octave (3:1).

Announced by Anglia Microwaves Ltd, the AGH Series is non-reflective at all signal levels and has a maximum attenuation of 60dB. The RF circuit consists of two microstrip arrays of pin diodes that are hybrid coupled at the input and output with flange couplers. This results in a

repeatable low-loss performance.

Solid-state construction is utilised and monotonicity is guaranteed. The attenuators are small, just  $2.6 \times 2.0 \times 0.33$  inches for the largest – the AGH-1020. They can be fitted with a choice of male or male and female SMA RF connectors.

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

## SM TANTALUM CHIP

The Kemet T491 series moulded tantalum chip capacitor is designed for direct mounting to PCBs or alumina substrates. It is now available from STC Electronic Services.

The solid tantalum anode is permanently attached to a solder-coated lead frame and the assembly is precision moulded so that it provides good dimensional consistency.

Supplied on tape – Cases A and B on 8mm and Cases C and D on 12mm tape – the series is suitable for use with most automatic, high-speed pick-and-place equipment.

The capacitance range offered is  $0.47\mu\text{F}$  to  $68\mu\text{F}$  with a voltage range of 6V to 35V and a tolerance of  $\pm 10\%$ .

*The Capacitor Group,  
STC Electronic Services,  
Edinburgh Way,  
Harlow,  
Essex CM20 2DF.  
Tel: (0279) 626777.*

## NOISE SUPPRESSION

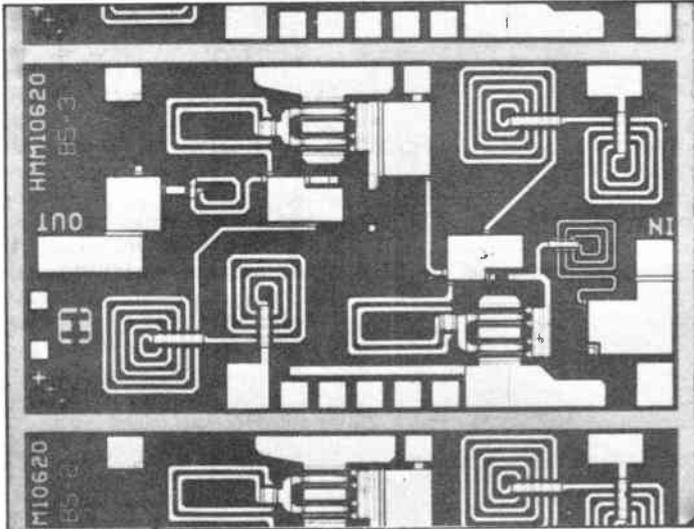
Corcom's G and N Series RFI filters are for common-mode and differential-mode attenuation in most digital electronic equipment, especially switching power supplies.

G Series filters are aimed at the 20kHz to 145kHz frequency range and meet the emission limits of VDE 0871 Level A requirements as well as FCC Part 15 Class B. One member, the EG model, caters for the low-leakage demands of SEV and VDE portable equipment standards, and also for UL544 non-patient medical equipment.

N series filters offer superior attenuation over the more stringent 50kHz to 145kHz range. These filters meet VDE 0871 Part B level stipulations, plus FCC Part 15 Class B.

Maximum current rating for all the filters is 6A; maximum rated voltage is 250V ac. In addition, all are UL recognised and CSA certified with VDE approval in process.

*Corcom UK,  
8 Westgarth Place,  
College Milton North,  
East Kilbride G74 5NT.  
Tel: (03552) 44248.*



### MMIC GaAs AMPLIFIER

A 2 to 6GHz, low-current gallium arsenide (GaAs) cascaded broadband MMIC (monolithic memory integrated circuit) amplifier is now available from Harris Microwave Semiconductor.

The HMM-10620 integrated broadband amplifier chip is designed to be directly cascaded and not require external dc blocking on the RF output port. It includes two GaAs FET gain stages using negative feedback, with active and passive bias circuitry within 37 x 70 thou chip dimensions. These gain stages provide a ± 0.5dB flat gain over the entire 2 to 6GHz

bandwidth, with a 3.5mA per dB of gain figure of merit (at typical gain bias).

The system is a cost-effective alternative to connectised amplifiers, by providing 10dB gain blocks on a single chip.

Output power is +13.0dBm (1dB gain compression), and small signal gain is 11.5dB. Input and output VSWRs are 1.75:1 and the unit offers a 5.5dB noise figure.

*Harris Semiconductor,  
2401 Palm Bay Road,  
Palm Bay,  
Florida 3290,  
USA.*

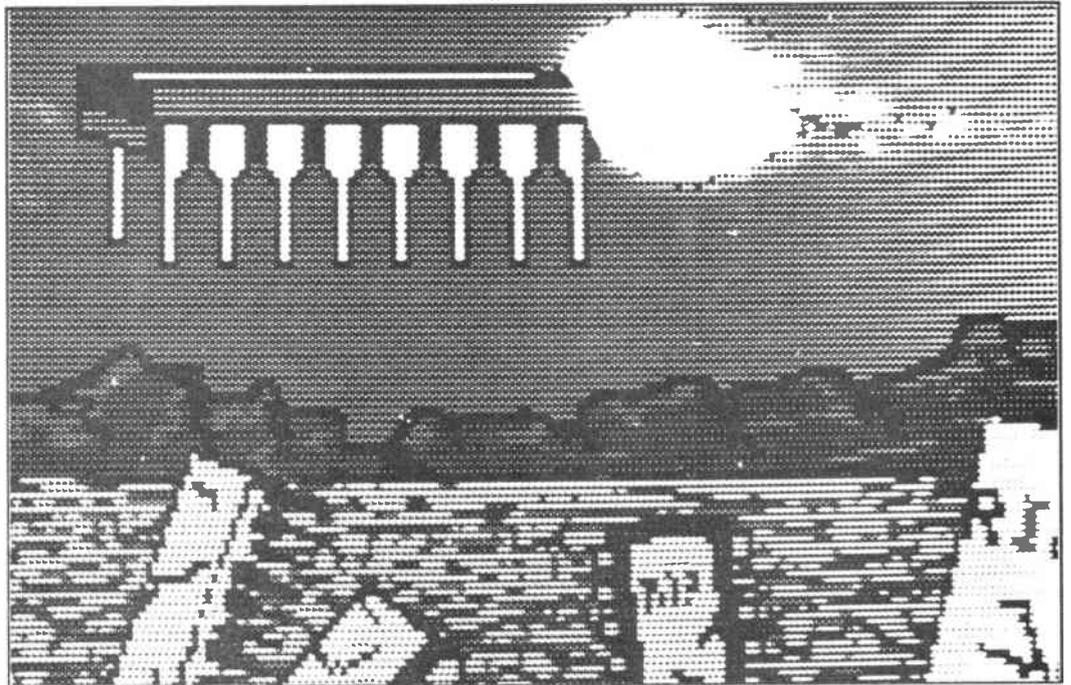
*Tel: 0101 305 724 7800.*

### SEMICUSTOM IC FROM CHERRY

Cherry Semiconductor has introduced the Genesis 1500 to replace series of circuits in complete systems. Both digital and linear elements are included, as I<sup>2</sup>L gates and bipolar components. There are 98 gates, 126 npn and 72 pnp transistors. There are 462 diffused-base resistors with a total resistance of 827k, and two pinch resistors. Exact configuration is tailored to customers' requirements.

The IC operating voltage can be from 1 to 12V and maximum toggle frequency is 2MHz. The circuit is quite compact, measuring 123 x 140 thou.

*Electronics Ltd,  
Kingsclere,  
Newbury,  
Berks RG15 8NL.  
Tel: (0635) 29874.*



### WIDEBAND MULTIPLEXER

Siliconix has introduced a new 8-channel wideband video multiplexer integrated circuit, the DG538, for video switching and routing, automatic test equipment, high-frequency crosspoints, communications systems and high-quality audio switching.

The DG538 offers programmability of single-ended or differential switching, fully TTL-compatible logic inputs, no input biasing, and a unique address latch read-back facility.

The device has a 500MHz bandwidth and -97dB of adjacent channel crosstalk at 5MHz, not achievable with CMOS multiplexers. Typical

on-resistance is 450 ohms and the multiplexer switching speed is 300ns.

A logic input configures the DG538 as either an 8-channel single-ended or a 4-channel differential multiplexer, making the device a versatile building block for large switching matrices. The channel address is latched internally, and all address and control inputs are TTL compatible.

A unique feature of the DG538 is the inclusion of bi-directional channel selection pins, which can be dynamically configured as inputs or outputs. If the output mode is selected, the controlling processor can then read back

the contents of the channel address latch.

Bi-directionality simplifies the control software, and is particularly useful when the system is recovering from a processor failure since previously established signal routes can be discovered by polling the multiplexers.

The DG538 is available in 28-lead DIP and PLCC packages for operation over the industrial temperature range (-40°C to +85°C) and in a 28-lead side-brazed package for the military temperature range.

*Siliconix Limited,  
3 London Road,  
Newbury,  
Berks RG13 1JL.*

### RAPID STOCK INTEL

Rapid Silicon is now stocking the 8098, the latest addition to Intel's MCS-96 16-bit microcontroller family.

The 8098 supports bit, byte and word operations, and four high speed trigger inputs are included to record the times at which external events occur. A 10-bit A/D converter, a serial port, a watchdog timer and a pulse width modulated output signal are all provided on chip.

*Rapid Silicon,  
Rapid House,  
Denmark Street,  
High Wycombe,  
Bucks HP11 2ER.  
Tel: (0494) 457267.*



## CLEAN UP

Deb has developed a new hand cleanser specifically for the removal of polymer-based paints, resins, inks and adhesives which predominate in modern industry and which can, if left on the skin, cause dermatitis.

Resinega is the result of two years' development and extensive trials in industry. It is equally effective against epoxy-based paints, adhesives and resins. Epoxy-based products, once cured, are very difficult to remove and those using them have often to wash up to 20 times a day.

Suitable for frequent use, Resinega contains non-abrasive polygrains for removing the most ingrained soiling. Its highly-refined solvent base quickly dissolves plastic polymers while preserving the skin's natural oils.

*Deb Group Ltd,  
Belper,  
Derbyshire DE5 1JX.  
Tel: (0773) 822712.*

## ICE WARNING KIT

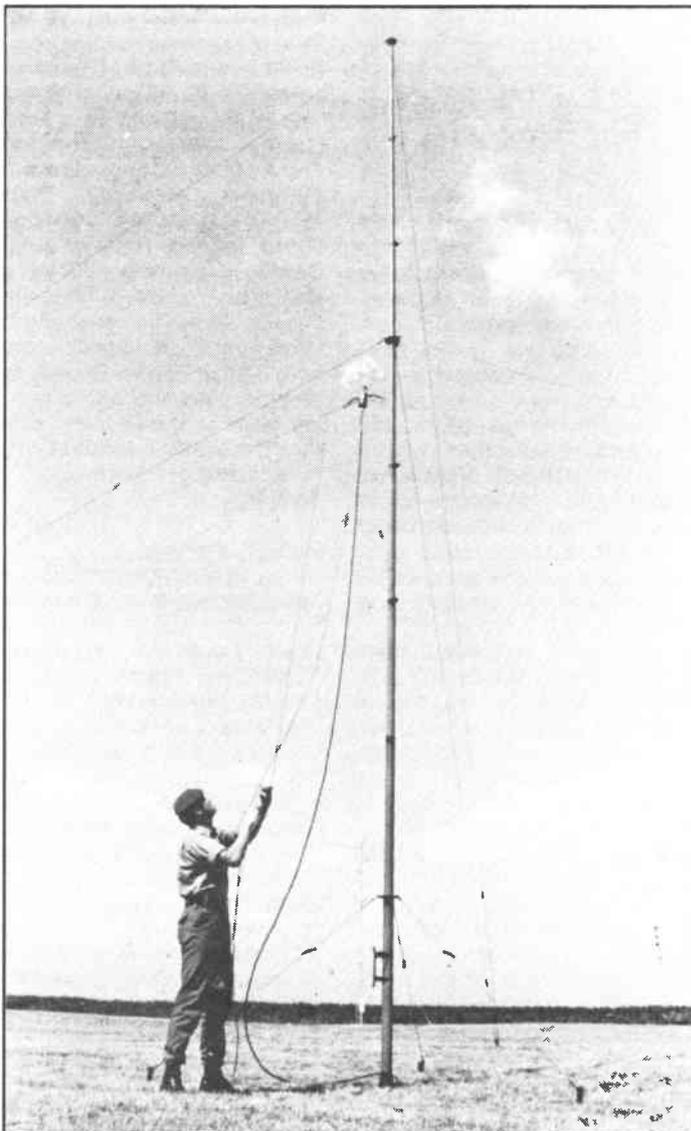
A simple-to-build electronic kit, the K2644, provides motorists with invaluable early warning of icy road conditions.

The kit is available from Electronic & Computer Workshop Ltd and comprises an electronics module, a rugged temperature sensor that attaches under the front bumper (or other convenient point on the car) and an LED indicator.

If the sensor detects temperatures around zero Celsius, the LED begins to flash to warn the driver. When it falls to below zero the LED remains on constantly. The kit runs directly from the car supply and can be fitted under the dashboard, measuring just 56 x 42 x 18mm.

ECW offers the kit at £12.88, inclusive of VAT and post/packaging.

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



## TACTICAL MASTS

CSA Antenna Systems of Rochester in Kent has launched a range of robust, lightweight telescopic masts for tactical use.

Using the latest carbon/glass fibre composite and Kevlar materials, the 'Carry-mast' range has a good strength to weight ratio, can be rapidly deployed and is independent of any vehicle. The range starts with a backpack version weighing only 3.7kg (8.5lb) which can be erected to a height of 8m (22ft).

Middle of the range is the 12m (40ft) version which can easily be carried by one man, as it weighs 10kg (22lb), and when stowed is only 1.63m long (5ft). It can be erected by one man in less than ten minutes and with its polyester

Kevlar rope stays will maintain head loads of 12kg.

Top of the range is the 15m (50ft) version capable of supporting a radio relay antenna similar to those manufactured by CSA Antenna Systems for the British Army's Ptarmigan project and for the United States Army's MSE program.

All masts in the range have a low radar cross-section and will give trouble-free service even in freezing conditions. If accidentally damaged, all the masts can be quickly recovered to operational status without fitting a replacement tube.

*C & S Antennas Ltd,  
Knight Road,  
Rochester,  
Kent ME2 2AX.  
Tel: (0634) 715544.*

## AUDIO/VIDEO

Bib are launching a range of six audio/video care systems to suit all requirements, specially devised for the exact maintenance requirements of VCRs, hi-fi, CD, VCR cameras, audio cassette decks and computers.

Each care system is packaged in a strong, handy luggage type case with a clear, hinged lid, snap lock and handle.

The kits available include a video care system, CS1; a compact disc care system, CS2, which includes a CD radial cleaner, cleaning fluid, a blower brush, cotton swabs and a cleaning cloth; an audio care system, CS3, including a carbon fibre anti-static record brush, a stylus brush with inspection mirror, head cleaning fluid and a tape splicer; a computer care system, CS4, including a 5/4in or 3/2in cleaning diskette or data cassette head cleaner as required, an anti-static screen cleaning fluid and cleaning cloth plus a blower brush.

These care systems, with their attractive and convenient storage cases, make ideal gifts for the audio/video enthusiast. The recommended retail price of each kit is £12.99, less than buying the components separately.

*Bib Audio/Video  
Products Ltd,  
Kelsey House,  
Wood Lane End,  
Hemel Hempstead,  
Herts HP2 4RQ.  
Tel: (0442) 233233.*

## CABLE STRIPPER

The Toggle range of low-cost precision coaxial strippers from STC Electronic Services gives unusual reliability combined with a forward-looking design.

Recommended for the preparation of BT coaxial cable used within their digital transmission and CATV wideband equipment, the strippers are available for cable measuring from 2.5mm to 10mm.

*STC Electronic Services,  
Edinburgh Way,  
Harlow,  
Essex CM20 2DF.  
Tel: (0279) 626777.*

# NEWS DESK

## Viruses hit computers

Viruses are short programs that hide in a host program for indefinite periods, replicate themselves then infect other programs when the host program is transferred via data highways to other computers. Often the host program is a computer operating system. It is this sort of virus that has recently been making the news.

Last November, Commodore Amigas were reported to be infected, now Apple Macintoshes and IBM PCs have gone down with their own strains. Viruses are so deeply embedded in assembly languages that victims are either reluctant or unable to undo their effects, preferring to suffer the loss of a few files or a screen of text.

Anti-copying devices can sometimes exacerbate the effect of viruses and program bugs, just like genetic mutations, and could cause unpredictable changes, so it is not the same virus which reappears but something possibly more devastating.

## Anglo-Irish cord

A submarine fibre cable between the United Kingdom and the Republic of Ireland will come into service this summer.

It will cost £7.2 million and will be the world's longest optical fibre cable in use without intermediate boosting. It runs 126km (80 miles) between Porth Dafarch, near Holyhead, Anglesey, and Portmarnock in the Irish Republic.

The cable is jointly owned by British Telecom and Telecom Eireann and will carry speech, data, text, graphics and facsimile.

The cable has 12 fibres. Each pair will support a system operating initially at 140Mbit/s which will give the pair a capacity of nearly 2,000 simultaneous phone calls. It will use the latest single-

mode technology with high-performance lasers operating at a wavelength of 1.5µm.

The cable was laid by British Telecom's cables ship, CS Alert and her sister ship CS Monarch. About 34km out from Holyhead, the CS Alert deployed British Telecom's submarine plough which buried the cable about a metre below the seabed to avoid the risk of damage. The first 34km of seabed are unsuitable for ploughing.

The cable to Ireland joins two others in the Irish Sea: a link from Cumbria to the Isle of Man and a link from Northern Ireland to Scotland.

## BBC BDGD RDS

BBC badged radios will possess core features of the radio data system (RDS): automatic tuning, readout of the station name and programme type, retuning to the strongest signal in the vicinity, accurate clock and date display.

BBC Enterprises is inviting industry to submit business plans. Two options are a company licensed to manufacture, distribute and market the radio, and a variety of co-ventures on aspects of design and promotion.

A prototype could be on show at the next BBC Radio Show at Earls Court in the autumn. It is hoped to have the new radio sets on sale by next year.

## Sony anniversary

Sony is to establish a 'Roll of Honour' to recognise the achievements of the radio industry during the 20 years Sony has been operating in the UK.

Membership of this elite will be through a special procedure alongside the general awards and there will be just 25 places available.

So far, 18 of the names are known - all are winners of the Gold Awards, Special Awards for Contribution to Radio or

Radio Personalities of the Year in the previous five years that Sony (UK) Ltd has sponsored the Radio Awards.

This means that Sue MacGregor, Brian Johnston, Frank Muir, Denis Norden, Margaret Howard, Brian Matthew, Jimmy Gordon, David Jacobs, Jimmy Young, Derek Chinnery, Douglas Cameron, John Timpson, Derek Jameson and Brian Hayes are included along with British Forces Broadcasting Service, the parliamentary units of the IBA and BBC and the world's longest running radio serial 'The Archers'.

## Design awards

The Rt Hon Kenneth Baker MP, Secretary of State for Education, will be presenting the prizes at the 1988 Young Electronic Designer Awards (YEDA) finals, being held at the Queen Elizabeth II Conference Centre, London, on 30 June.

Inaugurated in 1985, the scheme aims to develop in young people the ability to recognise where innovative electronics can meet a need; it also encourages them to develop skills to turn 'their ideas' into marketable commodities. Entrants must have both sound theoretical knowledge and astute commercial awareness.

The annual competition for students who are attending secondary schools, colleges, polytechnics and universities in the UK is divided into three age groups: under 15, 15-18, and 19-25. A panel of experts selects from each age group six projects, fully working and properly documented, for a place in the final.

In the senior age group, the winner receives a cheque for £500, trophy and certificate, plus sponsorship from Texas Instruments Ltd for the remainder of his or her course at the rate of £200 per term; a guaranteed vacation job; and a reserved place in Texas Instruments' graduate intake during the student's graduation year.

In addition, every educational establishment taking part in the regional heats will receive useful electronic test equipment from Cirkit Holdings plc.

## Solder studs for SMDs

A new process for attaching surface-mounted devices (SMDs) to ceramic circuit boards has been devised and developed by British Aerospace, who has been granted a provisional patent (No 8727926).

Benefits claimed for the process are improved heat transfer, the elimination of residual contamination and better access for inspection.

It is difficult to visually inspect SMDs which have been attached to the substrate by conventional methods then reflow soldered. Contaminants, especially corrosive flux residues trapped between the underside of a component and the board, cannot be totally removed by cleaning and may cause problems later. Small gaps between carrier and board act as capillaries and this has a tendency to accentuate the problem.

The new technique supports SM chip carriers clear of the surface of the circuit board at a consistent stand-off height between 250 and 300 microns (0.01in to 0.012in). The required stand-off height is created by positioning an adhesive pad on the board to support the carrier, and pre-printing solder studs of controlled height where the electrical connections are to be made on both the chip carrier and the circuit board. After the solder has been reflowed the carrier is fixed to its board by the adhesive pad and the mating solder studs, which will have fused to form connecting pillars. The 250 micron gap is wide enough to allow effective cleaning.

The adhesive conducts heat away from the chip carrier into the board, while the solder pillars withstand strains from local thermal gradients or applied loads that would fracture more rigid joints.

## PCB FAX

Martin Dawes Communications has launched the Sanyo SF100 for facsimile transmission of PCB layouts and schematics up to B4 size. It also has a worldwide G3/G2 compatibility and can dial up to 100 numbers automatically.

### CFC 113 still the best

A new paper released recently by ICI says that the electronics and engineering industries will continue to use the ozone-depleting chlorofluorocarbon (CFC) 113 solvent in cleaning processes for many years to come. CFC 113 is still best for vapour degreasing and until real alternatives have been found to equal it, the emphasis will be on conservation and more responsible handling of the solvent by users, producers and equipment suppliers.

Aqueous cleaning produces contaminated water which may be difficult to dispose of and is strongly opposed by the US military. The high surface tension of water makes it unsuitable for cleaning surface mount PCBs and components with small holes or capillaries.

Chlorinated solvents such as 1,1,1-trichloroethane have been used for more than 30 years. Blended with alcohols they have good cleaning properties, particularly for surface mount boards which carry components that are generally more resistant to the stronger solvents.

### But fruits on boards

Terpenes could be a substitute for CFC 113. These are a group of hydrocarbons based on the composition  $C_{10}H_{16}$ , which provide a starting point for many perfumes and give the characteristic aroma to citrus fruits. They are not known to deplete the ozone layer.

Bioact EC7 has been developed by Petroferm, a small American chemicals manufacturer based in Florida. The cleaner is a mixture of terpenes from orange rinds and surfactants which are added to improve wetting ability.

AT&T have been testing Bioact EC7 for over two years. Apparently, it works just as well as CFC 113 and could cut the company's 113 consumption by as much as a third of its present level.

### Packet switching

British Telecom is to enhance the Packet Switch-Stream (PSS) service on its public data network.

BT also plans to upgrade links to data networks in other countries to meet a recommendation by the CEPT (European Conference of Postal and Telecommunications Administrations).

BT has established 56/64kbit/s packet switching links with the USA, Belgium, France and the Netherlands, and will extend its coverage to other European, North American and Pacific routes during 1988.

Higher speed links use new digital transmission paths, such as the optical fibre cable between the UK and Belgium which came into service last summer.

Automatic alternative routing bypasses any fault on a single link by routing calls over another circuit.

Improvements to the 1984 update of X25 allow the length of the facility field in call set-up and call clear packets to be increased from 63 to 109 bytes, providing capacity for additional facilities. User data can be carried in the call request packet, even when the call has entered the data transfer phase. When a call is redirected, the called DTE is informed that it is chosen as an alternative destination for the call.

### Crystal-controlled power

The Ioffe Physical-Technical Institute, in Leningrad, has proposed new principles which have led to super-high-speed semiconductors for controlling super-strong currents.

Fast switching of large capacities has always been a serious problem which, until recently, has been dealt with using powerful gas-discharge and vacuum valves. Even today, they are indispensable; semiconductor switches (thyristors), though smaller and lighter, are neither as fast nor as powerful.

Electron devices use semiconductor crystals of two types: n-type and p-type. A p-n junction will pass current in one direction only and is formed where the two types are joined together. Thyristors that switch heavy currents consist of several p-n junctions, one of which is connected so it is non-conducting. By injecting elec-

trons into this junction, a chain reaction is set off which fills the entire thyristor with moving charges.

This explains the low speed and power of the thyristor. The switching chain reaction starts only at the control electrode, which is very small, then takes a long time to spread throughout the thyristor. A large current delivered as a short pulse will burn out the thyristor.

The Leningrad team's solution is to take the non-conducting p-n junction and briefly connect the p-layer to plus and the n-layer to minus, thus attracting charges towards the p-n junction.

The initial potential of the device is restored so rapidly that the charges have no time to leave the junction and trigger the chain switching process, filling the entire thyristor within a millionth of a second and allowing it to cope with a current of hundreds of thousands of amperes at voltages of thousands of volts, enough to control a large-scale power station.

### Avionics architectures

ERA Technology is to stage a seminar and exhibition on current military avionics architectures. Traditional black-box avionics systems are being overtaken by co-operating modules that undertake a range of functions which were partitioned into individual line-replaceable units in the past. Common modules could have far-reaching consequences for system availability and in-service support logistics.

The aim is to provide an awareness of the current system architectures, those being proposed for future systems, and the technology advances which will make modular avionics systems a reality. For further information, contact Laura Christie on (0372) 374151 ext 2290 or 2488.

### Summer school

In response to demand from the mobile radio industry, both in the UK and overseas, RTT are running a five-day residential summer school from 3rd to 8th July at Keble College, Oxford. For a mere

£995 + VAT you can enjoy a fine blend of history and an interesting standard of food and accommodation.

All aspects of mobile radio technology will be included, with a particularly close look at how new components, new circuit design techniques and new trunking architectures are influencing the ways in which mobile radio systems are installed, serviced and supported.

For further information, contact Geoff Varrall on 01-844 1811.

### Telconsultants Freetown

Under a £1.3 million EEC-funded contract, British Telecom's overseas consultancy service, British Telconsult, will manage the introduction of a new digital exchange for Freetown, capital city of Sierra Leone in West Africa. Completion is scheduled for the end of 1989.

### New clock for Greenwich

The Royal Greenwich Observatory at Herstmonceux Castle has been evaluating an electronic clock for the Greenwich Time Signal. The clock is a Leitch model CSD5300, based on a microprocessor and an oven-stabilised crystal reference oscillator, normally phaselocked to the incoming 5MHz from the caesium source. If the caesium source fails, the crystal oscillator can keep the time signal within accepted accuracy limits for three months.

An additional solid-state clock was installed as a temporary standby generator to provide the midnight Greenwich Time Signal on New Year's Eve. A time correction of one second is required at approximately yearly intervals to correct for changes in the rotational speed of the Earth.

The present reference drives a phonic motor and gear train to provide the time-interval for the six pips in the time signal.

Making the correction with the phonic motor is somewhat protracted, so it was decided to program the two Leitch clocks to add a seventh pip to the midnight time signal and to set back the indicated time by exactly one second.

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Mixed Semis amazing value contents include transistors digital, linear, IC's, tracs, 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

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PDP11/40 Cpu, 124k MMU £1,850.00  
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Also available less psu, with fans etc. Internal dim. 19" w, 16" d, 10.5" h. £19.95. Carriage £8.75

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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 every buy!! Sold by weight.

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

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20kls £19.50 + pp £4.75

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





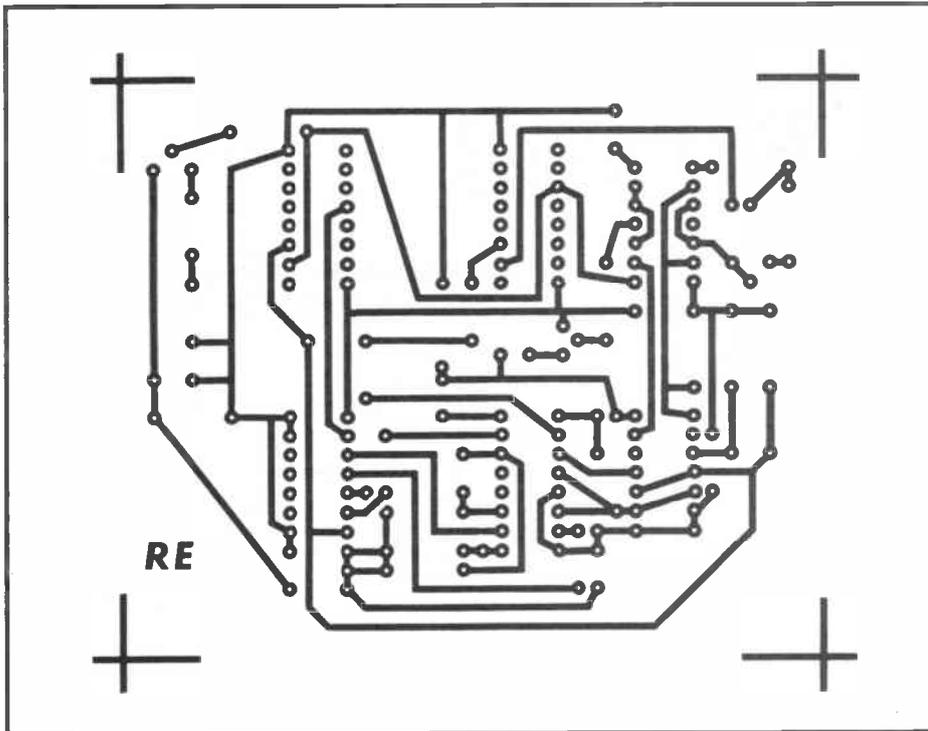


Fig 3 PCB artwork (half size)

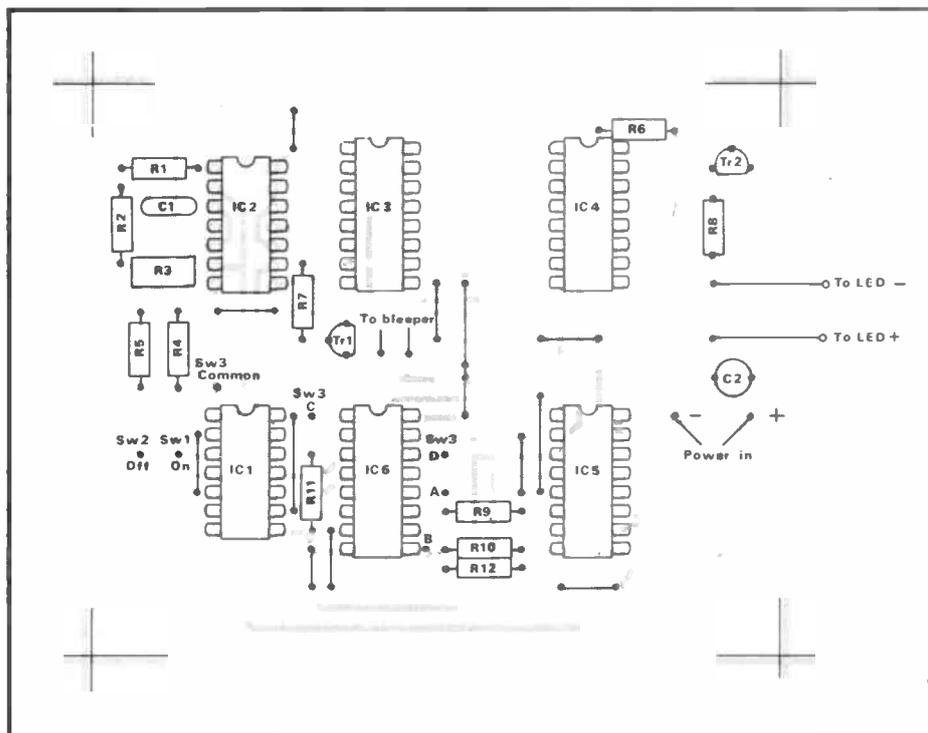


Fig 4 PCB artwork overlaid by components (half size)

By changing IC5 to a 4518, using both halves of the IC and adding another 4585 and thumbwheel, it is possible for the circuit to time up to 99 minutes. See Figure 2 for details.

In the author's prototype a 4520 and hexadecimal switch were used for IC5 and SW3 respectively, enabling periods of up to 15 minutes to be timed. However, using a hexadecimal switch means that

'A' represents 10 minutes, 'B' 11 minutes and so on.

#### Construction

The author's prototype was initially built on a small piece of Veroboard, which is perfectly satisfactory. However, for ease of construction, a PCB layout is included. It is good practice to use IC bases and to insert the ICs last; doing

this could save a lot of solder braid should a device prove faulty.

Any case of a suitable size can be used to house the circuit, but if the timer is to be used in a damp or humid environment, such as a kitchen, the circuit should be varnished (when it is completed and working, of course) to prevent leakage and possible malfunction.

#### Setting up

With the circuit set for maximum time, press SW2 to reset the circuits then activate the timer by pressing SW1. Adjust VR3 for 17.476kHz at pin 4 of IC2b using a frequency meter. If a frequency meter is not available then adjust VR3 so that D1 flashes 64 times per minute, ie just slightly more than once per second. With care, this second method of setting up will give adequate accuracy. If a test meter is available, it is a good idea to check that the circuit draws less than 25µA when it is not in use. REW

### Components List

#### Semiconductors

IC1	4013
IC2	4011
IC3	4020
IC4	4020
IC5	4520
IC6	4585
Tr1	BC108
Tr2	BC108
D1	LED

#### Resistors

R1	180k
R2	2k2
VR3	20k
R4	33k
R5	33k
R6	22k
R7	22k
R8	1k
R9	100k
R10	100k
R11	100k
R12	100k

All resistors 10% 0.25 watt

#### Capacitors

C1	4n7
C2	10µF 16V

#### Switches

SW1, SW2 from Cirkit, 53-76271  
 SW3 thumbwheel from Electromail, 337-431  
 End cheeks for SW3 Electromail, 337-419

#### Miscellaneous

Beeper from Electromail, 249-794  
 Box from Cirkit, 21-92753  
 Battery PP3

# AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

No doubt you will have read in the daily papers that the Central Electricity Generating Board (CEGB) is to spend half a million pounds researching whether electromagnetic fields can make people feel ill and even cause cancer or birth defects.

This question comes up for discussion amongst radio amateurs from time to time. Their hobby obviously exposes them to this form of radiation more frequently than most people, though the risks are not so great since most of the more powerful electromagnetic generators are contained in metal boxes, coloured black according to the saying. You could still be vulnerable if you build large linear amplifiers at home. These are used in transmitters and their power supplies are frequently home-made as well.

All kinds of devices and unscreened electric cables produce magnetic fields in the home. Compared with the Earth's magnetic field these are actually quite strong. A domestic electric stove may produce a magnetic field about fifteen times stronger than the Earth's magnetic field and an electric toaster produces a field which is similar to the Earth's.

Strong magnetic fields have produced abnormal development in chick embryos. There is no conclusive evidence that similar magnetic fields have produced deformities in human beings, so the CEGB is going to study magnetic fields in homes where there are children with cancers which are peculiar to children. The data will be compared with studies on children without cancers who come from similar homes. A recent report by Dr Samuel Milham of the Washington State Health Services in the United States says that some cancers are about twice as common in radio amateurs as in the rest of the community. However, the report also states that, on the whole, radio amateurs are a healthy lot and have a general mortality rate that is lower than average.

## More from the Poles

Both expeditions I mentioned in May have run into severe problems. Sir Ranulph Fiennes had to turn back after 15 days and the project has been abandoned for the time being. Members of the Russian/Canadian Skitrek Expedi-

tion have continued their skiing trip, but progress has been slow and they have made numerous diversions.

As well as individual listeners, quite a number of schools have been following the radio reports from UoSAT 2. It was most interesting to plot Skitrek's journey as it reported its position by digiTalker. After a slow start, progress improved considerably even in  $-35^{\circ}\text{C}$  temperatures and 20mph winds. Regular contact by 20m packet radio has been established between Leonid EX0CR on Sredniy Island, the expedition headquarters and the UoSAT Mission Control at Surrey.

## Maximum confusion

*Tomorrow's World* recently startled some of its viewers by suggesting that the current solar cycle is expected to reach its maximum towards the end of 1988.

The cycle began in September 1986, so the next maximum is not due till 1992. Speculation about an early maximum appears to have come from Dr McIntosh, the director of solar physics research at NOAA's Space Environment Laboratory in Boulder, Colorado. He has been quoted in the *New York Times* as saying that solar activity levels could reach normal maximum levels by this summer if current trends continue. These trends are based on three indicators of solar activity: the number of sunspots, the 10cm radio noise rate of increase and the prevalence of loop flares. However, it is a dodgy business predicting solar activity, and the current rapid rise could flatten out.

During periods of high solar activity, atmospheric heating increases. Increased atmospheric heating increases the drag on low flying satellites. This could have a significant impact on amateur satellites in a low orbit. UoSAT 1 and similar types show the first signs of being affected in this way.

There seems to be general agreement that conditions on the HF amateur bands are improving rapidly, particularly on 15m, with corresponding deterioration on the lower frequencies. There have been lots of good openings on 10m, and sometimes these have jammed 10m satellite downlinks. Good DX is coming through on both 15 and 20m. So far the 18

and 24MHz bands have not shown much activity. Maybe one should devote more time monitoring them from now on.

## The satellites

RS 11 has been on Mode KA for several weeks now and is being used so heavily that it is difficult to overcome the severe QRM and get into the system. Mode KA uses both 15m and 2m up and 10m down. The 15m up-link is 21.160 to 21.200MHz and this, of course, is used by 15m operators who are quite unaware that their signals are accessing the satellite at the same time as they are calling 'CQ DX' on the HF 15m band. Mode KA is particularly popular in the USSR, where 2m gear is in limited supply to amateurs. Mode KA also enables users to participate in satellite operations even if they have the more usual transponders which only cover the amateur bands from 10m to 80m.

The Russian authorities are going to try to stem the QRM by putting the 10/11 RS satellite on Mode A only (145.860 to 145.900MHz up and 29.360 to 29.400MHz) at weekends. This is when the heaviest loads occur. Apparently, the Russians plan to launch two more amateur satellites next year. These will be similar to the RS 10/11 satellite and will be a welcome addition if they materialise.

Other news suggests the Brazilians are to commission a satellite for educational and scientific purposes similar to the UoSATs. It is due for launch next year and will be designated *Peace Maker*.

Strong Morse signals have again been heard sending '501555'. These are said to be from RS 1, still partially functioning when the sun shines on its solar panels; quite remarkable I think.

Oscar 10 is functioning again, but frequent solar eclipses limit its use and this may continue for some time yet.

FO12-JAS-1 has recently been working to a more regular schedule and this has encouraged more people to use it. JAS-2 will not be launched until 1989. Though it was to have been a replica of JAS-1, it may have larger solar panels as the JAS-1 panels gave a very poor energy budget.

Oscar Phase 3C is due for launch very soon now, possibly on June 2nd. Teams from AMSAT-DL and AMSAT-NA should have left for Kourou by the time you read this.



The UoSATs have been supporting the Skitrek expedition. Satellite activity is at quite a high level.

### Balloon licence

The Hart team is attempting to fly a high altitude amateur radio transponder in a balloon (see this column, *Radio and Electronics World* January and March 1988). So far it has had problems obtaining a licence. After several months' consideration comes the reply that a licence cannot be granted due, apparently, to disapproval by the Civil Aviation Authority (CAA). The CAA claim that they cannot approve the project as the equipment has been built by amateurs and has not received type approval.

I ran into similar difficulties when applying for a marine transmitting licence to use home-constructed equipment on a yacht. It is difficult to get type approval and it is unusual for it to be granted to equipment that has not been constructed by a professional outfit. However, similar balloon projects have been built and flown by amateurs in other countries. It is very disappointing for the AMSAT-UK team, who conceived the idea and built the transponder. All they can do is await further negotiations.

### BARTG anniversaries

April 2nd was the tenth anniversary of the first BARTG News Service transmissions to overseas countries. BARTG received permission to transmit after

several months of negotiating with the licensing authorities, who were not keen on the idea at first. They regarded the transmissions as broadcasts, and broadcasts require special authority. Just over a decade ago all difficulties were swept away and the first news bulletin was transmitted overseas by Eric Yeomanson G3IIR from his QTH in south-east London.

These transmissions produced a lot of interest. They are still transmitted on the first and third Sundays of each month on six different beam headings. Next year will see the 30th anniversary of the founding of BARTG and special events are being planned to make it a memorable occasion.



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# ATV ON THE AIR

## Andy Emmerson G8PTH puts you in the picture

Spring has definitely sprung! Now the weather has improved thoughts shift to going outside and checking the aerial system... you know, make sure it's still there, all sealed joints are still waterproof and any guy wires are taut.

One TVer I know (no need to mention the call sign, really) did this during the winter and decided to lower his wind-up (or is it wind-down?) Bang! It came down a bit faster than he had reckoned with, and it was lucky he could jump so fast! The steel cable had rusted through and if nothing else, this is a word to the wise for those lucky(?) individuals with towers – check the cable regularly! It may look firm but how can you tell? I must admit I don't know, but I can tell you that it helps to keep it really well greased.

Grease! Who wants to get that stuff on their hands? Well, it's not as bad as it sounds, and if you use gloves you won't get any on your hands anyway. You can buy a large tube of it at your local filling station for a small sum and it will last ages. It's great stuff. Smear it over all ironwork in the aerial system, clamps, bolts and so on. If you dip nuts and bolts in the grease before you assemble mast-clamps they will always come undone easily afterwards, even several years later.

On the other hand, there's nothing worse than struggling with rusted bolts at the top of a ladder in biting wind. You don't have a spanner of the correct size, so you use an adjustable one, it slips and digs into your hand, you curse and drop it 30 feet, then you wonder why you took up such a stupid hobby. So *do* grease those bolts!

Also, remember that BNCs and UHF connectors cannot make waterproof joints, only N-types can. Water always gets into unsealed joints so tape up all connectors with self-amalgamating tape. It is expensive but it does the job, also you can often buy it cheaper at rallies. Don't forget *Coax-Seal*, my favourite 'goop on a reel', which you can buy at your local Tandy store. It is a kind of waterproof plasticine, very pliable and absolutely ideal for sealing up outside joints: not cheap but ideal! No doubt you find all this pretty obvious, but there are some people who only learn the hard way, which is a shame.

### New image on Severnside

The Bristol FM TV Group is no more (what a shame!) but has changed its name to the Severnside Television Group (STG). This change of name is, according to hon secretary Shaun O'Sullivan G8VPG, intended to reflect the wider potentials open to them.

In less than two years, this dynamic

group has obtained a licence and built a 23cm FM television repeater, GB3ZZ. The coverage area is far wider than the 'Bristol' of the group's original title and in fact they have regular viewers for some distance either side of the River Severn.

Their recent increase in power output to the full legal limit has brought high quality colour TV signals to an even wider area, perhaps even to Bath (whose presumed moribund AM repeater has not been heard of for a couple of years).

Best recorded DK for GB3ZZ so far is High Wycombe, under lift conditions of course, and this record will doubtless not last long.

The group is now keen to build up support for all ATV enthusiasts, not just those on 23cm FM. As a group, they will be pooling resources to enter TV contests and promote TV activity on all available bands. Members with camcorders will be out recording, to produce some good quality programming for transmission on the bands. So watch out for STG!

### High hopes need organisation

Making grand ideas work needs more than wishful thinking and the STG realise that this requires organisation. To help achieve these new objectives a new top team has been ordained. Roger Worth G4ZQF continues as chairman but the new chief engineer is Ted Halliday G3JMY.

Ted is no stranger to GB3ZZ, in fact he built a substantial part of it. Taking over as secretary is former 'techy' Shaun O'Sullivan, and Richard Williams G4NYK remains as treasurer. Taking up the new post of Membership Services Officer is former secretary Bryan Collins G4YQR, who will be assisted by committee newcomer, Phil Smith G1HIA.

Ivor Green G11XF continues as GB3ZZ site engineer, and two further newcomers are Ken Stevens G4BVK and Brian Kelly GW6BWX. With this kind of manpower, it seems to me that they cannot fail! Other repeater groups probably envy this level of teamwork...

### Team success

The Severnside Group entered the BATC's Spring Vision contest on March 12th/13th, their first entry as a group. Using Paul Green's very distinctive callsign G7ATV/P, they were active on both 70cm and 23cm from a location 203 metres above sea level. Points claimed are 2696 resulting from 26 contacts on 70cm (best DX, 234km; and 356 points from 10 contacts on 23cm (best DX being 58km, in P5 colour!).

This sounds most promising, and they

intend to enter more contests later in the year. At this rate they should indeed succeed in putting Severnside more squarely on the map, and their professional press release helps too. If you'd like me to feature *your* group as well, you know what to do – just write!

### Vintage matters

Nothing has been heard of the 405 Alive group since this time last year, so one must assume they have folded (with our subs!). In the meantime this leaves only the British Vintage Wireless Society covering the interest to those who collect old television bits. This society's most recent magazines have carried a number of articles to interest TVers. In volume 12, no 2, Tim Wander describes how he and others saved a Band I 405-line transmitter from Sutton Coldfield, while there is also a fascinating article by Philip Taylor on repairing valves. No doubt this will interest people who are unable to find replacements for scarce tubes.

In vol 12, no 3 are two letters pointing out other preserved TV transmitters in England. Also in the 'vintage vision' section is a warning by Tom Going about self-destructing CRTs and a note about having CRTs refurbished. All fascinating reading, and you can find out more about the BVWS by sending a stamped addressed envelope to them at 23 Rosendale Road, London SE21.

### Balloonic TV

Our American cousins don't have the monopoly on airborne experiments, it would seem. Paul PA0SON, ATV manager for the Netherlands, writes that he too had a go at this back in September last year. Here, in his own words, is what went on.

'On the occasion of the 11th lustrum of the mathematics and physics faculty of Nijmegen university on 27th September 1987, several activities had been planned in and around the faculty buildings. One of these activities was a demonstration of one of the possibilities of ham radio—a live ATV link from a hot air balloon.

'The balloon was scheduled to take off at 1pm from a car park, but due to the weather, this had to be postponed until 4pm. Around 3.45pm we started to build up the equipment into the balloon basket. Such a basket being very small, it was difficult to squeeze in two car batteries and the complete ATV transmitter and to allow two persons to fit in as well.

At 4pm we still faced bad weather conditions. The first start attempt, filling the balloon with hot air, had to be stopped after a couple of squalls. We

were dragged horizontally on the ground instead of a vertical lift-off.

'At our third start we succeeded at last to take off. Meanwhile it was 5.30pm. Almost immediately the ATV transmitter had been switched on and caused a hell of an activity. We got ATV reception reports from all over the Netherlands, from Germany, Belgium and France.

'Because of two unsuccessful starts, we didn't have enough gas to stay in the air for more than 45 minutes, but within this short period lots of people could watch the ATV pictures from out of the balloon. It is not clear yet what the best DX was because it was much too busy on the two metre link frequencies, but we'll see from the incoming QSLs.

'After all we were successful, certainly if you know that the balloon flight had been planned and organised only two weeks previously. Next time we will try to announce things a bit further in advance. Thank you very much to all involved for their co-operation in this unique experiment, certainly to be repeated. Special thanks to the German OMs who had switched off as many 70cm repeaters as possible on this occasion. The video frequency was 434.250MHz, 15 watts.'



**Fig 1** Immediately before take-off PA0SON (with camera) inspects the equipment. Clearly visible are the gas burners (1 million kcal)

#### PR + TV = QRM

'In some countries,' continues Paul, 'we ATV-users have a lot of problems with the signals of packet radio stations on 70cm. In Germany packet radio is on 438.025 - 438.175MHz and causes a lot of problems for the ATV stations. In Germany, Belgium and Holland most stations use 434.250MHz as picture carrier with upper sideband. The sound carrier is on 439.750 and with packet radio on 438 it is almost impossible to receive good colour pictures.

'The number of packet radio stations on 70cm in the Netherlands increased more than 100 per cent in the last six months. In PA0 packet radio stations use 432.675, 433.675 and 430.675MHz. On March 6th, we in VERON (one of Holland's national radio societies) formed a packet radio commission and decided that all packet activity will be in the band segment 430.600 - 430.800.

'I think that Belgium and France will follow our decision, so now we can say that there will be almost no interference any more from packet station in PA0, ON and F. Only DL will have many problems with PR on 438: let's hope that the DARC will also change the frequencies of the

PR bulletin board systems and repeaters to 430.

'Well, let's go on fighting for our ATV... after every problem there is sun (SON) shine!'

And that's it for this month: watch out for some reports from America!



**Fig 2** PA0SON busy starting up the ATV transmitter aloft. On the side of the basket is the big-wheel antenna which was lowered hanging on its co-ax. It was difficult to squeeze in two car batteries the complete ATV transmitter and still leave room for two people. A couple of unsuccessful starts meant they couldn't stay aloft for very long, but they still broadcast pictures to the people below

#### You win some . . .

My closing theme last month was the growing co-operation between 934MHz personal radio and 'traditional' ham radio, and how the two hobbies could only help each other. After all, we share the same interest in communicating and many of us have both kinds of licence.

I had a nice phone call from one of the Southend people, Steve G1XGP, saying thanks for the 'plug' and inviting me to their next rally. Well, I'm afraid the distance involved means I probably won't be able to make it to Southend, but I know it always used to be a good rally when I could get there, and I'm sure it still is.

# NETWORK

## 934

Andy Emmerson G9BUP

Rallies are a good place to meet friends old and new - and get hold of fiddly bits which aren't worth sending off

for by mail order. The bring-and-buy stalls are also a good way of clearing out old rubbish - and acquiring new rubbish! Only joking; it's amazing what some people want to get rid of. My shack contains several cast-offs from other people's shacks and I'm most satisfied.

#### . . . and you lose some

The night before Steve's call I had one on the answering machine from Mr Angry in Harby. At least I think that was who it was... the call cut off in mid stream probably because the wires were humming so hot. My oh my, was this guy furious - he said he was most hurt and demanded a letter of apology.

The gist of his argument was that I knew that 934 was very active in the Leics, Notts and Derbys district and what was I doing suggesting that Essex was the only part of the country where 934MHz was still alive? The general suggestion was that someone else could do my job writing this column a lot better!

Well, I'm sure the latter is quite true – does anyone wish to volunteer? They'll have to prove they can do a better job, of course. Seriously, though, I have tried to give 934MHz a bit of publicity in this column over the years. Don't forget, there is *no other* monthly magazine in this country with a 934 feature each month: only *Radio & Electronics World* looks after you!

I check the opposition mags and the one title which you might expect to cover the subject gives it only the rarest mention. If our friend in Harby had his way and had me sacked that would appear to be the end of regular 934 coverage in mainstream radio magazines (*Please stay, Andy! – Ed*).

Of course I am not forgetting the 934 UK Club's excellent newsletter, but this quarterly is available only to signed-up members, so people hovering on the edge of our hobby and the other 'non-club' types never get to see it.

So, I *appeal* to you, if you want publicity for your event or meeting just *let me know* and I'll willingly give you a plug. Do let me know in good time, please: because of production schedules, this

column is written up to two months before you see it in print. It's a shame to have to throw away interesting material because it has arrived too late.

Don't be like Mr Angry and blame me for not publicising your area group – you'll have to go to the effort of writing in. It doesn't take long to drop me a line care of the editor. The Essex group know this!

### 934 Club UK news

The latest magazine (issue 14) has just appeared and if you're not a member you'll have missed a number of goodies. Feature articles include an impression of 934MHz personal radio in Switzerland by Alfred Gugelmann of the Swiss club, PRS (Personal Radio Switzerland) and a useful guide to planning laws as they apply to masts and aerials.

No serious problems have arisen with the Swiss automatic calling system, and the only snag seems to be the 'well-nigh incomprehensible' user manuals supplied with the rigs! The Swiss users seem to be a co-operative crowd, though, and no doubt new users get a lot of help and encouragement from PRS club members.

Advertisers in issue 14 include the usual supporters of 934MHz – the big people like Nevada, Selectronic and LMW and all the local dealers too. You can find out more about the club by sending a stamped addressed envelope to the hon secretary, Mrs G Anthony, PO Box 424, Althorne, Essex CM3 6UP.

### Dates for your diary

If you get this magazine when it comes out you may wish to know of the Oxford Area Group rally on Sunday 22nd May. It is being held at Millet's Farm on the A415 at Frilford, near Abingdon. Talk-in on channel 10: it's a family event.

Don't forget the Southend and District radio rally on Sunday 5th June. The 934 fraternity will be well-represented here and it's at the Rocheway Centre in Rochford, Essex.

The following weekend you might wish to betake yourself to Harby in Leicestershire on Saturday 11th: there is a fair and 934 demonstration during the afternoon followed by a get-together for 934 people (with eats and drinks) during the evening in the village hall. Harby is near Melton Mowbray and there will be a talk-in.

This year's Epsom Downs rally takes place on Sunday 26th June behind the main grandstand of Epsom Racecourse. Wimborne (Dorset) is the location of the annual hamfest on 7th August, and there should be at least one 934MHz station.

Sunday 21st August sees the Brentwood rally in Essex: it starts at 10am and is a family outing for 934 and ham radio enthusiasts. A bit further away, on Sunday 16th October, is the 934MHz annual contest. The airwaves should certainly be buzzing that day.

### Signoff

That's it for this month. Let me have your news! If you send it I'll print it!



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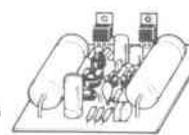
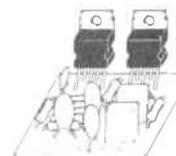
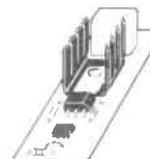
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# DECODING RTTY AND CW

by P J Cooper G3CXI

For twenty years I used a Creed 7B before changing to flexible modern technology. Nowadays I find memory banks are an absolute boon; I don't need a reinforced floor and I'm deafened by the silence, but I still have to cope with the strains of Jingle Bells.

Jingle Bells is a quaint expression for the musical tones of a radio teletype, RTTY for short. These can easily be decoded using a computer program and a suitable terminal. Most programs that decode RTTY also decode Morse. This article is about building a decoder which will work with any computer program and with old-fashioned units like my Creed 7B.

## Difference in time

Each RTTY system uses two tones, one for mark and one for space. The space tone usually has the lower of the two pitches, though most decoding programs will work on the opposite basis if needs be. What constitutes a mark or a space has been the subject of exhaustive argument so I have no intention of boring you with further speculation.

The difference between the two tones is called the shift. On the amateur bands it is 425Hz, 850Hz or even another frequency. But fear not, this decoder caters for them all. The universally accepted tones are 1445Hz mark and 1275Hz space. All shifts are calculated from the 1275Hz space frequency. America uses different frequencies but the shift is the same so it is possible to decode American RTTY without any extra equipment.

The decoder has to be able to cope with different mark/space transition times which depend on the signalling speed. There are dedicated devices available, aimed at the market for high-speed data streams, some of which are suitable for the amateur. Exar produce two reasonably priced chips: the XR2211 decoder and the XR2206 tone generator. If you don't intend to transmit, you only need the XR2211 which is available from most well-known suppliers.

Excluding packet radio, the fastest RTTY is likely to be sent at 300 baud ASCII. This decoder copes with 300 baud and even the much higher rates of fast commercial senders.

The decoder has been working with a Commodore 64 and the MBATOR program for some time now. Anyone just beginning RTTY is well-advised to look at

## Setting up the XR2211

1. Disconnect components from pin 3.
2. Connect a frequency counter to pin 3.
3. Tune potentiometer till counter reads calculated frequency.
4. Repeat for each shift position.
5. Adjust the variable potentiometer - this is merely to see its effect.
6. Reconnect components to pin 3.

this program from ICS Electronics, unequalled for amateur radio in my opinion, and I've tried quite a few.

## Setting it up

There are no special requirements other than a logical layout - all the clever stuff has been done by Exar. Veroboard is quite adequate and there is no need for a PCB.

Calculate the shift frequencies before setting up the XR2211. Add the mark frequency to the space frequency and divide by two, eg 1445Hz mark and 1275Hz space gives a setting frequency of 1360Hz.

Follow the directions in Boxes 1 and 2 and refer to the circuit diagrams in Figures 1 and 2 to set up the decoder correctly.

Usually it is not necessary to set up the chips to cope with any other shift, nor is it necessary to incorporate tone reversal. This is done in the computer program and in any case there are very few amateurs on the bands who use shifts other than 170Hz.

## Setting up the XR2206

1. Connect a frequency counter to the output.
2. Take pin 9 to +5V.
3. Adjust RV<sub>x</sub> till counter reads 1275Hz.
4. Take pin 9 to 0V.
5. Adjust RV<sub>y</sub> till counter reads 1445Hz.
6. Remove frequency counter.

## The RTTY filter

Sometimes it is necessary to filter RTTY signals on crowded bands, especially if your receiver is not all that good. The well-known quad op amp LM324 makes a useful one-chip filter if you take care to make the fine adjustments with a 10-turn potentiometer.

In the variable position, it is best to tune the decoder first and the filter second, otherwise you won't know which of them is off tone. Perhaps it would be an advantage to have a switch which takes the filter in and out of circuit between the receiver output and the decoder input.

The filter is tuned using a frequency counter, an audio generator and an oscilloscope. It is possible to use the XR2206 as the audio generator by temporarily returning it to the frequencies required (see Box 3).

It is possible to tune the filter without an oscilloscope, but an oscilloscope does make life much easier and you can really peak the filter for maximum. Without an oscilloscope, set the audio generator to the required frequency using the frequency counter, connect the generator to the filter input and connect the frequency counter to the output. Tune the adjustable resistor very carefully, and I stress very carefully, until the frequency shines through the filter and is indicated on the counter.

## Setting up the filter

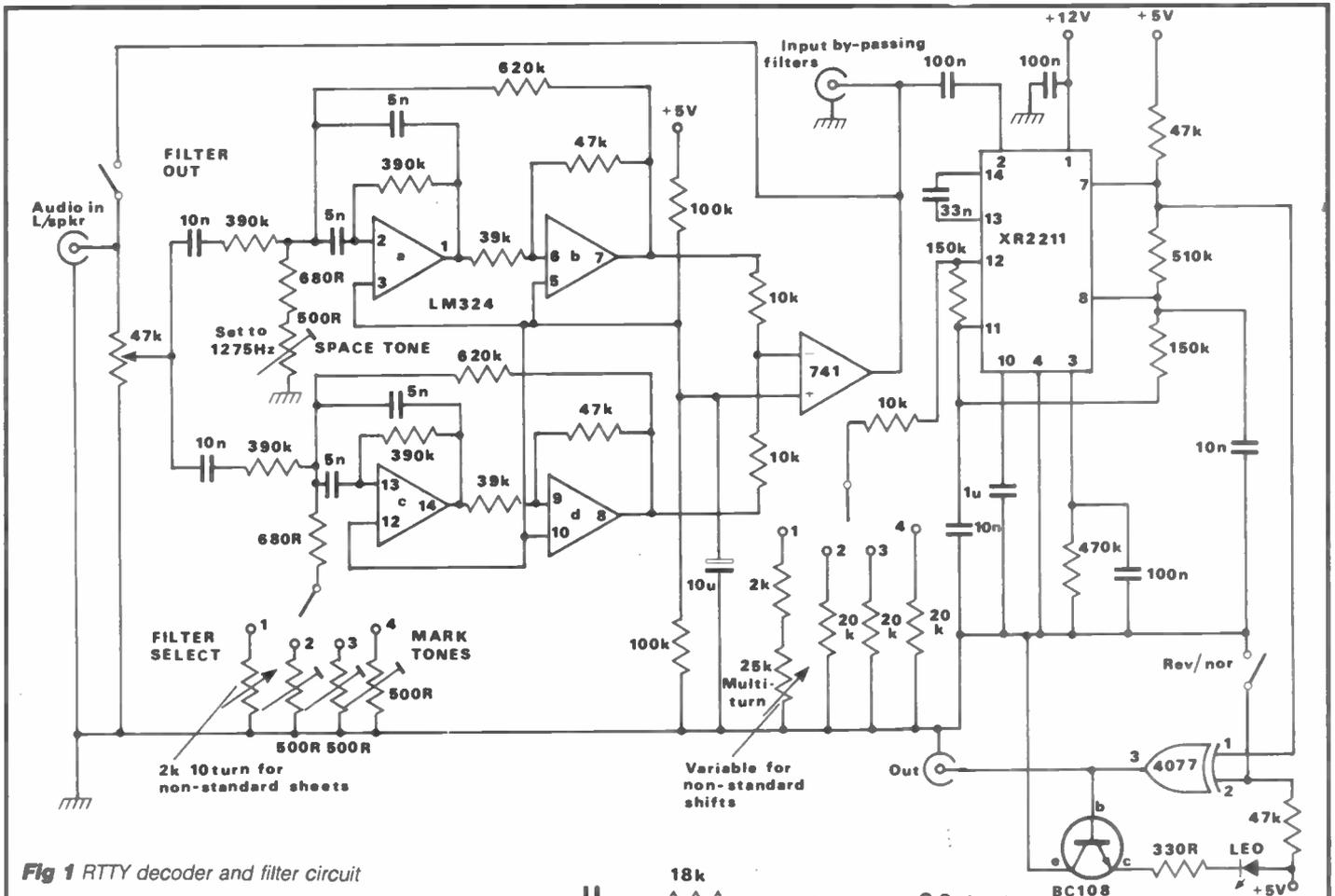
1. Connect an oscilloscope to filter output.
2. Inject an accurate 1275Hz signal.
3. Tune the adjustable resistor for peak output.
4. Reduce the audio generator output and repeat until you achieve the sharpest peak.
5. Repeat for all other frequency shifts.

## Watch the LED

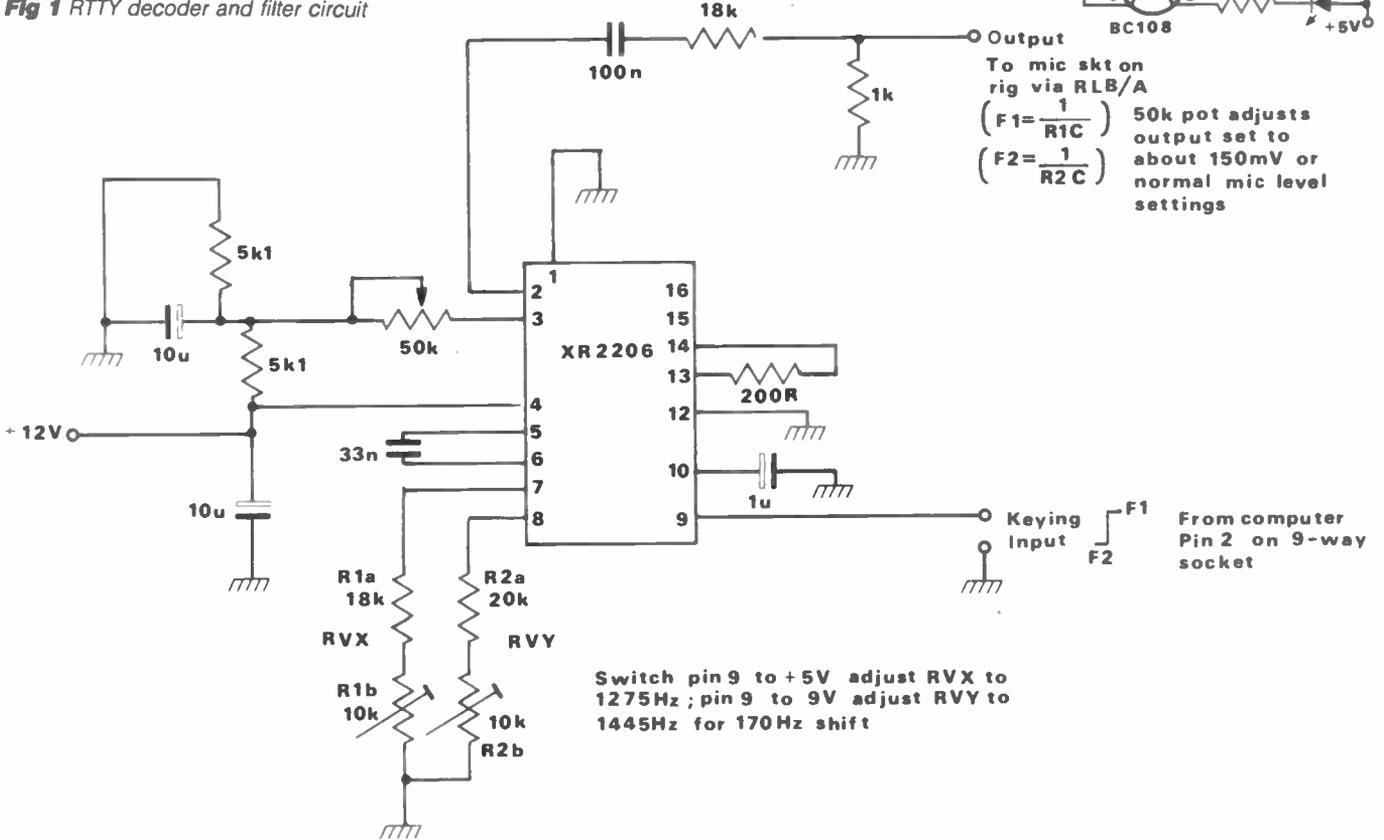
Connect the decoder between the speaker output of your receiver and the input of your computer. Tune around the bands for CW or RTTY and see what happens. A good place to look is 14.090MHz where there's a lot of 45 baud activity. If your program can copy AMTOR then try looking around 14.075MHz.

Watch the LED on the decoder while you're tuning. You are not decoding until it begins to flash in unison with the signal. If you are decoding and your screen shows garbage, throw the reversal switch and see if you start getting sense.

Normally the baud rate is 45 on the HF bands, but the commercials tend to use 50. You'll need to try the different baud

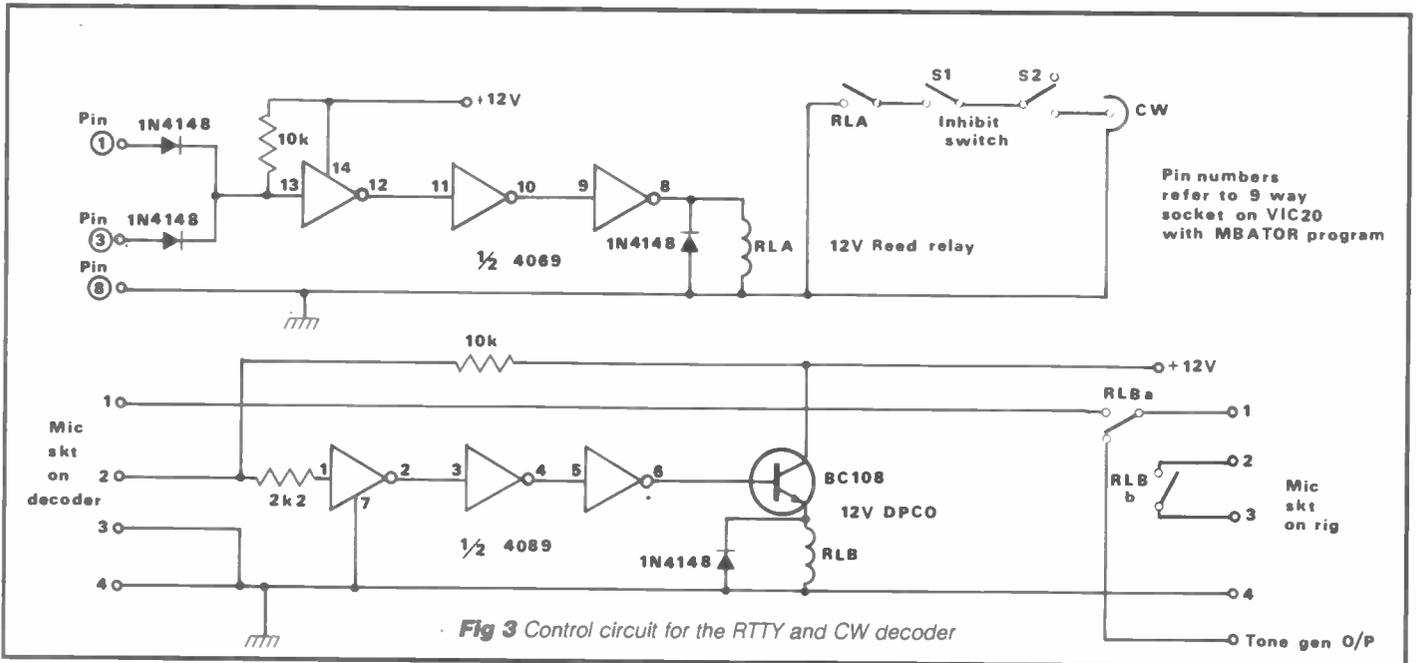


**Fig 1** RTTY decoder and filter circuit



**Fig 2** Tone generator circuit. The 9-way socket is on the VIC20 computer. Pins 1, 2, 3, 6 and 8 on the VIC20 socket correspond to E, F, H, J and 1-A-12-N on the CBM64 user port

# DECODING RTTY AND CW



rates and sometimes you will find an odd one, but it shouldn't take you long to sniff them out with the decoder.

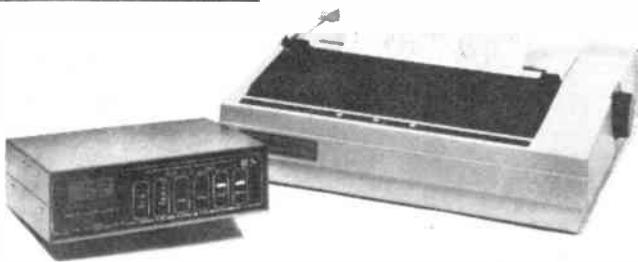
One final word which will interest those of you who need the control unit

(Figure 3). I almost forgot to mention how useful the inhibit switch is for running the system without transmitting – probably a face saver if you suddenly have to cut transmission without stopping the

system completely. The inhibit switch allows you to switch in the microphone to keep to the protocol that is used on VHF bands.

Good luck, and first class copy. 

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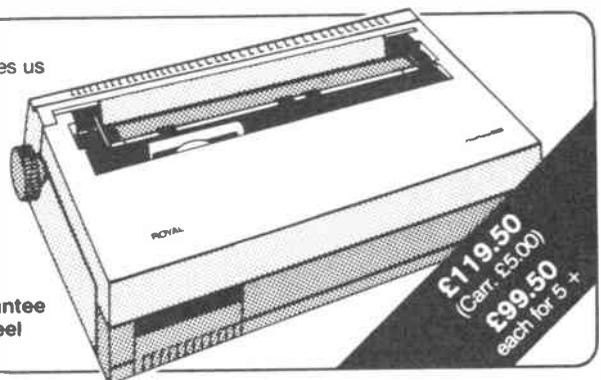
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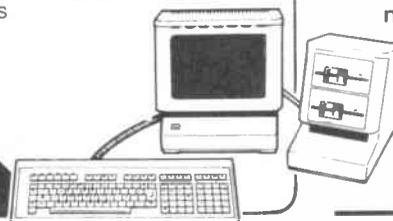
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AC187K	0.28	BC214	0.09	BD440	0.65	BF499	1.78	OC32	5.50	2N3055	0.52
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AF239	0.42	BC338	0.09	BF127	0.39	BR303	0.95	RC16303	0.85	2SC789	0.75
AJ106	6.95	BC347A	0.13	BF154	0.20	BRC3443	1.15	RC16334	0.95	2SC931D	0.95
AY102	2.95	BC461	0.35	BF177	0.38	BRC399	0.48	R2540	2.68	2SC946	0.80
BC107A	0.11	BC478	0.20	BF180	0.27	BSW64	0.95	RCA16029	1.45	2SC784	0.75
BC107B	0.11	BC478	0.20	BF180	0.27	BSW64	0.95	RCA16139	0.85	2SC789	0.75
BC108	0.10	BC547	0.10	BF158	0.22	BT100A/02	0.85	RCA16334	0.95	2SC931D	0.95
BC108B	0.12	BC548	0.10	BF178	0.26	BT106	1.49	RCA16335	0.95	2SC937	1.95
BC109	0.10	BC549A	0.10	BF179	0.34	BT110	1.20	RCA16572	0.85	2SC1034	4.50
BC109B	0.12	BC550	0.14	BF180	0.29	BT119	3.15	S2060D	0.95	2SC1096	0.80
BC109C	0.12	BC557	0.08	BF181	0.29	BT119	3.15	S2060D	0.95	2SC1096	0.80
BC114A	0.09	BC558	0.10	BF182	0.29	BT120	1.65	SKESF	1.45	2SC1106	2.50
BC115	0.55	BC639/10	0.30	BF183	0.29	BU105	1.95	TP12C	0.42	2SC1124	0.95
BC116A	0.55	BC733A	19.80	BF184	0.35	BU106	1.85	TP20V	0.45	2SC1162	0.95
BC116A	0.50	BD115	0.30	BF185	0.28	BU124	1.25	TP20V	0.45	2SC1172	2.10
BC117	0.19	BD124P	0.89	BF194	0.11	BU125	1.25	TP303V	0.85	2SC1173	1.15
BC119	0.24	BD131	0.42	BF195	0.11	BU126	1.60	TP902V	0.85	2SC1307	2.95
BC125	0.25	BD132	0.42	BF197	0.11	BU204	1.55	TP902V	0.85	2SC1364	0.50
BC139BC	0.20	BD135	0.40	BF198	0.16	BU205	1.30	TP915V	2.15	2SC1413A	2.50
BC140	0.31	BD136	0.30	BF200	0.40	BU208	1.39	TP934V			



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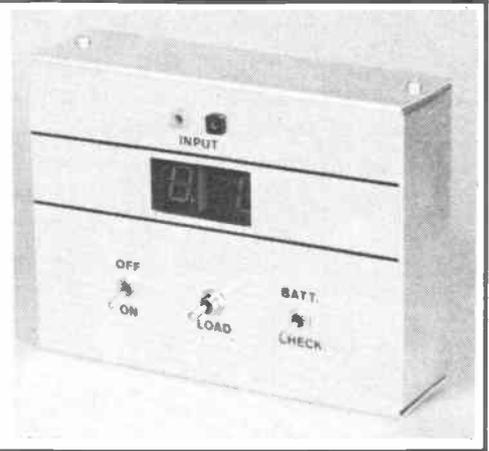
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E51 49.50	EF86 Mullard 4.50	KT44 4.00	PCC189 0.70	RR3-250 15.00	XF47 1.50	4CX350F 100.00	6DQ5 2.50	10GK6 1.50	50B5 1.95	5842 11.00
E80CC 19.50	EF86 Mullard 4.50	KT63 2.00	PCC805 0.70	RR3-250 15.00	XF50 1.50	4CX350G 100.00	6DQ6 2.50	10H1 3.50	50C5 0.95	5855 95.00
E80CF 12.50	EF86/VC4085 9.95	KT66 USA 9.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX350H 100.00	6DQ7 2.50	10I1 3.50	50C6DG 1.95	5886 13.95
E80F 18.50	EF89 1.50	KT66 GEC 25.00	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500A 98.50	6DQ8 2.50	10J1 3.50	50EHS 1.50	5894 39.50
E80L 29.50	EF91 1.95	KT66 Sp y sp-ot 19.50	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500B 98.50	6DQ9 2.50	10K1 3.50	50JH6 2.95	5899 4.50
E81CC 8.50	EF92 2.15	KT67 9.00	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500C 98.50	6DQ9 2.50	10L1 3.50	50KJ 1.50	5963 1.75
E81L 12.00	EF93 1.50	KT77 Gold lion 11.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500D 98.50	6DQ9 2.50	10M1 3.50	50L1 1.50	5965 2.15
E82CC 4.50	EF94 1.50	KT77 Gold lion 11.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500E 98.50	6DQ9 2.50	10N1 3.50	50M1 1.50	5965 2.15
E83CC 4.50	EF95 1.95	KT77 Gold lion 11.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500F 98.50	6DQ9 2.50	10O1 3.50	50N1 1.50	5965 2.15
E83C 8.50	EF96/VC4085 9.95	KT77 Gold lion 11.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500G 98.50	6DQ9 2.50	10P1 3.50	50O1 1.50	5965 2.15
E84CC 9.50	EF97 0.90	KT81 7.00	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500H 98.50	6DQ9 2.50	10Q1 3.50	50P1 1.50	5965 2.15
E85C 7.95	EF98 0.90	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500I 98.50	6DQ9 2.50	10R1 3.50	50Q1 1.50	5965 2.15
E86CC 3.50	EF98 0.90	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500J 98.50	6DQ9 2.50	10S1 3.50	50R1 1.50	5965 2.15
E88CC Mullard 4.95	EF183 0.75	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500K 98.50	6DQ9 2.50	10T1 3.50	50S1 1.50	5965 2.15
E88CC-01 5.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500L 98.50	6DQ9 2.50	10U1 3.50	50T1 1.50	5965 2.15
E90CC 7.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500M 98.50	6DQ9 2.50	10V1 3.50	50U1 1.50	5965 2.15
E90F 7.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500N 98.50	6DQ9 2.50	10W1 3.50	50V1 1.50	5965 2.15
E91H 4.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500O 98.50	6DQ9 2.50	10X1 3.50	50W1 1.50	5965 2.15
E92CC 3.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500P 98.50	6DQ9 2.50	10Y1 3.50	50X1 1.50	5965 2.15
E93F 8.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500Q 98.50	6DQ9 2.50	10Z1 3.50	50Y1 1.50	5965 2.15
E93L 18.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500R 98.50	6DQ9 2.50	10A1 3.50	50Z1 1.50	5965 2.15
E180CC 19.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500S 98.50	6DQ9 2.50	10B1 3.50	50A1 1.50	5965 2.15
E180F 6.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500T 98.50	6DQ9 2.50	10C1 3.50	50B1 1.50	5965 2.15
E182CC 9.00	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500U 98.50	6DQ9 2.50	10D1 3.50	50C1 1.50	5965 2.15
E186F 8.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500V 98.50	6DQ9 2.50	10E1 3.50	50D1 1.50	5965 2.15
E188CC 7.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500W 98.50	6DQ9 2.50	10F1 3.50	50E1 1.50	5965 2.15
E235L 12.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500X 98.50	6DQ9 2.50	10G1 3.50	50F1 1.50	5965 2.15
E280F 19.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500Y 98.50	6DQ9 2.50	10H1 3.50	50G1 1.50	5965 2.15
E283CC 12.00	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500Z 98.50	6DQ9 2.50	10I1 3.50	50H1 1.50	5965 2.15
E288CC 17.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AA 98.50	6DQ9 2.50	10J1 3.50	50I1 1.50	5965 2.15
E810F 25.00	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AB 98.50	6DQ9 2.50	10K1 3.50	50J1 1.50	5965 2.15
E1148 1.00	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AC 98.50	6DQ9 2.50	10L1 3.50	50K1 1.50	5965 2.15
E150 1.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AD 98.50	6DQ9 2.50	10M1 3.50	50L1 1.50	5965 2.15
EAS2 65.00	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AE 98.50	6DQ9 2.50	10N1 3.50	50M1 1.50	5965 2.15
EA78 1.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AF 98.50	6DQ9 2.50	10O1 3.50	50N1 1.50	5965 2.15
EA79 1.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AG 98.50	6DQ9 2.50	10P1 3.50	50O1 1.50	5965 2.15
EABC80 1.00	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AH 98.50	6DQ9 2.50	10Q1 3.50	50P1 1.50	5965 2.15
EAC31 2.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AI 98.50	6DQ9 2.50	10R1 3.50	50Q1 1.50	5965 2.15
EAF42 1.20	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AJ 98.50	6DQ9 2.50	10S1 3.50	50R1 1.50	5965 2.15
EAC74 1.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AK 98.50	6DQ9 2.50	10T1 3.50	50S1 1.50	5965 2.15
EB41 3.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AL 98.50	6DQ9 2.50	10U1 3.50	50T1 1.50	5965 2.15
EB91 0.85	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AM 98.50	6DQ9 2.50	10V1 3.50	50U1 1.50	5965 2.15
EB33 2.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AN 98.50	6DQ9 2.50	10W1 3.50	50V1 1.50	5965 2.15
EB41 3.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AO 98.50	6DQ9 2.50	10X1 3.50	50W1 1.50	5965 2.15
EB91 0.85	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AP 98.50	6DQ9 2.50	10Y1 3.50	50X1 1.50	5965 2.15
EB33 2.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AQ 98.50	6DQ9 2.50	10Z1 3.50	50Y1 1.50	5965 2.15
EB41 3.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AR 98.50	6DQ9 2.50	10A1 3.50	50Z1 1.50	5965 2.15
EB91 0.85	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AS 98.50	6DQ9 2.50	10B1 3.50	50A1 1.50	5965 2.15
EB33 2.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AT 98.50	6DQ9 2.50	10C1 3.50	50B1 1.50	5965 2.15
EB41 3.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AU 98.50	6DQ9 2.50	10D1 3.50	50C1 1.50	5965 2.15
EB91 0.85	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AV 98.50	6DQ9 2.50	10E1 3.50	50D1 1.50	5965 2.15
EB33 2.50	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AW 98.50	6DQ9 2.50	10F1 3.50	50E1 1.50	5965 2.15
EB41 3.95	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AX 98.50	6DQ9 2.50	10G1 3.50	50F1 1.50	5965 2.15
EB91 0.85	EF184 0.85	KT88 USA 10.95	PCC806 0.80	RR3-250 15.00	XF50 1.50	4CX500AY 98.50	6DQ9 2.50	10H1 3.50	50G1 1.50	5965 2.15
EB33 2.50	EF184 0.85	KT88 USA 10.95	P							

# BATTERY CHECKER

## by R A Penfold



The number of battery-powered gadgets in the average household seems to grow steadily along with portable televisions, compact disc players and Walkmans (Walkmen?); all of them recent additions to the list of available playthings.

Most radio and electronics enthusiasts have more than their fair share of battery-powered equipment such as multimeters, portable transceivers and cordless soldering irons. A quick count revealed that I have over two dozen batteries in various pieces of equipment and that's not including any of the projects I've built myself.

Moreover, it seems as though friends and relations are constantly presenting me with batteries and demanding to know whether or not they are flat, preferably with documentary evidence. An accurate battery tester appears decidedly useful.

Though it is often obvious when batteries have expired, there can sometimes be doubt whether they are actually flat or whether the equipment is at fault. A new set of cells can be an expensive and wasteful way of settling the matter. When dealing with nickel-cadmium rechargeable cells there can also be problems with one cell going faulty and having to be sorted out from a number of perfectly serviceable cells.

This battery tester was designed to accurately and reliably check any battery from 1.2V nickel-cadmium cells through to PP3s and other 9V types. It has a two-digit LED display which covers the voltage range 0 to 9.9V, as well as an adjustable load – an essential feature for proper battery checking.

The various types of high-power battery, particularly nickel-cadmium, generally have very low internal resistances so they tend to be fully operational or completely flat. The intermediate state is very brief.

A conventional dry battery starts off with a relatively high internal resistance which increases substantially as the battery discharges. A 9V dry battery might produce about 8V when measured using a multimeter, but this could rapidly fall to 6 or 7V when a few milliamps are drawn.

Three switched load-currents are provided by a constant current generator so

they are largely independent of the battery voltage. The currents are approximately 10, 30 and 100mA. The lowest current is suitable for low-capacity batteries such as PP3s; the middle and highest currents are applicable to medium- and high-capacity types such as HP7 and HP2 cells respectively. The circuit includes protection against test batteries being connected with the wrong polarity.

### Digital voltmeter (DVM)

The unit could be based on a panel meter, but most of the meters currently available do not seem to offer very high resolution and are not particularly cheap. A two-digit display is a more practical solution that gives better accuracy for about the same cost. Surprisingly, perhaps, no special one- or two-digit DVM integrated circuit seems to be available. A 3½- or 4½-digit type is over-specified and too expensive for the present application so a discrete two-digit DVM circuit had to be developed. This part of the unit might be suitable for other applications that require something less than 3½-digit accuracy.

Most DVM circuits use the single-slope integration technique (Figure 1). A linear ramp signal is fed to one input of a voltage comparator. The other comparator input is the voltage to be measured. The output of the comparator, initially at logic 1, activates a gate which connects

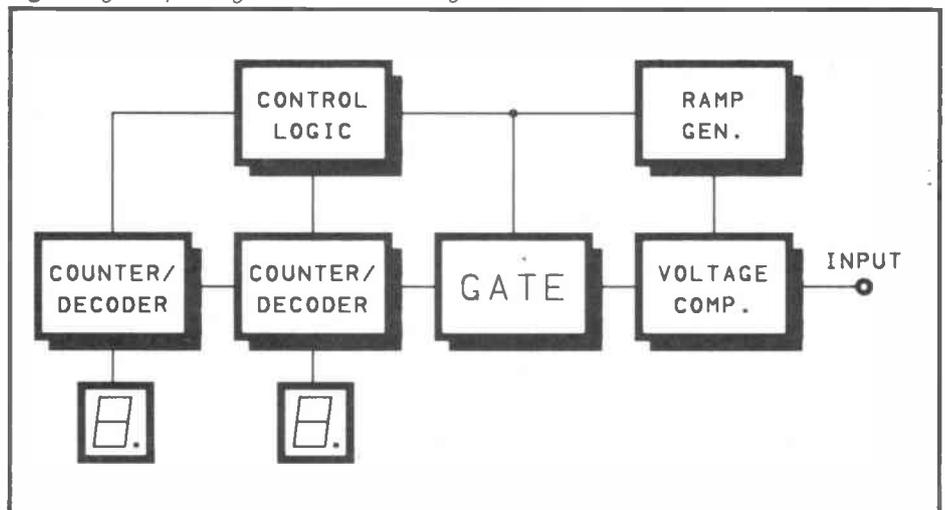
the clock oscillator to the counter. When the ramp voltage exceeds the voltage to be measured, the output of the comparator goes to logic 0 which blocks the flow of clock pulses through the gate and stops the clock. The higher the voltage to be measured, the longer it takes before the count is halted and the larger the final count.

This gives the required voltmeter action. The control logic repeats the sequence indefinitely, so a continuous stream of readings is taken. Accuracy largely depends on the linearity of the ramp generator, but it is usually possible to obtain a signal having excellent linearity.

Though the initial design was based on a circuit of this type, it lacked simplicity as it required too much control logic. A few experiments with unconventional DVM circuits eventually led to the adoption of the system in Figure 2. The current sink is the stage that provides the dummy load for the battery and has nothing to do with the voltmeter section of the unit.

The voltmeter is extremely simple. Ignore, for the moment, the voltage controlled oscillator (VCO), and see how the other blocks form a conventional digital frequency meter. The low-frequency oscillator controls the rate at which readings are taken. The low-frequency oscillator and the control logic ensure that the other stages

Fig 1 Single slope integration DVM block diagram



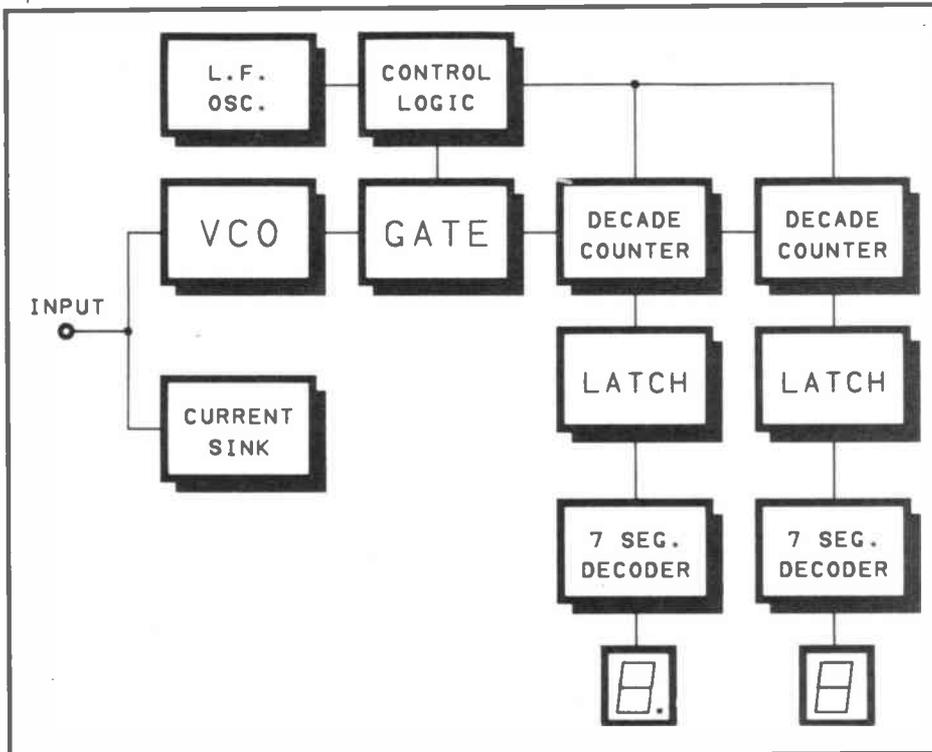


Fig 2 Battery checker block diagram

receive the appropriate control pulses at the correct time.

### Degree of Precision

The gate is activated for a period which allows pulses from the signal source, the VCO, to get to the counter. The higher the input frequency, the higher the final count on the display. A pulse fed to the latches results in the count being stored and fed to decoder/drivers, which display the count via two seven-segment LED displays. Next a reset pulse resets the counter to zero so that it is ready to start a fresh count, but the latch is unaffected and the original count is still displayed. A new gate period is commenced and the circuit cycles in this manner indefinitely, providing a continuous stream of readings on the display.

The voltage to be measured is connected to the control input of the VCO. The unit will operate as an accurate voltmeter provided the VCO gives an accurate voltage-to-frequency conversion. This system enables a very simple circuit to be used, but accuracy tends to be compromised by a lack of linearity in the control characteristic of the VCO. However, in this case we do not require the high degree of precision demanded by a 3½- or 4½-digit circuit. A VCO having a linearity of about 1% or better is adequate for a two-digit display. This degree of linearity can be achieved using a simple VCO based on an inexpensive dual operational amplifier. It does not require an expensive frequency-to-voltage conversion chip.

### Circuit operation

The full circuit diagram for the battery checker appears in Figure 3.

Tr1 acts as the basis of a standard constant current sink. S2 provides three switched emitter resistances which give the unit its three currents. Tr1 has to dissipate nearly a watt when a 9V battery is being tested using the highest current. Even so, the specified device does not require a heatsink. If the test battery is fitted with the wrong polarity, a substantial current can flow through Tr1. Though this is unlikely to damage the circuit, D3 is a wise precaution as it blocks any significant reverse current flow.

The voltmeter circuit is powered from a stabilised supply to ensure good long-term accuracy. A 5V stabilised supply is derived from the 9V battery using voltage regulator IC3.

IC6 is the basis of the VCO. The configuration used here is very similar to a square/triangular oscillator that is based on a Schmitt trigger and a Miller integrator. This slightly modified arrangement permits voltage control and provides excellent linearity. The circuit will only operate using a dual operational amplifier that is designed for single supply operation. Few devices can be successfully substituted for the LM358. D4 provides reverse polarity protection and S3 enables the unit to be switched to check its own battery. RV1 is used for calibration.

The low-frequency oscillator is a CMOS astable based on two NOR gates connected as inverters (IC1a and IC1b). The operating frequency is a little under

10Hz, but the control logic circuit provides a divide by three action that results in fresh readings being taken roughly three times per second.

A CMOS 4017BE one-of-ten decoder (IC2) plus the remaining two gates of IC1 provide the control logic. For one clock cycle the outputs of IC2 go high one at a time and in sequence. Outputs 0,1 and 2 provide the gate, latching, and reset pulses respectively. The gate and latching pulses must be negative types so the two gates are used as inverters to give signals of the right polarity. Output 3 of IC2 resets IC2 itself, effectively eliminating outputs 4 to 9 which serve no useful purpose in this circuit.

IC4 and IC5 are CMOS 40110BE decade counters, latches, and seven-segment decoder/drivers. The circuit is greatly simplified by having all three functions in a single chip. The gate, latch, and reset inputs are driven from the appropriate outputs of the control logic. The VCO directly drives the least significant digit of the counter circuit. Unlike most CMOS integrated circuits, the 40110BE can deliver a substantial output current from each of its segment outputs. Instead of driver transistors to boost the output current to the display segments, current limiting resistors (R4 to R17) are needed to keep the drive current down to an acceptable level.

The decimal point of the most significant display is driven from the positive supply via current-limiting resistor R3. Note that the display must be a common cathode type. Incidentally, the 40110BE is an up/down counter with a separate clock input for each of the two functions. It also has individual carry/borrow outputs. In this circuit the down clock inputs are simply connected to the negative supply rail, and the borrow outputs are just ignored.

An over-range indicator has been omitted from the circuit. It would be unusual if a 9V battery produced more than 9.5V so the voltmeter should not be driven beyond full scale.

LED displays inevitably draw a high current, typically about 65 milliamps (the exact figure varies enormously with the number of activated segments). Nevertheless, the unit can be run economically from a small 9V PP3 battery if it is used briefly and intermittently.

### Construction

Except for the battery, sockets and controls, all the components are mounted on the printed circuit board. Details of the board are provided in Figures 4 and 5.

IC1, IC2, IC4, and IC5 are CMOS integrated circuits that are vulnerable to damage by static charges. Take the normal MOS handling precautions when dealing with these devices, especially IC4 and IC5 which are quite expensive. I recommend IC holders for all the DIL



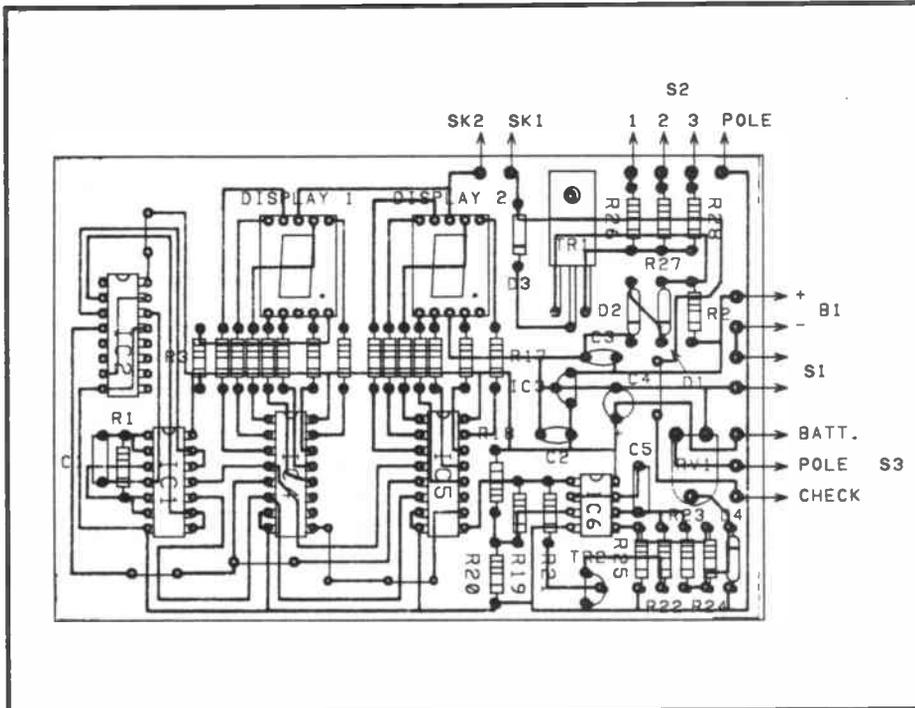


Fig 5 Components overlaid on PCB artwork

current switch set to the high position. This includes PP9s, high-capacity batteries and all but the smallest 1.5V cells, ie AAAs. The medium setting is suitable for AAAs, high-power PP3s, and medium-capacity 9V batteries such as the PP7s. The lowest setting is only used for low-capacity batteries such as PP3s, PP6s and watch/camera batteries.

The general idea is to choose a current that roughly matches the typical current drain on the battery being tested.

With ordinary dry cells the voltage of a

new battery, even under load, is likely to be a few percent higher than its nominal voltage. Just what constitutes a flat battery depends on the equipment the battery supplies. Some equipment will work perfectly well with a battery voltage that is well below the nominal figure. Other equipment seems to fail if the battery voltage is more than a few percent below par. In general, a battery is usable until its voltage falls to about 80% of its nominal voltage. The situation is different with nickel-cadmium batteries and other batteries which have a low

internal resistance. These tend to have comparatively little voltage variation during their working lives and can usually be regarded as exhausted when the loaded output voltage has fallen to 90% of the nominal battery voltage. Note that nickel-cadmium cells have a normal output potential of only about 1.2V or 1.25V, not 1.5V.

One final point concerns checking the battery-checking battery. A falling supply voltage substantially inflates voltage readings, so a higher than normal battery check reading indicates that the battery-checker battery is exhausted and needs replacement.

## Parts List

### Resistors (all 1/4 watt 5% carbon)

R1	2M2
R2	2k2
R3 to R17	330R (15 off)
R18,20	220k (2 off)
R19,23	100k (2 off)
R21	22k
R22,24,25	56k (3 off)
R26	68R
R27	22R
R28	6R8

### Potentiometer

RV1	47k sub-min or preset
-----	-----------------------

### Capacitors

C1	47n polyester
C2,3	100n ceramic (2 off)
C4	10µ 25V radial elect
C5	4n7 polyester

### Semiconductors

IC1	4001BE
IC2	4017BE
IC3	µA78L05
IC4,5	40110BE (2 off)
IC6	LM358
Tr1	TIP41A
Tr2	BC549
D1,2,4	1N4148 (3 off)
D3	1N4001
Display 1,2	0.5 or 0.56in common cathode LED

### Miscellaneous

SK1,2	2mm sockets (2 off)
S1	SPST miniature toggle
S2	3-way 1-pole (see text)
S3	SPDT miniature toggle
B1	9V PP3 size

### Battery connector

Case	about 135 x 102 x 38mm
8-pin DIL IC holder	
14-pin DIL IC holder	(3 off)
16-pin DIL IC holder	(3 off)
Display filter	
Printed circuit board	
Stand-offs	
Wire, solder, etc	

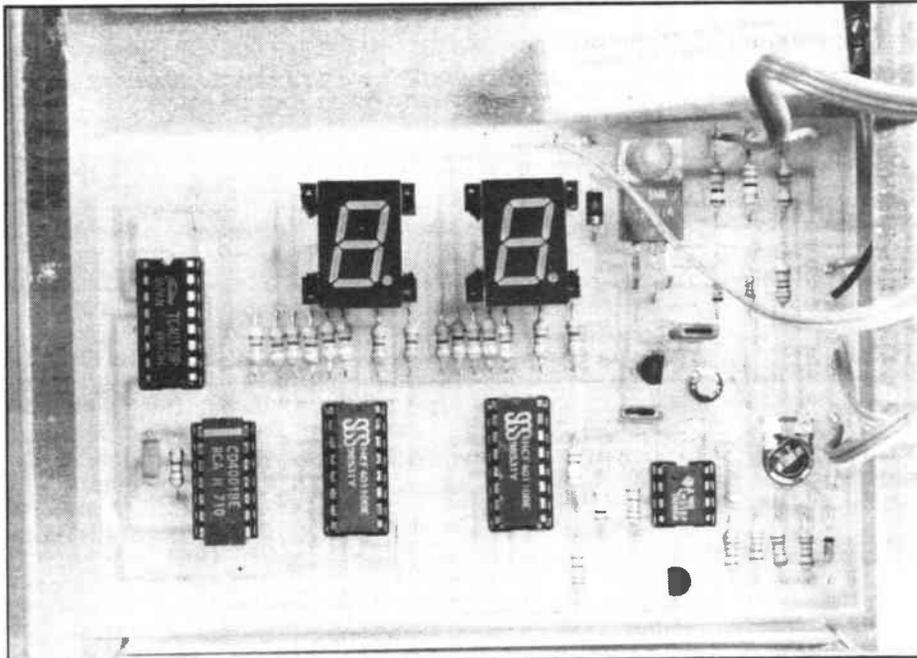


Fig 6 The completed PCB

# Latest Literature

## AN INTRODUCTION TO SATELLITE TELEVISION

by F A Wilson

This is a wide-ranging book which will be a boon for any would-be dish purchaser with a reasonably well-oiled brain.

The aim of the book is to give non-technical readers an insight into the system; boffins who feel deprived of formulae are directed to the appendices.

Because the book caters for the curious layman, the first few chapters deal with very basic facts—what a geostationary orbit is, prefixes used in the metric system, exponents and suchlike.

Having said that, the text does continue into more technical realms—information about the TVRO dish, where to site it, link signal levels and so forth. Appendix 10 gives a glossary of terms used in the book—most of them are fairly straightforward and would be familiar to anyone with a passing knowledge of amateur radio or electronics.

This is a nice simple text that will help the man in the street to get to grips with the basics of satellite television. The appendices give the electronics enthusiast something to get his teeth into, so this is a useful starter text.

Bernard Babani Ltd, £5.95.  
ISBN 0-85934-169-0.

## SHORT WAVE

by C J Both

Neat but not gaudy, this pocket-sized book is one of those reference books that really will come in handy. Basically, it's a list of the world's short wave stations, from 2260kHz to 2180kHz.

All very useful stuff, with an introduction in four languages. It appears to have been a Dutch text originally, since the English is rather quaint (but very charming, and a lot better than our Dutch).

This inexpensive softback is available only through PC

Publishing, 22 Clifton Road, London N3 2AR.

PC Publishing, £4.95

## USING THE AMSTRAD PCW9512

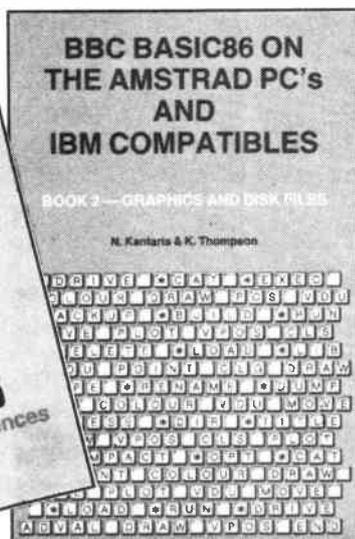
by John Campbell

The Amstrad PCW9512 is the latest model in the series of Amstrad dedicated wordprocessing computers. It comes complete with a hard

disk unit and daisy wheel printer. compatibles, this text continues exploring the fascinating combination of a very practical language and very powerful computers.

Book 2 explores the graphics commands to an advanced level, and the disk filing capabilities of the language.

Graded problems are included together with full working solutions. All the illustrations are incorporated into working programs, a



disk unit and daisy wheel printer.

This book introduces word processing to the user who has no experience with this type of word processor. The book is divided into sections, each of which deals with a number of topics.

Text and examples show in detail how the Locoscript 2 commands are used. The order of the sections follows the logical path of the user who will experiment with short simple documents, working up to items of much greater complexity.

Heinemann Newtech, £14.95.  
ISBN 0 434 90201 2.

## BBC BASIC 86 BOOK 2

by N Kantaris and K Thompson

The second book on transferring BASIC 86 to the Amstrad and IBM

most practical and constructive approach.

Designed for the Amstrad or IBM user wanting to explore this field further, this book will be a down-to-earth aid for the man who prefers hands-on experience to simple theorising.

Bernard Babani Ltd, £3.95.  
ISBN 0-85934-189-5.

## USING DATA COMMUNICATIONS ON THE AMSTRAD

by Mike James

For the first time user, new to computers, learning how to use the machine can be a daunting one.

This is a Step by Step book, designed for clarity and ease of use. The reader is gently guided through the stages of understanding how to use the hardware and software that makes up the Amstrad

PC1512/1640 computer system, quickly and effectively.

Data communications is one of the most exciting applications for the PC user. This book provides guidance for the PC user who wants to use information services, telex or electronic mail. Although an essentially serious guide to the way communications can increase efficiency, save time and even make money, the book also includes information on some of the more fun aspects of data such as Prestel and Bulletin boards.

Heinemann Newtech, £9.95.  
ISBN 0 434 90895 9.

## ADVANCED BASIC 2 PROGRAMS ON THE PC1512/1640

by P K McBride

This book carries on from the successful *Simple BASIC 2 Programs on the Amstrad PC*, although prior knowledge of the previous book is not assumed.

The aim of the book is to show how to design and develop substantial applications using BASIC 2. The programs included in the book are divided between personal and business applications demonstrating a range of advanced techniques and concepts.

Each program is fully documented, showing its development from a raw idea to a finished product. The documentation starts with an analysis of the application and the design of the logical structure.

It examines those special techniques needed to solve particular problems, describes the use of variables and files, explains the nature and purpose of each part of the final design and shows how to test the outputs.

This book will be of interest to both programmers using the Amstrad PC and to students in schools, colleges and universities.

Heinemann Newtech, £9.95.  
ISBN 0 434 91280 0.



### STC Instrument Services

STC Instrument Services has produced a massive 320-page catalogue, covering equipment ranging from computers and UPSs to oscilloscopes and speech design products from leading suppliers.

The 20-section publication now features an entirely new area dedicated to training, encompassing the Global Specialties CDA-1 powered proto-board; HP1 advanced logic designer; and PB503 proto-board as well as the MTP-80 microcomputer fundamentals program.

Speech Design's audio card, Rifa's PKC dc/dc converters and the Global Specialties 2005D function generator are among the products highlighted.

Details of the STC test house facilities, on-site exhibitions and STC's Opto-Electronics Division calibration centre are also provided.

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

### Computer Products

Recently published by Computer Products/Power Conversion Europe is a 175-page power supply engineering handbook with

electrical and mechanical specifications for over 2400 standard power supplies and dc/dc converters.

*The Engineering Handbook* – which is available free – features a 24 page technical section on the principles of power conversion, together with a glossary of power supply definitions.

The Handbook covers open frame switchers (25W to 1500W), encapsulated power modules (1W to 25W), open frame linears (15W to 125W) and dc/dc converters (0.5W to 360W). This handbook should help with the difficult task of specifying power supply requirements.

*Computer Products/  
Power Conversion Europe,  
Youghal,  
County Cork,  
Republic of Ireland.  
Tel: (010) 353 24 93130.*

### ITT Instruments

ITT Instruments has produced a full colour brochure on the company's recently-introduced OX709, the first dual channel 30MHz oscilloscope which meets IEC 348 Class II and BS4743 Class II double insulated safety requirements.

The special features offered by the OX709 make it suitable for electrical and industrial maintenance, servicing electronic and telecommunications

equipment and in rugged environments such as military and petrochemical situations.

The brochure gives full technical details of the OX709 and presents the main features in clear, easy-to-understand format, backed up with photographs.

A full technical specification of the oscilloscope is also included.

*ITT Instruments,  
346 Edinburgh Avenue,  
Slough,  
Berkshire SL1 4TU.  
Tel: (0753) 824131.*

### NEC Electronics

NEC Electronics have published issue No 4 of ConNEctions. This publication covers the V Series of microprocessors and microcomputers, with various peripherals and development support devices.

Printed in colour, this provides a quick and easy insight into the latest developments in some of the world's most advanced micros.

Copies are free from NEC Electronics' data distribution department.

*NEC Electronics (UK) Ltd,  
Carfin Industrial Estate,  
Motherwell ML1 4UL.*

### Imhof

A redesigned edition of Imhof's standard racks, consoles and accessories catalogue, covering the company's successful S80 and S80-600 enclosures and consoles ranges, makes the task of choosing and specifying enclosures much simpler.

The 52-page, full colour publication contains comprehensive technical data and ordering information, and details the wide range of racks, consoles and accessories available, all in a clear, 'user-friendly' format.

*Imhof,  
Ashley Works,  
Ashley Road,  
Uxbridge,  
Middlesex.  
Tel: (0895) 37123.*

### Incomtel

To mark a 50% increase in turnover, Incomtel has published a new colour brochure which outlines their full range of currently available facilities. Their services include feasibility studies and project planning, right through to project completion and on-site training for local staff. All design work is undertaken in the UK and Incomtel's own engineers and technicians always take up residence in the country concerned to supervise projects, an increasing number of which are now turnkey.

Copies of the new colour brochure are available from the company's headquarters.

*Incomtel Ltd,  
225 Goldhawk Road,  
London W12 8SB.  
Tel: 01-743 5511.*

### Epson

Three new Epson brochures, covering Epson printer mechanism graphic LCD modules and disk drives, are available to all components users and OEMs.

Details of the full range of Epson miniprinter mechanisms for use in applications such as EPOS, vending and ticketing are given. The range includes the new low profile, 42-column M260 miniprinter series available with autocutters.

Epson's graphic LCD models are featured including Super TN and Chip-on-Flex (where the LCD driver is mounted on flexible PCB strip).

The full range of Epson 3.5in and 5.25in floppy disk drives (FDD) and hard disk drives (HDD) is covered. Among the disk drives featured are the latest 3.5inch models – the 1MB SMD480M FDD, the switchable 1MB/2MB SMD440L FDD and the HMD900 series of high capacity 40MB and 70MB HDDs with enhanced SCSI interfaces.

*Epson (UK) Limited,  
Dorland House,  
388 High Road,  
Wembley,  
Middlesex HA9 6UH.  
Tel: 01-902 8892 x308.*



# ICOM

## IC-4GE 70cm FM Handportable

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

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

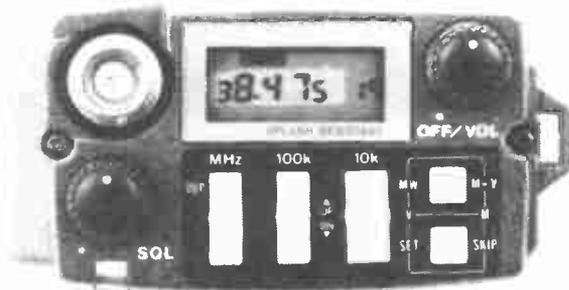
All circuits are designed using low power dissipation techniques to create a special power save circuit in the transceiver. The power saver circuit functions if no signal is received or no switch operation is performed for more than 30 seconds. In addition, the power saver circuit can be turned off for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

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

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



◀ Actual Size ▶



**Icom (UK) Ltd.**

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

# Count on us!



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

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

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

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

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

## IC-505, 50Mhz Transceiver

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



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

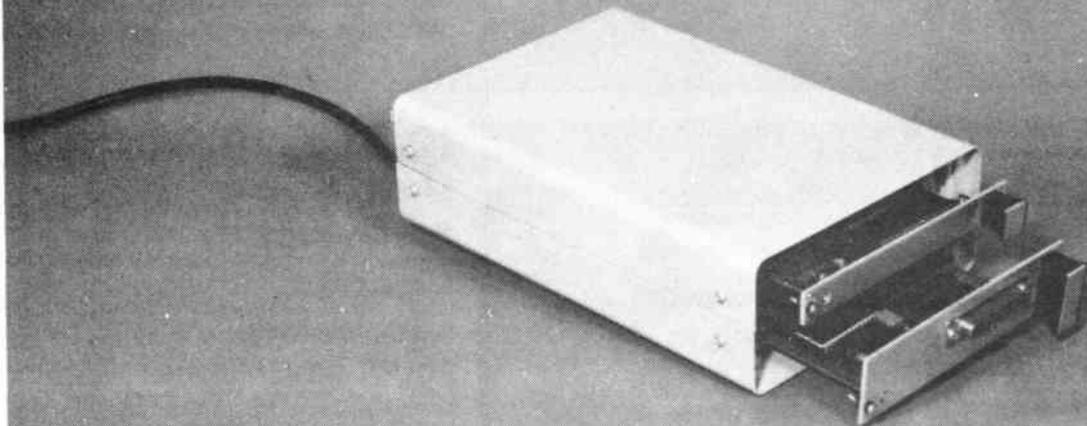
**Helpline:** Telephone us free-of-charge on 0800 521145, Mon-Fri 09.00-13.00 and 14.00-17.30. This service is strictly for obtaining information about or ordering Icom equipment. We regret this cannot be used by dealers or for repair enquiries and parts orders, thank you.

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# THE ELTRAK EIM052



*A microcontroller review by Samuel Dick*

**T**he March edition of *Radio and Electronics World* introduced the fascinating and Lilliputian world of microcontrollers. This month we examine a new microcontroller kit from Eltrak Electronics.

## Computer on a chip

A microcontroller is a complete computer in one chip. As well as the CPU, there are input and output ports, timers, and usually some memory. They are ideal for larger projects which need some imbedded intelligence but not an entire computer. And if you reckon they are only good for big industrial projects with teams of programmers, be prepared to think again.

While some devices are not all that user friendly, others go out of their way

to help the user, such as the Intel 8052 with its on-board BASIC. Though it is possible to build up a system yourself from discrete components, a system kit is a good alternative. One such kit is the EIM052 from Eltrak Electronics. Imagine it has just arrived. Let's open it up.

## Easy to assemble

The box is certainly packed very well. Inside are several tidy plastic bags containing the manual, the components, and the PCB.

The manual, some 200 pages long, is split into two sections: the first deals with the hardware, the second describes the 8052 software. Though I found that two components on the packing list had been omitted, they arrived next day, after a quick phone call to Eltrak. Apparently

this mishap had been caused by a recent design change.

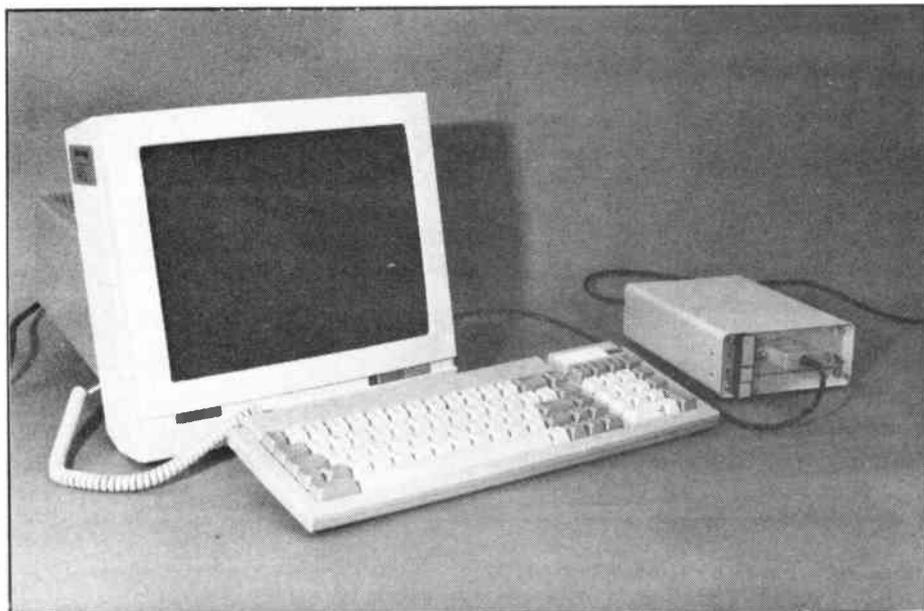
Assembly of the circuit board is straightforward. The manual does not give a step-by-step guide but the silk-screen mask on the PCB shows where to position all the components. The components simply need to be soldered into place.

The board is supplied with two surface-mounted devices already in place. This is just as well because they really are tiny and would require special care when soldering. The board is tidy but very tightly packed. A small soldering iron is essential and a magnifier helps to reduce eye strain. I'm an occasional but experienced builder of electronics, and it took me three hours to complete the board. Note that some ICs have to be soldered directly to the board, the 8052 CPU for one, so a quick soldering technique is required to avoid any of them overheating.

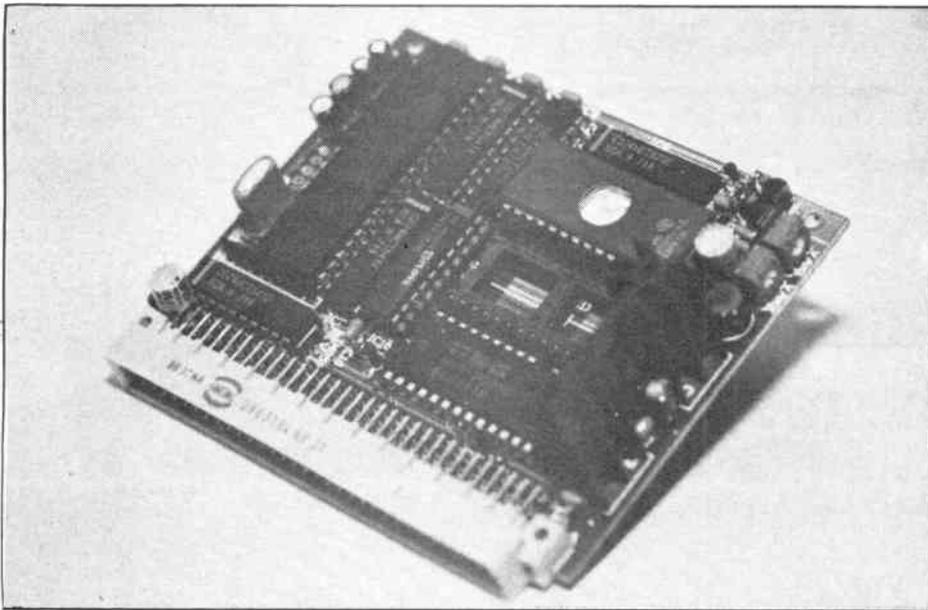
Once assembled, test it out using an 8 to 16V dc power supply and a dumb computer terminal. If a terminal is not available the board can be linked to a computer's RS232 port, providing it acts as a terminal when the computer runs appropriate software. Terminal emulators are commonly available for most micros. An RS232 link normally requires both positive and negative power supplies. However, the EIM052 generates its own supplies on-board, so there's no need to worry about any others.

On power-up, hit the space-bar once. The 8052 determines the baud rate automatically; it can cope with 300 to 9600 baud. It also replies with the version number of the BASIC, a READY message and a '>' prompt.

Two adjustments need to be made on the board. Just as the RS232 voltages are generated on board, so are those



**Fig 1** An EIM052 development system with tools



**Fig 2** The microcontroller PCB

voltages required for programming the EPROMs – more about this function later. The manual prescribes these voltages, which are set by small variable resistors and adjusted using a meter.

### No games machine

Using the EIM052 is just like sitting at the average home computer. It talks BASIC complete with 6-digit-accuracy floating-point numbers, transcendental functions like Sine and COSine, LOGarithms, and string functions.

IF . . THEN . . ELSE, FOR . . NEXT, DO . . WHILE, and DO . . UNTIL structures are all present. There are also numerous functions for controlling the input/output ports and reading from and writing to memory locations. Remember this is no games machine; it's designed for intelligent interfacing and its language reflects this bias.

A list of functions is given in the table. The software section of the manual gives full details of each BASIC function as well as examples. Assembler programming is also covered in the manual. Indeed there is a wealth of detail on how the 8052 goes about its business.

The BASIC stored in the processor's internal ROM is fairly rich but not particularly fast. So that programs take up little room, the BASIC is tokenised and then interpreted at run-time. A FOR . . NEXT loop has a 1.6 millisecond overhead while trig and log functions seem to take around 50 milliseconds. PRINTed accuracy is six figures, which should be adequate for almost any sensible purpose.

The simple program in *Figure 3* only takes 33 bytes; estimating ten bytes per line seems to be about right. The 32K RAM supplied with the kit therefore allows quite a large program to be stored. Once the program has been

developed, the 8052 comes in to its own. There are several BASIC commands which control an EPROM-blower on the board. Once a program has been written and debugged interactively, it is a simple matter to commit it to EPROM. If you make a mistake, just take the EPROM out of its socket and erase it with UV light.

```
10 FOR I=1 TO 30
20 B=SIN(I)
30 NEXT I
40 STOP
```

**Fig 3** Simple 33-byte program

Once programs have been committed to EPROM, you can choose which one you want to run, transfer it to the RAM then run it. Alternatively, the system can be set up so that it automatically runs a given program whenever the power is applied. This is useful for applications where the device has to be left unattended for long periods and must cope with power-cuts. Control-C is normally available to abort program execution, but it can be disabled to give a system which has a true turnkey nature. Whatever you have in mind, the BASIC will help you to implement it quickly. Very little learning time is involved.

### Robot mounted

In industry, such a system will end up controlling plant of some kind. For the hobbyist, there is a large number of applications. Taking home automation to new heights is one possibility – perhaps controlling an energy conservation system in an 'alternative' house.

Schools should find the kit, or the assembled version, valuable for teaching real-time control in the classroom. Its small size makes it very

easy to mount the unit on a robot, and it could be an intelligent data-logger for a variety of science experiments. The output-only printer port, which is available for program listings, could be used to provide hard copies of results.

### Neat trick

Eltrak has produced a good product for a wide range of applications. It has an attractive price, just over £100, but it does require care and experience to assemble it correctly, mainly because it is so small. The result is worth the effort as it is neat enough to fit into most projects where a spot of intelligence will do the trick.

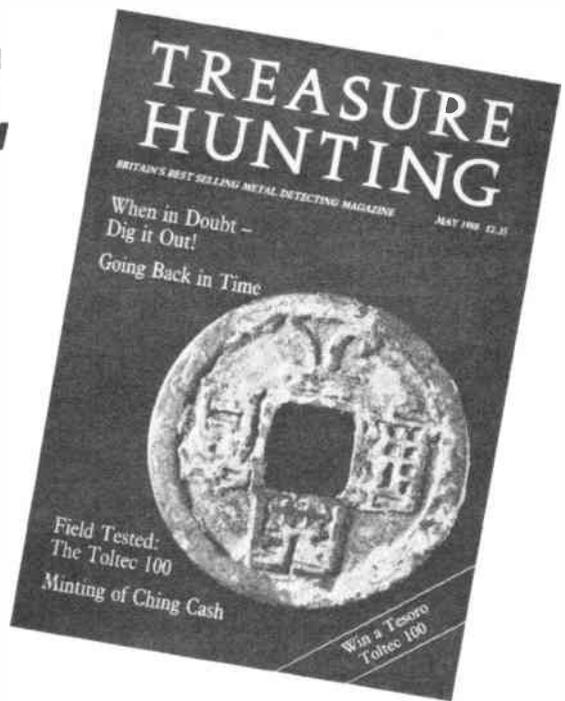
Commands	Statements	Operators
RUN	BAUD	ADD (+)
LIST	CALL	DIVIDE (/)
LIST#	CLEAR	EXPONENTIATION (**)
NEW	CLEAR#	MULTIPLY (*)
NULL	CLEAR!	SUBTRACT (-)
RAM	CLOCK0	LOGICAL AND (.AND.)
ROM	CLOCK1	LOGICAL OR (.OR.)
XFER	DATA	LOGICAL X-OR (.XOR.)
PROG	READ	LOGICAL NOT
PROG1	RESTORE	ABS ( )
PROG2	DIM	INT ( )
FPROG	DO-WHILE	SGN ( )
FPROG1	DO-UNTIL	SQR ( )
FPROG2	END	RND
	FOR-TO-STEP	LOG ( )
	NEXT	EXP ( )
	GOSUB	SIN ( )
	RETURN	COS ( )
	GOTO	TAN ( )
	ON-GOTO	ATN ( )
	ON-GOSUB	=, >, >=, <, <=, <>
	IF-THEN-ELSE	ASC ( )
	INPUT	CHR ( )
	LET	CBY ( )
	ONERR	DBY ( )
	ONEXT1	XBY ( )
	ONTIME	GET
	PRINT	IE
	PRINT#	IP
	PH0.	PORT1
	PH0.#	PCON
	PH1.	RCAP2
	PH1.#	T2CON
	PUSH	TCON
	POP	TMOD
	PWM	TIME
	REM	TIMER0
	RET1	TIMER1
	STOP	TIMER2
	STRING	TIME
	U10	XTAL
	U11	MTOP
	U00	LEN
	U01	FREE
		PI

*Table of functions for the EIM052 microcontroller*

# A FIND TO TREASURE

Britain's best selling magazine for the metal detecting enthusiast!

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120V/240V/415/440V SEC.	05	1	64.14	5	63.31	For Step-Up & Down	80VA
20VA	1	2	65.63	1	63.97		150
60	2	4	69.10	2	65.53		250
100	3	6	71.05	3	66.38		500
200	4	8	72.89	4	67.99		1000
250	5	10	74.11	4	69.17		1500
500	6	12	75.65	6	70.14		2000
1000	8	16	77.59	8	71.90		3000
1500	10	20	79.22	10	72.75		4000
2000	12	24	80.39	15	73.28		5000
3000	15	30	81.02	20	74.07		7500
6000	20	40	81.46	30	74.96		10KVA
				41	83.66		

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1	2	66.54	2.00	2	71.98	2.30
2	4	68.45	2.25	3	73.32	2.40
3	6	69.48	2.50	4	74.78	2.50
4	8	70.48	2.75	5	76.27	2.90
6	12	71.47	2.95	6	77.48	3.10
8	16	72.20	3.25	8	78.04	3.75
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## Ray Marston continues his investigation of IC audio processing circuits by looking at more designs for active filters and amplitude-control circuits.

The last two editions of *Data File* introduced the concept of audio processing and described a variety of linear amplifiers and active filters based on op amps, concluding with some popular passive tone control networks. This month begins with active tone control circuits.

### Active tone controls

An active tone control circuit can easily be made by wiring a passive tone control network into the negative feedback loop of an op amp linear amplifier, so that the system gives an overall signal gain (rather than attenuation) when its controls are in the flat position. Such networks can take the form of simplified versions of the basic *Figure 14* circuit shown last month, but more often are based on the alternative passive tone control circuit shown in this month's *Figure 1*, which gives a similar performance but uses linear control pots and fewer components.

Looking at *Figure 1*, it can be seen that at very low frequencies (when the two capacitors act like open circuits) the output signal amplitudes are controlled entirely by RV1 (since RV2 is isolated from the output via C2), but that at high frequencies (when the two capacitors act like short circuits) the output signal amplitudes are controlled entirely by RV2 (since RV1 is shorted out via C1). The low-frequency (bass) break point of the circuit is determined by the R1-C1 values, and the high-frequency (treble) break point is determined by C2 and the values of R1 to R3.

*Figure 2* shows how to use the above network to make a practical active tone control circuit that can give up to 20dB of boost or cut to bass or treble signals. This is an excellent high-quality design.

An even more useful circuit is shown in *Figure 3*. This design is similar to the above, but has an additional filter control network to cut or boost by up to 20dB frequencies around 1kHz - the midband of the audio spectrum.

### Graphic equalisers

The most sophisticated tone control is the graphic equaliser. This consists of a number of parallel-connected overlapping narrow-band variable-response filters that cover the entire audio spectrum, so an amplifier's spectral response can be precisely tailored to suit individual needs. The filter centre frequencies are usually spaced at one octave intervals; such systems are thus also known as octave equalisers.

*Figure 4* shows the basic circuit of a typical octave equaliser section. This circuit is very similar to that of the *Figure*

2 active tone control, except that the C2-R2 treble control network is fixed, not variable. The bass and treble break frequencies are fairly closely spaced, so that the two response curves overlap. The net effect of this is that the *Figure 4* circuit acts as a narrow-band filter which has a centre-frequency response that is fully adjustable via RV1 between plus 12dB (full boost) and minus 12dB (full cut).

*Figure 5* shows how ten of the above circuits can be interconnected to make a practical high-quality ten-band graphic equaliser. The ten equaliser sections are wired in parallel and their outputs are added together in the IC11 output stage. The ICs used here can be type-741 single or quad op amps. Note that two complete *Figure 5* circuits are needed in a normal stereo amplifier system.

### RIAA equalisation

Three types of phonograph record (disc) pickup are in general use: ceramic, crystal and magnetic. Ceramic and crystal pickups are fairly cheap, give large amplitude outputs, have a reasonably linear frequency response, and are widely used in low-fi to mid-fi equipment. Magnetic pickups, on the other hand, give a low amplitude output and have a non-linear frequency response, but are widely used on good quality hi-fi equipment.

A test disc (phonograph recording) of constant amplitude 20Hz to 20kHz three-decade span of sinewave tone signals generates a non-linear frequency response when played through a good magnetic pickup, even if the signals were recorded with perfect linearity. Perfect linearity is achieved by keeping a

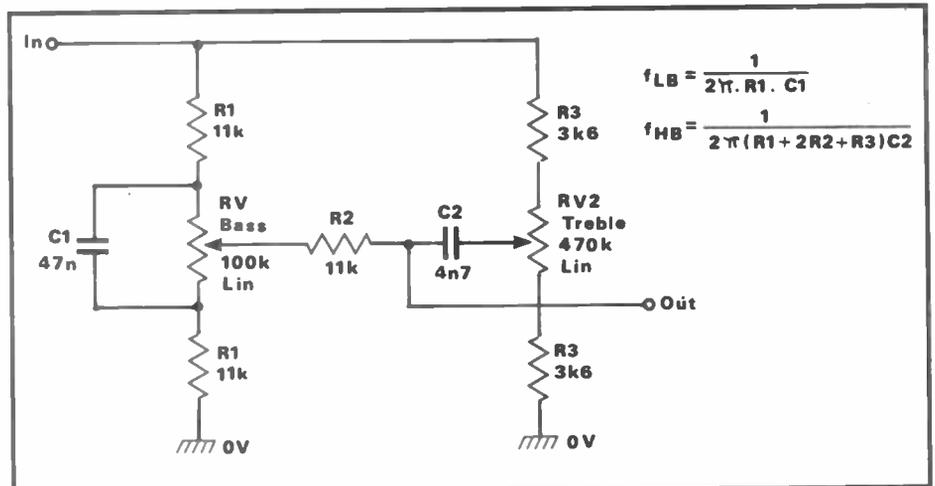


Fig 1 Alternative tone control circuit

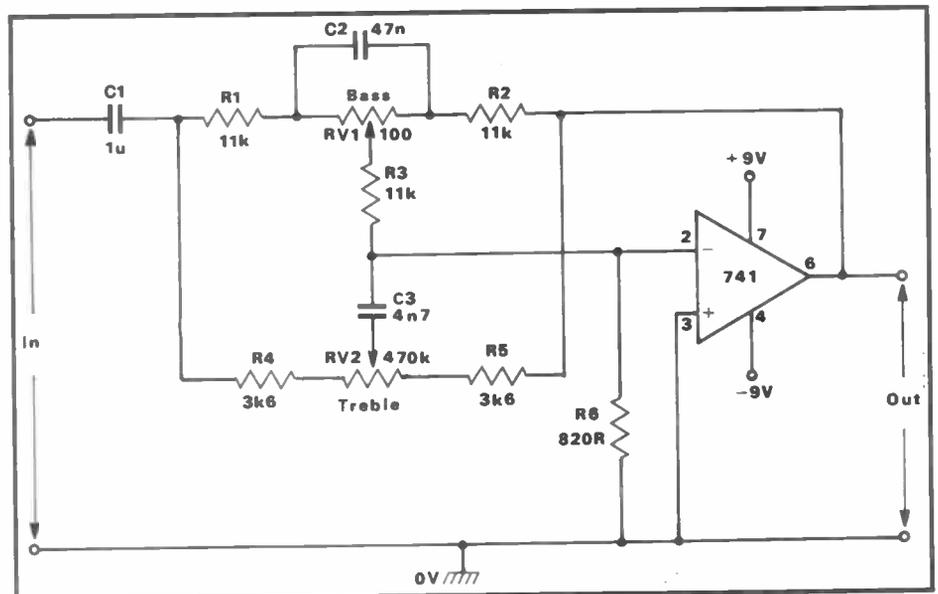


Fig 2 Active tone control circuit

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constant signal amplitude in the recording groove. Instead, the frequency response rises at a rate of 6dB per octave (20dB per decade). Thus, output signals would be very weak at 20Hz, but would be one thousand times greater (60dB greater) at 20kHz.

Non-linear frequency response is inherent in all magnetic pickups because their output voltage is directly proportional to the rate of movement of the pickup needle, itself proportional to recording frequency.

In practice, disc recording equipment does not give an exactly linear frequency response. To help enhance the effective dynamic range and signal-to-noise ratio performance of discs, frequencies below 50Hz and those in the 500Hz to 2.12kHz midband range are recorded in a non-linear fashion that is precisely defined by Record Industry Association of America (RIAA) standards. The non-linearity causes a midband drop of 12dB when played through linear-response ceramic or crystal pickups, but this modest decrease is too small to be objectionable in most low-fi to mid-fi playback equipment.

When a practical RIAA test frequency disc is played through a magnetic pickup, the pickup produces the frequency response curve shown in Figure 6. The dotted line shows the idealised shape of this curve: flat up to 50Hz, then rises at 6dB/octave to 500Hz, is flat to 2120Hz, then rises at a 6dB/octave beyond that. The solid line shows the practical shape of the curve.

The really important thing the reader should note from all this is that when a disc is played through a magnetic pickup in a good hi-fi system, the output of the pickup must be passed to the power amplifier circuitry via a pre-amplifier with a frequency equalisation curve the exact inverse of that shown in Figure 6, so that a linear overall record-to-replay response is obtained.

Figure 7 shows the actual form of the necessary RIAA equalisation curve and Figure 8 shows a practical example of a modern low-noise phono pre-amplifier with integral RIAA magnetic-pickup equalisation.

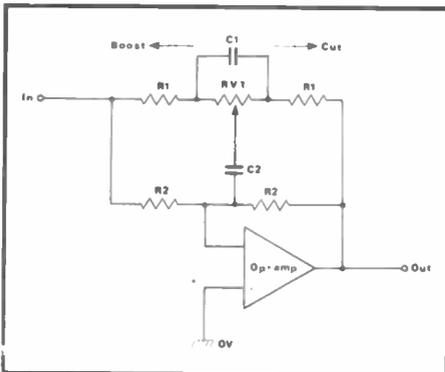


Fig 4 Typical equaliser section

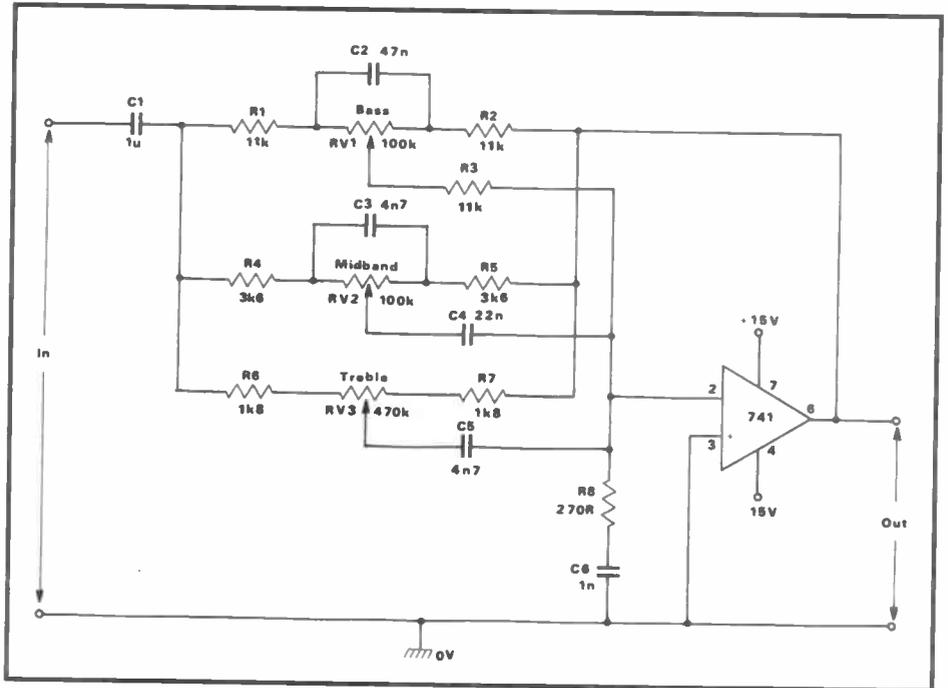


Fig 3 Three-band active tone control circuit

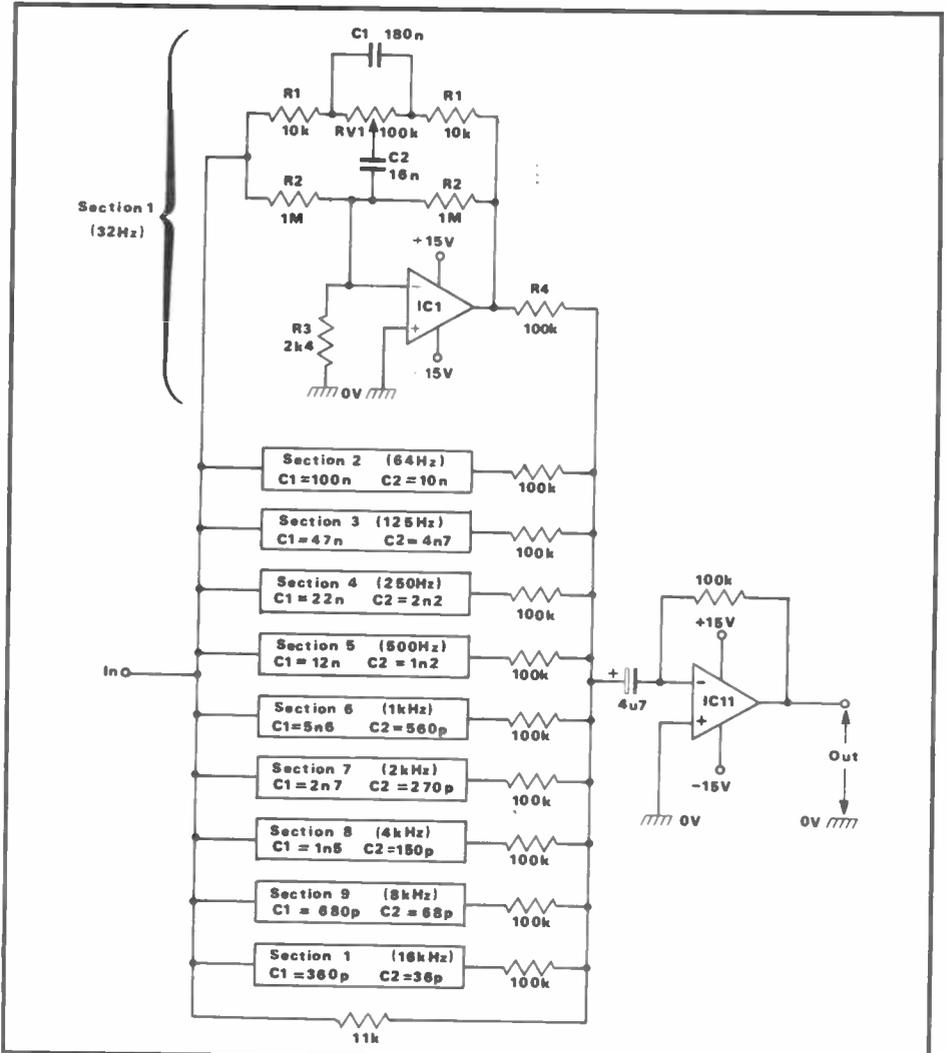


Fig 5 Ten-band graphic equaliser circuit



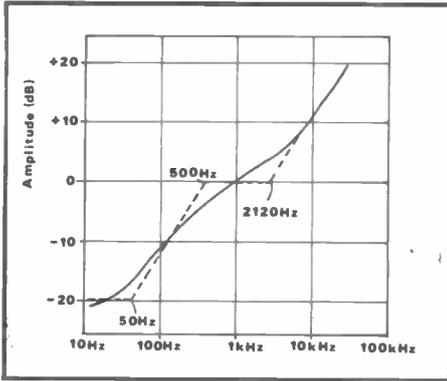


Fig 6 Phono disc playback response

**RIAA phono pre-amp**

Magnetic pickups are low-sensitivity devices which give typical midband outputs of only a few millivolts. Consequently, their outputs must be passed to main amplifiers via dedicated low-noise pre-amplifier ICs (not via simple op amps). The Figure 8 circuit is thus designed around LM381 or LM387 low-noise pre-amplifier ICs. These are dual ICs, so the diagram gives the pin numbers of one pre-amplifier in plain numbers and the pin numbers of the other in brackets. Note that two of these pre-amp circuits are needed in a stereo audio system, and these can thus be obtained from one dual IC.

The operating theory of the Figure 8 circuit is fairly simple. The IC is wired as a non-inverting amplifier, with negative feedback applied from the output to the inverting input terminal; potential divider R3+R4-R2 determines the circuit's dc biasing and the R5-C3-C4-R4 and R6-C2 networks determine the ac signal gain. At the 1kHz midband frequency, C2 and C3 have low impedances and C4 has a high impedance, so the ac gain is determined mainly by R5/R6 and equals  $\times 400$ . At lower frequencies the impedance of C3 starts to become significant and causes the ac gain to increase until, eventually, at very low frequencies, it is limited to  $\times 400$  by the R3/R6 ratio. At high frequencies, on the other hand, the impedance of C4 falls to significant levels and shunts R5, causing the ac gain to decrease until, eventually, at very high frequencies, it is limited to  $\times 10$  by the R4/R6 ratio. The pickup signals are ac coupled to the IC via C1, and the circuit can be used with any type of magnetic pickup unit.

**Non-linear amplifiers**

An op amp circuit can be made to act as a non-linear amplifier by simply incorporating a non-linear device in its negative feedback network, as shown in Figure 9, where the feedback elements comprise a pair of silicon diodes connected back-to-back. When very small signals are applied to this circuit the diodes act like very high resistances, so the circuit gives high voltage gain, but

when large signals are applied the diodes act like low resistances, so the circuit gives low gain. The gain in fact varies in a semi-logarithmic fashion, and the circuit sensitivity can be varied by altering the R1 value; the table shows the actual performance details of the circuit.

Note from the table of Figure 9 that a 1000:1 change in input signal amplitude can cause as little as a 2:1 change in output level. By taking its output to a simple ac millivoltmeter, this circuit can be used as a single-range bridge-balance detector or signal strength indicator.

When the above circuit is fed with a sinewave input, the two diodes limit the output voltage swing to about 1.4V peak-to-peak by clipping the waveform. The output is then approximately square in form and is rich in odd harmonics; when this waveform is fed through an amplifier, it sounds like a clarinet; in the music world this is known as a fuzz effect. Figure 10 shows how the circuit can be modified to make a practical fuzz generator; RV1 controls the level at which fuzz clipping begins and RV2 controls the circuit's output level or fuzz intensity.

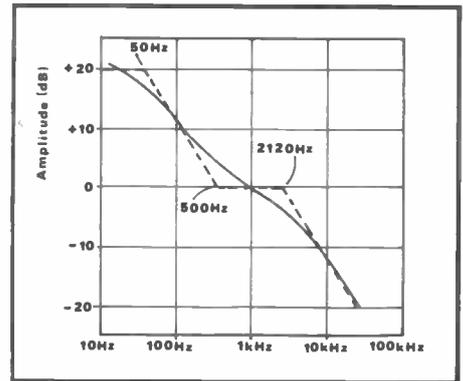


Fig 7 RIAA equalisation curve

amplitude distortion of the signal. In practice, it is often desirable to have a circuit which gives a constant-amplitude (constant-volume) output without generating signal distortion, and this can be achieved by using a self-adjusting voltage-controlled linear element (rather than a non-linear element) in the amplifier's negative feedback loop. Figure 11 shows a practical constant-volume amplifier of this type.

In this circuit the op amp is wired as an ac amplifier with its gain controlled by

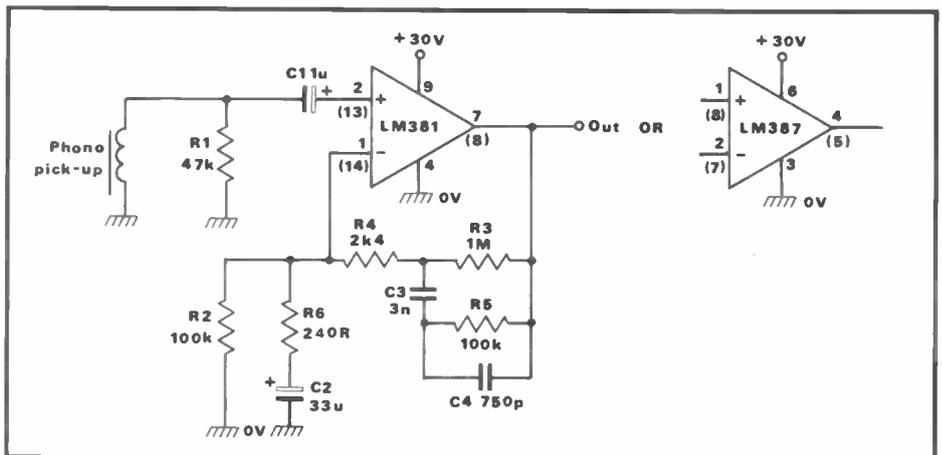


Fig 8 LM381 or LM387 low-noise phono pre-amp (RIAA)

The non-linear amplifier of Figure 9 gives a near constant-amplitude output signal over a wide range of input signal levels, but does so by introducing heavy

the R2/R1 ratio and by the ac potential divider formed by R4 plus the impedance of field-effect transistor Tr1. This FET is actually used as a voltage-controlled

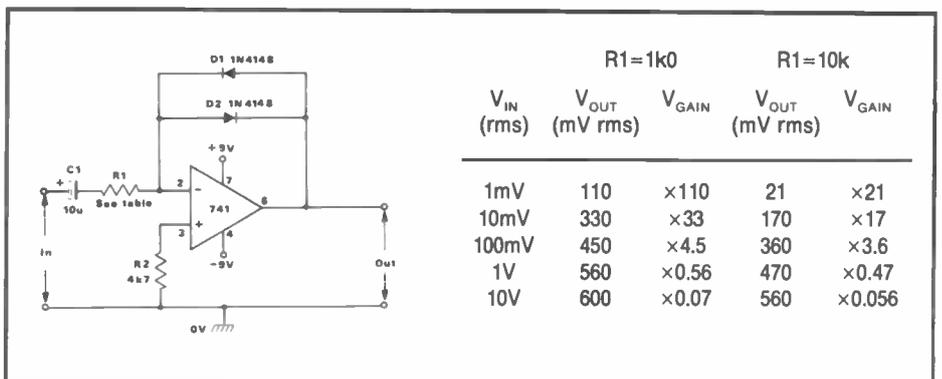


Fig 9 Non-linear (semi-log) amplifier

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resistor, with the control voltage derived from the op amp output via the D1-R5-R6-C3 network, which generates a voltage proportional to the mean value (integrated over hundreds of milliseconds) of the output signal. With zero bias applied to the gate Tr1, the FET acts like a low resistance (a few hundred ohms), but with a large negative bias voltage applied it acts like a high resistance (a few megohms).

When a very small signal is applied to the op amp its output also tends to be small, very little negative bias is developed on the FET gate via D1-R5-C3 and the FET acts like a resistance of only a few hundred ohms. Under this condition the R4-Tr1 potential divider causes very little negative feedback to be applied to the op amp, which thus gives a high voltage gain.

On the other hand, when a large input signal is applied to the op amp its output tends to be large, so a large negative bias is developed on the FET gate via D1-R5-C3 and the FET thus acts like a very high resistance. Under this condition the R4-Tr1 divider causes heavy negative feedback to be applied to the op amp, which thus gives very low voltage gain.

The net effect of the above action is that, as shown in the performance table of Figure 11, the mean level of the output signal tends to self-regulate at 1.5 to 2.85V over a 50:1 (500mV to 10mV) range of input signal levels, and does so without generating significant signal distortion. The R1 value determines the sensitivity of the circuit and is selected to suit the maximum input signal amplitude that the circuit is expected to handle, on the basis of 200k per RMS volt of input signal.

Thus, for a maximum input of 50V R1 has a value of 10M and for 50mV it has a value of 10k. Capacitor C3 determines the AGC time constant of the circuit and its value can be increased or decreased to suit individual needs.

R1 = 100k		
V <sub>IN</sub>	V <sub>OUT</sub>	V <sub>GAIN</sub>
500mV	2.85V	×5
200mV	2.81V	×14
100mV	2.79V	×28
50mV	2.60V	×52
20mV	2.03V	×101
10mV	1.48V	×148
5mV	0.89V	×180
2mV	0.4V	×200
1mV	0.2V	×200
500μV	0.1V	×200

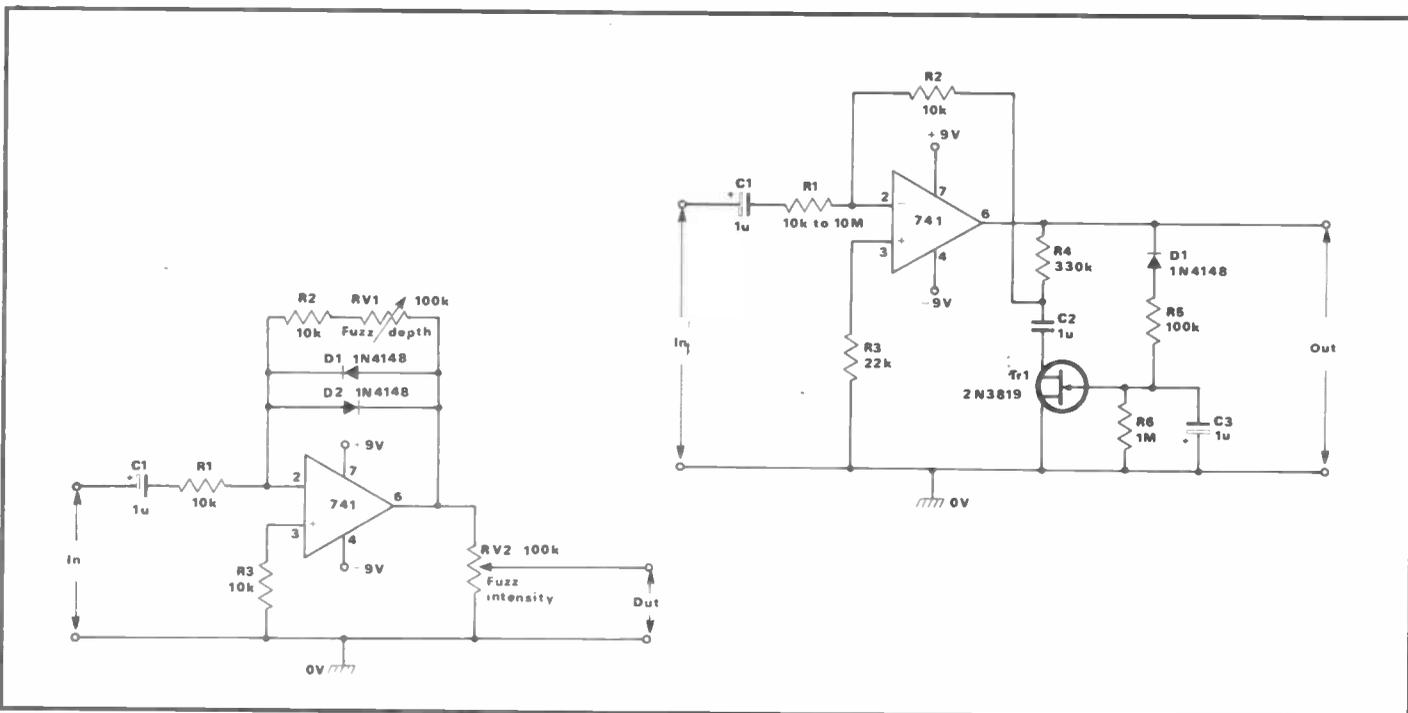
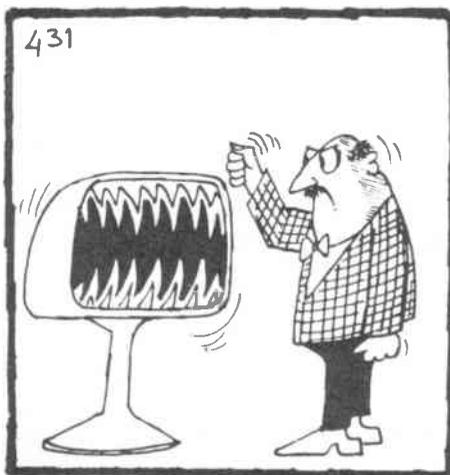


Fig 10 (lower left) Fuzz circuit

Fig 11 (upper right) Constant-volume amplifier circuit (see table for R1 values)



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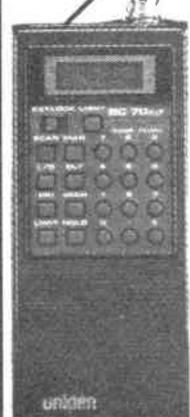
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# AIR TRAFFIC CONTROL CENTRES

BY BRIAN KENDAL G3GDU

## AVIATION ELECTRONICS

### Part Six

In the first article in this series I described the general principles of air traffic control and subsequently described the equipment used to achieve these objectives.

The task of the air traffic controller is to ensure that air traffic may transit the airspace under his jurisdiction in an expeditious manner, yet maintaining a safe distance from other aircraft. In general terms, this means that aircraft will be spaced by not less than three miles horizontally and a thousand feet vertically.

The difficulty of this task is compounded by the fact that different types of aircraft may be flying at speeds varying from just over a hundred to nearly six hundred miles per hour and, whilst the majority may be in level flight at predetermined flight levels, others will be climbing or descending with consequent possible conflicts. These changes in flight level can therefore only take place safely under the direct instruction of air traffic control when the airspace through which the aircraft will pass is clear of other traffic. The controller thus needs to know the position of every aircraft within his area together with its height, destination and sundry other useful information.

Depending on the geographical location and size of the controlled area, procedural or radar control may be used.

#### Procedural control

If the area is large and traffic is light, such as in some parts of the South Pacific, adequate separation may be maintained by requiring the aircraft to report their position and height at regular intervals. From these reports, their position at any time may be deduced and instructions given to ensure adequate separation.

#### Radar control

In busier areas, however, radar is essential and, where extremely high traffic densities exist, such as in Europe and the United States, extremely complex systems must be developed to ensure flight safety.

The airspace over the United Kingdom is one of the busiest airspaces in the world, if not *the* busiest, with the London Air Traffic Control Centre handling up to one million aircraft movements per year. Furthermore, several centres in Europe and the United States approach these levels of traffic. The ability to control these traffic densities is a result of highly skilled controllers making maximum use of extensive computer facilities and complex communications networks.

Let us look at the organisation of an air traffic control centre (ATCC). As no two centres are alike, rather than select any particular one I will describe the general principles and facilities which are common to the more modern centres in the world today.

#### Airspace management

The airspace under the jurisdiction of an air traffic control centre is known as a *flight information region*, this being divided into controlled and uncontrolled areas. The controlled areas, which may comprise airways or *terminal movement areas* (TMA), are further divided into sectors, each of which is under the jurisdiction of a single radar suite at the ATCC.

The TMA sectors are also responsible for the control of air traffic arriving at or departing from all airports within their areas. If an aircraft cannot be immediately accepted by its destination airport, it will be diverted into a 'stack' or holding pattern based on a VOR beacon until landing clearance can be issued.

#### Communications

It is a basic principle in the control of air traffic that no aircraft is cleared to enter the airspace of another sector unless the transfer has been previously co-ordinated. The controller handing over the aircraft must also comply with

any conditions which the receiving controller may lay down. It is therefore essential that the controller should not only be capable of speaking to any aircraft within his jurisdiction, but should also be capable of speaking directly with the controllers responsible for the adjacent sectors, be they within the same ATCC, or in the next FIR, country or continent.

In order to communicate with aircraft under his jurisdiction, the controller will have the ability to select from a number of preselected R/T channels. In relatively confined areas, such as in Europe, these will be in the VHF aeromobile band. Even so, transmitters located at the air traffic control centre will rarely have sufficient range; communication will therefore normally be through remote VHF stations which may be located up to several hundred miles away.

In very large FIRs, which may extend for hundreds of miles across oceans or deserts (for example, as in the Pacific), HF SSB may well be necessary to achieve sufficient range.

For liaison with adjacent sectors, systems may be as basic as a simple intercommunication system for those in the same ATCC. However, direct telephone circuits, HF SSB or even satellite links may be used for greater distances.

In addition to these links, there exists a world-wide communications network known as the AFTN or Aeronautical Fixed Telecommunications Network. This is dedicated to aeronautical information such as flight plans; and the serviceability of airports, etc. and provides communications between all the air traffic control centres, air traffic service units and airports in the world. In general, these are maintained by teleprinter, but I have come across other circuits which use telephone, HF/SSB, VHF R/T or even CW.

#### Radar

The development of primary and secondary plot extraction systems has made the integration of radar data from

different sources possible to a degree which was previously inconceivable.

In the past, the signals received from each radar station were individually processed and the controller could only view signals from a single radar at a time.

The incorporation of a major computing installation has made it possible to integrate the output signals from all available radar stations to form a single composite radar picture of the area, from which the most appropriate section for each control position may be selected.

To achieve this a system known as Mosaic is used, in which the airspace is divided into a grid of, typically, 16nm squares forming columns of air from the ground upwards.

These are known as *radar sort boxes*, each of which has up to four allocated radars which can provide service in that area. The radar giving the best cover is nominated 'preferred', the next best is 'supplementary' and the remainder form

'a reserve'. Whenever the information from the preferred radar is satisfactory this is used but, if the expected response from tracked aircraft is not received, or should the preferred equipment fail, the supplementary radar will be upgraded to 'preferred'.

By using such techniques the use of several radars improved the solid cover, decreasing or eliminating blind spots and also to temporary loss of returns from aircraft.

To enable the controller to correlate the aircraft return with its geographical position, the screen is overlaid with a map. This has very little in common with the maps with which we are all familiar, but indicates such features as the following: beacons and reporting points; airways; sector boundaries; etc. This information may be provided at several levels, for a controller will need different references for handling upper airspace traffic to those for handling lower levels. The level of map required can be

selected by a keyboard adjacent to the display.

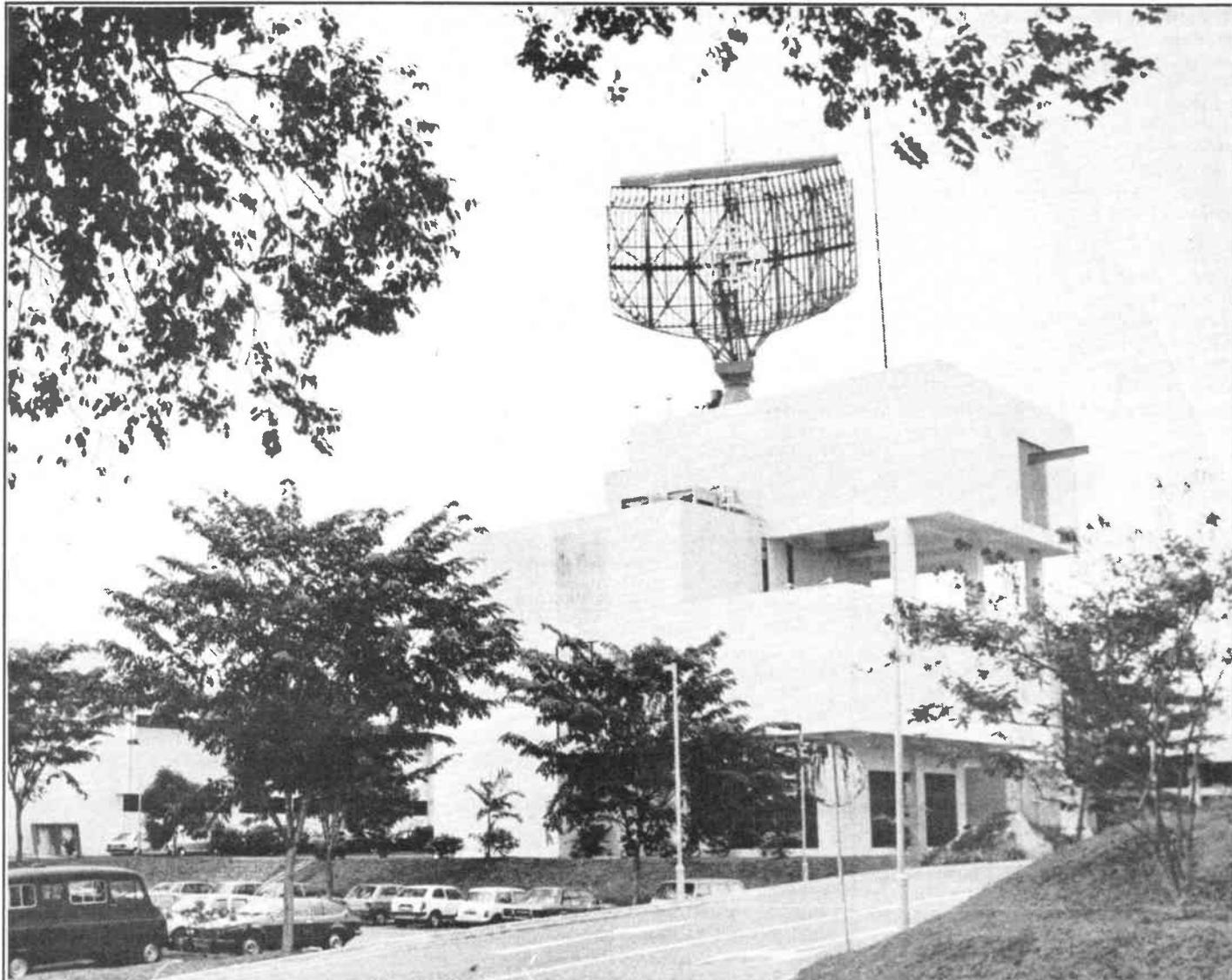
The use of a *radar data processing computer* also permits the application of certain positional corrections such as may be necessary to allow for slant range and the curvature of the earth. The computer program will also check whether plots can be linked to tracks already established within the system. Those which can be passed on to the automatic tracking program for further processing and all plots are routed for display.

#### **Automatic tracking**

The objective of automatic tracking is to maintain the unambiguous tracking of radar targets.

This requires the combination of both radar and flight plan information to create a common data base. The track history of targets is combined with the flight plan intentions to enable the progress of the flight to be accurately

**Fig 1** Air Traffic Control Centre at Changig, Singapore. This centre covers a large area over south-east Asia. The radar was manufactured by Signaal



monitored and a prediction of the search area where the next target position may be found.

By this means the computer maintains an automatic correlation between track and target, even when other aircraft within the same area are responding with the same SSR code. Furthermore, should the plot fade, the computed position of the target, based on extrapolation from the last plotted position, will be displayed until the target is regained or a predetermined time has elapsed.

Each SSR code comprises an octal number between 0000 and 7777. If this number were displayed on the radar screen, the controller would need a further reference to convert this to a callsign. Fortunately, however, the computer can easily achieve this task with the help of the code/callsign data base.

On the display, the position of the target is indicated by a mathematical symbol, usually a square or a triangle. The target history is indicated by a series of hatch lines, the number of which may be preset by the controller.

Identification of individual returns is facilitated by a data block positioned near to the target. This usually comprises: aircraft identification (which is derived from SSR return and code/callsign conversion database); flight level (derived from SSR Mode C response); cleared flight level (from flight data processing); and destination and routing (again from flight data processing).

On a fully processed display, weather returns will have been eliminated. This has the advantage that targets will not be masked, though it could mean that a controller inadvertently vectors an aircraft under his control into hazardous weather conditions. To preclude this possibility, severe weather is indicated on the screen by a series of hatched lines.

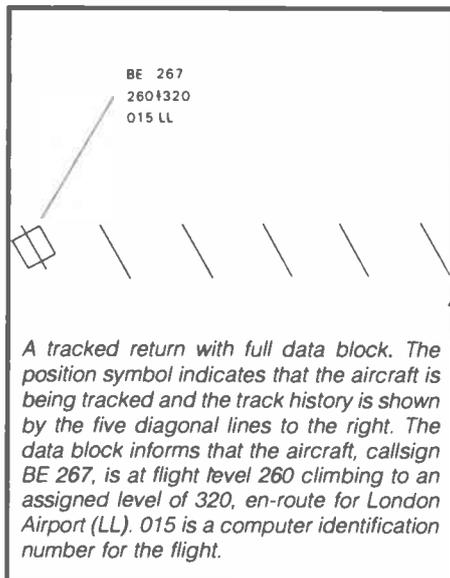


Fig 2 Area controllers at ATCC, Subang Airport, Kuala Lumpur

### Conflict alert

In recent months, there has been considerable alarmist publicity in the press regarding 'Airmisss' reports. Unfortunately, these stories are frequently written in the most sensational manner by journalists who neither have the facts available nor the knowledge to interpret them if they had.

Nevertheless, if a breach of separation standards does occur, a thorough investigation is instigated.

One way in which computers may help the controller to maintain separations is 'Conflict Alert'. This is a radar-based tactical conflict detection system which functions completely automatically, so it imposes no extra workload on the controller. In effect, it looks ahead two or three minutes for possible conflicts or reduction in separation standards. Should these be detected, warning is automatically given. The prediction time is intentionally limited so as not to give false warnings for situations which would be dealt with in the normal course of events.

### Recent incidents

Considerable publicity has been given to several recent incidents in British airspace and this has initiated discussion as to whether a conflict alert facility should be incorporated in the IBM 9020D installation at London Air Traffic Control Centre.

This facility has been available for a considerable time but has not been used as it was considered that, due to the extremely high traffic levels in British airspace, the possibility of false alarms was so high as to make the system unworkable. In view of the publicity in early February, however, it is understood that the situation is being re-examined.

### Recording systems

Even before the Second World War it was a recognised principle that all ground to air R/T transmissions should be recorded so that, should an incident occur, an accurate transcript of all conversations could be prepared for the subsequent enquiry.

In the earliest times this was achieved by an R/T operator copying the transmission in a highly developed speedwriting. Very soon, however, electronic systems were introduced, the earliest using a gramophone type recording on an 80ft continuous loop of 35mm film.

By the late 1950s these were being replaced by magnetic tape recorders which had up to 16 tracks on one inch tape. The most recent recorders still use one inch film but are capable of recording 64 tracks. The tape speed is usually  $1\frac{5}{16}$  inch per second which gives a tape duration in excess of eight hours. At such slow tape speeds the frequency response is extremely limited but, as the audio response of the R/T equipment is intentionally restricted to 300-3000Hz, this is of little consequence.

The introduction of plot extracted radar systems, in which each plot is described by a digital word, gave the great advantage that radar data could now be transmitted over normal landlines instead of the highly expensive coaxial or microwave systems which were previously used. This reduction in video bandwidth also gave the advantage that it could be recorded on a normal instrumentation recorder.

A system using Thorn-EMI recorders has been used at London Air Traffic Control Centre for the past ten years. These multichannel instruments record the plot extracted primary and secondary radar data from each station.

If desired, these recordings can be replayed through the centre's display systems for training purposes or investigation of incidents. London Air Traffic Control Centre was one of the earliest to incorporate a radar recording facility, but this has now been extended to most of the major air traffic centres.

All recording systems devote one track to the insertion of timing signals. In its most basic form, this may comprise a Morse signal at half-minute intervals to facilitate a manual search for any particular time segment; however, most modern equipment uses more complex signals so they can be used with automatic search circuits.

## Distress and diversion

Air has long been the safest means of travel from one place to another, yet air is a very unforgiving medium and safety is only achieved by meticulous attention to detail. It is inevitable that from time to time an emergency occurs, which may even cause an emergency landing or crash.

In such circumstances it is essential that every assistance is rendered by the appropriate air traffic control centre, both in the form of advice and alerting emergency services.

Many air traffic control centres maintain a dedicated Distress and Diversion (D&D) facility. This unit will normally be alerted to the emergency by the normal sector controller who will then hand over responsibility to the D&D controller. The D&D controller will then ask the aircraft to change frequency so that the sector controller may resume his normal work.

In a situation where an emergency landing is probable, the first priority is to determine the exact position of the aircraft. If the aircraft is under radar control this will present no difficulty as the D&D controller has access to all the centre's radar information. Sometimes, however, the emergency will occur in uncontrolled airspace and the D&D controller will have received the emergency call directly on the VHF or UHF emergency frequency. Operating on these frequencies, however, is a comprehensive chain of automatic direction finders.

The bearing information from these stations is transmitted by landline to the centre where it is displayed by a back projection system onto a map covering a whole wall of the D&D room. The distress frequency stations are sufficiently close together that any aircraft transmitting on the emergency frequencies will be

received by at least two stations and this will enable the position of the aircraft to be immediately indicated on the wall map.

Appropriate instructions can then be passed to the aircraft to enable the incident to be terminated with minimum risk. If, unfortunately, the worst does happen, the D&D controller is in an ideal position to co-ordinate the rescue services.

Air traffic control centres exist in almost every country of the world. The level of sophistication of equipment in each is dependent on the level of air traffic which they control. The author has even visited a number of centres in various parts of the world where radar has not yet been found necessary, and procedural control has proved more than adequate to provide satisfactory separation standards.

In comparison, many European and American centres take input from several radar stations, communicate through multiple VHF/RT stations and handle staggering traffic levels. But no matter how complex the equipment or the level of operations, all air traffic control centres are devoted to the safe passage of aircraft through the airspace under their jurisdiction. 

## NEXT ISSUE

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10	220uF 40v	45p
10	220uF 50v	45p
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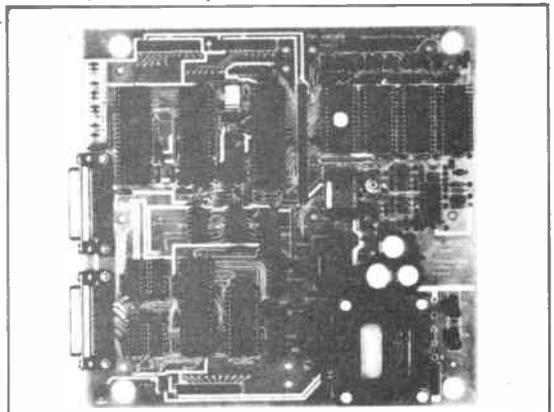
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# DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

Reception conditions throughout February could hardly be described as record-breaking on any of the TV bands; they weren't a complete disaster either. Signals were available but plenty of patience was required to receive them. The first half of the month was the best for DX reception in Band I via meteor shower and sporadic-E, while a small tropospheric lift on the 14th provided signals in Band III and UHF from France, Belgium, the Netherlands and West Germany.

## DX-TV log for February

The DX-TV reception log for February was kindly supplied by Simon Hamer of New Radnor in Powys.

**02/02/88:** BR-1 (Bayerischer Rundfunk - West Germany) on channel E2 showing the FuBK test pattern with 'GRUNTEN' transmitter identification; TVP-1 (Poland) on channel R1 with the dark background PM5544 test card; TVE-2 (Spain) from the 2nd network outlet at Santiago on channel E2 noted using the GTE colour test card.

**03/02/88:** TVP-1 on channel R1 showing the PM5544; CST-1 (Czechoslovakia) on R1 radiating the EZO test pattern with 'RS-KH' identification; RAI-1 (Italy) noted on channel IA with programmes and on-screen 'RAI UNO' identification; SRG-1 (Switzerland) from the Bantiger transmitter on E2 displaying the '+PTT SRG1' FuBK test pattern; RTE-1 (Eire) on channel IB identified from the clock caption at 1800.

**08/02/88:** SVT-1 (Sweden) on channel E2 broadcasting the PM5534 test card with 'KANAL 1' in the upper identification block and 'SVERIGE' in the lower one; DR (Denmark) received on channel E3 from the Fyn transmitter airing the PM5534 with 'DR DANMARK' identification; YLE-1 (Finland) seen on E4 showing the 'YLE TV1' FuBK test pattern.

**10/02/88:** RUV (Iceland) on channel E4 with the 'RUV ISLAND' PM5544.

**11/02/88:** SVT-1 noted on channel E2 during programmes with subtitles.

**14/02/88:** TDF (France) with Canal Plus programmes on Band III channels L5, L7, L8 and L9, TDF tf1, Antenne 2 and FR-3

programmes logged on UHF channels L34, L35, L37, L39, L45 and L48; NED-1 (Netherlands) seen on channels E4 and E39 during programmes; NED-2 on channels E45 and E47 showing the 'PTT NED 2' PM5544 test pattern; RTBF-1 (Belgian-French language network) on channel E8 from the Wavre transmitter; BRT-1 (Flemish language) on channel E10, also from Wavre.

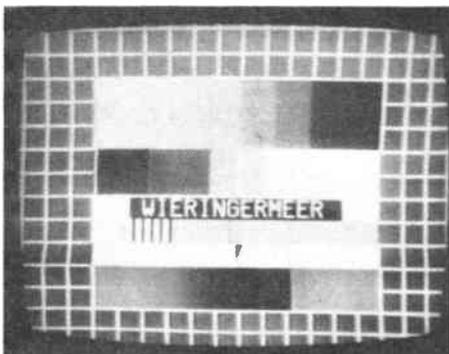
**19/02/88:** CST-1 on channel R1 radiating the 'RS-KH' EZO test card.

**21/02/88:** RTE-1 on channel E (possibly the 1kW relay at Achill); RTE-2 on channel 56 (vertically polarised) from the 250kW transmitter at Clermont Garn (County Louth).

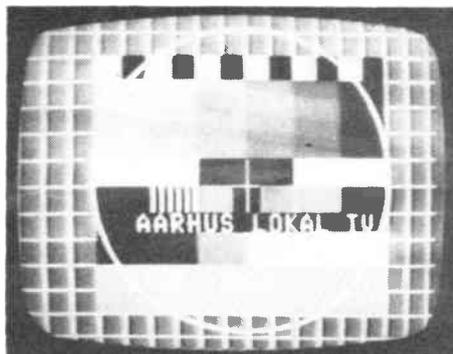
## Reception reports

Kevin Jackson of Leeds noted the Dutch NED-3 network showing winter sports on February 14th. The NED-3 outlets were officially on test at the time but apparently a decision was made to cover winter sports via the new network. The best DX was noted from the West German Grosser Feldberg transmitter

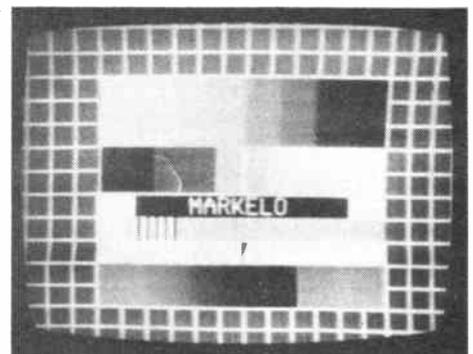
## PHOTO FILE ● PHOTO FILE ● PHOTO



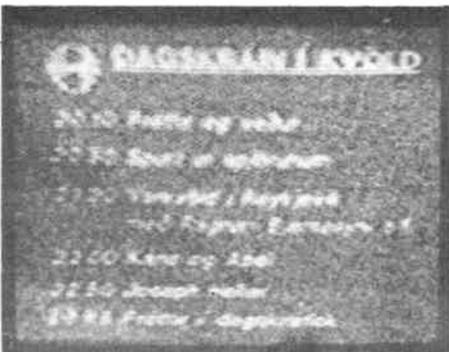
**Fig 1** Dutch third network test card received on channel E42



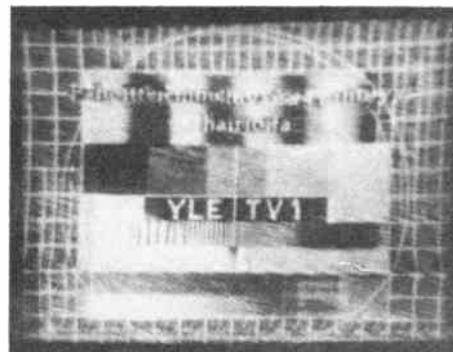
**Fig 2** Test card used by one of the many local stations in Denmark



**Fig 3** An FuBK test card from the Ned-3 outlet at Markelo on channel E51



**Fig 4** Icelandic programme schedule received by Bob Brooks on channel E51



**Fig 5** Finnish test card with additional text received by Bob Brooks



**Fig 6** Spanish news bulletin caption from the regional Catalunyan service

on channel E8. The signals were strong but short-lived.

Simon Hamer of New Radnor drove up into the Welsh hills (2000ft above sea-level) to take advantage of tropospheric lift conditions on the 14th and the 21st. His DX equipment consisted of a small portable Hitachi K2300 TV receiver, fed from a couple of log-periodic aerials for Band III and UHF. Two new Irish transmitters were noted on the 21st. One was an unknown low-power relay of RTE-1 on channel E and the other was Clermont Carn on channel 56, a vertically polarised outlet of RTE-2. Both were showing programmes at the time of reception. Earlier in the month, short-skip reception produced RTE-1 on channel B in Band I. This was identified by the clock caption.

Did you know that *Radio & Electronics World* reaches parts that other magazines don't? You didn't? Well, Miika Keipi, a reader of *Radio & Electronics World* in Finland, has offered an explanation regarding the strange message superimposed across the Finnish test pattern which was recently seen by Bob Brooks of South Wirral. The message read 'PAHOITTELEMME KUVASSA ESIINTYVIA HAIRIOITA' which, when translated, means 'We regret the interference on the Screen'. This is superimposed when there is a possibility of co-channel interference (and DX-TV reception) during lift periods.

Miika regularly explores Band I frequencies using an AR2002 receiver and monitors the many Soviet FM radio stations operating between 66 and 73MHz. Stations in Estonia are present all the time at Miika's location on the south coast of Finland. The Estonian language is similar to Finnish with many double vowels. In fact, on the northern coast of Estonia they often tune into Finnish TV and radio stations. The 68-86MHz spectrum can only be used for limited communications in Finland because of the presence of the Soviet FM radio band. However, some frequencies are available between the Soviet FM channels for two-way communication; there is also military activity in this part of the band.

Miika also comments that he finds Andy Emmerson's *Network 934* column extremely interesting, even though the Finns have no access to this band. Incidentally, there are no polar bears wandering around in Finland. Now you know!

## DX-TV down under

We continue with information from Duncan Fraser of New Zealand who has written describing recent DX events in the Southern Hemisphere. Duncan is now extremely optimistic about the next F2 peak as New Zealand and Australian radio amateurs have already made contact with Japan on the 6m band

(50MHz). Apparently, Russian TV on channel R1 was received in Melbourne on Christmas Day and Australian TV was logged in Japan during mid-February. Also in February, Hawaiian 6m hams received New Zealand TV and heard the 6m beacons from Auckland, Newcastle NSW and Townsville in Queensland but failed to raise anyone. Honolulu is 4,670 miles from Wellington. The muf (maximum usable frequency) even reached 49.3MHz across the Pacific one day in late January, bringing in US pagers and the Californian Highway Patrol. Higher up the bands, there have been several more trans-Tasman openings during November, December and January on both 2m and 70cm and at least once on 1296MHz. The distance involved is in excess of 1,390 miles! On one occasion NZ 2m operators were heard in the Adelaide area, a distance of 2,000 miles.

## Time to start DXing

By the time this issue of *Radio & Electronics World* is available on the magazine stands, DX-TV reception conditions will be rapidly improving to produce signals by one of the most exciting and mysterious forms of propagation: sporadic-E.

Every year, between May and September, intensely ionised layers or clouds form and randomly accumulate at roughly the same height as the E-layer, ie approximately 75 miles above the surface of the earth. The highly ionised clouds are capable of returning or refracting signals back to earth which would otherwise continue into space (see *Figure 7*).

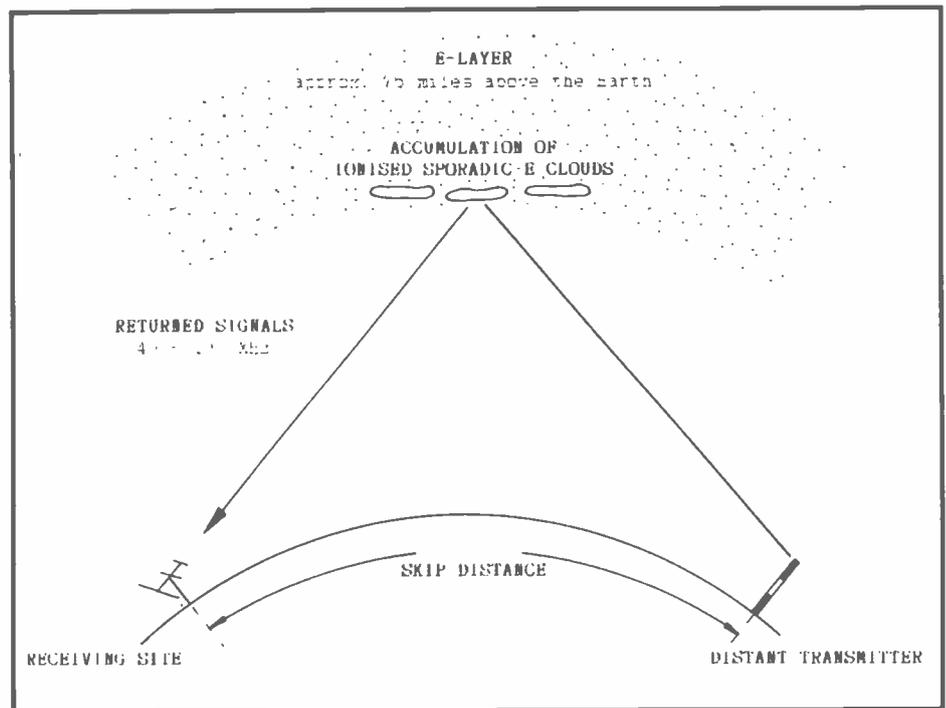
Not all signals are returned to earth. Sporadic-E propagation may favour certain frequencies, depending upon how the ionised clouds have formed and also their state. In general, frequencies between 40 and 100MHz are refracted, including the FM radio band and Band I TV channels.

These channels are widely used on the Continent, but in the UK they have not been used at all since the closure of the 405-line system in 1985.

Sporadic-E reception requires a TV receiver or converter system capable of covering these channels. Most large-screen TV receivers manufactured in the UK are designed only to receive UHF channels in Bands IV and V. Some small portables are already equipped to receive Continental channels and have a tuning scale marked with channels 2 to 4 (Band I), 5 to 12 (Band III) and 21 to 68 (UHF). However, this is only for guidance as some sets have a dummy scale and inactive band switching.

Before you buy, it is advisable to consult the manufacturer's technical literature to make sure that a multi-band tuner for VHF and UHF channels is fitted. If you already own a receiver marked with Continental channels it may be advisable to see if a multi-band tuner is fitted by checking the VHF bands with a signal generator.

In the case of a converter system, such as the very popular D-100, its output feeds the aerial socket of a normal TV receiver and you simply assign a spare push-button for your DXing activities. Tuning is by calibrated rotary controls on the front facia.



**Fig 6** How distant TV and FM radio transmitters located hundreds of miles away can be received via sporadic-E between May, June and September

# DX-TV RECEPTION REPORTS

Figure 7 shows the slight angle at which the returned signal arrives at the receiving aerial. This angle means that the height of the aerial is not very important. In many ways the reception process is analogous to satellite transmission except that sporadic-E signals vary in strength, quality, consistency and duration. The source and the duration of signals cannot be predicted in advance and TV signals can arrive from transmitters located just about anywhere. For instance, Russian signals may be present on one channel while Yugoslavia, Spain or Iceland may be present on another. Figure 7 also shows how the skip distance affects reception. Some Band I transmitters located close to the receiving site will be less easily received than those further afield. Generally speaking, transmitters located at a distance of between 500 and 1,200 miles from the receiving site are easier to receive. During the height of the sporadic-E season, usually in June and July, signals from other continents can be received by double skip. Signals from Canada, Africa and the Middle East were identified on numerous occasions during last year's exceptional conditions.

Many signals attain very high field strengths which means that simple aerials can be used to capture the transmission on its return journey to the earth. If siting the aerial out of doors is impractical then a loft location can still provide good results. A simple horizontally mounted dipole with each rod cut to 50 inches in length will suffice when signals are strong, but for weak signals a 3-element array is worth considering. Remember that both aerials require some means of rotation to pick up the maximum signal. Nowadays rotators are fairly inexpensive, but if funds are limited the aerial could be mounted atop a 16-foot 2-inch diameter scaffold pole and the whole lot hand rotated without too much difficulty.

Once you have installed the equipment and connected the aerial, you may strike lucky and receive signals immediately after switch-on. On the other hand, due to the random nature of sporadic-E reception, you may sit twiddling the knobs for hours, even a couple of days, without seeing anything and then wonder whether it is worth all the time and trouble. Usually, the first sight of a foreign test card or some distant identification caption mysteriously emerging from a snowy screen is enough to whet the appetite and create a craving for more signals!

## New deluxe D-100 converter

A deluxe version of the popular D-100 converter system is now available. The deluxe version has one big advantage over a multi-standard TV – its ability to resolve multi-system sound even when reduced IF bandwidths are selected.

The new version has a greater tuning range than previous versions. The lower end of Band III extends well below channel E5 thus embracing Moroccan channels M4 and M5. At UHF, the tuning range extends down to the ATV Band at 435MHz. Like its predecessor, it feeds a normal TV set for vision reception and connects to the telescopic aerial of an FM radio for the sound. The deluxe version can also resolve strong French System L signals (picture and sound) using a normal TV and radio receiver.

Further details of the deluxe D-100 Converter System, DX aerials and publications may be obtained from: HS Publications, 7 Epping Close, Derby DE3 4HR. An 18p stamp should be enclosed with any enquiry.

## New UHF networks

The new Dutch NED-3 network has provided DX-TV enthusiasts with new reception possibilities, although it can be argued that the new channels keep at bay signals from further afield.

During future tropospheric lifts the impact of the new Danish TV-2 service will be felt since the network consists of 16 UHF transmitters, many of them having an ERP of 600kW. Each transmitter is designed to provide coverage up to 40 miles from its location. Some of these are bound to play havoc with several UK transmissions, since there is a clear sea path between Denmark and us. Clearly, the new service will create more aggro for the general viewer but more fun for the DXer!

We have further information from Michael Summers Larsen in Denmark

concerning his country's new TV-2 network. Although a few of the 16 UHF transmitters have already entered service (see May's column), it will take until the end of 1989 before the TV-2 network is completed. All the transmitter masts will be approximately 300m in height compared with 200m for the VHF TV network. The cost of the new system will be at least DKr 450 million (approximately £40 million). The masts will be manufactured in Denmark but the transmitters and cabling will be imported. The stereo facilities of the TV-2 network will not use the West German system. It will probably be the NICAM system proposed by the UK and Sweden.

## Service information

**United Arab Emirates – Abu Dhabi:** A channel E3 transmitter is operational at Habshan using the PM5544 test card with 'CH 5 6 7' at the top and 'UAE-ABU-DHABI' in the lower rectangle.

**Tunisia:** Uses an analogue clock incorporating a floral design.

**France:** The 6m band is to be allocated to French radio amateurs, although the exact date is unknown at present. Whether a particular amateur will be able to use the band depends upon how far he lives from a Band I transmitter. Amateurs more than 200km away will be able to use an ERP of 10W, while those living between 150-200km from a transmitter will be limited to 3W ERP. No permits will be issued to operators closer than this.

A replacement TV mast at Bordeaux should be completed by June and the aerials will be 50m higher than the original ones.

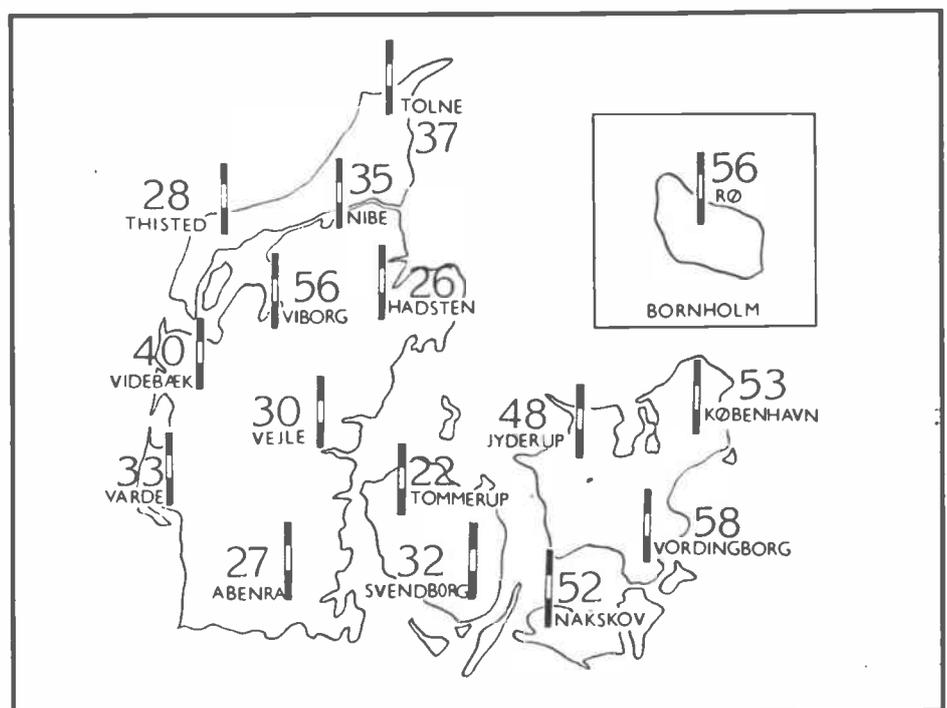


Fig 7 Map showing the distribution of the new Danish TV-2 transmitter network (numbers refer to the UHF channels to be used)

# DX-TV RECEPTION REPORTS

**East Germany:** A new transmitting tower for TV and FM radio broadcasts is under construction at Löbauer Berg and should be ready by June.

**West Germany:** Early listings have suggested that the outlets known as 'Network-1' will carry 'SAT-1' programmes and 'Network-2' will relay 'RTL+'. Now it seems that in most cases the lower channel allocation will relay 'RTL+' and the higher one will carry 'SAT-1' material!

Contrary to earlier information, there will not be a transmitter located in the city of Lübeck. Instead, transmissions will come from the Lübeck-Birkenthin site, which already broadcasts ZDF and NDR-3 programmes. Two channels will be beamed north-west to the city of Lübeck, while another two will beam to the south-west. The north-west beam will carry 'RTL+' on channel E25 and 'SAT-1' on E60. Both outlets will have an ERP of 2kW and should be operational by mid-summer. The E25 outlet was originally planned for channel E57 but the Deutsches Bundespost (DBP) intends to use it for other broadcasts. The south-west beam will carry programmes on channels E36 and E42 (both 34kW) but a commencement date has still to be announced.

The Flensburg outlets entered service

on January 18th with 'RTL+' on E24 (100W) and 'SAT-1' on E28 (200W). The Kiel relays commenced broadcasting in March with 'RTL+' on E24 (400W) and 'SAT-1' on E53 (400W). The transmitters located at Hendsted-Itzehoe are expected to enter service in September or October 1988 on channels E49 and E59 (both 100kW), but it has not yet been decided which programmes will use which channel. The 'Network-1' outlet at Süderlugem will use either channel E36 or E40. A final decision has still to be made.

The Hamburg outlet on channel E46 will increase its ERP from the present 1.7kW to 15kW during the summer of 1988. From April 1st it will relay 'RTL+' programmes which will be time-shared with Tele 5 and Music Box. The outlet on E48 has an ERP of 600W at the moment, but this will also increase during the summer. From April 1st it will relay 'SAT-1' material.

The 3rd Network of Westdeutsches Fernsehen is occasionally radiating the FuBK test pattern with 'WEST 3' identification.

**Poland:** A new high-power TVP-2 transmitter on channel R38 is already carrying regional programmes (TVP WROCLAW), some DXers have spotted. It is thought to

be located at Klodzko, south-east of Jelenia Gora, close to the border with Czechoslovakia. This is listed in the Stockholm Plan on R38 with an ERP of 300kW.

There is a TVP-1 transmitter at Klodzko using channel R52, according to a Polish magazine.

**Hungary:** A 1kW relay carrying Russian TSS-1 programmes on channel R58 became operational on December 16th 1987. Its location is Budapest Szecheny-hegy.

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

There is the possibility that Finnish radio amateurs may soon be able to use the 6m band (50MHz) after TV programmes have ended. Although its use would be unlikely to cause interference to Finnish Band I transmissions (their lowest channel is E3 at 55.25MHz) it would create problems with Russian broadcasts on channel R1 at 49.75MHz.

This month's service information was kindly supplied by Gösta van der Linden (Rotterdam, Netherlands), Miika Keipi (Huuvari, Finland), Michael Summers Larsen (Odense, Denmark), Jürgen Klassen (Berlin, West Germany) and the Benelux DX Club (Netherlands). 



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220/16 8p; 220/25, 220/50 10p; 470/16, 470/25 .....	11p
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# MEDIUM WAVE

# DXING



by Steve Whitt

Towards the end of last year I included a profile of station KDKA, Pittsburgh, Pennsylvania, USA, in which I mentioned that it was the world's first medium wave broadcast station. Little did I realise the can of worms this would open up. Further research revealed competing claims to the title from KQW, WWJ and WBZ. More recently I've seen a claim that WHA in Wisconsin is the legitimate holder.

This little-known station in Madison WI traces its roots back to the pioneering work of Professor Earle Terry of the University of Wisconsin, who began his wireless experiments on campus way back in 1902. By June 1916 the station was operating with an experimental licence (callsign 9XM) and by December of that year regular telegraph weather reports were broadcast. Voice and music followed in 1917 and by Autumn 1921 a full broadcast schedule was started. It was in September of that year that the first regular broadcast licences were issued, but 9XM didn't trade in its experimental callsign until January 13th 1922, by which time well over 25 other stations had started (including KDKA, WBZ and KQW).

Going by the date on which a station received its broadcast status, KDKA is almost certainly the first. However, by tracing station histories back to their earliest roots, it appears that WHA deserves the title. Today WHA still operates from the University as an educational station. It outputs 5000W on 970kHz. Since 1958 a plaque has proclaimed on campus that WHA is 'the oldest station in the nation'.

## Snap, crackle, pop!

If there is one thing that plagues the MW DXer above all else, it must be unwanted interference. In fact, the level of interference is usually the only factor that limits the reception of weak and distant stations on the MW band.

Interference is any unwanted signal, or noise, that adds to the desired signal and degrades reception of the wanted information. The interference most often encountered on the MW band is man-made in origin, especially for those listening-in from urban areas. There is

very little one can do about naturally occurring interference, but it is possible to do something about the man-made variety. Man-made interference can be split into two categories: interference caused by other broadcast stations and interference caused by electrical apparatus.

The first category contains several common types of interference such as:

**Co-channel interference:** since the MW band operates in channels and because the available MW spectrum is only 1080kHz wide, it is inevitable that several stations simultaneously transmit on each channel. This form of interference generally gets worse at night because interfering signals propagate further via the sky wave.

**Modulation splash:** or adjacent channel interference appears as unintelligible modulation of programmes originating from a station transmitting on a channel adjacent to that of the desired station. This can result when a station does not limit the bandwidth of its transmitted audio so that components of the transmitted sidebands interfere with signals on adjacent channels. It also originates from a poorly maintained or over-modulated transmitter. Alternatively, a similar form of adjacent channel interference can be generated within a receiver with insufficient front-end selectivity when receiving very strong signals.

**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 operate exactly on their assigned channels, heterodyne interference would not be a problem.

**Jamming:** is a deliberate attempt to interfere with reception and is usually a man-made noise transmission intended to blanket another programme, making it unintelligible.

These problems are really beyond the control of the DXer since they are rarely local, except for modulation splash within a poorly designed receiver. However, there are remedies that will

work to a greater or lesser extent. Short of moving house, a DXer's best weapon is a selective directional antenna such as a tuned rotatable MW loop.

The other type of interference, caused by non-broadcast electrical equipment, covers a multitude of problems which tend to affect listeners living in built-up areas, particularly near industrial zones. Man-made electrical interference can be classified as intermittent or long-term. Though it can be difficult to track down intermittent sources of interference, at least they are not a nuisance for very long. Common examples are engine interference from poorly suppressed spark plugs of passing cars and interference caused by electrical contacts arcing inside thermostats and switches. If the source is identified, it is generally not too difficult to suppress this sort of interference. Other examples are faulty street lights and faulty insulators on overhead power lines; in both cases the solution is to inform the relevant authority.

One of the more common of the longer-lasting varieties of interference is harmonic radiation from television time-bases. This is only audible if a nearby TV is operating. It is a rough buzzing located at intervals of 15.625kHz across the MW band. Unfortunately, this form of interference often restricts any serious DXing to outside TV hours. As more and more electrical equipment enters the home and office, the level of interference becomes greater and there is less chance of suppressing it. Recent sources of very potent interference are VDUs, computers, electronic telephones and office exchanges. Unless they own the offending piece of equipment, DXers can usually do very little to cure these interference problems. To hear the sound of a MW band clear of this sort of interference, you don't need to travel very far from the source or sources - interference effects are usually quite local. Try taking a short drive into the countryside away from street lights and power lines. Have a tune around the band and you'll be amazed at the difference.

## Club corner

By its very nature, radio listening is often a solitary hobby and many enthusiasts are quite happy all by themselves. However, others would often like to make contact with like-minded people and probably the best way is via one of the numerous radio clubs that exist. Most of them publish a magazine or newsletter and some even run tape circles - the spoken equivalent of a newsletter.

When it comes to clubs specialising in medium wave, be a little more selective since many clubs tend to cover a broad range of radio listening activities, eg short wave, VHF, utility, TV. In the UK there are several clubs interested in MW, though only one specialises in this activity. Recommended are:

**World DX Club:** Contact is their substantial monthly newsletter, often over 40 A4 pages, which covers the whole



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

## Happy 75th!

News from the Thornbury and District ARC this month – to commemorate the magic 75 years (no, of amateur radio, not the new world record for speedy delivery of a letter) they are holding an exhibition.

Various facets of the hobby will be demonstrated, including amateur TV (slow and fast scan). Packet radio, RTTY and microwave links will highlight the high-tech end of the hobby.

SWLs will also be represented – there will be an HF listening station equipped with both high-performance and economy communications receivers. Mine's two tin cans and some string...

The club would like to encourage participation by local schools, thus sowing the seeds for a whole new generation of radio hams (radio piglets?).

If you want to find out more about amateur radio, why not pay the club a visit on May 21st at the United Reform Church Hall, Thornbury, near Bristol. To find out more, contact S Goodwin G1ZAV who is the club PRO.

## Mission Impossible

Now here's a poser – how can you deliver a QSL card before making the contact? Easy, just get your time zones in a twist!

Douglas G3KPO was staying in Sydney, you see, with VK2APD. The night before he left he had a QSO with Peter KH6CTQ in Honolulu. He then flew directly to Hawaii from Oz, and immediately went to deliver the QSL card to Peter (envious sighs from the majority).

As Douglas had crossed the International Date Line during his flight, this meant that he had two Saturdays in that week, and effectively deli-

vered the card before the QSO...

Good job he didn't go the other way round, eh? He would have missed his Sunday dinner... It's all too much for us, though we've already taken up Douglas's advice – we're now refining our knitting techniques instead. Anyone for a jumper with a callsign knitted in?

## Fatal attraction

Fearful things are going on at the Wimbledon and District ARS meeting on June 10th. There will be a doctor in the house, and he may well be needed!

Dr Griffiths will be talking about nuclear magnetic resonance in medicine (magnetic body scanning). Oo-er! Wish we hadn't eaten those atomic fried mushrooms for breakfast.

Having watched Superman IV (purely for scientific purposes, of course), we're a little worried about Nuclear Man. Let's hope Dr Griffiths is the Man of Steel!

All club meetings are held on the second and last Fridays of each month at 7.30pm in St Andrew's Church Hall, Herbert Road, Wimbledon SW19. To find out more, contact David Love G4RBQ on (07373) 51559. Bet he's got a magnetic personality!

## RATSburgers

Rugby Amateur Transmitting Society has a busy month ahead, starting on June 7th with a test gear night. Various items of RF test gear will be provided, so that members can prod their hapless rigs in regions that it's probably better not to mention!

If you have a specific requirement, contact G8TWH QTHR. You should also contact this chap to find out the rules for the 2m DF contest, which takes place on June 14th.

June 21st brings a talk by a representative of C M Howes Communications. This will be about QRP kits. A moment's silence, please.

June 28th is the date of the annual barbecue – right up our street, this! Save us a burger, folks.

All club meetings are held at 7.30pm on Tuesdays at the Cricket Pavilion, BTI Radio Station, B Building entrance, A5 Trunk Road, Hillmorton, Rugby.

## Scratch patch

Is it a dog with fleas? A mad XYL with a scrubbing brush? Why are we asking these questions? Because June 8th is Quiz Evening at Farnborough and District RS, that's why, and the mysterious noise is the sound of multiple head-scratching. Be prepared to be perplexed.

June 22nd brings the VHF Field Day Review by G0GCI – what high frequency fun!

Club meetings are held at the Railway Enthusiasts Club, 103 Hawley Lane, Farnborough. Members should attend at 7.30pm for 8 o'clock-bar refreshments are available. Further details can be obtained from Tim G4UQE on Camberley 29321.

## Body building?

Chelmsford Amateur Radio Society, enterprising bunch that they are, will be holding a constructors' competition on

June 7th. Now I need a new garden shed, and the Ed wants a de luxe desk... don't think that they have this sort of thing in mind, though. Sigh.

CARS meets at the Marconi College, Arbour Lane, Chelmsford on the first Tuesday of each month. To find out more about the club, contact Roy G3PMX or Ela G6HKM on (0245) 360545.

## What DF?

Practice makes perfect, or so they say, so Wirral and District ARC ought to be perfectly good at DFing after June 1st. This heralds a practice DF hunt, so polish those cars, get the aerials sparkling, and hone your instincts.

The club is ten years old this year, and the birthday celebrations take place on June 8th, with special event stations going on the air. We don't know what the callsigns will be – anyone want to tell us?

Barbecues and June seem to go together – Wirral is another club going alfresco, at Heswall Shore on June 22nd. June 29th brings DFing proper, with the club competing for the Eileen Medley DF Cup.

The club meets at 8pm at the Irby Cricket Club, Irby Mill Road, Irby, Wirral. For further information please contact Alan G1XYP QTHR or on (051) 677 7517.

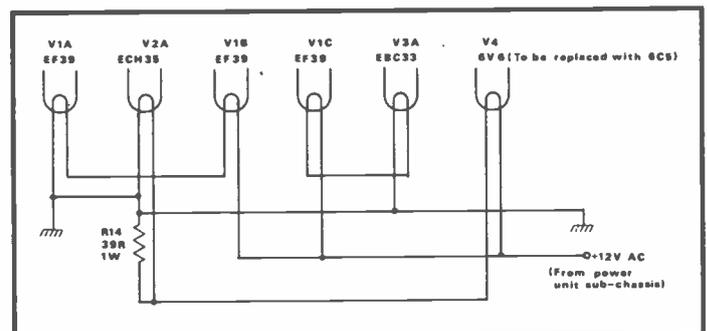
## Errata

In the *Long Range Long Wave Receiver* article published in the April issue, several errors have been noted.

- 1) In *Figure 6*, the HT voltages should read 250-320V and not 160-320V as printed.
- 2) On *Figure 3* it is shown that R14 (39 ohm) should be

removed. It would be better to substitute an 84-ohm, 1 watt resistor.

3) If the receiver is to be used extensively on the short wave bands, the HT voltage should be confined to 250-275 volts. On *Figure 3* there is an error in the depiction of the V1C/V3A heater wiring. It should be as follows:





## Touch wood

The Swindon and District ARC's Radio and Electronics Fair has changed dates – instead of Sunday May 8th, it is now Sunday 22nd May. Everything else is the same – fingers crossed...

## What's this?

Those odd noises coming from shacks in Stourbridge are actually members of the amateur radio society looking for junk. Those prized transceivers will be put to one side as the search for surplus equipment carries on.

Yes, June 20th brings the summer surplus sale, when the shack gets its annual clearout (until the resident amateur staggers back with armfuls of 'bargains' from the sale).

STARS also has a natter night on the air on June 6th, when they can prepare their jaws for the wrangling to come. Visitors and SWLs are welcome at all meetings, which are held at the Robin Woods Centre, Beauty Bank, Stourbridge at 8pm.

To find out more about the club, contact C Brunn G1WAI on (0562) 885602.

## School's out

Blackwood and District ARS may be close neighbours of the dreaded St Trinian's, as they are closed for half term. Barricaded in their shacks probably, with those precious antennas tucked away in the lounge. No, of course the XYL doesn't mind hoovering round a 30 foot mast!

June 10th brings a technical description of the FT101ZD by Ross Clare GW3NWS. This is your chance to find out what lies behind that familiar front panel, if the belles of St Trinian's haven't beaten you to it. As they say, there's many a gym-slip 'twixt cup and lip.

Robert Morgan talks about a sensitive subject on June 17th. He is from Islwyn Borough Council's planning department and he will be explaining how to get planning permission for that new tower. No, apparently you don't slip a fiver into the application form (that's inflation for you).

The month is rounded off with a natter night on June 24th – there will certainly be

plenty of things to natter about!

The club meets at 7pm on Fridays at Oakdale Community College, and visitors are welcome. For further information, please contact Brian GW6YYR on (0495) 243858 or GW4XCU on (0495) 222573.

## Got to pick a packet

Southgate ARC has persuaded Mike Dennison G3XDV, chairman of the Packet Working Group, to give a lecture on the finer points of packet radio. This will take place on June 9th.

Packet is in the air this month – two weeks later GOANN will be setting up a demo packet station on June 23rd. That should wrap the month up nicely...

Club meetings are held at Holy Trinity Church Hall (upper), Winchmore Hill, London N21. To find out more, phone Brian Shelton on 01-360 2453.

## Pearls of wisdom

Good news from MARS – the club, not the planet! The Midland Amateur Radio Society has found a new home, thanks to the efforts of the new President Peter G6DRN and his trusty band of helpers. Apparently the club is now located in Birmingham's historic Jewellery Quarter. Diamonds are a ham's best friend?

June 21st brings the mid-summer treasure hunt – well, in the Jewellery Quarter that could be spectacular. G4OMP and G0GPZ are organising things – we have to admit, we're curious. Is the amateur radio fraternity turning to metal detectors? Or is this a high class fox-hunt? All will be revealed on the day.

The club's new address is Unit 16, 60 Regent Place, Birmingham B1 3NJ. Morse classes and nights on the air are held every week; meetings usually start at 7.30pm.

## 34DX

Guess what? *Radio & Electronics World* refreshes the parts that other magazines can't reach. Africa, even!

Since we asked for news from clubs, we've had quite a response – though we didn't

## NOTES FROM THE PAST

*Setting an example of the amateur radio spirit and encouraging the young to take up the hobby*

Frankly, I don't think any youngsters can start off too soon. All old-timers were youngsters once. I remember in the early days, together with a school-chum, writing off in support of an organisation struggling to get wider recognition for 'wireless' experimenters and also BC facilities. To my surprise I got a reply almost by return – they addressed me as 'Esq' and I felt very flattered. It was an invitation to a meeting at a London hotel. The commissioner practically refused to let us in, but we defiantly flourished our invitations and dodged by smartly.

We were overawed when we discovered that several very well-known scientific figures were present, in fact, everybody there looked to us like important scientists or, at the least, university professors. I have often wondered what they thought when they saw a couple of schoolboys in knickerbockers take their seats. Luckily nobody said, 'Who let those little squirts in?' If they had, we should have curled up in shame. Instead we sat there marvelling and scarcely daring to breathe. Naturally we had not realised that such important people were behind it, but to our great relief one or two of them even spoke to us and gave us a few words of encouragement after the meeting had finished. We felt awfully proud, especially when they let us sign a petition they were presenting to the PMG or some other big-wig. I've often wondered what the PMG, or whoever it was, would have thought if we had put 'aged 13' after our signatures.

expect a letter from Cape Town! Colyn Brookes has written to tell us about an SWL club – the 34DX Club which Colyn and John Dimond formed in 1987.

Colyn goes on to say that he is an ex pommie, and that copies of British mags are as rare as chocolate teapots over there. But we got through, didn't we? Not so much Out of Africa as into it!

## Eggs-actly

Remember the days when every egg used to have a little blue lion on it? Well, there are still lions in Britain outside the safari parks – the Worcestershire Lions Amateur Radio Group, to be precise.

This club is running a special station, GB75WLG, to commemorate the RSGB's 75th anniversary. Any amateur or SWL hearing or contacting the station on three different bands can claim their award.

All you have to do is send three IRCs if you are in the UK and Europe, or four if you are outside this area. They should be posted to the Awards Manager, PO Box 67, Worcester, England.

The station will operate for two 28-day periods, from Sunday, May 29th and Sunday, August 28th. For further information, contact Ann G0BIR on (021) 233 1885 between 9am and 4pm.

## Nom de TV

The Bristol FM TV Group has changed its name to the Severnside Television Group. This change reflects the increasing success of the group, which in its two years has obtained a licence and built a 23cm FM TV repeater, GB3ZZ.

Since the area covered is far wider than just Bristol, as suggested by the original title, the new name is more appropriate. A recent output power increase has brought in reception reports from even further afield. Apparently, best DX so far is High Wycombe – unless, of course, you know differently?

The group is keen to attract support from all ATVers, not just 23cm users. They intend to enter contests (and did, in fact, enter the Spring Vision with creditable results) and promote TV activity.

To join or find out more, contact Shaun G8VPG on Saltford 873098.

## More Errata!

In the *RTTY for the Amstrad* article, published in the January issue, the following errors have been noted:

- 1) The value of R3 on the terminal board is given as 4.7k, and this should be 2.2k.
- 2) The component layout for the terminal board in Figure 8 is incorrect. C10 should be shown as C13 and vice versa. The capacitor adjacent to C9, also labelled C10, is in fact C8 and a second capacitor labelled C13, which is adjacent to

the link wire and Tr1, is C12. 3) The artwork for the components side of the interface was mistakenly printed as a mirror image.

## 934

In the May issue, Steve Blinkhorn's callsign is given as G1GXP in the *Network 934* article. This should read G1XGP – apologies to Steve for any inconvenience caused and to all those who tried to contact him QTHR.

We'd still like to know about 934 activity countrywide – we know how many enthusiasts there are out there and the amount of time, devotion and effort that is put into the band. So don't be shy – write to us at the editorial address on page 3 or Andy Emmerson c/o the magazine, and give us details of what's happening.

## Dr Kil-yagi

Edgware and District RS is going all digital in June – the 9th brings a talk on digital transmission for amateurs – what the future holds, to be given by E Kessler. Perhaps he's going to look into a crystal ball and tell you when your number is up?

On June 23rd the society is moving to Emergency Ward 10 for a little antenna surgery – a discussion on how to cut your wire antennas. Scalpel, please, nurse...

The club meets at the Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware. Club contact is Ian G4IUZ, whose telephone

number is Hatfield 65707. Why not call him?

## Special station

Special event stations are blooming this month. The RSGB has authorised a station, callsign GB0SMC, to operate from St Mary's Church Hall on June 3rd/4th.

The idea is to raise funds for the church, and the station is being sponsored by locals for every incoming call recorded.

Why not give them a call? Local amateurs will be operating from nine till six on both days. The public is invited to view the station – it would be well worthwhile as the church houses a statue of the madonna and child by Sir Henry Moore.

To find out more about the station contact G4YUG on (0473) 830147.

## New sec

Derby and District ARS have elected a new Hon Secretary, Kevin Jones G4FPY. Congratulations Kevin. Those wanting to know more about this club should contact Kevin on (0332) 669157.

Kevin replaces Jack G3KQF, who stepped down from his post after over 30 years on the committee.

## In training

We didn't realise it before, but those hordes of sad, anxious, pinstriped people peering down railway platforms aren't waiting for a train. Oh, no, they are in fact

radio amateurs wanting to achieve the British Railways ARS award, which celebrates 21 years of InterCity.

To get the award the amateur or SWL must produce a signed log sheet confirming contacts with 21 different stations whose postal address includes any of the towns listed in the index to the pocket-sized *InterCity Guide to Services*.

At least one contact must be with a member of the British Railways ARS or the club station 94LMR. No cross-band contacts are allowed, or repeater or satellite contacts. QSL confirmation is not required – the closing date for receipt of log sheets is 10.12.88.

Logs should be forwarded to the Award Manager, BRARS, 85 Surrey Street, Glossop, Derbyshire SK13 9AJ. Wonder if the awards will roll in on time?

## Wackol

Another special event station, GB2RGS, will be on air on May 21st. This will be located at the Royal Grammar School, High Wycombe, Bucks, and will be on the air between 1300 and 1730 on 80, 20 and 2 metres.

All QSOs will receive a QSL card; special cards will be issued for the six most distant stations in each band; the six worked closest to 1500hrs and for old boys who call in.

The station will be manned by members of the Chiltern ARS.

A QSL card from the 34DX Club in South Africa



Due to exceptional demand for PCBs for the *RTTY for the Amstrad* article in our January issue, these are now both available, price £9 including postage, from the editorial address on page 3

# LOW VALUE RESISTORS

*James Dick tells what to do if you're stuck for an ohm when the shops are closed*

Low value resistors have many applications. For example, they can be used in audio amplifiers or as current sensors in power supplies. However, while most shacks have a ready supply of resistors, the constructor will often find that the stock held ranges from a few hundred ohms to around one megohm. So, just when a project is about to be completed, our hapless ham is stuck for a 1 ohm resistor and, needless to say, the local shop is closed.

## Solving the problem

While a shortage of almost any other value of resistor may be overcome by placing a few in parallel or in series to make up the correct value, this is not a good solution when using low resistances. If the lowest value that you have in your box is 100 ohms then you will need one hundred of them in parallel to make up a single 1 ohm resistor. This is not really practical.

Fortunately, there is a simple solution. All wire (provided that it is not superconducting!) has resistance and the smaller the diameter of the wire the higher the resistance of a given length. The table shows the resistance per metre of copper wire of various diameters. While the diameter in millimetres is given, the more usual measure is the SWG number (standard wire gauge) and this is what suppliers will quote in their catalogues. The table also gives the approximate current that may be safely carried by the wire and some idea of the turns per inch – but more about this later.

Now, while it might be argued that the average shack would not have such large stocks of wire, most enthusiasts have wound their own coils at some time; a quick search through the author's junk

box located five rolls of wire ranging from 20 SWG to 44 SWG.

Once the length of wire required to provide a certain resistance is calculated, it may be cut off from the bobbin and wound in a bifilar manner onto some suitable former before being placed in circuit. Hey presto! A low value resistor.

## Some simple calculations

The one piece of information that must be to hand is the SWG value. It should be marked on the side of the bobbin. If it is not present, do not despair – the table also gives the number of turns per inch which can be obtained for enamel-coated copper wire. So, if an inch length of coil is made by winding the wire on a former (of any diameter) and the number of turns is determined, the table will provide a rough guide to the SWG value.

Knowing the SWG allows the resistance per metre to be found from the table. Hence, the length required is found by dividing the value of the wanted resistance in ohms by the resistance of

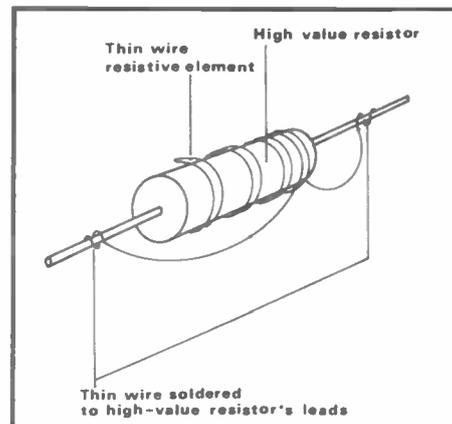


Fig 1 Minimising the inductance

the wire in ohms per metre. The length will be in metres.

## Further considerations

Of course, there is the problem of choosing the gauge of the wire so that it is suitable for the planned task. There is little point in placing a home-made resistor with 42 SWG wire where it will be expected to pass several amperes – the wire will only fuse! But the technique will provide excellent simple resistors for many applications.

## Construction

Once the length of wire has been calculated and cut from the bobbin, it only remains for it to be wound into a suitable package. It is possible to wind the wire in the form of a coil onto commercially available formers but, in general, it may be wound onto a small resistor of high value – perhaps one thousand times higher in resistance than the wire. The wire may be soldered to each end of the resistor.

Every winding will have an inductance associated with it and there are many instances where this will not be desirable. The inductance can be partially decreased by folding the wire in half and winding this in the conventional manner around the coil former, keeping the two strands very close together. The two original ends are soldered into the circuit as before.

This is illustrated in Figure 1. To finish the task, low-dissipation resistors may be 'potted-up' in a household epoxy resin.

SWG	Diameter (mm)	Typ max current (mA)	Ohms/metre	Turns/Inch
20	0.91	1000	0.03	26
22	0.71	600	0.04	33
24	0.56	350	0.07	41
26	0.46	250	0.10	51
28	0.38	170	0.15	61
30	0.29	120	0.22	73
32	0.27	90	0.29	83
34	0.23	70	0.40	98
36	0.19	50	0.58	116
38	0.15	30	0.93	143
40	0.12	15	1.45	180
42	0.10	10	2.09	217
44	0.08	8	3.27	270

# SHORT WAVE NEWS

## FOR DX LISTENERS

By Frank A Baldwin

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

Operating over the 90m band (**3200 to 3400**) is far from easy as the abundance of utility transmissions effectively ensures that wanted signals are inaudible. Most stations worth logging have weak signals buried under a more powerful utility transmitter.

Another hazard, especially common when logging African stations early or late in the evening, is the growing number of East European espionage transmitters radiating coded messages to agents in the West. The codes are changed so often they are presumed to be unbreakable, though their faith is probably unjustified. Such powerful transmissions, most of which are thought to originate from East Germany, ensure that life on the 90m band is made doubly difficult for the DXer.

### Spies like us

However, these paragraphs are intended primarily for those who wish to rove the band in search of Latin American signals. Spy transmissions tend to cause most problems during the evening. Most spies, agents and fellow travellers apparently go off the air after 2330; presumably tucked into their beds and safely ensconced in free, democratic societies.

We are concerned with relatively low-power transmitters located in this part of the world. They are equipped with omni-directional aerials, designed primarily to serve the various local populations, so even if there were not so many utility stations on the Latin American bands, still the logging success rate would not be high.

### Summer is best

Although Latin American stations can be heard throughout the calendar year, our summer is the best season, from around 2330 to 0300 UTC. Only the sign-off times and a few late night schedules are specified here. These stations do operate

during morning and afternoon periods in the UK, but the details are only of academic interest to us.

The following information updates my selection of Latin American stations on the 90m band, featured in the June 1984 issue of *Radio and Electronics World*.

### Start here

On **3205** is the 1kW Brazilian station Radio Ribeirao Preto. Located in the town of that name, it has been on the same frequency for many years. Its programmes in Portuguese, closes at 0400 and identifies as 'Radio 79', though it is rarely heard in the UK, owing to co-channel utility interference.

The Bolivian station Radio San Salvador, Totora, Cochabamba has a power of 1kW, carries programmes in Spanish from 2100 to 0020 on **3214.8** and identifies as 'Radio San Salvador, trabajando en los 3215kHz, banda de 90 metros en onda corta'.

### UK DX

You'll find HCJB Quito, Ecuador on **3220**. Its power is 10kW and it broadcasts in the Quechua language from 2100 to 0200 and in Spanish from 0200 to 0500. Reports of HCJB on this channel do appear from time to time in UK SWL club journals.

Radio Occidente, Tovar, Venezuela is on the air in Spanish closing at 0300 (Saturday and Sunday at 0400). The frequency is slightly variable either side of **3225**. The power is 1kW. From time to time it is heard in the UK.

Radio El Sol de los Andes in Juliaca, Peru operates a 0.4kW transmitter and programmes in both Spanish and Quechua. It signs off at 0400 and its frequency tends to vary slightly either side of **3229**. It is rarely reported by DXers in Europe. I notice that Radio Nuevo Continente, Cajamarca, Peru has been heard testing on nearby **3230**.

The rarely heard Radio

Clube Marilia, Brazil is on **3235** at 2kW in Portuguese until 0400.

Radio Antena Libre, Esmeralda, Ecuador uses Spanish and Quechua from 2200 to 0300 on **3239.6** at 1kW, the identification and slogan being 'Radio Antena Libre, emisora cultural cristiana, que transmite desde Esmeralda, nor oriente Ecuatoriano'. While making many references to Lima in Spanish, I logged Radio America, Lima, Peru on this frequency at 0315 one day early last year. Radio America works around the clock and has a power of 1kW.

Radio Luz y Vida, San Pedro Sula, Honduras broadcasts on **3249.6** in Spanish from 2200 to 0300 and in English from 0300 to 0400. The power is 1kW. Be careful, however, as nearby on **3250** there is Radio Collanuyo, Juliaca, Peru. At 1kW, it is on the air in Spanish and Quechua from 0900 to 0300.

Radio La Voz de Oxapampa, Oxapampa, Peru, identifies as 'La Voz de la Selva Central' and sometimes adds the slogan 'La Voz de Oxapampa, un informativo al servicio de Ud'. La Voz de Oxapampa radiates in Spanish and Quechua until sign off at 0500. The power is 2.5kW, the frequency **3260**.

### Seldom heard

In Calceta, Ecuador, La Voz del Rio Carrizal is active in Spanish and Quechua on **3260.9** until 0330 with a power of 2.5kW. Both this one and La Voz de Oxapampa are seldom heard far from signal source.

Radio Ecos del Oriente, Lago Agrio, Ecuador on **3269.3** is in Spanish until sign off at 0400.

The frequency **3279.8** presents DXers with a co-occupation problem: La Voz del Napo, Tena, Ecuador at 2.5kW and Estacion Huari, Ayacucho, Peru, at 0.5kW use Spanish and Quechua and both sign-off at 0300. The latter station as 'Transmite Estacion Huari, 3280kHz onda corta, la radio que have vivir a Ayacucho'.

Radio Belize, Belmopan, Belize uses a 1kW transmitter on **3285**. Radio Belize features programmes in Spanish and English, closing at 0605 with identification and slogan 'Belize Radio One, the Caribbean Beat in the Heart of Central America'. It is seldom heard by listeners in our part of the world.

La Voz del Rio Tarqui, Cuenca, Ecuador is now on **3285.7** at 0.4kW, being active until 0500 in Spanish and Quechua, identifying as 'Traves de la Voz de Rio Tarqui, somos los portadore de la Cuenca del Rio'.

Radio Tayabamba, Tayabamba, Peru operates from 2230 to a closing time varying between 0430 and 0500. The power is 1kW and the frequency **3290.1**. The identification and slogan is 'Transmite OAZ2G, Radio Tayabamba, 3290 kHz Onda Tropical en amplitud modulada, banda de 90 metros, transmite Radio Tayabamba, desde Tayabamba, capital de la provincia de Pataz, pueblu de desarrollo del Nor Oriente Liberteno y de Peru entero'.

### Utility interference

Very often heard in the UK are signals emanating from Radio Cultural in Guatemala City, Guatemala. The frequency is **3300** and the power 10kW. Radio Cultural programmes in Spanish, closing at 0730 but does feature a transmission in English timed from 0300 to 0430. Unfortunately, like many other channels listed here, it is subject to heavy utility interference from time to time, although there have been occasions when the writer has logged this station in the clear and listened to the channels, frequent programmes of non-stop light orchestral music.

Radio Universal, Cuzco, Peru at 10kW is on **3310** in Spanish and Quechua until close at 0400. Co-channel is the 1kW Radio Bagua, Bagua, Peru, on the air in Spanish and Quechua until close at 0400, with station identifica-

tion and the slogan 'La Senal que indica el Progreso de Nuestra Region'. Bedevilled by permanent utility interferences, this channel is hopeless for UK listeners.

### Worldwide DX

Also on **3310** is Radio San Miguel in Riberalta, Bolivia, having recently changed channel from **3320**, unwisely in my view. It has a power of 1kW, signs off at 0300 and programmes in Spanish, identifying as 'Radio San Miguel, La Voz del Vicariato Apostolico de Pando' or 'A traves de Radio San Miguel desde Riberalta'. Radio San Miguel is regularly reported by DXers worldwide.

Radio Pastaza, El Puyo, Ecuador at 2kW is on **3316** having been reactivated since August 1986. It is in Spanish and Quechua, closing at 0530. It is regularly reported by USA DXers.

In Macas, Ecuador, Radio Sangay closes at 0400. It broadcasts in Spanish and Quechua with a power of 1kW on **3322**.

This update will be continued in the next issue.

### ON THE AIR

Try adjusting your receiver to some of these frequencies and see whether you can log any of the transmissions reported here.

### AFRICA

#### Angola

Radio Nacional, Luanda on **4953** at 1932, a talk in Portuguese, some martial music then more talk with mentions of Luanda and Cuba. This 10kW transmitter is scheduled on the air from 1800 to 0530 entirely in Portuguese.

#### Burkina Faso

Ouagadougou on **4815** at 0531, orchestral rendition of the National Anthem followed by some vibraphone music, the station identification and announcements in vernacular. This station is active in vernaculars and French from 0700 to 0800 (Saturday and Sunday from 0530) and from 1700 to 2400. The power is 50kW.

#### Ghana

Accra on **3366** at 0607, YL with a newscast of both local

and world events, the station identification then OM with news comments. Radio Ghana operates in English on this frequency from 0530 to 0900 and from 1700 to 2300 with a power of 50kW.

#### Mozambique

Radio Mozambique, Maputa on **4865** at 0402, OM with a news bulletin in Portuguese featuring many local and other African place names. Emissao Nacional is active with programmes in Portuguese from 0255 to 0530 and from 1500 to 2205 with a power of 25kW.

#### Nigeria

Lagos on **7255** at 0758, African drums interval signal audible under AWR Forli (Italy). At 100kW, Lagos has programmes in English, Hausa and vernaculars to West Africa from 0500 to 2200 on this channel.

#### South Africa

RSA (Radio South Africa) Johannesburg on **11900** at 0443, YL with announcements in French followed by tribal music and songs in the French transmission for Central Africa, timed from 0430 to 0625.

#### Tunisia

Tunis on **7475** at 0754, music and songs in the Arabic presentation to Europe scheduled from 0430 to 0600 and from 1800 to 2400.

### CENTRAL AMERICA

#### Honduras

Sani Radio, Puerto Lempira on **4755** at 0021, local pops, folk songs and music, promotions and the station identification in Spanish. At 10kW, Sani Radio transmits in Spanish and Meskito from 1200 to 1600 and from 2200 to 0200.

Another Honduran signal often heard is that from La Voz Evangelica in Tegucigalpa on **4820**. It was recently logged at 0444 when a religious service was in progress. At 5kW, the schedule is from 1100 to around 0500 radiating religious programmes in Spanish.

### SOUTH AMERICA

#### Argentina

Buenos Aires on **11710** at 0434, OM with the station

identification, local style music and songs, the identification again coupled with a request for reports and the promise of QSL card return. All in the English transmission to North America timed from 0400 to 0500.

#### Bolivia

Radio Nueva America, La Paz on **4795.4** at 0116, OM with a talk in Spanish which included several mentions of La Paz, the talk being interspersed with short orchestral items, this being followed by several announcements. Radio Nueva America is on this channel in Spanish from 1000 to 1230 variable and from 2130 (varying from 2000) to around 0400 (Sunday 1000 to 2245) with a power of 1kW.

#### Brazil

Radio Nacional, Brasilia on **11780** at 2114, OM with a political talk about the Latin American policies of the USA. Entirely in Portuguese, Radio Nacional radiates to the surrounding area from 0900 to 2155.

#### Ecuador

Radio Nacional Espejo, Quito on **4679.6** at 0142, OM with a talk in Spanish which included several short musical items. The schedule of this 5kW transmitter is from 1100 to 0500 in Spanish and Quechua.

HCJB Quito on **15270** at 1930, pips timecheck, OM with the station identification followed by announcements in the English programme directed to Europe from 1900 to 2000.

#### Venezuela

Radio Nacional, Caracas on **11860.2** at 2124, music in the local manner complete with songs in the Spanish programme for South America timed from 1000 to 0400 (Saturday until 0600).

### ASIA

#### China

Gansu PBS on **4865** at 2312, OM and YL with a discussion in Chinese. The Home Service is scheduled from 2130 to 0130, from 0330 to 0620 and from 0900 to 1600. The power is 50kW and there is an English language lesson from 1330 to 1400.

#### Oman

Muscat on **7270** at 1555, songs, music, announcement and the station identification, chimes at 1600 in the Arabic programme for the Middle East timed from 0400 to 0600 and from 1400 to 1700. The Muscat signal was finally wiped out by VOA (Voice of America) West Germany sign on with the Ukrainian transmission for Eastern Europe.

#### United Arab Emirates

Dubai on **15435** at 1400, YL with the station identification and announcements at the end of the English transmission for Europe, scheduled from 1330 to 1400.

### CLANDESTINE

National Unity Radio, (Sudan?) on **9435** at 1440, OM harangue in a vernacular, orchestral music, announcement, slogans, orchestral anthem and off at 1503.

Voice of Unity on **15685** at 1535, OM with a newscast and a talk in Pushto with many mentions of place names such as Afghanistan, Kabul and Kandahar, YL with a song then some weird sounding music. Location thought to be Egypt. This is also heard on the parallel channel of **17540**.

### NOW HEAR THESE

Radio Santa Ana, Santa Ana de Yacuma, Bolivia on **4649** at 0107, OM with a news bulletin then a programme of folkloric music and songs in Spanish. With a power of 1kW, Radio Santa Ana is operational from 1100 to 1800 and from 2130 to a variable sign-off around 0200.

Radio Veritas, Manila, Philippines on **9770** at 1525, OM with a newscast followed by the station identification during the English programme for South Asia, timed from 1500 to 1530, some vibraphone music, identification again then into an announced Urdu programme.

### NOW LOG THIS

Bujumbura, Burundi on **3300** at 2040, OM with a talk, some stringed instrument music, OM with a song in vernacular then an orchestral rendition of the National Anthem and off at 2100.

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- Sony ICF7600D, world band coverage AM/FM pocketable size, inc mains adapter, ext ant, £80. Tel: 01-467 0720
- Hallicrafters Sky Challenger, circa 1939, £80. Spectrum Plus Two, plus joystick, 10 games, £95. FT726R with 2m, 70cm, HF and satellite modules fitted, also YM48 microphone, £850 no offers. JVC compact disc, cost £200, sell for £135. HF converter for scanners 100 to 150MHz-0-30MHz, £35. Mike G1XGM, 51B Brownhill Road, Catford, London SE6 2HB. Tel: 01-461 5398
- Mullard 5-10 (home-built) with extra I/O, shop-built Jason FMT3, Garrard 301 with TPA12 arm and cartridge, all in 22x44x36in contiboard clad cabinet with drawer and record storage cupboard under, Wharfedale Bronze 10 speaker mounted in beautiful base reflex cabinet. The whole lot to good home for £85 if buyer collects. Rushden, Northants. Tel: (0933) 318673
- AR2002 comms scanner receiver 25-550, 800-1300MHz, own power pack and extending aerial, little used and looks as new. This is a top quality set at a fair price, £325 ono. Tel: Preston (0772) 683098
- Advance type F model 1 A/F generator. Triplet 1632 sig gen 200kHz-120MHz frequency meter BC221 AH 125-200MHz. Two leak tuners, trough line leak TL12 plus amp (no values). Leak variscopes pre-amp, point one + valve voltmeter, Knight KG 625, offers. Edwards, 2 Beach Road, Burton, Bradstout, Dorset DT6 4RF. Tel: (0308) 897625
- CQ get on 10m and 2m. Tristar 777 multimode, 160 channel, 28 to 30MHz Tx/Rx, plus MM 10m to 2m transverter, £150 or will separate. G4DYM. Tel: (0934) 833478
- Yaesu FRG7700, ex cond, one year's guarantee, like new, £250. Ham Jumbo, just serviced by Arrow, low-low to high-high on AM/FM USB/LSB, ex cond, £175. Daiwa MT20E 2m hand-held, battery adapted to plug into car lighter, £60. Reace RT510F 500MHz frequency counter, 5 digit, £30. Francis McNally, 3E Langlands Court, Elderpark, Glasgow G51 4XJ. Tel: (041) 445 2155
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- Icom rigs for sale, IC25E and IC202S. Both in good working order and complete. Offers invited for the pair or will separate. Sale to help finance 50MHz operation. Moore G3VSU, 19 Chestnut Drive, Worth, Deal, Kent CT14 0BZ. Tel: (0304) 612369
- FRG7 schematic, please send £5 plus large SAE for photostat copy to G1ZKY, 25 Worcester Avenue, Garstang, Preston, Lancs PR3 1FJ
- Trio TS700 2m multimode. 10 watts SSB/CW, FM/AM, VFO, covers all 2m, has LSB facility for Oscar wkg. Ex cond, as new, complete with mic, manual and power cords, £225 ono. BARTG STSMC RTTY TV, as new, 170/425 shifts, auto print etc, complete with software for C64, leads etc for HF and VHF, little used, £100 ono. Will haggle on any of above. Simon GM4PM QTHR. Tel: (0505) 29363
- Realistic Pro2004, 300 channel scanning receiver, 25-520MHz and 760-1300MHz. Less than one year old, absolute mint condition, original box, £300. Tel: Swindon (0793) 828456 after 6pm
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case, hi-lo power, good cond, ideal 10m or holiday use, £48.

- UHF-TV masthead amplifier with mains power supply unit, Group B only, 13dB gain, only £12. Masthead amp without PSU, Group C/D, 12dB gain, £9. Antiference: CS1000 2-way combiner/splitter, £5. CS3000 3-way combiner/splitter, £6. UF22 FM/UHF diplexer, £5. Antiference TC18 Group B 18-element aerial, £12 (includes £2 post). Everything, apart from aerial, post free and brand new. J C Bridge, 21 Lilian Road, Burnham-on-Crouch, Essex CM0 8DS
- Acwelco (AVO) coil winder with automatic paper interleaving, exchange for AR88 working or faulty, must be complete and not seriously damaged. Colin Hewett, 4 Medway, Crowborough, East Sussex TN6 2DL. Tel: (0892) 654128
- Grundig 2100 SSB adaptor, also Sommerkamp FT250, FP250 mic, manual. Mint, reliable 80 to 10 metres HF rig. Urgently wanted, Sony CRF330K or 320 RX. Also ICF5900 Rx, cash paid for mint example. Will consider exchange HF rig (for Sony CRF330K or 320 + £150 cash). Tel: (061) 743 1570 any time
- Clearance! From my shack, the following all at £2.75 each! Pye PF2/PF70 microphone units, Pye Westminster remote-mount control box single channel, Pye remote-mount loudspeaker unit, 3 ohm 5 watt, connecting wire single-core multi-strand in long lengths, approx 150 metres. Add 25p per item postage. M J Ferguson G8THS, 65 Carlton, Norwich NR1 3PG

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- Poor student needs cash. FT DX401, £165. SWR/pwr meter, 2kW HF/VHF, £20. ARE microwader with Morse tutor, £75, or £250 the lot. Please write, giving your phone number, to Gareth G1LVN, 21 Regent Park Terrace, Hyde Park, Leeds, West Yorks LS6 2AX, or call round if local, (sorry no phone)
- HRO9-coils, working, £40. Telequipment indicator, £15. Heathkit distortion meter, £20. BC221 f/meter, £30. Plinth, £5. AVO all-wave oscillator, £15. Cossor scope 1035 Mk III, 10MHz, £25. Solartron SD1015.2 scope, no tube, £15. Counters, not working, £10 each. Newbury computer terminal, £10. Racal counter, working, £15. D Griggs, 5 Collingwood Avenue, Muswell Hill, London N10 3EH
- 50 simple LED circuits book, £2.50 post paid. Soar, 15 Brand Street, Hitchin SG5 1JE
- Sony ICF7600D, LW/MW/FM/SW: tuning range 153-29.995kHz AM, 76-108MHz VHF/FM, external antenna plug with wire, handbook. I'll even supply some lightweight headphones, ideal set-up for the SWL who wants a lightweight, full coverage receiver, as new, £95 ovno. XYL needs the cash. Tel: 01-505 6303
- Tektronix oscilloscope, 10MHz dual-beam with

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- Oscilloscope manuals HP180A, Tektronix 1A1, Telequipment 43, Cossor 1049 Mk III, Heathkit OS1, £4 each. Datel alphanumeric printer, A1P40 115V ac, £12. Lafayette SW radio 1.6-30MHz, needs MW coil, £15. Model 8 AVO, ex AM dc ranges, slightly out, £20. Advance digital multimeter, £20. Solartron DVM NiCads and mains, £15. Wayne Kerr LCR bridge, £30. Casio keyboard 701, 61 keys, 20 rhythms, 20 tones, £100. Clarke G8CZH. Tel: 01-859 1852

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- Atari 800XL: require hardware/software to enable use of 800XL for RTTY/AMTOR, etc, via amateur radio. Cash available. Bill Hurley, 20 Chestnut Grove, Caherdavin Lawn, Limerick, Eire. Tel: Limerick 52413
- Q-Fiver BC453 command receiver. Also book of CV type equivalents and especially on the tube type CV2431. Also want Eddystone type 850/4 and any Eddystone Panadapter. Ted. Tel: (070) 621 8290 after 7pm
- Any old books (pre-eighties please) on amplifiers, tuners, turntable and loudspeaker design, in good condition. Will pay very well for right ones. Also require *Audio Measurements* by N H Crowhurst. Please send list to M D Rose, 63 Rectory Road, Stoke Newington, London N16 7PP
- 50MHz module for 726R, £160 offered or swap for 70cm plus £25. Mike G1XGM. Tel: 01-461 5398
- Exchange Trio R600 gen cov recvr plus Black Jaguar hand-held scanner, both items as new; for Yaesu FRG9600 or Realistic Pro 2004. Must be in good cond. Tel: Langley Mill (0773) 761459
- New, boxed valves or unboxed if large/interesting/unusual. If possible send a list of type numbers and price required. Also looking for a valve tester, any type considered, and valve data books. Also particularly seeking large Mercury arc rectifier, high power transmitting valves, CRTs and camera tubes for my personal valve museum. All letters answered. Many thanks for your help. K Bailey, 40 Seymour Close, Selly Park, Birmingham B29 7JO
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- Wanted, dead or alive! Heath RA1Rxs for spares and project test-beds. Send condition details and price to Richard Marris, 35 Kingswood House, Farnham Road, Slough, Berks SL2 1DA
- HRO-50 Rx, will exchange for Collins 75A2 ham bands Rx. Tel: Malvern 4968
- Dead or alive! Samurai S16 MSDos machine. Parts, spares etc. I need a working/non-working unit, bits, chassis boards etc, everything needed - have you anything? MSDos software on Bin format. Any MSDos based PC, Zerex 820 CPM system etc, anything as long as it's cheap and extinct, disc based if possible, monitors etc not really needed, would consider any old scrap computer system if working - condition is not important. WHY? Any system that would run a BBC on packet. As above. 70cm + 2m Westminsters, again must be working but condition not important. Will consider any item. Westminster synthesizer article from *Rad-Com*, blue-covered year - any ideas? Perhaps a part-finished Wood & Douglas synth? Anything considered. Anything that transceives on 70cm FM. Simon GM4PLM QTHR. Tel: (0505) 29363
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9th JUNE  
1988**

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### POPULAR BAKERS DOZEN PACKS (still available)

All packs are £1 each, if you order 12 then you are entitled to another free. Please state which one you want. Note the figure on the extreme left of the pack ref number and the next figure is the quantity of items in the pack, finally a short description.

- BD1 5 13A junction boxes for adding extra points to your ring main circuit.
- BD2 5 13A spurs provide a fused outlet to a ring main where devices such as a clock must not be switched off.
- BD7 4 In flex switches with neon on/off lights, saves leaving things switched on.
- BD9 2 6V 1A mains transformers upright mounting with fixed clamps.
- BD11 1 6 1/2in speaker cabinet ideal for extensions, takes our speaker. Ref BD137.
- BD13 12 30 watt reed switches, it's surprising what you can make with these - burglar alarms, secret switches, relay, etc., etc.
- BD22 2 25 watt loudspeaker two unit crossovers.
- BD29 1 B.D.A.C. stereo unit is wonderful value.
- BD30 2 Nicad constant current chargers adapt to charge almost any nicad battery.
- BD32 2 Humidity switches, as the air becomes damper the membrane stretches and operates a microswitch.
- BD34 48 2 meter length of connecting wire all colour coded.
- BD42 5 13A rocker switch three tags so on/off, or change over with centre off.
- BD45 1 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day, original cost £40 each.
- BD49 10 Neon valves, with series resistor, these make good night lights.
- BD56 1 Mini uniselector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole.
- BD59 2 Flat solenoids - you could make your multi-tester read AC amps with this.
- BD67 1 Suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks.
- BD91 2 Mains operated motors with gearbox. Final speed 16 rpm, 2 watt rated.
- BD103A 1 6V 750mA power supply, nicely cased with mains input and 6V output leads.
- BD120 2 Stripper boards, each contains a 400V 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers, etc.
- BD122 10m Twin screened flex with white pvc cover.
- BD128 10 Very fine drills for pcb boards etc. Normal cost about 80p each.
- BD132 2 Plastic boxes approx 3in cube with square hole through top so ideal for interrupted beam switch.
- BD134 10 Motors for model aeroplanes, spin to start so needs no switch.
- BD139 6 Microphone inserts - magnetic 400 ohm also act as speakers.
- BD148 4 Reed relay kits, you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets.
- BD149 6 Safety cover for 13A sockets - prevent those inquisitive little fingers getting nasty shocks.
- BD180 6 Neon indicators in panel mounting holders with lens.
- BD193 6 5 amp 3 pin flush mounting sockets make a low cost disco panel.
- BD196 1 in flex simmerstat - keeps your soldering iron etc. always at the ready.
- BD199 1 Mains solenoid, very powerful, has 1in pull or could push if modified.
- BD200 8 Keyboard switches - made for computers but have many other applications.
- BD210 4 Transistors type 2N3055, probably the most useful power transistor.
- BD211 1 Electric clock, mains operated, put this in a box and you need never be late.
- BD221 5 12V alarms, make a noise about as loud as a car horn. Slightly soiled but OK.
- BD242 2 6in x 4in speakers, 4 ohm made from Radiomobile so very good quality.
- BD246 2 Tacho generators, generate one volt per 100 revs.
- BD252 1 Panostat, controls output of boiling ring from simmer up boil.
- BD259 50 Leads with push-on 1/4in tags - a must for hook-ups - mains connections etc.
- BD263 2 Oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into pattress.
- BD268 1 Mini 1 watt amp for record player. Will also change speed of record player motor.
- BD275 1 Guitar mic clip-on type suits most amps.
- BD283 3 Mid steel boxes approx 3in x 3in x 1in deep - standard electrical.
- BD293 50 Mixed silicon diodes.
- BD296 3 Car plugs with lead, fit into lighter socket
- BD305 1 Tubular dynamic mic with optional table rest.

Most other packs still available and you can choose any or free one.

### 5A BATTERY CHARGER KIT

All parts, including case, Only £5 plus £1 postage

### OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's Dozen range and you become entitled to a free gift with each dozen packs. A classified list of these packs and our latest 'News Letter' will be enclosed with your goods, and you will automatically receive our next news letter.



### THIS MONTH'S SNIP

3 1/2in Floppy Disc Drive, made by the Chicon Company of Japan. Beautifully made and probably the most compact device of its kind as it weighs only 600g and measures only 104mm wide, 162mm deep and has a height of only 32mm. Other features are high precision head positioning - single push loading and eject - direct drive brushless motor - Shugart compatible interface - standard connections - interchangeable with most other 3 1/2 and 5 1/4 drives. Brand new with copy of maker's manual. Offered this month at £28.50 post and VAT included.

**CASE** - adaptable for 3" or 3 1/2" FDD, has room for power supply components. Price only £4 includes circuit of PSU. Our Ref 4P8.

**POWER SUPPLY FOR FDD** - 5V and 12V voltage regulated outputs, complete kit of parts will fit into case 4P8 price £8 or with case £11.

**MULLARD UNILEX AMPLIFIERS**  
We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules - i.e. Mains power unit (EP9002) Pre-amp module (EP9001) and two amplifier modules (EP9000) all for £6.00 plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

**25A ELECTRICAL PROGRAMMER**  
Learn in your sleep. Have radio playing and kettle boiling as you wake - switch on lights to warn 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.

**MINI MONO AMP** on p.c.b. size 4" x 2" (app.)  
Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of £1.15 each, or £13 for 12.

**LIGHT BOX**  
This when completed measures approximately 15" x 14". The light source is the Philips fluorescent 'W' tube. Above the light a sheet of fibreglass and through this should be sufficient light to enable you to follow the circuit on fibreglass PCBs. Price for the complete kit, that is the box, choke, starter, tube and switch, and fibreglass is £5 plus £2 post. Order ref. 5P69.

**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 the adaptor kit is £2.30.

Ex-Electricity Board. Guaranteed 12 months.

**FANS & BLOWERS**  
5" £5 + £1.25 post. 6" £6 + £1.50 post.  
4" x 4" Muffin equipment cooling fan 115V £2.00  
4" x 4" Muffin equipment cooling fan 230/240V £5.00  
9" Extractor or blower 115V supplied with 230 to 115V adaptor £9.50 + £2 post.  
All above are ex-computers but guaranteed for 12 months.  
10" x 3" Tangential blower. New, very quiet - supplied with 230 to 115V adaptor to use two in series to give long blow £2.00 + £1.50 post or £4.00 + £2.00 post for two.

**9" MONITOR**  
Ideal to work with computer or video camera uses Philips black and white tube ref M24306W. Which tube is implosion and X-ray radiation protected. VOU is brand new and has a time base and EHT circuitry. Requires only a 16V dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VOU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only £16 plus £5 post.

**12 volt MOTOR BY SMITHS**  
Made for use in cars, etc. these are very powerful and easily reversible. Size 3 1/2" long by 3" dia. They have a good length of 1/4" spindle - 1/10hp £3.45  
1/8hp £5.75. 1/6hp £7.50

**TELEPHONE LEAD**  
3 mtrs long terminating one end with new BT flat plug and the other end with 4 correctly colour coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price £1 ref. BD552 or 3 for £2 ref. 2P164

**COMPACT FLOPPY DISC DRIVE EME-101**  
The EME-101 drives a 3" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 3 1/2" and 5 1/4" discs. We supply the Operators Manual and other information showing how to use this with popular computers BBC, Spectrum, Amstrad etc. All at a special snip price of £27.50 including post and VAT. Data available separately £2, refundable if you purchase the drive

**POWERFUL IONISER**  
Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, workshop etc. Makes you feel better and work harder - a complete mains operated kit, case included. £11.50 + £3 P&P

### J & N BULL ELECTRICAL

Dept RE, 250 PORTLAND ROAD, HOVE BRIGHTON, SUSSEX BN3 5QT  
MAK. ORDER TERMS: Cash, PO or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access and B card orders accepted. Brighton (0273) 734648 or 203500

### NEW ITEMS

Some of the many items described in our current list which you will receive with your parcel

**13A PLUGS** Good British make complete with fuse, parcel of 5 for £2. Order ref. 2P185.

**13A ADAPTORS** Takes 2 13A plugs, good British make, packet of 5 for £2. Order ref. 2P187.

**20V-0-20V** Mains transformers 2 1/2 amp (100 watt) loading, tapped primary, 200-245 upright mountings £4. Order ref. 4P24.

**BENCH ISOLATION TRANSFORMERS** 250 watt 230V in and out with plenty of tappings to give exact volts. £5 plus £2. Order ref. 5P5.

**POWERFUL 12V MOTOR** - was intended for Sinclair car, rating approx 1/2hp. Price £15. Ref. 15P8.

**BURGLAR ALARM BELL** - 6" gong OK for outside use if protected from rain. Mains or 12V battery operated, state which required. Price £8. Ref. 8P2.

**24 HOUR TIME SWITCH** - 16A changeover contacts, up to 6 on/off per day. Nicely cased, intended for wall mounting. Price £8. Ref. 8P6.

**CAPACITOR BARGAIN** - axial ended, 4700µF at 25V. Jap made, normally 50p each, you get 4 for £1. Our ref. 613.

**AGAIN AVAILABLE** - 12" mini fluorescent tubes. Price £1 each. Ref. BD314.

**POWER PACK OR AMPLIFIER CASE** - Size approx. 10" x 8 1/4" x 4 1/4" plated steel - with ample perforations for cooling. Front panel has on/off switch and EEC mains inlet plug with built-in RF filter - undoubtedly a very fine case which would cost at least £50 from regular sources. Our price is £5 each and £3 post. Ref. 5P111.

**MINIATURE BCD THUMB WHEEL SWITCH** - Matt black edge switch engraved white on black gold plated, make before break contacts. Size approx 25mm high, 8mm wide, 20mm deep, made by the famous Cherry Company and designed for easy stacking. Price £1 each. Ref. BD601.

**EDGE METER** - Miniature, whole size approx 37mm x 13mm 100ua Isd, centre zero scaled 0 to -10 and 0 to +10. Price £1 each. Ref. BD602.

**CLEANING FLUID** - Extra good quality - intended for video and tape heads. Regular price £1.50 per spray can. Our price 2 cans for £1. Ref. BD604.

**PIEZO ELECTRIC FAN** - An unusual fan, more like the one used by Madame Butterfly than the conventional type, it does not rotate. The air movement is caused by two vibrating arms. It is American made, mains operated, very economical and causes no interference, so is ideal for computer and instrument cooling. Price is only £1 each. Ref. BD605.

**SPRING LOADED TEST PRODS** Heavy duty, made by the famous Bulgin company very good quality. Price 4 for £1. Ref. BD599.

**TELEPHONE BELLS** These will work off our standard mains through a transformer, but to sound exactly like a telephone, they then must be fed with 25Hz 50V. So with these bells we give a circuit for a suitable power supply. Price 2 bells for £1. Ref. BD600.

**ULTRA SENSITIVE POCKET MULTIMETER** - 4k ohms per volt - 11 ranges - carry one of these and so be always ready to test ac/dc volts to 1000 DC milliamps and have an ohms range for circuit testing. Will earn its cost in no time. Price only £7. Ref. 7P2.

**BLOW YOUR ROOF OFF!** - 40 watt speaker systems - new type you must not hide! They have golden cones and golden surrounds and look really 'boothful'. 12" Woolfer, Midrange and tweeter and comes with a crossover at a special introductory price of £49 carriage paid. Two sets for £95 carriage paid. 140w Woolfer only £35 carriage paid.

**ASTEC P.S.U.** - Switch mode type. Input set for +230V. Output 3.5 amps at +5V, 1.5 amps at +12V, and 3 amps at +5V. Should be OK for floppy disc drives. Regular price £30. Our price only £10. Ref. 10T3A. Brand new and unused.

**APPLIANCE THERMOSTATS** - Spindle adjust type suitable for convector heaters or similar. Price 2 for £1. Ref. BD582.

**COMPOSITE VIDEO INPUT UNIT** - For our 9" monitor with notes on suppression of fly back lines and improving 'hold' makes our monitor ideal for use with any computer or camera. Kit contains p.c.b. and all components. Price £4. Ref. 4P23.

**3-CORE FLEX BARGAIN NO. 1** - Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for £2. Ref. 2P189.

**3-CORE FLEX BARGAIN NO. 2** - Core size 1.25mm so suitable for long extension leads carrying up to 13 amps, or short leads up to 25A. 10m for £2. Ref. 2P190.

**NOVEL NIGHT LIGHT** - Plugs into a 13A socket. Gives out a surprising amount of light, certainly enough to navigate along passages at night or to keep a nervous child happy, very low consumption, probably not enough to move the meter. Price £1. Ref. BD563.

**CASE WITH 13A PRONGS** - To go into 13A socket, nice size and suitable for plenty of projects such as battery trickle charger, speed controller, time switch, night light, noise suppressor, dimmers etc. Price - 2 for £1. Ref. BD565.

**SPEAKER EXTENSION CABLE** - Twin 0.7mm conductors so you can have long runs with minimum sound loss and for telephone extensions or burglar alarms, bells, intercoms etc. 250m coil only £3 plus £1 post. Ref. 3P28.

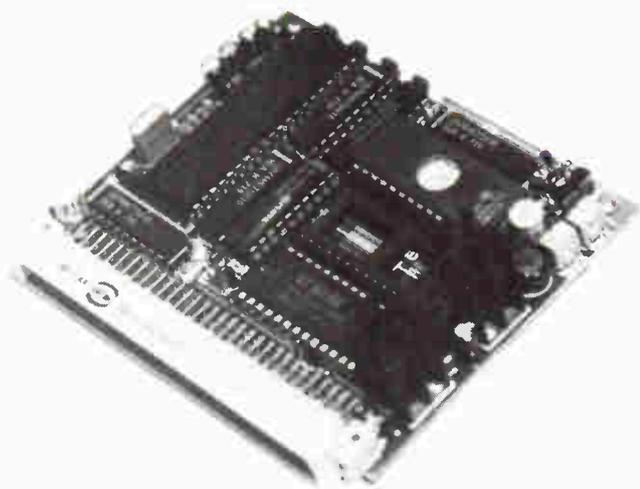
**ALPHA-NUMERIC KEYBOARD** - This keyboard has 73 keys with contactless capacitance switches giving trouble free life and no contact bounce. The keys are arranged in two groups, the main area field is a QWERTY array and on the right is a 15 key number pad, board size is approx. 13" x 4" - brand new but offered at only a fraction of its cost, namely £3, plus £1 post. Ref. 3P27.

**TELEPHONE EXTENSIONS** - It is now legal for you to undertake the wiring of telephone extensions. For this we can supply 4-core telephone cable, 100m coil £8.50. Extension BT sockets £2.95. Packet of 50 plastic headed staples £2. Dual adaptor for taking two appliances from one socket £3.95. Leads with BT plug for changing old phones, 3 for £2.

**MODULAR SWITCH** - Panel mounting highest quality and ideal where extra special front panel appearance is required, can be illuminated if required d.p.d.t. and latching. Price 2 for £1. Ref. BD607.

**WIRE BARGAIN** - 500 metres 0.7mm solid copper tinned and p.v.c. covered. Only £3 plus £1 post. Ref. 3P31 - that's well under 1p per metre, and this wire is ideal for push on connections.

# 8052-BASIC MICROCONTROLLER



**NEW**

Unbuffered  
8K Version  
for **ONLY**

**£99**  
(KIT)

## FEATURES INCLUDE

- ★ Powerful Enhanced Basic Interpreter
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