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Radio & Electronics World

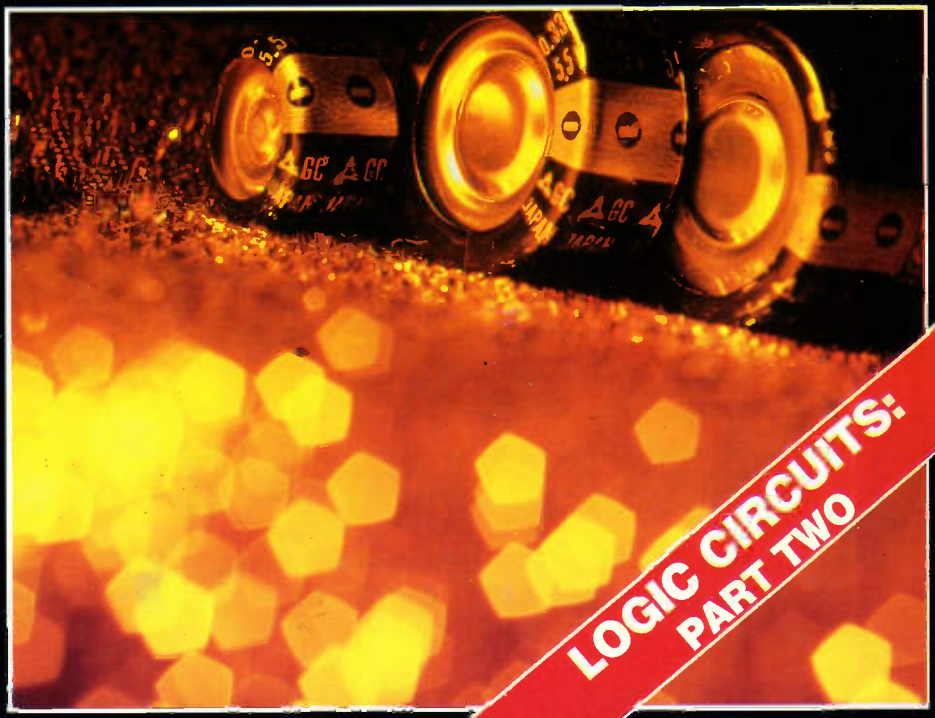
The communications and electronics magazine

INTERFACING:
MICRO TO MICRO COMMUNICATION

TS-440S REVIEW:
TRIO's ALL-BAND TRANSCEIVER

CONSTRUCTION:
A USEFUL CONTINUITY TESTER

DATA FILE:
INTRUDER ALARM SYSTEMS



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RWC are Radio Communication specialists and approved suppliers of ICOM and YAESU Business and Amateur Radios. We are also exclusive distributers for Kenpro handhelds and distributers of Uniden-Bearcat Short wave and scanning receivers. We specialise in the modification, improvement and frequency expansion (RX only for UK Market) of most brands of Amateur Radio Handhelds, Mobiles and Scanning Receivers. We also produce Mod-kits for CB to 10FM and PMR to Amateur Radio.

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OVER 100 Kits sold at Leicester!

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This is a complete modification board designed to fit all CB radios that incorporate modification board designed to fit all CB radios that have the SANYO LC7137 series of sythesizer chip, the unit comprises of a small pcb with six microchips and fits almost all current legal (CB 27/81) radios, the unit is supplied with full fitting instructions and can be fitted easily by most enthusiasts, with the currnet upsurge in interest in this band demand has been high as this means that over 90% of current CB radios can now be used on 10mtr amateur band.

PRICE £22.50 × £1.00 Post and packing (built & tested)

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* Only suitable for experienced constructors.

KIT OF PARTS AVAILABLE **£17.50 × £1 p&p.**

*Only available from RWC see R&EW March 1985 for full circuit description etc.

New Storno CQM713/P3 2mtr Modification Kit

NEW

This new kit of parts enables conversion of the Storno 55ch Radiophone to the amateur 2mtr band. The end result is a 80ch 25Khz steps 25W transceiver with repeater shift and option of local or remote control BCD or B. ary channels. The unit renders the ideal basis for a cost-effective mobile or Packet Radio transceiver or even Raynet emergency repeater! The kit comprises of two pcbs 2× adder chips, components (excluding external switches and pots) and 2× 7th overtone crystals and instructions and should present the average amateur with some constructional experience the minimum of difficulty. Why not have a go! Many parts available. Storno Mod Kit. **£29.50** Inc post.

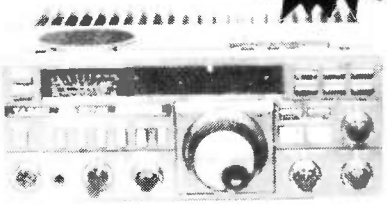
FRG9600 SCANNING RECEIVER

RWC Best seller £169 – with mod & carriage

The FRG9600 Scanning receiver was first modified by RWC and now has coverage up to 950Mhz and improved receiver performance and S meter. We fit an additional BNC socket for frequencies above 460Mhz and are able to supply optional antennas to cover this range. This has been our most successful mod to date with many delighted customers, to our competition who copy the mod we say "Immitation is the best form of flattery!"

INSIST THAT YOUR NEW 757 HAS OUR "FAST TUNE" MOD.....

Again we improve a fine HF transceiver by fitting our FAST TUNE FACILITY. The mod is "free of charge" at normal retail price, or send your rig, carriage paid and payment of £34.50 and we'll fit it for you. Can be fitted by experienced constructors. Built and tested kit at £20 Inc p&p.



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NEW

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Safety in the shack

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

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

Cover Photographs

Top – Thurlby's new quad mode dual bench PSU (p5)

Bottom – Going for gold (p10)

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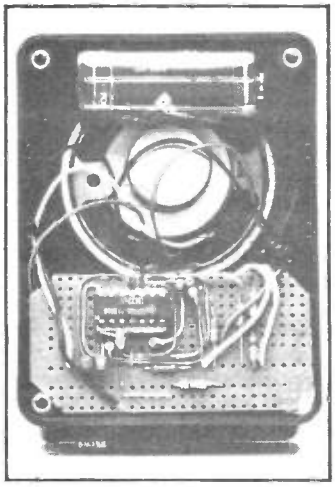
REGULARS

READER SERVICES

NEXT MONTH

☐ **Next Issue**
Cover date April 1987 on sale Thursday, 12 March

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



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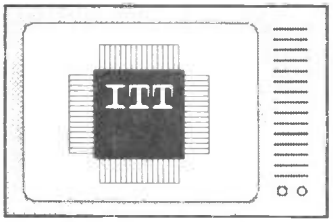

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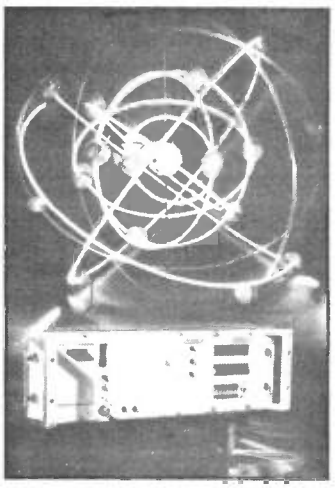

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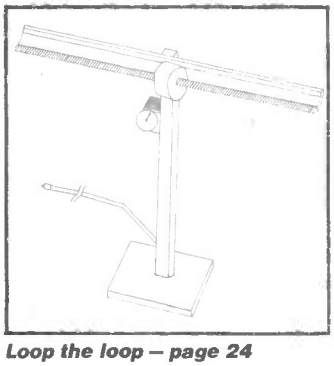


Loop the loop – page 24

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 SCOPE

Now available from Thurlby Electronics is the Hitachi V425, a 40MHz, two-channel oscilloscope.

A major feature of this instrument is its digital CRT readout of voltage/time differences whereby the user simply adjusts the cursor to obtain a direct digital readout of the voltage difference and time difference between two points on the display. The panel setting display function provides a digital CRT display of the CH1 sensitivity and the sweep time, thus preventing errors.

The V425 has an 8 × 10cm high resolution display with an internal graticule. 0%, 10%, 90% and 100% scale markings are provided to simplify pulse measurements.

Other features include a dc offset function which enables high-accuracy, vertically expanded measurements of any desired portion of a waveform; an alternate magnification facility whereby simultaneous observation of the ×10 magnified waveform and the original waveform is possible; and stable triggering on both channels, even if the signal frequencies of CH1 and CH2 differ.

The V425 also has a guaranteed ±3% accuracy for voltage and time over the 10°-35°C operating temperature range and a vertical sensitivity of 1mV/div, thereby enabling accurate measurement of the low level signals often encountered in microcomputer test and measurement applications.

Other features include eight divisions of dynamic range; a dedicated TV sync separation circuit which speeds up measurements of video signals; a built-in signal delay line, enabling measurement of the leading edge of fast rise-time signals; and an X-Y mode which enables accurate phase-difference measurements.

The Hitachi V425 measures just 310 × 130 × 370cm and weighs only 7kg.

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

RADIATION DETECTOR

A fully functional Geiger-Muller radiation counter is easily assembled from a new electronic kit, the K2654, available from Electronic and Computer Workshop Ltd.

The kit provides a lightweight portable detector that indicates the presence of gamma and beta radiation through its built-in loudspeaker. Battery-powered, the counter will operate for up to two months on one 9V cell. Dimensions are 99 × 54 × 25mm.

All the necessary components, including a printed circuit board and full instructions, are provided to ensure a successfully completed project. Built and tested units are also available at a small extra cost.

The K2654 Geiger-Muller counter kit can be purchased at a mail order price of £73.75, including post/packaging and VAT.

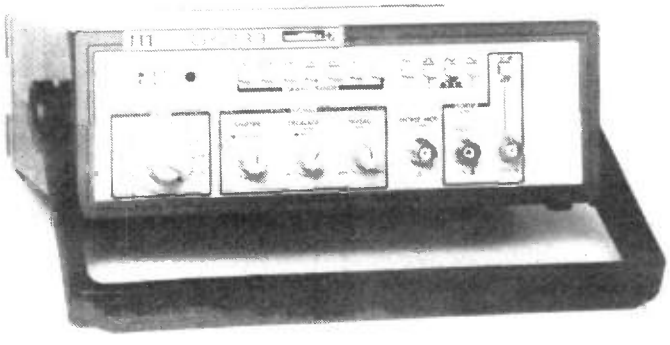
Electronic and Computer
Workshop Ltd,
171 Broomfield Road,
Chelmsford,
Essex CM1 1RY.
Tel: (0245) 262149.

GENERATING INTEREST

The new GX239 function generator from ITT Instruments is a universal instrument providing a choice of sine, square and triangle-wave signals as well as dc and pulse outputs.

The generator has an output frequency range from 0.2Hz to 2MHz, selectable over seven decade increments via front panel push-buttons. As a result, it is equally applicable to low frequency and high frequency use, and typical applications are likely to be found in vibration testing, general audio testing, AM radio testing, ultrasonics and servo-systems tests.

External sweep facilities allow the frequency to be varied by an external signal over a ratio of 1000:1 for a 10V voltage change, and the duty cycle can be varied from 20% to 80%. A variable dc offset control allows the voltage to be adjusted from less than −10V to more than +10V on open circuit, or less than −5V to more than +5V into a 50 ohm impedance.



The output level can be adjusted up to 20V peak-to-peak on an open circuit or 10V peak-to-peak on 50 ohms. Signal inversion is also possible on square waves or pulses.

Frequency accuracy of the GX239 is ±5% of full range, and sine-wave distortion is less than 1% below 200kHz.

The GX239 measures 270 × 95 × 295mm and weighs 1.8kg. It will operate on a 198-262V or 99-131V ac supply at 50 or 60Hz.

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

MINI OSCILLOSCOPE

The Hitachi V-209, available ex-stock from Thurlby Electronics, is a dual-trace 20MHz mini-portable oscilloscope which incorporates a highly versatile 3-way power supply system.

The oscilloscope can be operated from internal rechargeable batteries (supplied), an external dc supply (11-14V) or an external ac supply (95-265V). This enables the V-209 to be used in field service applications anywhere in the world, including areas where no power source is conveniently available.

The V-209 has a 3½in

rectangular CRT with an internal, parallax-free graticule of 8 × 10 divisions. Autofocus maintains an ultra-sharp trace and allows full use to be made of the oscilloscope's 3% measurement accuracy.

In line with its 20MHz bandwidth, the V-209 incorporates a wide range of professional features including 1mV/div sensitivity, 50 nanoseconds (nS)/div sweep speed, add and subtract facilities, and an active sync separator for video waveforms. These features make the V-209 suitable for applications within computer, video and instrumentation service applications as well as research and development.

The V-209 measures 110 × 215 × 350mm (4¼ × 8½ × 13½in) and weighs under 4½kg (10lbs). The price is £680 plus VAT, including the internal rechargeable batteries.

Thurlby Electronics Ltd,
New Road, St Ives,
Huntingdon, Cambs.

DUAL PSU

The PL320 quad-mode dual from Thurlby Electronics is a dual 30V, 2A laboratory bench power supply whose outputs can be automatically configured into any of four modes, including true parallel.

The four modes are selected by a bank of push-button switches. In isolated mode, the two PSUs operate entirely independently of each other. In series mode, the two outputs can be set independently but are internally linked, whilst in series-tracking mode the master voltage control sets up equal voltages on both supplies. In parallel mode, the master unit is converted into a true 30V, 4A PSU with the current being measured on one meter and no discontinuity occurring at any point.

In independent mode, each PSU has an output range of 0.31V and 0-2.2A. Both line and load regulation are better than 0.0% and ripple and noise are below 1mV. Operation can be constant voltage or constant current with automatic crossover and indication.

Remote sense terminals are provided to maintain regulation at high currents.

Voltage and current levels are simultaneously monitored to high resolution (10mV and 1mA) using twin 3¾-digit (3999 count) meters per output. A damping switch is incorporated on the current meter to enable rapidly fluctuating currents to be averaged out. A dc output switch enables each output to be set precisely in terms of both voltage and current levels before connection to the load.

The PL320 quad-mode dual measures 10 × 6.9 × 13.6in (255 × 175 × 345mm) and weighs 19½lb (9kg). It costs £339. A dual 30V 1A version is also available costing £269.

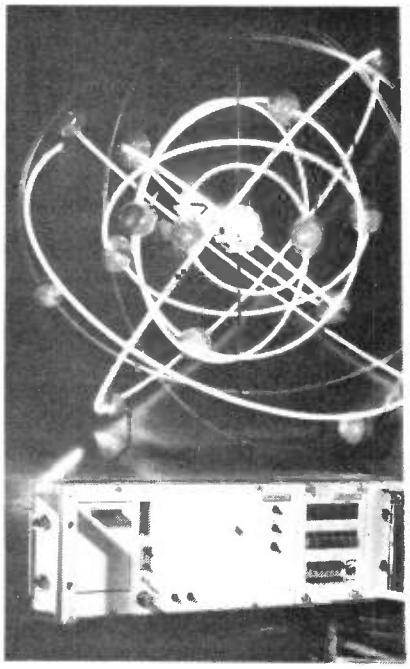
Thurlby Electronics Ltd,
New Road,
St Ives,
Huntingdon,
Cambs EE17 4BG.
Tel: (0799) 26699.

SO ACCURATE

Today, atomic standards are used in many fields of frequency and time measurements. Extremely high accuracy is primarily required in applications such as the synchronization of transmitter and data networks, radiolocation, radionavigation, goedesy and calibration. In these cases, primary standards, for example caesium standards, which produce an accurate standard frequency and feature low ageing, are employed.

These requirements are now met by the new version of the Rohde & Schwarz caesium frequency standard XSC. The increased accuracy is 7×10^{-12}, the stability over the entire operating temperature range (−20 to +50°C) being 7×10^{-12}. With a guaranteed tube life of three years, the long-term drift is $\pm 3 \times 10^{-12}$. The integrated power supply contains a battery which automatically feeds the instrument when the ac supply fails.

The digital clock CADM, which can be incorporated into the XSC, permits the digital readout of seconds, minutes, hours, days and years. This time information is additionally available as a BCD code on the rear panel of the clock. The CADM also supplies second or minute pulses. The second pulses can be delayed in 100nS



increments by means of coding switches. The frequency converter module, XSRM-Z, delivers output signals at 0.1MHz, 1MHz and 10MHz in addition to the standard frequency of 5MHz. The phase comparator XSRM-Z3 permits easy phase comparison between the caesium frequency standard and external test items.

Rohde & Schwarz,
Roebuck Road,
Chessington,
Surrey KT9 1LP.
Tel: 01-397 8771.

STRAIGHT AND LEVELL

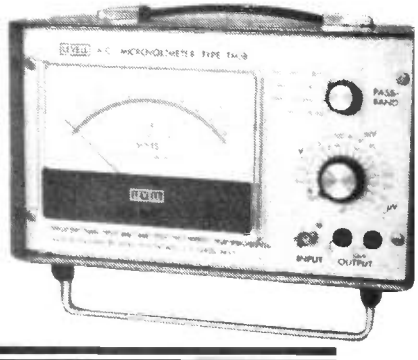
The Levell portable ac microvoltmeter type TM3B has many useful features, such as wide frequency range with variable bandwidth, high sensitivity and low noise level.

The TM3B has ranges from 15μV to 500V and −100dB to +50dB, with an input impedance of 10Mohm in parallel with <20pF on ranges above 50mV.

The meter has a 127mm scale length with mirror. Maximum bandwidth is 1Hz to 3MHz, but this may be reduced to 1Hz to 350Hz, 10Hz to 10kHz or 10Hz to 100kHz by use of the pass-band switch. An amplifier output is provided with gain variable up to 80dB. The TM3B is powered by a PP9 battery with a life of 1000 hours or from ac mains using an optional power unit.

It is housed in a robust steel case with dimensions 180 × 260 × 140mm and weighs 2.8kg.

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



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

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15 Day 'D' skt **£1.00**. **BNC** skt **75p BBC** interface cable **£5.50**

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Little or hardly used manufacturer's surplus enables us to offer this special converted **DECCA RGB** Colour Video TV Monitor at a super low price of only **£99.00**, a price for a colour monitor as yet unheard of!! Our own interface, safety modification and special 16" high definition PIL tube, coupled with the **DECCA 80** series TV chassis give 80 column definition and quality found only on monitors costing **3 TIMES OUR PRICE**. The quality for the price has to be seen to be believed!! Supplied complete and ready to plug direct to a **BBC MICRO computer** or any other system with a **TTL RGB** output. Other features are: internal speaker, modular construction, auto degaussing circuit, attractive TEAK CASE, compact dimensions only 52cm W x 34 H x 24 D, 90 day guarantee. Although used, units are supplied in **EXCELLENT condition.**
ONLY £99.00 + Carriage.

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

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

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All units are fully cased and set for 240v standard working with composite video inputs. Units are pre tested and set up for up to 80 column use. Even when MINOR screen burns exist – normal data displays are unaffected. 30 day guarantee.
12" **KGM 320-1** B/W bandwidth input, will display up to 132 x 25 lines. **£32.95**
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DC POWER SUPPLY SPECIALS

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GOULD G6-40A 5v 40 amp switch mode supply **NEW £130.00**
AC-DC Linear PSU for **DISK** drive and **SYSTEM** applications. Constructed on a rugged ALLOY chassis to continuously supply fully regulated DC outputs of **+5v** @ 3 amps, –5v @ 0.6 amps and +24v @ 5 amps. Short circuit and overvoltage protected. 100 or 240v AC input. Dim 28 x 12.5 x 7 cm **NEW £49.94**

Carriage on all PSU's £3.00

KEYBOARDS

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AMKEY MPNK-114 Superb word processor chassis keyboard on single PCB with 116 keys. Many features such as On board Micro, Single 5v rail, full ASCII coded character set with 31 function keys, numeric keypad, cursor pad and 9600 baud SERIAL TTL ASCII OUTPUT!! Less than half price
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Not a toy, the **BIG BROTHER** of the **EINSTIEN** computer, the **DUAL PROCESSOR PC2000** comprises a modern stylish three piece system with ALL the necessities for the **SMALL BUSINESS, INDUSTRIAL, EDUCATIONAL** or **HOBBYIST USER**. Used with the THOUSANDS of proven, tested and available CPM software packages such as **WORDSTAR, FAST, DBASE2** etc, the **PC2000** specification, at our prices, **CANNOT BE BEATEN!!**

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

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Carriage & Insurance £12.00

PC2000 Wordprocessor System with CPM and TEC FP25 daisywheel printer
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SURPLUS SPECIALS ON PRESTEL – VIEWDATA – TELEX

PLESSEY VUTEL, ultra compact unit, slightly larger than a telephone features **A STANDARD DTMF TELEPHONE** (tone dial) with 5" CRT monitor and integral modem etc. for direct connection to **PRESTEL VIEWDATA** etc. Designed to sell to the EXECUTIVE at over £600!! Our price **BRAND NEW AND BOXED** at only **£99.00**
DECCAFAX VP1 complete Professional **PRESTEL** system in slimline desk top unit containing Modem, Numeric keypad, CPU, PSU etc. Connects direct to standard RGB colour monitor. Many other features include: Printer output, Full keyboard input, Cassette port etc. **BRAND NEW** with DATA. A **FRACTION OF COST** only **£55.00**
ALPHATANTEL. Very compact unit with integral **FULL ALPHA NUMERIC** keyboard. Just add a domestic TV receiver and you have a superb PRESTEL system and via **PRESTEL** the cheapest **TELEX** service to be found!! Many features: **CENTRONICS** Printer output, Memory dialling etc. Supplied complete with data and **DIY** mod for **RGB** or Composite video outputs. **AS NEW** only **£125.00**
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Brand NEW metal 5¼" **DISK CASES** with internal **PSU.**
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Various disk drive PSU's **Ex Stock SEE PSU section.**
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PERTEC D3422 5+5 Mb **£495.00**
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Clearance items– Sold as seen – No guarantee.
ICL 2314 BRAND NEW 14" Mb Removable pack hard disk drive, cost over **£2000** with data **ONLY £99.00**
BASF 6172 8" 23Mb Winchesters **£199.00**
Unless stated all drives are refurbished with 90 day guarantee. Many other drives and spares in stock – call sales office for details.

MODEMS

Join the communications revolution with our super range of **DATA MODEMS**, prices and specifications to suit all applications and budgets.....
BRAND NEW State of the art products.
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Ex **BRITISH TELECOM** full spec, CCITT, ruggedised, bargain offers. Sold TESTED with data. Will work on any MICRO or system with RS232 interface.
MODEM 13A 300 baud unit, only 2" high fits under phone. CALL mode only **£45.00**
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MODEM 20-2 1200-75 baud. Same as 20-1 but for computer end **£65.00** +pp £6.50
DATEL 2412. Made by SE Labs for BT this two part unit is for synchronous data links at 1200 or 2400 baud using **2780/3780** protocol etc. Many features include 2 or 4 wire working, self test, auto answer etc. **COST OVER £800.** Our price **ONLY £199** +pp £8.00
DATEL 4800, RACAL MPS4800 baud modem, EX BT good working order. **ONLY £295.00** +pp £8.00

SPECIAL OFFER
MODEM TG2393. Ex BT, up to 1200 baud, full duplex 4 wire or half duplex over 2 wire line. **ONLY £85.00 PER PAIR** +pp £10.00

For more information **contact our Sales Office.**

MATRIX PRINTERS

SPECIAL BULK PURCHASE of these compact, high speed matrix printers. Built in Japan for the Hazeltine Corporation this unit features quality construction giving 100cps bidirectional, full pin addressable graphics, 6 type fonts, up to 9.5" single sheet or tractor paper handling, RS232 and CENTRONICS parallel interface. Many other features. **BRAND NEW** and **BOXED**. COST £420. **Our price Only £199.00**

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Dry Fit MAINTENANCE FREE by Sonnenschein & Yuasa.
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Standard VDU data entry terminals at give away prices!!
QUME QVT108. Current product, state of the art terminal with detachable keyboard, 12" Green screen, 2 page **RAM, TVI 925**, Hazeltine, **ADMSA** emulations, software setup, 25 x 80, Clock, Swivel and tilt base, Printer port, Function keys etc. **BRAND NEW** and **BOXED AT ALMOST HALF PRICE** Only **£425.00**
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100's of other terminals in stock, CALL for more details.

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

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

ERS — PRINTERS — PRINTERS — PRINTERS

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

Made to the very highest spec the **TEC STARWRITER FP1500-25** features a very heavy duty die cast chassis and **DIABLO** type print mechanism giving superb registration and print quality. Micro-processor electronics offer full **DIABLO/QUME** command compatability and full control via **CPM WORDSTAR ETC.** Many other features include bi-directional printing, switchable 10 or 12 pitch, full width 381mm paper handling with up to 163 characters per line, friction feed rollers for single sheet or continuous paper, internal buffer, standard **RS232** serial interface with handshake. Supplied absolutely **BRAND NEW** with 90 day guarantee and FREE daisy wheel and dust cover. Order **NOW** or contact sales office for more information. Optional extras **RS232** data cable **£10.00**. Tech manual **£7.50**. Tractor Feed **£140.00**. Spare daisy wheel **£3.50**. Carriage & Ins. (UK Mainland) £10.00

SUMMER OFFER ONLY £399.99!!

DIY PRINTER MECH

Brand New surplus of this professional printer chassis gives an outstanding opportunity for the **Student, Hobbyist** or **Robotics** constructor to build a **printer - plotter - digitiser** etc, entirely to their own specification. The printer mechanism is supplied ready built, aligned and pre tested but **WITHOUT** electronics. Many features include all metal chassis, phosphor bronze bearings. **132** character optical shaft position encoder, **NINE** needle head, 2 x two phase 12V stepper motors for carriage and paper control, 9.5" Paper platten etc. etc. Even a manufacturer's print sample to show the unit's capabilities!! Overall dimensions 40 cm x 12 cm x 21 cm.

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

TELETYPE ASR33
DATA I/O TERMINALS

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

EX NEWS SERVICE PRINTERS

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

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

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

Carriage and Insurance £7.50

GE TERMIPRINTER

A massive purchase of these desk top printer terminals enables us to offer you these quality **30** or **120** cps printers at a **SUPER LOW PRICE** against their original cost of over £1000. Unit comprises of full **QWERTY**, electronic keyboard and printer mech with print face similar to correspondence quality typewriter. Variable forms tractor unit enables full width - up to 13.5" 120 column paper, upper - lower case, standard **RS232** serial interface, internal vertical and horizontal tab settings, standard ribbon, adjustable baud rates, quiet operation plus many other features. Supplied complete with manual. Guaranteed working **GE30 £130.00. GE1200 120 cps £175.00**. Untested **GE30 £65.00**. Optional floor stand **£12.50**. Carr & Ins. £10.00.

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Mixed Semis amazing value contents include transistors digital, linear, IC's, triacs, diodes, bridge recs, etc. etc. All devices guaranteed brand new full spec with manufacturer's markings, fully guaranteed.
50+ £2.95 100+ £5.15

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

20,000 FEET OF ELECTRONIC AND COMPUTER GOODIES
ENGLAND'S LARGEST SURPLUS STORE - SEEING IS BELIEVING!!

DEC CORNER

PDP 1140 System comprising of CPU, **124k** memory & MMU 15 line RS232 interface. RP02 40 MB hard disk drive. **TU10** 9 track 800 BPI Mag tape drive, dual track system. VT52 VDU, etc. etc. Tested and running	**£3,750.00**
BA11-MB 3.5" Box, PSU, LTC	**£395.00**
DH11-AD 16" x RS232 DMA interface	**£1,900.00**
DLV11-J4 x EIA interface	**£350.00**
DLV11-E Serial Modem support	**£190.00**
DUP11 Synch. Serial data i/o	**£650.00**
DQ200 Dilog - multi RK controller	**£495.00**
DZ11-B 8 line RS232 mux board	**£650.00**
KDF11-B M8189 PDP 1123 PLUS	**£1,100.00**
LA30 Printer and Keyboard	**£80.00**
LA36 Decwriter EIA or 20 mA loop	**£270.00**
MS11-JP Unibus 32kb Ram	**£80.00**
MS11-LB Unibus 128kb Ram	**£450.00**
MS11-LD Unibus 256kb Ram	**£850.00**
PDP11/05 Cpu Ram, i/o etc	**£450.00**
PDP11/40 Cpu, 124k MMU	**£1,850.00**
RT11 ver 3B documentation kit	**£70.00**
RK05-J 2.5 Mb disk drives	**£650.00**
KL8 JA PDP 8 async i/o	**£175.00**
M18E PDP 8 Bootstrap option	**£75.00**
VT50 VDU and Keyboard - 20 mA	**£175.00**
VT52 VDU and RS232 interface	**£250.00**

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

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

MAG TAPE DRIVES

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

CALL FOR DETAILS

COMPUTER/SYSTEM CABINET & PSU

All in one quality computer cabinet with integral switched mode PSU, mains filtering, and twin fan cooling. Originally made for the famous **DEC PDP8** computer system costing thousands of pounds. Made to run 24 hours per day the psu is fully screened and will deliver a massive **+5v DC at 17** amps, **+15v DC at 1 amp** and **-15v DC at 5 amps**. The complete unit is fully enclosed with removable top lid, filtering, trip switch, **power** and **run** leds mounted on ali front panel, rear cable entries, etc. etc. Units are in good but used condition - supplied for 240v operation complete with full circuit and tech. man. Give your system that professional finish for only **£49.95** + carr. 19" wide 16" deep 10.5" high. Useable area 16" w 10.5"h 11.5"d.

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

66% DISCOUNT ON ELECTRONIC COMPONENTS EQUIPMENT

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**
5 kls £6.90 + **£1.80**
10kls £11.25 + pp **£2.25**
20kls £19.50 + pp **£4.75**

CENTRONICS 710 PRINTERS

Ex **RENTAL**. Heavy duty full width carriage printer up to **132** columns on 17" fan fold sprocket fed paper. 60 cps print speed with standard **RS232** or 20 mA loop interface. Supplied in **TESTED** used condition with data **ONLY £85.00** carriage and insurance **£10.00**.

MAINS FILTERS

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

EPROM COPIERS

The amazing **SOFTY 2** The "Complete Toolkit" for copying, writing, modifying and listing **EPROMS** of the **2516, 2716, 2532, 2732** range. Many other functions include integral keyboard, cassette interface, serial and parallel i/o UHF modulator ZIF socket etc.
ONLY £195.00 + pp £2.50.

"GANG OF EIGHT" intelligent Z80 controlled 8 gang programmer for ALL single 5v rail EPROMS up to 27128. Will copy 8 27128 in ONLY 3 MINUTES. Internal **LCD** display and checking routines for **IDIOT PROOF** operation. Only **£395.00** + pp £3.00.

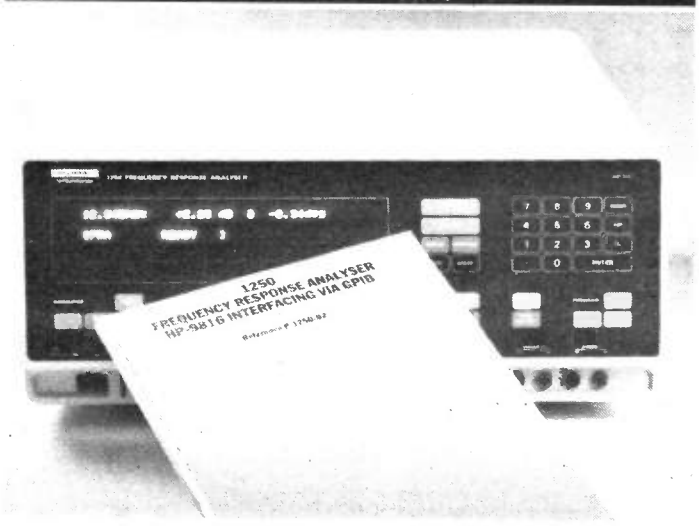
"GANG OF EIGHT PLUS" Same spec. as above but with additional **RS232** serial interface for down line loading data from computer etc. **ONLY £445.00** + pp **£3.00**

Data sheets on request

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

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

FRA INTERFACING



A new booklet describing the procedures a user has to follow to use an HP-9816 computer via the GPIB interface to communicate with and control Solartron Instruments' 1250 frequency response analyser, FRA, was released recently.

The 28-page booklet outlines a software program which enables a 1250 FRA to be controlled when connected to an HP-9816 computer via the IEEE 488-1978 GPIB.

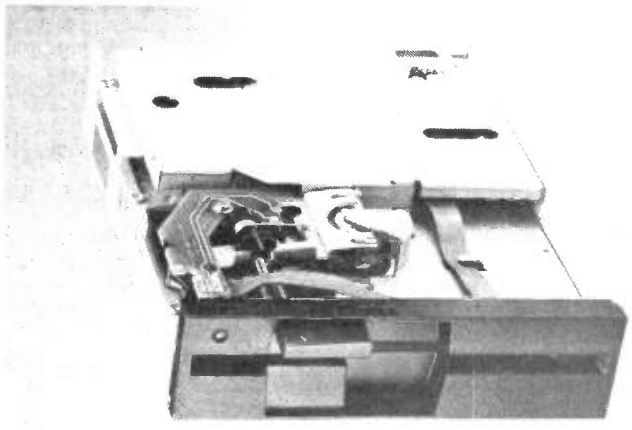
Solartron Instruments,
Victoria Road,
Farnborough,
Hants GU14 7PW.
Tel: (0252) 544433.

FLOPPY DISC PRODUCTS

Epson UK's OEM Division have announced two new half height 5¼in floppy disc drive products to meet the industry standards on interface, dimensions, functions and media. These products are designed to meet on-going, volume demand for IBM-compatible hardware.

The Epson SD 621L is a 48 track, 500KB device with a 6mS track-to-track access time. It features reduced power consumption of 4.3W when reading and as little as 1.1W in standby mode. The SD 621's signal circuit is composed of two chips, an analogue IC and a custom logic IC, so that it has 40% fewer parts and results in a PC board half as large as its predecessor. There is a simple lever mechanism for load and eject.

Epson's other new entrant is the SD 680L, a switchable 1MB/1.6MB FDD with dual 300/360rpm rotation speed. The device operates in three modes: 1MB 300rpm 250Kb/S data transfer rate; 1MB 360rpm 300Kb/S data transfer rate; and 1.6MB 360rpm 500Kb/S data transfer rate.



The second and third modes are directly compatible with IBM PC/AT standards. The SD 680's power consumption is only 5.1W (typical) and boasts a 3mS track-to-track access time.

Epson UK Ltd,
Dorland House,
388 High Road,
Wembley,
Middlesex HA9 6UH.
Tel: 01-902 8892.

IN THE PRINT

Ideal for use in portable instrument applications, a miniature desk-top printer unit from Electronic and Computer Workshop Ltd provides 40 characters/line text and high resolution graphics output for all types of portable instrumentation.

The printer, the MP-234-40, is contained in an attractive black moulded case and contains the printer mechanism with the plain paper roll. Room is provided for a controller board, such as the MP-181 parallel interfaced board, while the front panel can include a calculator-style keypad and display, if required.

The MP-234-40 utilises a high reliability plain paper printing mechanism which uses 58mm wide plain paper rolls and gives 240 graphic dots per line, with a dot spacing of 0.2mm. The mechanism gives a good quality print appearance of use in portable equipment, instrument front panels and other data printing applications.

ECW offers the MP-234-40 printer at a mail-order price of £74.63, including post/packaging and VAT.

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

FRESH AS A DAISY

First Software continue their expansion into the hardware market with the addition of two high quality daisy-wheel machines to Panasonic's popular printer range.

Known as the KX-P3131 and KX-P3151, these printers are compatible with the majority of business and personal computers on the market today. The KX-P3131 is a 110-column machine that prints at 17cps, while the larger 182-column KX-P3151 produces text at 22cps.

Both machines – which can print on cut sheets, continuous stationery and multi-part forms – feature logic seeking, parallel interface, and bi-directional printhead as standard. A margin/justification control switch is also incorporated and a serial interface, tractor feed and automatic sheet feeder are available as optional extras.

First Software,
Intec 1,
Wade Road,
Basingstoke,
Hants RG24 0NE.
Tel: (0256) 463344.

CMOS/EPROM BOARD

PPM Instrumentation Ltd has launched an unpopulated memory board for the Magus measurement and control system.

The measurement system's 9620 board accommodates up to 64Kbytes of memory and can accommodate ROM and RAM on a mix and match basis. The standard Eurocard boards can be supplied with or without battery back-up; if total independence is not required the backplane battery can be utilised.

As an EPROM board it may provide stand-alone systems with final applications software or increase system speed and reduce boot time. When used with CMOS static RAM it draws little power and gives faster operation. In this mode an on-board software protection lock can be utilised to secure data through a cold start. In the mix and match mode the 9620 provides a low cost EPROM/RAM facility up to 64Kbytes in 8Kbyte increments.

The maximum transfer rate in halt-burst mode is 2Mbits/S. Data write and data read times are 180nS and

150nS respectively. An optional fully-populated CMOS board (9620-64C) can also be supplied.

PPM Instrumentation Ltd,
Hermitage Road,
St Johns,
Woking,
Surrey GU21 1TZ.
Tel: (04867) 80111.

HIGH PERFORMERS

Rapid Systems have announced that the latest Intel high-performance 16-bit single board computers for MULTIBUS-based systems are now available from stock.

Known as the iSBC 286/12, iSBC 286/14 and iSBC 286/16, these boards all feature a 16-bit 80286 microprocessor running at 8MHz, and have 1, 2, or 4MB of zero-wait-state parity memory respectively. They incorporate two iSBX interface connectors for I/O expansion and an iLBX/high speed synchronous interface which supports both iLBX memory boards and zero-wait-state read/write EX memory boards.

Also on-board are two programmable multi-protocol serial interfaces (one RS232C, the other RS232C or RS422/449 compatible) and a Centronics parallel interface.

The boards contain two sockets for the addition of an 80287 numeric data processor and 82258 advanced direct memory access controller, and two JEDEC 28-pin sites for up to 128KB of local EPROM (expandable to 256KB using an iSBC 341 expansion module). Other features include 16-levels of vectored interrupt control and three programmable timers.

Rapid Systems,
Rapid House,
Denmark Street,
High Wycombe,
Bucks HP11 2ER.
Tel: (0494) 26271.

SUPERAMPS

Sage Audio have introduced two highly advanced audio power amplifiers: the 'Superamp' bipolar amplifier and the 'Supermos' MosFET amplifier.

They incorporate all the most up-to-date technical features in one amplifier, including: dynamic non-switching, high efficiency (70%) class A output stage; fast slew rate of 125V/μS for the Superamp and 250V/μS for the Supermos; 4 rugged, high ft 25A power transistors; low distortion at typically 0.0009% for the bipolar and 0.0002% for the MosFET amplifier; localised multiple nested feedback loops with low overall feedback; frequency response from 5Hz-125kHz-3dB (200kHz for the Supermos); high transient current capability typically 45A p-p, including SOAR and thermal overload protection. Many of these features are exclusive to these amplifiers.

Sage Audio,
Construction House,
Whitley Street,
Bingley,
West Yorkshire BD16 4JH.
Tel: (0274) 568647.

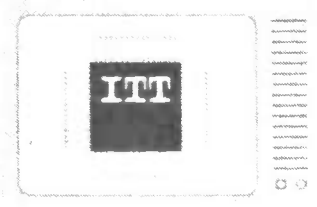
THE ELIMINATOR

Line flicker is eliminated in TV sets by displaying each line at double speed. ITT has introduced a double-scan processor which contains all the processing necessary for doubling the horizontal frequency over a wide band of RGB signals on one chip, giving much improved picture quality.

The ITT RGB2923 double-scan processor uses a special A/D converter that has a low brightness resolution, but a high time resolution of ⅛ of the clock interval of typically 70 to 80nS. A special switched D/A converter translates the input signals to analogue output signals with doubled frequency. This provides a major improvement over the old method of storing the A/D converted video signal in a line buffer before displaying it twice.

Two major modes are implemented by the IC: personal computer mode, in which the input data is 1 bit RGB as generated by a home computer; and teletext mode, with three level RGB data and two additional two level signals YS and YM. The data period is a minimum of 60nS in PC mode and 85nS in teletext mode.

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



COLOUR MONITOR

Reflex have introduced a new high performance colour monitor from Electrohome which is compatible with all the graphics adapters (CGA, EGA and PGA) in IBM or compatible computers. In addition, the monitor can be used with a wide range of other computers with horizontal scan frequencies between 15 and 34kHz.

Known as the ECM 1311, this high resolution 13-inch colour monitor incorporates vari-scan circuitry which enables the monitor to automatically lock on to the video signal from the computer. There is no need to make any adjustments apart from the usual horizontal and vertical position of the picture using easily accessible controls on the back of the monitor.

All the user has to do is follow the instructions on installing a CGA, EGA or PGA board of his choice and the Electrohome monitor will automatically adjust itself accordingly.

The ECM 1311 accepts either analogue or TTL input signals. The wide bandwidth video amplifier in the monitor and the high quality picture tube provide crisp clear images of even the most complex graphics.

Reflex Ltd,
Wellington Industrial Estate,
Basingstoke Road,
Spencers Wood,
Reading RG7 1AW.
Tel: (0734) 884611.

BULK ERASER

A new low cost magnetic tape bulk eraser for instrumentation, computer and VTR magnetic tapes is now being manufactured by Vanwell Recording Systems Ltd. The equipment, known as the V90, has been designed to erase tapes to an absolute minimum using fully automatic operation.

This product provides at least 80dB erasure of previously recorded tapes. The cycling rate can be completed in at least 45 seconds, and the equipment has a total capacity of up to 40 reels an hour. The standard unit will handle any reel up to 14 inches in diameter and up to 1 inch wide. It is suitable for high energy tapes used by video and instrumentation recording facilities.

Vanwell Recording
Systems Ltd,
North Block,
Bentley Hall,
Blacknest,
Alton,
Hampshire GU34 4PU.
Tel: (0420) 23364

PRODUCT NEWS

MORE MODS

After many months of research and development R Withers Communications Ltd have announced their latest HF modification for the Yaesu FRG9600. Now included is LF/HF/VHF and UHF coverage from 100kHz to 950MHz, improved S-meter and a typical receiver sensitivity of >2μVpd HF, >1μV 60-950MHz, 12dB sinad.

In addition a high performance HF front end has been fitted, manufactured by AKD. This section is fitted internally with switching circuits and a small toggle switch on the rear apron. The latter enables band change, whereby the display changes to read actual frequency (100kHz-60MHz). The standard SO239 antenna connector has now been changed for an N-connector for coverage from 60-950MHz and an SO239 connector fitted for HF coverage, 100kHz-60MHz (UHF extended coverage is now standard, as per RWC's original Mk2 modification up to 950MHz).

An N-connector is now fitted to all RWC FRG9600s for VHF-UHF coverage, so it is possible to use a wideband discone antenna such as the Icom AH7000, which is supplied with low-loss coaxial cable and N-connectors. A dipole or long wire antenna can be used for HF coverage with very good results. This facilitates use of two antennas for all bands.

RWC now offer the new FRG9600 in two versions. Option 1 is the FRG9600 Mk2, series 2, 60-950MHz N-connector, available for £519.00 plus £5.00 carriage, or the company will modify a standard unit for £40.00 inc VAT and return insured carriage.

Option 2 is the FRG9600 Mk3 100kHz-950MHz HF switchable, actual frequency readout (no external units) N-connector for V-UHF and SO239, fitted for HF at £599.50 plus £5.00 carriage. RWC will modify an existing unit for £129.50 inc return carriage, which will have the 950MHz extended coverage fitted at the same time (existing Mk2 owners can have this HF mod fitted for £99.00 including return carriage.

R Withers Communications Ltd, 584 Hagley Road West, Warley, Birmingham B68 0BS. Tel: (021) 421 8201.

GOING FOR GOLD

Now available from RR Electronics Ltd is the Panasonic range of Type F gold capacitors.

Suitable for memory back-up for CMOS RAMs, these devices provide super large capacitance by a unique electrode and miniaturisation technology.

Features include 0.033 farads to 0.47 farads capacitance values at 5.5V dc; excellent self-discharging characteristics; low-profile design – 9mm height and 5mm standardised terminal spacing.

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

KIT CAT

Greenweld Electronic Components have announced the availability of their new catalogue, *Kit-Cat*, which is free on request.

It offers an extensive range of electronic kits catering for all abilities, from the novice to the professional. Kits include amplifiers, pre-amps, transmitters, receivers, power supplies, panel meters, timers, doorbells, running lights, sound to light units, dimmers and computer interfaces.

Greenweld Electronic Components, 443 Millbrook Road, Southampton SO1 0HX.

P-MOSFETS

To meet the growing demand for p-channel devices, Siliconix is offering 16 new p-channel Mospower-6 transistors. These 16 devices feature breakdown voltages of −150 and −200 volts, on-resistance ranging from 0.8 to 2.4 ohms, and exceptionally reliable performance. They will be useful designers of dc motor drives, complementary push-pull power circuits and power supplies. Samples of these new products are available from stock.

According to Siliconix, the company will introduce 40 more military and commercial Mospower-6 p-channel devices within the next 6 months.

Siliconix Ltd,
Morriston,
Swansea SA6 6NE.
Tel: (0635) 30905.

RAMBO AMP

The MED range of RF solid-state power amplifiers is now available from Anglia Microwaves Limited, the sole UK representative. These amplifiers offer nominally 40 watts output power over the frequency range from 850 to 2300MHz in overlapping bands.

The MED model 7240 can provide outputs of up to 40 watts from 900 to 1300MHz into a load with infinite VSWR. Contained in a compact 520 × 170 × 450mm rack-mount or bench-top enclosure, the amplifier utilises the latest GaAs technology to achieve power levels previously associated with tube amplifier generators.

In a typical laboratory application used in conjunction with a programmable sweeper, the amplifiers provide automated microwave benches which reduce the complexity of characterising and testing high power devices and amplifiers to a relatively simple task.

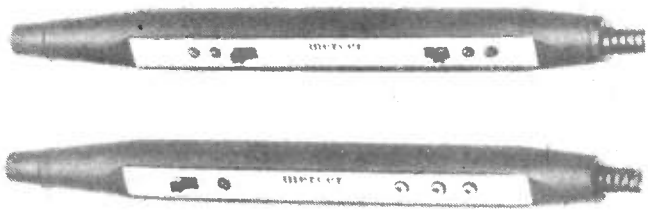
Ruggedised versions for use in extreme environments are also available. Currently, four models are included in the range: the Model 7420 (850 to 1300MHz); Model 7212 (960 to 1410MHz); Model 7242 (1300 to 1850MHz); and the Model 7250 (1650 to 2300MHz).

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

IT'S A PROBE

Two new logic probes (20MHz and 50MHz) and a new pulser probe are now being marketed by Mercer Electronics, a division of the Simpson Electric Company based in Illinois, USA.

Models 9604 (20MHz) and 9605 (50MHz) are handy trouble-shooting tools for various types of TTL and CMOS logic families. Their slim and compact design makes them easy to use in densely populated PC boards. In addition, levels and pulses can be viewed easily from two front-mounted LEDs and stored by means of a convenient switch. Two additional LEDs in the base of the unit display any improper connection of over-voltage applications.



The Mercer pulser, Model 9606, is a multifunction pulser instrument. In the pulse mode, it can inject 50μS pulses into a logic circuit without isolating ICs. It also has a sync input to allow the use of an external synchronizing signal. It is ideal for isolating opens, shorts and malfunctioning ICs in logic circuits.

All three models are available off the shelf.

Mercer Electronics,
859 Dundee Avenue,
Elgin IL 60120 3090,
USA.

INDICATORS

A broad range of Sedeco indicator lights and accessories, covering panel mounting LEDs, neons, bulbs and holders, is now available from Watts International Components of Bognor.

A comprehensive catalogue covers all the available options. Standard and high brightness LED indicators can be supplied, with or without built-in resistor protection. The same protection option applies to the neon range. Low voltage dc as well as mains neons are covered. Built-in incandescent and bulb-holding indicators are included. Bulb-holding sockets, with or without lenses, are also featured. Many physical shapes and sizes of panel mounting bodies in a choice of colours can be supplied.

The indicators are suitable for all panel display applications. The choice of round, square, clip-fixing or back-nut fixing gives great flexibility to design engineers.

Voltage ranges for LEDs cover 6V, 8V, 12V and 24V. Neon ranges are 110/220V ac, and 6V, 12V and 24V dc. Built-in incandescent range is 6V, 12V and 24V. Bulb range is 6.3V, 8V, 12V, 18V and 24V.

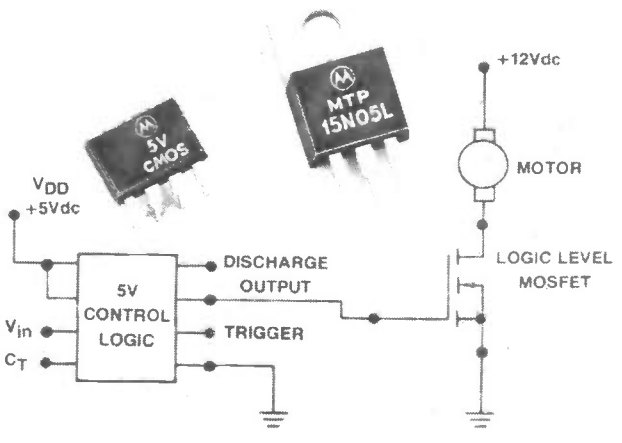
Watts International Components Ltd,
Suite 6,
Wyvern House,
Bognor Regis,
West Sussex.
Tel: (0243) 860404.

LOGIC LEVEL FETS

Motorola has introduced its first family of logic level, n-channel, enhancement mode, silicon gate power MOSFETs. These devices are designed to turn completely 'on' with a gate-to-source voltage of 5 volts. Representing the first of a series of low threshold voltage devices planned for introduction in the near future, these twelve power MOSFETs are based on the TMOS technology used in Motorola's standard power MOSFET product lines. The initial devices are 10 to 25 amps, 50 to 150 volts with a maximum on-resistance, $r_{DS\ (on)}$, as low as 0.08 ohm for the 25 amp devices.

Typical applications for these logic-level power MOSFETs are motor controls, switching power supplies, automotive switching, lamp drivers, and other switching applications where the magnitude of the available drive voltage is a constraint.

Motorola Semiconductor Products Inc
PO Box 52073,
Phoenix,
Arizona 85072.
Tel: (602) 244 4911.



NEWS DESK

Gissa job!

Job prospects for the first quarter of 1987 in the electronics manufacturing industry (which includes computer manufacture) are more optimistic than this time a year ago, according to the latest survey of employers in the industry by temporary staff specialists, Manpower.

More than one in four employers (27%) plan to increase their staff in the first quarter of 1987. This figure is slightly less than the final quarter of 1986 and this time last year (29% in each case), but job cuts are forecast by 11% of employers in electronics manufacturing – compared with 20% a year ago.

Prospects in the electronics industry are more hopeful than most of the manufacturing sector and Britain as a whole. Nationwide, and in every industrial sector, fewer than one in five employers (19%) plans to take on staff in the coming quarter.

Mellow yellow

British Telecom's Electronic Yellow Pages (EYP) went live in January, allowing most on-line communicating terminals in the UK and abroad free access to a database of Yellow Pages advertisers.

Information on EYP will Initially cover the whole of London, Reading, Guildford, Watford and St Albans. The information will be broken down by classification headings as in the printed books. EYP is available to users free of subscription and computer time-based charge. Connection to EYP can be either via a Gateway on Prestel or by direct dialling over the telephone network (PSTN) at the normal tariff.

Full instructions on how to access EYP will be published in all Yellow Pages books where EYP is available. The first book to carry such information is London South West covering the Richmond, Egham and Leatherhead areas.

Itemised phone bills

More than 2,500 customers in the City of London are being offered more detail on their telephone bills in a British Telecom trial scheme which began in January.

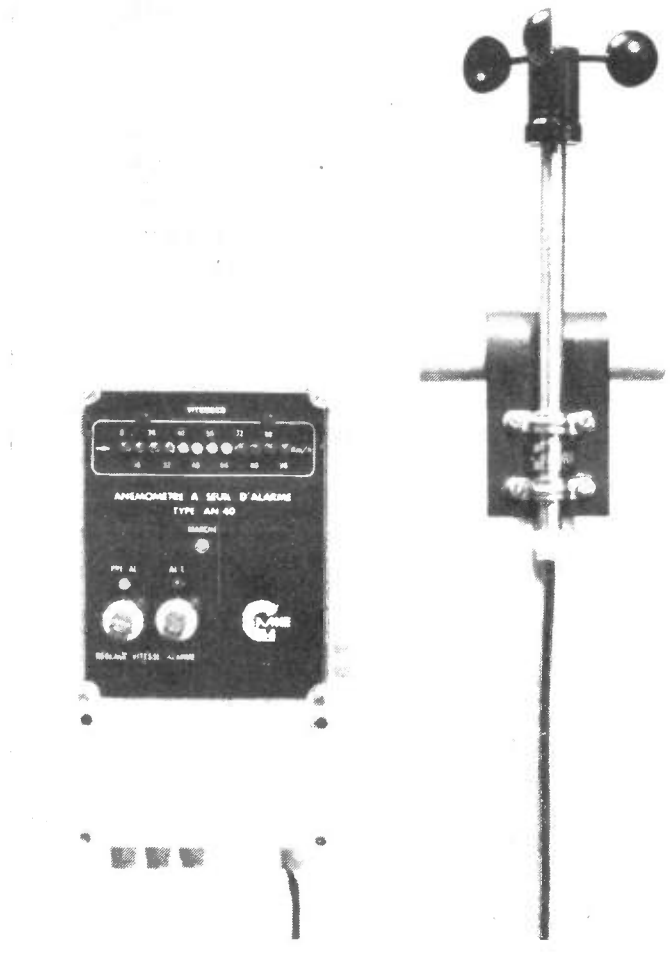
Bills will show details of all dialled calls of 10 units and more (ie, those which cost more than about 50p, including VAT). Details to be shown on the bill will be: the date and time that the call is made; the number called; the duration of the call; and the charge for the call. The cost of other calls and the number of units used in making them will be shown as a bulk figure.

Customers opting for this new service will be charged £1 per quarter for each exchange line on which calls are itemised. The six month trial will cover about 10,000 lines on three exchanges in the City of London. The telephone numbers involved begin with the prefixes 01-600, 01-726 and 01-489.

Band III gear

Band III private mobile radio users will be able to install British manufactured mobile radio equipment for use on the new system following an agreement between Robert Bosch GmbH and Burndept Electronics Ltd.

Under the agreement, Burndept will produce under licence the Bosch range of VHF and UHF mobile radio equipment at its new Thamesmead factory and will



Gone with the wind

High wind speeds are a potential danger to all who work on radio and television masts. A self-contained anemometer system which not only senses and indicates wind speed but also provides alarms has been launched in the UK by Cranesafe Ltd of Walton-on-Thames. The standard version comprises a robust, environmentally-sealed sensor connected to an electronic processor unit for £391 ex-works.

Wind speeds and their degree of hazard can be gauged at a glance by reference to a horizontal LED bar graph on the front of the processor unit. LEDs indicating low speeds (up to 32km/hr) are coloured green, yellow LEDs show intermediate speeds (up to 64km/hr) and finally red LEDs are lit for high (potentially dangerous) speeds. Slave display units can be provided for repeater stations.

The alarm points are set by graduated potentiometers on the processor unit. A perspex window allows the settings to be inspected whilst protecting the potentiometers against accidental damage and tampering.

Local warnings of adverse conditions are provided by alarm LEDs on the processor unit itself: a flashing yellow LED indicates wind speeds in excess of a first ('pre-alarm') set point, whilst a steady red LED and a built-in buzzer show that a second ('alarm') set point has been reached. Additionally, external alarm equipment such as warning lamps and sirens can be actuated by 10 amp relay outputs available from each alarm set point.

The sensor will withstand wind speeds in excess of 96km/hr without damage. Two spare cups are supplied with each system to cover accidental breakage and these can be replaced easily in a few seconds. The shaft rotates on a ball bearing to provide a long and reliable life, whilst the whole unit is environmentally-sealed to withstand even arduous marine conditions, under which the sensors are already successfully employed.

Details of the system are available from Cranesafe Ltd, telephone: (0932) 225549.

distribute other Bosch telecommunications products throughout the UK. Other potential suppliers to Band III users are likely to source their equipment from outside the UK.

The equipment range includes models suitable for use on Band III. The design will be similar to Burndept's model BE1630, which recently won approval from the Department of Trade and Industry, meeting the specifications of the Nationalised Power Industries' Joint Radio Committee.

The equipment will handle speech and data and additional features will be developed to meet the requirements defined by Band III customers and operational safety.

The Chinese way

Several Chinese authorities are being supplied with advanced radio communications systems from the Swedish company Ericsson Radio Systems.

The systems are based on Ericsson's new TC549 radio exchange and comprise base stations, mobile and portable installations. Several systems include mobile switching and encryption facilities.

In addition to supplying this radio equipment, a servicing agreement has been signed with the local company Jing An in Beijing.

Military coup

Military communications equipment, designed and manufactured in Britain by the Portsmouth-based Secure Radio Division of GEC subsidiary Marconi Defence Systems, is to equip the entire Swedish Army plus elements of the Swedish Navy. This will be achieved under a £40 million plus contract being placed with the company by the Stockholm-based Ericsson Radio Systems AB.

Under the terms of the contract Marconi will act as the principal sub-contractor to Ericsson in fulfilling the requirement of the Swedish Armed Forces Material Administration for a second-generation frequency-hopping VHF combat net radio (CNR) incorporating voice and data. This will be designated internationally as STARCOM (TR8000 in Sweden). The five year re-equipment plan involves many thousand vehicle and manpack sets, each of which will incorporate a substantial element of Marconi's tried and tested Scimitar V CNR.

The marriage of Marconi's highly advanced, silicon-on-sapphire LSI based radio technology with an Ericsson designed front panel/control unit and sophisticated electronic counter measures modules has produced a system specifically designed to meet Sweden's special requirements. With full band frequency-hopping (from 30-88MHz) and in-built digital encryption, the result is a system which gives the user immunity from interception, jamming and direction finding.

Shipshape and secure

The Department of Trade and Industry recently announced a new frequency for radio alarms to protect ships from vandalism and theft.

Security at marinas has become an increasing problem and the new alarm service is designed to protect small mobile pleasure craft that are not permanently moored. Conditions of use and a new equipment performance specification have been agreed with the security industry and the service will be exempt from the licensing requirements of the Wireless Telegraphy Act 1949. This will enable users, suppliers and the DTI to operate the new service with the minimum of administrative burden.

Good as gold

Improved telex facilities are now available to customers of Telecom Gold, British Telecom's electronic mail service.

Telecom Gold has recently installed CASE Beeline equipment to provide increased capacity for message delivery to the telex network. Customers will benefit from an increased number of telex lines and an even spread of telex traffic. The upgraded system offers fast, reliable and efficient telex delivery and provides the increased capacity necessary to accommodate the expected growth in demand.

Must do better

A survey by National Utility Services of 200 top UK companies reveals that 63% think that British Telecom's services have either deteriorated or failed to improve since privatisation. The survey further reveals that over 90% believe that the level of service must improve as competition increases.

On the question of pricing, 32% believe that British Telecom's pricing policy is unfair, with a lack of flexibility and excessive charging as the principal complaints. The most common problem experienced by British Telecom customers has proved to be technical faults, with delays taking second place.

The survey indicates that Mercury Communications' challenge to British Telecom has, as yet, to provoke any significant response in terms of servicing from BT. At the same time, customers seem reluctant to fully commit themselves to what is perhaps still a relatively unknown quantity.

Only 13% of respondents were considering replacing British Telecom with Mercury as their network supplier and of these all said they would only use Mercury partially rather than for all network services.

However, of the companies considering changing to a new telephone system, only 25% stated that they were likely to use British Telecom, the remainder preferring to go to a private contractor.

New cellular service

Recently announced by Novatel Communications Ltd and Alberta Government Telephones was the start up of an 800MHz cellular service in Calgary (Canada).

Alberta Government Telephones, who are providing the mobile service, say this new NovAtel system will allow for expanded telephone service to all its cellular customers. The 800 cellular mobile service will join AGT's Aurora 400MHz province-wide Cellular Plus system as the largest mobile telephone network in North America today.

Both the 800 and the 400MHz systems were designed and manufactured in Calgary by NovAtel, the only manufacturer of cellular telephones and systems in Canada.

This system is compatible not only with other Canadian Cellnet systems, but also with the 800MHz systems that are presently in operation in over 90 of the largest cities in the United States.

C&S Antennas Ltd of Rochester has won a multi-million dollar contract to supply high gain military tactical antennas to GTE of the United States for the US Army's mobile subscriber equipment (MSE) communications programme.

These antennas are already in service with the British Army as part of the Ptarmigan system

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

As I write this, I have just completed the first of my New Year's resolutions – to get up to date with my QSLing! It is one of those little jobs that one has a habit of putting to one side until the task amounts to a real effort! Imagine my horror, when looking back in my log, on finding I had not sent any QSLs since this time last year!

Despite having been in amateur radio for a good few years now, I still enjoy receiving QSL cards. They add yet another facet to this most versatile of hobbies. It is not just the information which may be on them, though this is of interest at times; for example it is useful to see just what equipment those stations which put out unusually strong signals are using, particularly in the VHF DX or satellite fields. Of equal interest is the picture or motif on the card. A few years ago, I had an aerial up which favoured Japan and the QSL cards which came from that quarter were particularly pleasing. Yes, I must keep that New Year's resolution going. I'll do my QSLing chore regularly this year!

My mail this past few weeks has contained several missiles from the malcontents. There seems to be a group of newcomers to amateur radio who do not like what they've found. They are full of bright ideas for improving this and that and their complaints are directed primarily at the RSGB. I'm afraid my response has been in the form of another New Year's resolution, *viz* , 'See if you cannot find something good to say during 1987 and propagate that, instead of carping about the things you don't like!' There are doubtless a number of other resolutions I might well apply to myself, but I guess we'll leave it at that!

QSLing

On the question of QSLing, a few words which may help to soften the disappointment of those newcomers to amateur radio who do not get the response to the QSLs they ask for. It is a frequent topic of complaint in the letters pages of some amateur radio magazines. These days, few of us can afford to send a QSL card for every contact we make. The most disillusioned of the radio enthusiast fraternity are undoubtedly the short wave listeners. They send cards to amateur radio stations expecting a response and, according to various complaints, get a card back very rarely indeed. In fairness to the transmitting amateur, it must be said that he obtains all the information that he wants about his signals over the air. So getting a QSL from an SWL is usually of little interest to him.

A lot has been written about QSLing by SWLs to amateur stations and more will without doubt be written in the future, so this is no place to enlarge on it. Unless your transmitting amateur is one of those nice, friendly types who goes out of his way to help the newcomer – and there are few of those about these days – you'll be lucky if you get a card back, no matter how much you try. So don't be too disappointed! I suppose the SWL gets his views on QSLing from the short wave broadcast stations who usually QSL 100% – they have the resources to do it.

As a very active radio amateur, my policy is as follows: I make a note in my log of those stations who specifically request a card, but I make it clear in the QSO that it will be via the 'bureau' and that I'd appreciate a card from them. I also QSL stations I have a particular interest in – special DX contacts, satellites and so on. I try to QSL quickly to stations seeking confirmation for awards.

Perhaps it would be a good idea to create a new Q code signal to mean 'I really would like your QSL card. My request is genuine'. One has the feeling that as things are at present 'Pse QSL' is sent more or less as a terminal signal for a QSO and does not really indicate the sender's intention.

Beacon project changes

The 28MHz Beacon Project has been running for the past twenty years. It has grown to such a degree that it is now felt that it should be put under international control. The Administrative Council of the IARU has recommended that 28.190 to 28.199MHz should be allocated to regional beacon networks operating on a time-share basis. They have also recommended that 28.200MHz should be used for a world-wide time-shared network similar to that of the 14MHz Northern California DX Federation system. The present system of continuous duty stations is due for review and 28.201 to 28.225MHz will be replaced by the new system, An expansion of the International Beacon Project to cover 21MHz is proposed and may come into operation soon, possibly using 21.150MHz in a world-wide time-sharing system. The 14MHz Northern California DX Federation system may be increased to provide a total of fifteen stations to give greater coverage.

Now that solar and propagation data is no longer broadcast by the Meudon Observatory, it is hoped that a solar data beacon may be operated just outside the 80 metre band to take over this activity. The IARU Region 1 VHF beacon band is currently 144.845 to 144.990MHz. The increasing use of the 2 metre band has brought requests for a review of the frequency allocations in this band. At a recent VHF managers meeting, proposals were put forward to reduce the width of the beacon allocation and for this matter to be put on the agenda for the forthcoming Region 1 Conference.

National convention

The dates for the 1987 National Amateur Radio Convention have been changed from those previously announced. It will now take place on Friday 27th and Saturday 28th March, at the National Exhibition Centre, Birmingham. Last year's convention was the biggest so far held, some eight thousand people attending. The special provision made by the RSGB at their stand for disabled visitors will again be available – a facility much appreciated.

ESA testing

Though strictly not an amateur radio satellite facility, the recently completed large space simulator for the ESA's Technical Establishment at Noordwijk, Holland, deserves mention. Who knows – the day may come when amateur satellites use it, considering the advances which have been made in the twenty-five years since the first Oscar 1 was launched!

The large space simulator (LSS) was formally inaugurated on Wednesday 14th January at the European Space Research and Technology Centre (ESTEC) in Noordwijk. It is designed to provide close simulation of in-orbit environmental conditions for large payloads. The facility is unique. It can provide solar simulation, infra-red radiation and temperature cycling under

vacuum for test modes. On the mechanical side, it can be used for testing the deployment of large structures, dynamic balancing and deformation measurements.

The chamber into which test structures can be accommodated has a volume of 2,100 cubic metres and allows for a high vacuum of approximately 10^{-6} millibars. The sun simulator provides a horizontal beam of 6 metres in diameter. The lamp house contains nineteen xenon lamp modules at a nominal power of 20 kilowatts per lamp directed at a large collimation mirror of 7.2 metres in diameter and consisting of 121 hexagonal mirror segments. The inside of the chamber is covered with shrouds operating at temperatures varying between −196°C and +100°C.

IRIS

Tests scheduled for 1987 are for the structural-thermal model of the Italian IRIS, a two-stage space cradle which will be used with a space shuttle in the nineties; the thermal model of Eureca, the European retrievable carrier; the large solar arrays of the Intelsat spacecraft and the protoflight model of the ESA scientific spacecraft, Hipparcos.

The troubles with Oscar 10 have been due to memory failure of the on-board computer due to radiation damage. The high elliptical orbit through which Oscar 10 passes takes it through the Van Allen radiation belt regularly. Oscar 10 was built several years ago and the design of its data processing and storage computer facilities did not use the radiation hardened solid-state devices currently utilised. The next satellite in the Oscar 10 series, Phase-3C, will have a new in-house unit (IHU) memory board which will use new ICs.

The Harris Corporation of Melbourne, Florida, has agreed to supply Amsat with special memory modules for use on Phase-3C. These modules are specially radiation-hardened for use in space. They are valued at 80.000 dollars and are produced by Harris' Custom Integrated Circuit Division in Melbourne, Florida. They will provide the IHU with 32kbytes of memory.

The latest projected schedule for the launching of Phase-3C is August 1987, but no firm date has yet been fixed.

Computer confusion

In his presidential address at the British Radio Teleprinter Group's (BARTG) AGM last November, Mr TI ('Smudge') Lundegard G3GJW drew attention to a matter which your scribe feels strongly about, *viz* the lack of standards in the microcomputer world – typically on the input/output connections used on micros and of course in the software. BARTG have members who are prepared to help with queries concerning the BBC computer and the Commodore. But Atari, Amstrad, Dragon and Sinclair are equally popular microcomputers and BARTG would like volunteers to help with these too.

Offers to: Chris Reed G8MFP, Ashlea, London Road, Stretton Dunsmore, Rugby, Warcs. REW

Arthur Gee G2UK is Chairman of Amsat-UK, the radio amateur satellite organisation. More details can be obtained from: R Broadbent, 94 Herongate Road, London E12 5EQ

A VERSATILE CONTINUITY TESTER

Brian Kendal and Jeff Howell present a useful piece of test equipment

For any person involved in a profession or hobby which concerns electrical circuits, the continuity tester (or circuit tracer) is a most basic and useful piece of test equipment. Whether this takes the form of a battery and bulb or buzzer, a multimeter or a sophisticated digital cable tracer, the principle of operation is the same: a voltage is applied to the circuit under test and if a current flows which corresponds to a predetermined low circuit impedance, then some form of indication, visual or aural, is given.

There is no doubt that even the simplest forms of tester are extremely useful when used in the correct context. Unfortunately, however, many modern semiconductor devices operate at very low voltage levels and are consequently delicate and susceptible to damage from quite moderate levels of applied signal. Even standard multimeters can give sufficient output current or voltage when used on resistance ranges to prove fatal to some semiconductor devices. A further complication is that semiconductors often contain parasitic diodes which may lead to misleading indications.

At times, the tester itself may be at risk, for circuits incorporating high value capacitors, even when switched off, may well retain sufficient charge to damage the test instrument.

Design considerations

In building a continuity tester, there are many desirable features which could be included in the design:

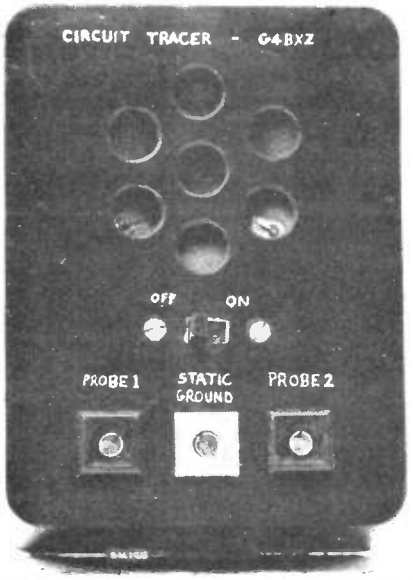
- It should not affect the circuit under test in any way. This applies to both test voltage and current and also any electrostatic charges built up on the equipment.
- The tester should not be affected by currents and voltages present within the equipment under test.
- Only direct connections should be detected and connections through large value capacitors, low value inductors and semiconductors should be ignored.
- Indication of continuity should be obvious to the user under the prevailing conditions.
- It should be cheap and simple to both manufacture and use.

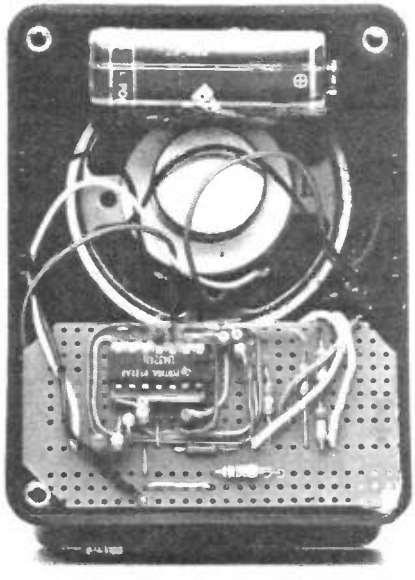
While the design given in this article does not meet every point mentioned above, nevertheless it does meet most.

By using a relatively low current supplied through high value resistors, the risk to the circuit under test is minimised even under fault conditions, whilst an active voltage limiter affords further protection. These series resistors also safeguard the tester by limiting any voltage induced from the circuit under test to safe levels.

The voltage sensing element is not polarity conscious and only recognises a very narrow band of input voltages. It is therefore unlikely to give false indications due to stored or applied circuit voltages.

An audio indicator was considered most suitable, for it enables tests to be conducted without the user taking his (or her) eyes from the circuit under test. Construction is cheap and simple: it only requires a single inexpensive integrated circuit and a dozen and a half components to be mounted on a small piece of Veroboard, and these to be fitted in any convenient box or container together with a small loudspeaker and battery.





Left: *Front view of the prototype continuity tester* ***Right:*** *Rear view of tester with circuit board removed to show component side*

Sensitivity

In principle, the circuit may be modified to respond to any range of resistance which the user desires, but in practice the stability of the amplifiers limits the span to about 20 ohms, with 50

ohms being a more practical value. Lower resistance values could be sensed if the polarising current was increased, but this may negate some of the advantages of the present design.

The sensitivity of the instrument may be altered by varying circuit component values when the response range (Rx) may be determined from:

$$Rx = \left(\frac{\pm 3}{R8} + \frac{4}{R5+R6}\right) \frac{R7\,(R1+R2)}{8}$$

Circuit operation

The polarising current is supplied to the circuit under test through resistors R1 and R2. First consider the situation where the probes are open circuit. No appreciable current will flow in either resistor, so P1 will be near ground potential and P2 will be set at about 1 volt by the polarising voltage limiting amplifier IC1a. It is essential to maintain sufficient voltage to electrically break down the oxide film which forms on exposed base metal surfaces and would otherwise prevent good contact.

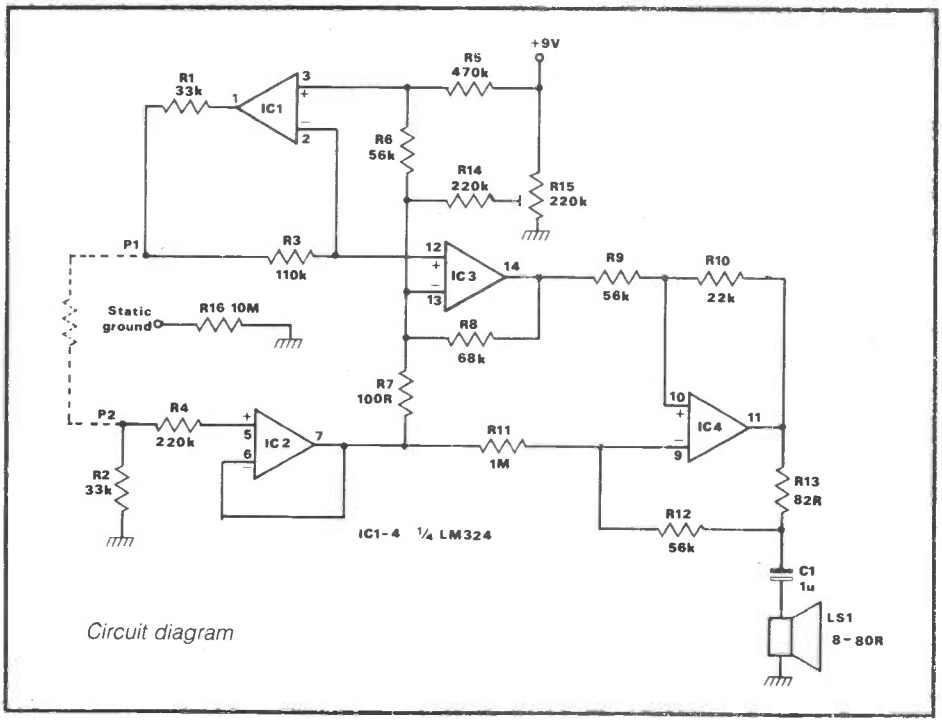
Now consider the situation as the resistance between the probes decreases. Initially the voltage between P1 and P2 will be maintained because the output of IC1a will rise to counteract the reduction in P2 or (indirectly) a rise in P1. When the resistance reaches about 6 kilohms, IC1a will saturate. The full battery voltage will then appear across R1 and R2 to maximise the polarising current. Any further decrease in resistance will reduce the voltage difference between P1 and P2.

Voltage follower

IC1b is a voltage follower which feeds both IC1a and IC1c, the differential probe voltage amplifier. This is configured such that when the probe voltage difference is about +3mV, the output is midway between ground and battery positive. Any appreciable deviation from this level will send the output towards one or other of the supply rails. As the cumulative offset voltage tolerance of IC1b and IC1c is near 5mV, an offset null adjustment (R15) is desirable. R3 is half the value of R4 because it carries the input current for two amplifiers.

IC1d is a simple relaxation oscillator which operates at around 2kHz. R9 and R10 provide positive feedback, making the amplifier into a bistable. The voltages necessary at pin 11 to switch the bistable are related to the output from IC1c in that the switching levels must always lie either side of this.

R13 and C1 define the oscillator time constant – the charge on C1 always changes to oppose the current state of the bistable. IC1d would always oscillate if this charge voltage were fed back to pin 11 directly, but voltage control is achieved by reducing this charge sense voltage slightly, using R11 and R12. Since



Circuit diagram

the voltage at pin 11 can never quite reach the supply rails, oscillation is inhibited whenever the output level from IC1c approaches either. R11 is only connected to IC1b as a convenient point of half supply voltage.

The choice of such low impedances for R13 and C1 is merely to allow direct connection of the loudspeaker as shown without restriction of the loudspeaker impedances. The circuit works equally well if C1 is grounded and an 80 ohm speaker fitted in place of R13.

R16 allows any static charge in the tester or (more importantly) the user to leak away to earth. The static ground connection is only necessary when working on electrostatic discharge sensitive equipment. For those who are unsure of the importance of static precautions, take note that certain companies will immediately dispense with the services of any engineer caught disregarding the necessary precautions while working on equipment.

Using the tester

The technique of using a continuity tester is well known, but it is possible to obtain erroneous indications under certain circumstances.

For example, a high value series capacitor can initially be indicated as a short circuit. However, in the instrument described in this article, the test current of 150 microamps will charge even a 100,000 mfd capacitor at the rate of 1.5 millivolts per second. After only four seconds charging at this rate, sufficient charge will have built up to exceed the threshold of the voltage sensor and the tester will then correctly indicate an open circuit. In practice, most large capacitors hold a small residual charge, thus reducing, or even eliminating, the build-up time.

The high sensitivity and low test current of this instrument enables it to be used on many low power circuits without even switching them off. In fact, in many cases it may not even affect their operation. Of course, this technique cannot be recommended where high voltages are present, on grounds of personal safety.

The final advantage of this instrument is that the high value resistors in series with the probes limit the current available to a very low value. We believe that this characteristic may well make the tester suitable for operation in flammable atmospheres, for there is insufficient energy present to cause ignition even if a fault should develop within the tester.

The tester described consumes only an IC, a handful of passive components and a short evening's work. For this low outlay it is possible to possess a small, convenient unit which is capable of use on circuits which would otherwise be destroyed in the testing by more conventional instruments. REW

COMPONENT LIST

R1 – 33K	R10 – 22K
R2 – 33K	R11 – 1M0
R3 – 110K	R12 – 56K
R4 – 220K	R13 – 82R
R5 – 470K	R14 – 220K
R6 – 56K	R15 – 220K POT
R7 – 100R	C1 – 1MFD
R8 – 68K	IC – LM324
R9 – 56K	L5 – 3-80R

NEW FOR '87.
NEW FOR '87.

NEW! IC-275E, 25 WATT 2 METRE MULTIMODE.

The ICOM IC-275E is the most advanced all-mode transceiver available to the Amateur today. It features a new technological breakthrough in frequency synthesizer sytems. This Direct Digital Synthesizer (DDS) operates in just 5 milliseconds, providing one of the fastest transceiver lock-up times available. Ideal for PACKET and AMTOR communication modes. The IC-275E has high sensitivity and dynamic range making it an ideal unit for contests and DX operation.

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, lock-out scan.

A new LCD uses a soft orange backlight for ease of operating even in bright daylight. The CI-V communications interface for computer control via a serial port is mounted on the rear panel. Pass Band Tuning and Notch Filter Systems have been incorporated to provide clear operating reception.

This transceiver has a built in A.C power supply but can also be used on 13.8v D.C for mobile or portable operation. Optional accessories available are AG25 Masthead pre-amplifier, VT36 Voice Synthesizer, FL83 CW Narrow Filter and CR64 High Stability XTAL.

To fully appreciate all the facilities of this sophisticated transceiver contact your local ICOM dealer or Thanet Electronics for further information.

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ICOM

NEW! IC-MICRO-2, MINI-HANDPORTABLE.

This is the smallest handportable from ICOM. The Micro-2, 2 metre FM measures only 148 x 31mm with the BP22 nicad battery pack. The Micro-2 is a hand-size transceiver which will equally fit most pockets.

On the top panel a clear LCD readout gives frequency, memory channel number, signal and R.F power bargraph. A LCD backlight is provided for viewing under difficult conditions. ICOM's innovation has replaced thumbwheel tuning with up/down toggle switches to select 1MHz, 100KHz or 12.5KHz steps. Scanning is possible by depressing and hold the 12.5KHz switch. 10 memories are provided and are automatically programmed by retaining what is selected by the toggle switches. Full repeater and simplex operation facilities including repeater access tone. An automatic power saving function reduces battery power consumption when in receiver mode. Output power is 1.5 watts or 100 milliwatts (low) with the BP22 nicad pack. 2.5 watts is possible with the BP24 pack.

The ICOM Micro-2 is very advanced 2 metre miniature handheld and yet still provides a simple mode of operation. This handy transceiver is supplied complete with BP22 nicad pack, A.C wall charger, helical antenna.

Optional accessories include the BC50 desk charger, rapidly charges the Micro-2 nicad packs in one hour, a variety of rechargeable nicad packs, dry cell battery pack, D.C regulator and soft cases. Contact Thanet Electronics or your local ICOM dealer for more details on this exciting new product.

Actual Size Photograph.
This shows the non-standard low capacity battery pack. N.B. Standard battery pack is normally the higher capacity BP22 as mentioned in text.

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TRIO TS-440S

ALL-BAND TRANSCEIVER

A user review by

KEN MICHAELSON G3RDG

What interested me most about this rig at first sight was its small size. It measures only 279mm wide × 108mm high × 335mm deep (roughly 10½ins × 3¾ins × 12½ins), so you can see that it isn't very big. Included inside the case is the AT-440 automatic antenna tuning unit and the VS-1 voice synthesizer unit, making the total weight 7.3kg (16.1lbs).

The mains power supply (the PS-50) is a separate unit and is intended to stand alongside the rig when it is used as a base station. It naturally matches the rig in height and colour – gun metal grey – with the front panel and surround in a darker shade. The front panel of the rig and the power supply are made of plastic, as opposed to the usual aluminium casting. I imagine that this can be withdrawn to give access to the microswitches, etc on the front of the unit for any servicing which might be required.

The receiver is a synthesized triple conversion superheterodyne, the intermediate frequencies being 45.05MHz, 8.83MHz and 455kHz. It gives either all nine of the amateur bands or acts as a general coverage receiver from 100kHz to 30MHz with no breaks. Control of this facility is enabled by a microswitch to the lower right of the main tuning control marked '1MHz'.

It is an all-mode unit, receiving or transmitting in LSB, USB, CW, AM, FM, and either AFSK or FSK for RTTY or AMTOR, but naturally only transmits within the amateur bands. However, when the rig is in the FM transmit mode it operates as a double conversion superheterodyne, the intermediate frequencies being 36.22MHz and 45.05MHz. There are two digital VFOs which are controlled by the microswitches discussed below.

It has no bearing on operation by a user, but I feel I must list the number of transistors, etc which are used in the set. When the automatic ATU is incorporated, as is the case with the review unit, there are 174 transistors, 22 FETs, 58 ICs and 277 diodes! When used as a mobile installation, the unit requires 12 to 16 volts, negative earth, with a current consumption of 1.9 amps in the receive mode with no input signal and 20 amps in the transmit mode using full power. I was using the PS-50 mains power supply and, apart from the fact that the finning at the rear of the unit got warm, I was not aware of the requirement of 20 amps! It will give 200 watts PEP input on LSB, USB, CW, FM and FSK, with 110 watts PEP in the AM mode.

I will not quote all the figures for sensitivity and selectivity, except to say that the rig has dual IF crystal filters for SSB, an IF shift circuit (the same type of arrangement as in the TS820/830 series) and a tunable notch filter. So, you can appreciate that I had no problems on this issue.

There are four switches on the front panel, the top left-hand one being the power on/off switch. Below this are three switches in a row. The left-most one of these actuates the voice synthesizer unit, VS-1, if fitted to the unit as an optional extra, as on the review sample. A female voice announces the frequency and for a dial setting of, say, 14.200.0 she will say 'One four point two zero zero zero zero'. The last digit is not shown on the dial unless a small modification is carried out inside the rig. This merely means cutting out diode D66 on the control unit.

The next switch is the noise blanker, followed by the attenuator switch, both push on/push off. When the latter is in circuit the incoming signal is reduced by approximately 20dB. Below this is the ALC/PWR/SWR switch.

Under this are three more switches. The left-hand one is labelled 'SEND/RECEIVE' (for manual operation), the centre one 'AUTO/THRU', and the right-hand one 'AT TUNE'. Below these are the microphone and earphone sockets.

Which mode?

To the right of this lot is the MODE/KEY (numeric keypad) panel. These keys are used to select the desired mode of operation (USB, LSB, CW, AM, FM and AFSK), and are announced by the initial letter of each mode being heard in CW as the key is pressed. This, of course, is of great benefit to a 'white stick' operator, as when combined with the voice synthesizer he or she will know exactly what mode and what frequency the unit is set for.

The lower row of the microswitch keys are marked 'PG S1' and 'PG S2'. These are for program scan, a very interesting facet. It works in the following manner. Using PG S1 first, you select memory channels 6 and 7 and enter the lower frequency limit in channel 6 and the upper limit in channel 7. Then enter the VFO mode by pressing the 'VFO/M' key, then the 'SCAN' key, and the unit will scan through the frequency range decided upon in 10Hz steps for USB/LSB/CW/AFSK and 100Hz steps for AM and FM. It will then return to the lower limit to start again unless stopped by pressing the 'PTT' switch or the 'CLEAR' key. The same thing is available with PG S2, which uses channels 8 and 9, thus allowing the operator two separate ranges of scan.

These keys can also be used numerically, ie they can enter a frequency of the operator's choice. When you press 'enter' in either 'VFO A' or 'VFO B', a line of '---' appears. The desired frequency is then keyed in. It is necessary to remember to key the first two digits in before the decimal point, even though they may be zeros, otherwise keying in Radio 2 on 909kHz, for example, would give you either 90.900MHz, which would be refused by the unit, or 9.090MHz which, of course, is the wrong frequency. This method of entering a frequency also applies when one just wants to enter a single frequency when receiving.

The display opening along the top of the front panel shows the frequency as six digits (the seventh digit is enabled by cutting out diode 66, as mentioned previously). In the centre in blue and across the top in red from left to right are

MEMORY CHANNEL, SCAN, 'A', VFO, 'B', SPLIT, RIT AND XIT. Two digits are displayed for the memory channel, eg 01, 02 etc, and in the case of the VFO the letters 'VFO' are illuminated, plus 'A' or 'B' to show which VFO is in use.

To the left of the memory channel display is the meter, which can give three readings when in the 'transmit' mode and acts as an S-meter when in receive. To the right of this and running along the bottom line of the display opening are six little indicators, from left to right, 'ON AIR', 'M.SCR', '1MHz', 'F.LOCK, 'NOTCH' and 'AT TUNE'. Under each of these is a little LED.

No backlash

In the centre of the front panel is the tuning knob. Gone are the days when one expected beautifully cut reduction gears split to avoid backlash with heavy duty bearings, etc. Today the VFO tuning is controlled by a rotary optical encoder in which two different clock signals, 90° out of phase, are fed into the 7800 chip by way of two other chips, a 4011 and a 4033, which tell the 7800 which direction the tuning knob is being turned! The control tunes in 10Hz steps, at a rate of about 10kHz per revolution when turned slowly and 100kHz when spun quickly.

To the right of the main tuning knob are six microswitches under the heading 'FUNCTION'. 'RIT' and 'XIT' shift either the RECEIVE or TRANSMIT frequency (or both) ±1.2kHz; 'T-F SET' allows rapid checking of the transmit frequency during SPLIT operations; 'A/B' switches from one VFO to the other; 'SPLIT' allows the use of one VFO for transmitting and the other for receiving; and 'A=B' will make VFO 'A' equal to VFO 'B'.

On the right-hand side of the front panel we have four concentric controls, giving eight variations. At the top left is the MIC/CARRIER control, top right SQUELCH/NOTCH, bottom left RIT-XIT/IF SHIFT and bottom right AF/RF (gain). At the bottom of the panel, under the 'mode/key' assembly, there are six microswitches in two lines of three. From left to right these are: 'M/V' (used to recall a frequency from memory to the VFO); 'SCAN', which if pressed when in the VFO mode will initiate program scan, and if pressed when in memory operation will cause the unit to scan the memory; 'CLEAR', which is used to cancel memory storage operations or to cancel a direct keyboard entry; 'VFO/M', which switches between the VFO and memory frequencies; 'M.IN', used to enter a frequency into the memory storage; and 'ENT', mentioned previously. This is used to enter a frequency directly from the numeric keypad.

At the bottom right of the front panel is a group of microswitches and a five position rotary switch. The 1MHz switch allows the operator to choose the general coverage operation of the receiver, ie between 100kHz to 30MHz. All nine bands are controlled in this manner, which allows a very quick check on the conditions on various bands.

Four more microswitches complete the large number of variations which are available on this equipment. They are, from left to right, 'F.LOCK', which will lock the frequency indicated; the speech processor switch 'PROC'; 'NOTCH' filter switch; and AGC, slow or fast.

I was very surprised to find that the notch control was not effective against SSB, AM or FM type signals. When working today's crowded bands it seems to me that the elimination of interfering QSOs is a necessity.

There is no means of switching the AGC off altogether. The fast position of AGC was best for RTTY and, in fact, was used when working AMTOR, but I felt that if one worked a lot of AMTOR the reception of weak stations might prove difficult with no means of switching it off.

Selectivity

The last control is the five position rotary switch. This controls the selectivity, and when placed in the 'AUTO' position the rig automatically uses the correct selectivity (filter) for the mode in use. One can, of course, override the AUTO by turning the switch. The unit I had for review was equipped with both the YK-88C, used in the N position, and the YK-88SN, which is used in the 'M1' position. When using the YK-88C filter the width can be altered for three mode, SSB, CW and FSK. SSB can be either 2.4kHz or 1.8kHz and both CW and FSK can be 500Hz or 270Hz. The desired filter width can be selected by changing the jumper line connection in the IF unit; I thought this was an excellent facility.

On the rear of the unit are a number of sockets giving many options. On the left-hand side there are seven means of connection, and to the left of this assembly are two DIN sockets, the upper one being labelled 'REMOTE' and intended to control a linear amplifier. There are also connections for an external control relay, isolated from the chassis, one from the PTT circuit intended for a foot operated PTT switch, and a 12 volt supply at 10mA which is ON on transmit.

The DIN socket below this is a 13-pin version, which among other things is intended for the input and output of data. This raises all sorts of interesting possibilities. As mentioned earlier, there are already 100 memories available, but with the proper interface and a computer the facilities appear limitless.

There are three 'phono' type sockets to the right of the DIN sockets, and from top to bottom these are 'AFSK IN', 'AFSK OUT' and, very helpful this, a blank socket with no internal connections. At the bottom is the GROUND connection in the form of a wing nut and the antenna socket, the usual SO259 type.

On the right-hand of the rear panel there are eight connections. Starting on the top line there are three preset potentiometers, from left to right, 'ANTI-VOX', 'DELAY' and 'VOX GAIN'. I feel that readers will appreciate the use and meaning of these controls so I shall not elaborate. Below these is a 6-pin DIN socket designed for connection to the computer interface IF-232/IC-10, which is available as an optional extra. Two more sockets are below this, the left-hand one being the KEY socket requiring a normal ¼in jack plug, and on its right a 3.5mm extension speaker socket. At the bottom of this assembly is the dc power connector socket. When the mains power supply unit, PS-50, is used, a pre-prepared lead is included to plug straight into this socket from the PS-50. Supplied with the unit as standard is a battery lead intended for connection to the car battery. This also terminates in the correct male plug for the dc socket.

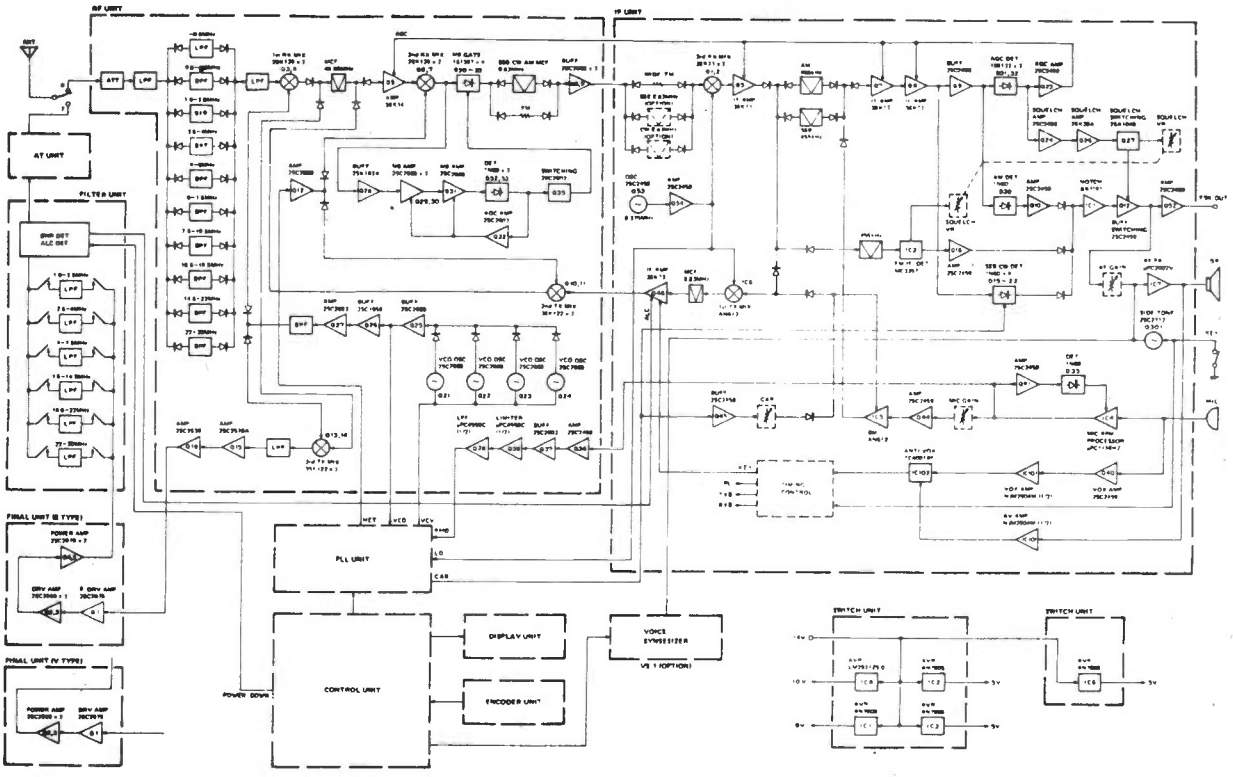
There are also various adjustments which the owner can carry out without having any test equipment. These are the digital display calibration using the calibration cable supplied, arranging for the optional 10Hz display resolution, mentioned earlier, and altering the CW zero beat frequency, which can be varied between 400Hz and 800Hz to suit the operator. One can also alter the side tone level and change the beep tone output. As supplied it emits the initial letter of the mode in use in the morse code. This can be changed to give just a single beep by cutting out diode D56 on the control unit. Also, the external keying relay for a linear amplifier can be enabled. To do this, one just has to move a jumper wire from the 'OFF' socket to the 'ON' position.

Automatic antenna tuner

A word or two about the automatic antenna tuner, AT-440. As I said before, this item was installed in the review rig, and during the short review period I found it a great help in speedy operation. Although the equipment operates from 1.8MHz (Top Band), the antenna tuning unit will only function from 3.5MHz to 29.7MHz. This is a point that must be remembered. However, given that restriction, its operation was excellent.

My antenna is a Sagant EL-40X 40/80 metre dipole up about 30 feet, and it will also function on 20 metres. Using this antenna everything worked as it should. To operate, one switches the 'AUTO/THRU' switch to the 'AUTO' position, and presses the 'AT TUNE' switch to ON. The 'AT TUNE' indicator now lights and the unit begins tuning. Then the CW light comes on, and after a short time the 'AT TUNE' light goes out and the motors stop turning. One presses the 'AT TUNE' microswitch to the off position and proceeds to transmit. Everything is now in resonance.

TS-440S BLOCK DIAGRAM



I should mention the operation of the 100 memories. One can put any frequency into any memory, complete with the mode, and recall it when required. I have already mentioned 'program scan', but apart from that any sequence of frequencies can be stored. Having stored these frequencies, they can be recalled by first pressing the 'VFO/M' key to enter the memory mode, and then either pressing the 'UP' or 'DOWN' key or turning the main tuning knob. An interesting facility.

The unit will scan from channel 00 to channel 99 at approximately 3-4 second intervals. You can stop scanning at any time by pressing the CLEAR key or the microphone PTT switch. Pressing the PTT switch will allow you to continue scanning from the point at which you stopped, but pressing the CLEAR key will put you back to the beginning. To resume scanning just press the SCAN key again.

Only the memory channels with data entered are scanned. One may also specify which memory groups one wants to scan. To do this, you enter the memory mode by pressing the 'VFO/M' key. The groups are divided into sets of ten, eg 00-09, 10-19 etc, so you then have to press and hold down the SCAN key while entering on the numeric keyboard the number of the group you wish to be scanned. The group 00-09 counts as 0, the next group, 10-19, being 1 etc, ending up with the group from 90-99 which is keyed in as '9'. Another variation is available which is a means of memory channel lockout. This means that you can temporarily skip unwanted channels during a scan. To do this, assuming you are still in memory mode, select the memory channel you wish to skip using the numeric keypad, the main tuning knob, the UP/DOWN switches on the microphone or the BAND switches (such a choice!), and then press the CLEAR switch. You will see a decimal point appear after the figures giving the memory channel number. This indicates that the particular channel will be skipped. To cancel, select the channel again and press the CLEAR switch.

I have endeavoured to give a brief description of this latest offering from Trio, but it is really impossible to do justice to the unit in the time of a review. The variations available to the operator are so great that I feel I have only scratched the surface of the equipment's facilities. There was only one thing missing, it seemed to me, and that was the provision of a transverter take-off socket. I would imagine that somebody buying this unit would expect everything to be there for him to use, and in view of the excellent performance of the rig and the growing interest in VHF communications I would have thought this facility essential.

I had a very pleasant time using the equipment, and enjoyed perfectly effortless QSOs. Everyone whom I worked commented on the very good audio quality, and their signals were also very readable. Stations in the normal broadcast band were also received well.

I had several contacts in the AMTOR mode, all of which were achieved with no problems. It is interesting to note that no modifications appeared to be necessary in order to operate AMTOR, because the recovery time of the unit was within the allowable limits of the system. RTTY was also used, and in this mode it was possible to use full power when transmitting without any ill effects. This is achieved because of the high efficiency

PRICE LIST

TS-440S	£950.00
AT-440 automatic antenna tuning unit	£125.00
PS-50 power supply	£192.00
VS-1 voice synthesizer	£27.70
MC-42S fist microphone with UP/DOWN buttons	£18.00
MB-430 mobile mounting bracket	£13.56

All prices include VAT, but carriage is £7.00 extra for the larger items

of the cooling system. One could only use full power, key down as it were, for periods up to about one hour, but in practice I was spending some of the time receiving, so full power was in fact used for longer than one hour.

Before concluding, I must mention the idea and design of the cooling system itself. It is of aluminium construction and combines forced and natural air cooling for maximum heat radiation, even during full power operation. It uses what is called the TS (total shutter) system. The idea of this is to install a shutter panel to prevent cavitation and the return of hot air inside. The design makes use of a structural member at the back of the chassis, and allows the cooling fan to blow air out of the back of the unit. The air flow cools the fins behind and also flows above the final and filter units and out through the back of the set. The cooling fan uses a quiet dc motor that produces little electrical noise, and is turned on when the temperature rises above a preset level. All this results in a cooling system which can handle a continuous duty cycle transmission for periods exceeding one hour.

The automatic antenna tuning unit also worked perfectly, and gave me the quickest tune up I have ever had.

There are a number of accessories available for the unit. Both the AT-440 internal ATU, the VS-1 voice synthesizer unit, the MB-430 mobile mount and the MC-42S UP/DOWN microphone are classed as optional extras. The prices of all units can be seen in the table. REW

LW ROD LOOP DXer

This unusual design dramatically increases long wave reception ranges

by Richard Marris G2BZQ

The long wave band seems to have been rediscovered by amateurs who had either never listened to it or who had forgotten all about it! There is far more activity on this band than first meets the eye (or ear). Forget BBC4 on 200kHz and the other high power stations; there is a lot more in between the 'big boys'.

In the April 1986 issue of *R&EW*, an article of mine appeared entitled *Long wave antenna* , which aroused considerable interest. In his monthly column *Medium Wave DXing* , Steve Whitt has mentioned this LW loop several times, and is now giving regular information on what might be heard on the band. In addition, the writer has received several communications from some very enthusiastic listener/constructors.

The published LW loop (in 'box' configuration) was originally designed in 1984 and tested over a period. Meanwhile I have continued to mess about with loops for all frequencies between the long waves and 32MHz, and even lower in frequency. This has included some interesting experimental work on ferrite rod antennas. I have always felt that a ferrite rod design could be evolved giving a far superior performance to a transistor radio, which is now the accepted 'norm' for everyday entertainment listening.

Information on ferrite rod antennas is not plentiful. A few suppliers will offer you 5/16in or 3/8in diameter rods fitted with MW, or MW plus LW, coils for building into radios. To these can be added the possibility of using commercial rods, plus MW and LW coils, plus coupling coils to assemble your own antenna. The length of the rods appears to vary between about 3½in and 8in. Of course, we must not forget the multitude of transistor radios, usually of Eastern manufacture, which contain a variety of rod antennas in a quite astounding variety of lengths and diameters.

Search the textbooks and you will find the odd circuit for a radio using a ferrite rod antenna. But look for detailed information on what they really do and how they do it, how to design them and how to improve their performance, and you will be disappointed.

Having experimented with ferrite rods, certain conclusions have been reached. Homemade and commercial coils have been used to make antennas for external connection to a good receiver. Odd titbits found in various publications were added, and then tried and tested. The important conclusions are as follows:

- It was found that the inductance of a coil increases substantially as it is moved from the end of a ferrite rod towards to centre.
- The longer the rod used, the greater the pick-up range of the antenna and the better the nulling.
- It was discovered that a narrow multilayer coil gave much better nulling and pick-up range than a solenoid wound coil.

With these points in mind, it was decided that it was possible to design a much longer range external LW rod antenna with superior nulling when compared with an external ferrite rod antenna using commercial LW and coupling coils. In the latter case the LW coil had, in accordance with instructions been located just inboard of one end of the rod, and the coupling coil just inboard of the other end. Using a good separate receiver it gave noticeably better results than a conventional transistor radio.

The following appeared to be necessary:

- Very long ferrite rods, which are not obtainable! It was therefore decided to super glue a number of 6 5/16in rods together end to end. For any reader trying this and using, say, 8in rods, it should be noted that a ferrite rod can be carefully cut using a junior hacksaw with a new blade (which will be useless thereafter). In tests it was discovered that 2 rods gave better results than one rod and 3 rods better than 2, but 4 rods did not noticeably improve results obtained

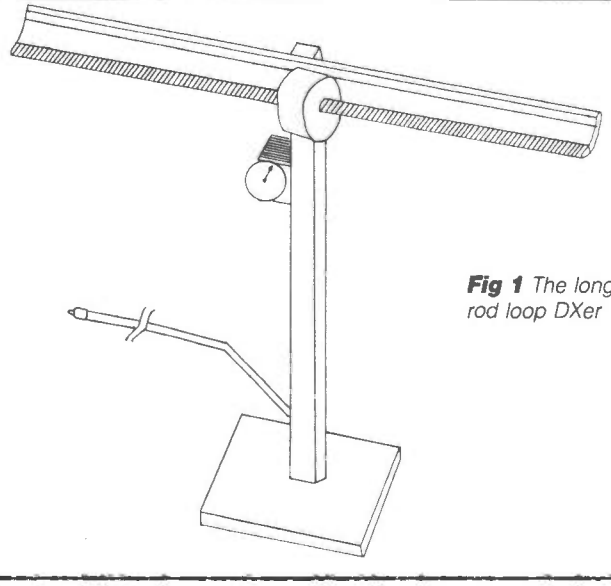


Fig 1 *The long wave rod loop DXer*

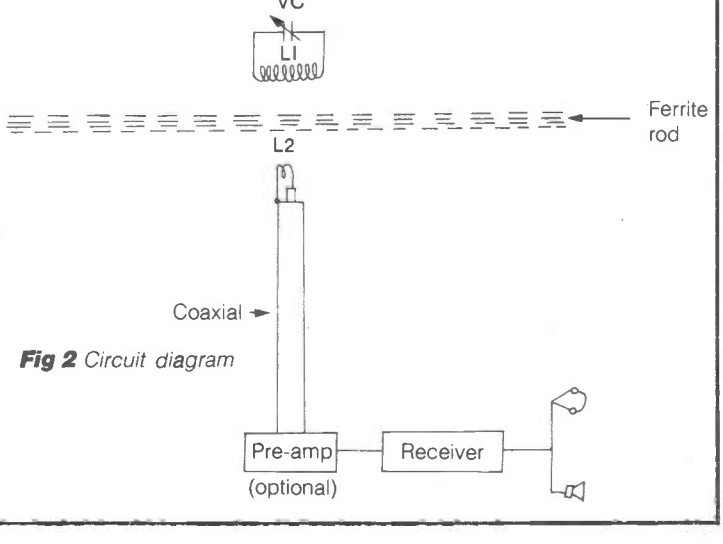


Fig 2 *Circuit diagram*

with 3. ⅜in diameter grade F14 rods were used.

■ A multi-layer narrow width coil, with the actual wire turns spaced apart. It was decided that this could best be done by constructing a bobbin, onto which would be wound layers of thin PVC-covered single wire conductor, the PVC effectively keeping the wire conductors apart in adjacent turns. Luck later helped the bobbin idea!

■ The resulting very long 15in rod would have to be securely supported, because a gentle tap will fracture a rod. This was found out the hard way, when the first 19in rod rolled off the table onto a carpeted floor!

The end result, after many trials and tribulations, appears in *Figure 1*, with the circuit in *Figure 2*.

The rod loop, *Figure 1*, consists of a 19in × ⅜in diameter, grade F14 ferrite rod, plus a multi-layer narrow width coil on a bobbin with a coupling coil wound over it. The whole thing was super glued to a wooded cross boom, supported by an upright member attached to a small heavy base. The end result was even more impressive than expected, with its long pick-up range and sharp nulling!

The circuit in *Figure 2* consists of an inductance L1 resonated by VC, which is a good quality, air-spaced 250pF variable capacitor. VC (see *Figure 1*) is mounted on the vertical upright, just under the coil, using a small piece of non-metallised circuit board. The L1/VC combination is coupled to the Rx input via a coupling coil L2 (wound over L1) and coaxial feedline. An optional preamplifier is shown, though I find this quite unnecessary with a good Rx.

Construction

The general form of construction is shown in *Figure 1*, and construction of each part is taken in turn:

1) The detail of the bobbin/winding is shown in *Figure 3*. Earlier experiments used bobbin handmade using paxolin sheet and tubing; until luck took a hand! The final bobbin, a moulded plastic one used by suppliers of small quantities of thin wire, contained 4oz of 22 SWG tinned copper wire. It has 1⅝in diameter cheeks, which are spaced 1³⁄₁₆in apart with a tubular core of ⁷⁄₁₆in inside diameter, which is a comfortable fit over a ⅜in diameter ferrite rod.

Conveniently, the moulded bobbin has a small slot to bring out the start of the wire, and could be fabricated using *Figure 3* as a guide.

The wire used for L1 and L2 is 1/0.6mm (1.2mm o/d), PVC covered. For L1, 10 layers of 20 turns each are close wound, giving a total of 200 turns. L1 is covered with 4 layers of PVC insulating tape, as shown. Coupling winding L2 consists of 11 turns of the same wire, close wound as shown, and is covered with PCV tape. 4in lead-outs are brought out from the ends of each winding. The number of turns for L2 was found experimentally as the best to match into 70 ohm coaxial feedline.

2) At this stage the 15in ferrite core rod was fabricated using three ferrite rods, each 6⁵⁄₁₆in long, super glued together end to end, making absolutely sure that the ends were clean by wiping them with surgical spirit. Great care was taken to ensure that the resulting rod core was absolutely straight.

3) The wooden boom arm consists of two pieces of wood, both 8¾in × ⅜in × ¾in, and another piece 19in × ⅜in × ¾in, carefully glued together in a 'T', as shown in *Figure 4*. The ferrite rod *is not* attached at this stage. A vertical support of ½in × ⅞in wood is glued in the centre, at right angles as shown, and the other end attached to a small heavy base. The whole thing is then doped with a teak colour spirit based wood dye *except* for the end to which the ferrite rod is eventually attached.

4) The 250pF variable capacitor VC is fitted on the vertical arm using a small piece of non-metallised board.

5) At this stage the bobbin/winding is slipped over the rod and the rod *taped* (not glued) to the boom arm in the position shown (*Figure 4*). The lead-outs from L1 are soldered across VC and L2 to a length of coaxial 70 ohm feedline cleated to the rear of the upright and taken to the Rx antenna input.

Final adjustments

After tuning the Rx to BBC4 on 200kHz VC, the rod loop should be resonated for maximum signal, as a simple test of workability. Next, the Rx should be tuned

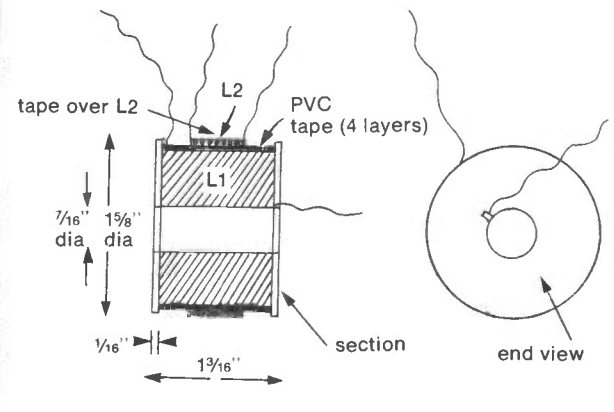


Fig 3 *Bobbin and winding details*

L1, L2 = 1/0.6mm (1.2mm o/d) PVC covered wire
L1 = 10 layers of 20 turns per layer – close wound = 200 turns
L2 = 11 turns close wound

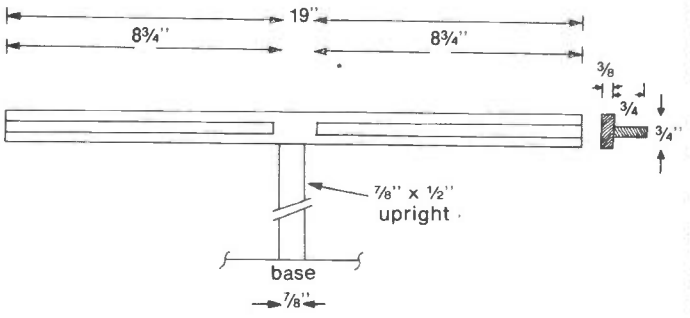


Fig 4a *Wood frame*

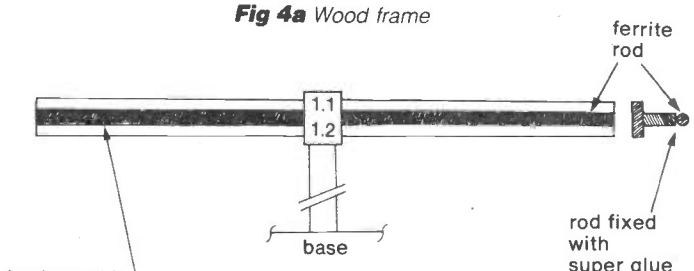


Fig 4b *Side view*

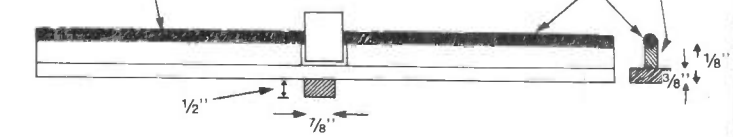


Fig 4c *Top view*

to approximately 150kHz (2000 metres) and resonated for maximum noise. The Rx should be retuned to the nearest weakish station and VC resonated again. If the loop is rotated the maximum signal will be located and the maximum nulling found at 90°, with a complete loss or reduction in signal strength.

This procedure should be repeated down the high frequency end of the band at 200kHz (1000 metres) for maximum noise, followed by Rx retuning to the nearest signal. The rod loop covers 150-300kHz (2000-1000 metres) with a good frequency overlap at the band ends. If VC is replaced by a 500pF variable, then the rod loop will resonate LF of 150kHz, but the tuning will be very sharp on the LW band and an SM drive will be needed.

It must be stressed that the rod loop has not been designed to pick up BBC4 on 200kHz and the other big boys in France, Germany and Luxembourg. Even the cheapest, least efficient LW transistor radio will do this!

Comparative tests indicate the rod loop's longer range and nulling potential. On the model described comparative tests were conducted using the following test set-ups:

Rx set-up A: A good transistor radio with in-built ferrite rod antenna.

Rx set-up B: A good quality valve receiver using an external ferrite rod antenna (consisting of an 80in long, ⅜in dia ferrite rod plus a commercial LW winding just inboard from one end) and a commercial coupling coil just inboard of the other end. Positions are as the manufacturer's specification.

Rx set-up C: The Rx used in B but using the rod loop DXer.

All tests were conducted indoors in an apartment block, where the antenna would normally have to work. The results were dramatic! The tests were conducted near to the extreme ends of the band away from the 'big boys'.

A signal which could not be heard on A would be quite audible on B, and of very reasonable signal strength on C. Weak signals on A were of comfortable listening strength on B and of good signal strength on C. Using the rod loop, interference from powerful stations could be greatly reduced or nulled out by slow rotation of the loop. BBC4 on 200kHz did present difficulties, however, believed to be caused by the several relay stations in the UK, and does not respond too well on nulling. Apart from that, the nulling is sharp; if one is looking for a particular station of distant origin, it is a good idea to estimate the bearing for initial loop direction. It has to remembered that stations on the sai or recriprocal, bearing cannot be nul out for obvious reasons.

Electrical and other similar interf ence can be greatly reduced, or elim ated, by rotation of the rod loop.

Caution! It was found that if the loop was placed on top of an ac mains this introduced mains hum, picked up the rod from the mains transformer. T rod loop is operated approximately 3 f away from the Rx standing on a table

Having successfully completed above tests, the stage arrived for final assembly: the point of no retu The tape which is holding the 19in roc the boom arm has to be carefu removed and the rod glued to the bo arm.

Using super glue results in a hi speed operation, as this stuff sets quickly. A quick setting Araldite will g a few minutes breathing space to ap the adhesive and line everything up.

In conclusion, it can be said that tests made and from general usage, t pick-up range of the rod loop is drama and the nulling impressive. The impli tions of this design are obvious to tho wishing to use the same principles reception under 150kHz.

LINEAR ICs

This part of D Corder's occasional series deals with

TIMERS AND OSCILLATORS

In this article I hope to outline the most useful types of timer and oscillator integrated circuits, along with some specimen circuits which hopefully will have a practical use.

The 555 family

The 555 family includes the standard bipolar 555, along with the improved bipolar replacements such as the LM555, the low power CMOS ICM7555 and, the most recent development, the TLC555. A bipolar 555 may be replaced with any of these alternatives.

The standard 555 is a good, accurate general purpose timer, but does experience problems of interference through the supply rails when it resets, meaning that a large value electrolytic is needed to decouple the supply. It also has a rather high current consumption of 10mA at 15V, especially if the circuit is to be battery powered.

The 7555 is a CMOS version of the 555 and has the advantage of a much lower supply current of around 80μA, a wider supply voltage range of 2V to 18V and, as a result of its lower supply current, it does not upset the supply rail.

The TLC555 is the most recent development and has a low supply current (360μA at 15V), does not upset the supply rail and, most important, in the astable mode it will oscillate up to 2MHz.

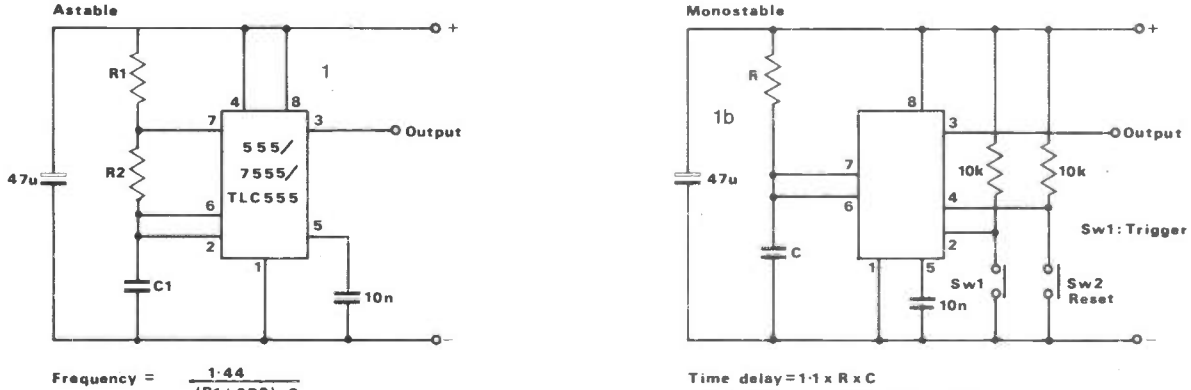
With both the 7555 and the TLC555, the timing capacitor should be a low value, low leakage non-ceramic capacitor and the resistor a high value one if full advantage of the low supply current is to be taken. This reduces the current taken by the timing components to a minimum. This technique cannot be used with the standard 555 since it draws too much current through its threshold pin. If a high value resistor was used it would result in inaccurate timing.

Ray Marston has covered the 555 in his *Data File* series (July-October '85), but for the sake of completeness the basic circuits are shown in *Figure 1*. In the October 1985 issue several ramp generating circuits are shown, and if the TLC555 is used in these then their upper frequency can be greatly extended. The LM335Z constant current source described in my last article (June 1986) may be used to replace the transistor and associated components. However, it does not work well at high frequencies.

A circuit which illustrates the versatility of the 555 as well as being very useful in its own right is given in *Figure 2*, along with a PCB design. Veroboard is also a suitable alternative since the layout is not critical. The circuit is for a continuity tester which, unlike the simpler circuits, will only respond to a genuine low resistance.

This circuit works on the fact that the reset pin of the integrated circuit (pin 4) must be taken more than about 0.7V positive to enable the otherwise ordinary astable. This pin is normally taken to the positive rail. In this circuit the voltage is adjusted to just enable the oscillator by means of VR1. Any increase in the resistance between the probes will act as a potential divider along with R and reduce the voltage, thus disabling the oscillator. R may be made lower in value to increase the circuit's sensitivity, but this increases the current consumption and also the current through the item under test. The supply to VR1 should be stabilised and isolated from the supply to the 555. This is most easily done by using a 78L05 regulator as described in my last article. To get the most accurate settings of VR1, and therefore the greatest sensitivity, it should be a multiturn, although the PCB has been designed to accept a normal type as well. If the 555's supply is not isolated from that of VR1 then problems due to the supply rail disruption that the 555 produces will arise. Since this is not a critical circuit, or one that will be on for long periods, then the standard bipolar version may be used since it is the cheapest.

The 556 is simply a dual 555 and is very useful since they are in the same package. For instance, one of the sections may be used as a timer (monostable configuration) and the other as the alarm oscillator (astable configuration). A long period astable may also be made with the 556. Both of the sections would be configured as monostables, one triggering the other when it reaches the end of its time. The block diagram of this circuit is shown in *Figure 3*. The mark to space ratio of this astable is set by selecting the times for the monostables to give the correct ratio. If the circuit is for general purpose use then the bipolar 555 may be used for this circuit, one for each monostable, but the



Frequency = $\frac{1.44}{(R1+2R2)\times C}$

R in ohms; C in farads; frequency in Hertz
Time output high = 0·693 x (R1 + R2) x C
Time output low = 0·693 x R1 x C

Time delay = 1·1 x R x C
R in ohms; C in farads; time in secs.

Fig 1

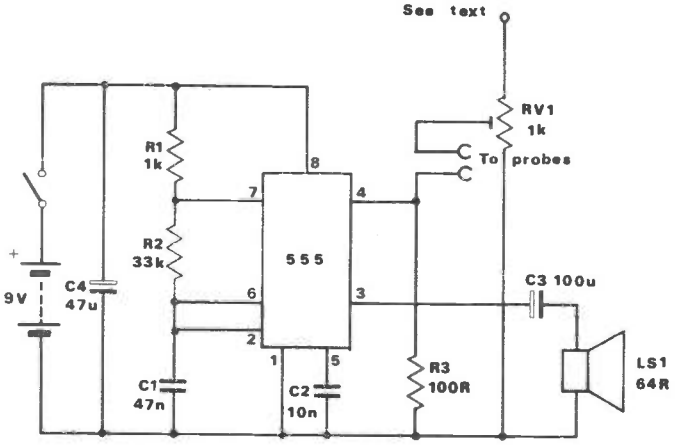


Fig 2

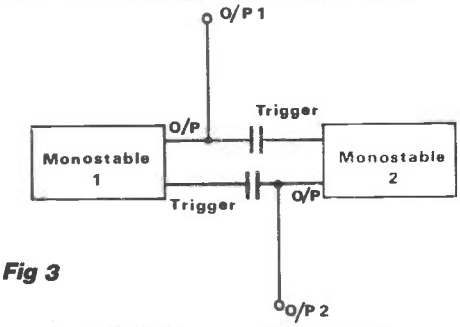


Fig 3

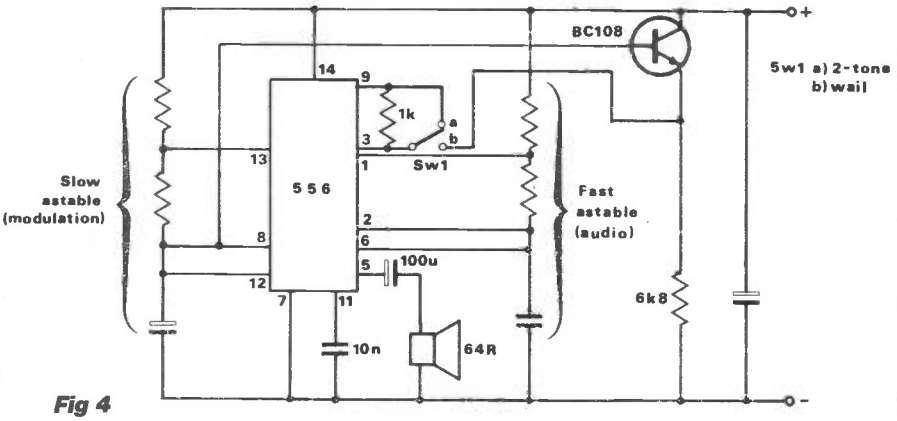
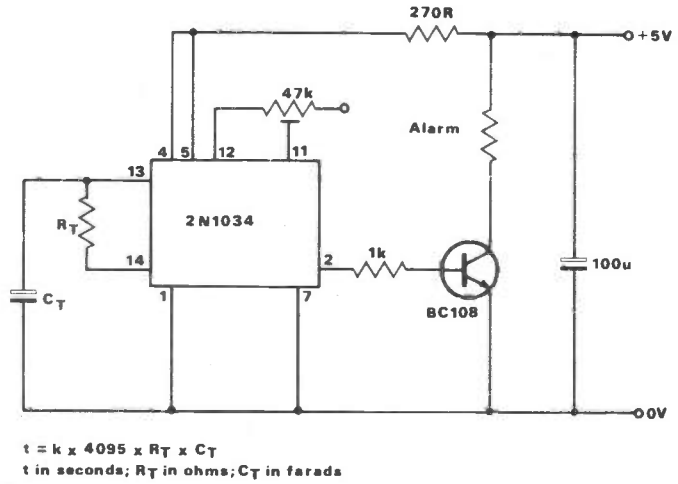


Fig 4



$t = k \times 4095 \times R_T \times C_T$
t in seconds; R_T in ohms; C_T in farads

Fig 5

556 is a far better solution. Another use of the 556 is as a modulated alarm.

One of the sections produces a square wave or ramp of low frequency, which is then used to modulate the second via a resistor. The pin used for this is the control voltage pin (pin 3 or 11). The higher the voltage on this pin (up to the positive supply voltage) the lower the frequency of the astable (or the longer the time delay with a monostable). Thus in this circuit the changing voltage from the first astable frequency modulates the second. This type of alarm is certainly more penetrating than the normal steady type. A circuit is shown in *Figure 4*, values of the timing components being selected to provide the required sound. The transistor is used when a sawtooth signal is used to modulate the oscillator. It acts as a buffer to avoid the different voltage levels in each section upsetting the operation of the modulating oscillator.

ZN1034

This is the other timer (monostable) device, and is useful for generating long time delays which the 555 cannot. It can produce delays of up to several days. Inside the integrated circuit itself there is an astable, frequency set by the timing components. This feeds a 12 stage divider, which when it reaches the end of its count triggers the output.

A potentiometer connected between pins 11 and 12 with a value of between 50K and 500K allows adjustment of the time to compensate for timing component tolerances. The standard circuit is given in *Figure 5* along with the formula for time delay. K depends on the value of the trimmer; for the 47K used in this circuit it is 0.8324, this preset giving an adjustment range of ±12%. The timing resistor should have a value of between 15K and 5M, and the timing capacitor should be greater than 33nF. For example, a 1M resistor and a 10μF capacitor would give a delay of just under 10 hours. Supply voltage should be greater than 5V, 9V being ideal for this circuit. At 5V the supply current is 3.5mA.

The output pin 2 goes high at the end of the interval. This pin can only supply a maximum of 25mA so a transistor buffer should be used, or alternatively it could be connected to the reset pin of a 555 astable. A silicon diode will have to be used to drop the residual voltage from the output of the ZN1034, this being about 0.2V. The 555 then provides an alarm.

LM3909

This is another astable, which like the 555 can run from a few hertz up to audio frequencies. Its biggest advantage is that it will operate from a single 1.5V cell yet still produce pulses large enough to flash an LED. For all other astable applications the 555 is cheaper.

The basic circuit exploiting this useful feature is shown in *Figure 6*. It is very economical on components, and since it only draws 500μA at 1.5V (with whatever the LED current is) it can easily be used where power consumption must be kept low, for example as a power on indicator in battery powered equipment. If the

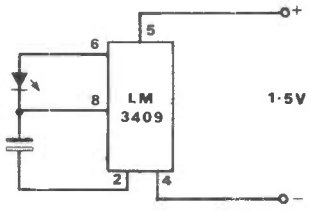


Fig 6

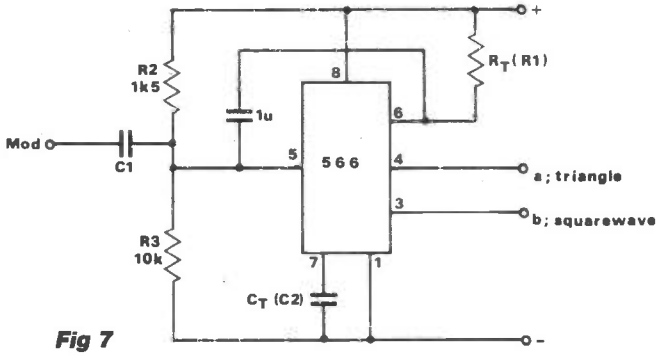


Fig 7

Frequency $\frac{2 \times (V^+ - Vmod)}{R_T \times C_T \times V^+}$

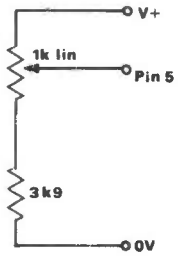


Fig 8

battery voltage is greater than 1.5V then a resistor should be used to drop the excess voltage in order to maintain the low current consumption. This circuit also works well as an alarm indicator, a flashing light being much more likely to attract attention than a steady one.

Above 6V the simple circuit ceases to operate, the LED remaining on all the time. The flash rate is dependent upon the supply voltage, higher voltages increasing the flash rate, and the capacitor, larger values giving slower flash rates. The brilliance of the flash is controlled mainly by the capacitor, larger values giving a brighter flash, and the supply also has a limited effect, higher voltages giving a brighter flash.

NE556

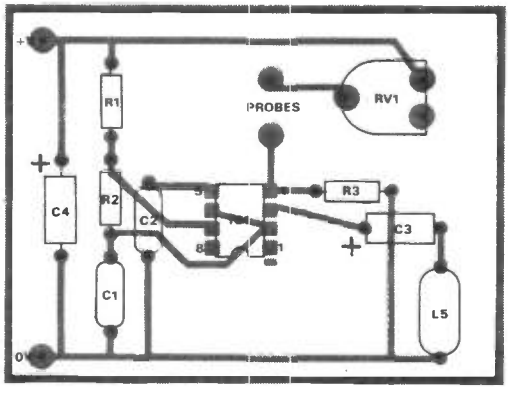
This is the final integrated circuit under consideration. With a single resistor and capacitor it produces highly accurate triangle and square waves over the range 0.5Hz to 1MHz. A control voltage pin allows frequency change over at least a 10:1 range. Using the basic circuit, along with the formula for its frequency output, R1 should have a value of between 2K and 20K. The voltage on the control pin should lie between three quarters of the supply voltage and the supply voltage. If the applied modulating signal lies within these limits then it may be applied without C1. The modulating pin on this device is more useful than that on the 555, because as well as allowing a large frequency change its effect can be calculated by including the correct value in the equation. If an alternating voltage is used for modulation then the frequency deviation may be calculated by working out the frequency first with the minimum voltage and then with the maximum voltage, the difference in frequency being the deviation.

If R1 and C2 are made fixed components then the frequency may be altered by using the circuit in *Figure 8* in place of R1, R3 and C1. By using various fixed components for timing and switching these a versatile function generator may be made. No layout for this circuit has been given; it is not important and depends on whether it is intended to alter the timing resistor or modulating voltage to change the frequency.

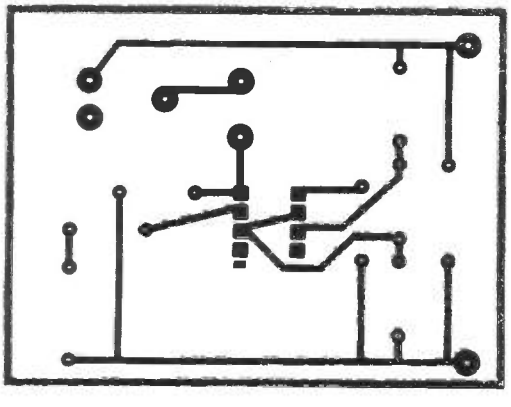
This circuit is very useful for testing the performance of audio amplifiers, as well as being used as a signal injector. Cross-over distortion in an amplifier may be detected by using the triangle output injected at the input and an oscilloscope and suitable load connected to the output. Any cross-over distortion will show up as a 'glitch' on the otherwise straight sides of the wave. The linearity of the amplifier may be checked with the same set-up. If the amplifier does not amplify linearly then the otherwise straight sides of the triangle wave will become bent, and the worse this is, the more non-linear the amplifier.

The high frequency response of an amplifier may be determined using the square wave output of the circuit at around 10kHz. When viewed with a scope connected across a suitable load, a good square wave with a fast rise time should be observed. Any rounding of the edges of the wave or a slow rise time indicates a lack of high frequency response.

The low frequency response of an amplifier may be estimated by reducing the square wave frequency gradually. The tops of the square wave do not remain horizontal, but develop a slope. The more severe this slope at a given frequency, the worse the low frequency response. Where possible the oscilloscope should be set to dc coupling to avoid distorting the input. If the amplifier has no input blocking capacitor then one should be used of as large a value as possible since the output of the circuit is superimposed on a steady dc voltage. REW



PCB Component Side



PCB Copper Side

MICRO TO MICRO INTERFACING PRINCIPLES

by Alan Pickard

This article is intended to demonstrate from first principles what the requirements are to enable data to be transferred from one microcomputer system to another. The objective is also to introduce concepts rather than the minute detail of the two micros used, or interface chips, or programming of either machine. User manuals and data sheets will need to be referred to, especially where alternative micros or interface chips are utilised.

The two machines actually referred to are the BBC Model B and a simple micro, the now rather aged MK14, which was the pre-ZX80 Sinclair machine. It appeared around 1979 and was based on the SC/MP 8060 CPU.

Micro 2 8060 m/c Listing 1	Program to send data byte from user port to micro 1 user port (MK-14 ➔ BBC)
Micro 1 BBC Basic Listing 2	Program to receive data byte from micro 1 and display on screen (BBC ➔ MK14)
Micro 1 BBC Basic Listing 3	Program to send data byte from user port to micro 2 user port (BBC ➔ MK14)
Micro 2 8060 m/c Listing 4	Program to receive data byte from micro 1 and display on seven segment display (MK14 ➔ BBC)

Fig 1 *Programs required*

	Port B bits								
Register valves	7	6	5	4	3	2	1	0	Action
DDB at &FE62 = & FF	1	1	1	1	1	1	1	1	PBO-PB7 set to o/p
DRB at &FE60 = & 41	0	1	0	0	0	0	0	1	(Binary) ASCII code for A (data)

Fig 2 *Register contents for Port B*

When the MK14 was launched it provided a useful introduction to machine code programming and also to the relevant hardware. It is now common knowledge, however, that apart from restrictions imposed by the memory size and simplicity of design, the main limitations were due to the very poor hexadecimal keypad and so-called 'system' expansion.

After fitting a more suitable hex keyboard, upgraded monitor (in ROM) and cassette interface, it was possible to make proper use of the machine. Whilst it would have been interesting to have extended the machine to the VDU stage, this required more expense and 'bodging' of the main board, neither of which were considered to be worthwhile.

Having proceeded to the BBC Model B stage, the opportunity arose to investigate the use of the BBC micro as an 'instant' VDU for the MK14. Apart from being a useful hardware and software interfacing exercise, it would have been interesting to see the MK14 operate using a VDU screen instead of its tiny seven segment display.

A more practical example of interfacing the MK14 to the BBC micro would be to have the MK14 carrying out a dedicated task, such as controlling a simple robot, with its operating program(s) being stored on the BBC machine as hex files. These could then be downloaded from the BBC micro as required, thus dispensing with the tedious MK14 cassette operating system. Following on from this, the MK14 could act under the control of the BBC micro (via handshaking) and also independently, as required.

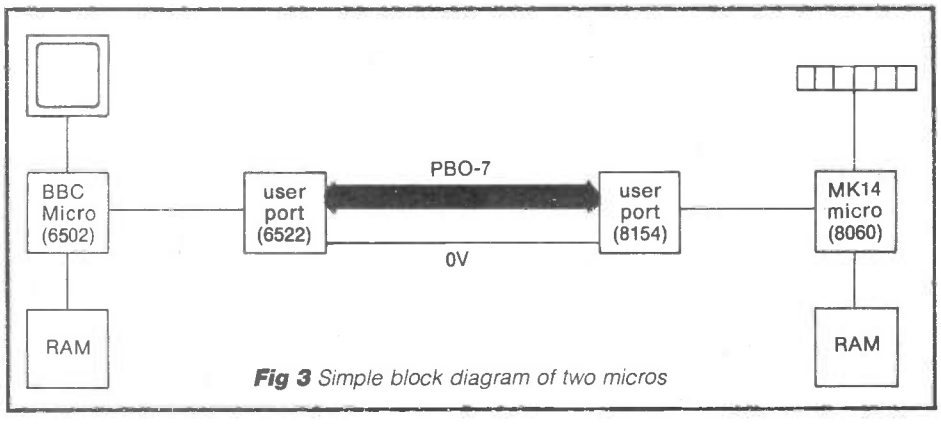


Fig 3 *Simple block diagram of two micros*

An example of micro to micro communication can therefore be demonstrated using the BBC micro and a simple micro such as the MK14 which utilises the 8060 CPU and is operated directly in machine code. Whilst some knowledge of the function of the MK14 and an appreciation of how to run simple machine code programs would be useful, and also similar familiarisation of the BBC micro, the reader should be able to adapt the principles to his or her particular machine(s). Simple hardware and software details are as follows.

The BBC machine has an 8-bit parallel user port which is utilised for communicating with the external microcomputer system. Although the BBC machine is designed to connect to a number of optional 'second' processors, this is via the tube connector which is a specific concept of the BBC system. In this exercise, use is made of the more straightforward general purpose user port. Thus, as already stated, the principles discussed should be easily understood and adapted for a machine other than the BBC micro (or MK14). Similarly, although the MK14 is chosen as the second micro, any other machine could be used, eg another BBC micro, Electron, Atom, ZX81, Spectrum, etc. In fact, any micro with an 8-bit user port facility.

System specification

The BBC micro has 32K ROM, 32K RAM and many advanced features, the details of which are beyond the scope of both this article and this interfacing exercise. The important facilities are the 8-bit programmable user port and the facility to write machine code programs (in this case via a 6502 assembler).

The MK14 is a very basic hex input micro with only 512 bytes of ROM and 256 bytes of RAM, but again the relevant

MK14 → BBC	
Load program (Listing 1) Program function: Set Port B to o/p Set bit pattern Return to monitor	
	Load program (Listing 2) Program function: Set Port B to i/p Read data register Print value Store value in screen RAM Print contents on screen
Run program	
	Run program

BBC → MK14	
Load program (Listing 3) Program function: Set Port B to o/p Set bit pattern Read data register Print contents on screen	
	Load program (Listing 4) Program function: Set Port B to i/p Read (read/write) register Load value into accum Load acc contents to display position
Run program	
	Run program

Fig 5 *Program sequence*

points are its 8-bit (programmable) user port and, of course, machine code facility.

Connection of these two machines and the subsequent transfer of data between them can enable us to get down to the 1s and 0s of the two CPUs and therefore have a good understanding of what is involved at this low level.

Objective

Before continuing, it is worth clarifying the objective of the exercise.

The (programming) task can be separated into four stages, as follows:

- MK14 program: Send data byte from MK14 (RAM) to BBC (RAM).
- BBC program: Receive data byte from MK14 into (screen) RAM and thus display on screen.
- BBC program: Send data byte from BBC (RAM) to MK14 (RAM).
- MK14 program: Receive data byte from BBC into MK14 RAM and then display on seven segment display.

See also *Figure 1* for a summary table.

Programming the interface chips

A microcomputer is usually equipped with an interface chip such as the 6522 or 8154 used in the chosen micros. Whilst these chips are usually as complex as the CPU itself, they can be treated fairly simply from a programming point of view.

The 6522 contains a data direction register (DDRB) associated with Port B. This register enables the programming of each of the 8 bits or lines of Port B to be set to input or output. For example, a binary value in this register of 0000 0011 would mean that PB0 and PB1 were set to OUTPUT whilst the remainder, PB2-PB7, were set to INPUT. All bits are set to input by default. The data register for Port B (DRB) contains the actual data value (bit pattern) to be sent or received, depending on the state of the data direction register.

For this exercise, as we are concerned with transferring parallel data bytes, the DDRB will be set to either all 1s or all 0s, depending on the direction of data transfer.

These two registers are memory mapped and are therefore treated as memory locations by the CPU. In the BBC micro, DDRB is located at &FE62 on the memory map and DRB at &FE60. An example of the contents of the two registers is shown in *Figure 2*.

The 8154 interface chip used by the MK14 can also be treated simply for programming purposes, although it is not as easy to program as the 6522. The relevant registers in this case are the Read/Write Port B register (same function as DRB in 6522). This register is memory mapped at 0A20H on the MK14. The other register is the output definition register B (ODB) which is memory mapped at 0A23H.

Details of the contents of the data and data direction registers of each micro can be seen in the program listings.

Listing 1
Parallel output from MK14 Port B to BBC Port B

Address	Instruction	Data	Mnemonic	Data	Functional description
OF 20	C4	0A	LDI	0A	Loads P1 with 0A00, address of I/O device
OF 22	35		XPAH P1		(0A00 → 0AFE)
OF 23	C4	00	LDI	00	
OF 25	31		XPAL P1		
OF 26	C4	FF	LDI	FF	Loads ac with IIII IIII
OF 28	C9	23	ST P1	+23	Store FF in 0DB at 0A23 (sets all bits to o/p)
OF 2A	C4	41	LDI	41	Loads 41 and stores at 0A21, Read/Write
OF 2C	C9	21	ST P1	+21	Port B, setting PB0-PB7 to 0100 0001
OF 2E	3F		XPPC		P ↔ PC return to monitor

Listing 1

Listing 2
Parallel input from MK14 Port B to BBC Port B

Line no	Program	Comments
10	REM MK14→BBC/2 AP83	
20	CLS	
30	? &FE62 = 0	Set Port B to input (data direction register B)
40	PRINT ~ ? &FE60 '''''	Print contents of data register (in decimal)
50	P% = &1500	Start address of m/c program
60	[	
70	LDA &FE60	Load acc w/ data reg contents
80	STA 32533	Store acc contents at screen loc
90	RTS	
100	]	
110	CALL &1500	Run assembled m/c prog
120	END	

Listing 2

Listing 3
Parallel output to MK14 Port B from BBC Port B

Line no	Program	Comments
10	REM BBC→MK14/3 AP83	
20	CLS	
30	? &FE62 = 255	Set data direction reg B to o/p
40	? &FE60 = 94	Set data reg B with data
50	PRINT ? &FE60	Print contents of data reg
60	END	

Listing 3

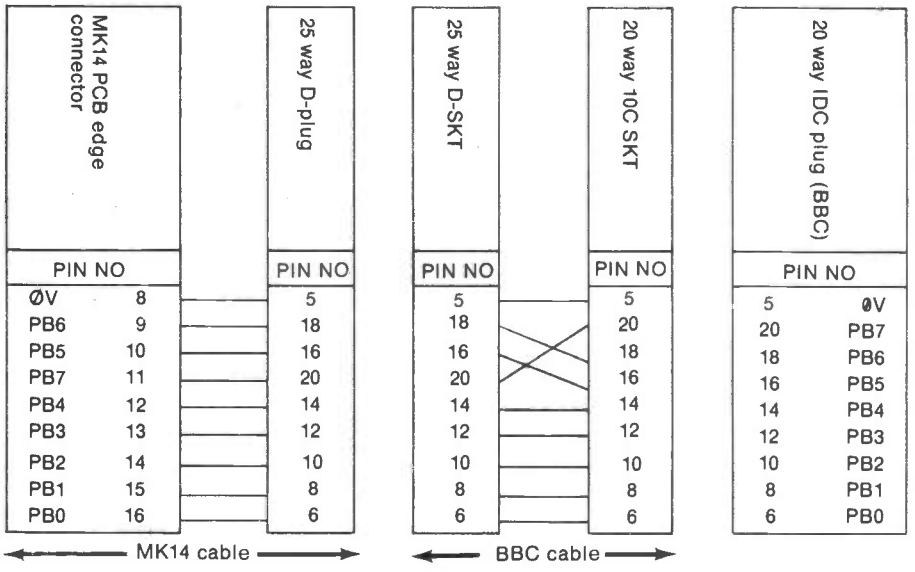


Fig 4 *Cable connection details for two micros*

Listing 4
Parallel input to MK14 Port B from BBC Port B

Address	Instruction	Data	Mnemonic	Data	Functional description
0F 20	C4	0A	LDI	0A	
0F 22	35		XPAH P1		See Listing 1
0F 23	C4	00	LDI	00	
0F 25	31		XPAL P1		
0F 26	C4	00	LDI	00	Loads ac with 0000 0000
0F 28	C9	23	ST P1	23	Store 00 in ODB (at OA23). Sets all bits to i/p
0F 2A	C0	21	LD	21	Loads address OA21
0F 2C	CA	07	ST	07	Segment display position 07
0F 2E	C4	01	LDI	01	
0F 30	37		XPAH 3		
0F 31	C4	84	LDI	84	
0F 33	33		XPAL 3		Keyboard/display routine (monitor)
0F 34	3F		XPPC		
0F 35	90	DB	JMP	DB	
0F 37	90	DD	JMP	DD	
0F FB	0F	00			Pointer 2 registers (P2H, P2L)

Listing 4

Connecting up the micros

The chosen hardware connection method is via the parallel I/O port on both machines. The BBC machine is equipped with the 6522 VIA IC which consists of two programmable 8-bit ports and various timers and control lines. This enables communications with the outside world, and for the purpose of this exercise we will be utilising just one port, Port B.

The MK14 is also equipped with an I/O port IC in the form of the INS8154N RAM I/O IC. This device consists of two programmable 8-bit ports and also 128 bytes of RAM. Again, only one port will be utilised, Port B.

Another method of communication would be via the RS432C serial port on the BBC micro and the SIN, SOUT pins on the 8060 CPU. In order to transfer data serially, however, some level shifting circuitry would be required to convert the CPU logic levels to RS232 (RS432) standard.

The block diagram *(Figure 3)* shows the method of connection. *Figure 4* shows the BBC Port B (user port) to MK14 PCB edge connector interconnections. The recommended method is via a cable from the MK14 edge connector to a 25-way D plug and a second or intermediate cable comprising a 25-way D socket, ribbon cable and 20-way IDC socket. This cable then connects to the BBC user port. The intermediate cable provides more convenient disconnection of the two machines.

Programming the micros

Listing 1 shows a simple machine code program which produces a specific data byte at the Port B output and which therefore appears at the BBC Port B. The listing details how the MK14 is initialised and then how the output definition register is loaded with FFH to set all bits or lines to OUTPUT. The ASCII value 41H is then loaded into the accumulator for outputting from the MK14.

Listing 2 is a BBC Basic/Assembler program which receives a data byte from the BBC machine and then displays it on the screen. The purpose of the program is to accept the data byte sent from the MK14. Line 40 prints the contents of the data register on the screen.

Lines 60-100 transfer the incoming data byte from the data register to accumulator, and then to a suitable screen location. Line 110 runs the assembled m/c program, completing the data transfer between machines.

Listing 3 is a BBC Basic program which sends a data byte to the MK14. Port B is set to output and places a data value of 94 in the data register. This value is also printed on the screen.

Listing 4 is an MK14 machine code program which receives a data byte from the BBC machine. Port B is set to input and loads the contents of the data (Read/Write) register at 0A21H into memory. The monitor display routine then places this byte in the appropriate display segment. The value 94 (decimal) corresponds to 5E in hexadecimal which produces a 'd' on the seven segment display.

Program sequence

Sheets A and B show the sequence of program loading and running to effect the transfer of data in both directions. The chart in *Figure 5* shows how to achieve the transfer of data in each direction. Both programs must be loaded, eg *Listing 1* and *Listing 2*, to enable data transfer, and of course each program must be run!

Experiment will show that it is important to do this in the correct order. Different ASCII codes can be inserted to prove the system.

Conclusion

Hopefully, this article has illustrated the basic requirements or concepts involved in interfacing one microcomputer controlled device with another. Although dealing only with the fundamental principles, it can be seen that various hardware and software considerations apply. Thus interfacing, especially of microprocessor controlled devices, requires the interfacing of hardware and software. The hardware must relate directly to the software in each system and both systems must be synchronised to the other in the time sense for data to be transferred between them in each direction.

The exercise covered in this article only enables the transfer of individual bytes. The transfer of blocks of data (ie programs or files) requires the use of handshaking and other interfacing techniques (involving hardware connection of control lines and software modification) which will be the subject of a further article. REW

DATA FILE . . .

Ray Marston looks at infra-red light-beam intrusion alarm systems in this latest edition of 'The File'.

In last month's edition of *Data File* we presented a concise survey of modern electronic devices and techniques, and included brief mentions of light-beam systems which can (amongst other things) be used as the basis of intrusion alarms and remote control systems. In the present edition of 'The File' we expand on this theme by showing practical ways of making infra-red light-beam intrusion alarms. We start off by looking at some basic principles.

Intrusion alarm basics

A simple light-beam intrusion alarm or detector system can be made by connecting an infra-red light transmitter and receiver as shown in *Figure 1*. Here, the transmitter feeds a coded signal (often a simple fixed-tone square wave) into an infra-red LED, which has its output focused into a fairly narrow beam (via a simple lens that is moulded into the LED casing) aimed at a matching infra-red photodetector (photo-transistor or diode) in the remotely placed receiver. The system action is such that the receiver output is off when the light-beam reaches the receiver, but turns on and activates an external alarm, counter or relay if the beam is interrupted by a person, animal or object. This basic type of system can be designed to give an effective detection range of up to 30 metres when used with additional optical focusing lenses, or up to 8 metres without extra lenses.

The above system works on the pin-point 'line-of-sight' principle and can be activated by any object bigger than a pin that enters the line-of-sight between the transmitter and receiver lenses. Thus, a weakness of this simple system is that it can be falsely triggered by, for example, a fly or moth entering the beam or landing on one of the lenses. The improved dual-light-beam system of *Figure 2* does not suffer from this defect.

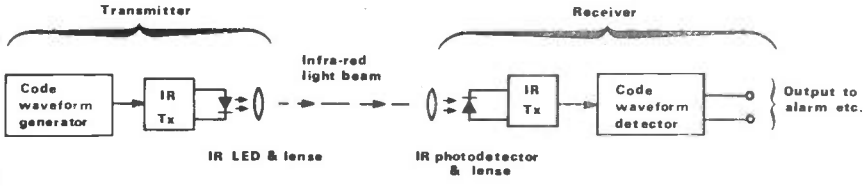


Fig 1 *Simple light-beam intrusion alarm/detector system*

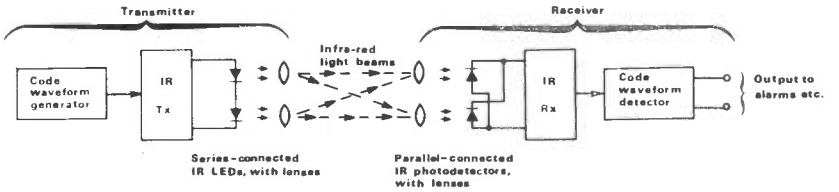


Fig 2 *Dual light-beam intrusion alarm/detector system*

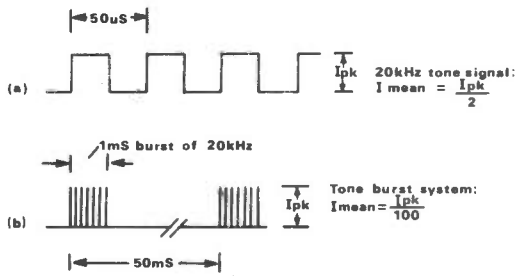


Fig 3 *Alternative types of IR light-beam code waveforms with typical parameter values*

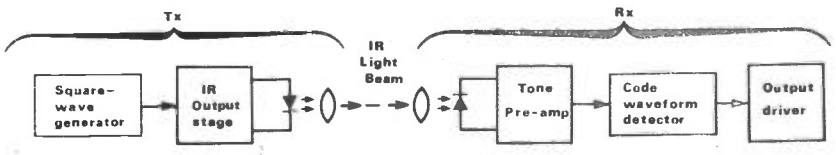


Fig 4 *Block diagram of continuous-tone IR light-beam alarm/detector system*

Series-connected LEDs

The *Figure 2* system is basically similar to that already described, but transmits the infra-red beam via two series-connected LEDs that are normally spaced about 75mm apart, and receives the beam via two parallel-connected photodetectors that are also spaced about 75mm apart. Thus, each photo-detector can detect the beam from either LED and the receiver will thus activate only if *both* beams are broken simultaneously; this will normally only occur if a large (greater than 75mm) object is placed within the composite beam. This system is thus virtually immune to false triggering via moths, etc.

Note that, as well as giving excellent false alarm immunity, the dual-light-beam system also gives (at any given LED drive-current value) double the effective detection range of the simple single-beam system (ie up to 16 metres without additional lenses), since it has twice as much effective infra-red transmitter output power and twice the receiver sensitivity.

System waveforms

Infra-red beam systems are usually used in conditions in which high levels of ambient or background infra-red radiation (usually generated by heat sources such as radiators, tungsten lamps, and human bodies, etc) already exist. To enable the systems to differentiate against this background radiation and give good, effective detection ranges, the transmitter beams are invariably frequency modulated and the receivers are fitted with matching frequency detectors. In practice, the transmitted beams invariably use either continuous-tone or toneburst frequency modulation, as shown in *Figure 3*.

Infra-red LEDs and photodetectors are very fast acting devices. Consequently, the effective range of an infra-red beam system is determined by the peak current fed into the transmitting LED, rather than simply by the mean transmitting current. Thus, if the waveforms of *Figure 3* are used in transmitters giving peak LED currents of 100mA, both systems will give the same effective operating range. The *Figure 3a* continuous-tone transmitter, however, will consume a mean current of 50mA, while the toneburst system of *Figure 3b* will consume a mean current of only 1mA (but will require more complex circuit design).

The operating parameters of the toneburst waveform system require some consideration, since the system actually works on the 'sampling' principle. For example, it is a fact that at normal walking speed a human being takes about 200mS to pass through a simple

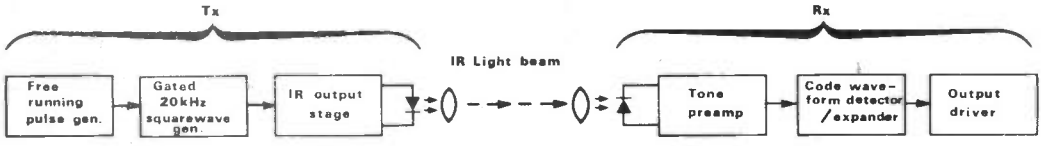


Fig 5 *Block diagram of toneburst IR light-beam intruder alarm/detector system*

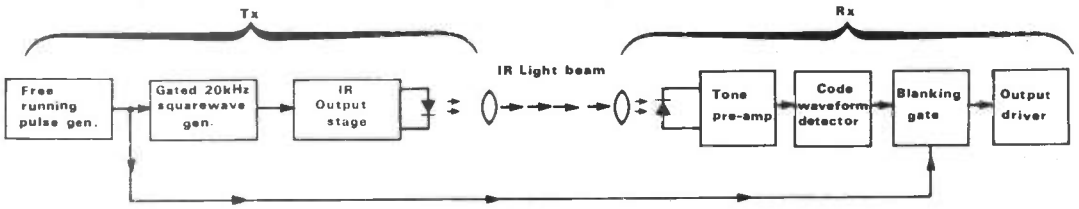


Fig 6 *Block diagram of alternative IR light-beam system*

infra-red light-beam, and it is also a fact that burglars rarely exceed walking speed while on business. Thus, to be effective, an infra-red light-beam burglar alarm system does not need to be turned on continuously, but only for brief sample periods at repetitions far less than 200mS (at, say, 50mS). The sample period should be short relative to repetition time, but long relative to the period of the tone frequency. Thus, a good compromise is to use a 20kHz tone with a burst or sample period of 1mS and a repetition time of 50mS, as shown in *Figure 3b* .

System design

The first step in designing any electronics system is that of drawing up suitable block diagrams. *Figure 4* shows a suitable block diagram of a continuous-tone infra-red intrusion alarm/detector system, and *Figure 5* shows a toneburst system. Note that a number of blocks (such as the infra-red output stage, the tone preamp and the output driver) are common to both systems.

The continuous-tone system (*Figure 4*) is very simple, with the transmitter comprising nothing more than a square-wave generator driving an infra-red output stage, and the receiver comprising a matching tone preamplifier and code waveform detector, followed by an output driver stage that activates devices such as relays and alarms, etc.

The toneburst system is far more complex, with the transmitter comprising a free running pulse generator (generating 1mS pulses at 50mS intervals) that drives a gated 20kHz square-wave generator, which in turn drives the infra-red output stage, which finally generates the toneburst infra-red light-beam. In the receiver, the beam signals are picked up and passed through a matching preamplifier, and are then passed on to a code waveform detector/expander block, which ensures that the alarm does not activate during the 'blank' parts of the infra-red waveform. The output of the expander stage is fed to the output driver.

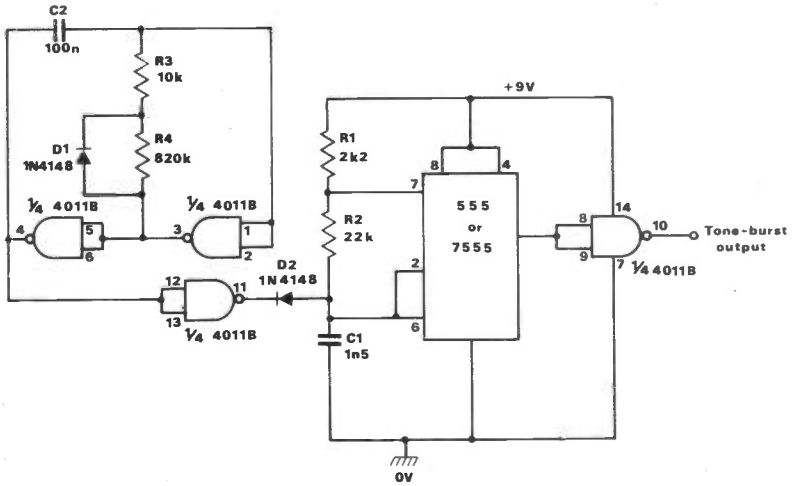


Fig 11 *Toneburst (1mS burst of 20kHz at 50mS intervals) waveform detector*

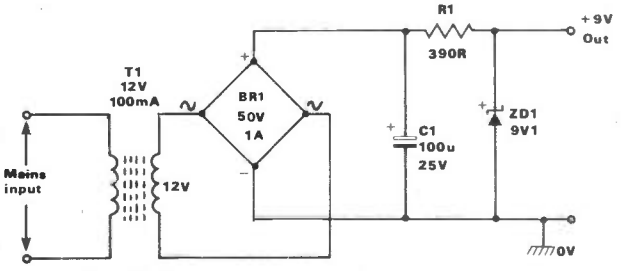


Fig 12 *Mains powered 9 volt supply*

Figure 6 shows an alternative version of the toneburst system. This is similar to the above, except that a simple code waveform detector is used in the receiver section and a 'blanking' gate is interposed between the detector and the output driver. This is directly driven by the transmitter's pulse generator to ensure that the alarm is not activated during the blank parts of the infra-red waveform.

Transmitter circuits

Figure 7 shows the practical circuit of a simple continuous-tone dual-light-beam infra-red transmitter. Here, a standard 555 timer IC is wired as an astable multivibrator that generates a non-symmetrical 20kHz square-wave output. This drives the two infra-red LEDs at peak output currents of about 400mA via R4 and Tr1 and the low source impedance of storage capacitor C1. The timing action of this circuit is such that the ON period of the LEDs is controlled by C2 and R2 and the OFF period by C2 and (R1+R2), so that the LEDs are ON for only about one eighth of each cycle. The circuit thus consumes a mean current of about 50mA.

The above circuit can use either TIL38 or LD271 (or similar) high power infra-red LEDs. These devices can handle mean currents up to only 150mA, but can handle brief repetitive peak currents several times greater than this value. *Figure 8* shows the outline and connections of these devices, which have a

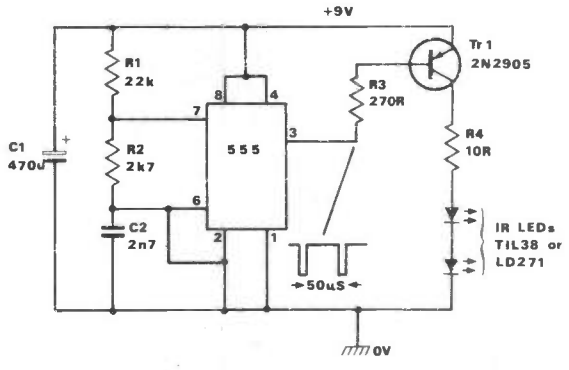


Fig 7 *Simple continuous-tone IR light beam Tx*

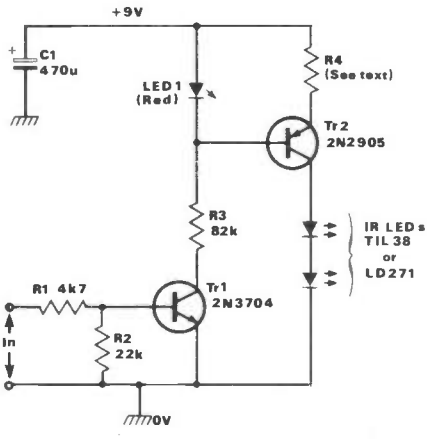


Fig 9 *'Universal' IR Tx output stage*

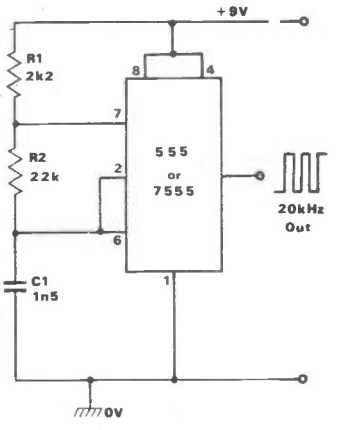


Fig 10 *20kHz square-wave generator*

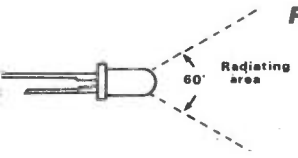


Fig 8 *Outline connections of the LD271 and TIL38 IR LED*

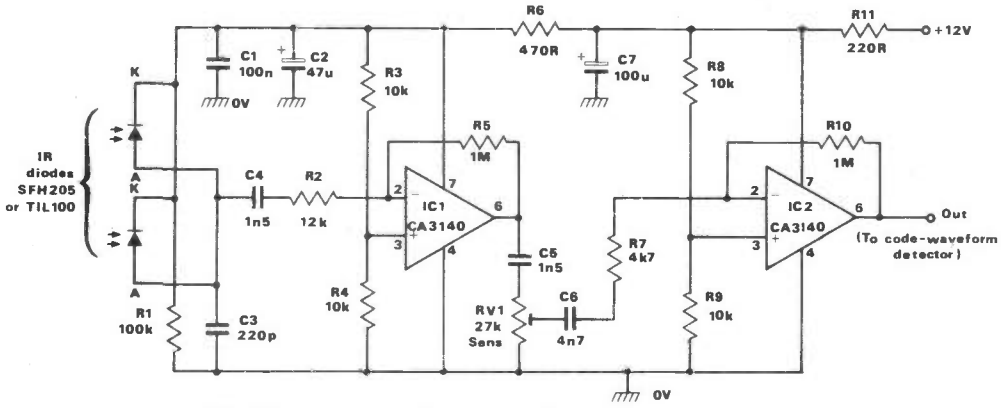


Fig 13 *Infra-red receiver preamplifier circuit*

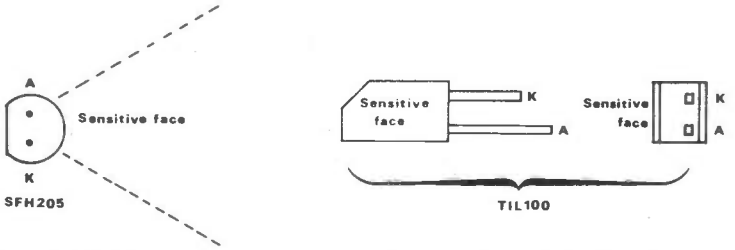


Fig 14 *Outline and connections of SFH205 and TIL100 IR photodiodes*

moulded-in lens that focuses the output into a radiating beam of about 60 degrees width. At the edges of this beam the infra-red signal strength is half of that at the centre of the beam.

Minor weaknesses of the infra-red output stage (Tr1 and R3-R4) of the *Figure 7* circuit are that it has a very low input impedance (about 300 ohms), it gives an inverting action (the LEDs are on when the input is low), and the LED output current varies with the circuit supply voltage. *Figure 9* shows an alternative, universal infra-red transmitter output stage that suffers from none of these defects.

In *Figure 9*, the base drive current of output transistor Tr2 is derived from the collector of Tr1, which has an input impedance of about 5k0 (determined mainly by the R1 value). Thus, when the input is low Tr1 is off, so Tr2 and the two infra-red LEDs are also off, but when the input is high Tr1 is driven to saturation via R3, thus driving LED1 (a standard red LED), Tr2 and the two infra-red LEDs on.

Note that under the latter condition about 1.8 volts are developed across LED1, and thus about 0.6 volts less than this (1.2 volts) is developed across R4. Consequently, since the R4 voltage is determined by the Tr2 emitter current, and the Tr2 emitter and collector currents are virtually identical, it can be seen that Tr2 acts as a constant-current generator and the infra-red LED drive currents are virtually independent of variations in supply voltage. Thus, the peak LED drive current approximately equals 1.2/R4, and R4 (in ohms) equals 1.2/I, where I is the peak LED current in amps.

Figure 10 shows a 20kHz square-wave generator (using a 555 or 7555 timer IC) that can be added to the *Figure 9* output stage to make a continuous-tone transmitter. In this case R4 should be given a value of 8.2 ohms or greater, to limit peak LED currents to less than 150mA. Alternatively, *Figure 11* shows the circuit of a toneburst generator (giving 1mS bursts of 20kHz at 50mS intervals) that can be added to *Figure 9* to make a toneburst transmitter. Here, two sections of a 4011B CMOS quad 2-input NAND gate IC are wired as a non-symmetrical astable multivibrator producing 1mS and 49mS periods. This waveform is buffered by a third 4011B stage and used to gate a 20kHz 555/7555 astable via D2; the output of the 555/7555 astable is then inverted via a fourth 4011B stage, ready for feeding to the transmitter output stage.

Note when using the *Figure 11* circuit that R4 in *Figure 9* can be given a value as low as 2.2 ohms, to give peak output currents of about 550mA, but that under this condition the transmitter will consume a mean current of little more than 6mA. This current can be provided by either a battery or a mains-derived supply; a suitable mains-powered supply is shown in *Figure 12* (note that BR1 is a bridge rectifier).

A receiver preamp

Figure 13 shows the practical circuit of a high-gain 20kHz tone preamplifier designed for use in an infra-red receiver. Here, the two IR detectors are connected in parallel and wired in series with R1, so that the detected infra-red signal is developed across this resistor. This signal is amplified by cascaded op-amps IC1 and IC2, which can provide a maximum signal gain of about ×17,680 (= ×33 via IC1 and ×213 via IC2), but have gain fully variable via RV1. These two amplifier stages have their responses

centred on 20kHz, with 3rd order low frequency roll-off provided via C4-C5-C6, and 3rd order high frequency roll-off provided by C8 and the internal capacitors of the ICs.

The above circuit can be used with either SFH205 or TIL100 infra-red diodes. These devices are housed in black infra-red transmissive mouldings which reduce ambient white light interference. *Figure 14* shows their outlines and pin connections.

The output of the *Figure 13* preamplifier can be taken from IC2 and fed directly to a suitable code waveform detector circuit, such as that shown in *Figure 15*. Note, however, that if the Tx-Rx system is to be used over ranges less than 2 metres or so, the preamp output can be taken directly from IC1 and all the RV1 and IC2 circuitry can be omitted from the preamp design.

Code waveform detector

In the *Figure 15* code waveform detector circuit the 20kHz tone waveforms (from the preamp output) are converted into dc via the D1-D2-C2-R5-C3 network and fed (via R6) to the non-inverting input of the op-amp voltage comparator, which has its inverting input connected to a thermally stable 1V0 dc reference point. The overall circuit action is such that the op-amp output is high (at almost full positive supply rail voltage) when a 20kHz tone input signal is present, and is low (at near zero volts) when a tone input signal is absent. If the input signal is derived from a toneburst system, the output follows the pulse-modulation envelope of the original transmitter signal. The detector output can be made to activate a relay in the absence of a beam signal by using the expander/output driver circuit of *Figure 16*.

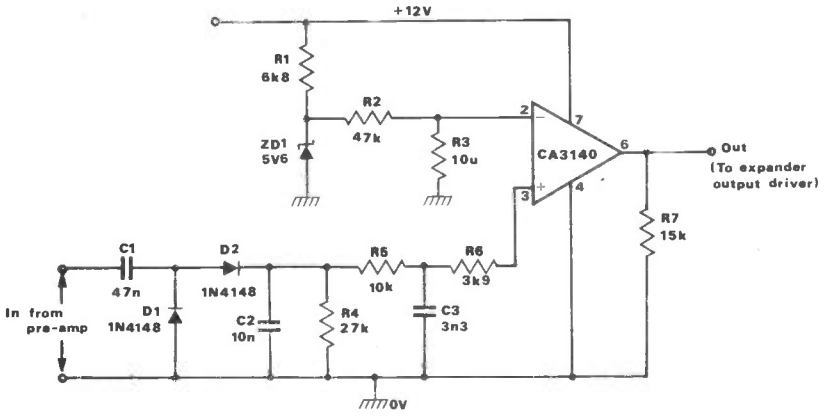


Fig 15 *Code waveform detector circuit*

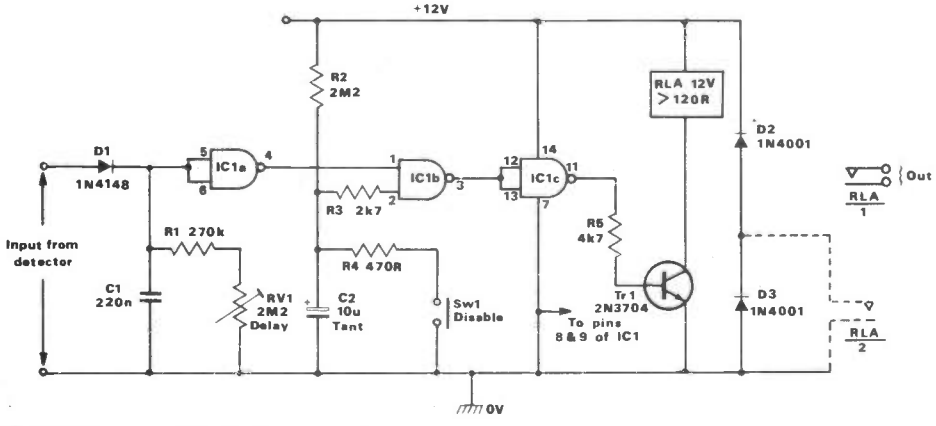


Fig 16 *Expander/output driver circuit*

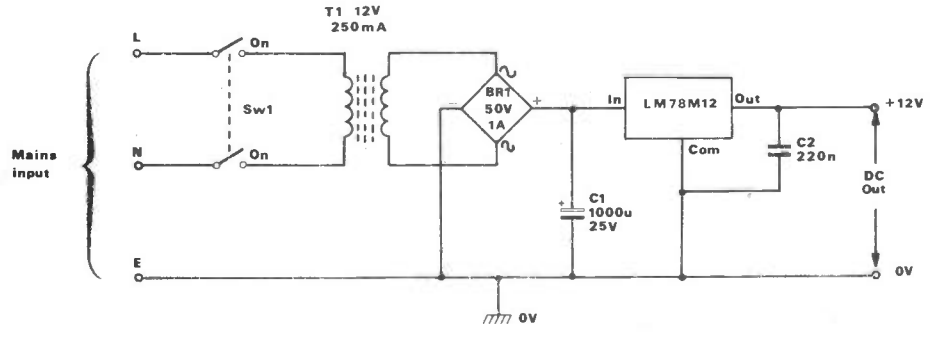


Fig 17 *Mains powered regulated 12V supply*

Expander/output driver

The operating theory of the *Figure 16* circuit is fairly simple. When the input signal from the detector circuit switches high, C1 charges rapidly via D1, but when the input switches low, C1 discharges slowly via R1 and RV1. C1 thus provides a dc output voltage that is a 'time-expanded' version (with expansion pre-settable via RV1) of the dc input voltage. This dc output voltage is buffered and inverted via IC1a and used to activate relay RLA via Tr1 and an AND gate made from IC1b and IC1c.

Normally, the other input of this AND gate (pin 2) is biased high via R2, and the circuit action is such that, when used in a complete infra-red light-beam system, the relay is off when the beam is present but is driven on when the beam is absent for more than 100mS or so. This action does not occur, however, when pin 2 of the AND gate is pulled low; under this condition the relay is effectively disabled.

The purpose of the R2-C2 network is to automatically disable the relay network via the AND gate (in the way described above) for several seconds after power is initially connected to the circuit or after disable switch S1 is briefly operated, so that the owner can safely pass through the beam without activating the relay. Note that the relay can be made self-latching, if required, by wiring normally-open relay contacts RLA/2 between Tr1 emitter and collector, as shown dotted in the diagram.

A power supply

The circuits of *Figures 13, 15* and *16* can be directly interconnected to make a complete infra-red light-beam receiver that can respond to either continuous-tone or toneburst signals. Such a receiver should be powered via a regulated 12 volt dc supply. *Figure 17* shows the circuit of a suitable mains-powered unit.

In next month's edition of *Data File* we will look at multi-channel infra-red light-beam remote control systems. REW

NEXT ISSUE

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C1112G	70.00
C1108	65.00
C1134	32.00
C1148A	115.00
C1150/1	135.00
C1534	32.00
CCA	2.60
CC3L	0.90
CL33	2.00
CV Nos Prices on request	
D3a	29.50
D63	1.20
DA41	22.50
DA42	17.50
DA90	4.50
DA100	125.00
DAF91	0.45
DAF91	0.70
DAF96	1.00
DC70	1.75
DC90	1.20
DCX4-1000	12.00
DCX4-5000	25.00
DET16	28.50
DET18	28.50
DET23	35.00
DET24	39.00
DET25	22.00
DF91	1.00
DF92	0.60
DF96	0.65
DF97	1.00
DH63	1.20
DH77	0.90
DH79	0.56
DH149	2.00
DK91	0.90
DK92	1.20
DL35	2.50
DL63	1.00
DL70	2.50
DL73	2.60
DL91	1.50
DL92	0.95
DL93	1.10
DL94	2.50
DL96	2.50
DLS10	13.50
DLS16	10.00
DM70	1.95
DM160	2.75
DY51	1.50
DY86/87	0.65
DY802	0.72
E80CF	11.00
E80F	18.50
E80L	25.00
E81CC	3.15
E81L	12.00
E82CC	3.50
E83CC	3.50
E83F	5.50
E86C	9.50
E88C	7.95
E88CC	3.50
E88CC Siemans Special	5.95
E90CC	7.95
E90F	7.95
E91H	4.50
E92CC	3.95
E99F	6.99
E130L	18.50
E180CC	9.50
E182CC	9.00
E180F	5.50
E186F	8.50
E188CC	7.50
E280F	19.50
E283CC	10.00
E288CC	13.50
E55L	42.00
E810F	25.00
E1148	1.00
E1524	6.95
EA50	1.00
EA76	1.95
EA79	1.95
EAA91	0.60
EABC80	0.70
EAC91	2.50
EAF42	1.20
EAF801	2.00
EB34	1.50
EB41	3.95
EB91	0.85
EBC33	2.50
EBC41	1.95
EBC81	1.50
EBC90	0.90

EBC91	0.90
EB91	0.60
EBF80	0.65
EBF83	0.65
EBF85	0.95
EBF89	0.70
EBF93	0.95
EBL1	2.50
EBL21	2.00
EC52	0.75
EC70	1.75
EC80	9.50
EC81	7.95
EC86	1.00
EC88	1.00
EC90	1.10
EC91	5.50
EC92	1.95
EC93	1.50
EC95	7.00
EC97	1.10
EC157	475.00
EC8010	12.00
ECC32	3.50
ECC33	3.50
ECC35	3.50
ECC81	1.15
ECC81 Special quality	1.95
ECC82	0.55
ECC82 Mullard	1.60
ECC82 Philips	1.95
ECC83 Siemans	2.50
ECC83	
ECC83 Philips	1.95
ECC83 Siemans	2.50
ECC83 Tungsram	1.50
ECC84	0.50
ECC85	0.75
ECC86	2.75
ECC88	0.95
ECC91	2.00
ECC180	0.72
ECC189	1.95
ECC801S	3.50
ECC803S	4.95
ECC804	0.60
ECC2000	12.00
ECF80	1.15
ECF82	1.15
ECF86	2.25
ECF200	1.85
ECF202	1.85
ECF801	0.85
ECF805	2.50
ECF806	10.25
ECH3	2.50
ECH4	3.00
ECH35	3.50
ECH42	1.50
ECH81	1.00
ECH83	1.00
ECH84	1.00
ECH2000	1.50
ECL80	0.50
ECL82	0.79
ECL81	0.55
ECL83	2.50
ECL84	0.74
ECL85	0.69
ECL86	0.80
ECL805	0.59
EF22	2.50
EF37A	2.50
EF39	1.50
EF40	4.50
EF41	3.50
EF42	3.50
EF50	2.50
EF55	4.95
EF70	1.20
EF71	1.60
EF72	1.20
EF73	1.00
EF80	0.55
EF83	3.95
EF85	0.50
EF86	2.25
EF86 Mullard	4.50
EF89	1.50
EF91	1.95
EF92	2.15
EF93	0.95
EF94	0.95
EF95	1.95
EF97	0.90
EF98	0.90
EF183	0.65
EF184	0.65
EF730	1.80
EF731	3.50
EF732	3.50
EF800	11.00
EF805S	13.50
EF812	0.66
EFL200	1.50
EH90	0.72
EK90	9.95
EL32	0.95
EL33	5.00
EL34	2.25
EL34 Mullard/Philips	4.50
EL36	1.95
EL37	9.00
EL38	4.75
EL41	3.50
EL42	2.00
EL81	5.95
EL82	0.58
EL83	5.95
EL84	0.95
EL85	4.50
EL86	1.25
EL90	2.15
EL91	5.00

EL95	1.75
EL153	12.15
EL183E	3.50
EL183P	3.50
EL500	1.40
EL504	1.40
EL509	5.25
EL519	6.95
EL802	3.65
EL821	8.50
EL822	12.95
EM1	9.00
EM4	9.00
EM80	0.70
EM81	0.70
EM84	1.65
EM85	3.95
EM87	2.50
EN32	16.50
EN91	1.95
EN92	4.50
ESU150	14.95
ESU872	25.00
EY51	0.80
EY81	2.35
EY83	1.50
EY84	5.95
EY86/87	0.50
EY88	0.55
EY91	5.50
EY500A	1.50
EY802	0.70
EZ35	0.75
EZ40	2.75
EZ41	2.15
EZ80	0.75
EZ81	0.75
EZ90	1.50
F6064	2.95
FW4/800	2.95
G55/1K	9.00
G180/2M	6.95
G232 Mullard	3.95
G240/2D	9.00
GC10B	17.50
GC10D	17.50
GC10/4B	17.50
GC10/4E	17.50
GC12/4B	17.50
GD86W	5.00
GDT120M	5.00
GN4	6.00
GN10	15.00
GR10G	4.00
GS10C	16.50
GS10H	12.00
GS12D	12.00
GT1C	14.00
GT1C S/S	13.00
GTE175M	8.00
GTR150W	1.00
GU20	35.00
GXU1	13.50
GXU3	24.00
GXU50SS	14.50
GY501	1.50
GY802	1.50
GZ30	1.50
GZ31	1.50
GZ32	1.50
GZ33	4.50
GZ34	2.15
GZ37	4.50
HAA91	1.00
HABC80	0.90
HBC90	0.75
HBC91	0.80
HF93	0.75
HF94	1.50
HK90	1.06
HL2K	4.95
HL23DD	4.00
HL90	0.70
HL92	1.50
H133/DD	3.50
HR2	4.00
HY90	1.00
HVR2	3.00
K3118	86.00
KR6/3	45.00
KT8C	7.00
KT33C	3.50
KT36	2.00
KT44	4.00
KT45	4.00
KT61	5.00
KT63	2.00
KT66/CV1075 special yellow ssss pot	19.50
KT66 USA	9.95
KT77 Gold Lion	10.95
KT81	7.00
KT88 USA	10.95
KT88 Gold Lion	18.95
KTW61	2.50
KTW62	2.50
KTW63	2.00
KTZ63	2.50
L102/2K	5.95
L120/2K	12.00
LB7-20	95.00
LS9B	6.95
M502A	60.00
M537A	60.00
M5143	155.00
M8079	6.00
M8082	7.50
M8083	3.25
M8091	7.50
M8096	3.00
M8098	5.50
M8099	5.00
M8100	5.50
M8136	7.00
M8137	7.95
M8161	6.50
M8162	5.50

M8163	5.50
M8190	4.50
M8195	6.50
M8196	5.50
M8204	5.50
M8223	4.50
M8224	2.00
M8225	3.50
ME1401	29.50
ME1402	29.50
ME1501	14.00
MH4	3.50
MHLD6	4.00
ML4	4.50
MS4B	5.50
MU14	3.50
N37	12.50
N78	9.85
OA2	0.85
OA2WA	2.50
OA3	2.50
OB2	0.85
OB2WA	2.50
OC2	2.50
OC3	1.50
OD3	1.70
OM4	1.00
OM5B	3.00
OM6	1.75
ORP43	2.50
ORP50	3.95
P61	2.50
P41	2.50
PABC80	0.50
PC86	0.75
PC88	0.75
PC92	3.50
PC97	1.10
PC800	1.10
PC900	1.25
PCC84	0.40
PCC85	0.54
PCC88	0.70
PCC89	0.70
PCC189	0.70
PCC805	0.70
PCC806	0.80
PCE82	0.80
PCF80	0.65
PCF82	0.60
PCF84	0.65
PCF86	1.20
PCF87	0.40
PCF200	1.80
PCF201	1.80
PCF800	0.40
PCF801	1.35
PCF802	0.60
PCF805	1.25
PCF806	1.00
PCF808	1.25
PCH200	1.50
PCL82	0.85
PCL83	2.50
PCL84	0.75
PCL85	0.80
PCL86	0.85
PCL800	0.80
PCL805	0.90
PD500	3.50
PD510	3.65
PEN25	2.00
PEN40DD	2.50
PEN45	3.00
PEN45DD	3.00
PEN46	2.00
PEO5-25	39.50
PEO5-40N	42.50
PFL200	0.95
PL21	2.50
PL36	1.75
PL38	1.50
PL81	0.72
PL81A	0.72
PL82	0.50
PL83	0.52
PL84	0.78
PL88	1.00
PL95	1.75
PL302	1.00
PL345	12.50
PL500	0.95
PL500	1.10
PL504	1.15
PL508	1.75
PL509	4.85
PL519	4.95
PL802T	3.50
PL820	2.95
PL5557	29.50
PL5727	2.50
PY32	0.60
PY33	0.50
PY81	0.70
PY82	0.70
PY83	0.70
PY88	0.66
PY500A	1.95
PY800	0.79
PY801	0.79
QB3-300	54.95
QB5-1750	139.50
QBL5-3500	495.00
QEO3-10	4.95
QE08-200	£145.00
QF40	65.00
QP25	1.00
QQEO2/5	19.50
QQEO3-12	7.95
QQEO3-20	35.00
QQEO6/40	45.00
QQVO2-6	19.50
QQVO3-10 Mullard	15.00
QQV03-10	5.50

QQVO3-20A	25.00
QQVO3-20B	32.00
QQVO6-40A	27.50
QQVO7-50	63.50
QQZO3-20	42.50
QS75/20	1.50
QS75/40	3.00
QS92/1D	6.00
QS95/10	4.85
QS108/45	4.00
QS150/15	5.95
QS150/30	1.15
QS150/45	7.00
QS1200	3.95
QS1202	3.95
QS1203	4.15
QS1205	3.95
QS1206	3.95
QS1206	1.05
QS1207	0.90
QS1208	0.90
QS1209	3.15
QS1210	1.50
QS1211	1.50
QS1212	3.20
QS1213	5.00
QS1215	2.10
QS1218	5.00
QU37	9.50
QU37	11.50
QVO3-12	4.95
QVO5-25	1.75
QVO6-20	29.50
QV2-250C	45.00
QVO8-100	145.00
QY3-125	65.00
QY4-250	70.00
QY4-400	76.00
R10	4.00
R16	12.00
R17	1.50
R18	2.50
R19	2.50
R20	1.20
R1169	55.00
RG1-125	4.95
RG1-240A	14.50
RG3-250A	3.50
RG3-1250A	35.00
RK2K25	62.50
RK-20A	12.00
RL16	1.50
RPL16	12.00
RPY13	2.50
RPY43	2.50
RPY82	2.50
RR3-250	15.00
RR3-1250	35.00
RS613	45.00
RS685	54.95
RS688	52.15
S6F17	5.95
S6F33	29.95
S11E12	38.00
S30/2K	12.00
S104/1K	10.00
S109/1K	15.00
S130	5.95
S130/P	5.95
SC1/800	5.00
SC1/1100	5.00
SC1/1200	5.00
SC1/1300	5.00
SC1/2000	9.00
SD6000M	45.00
SP4B	4.95
SP41	5.00
SP42	3.00
SS501	35.00
ST11	1.50
STV280/40	11.95
STV280/80	19.95
SU42	4.95
TB2.5/300	85.00
TB2-300	45.00
TB3/2000	395.00
TBL-2-300	275.00
TBL2-500	395.00
TD03 10E	40.00
TD03 10	35.00
TD03 10D	40.00
TD03 10F	40.00
TD1-100A	25.00
TD3-12	4.00
TP25	1.50
TSP4	7.00
TT11	1.50
TT21	45.00
TT22	45.00
TT100	57.00
TTR-31MR	66.00
TY2-125A	65.00
TY4-400	85.00
TY8-600W	365.00
TYS2/250	375.00
U18-20	2.75
U19	11.95
U24	2.00
U25	0.90
U26	0.90
U37	9.00
U41	6.95
U50	2.00
U82	3.00

U191	0.70
U192	1.00
U193	0.65
U251	1.00
U801	0.75
UABC80	0.65
UAF42	1.00
UBF80	0.50
UBC41	2.25
UBC81	1.50
UBF89	1.00
UBL21	1.75
UC92	1.20
UCC84	0.70
UCC85	0.60
UCF80	1.00
UCH21	1.20
UCH41	2.50
UCH42	2.50
UCH81	1.00
UCL82	1.75
UCL83	2.50
UF85	1.20
UF41	1.15
UF42	1.15
UF80	0.80
UF89	2.00
UL84	1.50
UL41	5.50
UL44	3.50
UL84	0.85
UU5	3.50
UU7	6.00
UU8	9.00
UY41	3.50
UY85	0.70
V235A/1K	250.00
V240C/2K	225.00
V241C/1K	195.00
V246A/2K	315.00
V339	3.50
VLS631	10.95
VP133	2.00
VR75/30	3.00
VR101	2.00
VR105/30	1.50
VR150/30	1.15
VT52	2.50
VU29	4.50
VU39	1.50
W77	5.00
W729	1.00
W739	1.50
X24	1.00
X66/X65	4.95
X76M	1.95
XC24	1.50
XC25	0.50
XFW47	1.50
XFW50	1.50
XG5-500	22.50
XL1-5V	1.50
XL628FT	7.50
XNP12	2.50
XR1-1600A	49.50
XR1-3200A	79.50
XR1-6400A	115.00
ZM1020	6.00
Y65	6.95
Y503	25.00
Y602	12.00
Y4070	130.00
YD1100	75.00
YJ1060	265.00
YL1000	9.50
YL1020	42.50
YL1030	59.50
YL1060	95.00
YL1070	195.00
YL1071	195.00
YL1290	69.50
Z77	1.20
Z303C	9.00
Z359	9.00
Z505S	15.00
Z520M	4.00
Z521M	8.00
Z700U	3.00
Z749	0.50
Z759	19.95
Z800U	3.00
Z803U	18.95
Z900T	9.50
ZA1000	12.50
ZA1001	1.50
ZA1002	1.50
ZC1040	8.00
ZM1005	8.00
ZM1020	8.95
ZM1021	8.00
ZM1023	7.95
ZM1041	14.00
ZM1082	9.00
ZM1084	10.00
ZM1177	9.00
ZM1202	55.00
ZM1263	4.00
ZM1612	3.00
1A3	4.50
1AC6	1.20
1B3GT	1.95
1B22	10.00
IB27	55.00
1B35A	45.00
1C5GT	2.50
1FD1	2.50
1G3GT	2.50
1K3GT	2.50
1N1	4.50
1N2	4.50
1P28	25.00
1N5GT	2.50
1P28	25.00
1S2	0.65
1S5	0.70
1T4	1.00
1U5	1.00
1X2B	1.40
1Z2	8.95
2AS15A	11.50
2B22	59.50

2C39A	32.50
2C39BA	39.50
2C40	37.00
2C42	29.50
2C51	0.75
2CY5	1.50
2B7	1.50
2D21	1.95
2D21W	2.50
2E22GY	45.00
2E26	7.95
2J42	93.00
2K25	35.00
2K25 Ray	75.00
2K26	95.00
2K29	250.00
2K56	250.00
3A108A	9.00
3A/107B	12.00
3A/109B	11.00
3A/110B	12.00
3A/141K	11.50
3A/147J	7.50
3A/167M	10.00
3A2	3.95
3A3A	3.95
3A4	1.10
3AL5	0.95
3AT2	3.35
3AU6	0.65
3B2	3.00
3B4	7.00
3B7	4.50
3B24	10.00
3B26	24.00
3B28	12.00
3BZ6	1.50
3C4	2.50
3C45	24.00
3CB6	1.50
3CN3A	2.50
3CS6	0.95
3CY5	1.50
3CX3	2.50
3D6	4.50
3D21A	29.50
3E22	49.50
3EH7	1.95
3EJ7	1.95
3W4GT	2.50
4B32	35.00
4B551B	115.00
4BQ7A	1.75
4BZ6	1.95
4-65A	59.00
4-125A	72.50
4-250A	79.50
4-400A	87.50
4C27	25.00
4C28	25.00
4CB6	1.95
4CX250B	49.00
4CX25OB EIMAC	£59.50
4CX250BM	75.00
4CX250K EIMAC	95.00
4CX350A	95.00
4CX350F	79.50
4CX1500B	398.50
4GS7	2.25
4GV7	2.25
4JC6A	2.95
4J52	75.00
4KT6	1.50
4X150A	35.00
5A/102D	9.50
5A152M	9.00
5A163K	10.00
5A170K	5.25
5A-206K	10.00
5A-180M	9.00
4AM8	4.15
5AM8	2.15
5AN8	1.20
5AR4	2.00
5AU4	1.50
5B.110M	10.00
5B-254M	14.50
5B-255M	19.50
5B255M	19.50
5B/256M	15.00
5B-257M	15.00
5B-258M	14.50
5C22	125.00
5R4GB	5.50
5R4GY	4.95
5T4	5.95
5U4G	2.95
5U4GB	3.50
5V4G	1.50
5Y3GT	1.95
5Z4GT	1.50
6/30L2	0.70
6A/203K	9.00
6A7	4.95
6A8G	1.50
6AC7	2.00
6AF4A	2.50
6AG5	1.50
6AG7	1.95
6AH6	2.50
6AJ4	2.00
6AJ7	2.00
6AK5	1.95

6AK6	2.50
6AL5	0.50
6AM4	3.25
6AM5	6.00
6AM6	1.95
6AN5	4.50
6AN8A	3.50
6AQ5	2.15
6AQ8	0.85
6AR5	5.95
6AR8	3.95
6AS5	1.50
6AS6	2.50
6AS7G	4.50
6AT6	0.75
6AT8	1.75
6AU4	2.00
6AU6	0.95
6AV6	0.75
6AW8A	2.50
6AZ8	4.50
6B7	2.80
6B8G	1.50
6BA6	0.95
6BA7	4.50
6BA8A	3.50
6BC8	1.00
6BE6	0.95
6BG6G	3.00
6BH6	1.95
6BH8	1.50
6BJ6	1.50
6BK4	4.00
6BK7A	1.95
6BL8	1.15
6BM8	0.58
6BN4	1.65
6BN6	1.55
6BN7	4.50
6BN8	3.95
6BQ5	0.75
6BQ7A	0.72
6BL7GTA	3.95
6BL8	1.15
6BR5	0.70
6BR7	4.95
6BR8	2.15
6BR8A	2.15
6BS7	5.50
6BW4	1.50
6BW6	5.35
6BW7	1.50
6BW8	4.00
6BX6	0.48
6BX7GT	3.50
6BZ6	2.50
6BZ7	2.95
6C4	1.25
6C5	1.95
6C6	2.50
6C8G	1.50
6C11	2.50
6C18	2.50
6CA4	4.95
6CA7	3.50
6CB5	3.95
6CB6	1.95
6CD6GA	4.50
6CF6	1.50
6CG7	2.25
6CH6	6.95
6CL3	3.95
6CL6	3.25
6CL8A	2.00
6CM5	1.60
6CM7	2.95
6CS6	0.75
6CS7	0.95
6CW4	6.50
6CY5	1.00
6CY7	2.95
6D6	2.50
6DC6	2.95
6DJ8	0.95
6DK6	1.50
6DQ5	5.95
6DQ6B	2.50
6DW4	2.15
6EA4	4.95
6EA7	2.50
6EA8	2.50
6EB8	1.75
6EM5	2.50
6EM7	2.50
6EU7	£1.95
6EU8	1.75
6EV7	2.95
6EW7	4.50
6EW6	1.50
6F1	2.00
6F5	4.95
6F7	5.50
6F6G	2.00
6F12	1.50
6F13	3.00
6F14	1.00
6F17	2.75
6F21	2.50
6F23	0.60
6F24	1.25
6F25	1.25
6F28	1.25
6F32	1.25
6F33	17.00
6FH8	12.50
6G6G	5.50
6GH8A	0.80

6GK5	1.50
6GK6	1.95
6GM6	0.95
6GS7	2.15
6GV7	2.50
6GW8	0.80
6H1	9.50
6H3N	2.50
6H6	1.95
6H6GT	1.95
6HB7	0.95
6HF5	5.50
6HF8	2.50
6HS6	4.95
6HS8	1.95
6HZ6	2.65
6J4	2.15
6J4WA	3.15
6J5	2.50
6J6	2.05
6JB6A	3.95
6JE6C	6.50
6JM6	3.95
6JS6C	6.50
6JU8	2.50
6J7	2.50
6K7G	2.00
6K8Y/G	3.00
6KD6	5.50
6KM8	2.50
6KT8	2.95
6KZ8	1.95
6L1	2.50
6L19	3.95
6L6GC	2.95
6L6GC (GE)	4.95
6L6GT	1.95
6LD20	1.15
6LF6	7.50
6LJ8	2.50
6LQ6	5.50
6L15	3.15
6MJ6	4.95
6N7	2.50
6N7GT	2.50
6P15	1.50
6P25	4.00
6P26	4.00
6P28	2.00
6Q7	1.75
6Q7GT	1.20
6R7G	3.15
6S4A	1.50
6SA7GT	1.35
6SC7	1.50
6SG7	2.50
6SH7	1.35
6SJ7GT	1.35
6SK7	1.35
6SK7GT	1.35
6SL7GT	0.85
6SN7GT	1.35
6SQ7	1.35
6SS7	1.95
6U4GT	1.75
6U8	1.15
6U8A	1.50
6V6GT	1.50
6X2N	1.00
6X4	1.50
6X5GT	1.00
6X5GTY	1.00
6X8A	2.25
7A6	4.50
7A7	2.00
7AD7	1.75
7AU7	1.50
7B6	3.50
7B7	2.50
7C6	2.50
7E7	2.50
7J7	5.50
7V7	4.15
7Y4	2.50
8B10	2.50
8BQ5	1.95
8D8	2.50
8EQ7	1.95
8298A	8.50
85A8	1.50
10D2	1.25
10DE7	2.50
10F1	0.75
10GK6	1.95
10P14	2.50
10P18	0.70
10LD12	0.65
11E3	55.00
12A6	3.95
12AD6	1.50
12AG8	1.50
12AL5	1.00
12AT6	1.25
12AT7	1.15
12AT7WA	2.50
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12AU7	0.65
12AV6	1.95
12AX4GT	1.00
12AX7	0.65
12AX7WA	2.50
12AY7	3.95
12AZ7A	1.95
12B4A	4.50
12BA6	1.50
12BE6	1.95

12BH7A	2.50
12BL6	1.75
12BY7A	2.75
12CA5	1.95
12CX6	1.20
12DQ6B	3.50
12DW4A	3.50
12DW7	2.50
12E1	17.95
12E14	38.00
12GN7	4.50
12HG7A	4.50
12J7GT	3.50
12K5	1.95
12K7GT	1.50
12K8	1.95
12SA7GT	1.95
12SG7	4.75
12SH7	1.95
12SK7	1.95
12SJ7	1.50
12SN7GT	1.85
12SQ7GT	1.95
13D3	3.20
13D7	3.20
13D7	2.50
13D9	3.20
13DR7	2.95
13EI	145.00
13EM7	3.50
14S7	1.95
7BR3	3.95
17EW8	0.95
17DW4	2.50
17DW4A	2.95
17JZ8	4.50
18D3	6.00
19AQ5	3.50
19AU4GT	2.50
19G3	17.00
19H5	33.50
19Q6	9.00
20A2	10.50
30D1	0.70
20LF6	3.50
20L1	0.95
20P1	0.55
20P3	0.60
20P4	1.95
20P5	1.15
21JZ6	3.15
21LU8	3.75
24B1	39.50
24B9	39.50
25L6GT	1.75
25BQ6	1.75
29C1	19.50
29KQ6	6.50
30C17	0.40
30C18	1.48
30F5	0.95
30FL1	1.00
30FL2	1.35
30FL12	0.95
30FL13	1.10
30FL14	1.25
30L1	0.45
30L15	0.60
30L17	0.80
30P4MR	1.00
30P12	1.00
30P18	0.60
30P19	1.00
30PL1	2.50
30PL13	0.60
30PL14	1.75
31JS6A	5.50
33A/158M	19.50
35A5	4.50
35L8GT	2.00
35W4	0.70
35Z3	1.85
38HE7	4.50
40KD6	5.50
42	6.95
47	5.00
50A5	1.50
50C5	0.95
50CD6G	1.15
50EH5	1.50
52KU	2.00
53CG	15.00
60B5	1.00
60JY6	2.96
61SPT	4.50
75B1	3.50
75C1	2.50
83	8.50
83AI	9.00
84	3.00
85A1	6.50
85A2	1.95
90AV	15.00
92AG	19.50
92AV	15.00
95A1	6.50
108C1	1.50
150B2	5.50
150C2	2.50
150C4	2.15
185T	1.50
274A	15.00
307	5.00
328A	15.00
388A	17.50

404A	10.95
425A5	8.00
431U	4.50
572B	55.00
5636	1.50
6146A	7.50
6158	3.20
6386	14.50
6883B	9.95
6973	5.95
705A	8.00
706A	8.00
715C	45.00
725A	275.00
7527	89.50
7703	395.00
803	14.95
805	39.00
807	1.95
810	85.00
811A	15.00
813	23.50
829B	14.50
832A	14.50
833A	95.00
866A	6.50
872A	20.00
873	50.00
884	5.50
927	15.00
930	9.95
931A	17.50
954	1.00
958A	1.00
1299A	0.60
1619	2.50
1625	3.00
1626	3.00
1927	25.00
2050	5.50
2050W	5.95
3545	4.00
4313C	4.00
4328D	9.00
5642	9.50
5651	2.50
5654	1.95
5663	1.95
5670	3.25
5672	4.50
5687	4.50
5692	3.50
5696	4.50
5704	3.50
5718	6.15
5725	2.50
5726	2.50
5727	2.50
5749	2.50
5750	1.85
5751	2.95
5763	4.95
5814A	3.25
5829WA	6.50
5840	3.50
5842	11.00
5847	10.95
5879	5.00
5886	13.95
5894	39.50
5899	4.50
5963	2.00
5965	2.25
6005	1.85
6012	16.00
6021	3.65
6057	3.75
6058	3.95
6060	2.25
6062	4.50
6063	2.00
6064	2.95
6067	7.00
6072	4.20
6080	7.95
6132	10.00
6146B	9.50
6688	6.50
6887	9.50
6080	7.95
6080WA	9.50
6096	5.50
6132	10.00
6136	2.50
6146B	9.95
6157	2.50
6201	6.45
6211	2.50
6267	2.25
6550AGE	10.95
6550RCA	15.00
6350	3.50
6688	5.50
6870	11.50
6887	9.50
6873	4.50
7189	3.50
7199	6.15
7239	17.50
7247	4.95
7360	13.50
7527	85.00
7586	15.00
7591A	4.95
7868	4.95

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LOGIC CIRCUITS

The penultimate part of D Stewart's series

We will begin this month by taking a short break from logic gates and looking at number systems. What do we mean by number systems? The number system we normally use is the decimal one; we have ten figures so we count to ten, then merely extend the digits into the tens, hundreds, thousands, etc, as required. For example, 54.93 means:

$$(5 \times 10) + (4 \times 1) + (9 \times 0.1) + (3 \times 0.01)$$

Binary system

Two is used as the base for binary systems as there are only two possible states, 1 or 0. This means that a large number of digits is required to represent quite small quantities, eg decimal 8 is represented by 1000 in binary.

Just as each column of a decimal number is weighted, so is each column of a binary number, as in *Table 9*. One type of binary system is called the 8421 weighted binary coded decimal, or simply BCD. There are other BCD codes, like the 7421, 5421, 2421, but when the letters BCD are used on their own, they imply the 8421 code.

Weights				Decimal equivalent
$2^3=8$	$2^2=4$	$2^1=2$	$2^0=1$	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9

Table 9

BCD code

To convert a decimal number like 783 into BCD we simply write the BCD code for each digit, ie 0111 for 7, 1000 for 8 and 0011 for 3. This code is used in counters and printers since these are operated by ten fingered humans. But the BCD code is not economical since in straightforward binary 4 bits can count up to 16 (represented by 1111), yet in BCD 4 bits can count only up to ten, ie 0 to 9, as in *Table 9*.

Octal

Octal, as the name implies, is to the base eight, ie counting from 0 to 7. For instance, to convert 11111001 into octal, we start from the right and group the bits in threes: 11,111,001. Then we write the decimal equivalent of these groups as 371. Binary is nice for machines but not so easy for humans, so this gives a tidy shorthand rotation.

Hexadecimal

This is to the base 16 and the binary and decimal of this code is given in *Table 10*. For instance, to convert 111001000010 into hexadecimal we group it in 4 bits, starting from the right again: 1110,0100,0100,0010. Then from *Table 10* we get the hexadecimal equivalent as E442.

Hexadecimal is used in communications systems and in the IBM 360 computer. It is also used in 8 bit and 4 bit microcomputers because it is more economical for displaying alphanumeric characters compared to the octal system. For instance, 11110010 in binary would be F2 in hexadecimal and 362 in octal. This uses only two characters in hexadecimal but three in octal.

Hex	Decimal	Binary
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
A	10	1010
B	11	1011
C	12	1100
D	13	1101
E	14	1110
F	15	1111

Table 10

Decimal	Gray
0	0000
1	0001
2	0011
3	0010
4	0110
5	0111
6	0101
7	0100
8	1100
9	1000

Table 11

Gray code

The Gray code is shown in *Table 11* and is one of the most useful codes. It is used in analogue to digital encoders, especially shaft encoders where it is necessary to change only one bit at a time. This produces fewer errors and is therefore used in optical and mechanical devices for positioning automatic tools.

Parity checks

Connected with transfer of data from one location to another are parity checks. These do not check the arithmetic or logical operations; they merely ensure that whatever data is transmitted is not corrupted. Odd parity or even parity can be employed. In even parity checks, an extra '1' is added to odd numbers of ones, and at the receiving end a check is made for an even number of ones in the bit stream. If there is an odd number, then there is an error. The opposite arrangement is made if odd parity is employed.

Decimal to binary conversion

Binary to decimal conversion is carried out by multiplying each bit by its weight. The reverse process is obtained by dividing by 2. For example, convert 22 to binary:

$$\begin{aligned} 22 \div 2 &= 11 \text{ remainder } 0 \\ 11 \div 2 &= 5 \text{ remainder } 1 \\ 5 \div 2 &= 2 \text{ remainder } 1 \\ 2 \div 2 &= 1 \text{ remainder } 0 \\ 1 \div 2 &= 0 \text{ remainder } 1 \end{aligned}$$

The binary equivalent is given by the remainders in reverse order, ie 10110. This can be checked by the reverse conversion:

$$\begin{aligned} 0 \times 2^0 &= 0 \\ 1 \times 2^1 &= 2 \\ 1 \times 2^2 &= 4 \\ 0 \times 2^3 &= 0 \\ 1 \times 2^4 &= 16 \\ &\overline{22} \end{aligned}$$

Binary addition

Binary addition is simple if the rules

are remembered. To summarise: 0+0 = 0. 0+1 = 1+0 = 1, 1+1 = 10, 1+1+1 = 11. For example, 1011 + 11 = 1110.

Binary subtraction

Once again the rules are 0−0 = 0, 1−0 = 1, 1−1 = 0, 10−1 = 1. The four mathematical operations, addition, subtraction, multiplication and division, can be performed by a single piece of electronic circuitry called an adder. This may seem a startling prediction but isn't 5 × 10, say, merely the addition of 10, five times? Of course separate circuits could be designed for each of the four mathematical operations, but why make the device cumbersome?

What is not so obvious is how an adder can be used in subtraction. If we operate on the complement of a number, its mirror image or 'other half' so to speak, then we could add it instead of subtracting it.

The nine's complement of
0 1 2 3 4 5 6 7 8 9
is 9 8 7 6 5 4 3 2 1 0
since each column adds up to nine. To get the ten's complement of these we simply add one to the 9's, giving from left to right 10,9,8,7,6,5,4,3,2,1.

In binary the 1's complement is obtained by simply inverting all the bits so that the 1's complement of 0101 would be 1010. The 2's complement is obtained by adding one to 1010 giving 1011. So if we want to subtract 0101 from, say, 1111, we simply add the 2's complement and ignore the last carry if there is one.

```
 1  11  1    carries
    11 11
 +10  11     2's complement
 ------
    10 10
```

straightforward subtraction

```
   11 11
  −0101
  -----
   1010
```

These give the same answers and we have a method of subtracting via addition. The same is applied to division since division is only successive subtractions.

Binary multiplication

As a final example let us look at multiplication.

```
   1.101
  ×1.01
  -----
   1101
  0000
 1101
 -------
 10.00001
```

As in decimal multiplication the partial products are added. We could have also ignored multiplication by zero and shifted one space to the left for the next partial product.

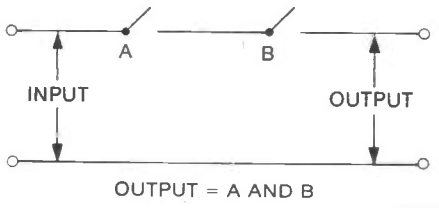


Fig 18 *Switch representation of AND logic*

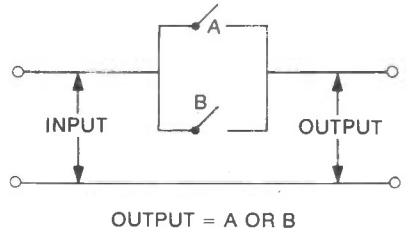


Fig 19 *Switch representation of OR logic*

Logic circuits

The representation of an AND gate using switches is shown in *Figure 18*. The series switches must be closed in order to produce an output.

The representation of an OR gate using switches is shown in *Figure 19*, and here, if either of the parallel switches are closed, the input will be transferred to the output.

Diode-resistor logic

If a diode is used as a switch, a circuit could be arranged as in *Figure 20* to form an AND gate. As the circuit stands there is no input, hence the output will be zero. If either of the inputs is connected to +V, volts, the other diode still remains conducting and brings the output down to zero volts.

Only when both diodes are connected to +V and made non-conducting is the voltage +V allowed to appear across resistor R giving an output.

By rearranging the components as in *Figure 21*, an OR circuit is obtained. This one is easier to explain since a voltage applied to either of the inputs will cause the diode to conduct and the input to appear at the output.

There are two disadvantages to using diodes. Any conducting diode has about 0.7 volts across it and causes the logic levels to be ill-defined. The other problem is that these voltage drops add up for circuits in tandem, giving reduced driving capability.

The logical operations discussed so far are called combinational logic, since the outputs change as quickly as the inputs. Later, sequential logic will be dealt with, where the outputs change after a predetermined time has elapsed from a change of input levels.

The other point worth noting about

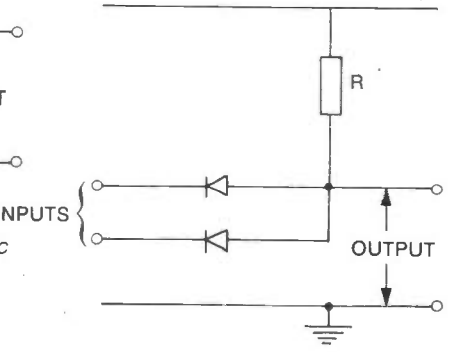


Fig 20 *Diode resistor AND logic*

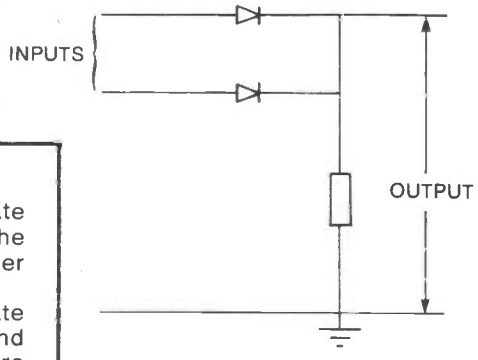


Fig 21 *Diode resistor OR logic*

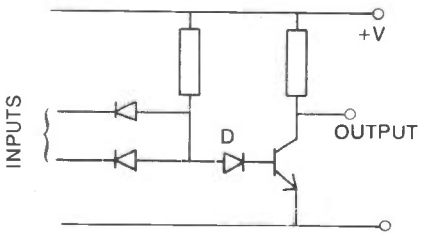


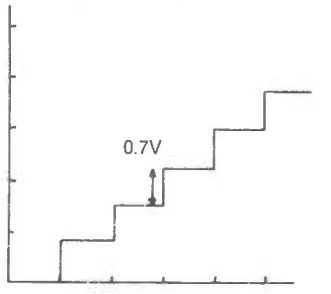
Fig 22 *DTL NAND gate*

logic levels is the difference between positive and negative logic. This simply refers to the polarity of the output. If logic zero is close to earth potential, then logic 1 is furthest away from earth potential. This can be +V or −V depending on whether a positive or negative supply is used. So if logic 1 is represented by +V, then positive logic is being used. Similarly −V will represent negative logic.

Diode transistor logic (DTL)

A transistor can be added to the diode resistor gates to act as a simple amplifier, and since a transistor inverts its input, the AND gate is turned into a NAND gate *(Figure 22)*.

Fan out is the number of gates that a circuit can drive. Fan in is the number of inputs that can be connected to a given gate.



AND gates in series

Fig 23 *Voltage losses across diodes*

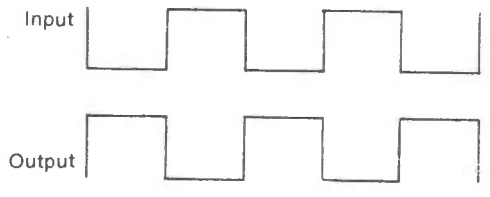


Fig 24 *Transistor output with square wave input*

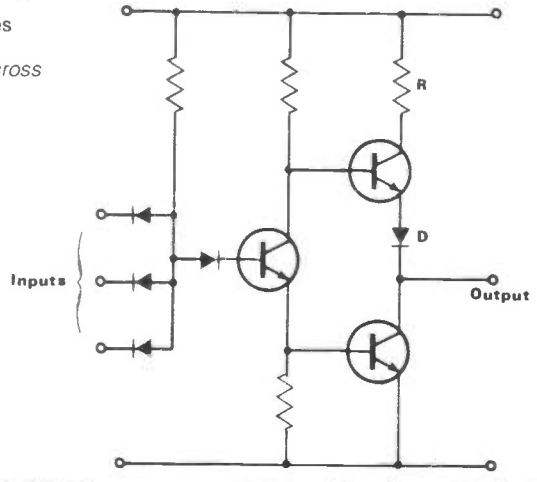


Fig 25 *Totem pole*

The diode resistor gate suffered from ill-defined logic since each gate would 'steal' 0.7 volt from the supply, as shown in *Figure 23*, giving poor fan out. The DTL circuit overcomes this and gives an output that follows the input quite faithfully *(Figure 24)*. There is a slight problem in that 0.7 volt is sufficient to turn on the transistor, so 0.7 volt across the diode gates would turn the transistor on, giving the circuit poor noise immunity. Therefore level shifting diode D is added and now 1.4 volts is required to turn the transistor on. This enables the circuit to accept anything below 0.7 volt as logic 0.

The circuit of *Figure 22* is quite a good one except that if it needs to switch something like 10^6 times per second then stray capacitance prevents rapid charge-discharge. This can be overcome by employing a second transistor, giving the totem pole appearance of *Figure 25*. The transistors in the totem pole switch alternately, giving a nice square wave output.

Diode D protects the upper transistor and the collector resistor R is of lower value than that in *Figure 22*, acting as a surge limiter. REW

To be continued

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

With the onset of winter the slow-scanners have emerged from hibernation, and I'm pleased to record a few letters from this fraternity. Dave Probert G4JBU sends a note to let us know there are still a few SSTVers knocking around in the West Midlands:

'I have been very active myself,' he writes, 'as well as having set up an SSTV station for the Boy Scouts' Jamboree on the Air, which was very successful. We worked into the States and Italy, and a superb 'cop' was a T77G in San Marino – probably the only SSTVer in that country. Arthur G5KS, Ken G8DIR and Alan G1TBL are all active on slow-scan locally, and we shall shortly be getting another convert, Jack G0ESP, who has just purchased a second-hand Robot.'

At the St Albans Rally I met Arthur G3RYF, who reminded me that there is a slow-scan net daily except Sundays on 7040kHz. It starts at 08.15 GMT and has participants from Austria, Denmark and Germany – as well as the UK. Everyone is welcome and this regular session will be useful if you need to test a receive converter. Arthur has just built the ZL1 converter and is now ironing out the gremlins.

Now onto a letter from Dudley Gordon GW6ZUQ, who is in Chepstow. He says: 'I have recently acquired a DRAE SSTV transceiver and am looking for contacts on two metres. Repeated calls on 144.50 have brought no response. Anyone interested in contacts can arrange a sked by ringing (02912) 6867 and I shall be only too happy to try.

'HF facilities are an FT-707 which has been in use for many years for SWLing, and recent pictures include a large number sent by JOTA stations and during European contests. The highlight for me and the children was a set of pictures sent from Italy showing Disney characters.

'I am a member of two local clubs, and the Newport Amateur Radio Society hopes to be active on Monday nights with HF SSTV on 80 metres (callsign GW4EZW). They look forward to the contacts and also have facilities for ATV on 432MHz.'

A phone call from Andy G6OHM in March, Cambs, advises us that, thanks to the Fenland net, SSTV is still very much alive in East Anglia. Regular participants include the relocated G3WW, G6SXB (Les, a newcomer), G4TUK, G4RRY, G6YQC, G4BDD and others. So beam towards the east and see what's happening!

Finally, two letters arrived from Sandy Pimlott G8IDE in St Budeaux by Plymouth, who was attracted to SSTV a couple of years ago by a Bernard Babani paperback. Book no 215, *Shortwave Circuits and Gear for Experimenters and Radio Hams*, contains an article on building an SSTV monitor, and Sandy decided he could construct this virtually from junk-box material. Finding a suitable tube was not easy, and eventually he settled for a Brimar SES-DP2 (but with no data!). Anyway, this was put to work and signals were received at length on 14.230MHz.

'Great fun!' says Sandy, 'Shades of Logie Baird as ghostly letters and shapes punctuated by bright flashes appeared on the screen. And much more fun than drivelling black boxes!'

Sandy has also built his own camera to record the SSTV pictures as 'hard copy' (no simple Polaroid for him!). The camera is made of plastic drain-pipe and a plant pot, with lens from an old projector. Pictures are recorded direct onto contact paper, and exposure timing is controlled by an Answerphone mechanism! Sounds fabulous and I have seen the results to prove it, although they would not be easy to reproduce here. Sandy would be pleased to hear from anyone who knows where to obtain slow-speed negative slides (glass or celluloid).

Microwave matters

We start with Terry Court G4IAG, who lives at Corley Ash near Coventry. He says he is now active on 10GHz ATV. The equipment has been built and he is ready for portable operation, so watch out for G4IAG/P.

Peter G3PYB and Barry G8AGN have both worked /P from the TV tower at Emley Moor, making a one-way contact with Derek G0BTA/P in Steinigot, Lincolnshire. Steve G8EBM has a TWT working on 10GHz and can send ATV. He is anxious for skeds with anyone in a 75 mile radius of Derby for 24GHz as well!

The Crawley repeater, GB3CT, has been on the air since 2nd November, as you will probably know if you are within viewing distance. They have solved the problem of varying deviation levels caused by people operating with different video levels on the input. The cure is a Worthing group video AGC module, which brings all input signals to a fixed 1 volt level. This little gadget is highly recommended and can be obtained from the group for £16 (cheques should be made payable to W&DVRG and sent to GB3VR, Toftwood, Mill Lane, High Salvington, Worthing, Sussex).

The Worthing repeater in Brighton was re-established on the same day (confused?). It now uses two G3JVL quad yagis for Tx and Rx beaming west. These may be converted later to a steerable array. P5 pictures are received from the repeater from Brighton along to Chichester, so the new site is a great improvement. Reception reports have been received from as far away as Portsmouth, where G3VPS gets in with P3 results. Other P5 users include G4WTV, G6CSX, G8KOE, G1NBX, G8VEH, G6MPE, G4LXC, G4HSY, G8DHE, G8XRX and G8XEU. I am told it was like bedlam on the opening night – let's hope it is sustained! Never short of new ideas, the repeater group is now considering establishing 10GHz links to the repeaters at Crawley and Hastings. The latter is definitely a line-of-sight path and the repeater itself should be on the air within a few months.

At Bristol work proceeds apace on GB3ZZ. The hardware is partially built and site trials from the actual location were held on 2nd November. The 3-5 watt pilot transmitter was received with P4 pictures 24 miles away at Stroud, so the site seems to be adequate! The finished repeater will run the full legal limit with a BLV93 PA from LMW Electronics. They have bought an Alford Slot antenna from G3JVL (and were donated free crystals by Quartslab – good for them!). The rest of the transmitter uses Wood & Douglas modules, and the latter firm also supplied a GaAsFET preamp at a special discount (good for them, too!).

The receiver itself is a modified *R&EW* downconverter feeding a Wood & Douglas 50MHz VIDIF and sound board. Test card is produced by the *R&EW*/ Worthing device and logic is modified GB3US. Duplexing into the antenna is with interdigital filters made up from designs in the *RSGB VHF/UHF Manual*. Shaun G8VPC says they have 30 members now, which is not bad at all.

Moving west towards Oxford, G6ZHC in Cholsey has built the Solent equipment and is exchanging P5 pictures with G6IMQ, who is a mile away. The latter is running 10mW from a single BFR96

NETWORK 934

Andy Emmerson G9BUP

transmitter and Solent converter plus BATC FM board for receive. G3UMF, above Oxford, has received the Dunstable repeater with a home-made converter and BATC FM demodulator. In Oxford itself, G8PX is still experimenting with his W&D UFM01+PT4577 linear+TRW MX15 amplifier. This gives 12 watts on 428MHz, driving a home-made tripler, and produces 4 watts at 1268MHz. Jeff is looking for a good mono camera which runs on 12 volts, so if you have one for sale give him a call on Oxford 58785 (palindromic number!).

Seventy cm

I had an excited phone call from Simon Hamer recently, who is a TV-DXer in New Radnor, Powys. During the excellent lift of 30th November last he saw P5 pictures from PE1DWL with just a whip aerial on a portable TV. Many German broadcast TV stations were coming in at the same time, on Band III and on UHF.

Jeff Jefferies G8PX pops up again on 70cm with a report on ATV activity in the Oxford area. The local net operates on Tuesday and Thursday evenings, as well as Sunday mornings. It is well supported by G3UMF, G4PUU, G6YTW, G6ZHC, G6IMQ, G0CAD and G8PX. Three welcome newcomers are G6MSQ, G8FHY and G8SIN. Jeff has put up a masthead GaAsFET preamp and finds a P1 improvement. He is now working on a linear so that he can put out as good a signal as he receives!

Well, that's it again. Please let me have your news and photos. REW

Good news on the licence conditions front! A recent consultative meeting held at Waterloo Bridge House recommended a number of changes to the rules governing 934MHz operation. They will come into effect in a few months' time and the big news is that longer beams are to be legal.

Antennas with up to 12 elements are to be permitted, which means maximum legal antenna gain is now 14dB (isotropic). It is difficult to translate this exactly into watts in a real world situation, but this much is clear. Twelve elements are a lot better than four, so many DXers will be thanking the DTI.

One point I have to make – at the risk of boring you – is that with a mobile installation this means that you can now concentrate the 5 watts from your transceiver into an extremely narrow beam. Prolonged exposure of humans to this kind of power is unlikely to do them any good, so do make sure you don't accidentally point the beam at people while transmitting. Best of all get one of those lightweight 12 foot masts with a tripod base; this will get your signal up in the clear and launch it better, as well as making sure you aren't sterilising people.

There are no other major changes in the licence – so no high power linears will be allowed – but the text of the licence will be made clearer. This will clarify some previously grey areas and indicate that business use of the band is definitely permitted.

Cellular interference filters

In the past I have mentioned a cavity filter offered as a cure for interference caused by nearby cellular radio base stations. It turned out to be rather less than the miracle cure suggested (surprise, surprise) and that scene went rather quiet. Now a new design has appeared, in the shape of a three-pole interdigital filter. This design (you can look it up in the *RSGB VHF/UHF Manual* in most libraries) offers better rejection characteristics than single cavities, so it might be a goer. The distributor is quite pleased with its effect but sensibly is offering it on a sale or return basis, so if it turns out to be less than the perfect cure you haven't lost £65. Once I have put it through its paces I shall let you know what it's like.

PRS progress

I have mentioned before the kind of automated radio they have in Japan and Switzerland, called Personal Radio Service (PRS). It's a bit like a cross between UHF CB and cellular radio, because you dial the call numbers of the person you want on a keypad and once you have made contact other people cannot accidentally break into your QSO. Unlike cellular radio, though, there is no repeater station involved, so your partner has to be in range.

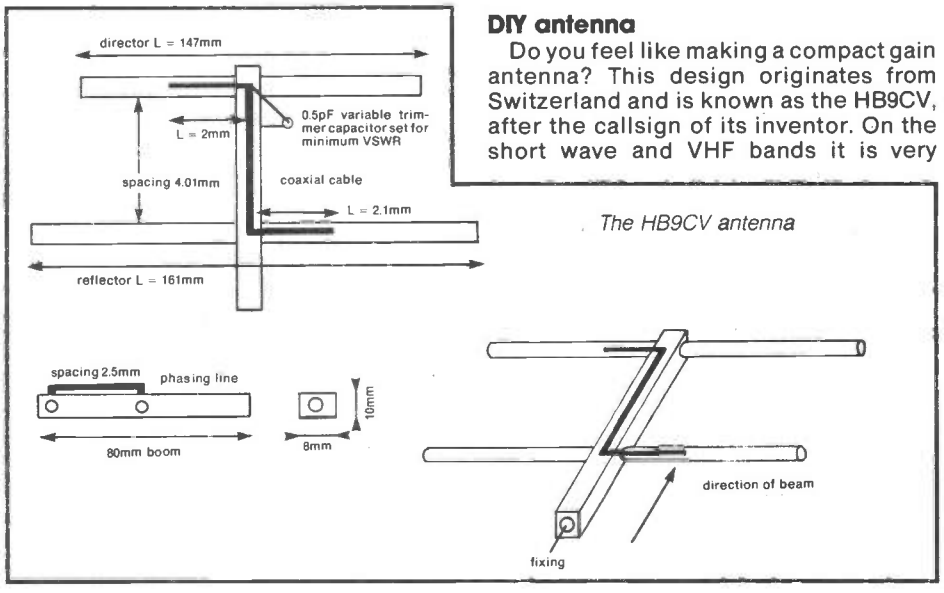
PRS is probably best expressed as a superior kind of selective calling (selcall) system, and the sets on sale in Switzerland also give you the option of using the 'traditional' means of calling the person you want, direct on the calling channel (or any other channel of your choice).

Several people thought that PRS (called SRR or Short Range Radio by the DTI) would be a useful facility in the UK. There is a spare megahertz set aside for personal radio services at 933MHz, and this has in fact been reserved for this purpose throughout western Europe. I must admit that I am very much in favour of PRS; it would give people who are not really into CB or amateur radio a handy low-cost private channel system. The privacy and freedom from unwanted break-in would appeal to them and also to those business users who are currently on 934MHz. Don't assume, however, that everyone shares this viewpoint. There are commercial interests which see PRS as a threat to cellular and business radio (PMR), and they are trying to persuade the Government to allocate 933MHz to radiopaging or some other commercial use.

So far, not many trials have been made of PRS in this country; in fact only three people have PRS sets as far as I know, and they have had to be imported from Switzerland. In fact it was only last month that the first 933MHz PRS test and development licence was issued, to Selectronic of Canvey Island. This, incidentally, is not due to lack of motivation; it takes a long time to get one of these licences – I have been waiting since last August for mine, such is the speed of the DTI's licence branch! A PRS Club of Great Britain has also been formed, though since their first newsletter last summer nothing has been heard from them.

DIY antenna

Do you feel like making a compact gain antenna? This design originates from Switzerland and is known as the HB9CV, after the callsign of its inventor. On the short wave and VHF bands it is very



The HB9CV antenna

popular because of its small size, and it would be ideal for mobile or portable use. It is not really weather-proof, so it would not be the kind of thing you could leave out in the rain as a base station aerial (and you might want something bigger at home, anyway).

This is not the place to go into the theory of the HB9CV mini-beam – you can find that on page 830 of Jessop's *VHF/UHF Manual*, published by the RSGB. The materials are aluminium rod and square section, available from some DIY and model aircraft shops, though you could also try brass, stainless steel or whatever. The trimmer capacitor should be found in most amateur radio emporia. Note that the phasing wire must be kept insulated from the boom of the antenna, and the spacing should be adhered to.

I would recommend this design to people who already have some experience of playing around with aerials; I have not tried it myself but it has the recommendation of Personal Radio Switzerland, the Swiss 934MHz club. Good luck!

The technical data is as follows:

Gain ..... 4dB over a dipole
Front-to-back ratio 14dB
Horizontal beamwidth ..... 75 degrees
Vertical beamwidth ..... 110 degrees

Mechanical details:

Diameter of the elements 4mm
Metal boom ..... 8mm × 8mm
Phasing wire ..... 1.5mm diameter, fixed 2.5mm away from the elements and boom
Compensating capacitor ..... 0.4 to 0.5pF

MEDIUM WAVE DXING

by Steve Whitt

If you've been reading this section in previous issues of *R&EW* and have wondered how to get started in the world of medium wave DXing, worry no more, since this month I shall answer questions like 'What can I hear?', 'How much will it cost?' and 'What sort of radio do I need?'

Back to basics

In this section I will take a brief look at what one needs to become an MW-DXer and how to go about getting started. Firstly, it is important to realise that the MW-DXer can start listening with very cheap and simple equipment; any domestic radio will tune the MW band and it is quite easy to hear 50-100 different stations at night using just an internal aerial. However, it is probably preferable to use a better quality domestic radio or a good car radio to get started, and with this equipment stations from all over Europe and North Africa will be heard.

If radio conditions are favourable and you listen at the right time, reception of some North American stations should be possible. In this way you can have a go at DXing the MW band before committing yourself to any more sophisticated (or expensive) equipment.

On the other hand, if you are already a practising short wave listener, all that is needed to get going on MW is a change of waveband. Indeed, many SW listeners tend to overlook the fact that their radios can usually tune the MW band and that their outdoor aerials are also effective in picking up distant MW signals. For the SW listener who has grown tired of the mega-watt propaganda stations (and their associated jammers) a fresh challenge can be found on the MW band.

Round the clock

It is possible to DX on the MW band 24 hours a day (provided you don't need to sleep!), but the band has two distinctly different 'personalities' according to the time of day. During daylight hours MW radio signals are absorbed in the lower layers of the ionosphere and only ground wave signals propagate. These signals radiate away from the transmitter rather like ripples in a pond and allow reception at distances up to about 500km away. Daytime is a good time to listen for low power local radio stations in the UK, since very few distant signals are audible and therefore interference is at a minimum.

At night the ionosphere tends to reflect, rather than absorb, MW signals and thus energy radiated upwards from a transmitter is reflected back down to Earth at some point far away from the transmitter. It is quite possible for night-time signals to undergo multiple hops with alternate reflections occurring in the ionosphere and off the Earth's surface. This mechanism allows reception to take place many thousands of km away from a transmitter.

For example, Radio Globo in Rio de Janeiro, Brazil is regularly heard in the UK, its signal having to cross 9500km of ocean on the way. You will, of course, notice that night-time skywave propagation fills your radio dial up with hundreds of powerful European signals, so how is it possible to hear the weak DX signals?

Over the years international broadcasting organisations have agreed a band-plan arrangement on the MW band which entails all stations in an area operating on fixed frequency channels. This has been arranged to maximise the number of broadcasters who can operate and to minimise the degree of interference affecting the listener. Fortunately for the DXer, international agreement is not perfect and as a result different MW bandplans are operated in different continents; most European, African and Asian stations use channels that are exact multiples of 9kHz, whereas in the Americas channels are assigned as multiples of 10kHz. This means that by tuning between the European broadcasters, reception of transatlantic stations becomes possible. For example, 1008kHz (112 × 9kHz) = NOS Hilversum, Holland; 1010kHz (101 × 10kHz) = WINS New York, USA; 1017kHz (113 × 9kHz) = SWF Baden Baden, Germany.

This particular example also illustrates the value of knowing a station's timetable. Although reception of WINS is technically possible as soon as a path of darkness exists between New York and the UK, NOS is a pretty powerful signal and will cause interference. However, NOS signs off for the night at the unusually early time of 2100 or 2200hrs GMT, and knowing this it is possible to tune a virtually interference free signal from WINS before midnight. And if you've yet to hear your first American station, WINS is a pretty good bet; try any

Laser on the mv Communicator. To be or not to be?

time after 2300 and listen for an all news/talk station with the slogan 'Give us 20 minutes and we'll give you the world'.

News headlines

It's all change (again) this month in the news department. Laser Hot Hits' return to the air was short-lived since they abruptly signed off on 15th December. Stormy seas were causing severe arcing over the aerial insulators and there were apparently problems with the generators.

Laser's management therefore decided to pull the plug until all engineering work could be carried out to make the station shipshape. At the time of writing 576kHz is still silent, although tests were heard from the *mv Communicator* just before the New Year.

Reports from Japan indicate that the Soviet Union has ceased jamming Radio Beijing's Russian language programmes for the first time in twenty years. Fortunately, jamming on the MW band is not as widespread as on the higher frequencies, but nevertheless it is still there. Currently, the most active jammers on the band are Iraq and Iran who, in addition to the war on the ground, are fighting a propaganda battle of the airwaves.

DX FILE

Even as I write this column, radio propagation conditions for MW-DX are the best they have been for many years. Keen MW-DXer Derek Taylor has been listening to the MW band for some 20 years, but describes reception in early January as some of the best ever. Using a Sony ICF2001D with a tunable loop aerial, Derek heard the following at his Preston location.

620kHz WSKQ Newark, New Jersey *
790kHz KURM Roger, Arkansas *
790kHz WPFA Pensacola, Florida *
820kHz WBAP Ft Worth, Texas *
930kHz CJCA Edmonton, Alberta *
1090kHz KING Seattle, Washington *
1090kHz KAAY Little Rock, Arkansas *
1140kHz CKXL Calgary, Alberta *
1410kHz CFUN Vancouver, British Columbia *
1510kHz KGA Spokane, Washington *

The majority of these stations were logged in the early hours of 8th January and those marked with an * are believed to be UK 'firsts'. In fact, Derek described KURM as 'probably his best DX catch ever!' Radio conditions were definitely out of the ordinary since I noted that CJYQ, for example, which is a regular on 930kHz, was totally absent and instead CFBC in New Brunswick was coming through clearly. Similarly, on 1050kHz WHN, the New York country music station, had been displaced by CHUM from Toronto with 'golden oldies'. In addition to the North Americans, my log for this period also includes a number of stations in the Caribbean islands of St Vincent, Antigua, Turks and Caicos, and Anguilla.

Well that rounds it off for another month. Good luck chasing the DX and do let me know how you get on. If you have any tips, ideas or problems just drop me a line c/o *R&EW* at the address on the contents page. REW

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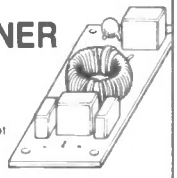
Complete Parts Sets for Top Projects

MAINS CONDITIONER

FEATURED IN ETI, SEPTEMBER 1986



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

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

Our approved parts set consists of PCB, all components, toroid*, enamelled wire, fixing ties, fast response VDR*, and full instructions

ETI MAINS CONDITIONER PARTS SET ONLY £4.60!

***Note:** the toroid and VDR supplied are superior to the types specified in the article.

TACHOMETER AND DWELL METER

FEATURED IN ETI, JANUARY 1987

MOTORISTS QUIZ

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

Do you

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

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

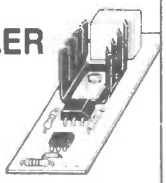
TACHOMETER AND DWELL METER PARTS SET

£12.90 (with terminals for external meter)

£16.40 (with self contained meter)

MAINS CONTROLLER

FEATURED IN ETI, JANUARY 1987



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

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

The mains controller connects directly to most TTL families without external components, and can be driven by CMOS with the addition of a transistor and two resistors (supplied).

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

MAINS CONTROLLER PARTS SET £6.20

POWERFUL AIR IONISER

FEATURED IN ETI, JULY 1986

Ions have been described as 'vitamins of the air' by the health magazines, and have been credited with everything from curing hay fever and asthma to improving concentration and putting an end to insomnia. Although some of the claims may be exaggerated, there is no doubt that ionised air is much cleaner and purer, and seems much more invigorating than 'dead' air.

The DIRECT ION ioniser caused a great deal of excitement when it appeared as a constructional project in ETI. At last, an ioniser that was comparable with (better than?) commercial products, was reliable, good to build — and fun! Apart from the serious applications, some of the suggested experiments were outrageous!

We can supply a matched set of parts, fully approved by the designer, to build this unique project. The set includes a roller tinned printed circuit board, 66 components, case, mains lead, and even the parts for the tester. According to one customer, the set costs 'about a third of the price of the individual components'. What more can we say?

Instructions are included

DIRECT ION PARTS SET £9.50

MATCH BOX AMPLIFIERS

20W Single IC parts set £6.50

50W Bridge Amplifier parts set £8.90

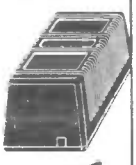
L165V Power Amplifier IC, with data, £3.90

LM2917 EXPERIMENTER SET

Consists of LM2917 IC, special printed circuit board and detailed instructions with data and circuits for eight different projects to build. Can be used to experiment with the circuits in the 'Next Great Little IC' feature (ETI, December 1986)

LM2917 Experimenter Set £5.80

RUGGED PLASTIC CASE,



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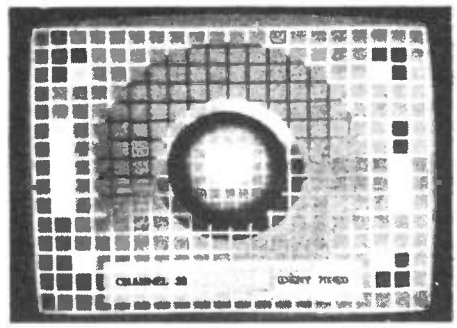
WHITE IONISER PARTS SET ONLY £9.80!

Orders should be sent to Specialist Semiconductors at the address below including 60p towards postage and packing. Please allow up to 14 days for delivery. There is no telephone service at the moment, but all letters or requests for lists will be answered (at top speed if you send SAE!)

Specialist SEMICONDUCTORS

FOUNDERS HOUSE REDBROOK MONMOUTH GWENT

DX-TV RECEPTION REPORTS



Compiled by Keith Hamer and Garry Smith

November was a remarkably active month for all types of DX propagation. Sporadic-E was in abundance considering the time of year, with openings on many days, especially the 12th when the whole of Band I became extremely active during the morning.

Meteor shower DX increased towards the latter part of the month and there were even instances of auroral activity in Scotland on the 12th and 15th, with identified signals from Norway and Iceland.

A high pressure system over Europe resulted in an intense trop opening on the 29th and 30th which brought in signals from as far away as Sweden on UHF channels. All in all, it was quite a pleasant month with lots to see.

DX-TV logs for November

This month we are featuring two logs. The first has been sent in by Bob Brooks of South Wirral and shows his successes via sporadic-E.

2/11/86: Unidentified news programme with letters 'NRD' at 1014; CST (Czechoslovakia) R1 with CST logo and feature film between 1040 and 1129; ORF (Austria) E2a showing the PM5544 test pattern with 'ORF FS1' identification.

6/11/86: NRK (Norway) E2 with programme schedule at 0848.

7/11/86: RAI (Italy) IA radiating the 'RAI 1' PM5544 test pattern at 0816.

12/11/86: TSS (Russia) R1 with the UEIT electronic test pattern followed by the 0249 monoscopic test card at 0924; unidentified programmes noted on R1 and R2 in SECAM colour.

19/11/86: TSS R1 showing the 0249 test card at 0857; CST R1 with the 'RS KH' EZO test pattern; SVT (Sweden) E2 with the 'TV1 SVERIGE' PM5534 at 1452.

20/11/86: Unidentified programmes on R1 at 1016; CST R1 with the 'RS KH' EZO test pattern at 1159.

24/11/86: CST R1 radiating the 'RS KH' EZO test pattern at 0834.

25/11/86: TVE (Spain) E3 and E4 in colour between 1010 and 1035.

Our other log comes from Simon Hamer in New Radnor (Powys) and shows some of the stations received via enhanced tropospheric conditions.

28/11/86: TDF (France) Canal Plus on channel L5.

29/11/86: RTL (Luxembourg) RTL+ on channel E7 (Dudelange transmitter); NOS1 (Netherlands) E4, 5, 6 and 7; TDF Canal Plus L5, 6, 7, 8 and 10; BRT1 (Belgium) E10; RTBF1 (Belgium) E3, 8 and 11; West Germany WDR1 (Westdeutsches Fernsehen) E9; TDF (tf1, A2 and FR3 networks) E22, 23, 25, 28, 34, 35, 37, 48, 53, 63.

30/11/86: NOS1 E4, 5, 6, 7, 29, 39, 50; NOS2 E27, 31, 53, 54; BRT1 E10, 43; BRT2 E46, 62; RTBF1 E3, 8, 11; RTBF2 E42; WDR1 E9; West Germany NDR1 (Norddeutscher Rundfunk) E53; NDR3 E53, 55, 57; West Germany ZDF (Zweites Deutsches Fernsehen) E34, 35, 37; DR (Denmark) E7; DFF1 (East Germany) E11, 12; TDF Canal Plus L5, 6, 7, 8, 10; TDF (tf1, A2, FR3) E22, 23, 24, 25, 28, 37; RTE1 (Eire) channel F, H and E29; RTE2 channel I, J and E33.

Our thanks to Bob and Simon for sending their DX-TV logs. We are always pleased to hear from our readers, so why not send in details of your successes?

Reception reports

Iain Menzies of Aberdeen saw quite a few signals via sporadic-E during the month. The 2nd brought in Yugoslavia on channels E3 and E4, while the 15th raised Italian signals during the late afternoon on channel IA. The most interesting opening, however, occurred on the 12th with intense activity from Russia on channels R1 and R2. Two Russian test cards were seen – the UEIT electronically generated type and the rather antiquated '0249' monoscopic test card. The opening also produced Italian channel IA DX and various Eastern European FM radio transmissions between 63MHz and 72MHz.

Tony Privett of Basingstoke has commented on the scarcity of DX in his neck of the woods during the past few weeks. Even so, the recent high pressure over Europe resulted in DX from Belgium, France, West Germany, Luxembourg and the Netherlands in Band III, with many reasonable UHF signals as well.

Tony has queried an FuBK test card on channel IA which he received during a recent sporadic-E opening. This was almost certainly 'Radio-Tele-Uno' using their distinctive electronic test card, which in some respects resembles an FuBK but it has a characteristic chequered band in the top part of the pattern. If anyone knows the correct name for this type of test card, which is used extensively by many private stations throughout Italy and even Denmark, please let us know.

The tropospheric opening at the end of November generated lots of excitement for Simon Hamer of New Radnor in Powys. Despite his location he managed to see East German transmissions on channels E11 and E12 from Schwerin and Sonneberg respectively. Of special interest to Simon was reception of Norddeutscher Rundfunk's FuBK test card which carried the identification 'NDR3 HMBG'. This transmission was noted on channels E53, E55 and E57.

Simon Bryant of Fareham in Surrey discovered he'd received Sweden on channel E33 without knowing while he was playing back a video recording of a BBC2 programme transmitted earlier in the day. The Swedish second network 'TV2' logo could be clearly seen in the background. The transmitter most likely to have been received was Hörby situated in the southern tip of the country. The outlet's ERP is 1000kW.

Other DX-TV signals noted by Simon included many West German ZDF stations and NDR-1 and NDR-3 programmes on UHF from northern Germany. It goes without saying that many Dutch transmitters were also present. Another important DX event for Simon was his first amateur TV signal from G6OBK in Ramsgate who, incidentally, was beaming towards the Netherlands at the time. Bands I and III weren't quite so productive, although Danish transmissions from Fyn on E3 and Sonderjylland (channel E7) appeared during the opening.

S J Smith has written in from Danbury in Essex with details about his latest DX successes. He uses two Antiference XG 14 aerials connected via masthead amplifiers for groups A and C/D. The arrays are joined to produce wideband coverage with a dip at around channel 40. Although joining two aerials together in this way isn't normally recommended, it certainly seems to work in this particular case. Not only has he received numerous British regional TV stations, but signals have also come in from Belgium, France, the Netherlands, West Germany and Luxembourg. Many ATV stations have also been logged.

The excellent tropospheric DX conditions towards the end of November produced a first for Ray Davies in Happisburgh (Norfolk). While tuning at the top end of the UHF band on the 30th, he noted weakish line syncs. Ray was using a Grundig colour receiver with frequency synthesized tuning, and adjustment revealed that the signal was not a standard CCIR channel allocation. It was, in fact, a system 'M' type, as used in the USA or by the American Forces TV stations in Europe. The signal came through at high levels for most of the afternoon and captions confirmed that an American Forces outlet was being received. The only high power station operated by AFN-TV at the top end of the band is Soesterburg in the Netherlands on channel A80. This corresponds to a vision frequency of 867.25MHz. The sound and colour were absent since the transmission was NTSC with 4.5MHz sound spacing.

One interesting observation was the ability of Ray's set to detect the 60Hz frame frequency component of the signal and provide the application of the necessary frame timebase correction automatically. This is a feature of recent timebase design.

Recognising 525-line signals

Most enthusiasts are a little puzzled about what to expect should they be lucky enough to receive a 525-line system 'M' transmission. Adjustment of the line-hold always springs to mind, but in fact the line timebase frequencies are very similar in the 525 and 625-line systems due to the different field frequencies which are used. At 525 lines the line frequency is 15.750kHz which is actually higher than the 625-line frequency (15.625kHz). It is the frame timebase where correction is usually necessary, since the 525-line system 'M' standard is 60Hz, whereas on the 625-line system it is 50Hz.

A 525-line signal can often be recognised by the loss of frame sync on weak signals. Sometimes the timebase will lock without further adjustment of the frame-hold control if the signal is strong. There is, however, a noticeable feature in that the height is greatly reduced. During the last sunspot peak between 1979 and 1980, signals from across the Atlantic could be easily recognised.

American Forces network in Europe

Kevin Jackson has sent in details about the AFN-TV service which is centred at SHAPE in Belgium. Transmissions are vertically polarised and are beamed from a 60 metre high antenna on channel 34. The ERP is 1.5kW, with a special loop towards Chievres Air Base near Ath (Belgium) giving a maximum ERP in that direction of 4.5kW. The American 525-line system 'M' is used with NTSC colour.

All programming originates from Frankfurt in West Germany utilising video tapes which are relayed to SHAPE via microwave. Direct programmes from the USA are relayed via satellite to Frankfurt and then passed on to SHAPE. The microwave network is expected to be replaced by a satellite link from Frankfurt in the near future.

AFN-TV Europe operates from 0600 GMT until 0200 the following morning. On Friday and Saturday nights and also evenings prior to American holidays, AFN-TV broadcasts throughout the night. During the four-hour break in transmissions between 0200 and 0600, AFN-TV radiates a colour bar pattern.

BBC TV on channel E6!

During the tropospheric opening at the end of the month, Tony Privett noted a faint BBC transmission on channel E6. This phenomenon has occurred during other trop openings and Tony thinks that it may be extraneous RF from the distributed TV and radio system used in a local hotel some half a mile away. Has anyone else witnessed such an effect over this distance during a trop opening?

Several years ago West German TV signals used to appear roughly half-way between channels E5 and E6 amid intense openings. The frequency offset was far too great for it to have been a normal transmission channel. Because many DX-TV enthusiasts reported this effect, the possibility of instability and cross-modulation being produced within the DX receiver system was ruled out. The leakage of RF from CATV systems on the Continent was one suggestion, but if anyone can comment on this subject many readers will be grateful!

Strange reception in Majorca

Two unidentified signals were recently noted in the Mallorcan capital, Palma. The first was received in Band III and was picked up during a period of high pressure, leading one to assume that it was received via tropospheric propagation. The network was called 'The Arts Channel' and, although sound and colour could not be resolved, programmes were obviously in English due to on-screen captions.

The second mystery reception in Palma consisted of a colour bar test pattern late at night on channel E11 or

PHOTO FILE ● PHOTO FILE ● PHOTO

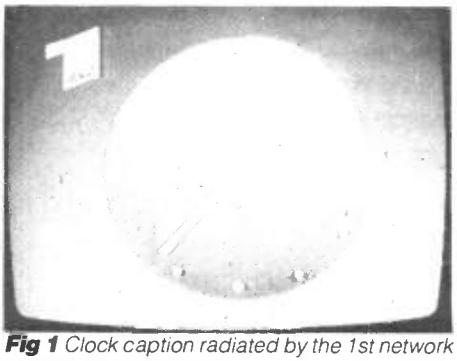


Fig 1 *Clock caption radiated by the 1st network of ARD, West Germany*

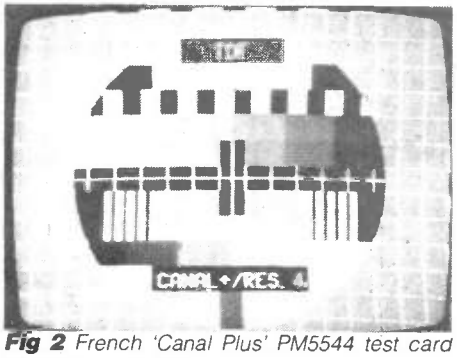


Fig 2 *French 'Canal Plus' PM5544 test card transmitted by TDF*

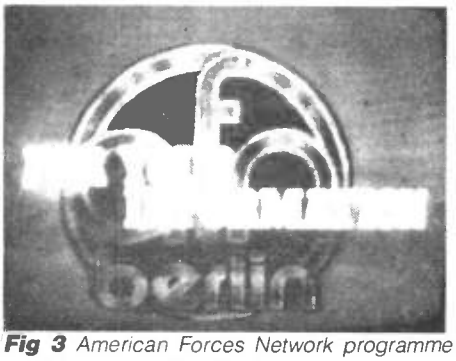


Fig 3 *American Forces Network programme caption used in West Berlin*

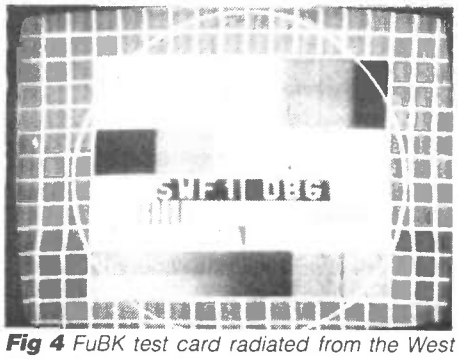


Fig 4 *FuBK test card radiated from the West German outlet at Dillberg*

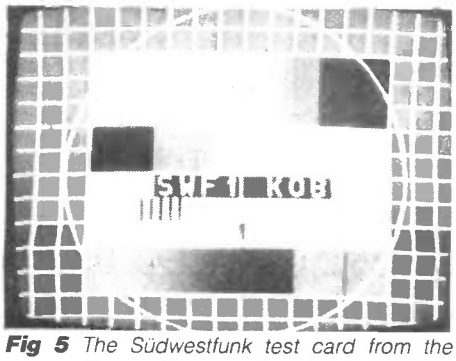


Fig 5 *The Südwestfunk test card from the Koblenz transmitter*

Fig 6 *News programme from NOS in the Netherlands*

E12. The lower portion of the pattern was blank and it incorporated the identification 'SRT 1' or perhaps 'SAT 1' in small white lettering. Again, reception appeared to resemble a trop signal which disappeared as soon as the anticyclonic weather system moved away.

Both TV services were received on a JVC colour portable using the set's telescopic aerial. Please send any information which you may have about these services via *R&EW*.

Service information

Spain: TVE-1 (mainly on VHF) transmits regional programmes for the following areas: Andalucia, Aragon, Asturias, Baleares (Balearic Islands), Cantabria, Castilla-Leon, Galicia, Madrid, Murcia, Navarra, Pais Vasco and Comunidad Valenciana. Most begin at around 1330 local time, although some are broadcast at 0825.

Despite the use of sample teletext pages (called 'Teletexto') during the late morning (which continue until the start of regional transmissions), the GTE colour test card is still radiated via the TVE-1 network. There's only one snag – you'll have to rise nice and early to see it. It's only shown just prior to the start of 'Buenos dias' (TVE's version of 'Breakfast Time'). The test card is also shown for a few seconds after close-down, which is normally around 0030 local time.

TVE-2 operates a national programme (mainly on UHF), although regional transmissions are aired in the Balearic Islands.

The following private TV stations operate in Spain: TVG in Galicia (studios in Vigo, Coruna); ETB (Euskal Telebista) from Bilbao; TV3 from Barcelona for the Catalunya region. Televisio De Catalunya programmes are relayed to the Balearic Islands. The PM5534 test card is used with the identification 'TV 3' at the top and 'TV DE CATALUNYA' in the lower black rectangle. Test card transmissions are listed in programme schedules as 'Aula Visual', whereas TVE list these periods as 'Carte de ajuste'.

West Germany: Private TV stations are planned to come into service in the very near future. In fact, one is already on the air with 1kW ERP on channel E59 from Munich. The service is known as 'MGK'.

Hamburg is to have two channels for private TV (these are expected to be E36 and E48). They will begin in 1988 and both channels will operate with ERP's of about 10kW. Also due to start in 1988 is an outlet for RIAS TV in Berlin. The channel most likely to be used is E25 with an ERP of between 50kW and 250kW.

Czechoslovakia: The first network FuBK test card radiated by Ceskoslovenska Televize now uses the identification 'ODK 2' instead of 'CST 01'. To slightly confuse the issue, CST-2 uses the identification ODK 1' on its FuBK.

Iceland: The state-owned television service operated by Rikisutvarpid-Sjonvarp (RUV) has started radiating programmes on Thursdays. It's not so long ago that RUV closed down for several weeks each summer. Perhaps the extended hours of broadcasting are due to the possible threat from private stations in Iceland.

Teletext is being introduced by RUV, but at the moment there are a few technical problems such as the generation of certain characters. Some of the strange Icelandic accents are difficult to produce with existing technology. A new private station has opened in Reykjavik. It is known as 'Stöd 2' (Station 2) and operates on channel E12 with an ERP of 20kW. The transmitting aerials themselves are mounted on the Vatnsendi mast.

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

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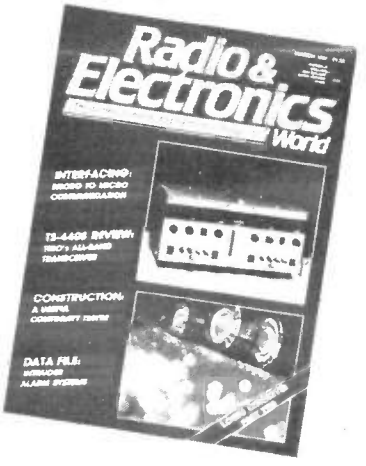

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For the FRG 9600/965 our new HF Converter, connects to the aerial socket, and powered direct from the 8 Volt o/p of the FRG 9600. Tune from 100, 1Mhz to 160Mhz, gives tuning range of 100Khz to 60Mhz, uses double balanced mixer, with low pass filter on input.
★ Can be supplied with BNC termination for other scanners ★

GPA1 PRE-AMP £24.95

2 Mtre RF Pre-amp using BF961 dual gate FET 18 db gain; Low noise, 2Mhz Bandwidth SO 239 termination 25 watts through power. Failsafe switching, can be left in line when not required, auto RF sensing even at ½ watt, can be factory tuned between 28-170Mhz.
★ Can also be tuned for 6-4 mtrs ★

A SELECTION OF OUR MOST POPULAR FILTERS (SEND SAE FOR FULL RANGE DATA SHEET)

RBF1
A range of UHF notch filters (for inner only) stocked at the following frequencies: 435MHz (70cms) channel 36 (for radar blips), 846MHz (RAF Boulmer interference) can be factory tuned from 420MHz to 890MHz. £6.75 each
To order quote RBF1/ followed by type.

HPF1
Low insertion loss high pass filter with capacitive braid breaker for use with UHF TV, VIDEO & PRE-AMPS. £6.75 each

HPFS
High pass filter with transformer braid breaker, better performance than HPF1 but the insertion loss is a little higher. 1-2db best for severe problems for UHF only. £7.00 each

TNF2
A range of notch filters specifically tuned for the frequency of interference on inner and outer bandwidth >1Mhz (2Mhz above 100Mhz). VERY LOW INSERTION LOSS TYPICALLY <0.5db. Stocked for the following frequencies: 14Mhz, 21Mhz, 27.5Mhz (CB), 29Mhz, 50Mhz, 71Mhz, 145Mhz. Also spot tuned at any frequency to 300Mhz. £6.75 each
To order quote TNF2/ and the frequency.

BB1
Transformer braid breaker >25db at 30Mhz, often used with other filters in our range for very severe interference. Ideal at the input of VCR and PRE-AMPS. £6.75 each

IDEAL FOR CLUBS OR EMC GROUPS FOR EVALUATION OF INDIVIDUAL SITUATIONS

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Kit of all filters in our range (11 in all) except for RBF1/846Mhz. £41.70

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YAESU FRG9600/RWC MK3 HF-UHF SERIES

After many months of research and development RWC LTD are pleased to announce their latest HF modification for the Yaesu FRG9600 which now includes LF/HF/VHF/UHF coverage from 100kHz to 950MHz and improved 'S' Meter and a typical receiver *sensitivity now >2μV pD HF, >1.5μV 60-950MHz all @ 12dB SINAD. (Please contact us for detailed specifications).

We have fitted a High performance HF Front-End made for us by AKD. The new HF section **is fitted internally** with switching circuits and a small toggle Switch on the rear apron to enable band change whereby the display changes to read actual frequency (100kHz-60MHz). The standard SO239 antenna connector has now been changed for an 'N' connector for coverage from 60-90MHz and an SO239 connector fitted for HF coverage 100kHz-60MHz. (UHF extended coverage is now standard as per our original MK2 modification up to 950MHz).

As an 'N' connector is now fitted to all RWC FRG9600s for VHF-UHF coverage it is possible to use a wide-band discone antenna such as the ICOM AH7000 which is supplied with low-loss coaxial cable and 'N' connectors. A dipole or long-wire antenna can be used for HF coverage with very good results. **This facilitates use of two antennas for all bands.**

All modifications are Fully Guaranteed for twelve months from date of purchase/modification providing our modifications seals are unbroken.

* We reserve the right to change specifications due to continuous development and modification of this product.

FRG9600/RWC MK3

AM-FM (WIDE & NARROW) LSB, USB. 100kHz-950MHz

Ask the hundreds of FRG9600/RWC MK2 owners how pleased they are!
FRG9600 MK2 Model 60-950MHz 'N' connector @ £519.00 + £5.00 carriage. (Modified unit only).
FRG9600 MK3 Model 100kHz-950MHz 'N' connector and SO239 for HF @ £625.00 + £5.00 carriage. (Modified unit only).
RWC Exclusive Base Station Complete HF-UHF Package FRG9600 MK3 Model, Icom AH7000 ant, G5RV HF multiband, PA4C ac-13V dc adaptor, inclusive carriage UK £725.00.

ICOM AH-7000

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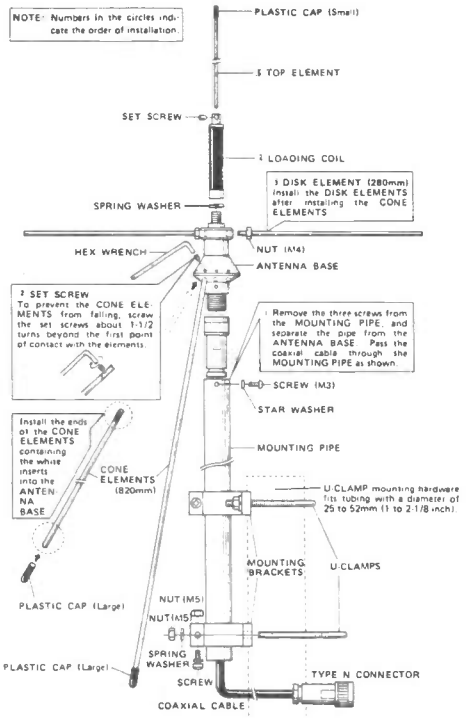

SPECIFICATIONS

Frequency coverage	Receive	25 to 1300MHz
	Transmit	50, 144, 430, 900, 1200MHz bands
Input power rating		200 watts
Input impedance		50 ohms
Supplied connectors		Type N
Supplied coaxial cable		5D-2V (50 ohm)
Type of antenna		Discone
Length		1.7 meters
Weight		1kg

Icom AH7000 @ £82.50 (inc free carriage UK mainland).

YAESU/RWC FRG9600 Options.

PA4C ac adaptor £16.50 inc post.
FIF232C RS232 computer interface @ £75.00 inc post.
Raycom GP900 900-950MHz 3dB, base station ant @ £22.00 inc post.
AM-FM wide & narrow IF filters POA.
RWC 9600 MK2 owners HF mod @ £99.00 inc carriage (send unit).
FRG9600 existing owners HF & UHF mod – 100kHz-950MHz. Send unit carriage paid @ £129.00.
YAESU FRG9600 Service Manual (inc Cat Prog) @ £12.50 inc post.
Raycom VHF-UHF Discone 60-600MHz SO239 connector @ £27.50 inc carriage.
RWC Modified Video Unit. 6.00MHz IF video (modified from NTSC) @ £27.50 inc post.

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QSO

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

ARMS disarmed

In the November issue we published an item on the Amateur Radio Maintenance Service (ARMS), an insurance scheme for radio equipment.

However, the company recently contacted us concerning some problems which they have experienced with the Post Office, causing considerable inconvenience to customers. After advertising in November and receiving no response whatsoever, they became suspicious and decided to do a test posting to the company address. Seven days later, they had still received nothing.

Enquiries at the Head Post Office in Liverpool revealed that all the company's mail was being directed to the Returned Letter branch in error.

We therefore advise readers who are still awaiting replies to correspondence with ARMS to contact them again. We are assured that all enquiries are normally dealt with in a matter of days. Write to: *Amateur Radio Maintenance Service, Freepost, Ormskirk, Lancs L39 3AB.*

High as a kite

A date for your diary is the Chelmsford Amateur Radio Society's lecture on 3rd March, entitled 'Kite Antennas' and due to be delivered by Tony Gilbey G4YTG.

A regular club net takes place on 2m FM at 145.225MHz and 10m SSB at 28.325MHz. The times are 8.00pm for 2m FM and 8.30pm for 10m SSB.

Further details of venue, etc can be obtained from Roy G3PMX and Ela G6HKM on (0245) 360545.

Feedback

The Bury Radio Society meets every Tuesday evening at 8.00pm in the club room of the Mosses Youth and Community Centre, Cecil Street, Bury, North Yorkshire.

The society produces a monthly journal, *Feedback*, which is distributed to members. It includes news, chat, technical articles and construction projects.

If you would like to find out more about the society, contact the Honorary Secretary, M Sivieri G4ZTB, 47 Ramsay Avenue, Bacup, Nr Manchester, or telephone (061 764) 5018.

QTI-TNA

After a successful year working with *QTI-TNA*, the radio magazine for the blind, Shirley Evans is moving on to pastures new. Her position has been filled by Janine Gillingham.

Enquiries should now be directed to Janine at 2 Cartmel Walk, North Anston, Sheffield S31 7TU. Telephone (0909) 566301.

BARTG awards

The RTTY awards currently being sponsored by the British Amateur Radio Teleprinter Group are as follows:

- Quarter Century Award (QCA): For working/hearing amateur radio stations in 25 different countries.
- Century Award: For working/hearing 100 different stations on the 144MHz band, or 50 different stations on the 432MHz band, or 10 different stations on the 1296MHz band. A different award is available for each classification.
- Members Award: For working/hearing at least 25 different BARTG members on any band.

Full details of these awards can be obtained from BARTG's awards manager, Ted Double G8CDW, 89 Linden Gardens, Enfield, Middlesex EN1 4DX.

Ted has just published a book entitled RTTY Awards, which describes about 60 international awards and contains a comprehensive prefix and zone list. Enquiries should go to P Adams G6LZB, 464 Whippendell Road, Watford, Herts WD1 7PT.

Secret squirrel

The March lecture at the Bury Radio Society will be '3rd clandestine radio', by Gordon G3LEQ. The venue is the Mosses Centre, Cecil, Bury.

Further information can be obtained from the secretary at 36 Dovebank Road, Little Lever, Bolton, Lancs BL3 1DB.

Constructive

The Southgate Amateur Radio Club has a talk lined up for 12th March entitled 'Building the PW Halford HF transceiver', by Gunther Engel G4MVF. This will be followed by an informal evening on 26th March.

The venue is the Holy Trinity Church Hall (Upper), Green Lanes, Winchmore Hill, London N21.

Down in Devon

The Tiverton Short Wave Radio Club Mid Devon Rally is to be held on 22nd March this year.

The venue is the Pannier Market, Tiverton, Devon, and doors open at 10.00am. Talk-in will be on S22.

Enquiries should go to G4TSW, PO Box 3, Tiverton, Devon EX16 6RS.

Cables and connectors

A lecture entitled 'Cables and connectors' will be presented to the South Bristol Amateur Radio Club on 4th March by Mark G4KUQ. For those interested in the use of computers in amateur radio, a computer activity evening will be held on the 18th of the month.

The club meets every Wednesday at the Whitchurch Folk House, East Dundry Road, Whitchurch, Bristol, Avon BS14 0LN. Contact Len Baker G4RZY on Whitchurch 834282 for details.

Aberdeen activity

The March schedule of the Aberdeen Amateur Radio Society kicks off with a junk sale on 6th March, followed on the 13th by an illustrated talk from Stuart Cooper GM4AFF on a 'Portable Meteor Scatter DXpedition'.

On 20th March a demonstration on amateur TV will be given by Tony Thomasson GM0GAT, followed on the 27th by the club's regular feature, Beginners' Night. Propagation will be the subject, presented by Findley Baxter GM3VEY.

The club meets every Friday at 7.30pm at 35 Thistle Lane, Aberdeen. Further information is available from Don GM4GXD on (04676) 251.

Computer buffs

The latest issue of *ACCumulator*, the newsletter of the Amateur Computer Club, includes articles on 'Adding a programmable baud rate generator', 'Output expansion' and the Sinclair QL.

To join the ACC and obtain copies of *ACCumulator*, send £6.00 to the Membership Secretary, Andy Leeder, Church Farm, Stratton St Michael, Norwich NR15 2QB.

Amstrad design

Vaughan Henderson ZL1TGC, of Auckland, New Zealand, has sent a version of the Active Audio Filter Design program featured in the October 1986 issue, but for the Amstrad rather than the ZX Spectrum. He feels that it may be of interest to readers who are not too familiar with programming in Basic.

He says: 'My version of the program may prove a little more 'transportable' than the Spectrum one. For those wishing to use it on other home computers, the following comments may be of assistance. In line 70 a call to an Amstrad machine code routine is used to pause and wait for a key to be pressed. This could have been written as:

70 A$=INKEY$:"" THEN 70

'In addition, the LOCATE function is not used in all versions of Basic. The LOCATE as used by the Amstrad positions the cursor on the screen to the position specified by the x and y coordinates given in brackets after the command. For example, line 90 in the listing can be replaced by:

90 PRINT: PRINT: PRINT: PRINT:PRINT TAB (5) "Which

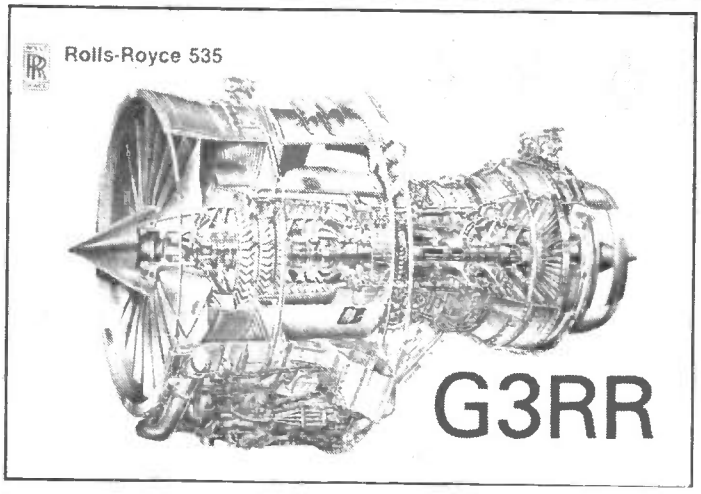
filter ?"

'Since the Amstrad does not offer the COPY function used in the original program, this version is necessarily longer than G3VZM's to accommodate the hard copy option. The PRINT#8, command used is required to output to the Centronics parallel port on the Amstrad. This can be replaced with the command LPRINT on most other versions of Basic.

'With these few changes, the program should be readily usable on most makes of home computer.'

```
10 REM Active Audio Filter Design by F. Houghton
   G3VZM from R&E.W.October 1986
20 REM This version, for the Amstrad CPC
   464/664/6128 by V.N.Henderson ZL1TGC.
30 CLS: LOCATE 10,8: PRINT"ACTIVE FILTER DESIGN"
40 LOCATE 10,9:PRINT STRING$(20,"-")
50 LOCATE 9,12: PRINT"FOR AUDIO FREQUENCIES"
60 LOCATE 9,20:PRINT"Press any key to start"
70 CALL &BB06:'like inkeys, waits for key to be
   pressed
80 CLS
90 LOCATE 5,5:PRINT"Which filter ?"
100 LOCATE 5,7:PRINT"  L  -  Low Pass"
110 LOCATE 5,9:PRINT"  H  -  High Pass"
120 LOCATE 5,11:PRINT"  B  -  Band Pass"
130 LOCATE 5,13:INPUT"Enter letter ";L$
140 IF L$="L" OR L$="l" THEN GOSUB 200
150 IF L$="H" OR L$="h" THEN GOSUB 600
160 IF L$="B" OR L$="b" THEN GOSUB 1000
170 CLS:LOCATE 1,8:INPUT"Want to design another
    filter(Y or N)";A$
180 IF A$="Y" OR A$="y" THEN GOTO 10
190 END
200 REM Low pass filter design
210 CLS:LOCATE 12,5:PRINT"LOW PASS FILTER"
220 PRINT:INPUT"Cut off frequency (Hz)";f
230 PRINT:INPUT"Gain (numerical, not dB)";g
240 PRINT:INPUT"Value of C1 (microfarads)";c1
250 PRINT
260 PRINT:INPUT"Are these values correct";Q$
270 IF Q$="Y" OR Q$="y" THEN 290
280 GOTO 260
290 REM calculations
300 w=2*PI*f
310 a=SQR(2)
320 c1=c1*0.000001
330 r1=a/(2*g*w*c1)
340 r2=g*r1
350 r3=r2/(g+1)
360 c2=(2*(g+1))*c1
370 c2=c2/0.000001
380 c1=c1/0.000001
390 REM print results to screen
400 CLS
410 LOCATE 5,5:PRINT"LOW PASS FILTER"
420 PRINT:PRINT"Cut off frequency (Hz)";f
430 PRINT:PRINT"Gain (numeric)          ";g
440 PRINT:PRINT"C1 (microfarads)        ";c1
450 PRINT:PRINT"C2 (microfarads)        ";c2
460 PRINT:PRINT"R1 (ohms)               ";r1
470 PRINT:PRINT"R2 (ohms)               ";r2
480 PRINT:PRINT"R3 (ohms)               ";r3
490 PRINT:INPUT"Want hard copy (Y or N)";HC$
500 IF HC$="Y" OR HC$="y" THEN 510 ELSE 590
510 PRINT#8,"LOW PASS FILTER DESIGN"
520 PRINT#8,:PRINT#8,"Cut off frequency (Hz)";f
530 PRINT#8,:PRINT#8,"Gain (numeric)          ";g
540 PRINT#8,:PRINT#8,"C1 (microfarads)        ";c1
550 PRINT#8,:PRINT#8,"C2 (microfarads)        ";c2
560 PRINT#8,:PRINT#8,"R1 (ohms)               ";r1
570 PRINT#8,:PRINT#8,"R2 (ohms)               ";r2
580 PRINT#8,:PRINT#8,"R3 (ohms)               ";r3
590 RETURN
600 REM High Pass filter design
610 CLS:LOCATE 12,5:PRINT"HIGH PASS FILTER"
620 PRINT:INPUT"Cut off frequency (Hz)";f
630 PRINT:INPUT"Gain (numerical, not dB)";g
640 PRINT:INPUT"Value of C1 (microfarads)";c1
650 PRINT
660 PRINT:INPUT"Are these values correct";Q$
670 IF Q$="Y" OR Q$="y" THEN 690
680 GOTO 660
690 REM calculations
700 c1=c1*0.000001
710 w=2*PI*f
720 r1=((2*g)+1)/(w*c1)
730 r2=1/(w*c1*(2+(1/g)))
740 c2=c1/g
750 c2=c2/0.000001
760 c1=c1/0.000001
770 REM print results to screen
780 CLS
790 LOCATE 5,5:PRINT"HIGH PASS FILTER"
800 PRINT:PRINT"Cut off frequency (Hz)";f
810 PRINT:PRINT"Gain (numeric)          ";g
820 PRINT:PRINT"C1 (microfarads)        ";c1
830 PRINT:PRINT"C2 (microfarads)        ";c2
840 PRINT:PRINT"R1 (ohms)               ";r1
850 PRINT:PRINT"R2 (ohms)               ";r2
860 PRINT:INPUT"Want hard copy (Y or N)";HC$
870 IF HC$="Y" OR HC$="y" THEN 880 ELSE 950
880 PRINT#8,"HIGH PASS FILTER DESIGN"
890 PRINT#8,:PRINT#8,"Cut off frequency (Hz)";f
900 PRINT#8,:PRINT#8,"Gain (numeric)          ";g
910 PRINT#8,:PRINT#8,"C1 (microfarads)        ";c1
920 PRINT#8,:PRINT#8,"C2 (microfarads)        ";c2
930 PRINT#8,:PRINT#8,"R1 (ohms)               ";r1
940 PRINT#8,:PRINT#8,"R2 (ohms)               ";r2
950 RETURN
960 REM
970 REM
980 REM
990 REM
1000 REM Band-pass filter design
1010 CLS:LOCATE 12,5:PRINT"BAND PASS FILTER"
1020 PRINT:INPUT"Center frequency (Hz)";f
1030 PRINT:INPUT"Bandwidth (Hz)";b
1040 PRINT:INPUT"Gain (numerical, not dB)";g
1050 PRINT:INPUT"Value of C1 (microfarads)";c1
1060 PRINT:INPUT"Value of C2 (microfarads)";c2
1070 PRINT:INPUT"Are these values correct";Q$
1080 IF Q$="Y" OR Q$="y" THEN 1100
1090 GOTO 1070
1100 REM calculations
1110 w=2*PI*f
1120 q=f/b
1130 c1=c1*0.000001
1140 c2=c2*0.000001
1150 r1=q/(g*w*c1)
1160 r2=1/((q*(c1+c2)*w)-(1/r1))
1170 r3=(q/w)*((1/c1)+(1/c2))
1180 c2=c2/0.000001
1190 c1=c1/0.000001
1200 REM print results to screen
1210 CLS
1220 LOCATE 5,5:PRINT"BAND-PASS FILTER"
1230 PRINT:PRINT"Center frequency (Hz) ";f
1240 PRINT:PRINT"Bandwidth (Hz)         ";b
1250 PRINT:PRINT"Gain (numeric)         ";g
1260 PRINT:PRINT"C1 (microfarads)       ";c1
1270 PRINT:PRINT"C2 (microfarads)       ";c2
1280 PRINT:PRINT"R1 (ohms)              ";r1
1290 PRINT:PRINT"R2 (ohms)              ";r2
1300 PRINT:PRINT"R3 (ohms)              ";r3
1310 PRINT:INPUT"Want hard copy (Y or N)";HC$
1320 IF HC$="Y" OR HC$="y" THEN 1330 ELSE 1420
1330 PRINT#8,"BAND-PASS FILTER DESIGN"
1340 PRINT#8,:PRINT#8,"Center Frequency (Hz) ";f
1350 PRINT#8,:PRINT#8,"Bandwidth (Hz)        ";f
1360 PRINT#8,:PRINT#8,"Gain (numeric)        ";g
1370 PRINT#8,:PRINT#8,"C1 (microfarads)      ";c1
1380 PRINT#8,:PRINT#8,"C2 (microfarads)      ";c2
1390 PRINT#8,:PRINT#8,"R1 (ohms)             ";r1
1400 PRINT#8,:PRINT#8,"R2 (ohms)             ";r2
1410 PRINT#8,:PRINT#8,"R3 (ohms)             ";r3
1420 RETURN
```

QSO



G3RR

The Rolls Royce Amateur Radio Club run regular Morse classes every Monday night and shack nights every 2nd and 3rd Wednesday, both starting at 7.30pm sharp.

In addition they are holding a members' construction contest on 4th March and an interclub games night on 1st April. Both activities start at 8.00pm.

Meetings are held in the Rolls Royce Sports and Social Club, and further information is available from the Hon Sec, L Logan G4ILG, 19 Fenton Avenue, Barnoldswich, Colne, Lancashire BB8 6HB.

Calling all club secretaries!

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

1) Typed press releases on A4 paper are much more legible than scrawled notes on loo paper, and are less prone to misinterpretation.

2) Check that all the relevant information concerning an event is included, such as venue (with full address and directions if necessary), time and date.

3) A contact address, such as that of the club secretary, is essential. Please give a full postal address and phone number if possible.

MW news

Medium and long wave enthusiasts will be interested in an informative and up-to-date newsletter, *Medium Wave News*, published by the Medium Wave Circle.

It contains all the latest news and views, reception tips and feature articles.

For a free sample issue and full subscription details send a large stamped addressed envelope to the MW Circle, 103 Foxhall Road, Ipswich, Suffolk IP3 8JZ.

Border Award

Following the success of the Oswestry and District ARC's award for operators/SWLs, which began on 1st January 1986 and was based on the county of Shropshire and its border counties using 144MHz and above, the club has introduced another award for the 10m-160m bands. Bands and modes may be mixed but all stations worked/heard must be from 1st January 1987.

This time the border is between England and Wales. Claims are based on the counties of: GW – Clwyd, Powys, Gwent; G – Cheshire, Shropshire, Hereford/Worcester and Gloucestershire.

Applicants must work/hear either a club member, the club callsign (G4TTO) or any special event station organised by the club, plus the following: QTH UK (and Eire) – 10 stations in each county; other regions – 5 in each county. Total required = 71 stations (UK) and 36 stations (other regions).

To claim, send a list of log entries, certified correct by 2 other amateurs or SWLs, giving date, callsign, frequency, mode and county of each station worked to Tony, PO Box 6, Oswestry, Shropshire SY11 1ZZ. The award costs £1.75 or 10 IRCs.

Further details are available by sending an SAE to the above address.

More than radio

The Dumfries and Galloway Radio Amateur and Electronics Club meets on the first and third Mondays of the month at 7.30pm in the Cargenholm Hotel, New Abbey Road, Dumfries. All visitors are welcome.

Details of club activities are available from John Young GM6LYJ, 22 Hallmeadow Place, Annan, Dumfriesshire DG12 6BZ.

Think tank

The Sutton Coldfield Radio Society has an item on its March agenda entitled 'Think tank on your project' on the 9th, where members are invited to bring along questions. This is due to be followed on the 23rd by the society's annual junk sale.

The club's regular venue is the Sutton Coldfield Public Library at the Sainsbury Centre in the West Midlands. New members are welcome.

For further details contact Mike Jones G4MFN QTHR.

BRES 144MHz award

This year's Barking Radio and Electronics Society 144MHz contest takes place on 29th March from 13.00 to 17.00GMT.

Sections include: high power – full legal limit; low power – 20 watts PEP SSB output or equivalent in other modes; SWL. There are no restrictions as to the number of operators at each station, which may be fixed, portable or mobile.

The contest exchange should consist of the normal RST report, and the usual three digit serial number (starting at 001). In addition, the county in which the station is located should also be sent.

Each completed contact will score 1 point, but contacts with G3XBF or G8XBF score ten points. The final score is the total contact points multiplied by the number of counties. Each country worked outside the UK counts as an additional county.

Unmarked duplicates will be deducted at double the claimed score. More than five unmarked duplicates will result in disqualification.

All entries should be on RSGB VHF log sheets or similar, and the column headings should be: time, station worked, RST/serial number sent, RST/serial number received and county received. A separate check list of counties worked should also be included.

Entries should be sent to BRS31976, 32 Wellington Road, Rayleigh, Essex SS6 8EZ and must be postmarked not later than 13th April 1987.

Awards will be made to the winner and runner-up in each section and also to the leading Essex station in each section. The decision of the committee of the Barking Radio and Electronics Society will be final.

Entrant's attention is pointed towards rules 15 to 21 of the 1987 RSGB general rules, which should be used as a guide to the operation of all competing stations.

Southgate action

The Southgate Amateur Radio Club meets at the Holy Trinity Church Hall (upper), Green Lanes, Winchmore Hill, London N21, for 7.45pm.

On the agenda for March they have a talk entitled 'Building the P W Halford HF Transceiver' on Thursday the 12th and an informal meeting on the 26th. All visitors are welcome.

For further information on the club or its activities contact: D C Elson G4YLL, 200 Churchgate Road, Cheshunt, Hertfordshire EN8 9EL.

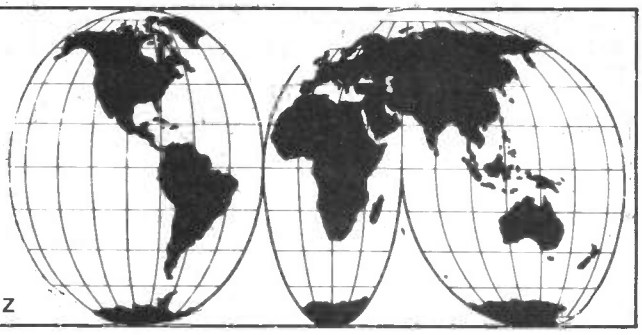
Components fair

On Sunday 5th April, from 11am to 4.30pm, the Pontefract and District ARS are holding their Components Fair for radio and electronics enthusiasts. The event is taking place at the Carleton Community Centre, Carleton, Nr Pontefract, just off the A1 at Darrington.

All the usual attractions will be there, including trade stands, a bar and a bookstall. Talk-in will be on S22.

For further information contact Colin Mills, telephone (0977) 43101.

SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

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

Our series of articles (see the previous three issues) providing information on some of the Indonesian transmitters operating on and around the Tropical Bands continues here with a review of those within the frequency limits **3803** to **4607.3**.

RRI (Radio Republik Indonesia) Gorontalo, in Sulawesi (Celebes), is on **3803**, the frequency being variable. With a power of 10kW, it is scheduled from 2100 to 0100 (Sunday until 0500) and from 0830 to 1600. From reports it would appear that this channel alternates with that of **3265**. RRI Gorontali is rarely heard by Western European DXers.

Listed on **3905** at 10kW but actually logged on **3904.8**, RRI Banda Aceh in Sumatera (Sumatra), is on the air from 2200 to 0200 (Sunday until 0500), from 0500 to 0800 and from 1000 to 1600 varying up to 1805. The frequency is an alternative to the more often reported **4954.7**. On **3905**, AIR (All India Radio) Delhi at 100kW effectively ensures that the signals from RRI Banda Aceh are not often logged in our part of the world.

More often reported by DXers world-wide are the transmissions from RRI Semarang, Jawa (Java) on **3934.5**. At 10kW, the schedule is from 2200 to 0100 and from 0800 to around 1700.

RRI Denpasar in Bali carries the Programa Regional on **3945** from 2200 to 0100 and from 1000 to 1600 (Sunday 0700 to 2100) with a power of 5kW. Reportedly heard from 1915 to 2040 and with an English programme from 2330 to 2400. Needless to say it is only occasionally heard here in the UK – which is all the more reason to keep trying.

Regional stations

Regional government stations, ie not RRI transmitters, are to be found in the main population centres and exist to serve the Propinsi (Province) or Daerah Istimewa (Special District). These regional stations, Radio Pemerintah Daerah Tingat Dua, are prefixed RPDTD (not RRI) and are reported by DXers as RPDTD or sometimes RPDT2.

Many differing station identifications are used by transmitters in these networks, that most often reported being RPDTD. On occasions, however, DXers living near to Indonesia report RPDT2 as Radio Khusus Pemerintah Kabupaten Daerah Tingat Dua, although the identification sometimes omits Khusus (Special) and Tingat, meaning District. Municipal stations providing a service to the immediate locality identify as Radio Khusus Pemerintah Daerah followed by the location, ie Radio Khusus Pemerintah Daerah Surabaya.

These regional capitals with their attendant provinces and special districts are as follows, the first named being the capitals: Ambon, Propinsi Maluku (Province Moluccas); Banda Aceh, Daerah Istimewa (Special District) Aceh in Sumatra; Bandung, Propinsi Jawa (Java) Barat; Banjarmasin, Propinsi Kalimantan (Bornea) Selatan; Bengkilu, Propinsi Bengkulu in Java; Denpassar, Propinsi Bali; Jakarta, Daerah Khusus-Jakarta Raya in Java; Jambi, Propinsi Jambi in Sumatera (Sumatra); Jayapura, Propinsi Irian Jaya (West Irian); Kupang, Propinsi Nusa Tenggara Timur (Timor); Mataram, Propinsi Nusa Tenggare Barat in Lumbok-Sumbawa; Medan, Propinsi Sumatera (Sumatra) Utara; Menado, Propinsi Sulawesi (Celebes) Utara; Padang, Propinsi Sumatera Barat; Palankaraya, Propinsi Kalamantan (Borneo) Tengah; Palembang, Propinsi Sumatera Selatan; Palu, Propinsi Sulawesi (Celebes) Tengah; Pekanbaru, Propinsi Riaw in Sumatra; Pontianak, Propinsi Kalimantan (Borneo) Timur; Semerang, Propinsi Jawa (Java) Timur; Tanjung Karang, Propinsi Lampung, Ujung Pandang and Sulawesi Selatan.

More Indonesians

Also on **3945** is RRI Ternate in Propinsi Malaku (Moluccas) from 2000 to 0030, 0300 to 0600 and from 0800 to 1500 with a power of 1kW.

The **3946** channel, **3945** nominal, is occupied by RRI Tanjungkarang in Sumatra from where it is on the air from 0800 to 1700 with a power of 2.5kW. This one radiates in parallel on **3394.9** on which frequency it is regularly reported by many DXers – which is more than can be said of **3946**!

In Java, the rarely heard 1kW transmitter of RRI Bogor operates from 2200 to 0100, from 0400 to 0800 and from 1000 to 1605 on **3953**, this being a move from **3960**.

RRI Palu in Celebes is on **3960** at 10kW operating from 2200 to 0100 and from 0900 to 1600. Although seldom heard here in Western Europe, it is often reported by listeners residing elsewhere. On **3976** but varying to **3977.5** at times, RRI Surabaya in Java is scheduled from 2200 to 0100 and from 0900 to around 1605. With a power of 10kW it is reported more frequently by those residing nearer to Indonesia than UK listeners.

The 1kW RRI Manokwari in Irian Jaya (West Irian) is regularly heard by those local to Indonesia but not, I might add, in Europe. This is not surprising considering that all Tropical Band transmitters concentrate radiation in the vertical direction, thereby limiting the service area to a maximum of 200km from the transmitters, the low powers of many reducing even this small area. RRI Manokwari is on the air from 2000 (Saturday, Sunday and local holidays from 2200) to 2400 (Saturday, Sunday and on holidays to 0615), and from 1000 to 1400, the frequency being **3986**.

In Kalimantan (Borneo), RRI Pontianak is on the air from 2200 to 0100 (Sunday from 0100 to 0400), from 0400 to 0730 and from 0900 to sign-off at 1520 or sometimes 1600. With a power of 1kW and not often reported, it is on **3995**.

Also on **3995** is RRI Tanjungkarang in Sumatra. With a power of 2.5kW, it is on the air from 1630 to 2200 and like the co-channel RRI Pontianak is rarely reported in the SWL press.

More often heard

Just slightly above **4000**, on **4000.2** in fact, operates RRI Kendari in Celebes. With a power of 5kW it is on the air from 2100 to 2400 and from 0900 to around 1515. Like RRI Padang, see below, it is regularly reported by DXers world-wide, including some in the UK – myself included.

RRI Padang in Sumatra on **4002.7** at 10kW is scheduled from 2300 to 0130 and from 1000 to 1700.

AROUND THE DIAL

Look below and have a go! Commencing with reports on some African stations, conclusion is made by bringing to mind a few of the more difficult to receive transmissions from other parts of the world.

AFRICA

Cameroon

Radio Garoua, Garoua on **5010** at 0502, OM with a newscast in English mainly of local but with some international events. News bulletins in English are timed at 0500, 1800 and at 2100. This 100kW transmitter carries the Home Service mainly in local vernaculars and French, being scheduled from 0425 to 0800 (Sunday from 0630 to 0800) and from 1645 to 2315.

Egypt

Cairo on **17670** at 1306,

songs and music in the Arabic programme for Southern Africa, scheduled daily from 1200 to 1900.

Liberia

ELWA (Eternal Love Winning Africa) Monrovia on **11830** at 2028, when radiating a USA taped religious programme in the mid-West bible belt hot gospel manner. This English transmission to West Africa is timed from 2015 to 2135.

Tunisia

Tunis on **7225** at 0559, OM and YLs with songs, music in the local style then OM with the station identification and a newscast during the Arabic programme for Europe, which is on the air from 0430 to 0700 and from 1700 to 2400.

CENTRAL AMERICA

Costa Rica

Radio Reloj, San José on **4832** at 0434, OM with a talk in Spanish, some promos (promotions) then back to the talk. This 3kW transmitter is scheduled from 2200 to 1000 and is heard and reported worldwide, the frequency used being mainly the reason for its globular audience. San José in West Central Costa Rica is the capital and largest city, being founded circa 1738. It is the centre of economic, political and social life of the republic.

SOUTH AMERICA

Brazil

Radio Nacional, Boa Vista on **4875** at 0317, OM with promos, the station identification and into a programme of sambas. At 10kW, this one is scheduled from 0900 to 0400, the closing time of this Radiobras station varying on occasions.

Radio Difusora Acreana, Rio Branco on **4880** at 0249, OM with announcements in Portuguese followed by songs and music in the local style. The schedule is from 0900 to 0405, the power being 5kW.

Peru

Radio Eco, 'La Estacion del Amor', Iquitos on **5010** at 0258, OM with frequent announcements interspersed with Andean pipe music then the station identification in Spanish. Radio Eco operates from 1000 to a variable sign-off time around 0500.

ASIA

China

Voice of the Strait, in Standard Chinese Hai-xia-zhi-sheng guang-bo dian-ti, Fuzhou on **2490** at 1543, YL with a talk in Chinese, Haixia 1, the DXer's term for the 1st Programme, is in Standard Chinese and Amoy to offshore islands and Taiwan from 1200 to 2400 with a power of 50kW.

Xinjiang PBS, Urumqi on **4735** at 1530, OM with a talk in the Uigher Home Service timed from 1030 to 1730 and from 2300 to 0230 with a power of 50kW. For those interested, the Chinese New Year is 13th February.

NEAR AND MIDDLE EAST

India

AIR (All India Radio) Hyderabad on **4800** at 1543, OM with an announcement in English of plane take-off times from New Delhi airport. Hyderabad carries programmes mainly in Indian languages but has English newscasts at 0035, 1230, 1530 and at 1730. The schedule is from 0025 to 0215 and from 1200 to 1741. The power is 10kW.

AIR Calcutta on **4820** at 1631, OM with an announcement in vernacular then music in the Indian style. This station is active from 0025 to 0210 and from 1230 to 1730 with a power of 10kW. An English news bulletin is timed at 0035.

Iraq

Baghdad on **11705** at 1851, YL with a talk in the Arabic programme for Eastern Europe scheduled from 1700 to 2400.

Israel

Kol Yisrael, Jerusalem on **11585** at 1335, USA pop records and OM with announcements in the Hebrew transmission for Western Europe timed from 1200 to 1600 and from 1830 to 2315.

Nepal

Radio Nepal, Kathmandu on **5005** at 1639, OM and YL with a duet in Nepali. Kathmandu is on the air with the Home Services 1 and 2 from 0015 to 0445, from 0715 to 1015 and from 1145 to 1715 with a power of 100kW. There are English news bulletins at 0215 and at 1445, a Foreign Service transmission in English from 1045 to 1115 and in Nepali from 1115 to 1145.

Pakistan

PBC Islamabad on **4780**at 1505, OM with a news bulletin, being a relay of the Peshewar programme in Pushto timed from 1300 to 1600. The power is 100kW, the frequency being subject to variation plus or minus that shown here.

PBC Islamabad on **15605** at 1100, OM with the station identification, schedule information announcements followed by a bulletin of local news in English read at slow speed. This newscast is timed from 1100 to 1115.

Saudi Arabia

Riyadh on **11685** at 0520, OM with a talk about World War II in the Turkish programme to South-East Europe scheduled from 0400 to 0555.

Syria

Damascus on **7455** at 2115, OM with an anti-Israel talk during the English presentation to North America, scheduled from 2110 to 2210.

Turkey

Ankara on **7215** at 2101, OM and YL in English with alternate news items on local affairs and events. This English programme for Western European consumption may be heard daily from 2100 to 2150.

EUROPE

Albania

Radio Tirana on **11985** at 1408, YL with a talk about Albanian youth in an English programme directed to Eastern North America and timed from 1400 to 1425.

Greece

The Voice of Greece, Thessalonika on **11595** at 1425, songs together with some local music in a Greek Home Service programme for Europe scheduled from 1000 to 1730. Thessalonika, formerly Salonika, is a city and seaport in Macedonia at the head of the Gulf of Thermal, east of the Vardar delta.

CLANDESTINE

Voice of Unity on **11490** at 1532, OM with a harangue in Pushto/Dari. The transmission is subjected to Soviet jamming identifying in morse as MP, the programme being intended for an Afghan audience. Also logged in parallel on **15685** but not jammed. Oh dear!

NOW HEAR THESE

RRI (Radio Republic Indonesia) Banjarmasin in Java on **3250** at 1520, YL with songs in Indonesian together with music in the local manner. Sign-off without the usual Indonesian closing tune 'Love Ambon' at 1530. With a power of 10kW, this one is on the air from 2125 to 0100 and from 0830 to 1530 (Sunday 2300 to 0715 and from 0900 to 1530). An English programme is timed from 0830 to 0900. The power is 10kW.

RRI Banda Aceh in Sumatra on **4955** at 1541, recitations from the Holy Quran. This Indonesian station operates from 2300 to 0200 (Sunday until 0600), from 0500 to 0800 and from 1000 to 1600 or sometimes 1700 or 1805. This channel is an alternative to **3905**. The power is 10kW.

Dhaka, Bangladesh on a variable **4890** at 1522, OM and YL with songs and music in the Bengali programme scheduled on this frequency from 1130 to 1715. The power is 100kW.

NOW LOG THESE

AIR Lucknow on **3205** at 1518, OM with a talk in vernacular. Lucknow operates with a power of 10kW from 0025 to 0215 and from 1215 (Sunday from 1100) to 1741. There are newscasts in English at 0035, 1530 and at 1730. Lucknow is the capital of Uttar Pradesh State and was the capital of the Kingdom of Dudh from 1775 to 1856. During the Indian Mutiny 1857-58, sometimes termed the Sepoy Rebellion, British troops suffered a five month siege, being eventually relieved by a force under the command of Sir Colin Campbell.

AIR Kurseong on **3355** at 1535, YL with a newscast in English. At 10kW, Kurseong is active from 1130 to 1741 with English news bulletins at 1230 and 1530. REW

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■ Trio TR2500 2m h/held with dc-dc converter, £150 ono, or exchange for VHF/UHF scanner or Sony portable HF Rx ICF7600 or 2001. Please write, no phone. J Young, 22 Hallmeadow Place, Annan DG12 6BZ

■ Yaesu FT One, superb all-band HF multimode Txcvr. All options fitted (except auto-keyer) complete with MD1 base scanning mike. Offers around £1,250. Jerry. Tel: (0529) 21327 after 9.30pm

■ Sabtronics 8610A 600MHz digital frequency counter, with manual, packing and nicads, nice cond, £60. Dave Logan, 27 Shaw Street, Mottram, near Hyde, Cheshire SK14 6LE. Tel: Mottram 62799

■ Trio TS530SP transceiver, as new, current model, £595. National HRO-M, power supply, 9 coils, very clean, £75. Hallicrafter S72 mains/battery, 8 valves, gen coverage, £50. Echophone commercial, 500kHz-30MHz, £45. McMichael 135 mains, 1934, £35. Ferranti UNA 1934 battery set, £25. 1938 GEC mains radio, £18. 1929 Rolls-Caydon suitcase portable, £35. 1928 Marconi portable, £20. Large collection early radios for disposal or exchange; want early crystal sets, wireless sets. Also want TS930 for cash. Jim Taylor G4ERU, 5 Luther Road, Winton, Bournemouth. Tel: (0202) 510400

■ 10 amp 13.8V PSU, £25 (switch mode). Have 4, all in good condition. Simon Mohan, 75 Pennine Road, Glossop SK13 9UL

■ Digital impedance meter ESI 251 plus instruction manual, unused, measures inductance, resistance, capacitance and conductance, £145. Tel: Brighton (0273) 738825 after 5.30pm, ask for Graham

■ Wayne Kerr CT53 8.9 to 300MHz RF sig jenny, £25. Advance J1 audio jenny, 4 to 50kHz, £25, or £40 the pair. Fairly large so buyer collects. Datong PC1 short wave to 2 metre converter (eg FT290 to short wave receiver), £70, gwo. Eagle A7400 25 watts per channel stereo amp, £30 (a bargain, or swap all above for hi band or UHF FM PMR equip, WHY, Motofones, Cambridges etc). Chris Barker, 52 Spode Street, Stoke on Trent, Staffs. Tel: (0782) 46570 any time

■ Sharp GF-780D double deck tape hi-fi, detachable speakers, with search system, five band equaliser, Dolby etc. As new, boxed, value £285, exchange for FRG7700 receiver, must be in good condition. Tel: 08357 314

■ Goodman Audiom series speakers, 15 amps/15 ohms, no cabinet, £15 the pair. N Hooton, 2 Hazel Mount Ave, Carnforth, Lancs. Tel: (0524) 733870

■ Sony ultra-sophisticated digital synthesized multiband radio with clock, ICF2001D. Under guarantee, as new. Cost £350, accept £250 ono. Tel: Stratford upon Avon (0789) 67915

■ Scanner owners, I have photocopy of service manuals for the following scanners: Tandy PRO30, PRO31, PRO32, PRO2021, and Thandar TC200 frequency counter, just send £5 + postage for copy. I also have thousands of unpublished very interesting UK frequency allocation books. Tel: (0473) 85526

■ Storno 2m Tx/Rx, approx 90 watts. Base unit for wall mount with small control panel for desk top, buyer collects, £45. Mr Bede G8ZIT, 1 Dane Common, Kedington, Suffolk CB9 7NU. Tel: (0440) 705216

■ SX200 scanner with AM/FM modes, covering 26-88MHz, 108-180MHz, 380-514MHz. With Gemscan antenna for indoor/outdoor use plus MPU, manual, box, in vgc, £160. Carriage a little extra. N Porter, 23 Calder Court, Britannia Rd, Surbiton, Surrey. Tel: 01-390 2650

■ Shack clearance of valves, to suit all Tx/Rxs. Ex-gov and civilian, UK and USA surplus equipment a speciality, transmitting valves of all types. Some pre-war civilian valves, most half list price: sae for requirements or phone (0202) 680500 or (0202) 622051

■ Trio 2m and 70cm dual band mobile TW-4000A. 9 months old. Never mobile. Lack of interest reason for sale, £325. P/ex video or satellite dish. Also Trio 2m slim mobile TM-201A, £195. Both mint condition. Russ Pyne, 79 Highcroft Ave, Oadby, Leicester. Tel: (0533) 715160, if out (0860) 520589

■ Components: all new and unused, no longer wanted. Include BC108s, NE555 ICs, UA741 ICs, 8 and 14 pin sockets, IN4148 diodes, red LEDs TL209s. A mixed bag £5.25 post free. I only have 5 bags. Electronic noise maker circuit makes gun, laser, etc. 6 push-buttons, £5. Plastic bags, good quality 5in wide, 7in deep, 100 £5. Praktica LLC repair manual and exploded views of LTL, and super TL models, £14. By post only. D Martin, 7 Griffin Crescent, Littlehampton, W Sussex

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■ Sell or swap for radio receiver, good coverage, all my TV test equip, scope, dual trace digital multimeter, transistor tester, logic probe, voltage tester, isolating transformer, books, component box, 30 trays semiconductor spares, soldering iron and stand, solder reel, other bits as well. Do not want valve model in swap. Sale price £150 lot. Will not split. Mr V Tedman, 40 Dixon Clark Court, Canonbury Road, London N1 2UR. Tel: 01-359 8623

■ Ralph Allen 6809 computer system with flex in 19in rack with full set of seven boards. Built-in power supply, disc cable. Carter keyboard. Offers over £400 or swap colour monitor/synthesizer/organ or WHY. Maplin modem in new condition, £45. Pair JPW hi-fi speakers, with stands if required, £70. Small b/w monitor with 7in tube ex-equipment (no information), £10. Mystery computer terminal marked EFTT-1619 with built-in printer, £25. Toms, 212 Teignmouth Road, Torquay TQ1 4RX. Tel: (0803) 35177

■ Polaroid 800 b/w roll film camera with real leather case (bellows and all). Beautifully made in US about 25 years ago. With 'auto' adaptor, fill-in light, etc, good for collector/enthusiast, £50. Ken Evans, Shelford Cottage, Redman's Lane, Melbury Abbas, Shaftesbury, Dorset. Tel: Shaftesbury 3515

■ Valves: brand new, boxed, Mazda, Mullard, etc. G'teed. 6F23, 6F25, 6F26, 6F28, 6F29, 6LD20, 6L12, 6L19, 6/30L2, 10F1, 10LD11, 10P13, 10L14, 12AT6, 12Q7GT, 14K7, 20D1, 20D4, 20F2, 20L1, 30C1, 30C17, 30C18, 30F5, 30FL2, 30FL12, 30FL14, 30L1, 30L15, 30L17, 30P12, 30P16, 30PL1, 30PL13, B319, DF91, DF96, DF97, DK91, DK92, DL91, DL92, DL93, DY86/7, EB91, EBF80, EBF83, EBF89, only 50p each plus 55p p&p per order. K Bailey, 40 Seymour Close, Selly Park, Birmingham B29 7JD. Tel: (021) 472 3688

■ Tandy Realistic radio receiver DX200L, covers all bands to 30MHz, very good condition, nearly new, hardly used, £75. Eddystone dual crystal oscillator, freq 1 meg, 100kHz, exc condition, complete PSU, £5. Mr R A Pears, 573 Pentregethin Road, Ravenhill, Swansea SA5 5ET. Tel: (0792) 582941

■ Magnetic ¼ins studio tape, Ampex, Racal, EMI. Six 7ins and six 10½ (alum) reels. All recorded but virtually new, £15. Collect or post from north London. M Evans. Tel: (01) 886 3057

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■ Nato 2000 for conversion to 28MHz. 7700 Yaesu 0-30MHz with memory. Offers. Tel: (0283) 221870

■ Hokushin HS HF5 5-band trap vertical plus radial kit, loading coil, etc, £40 collected. W H Ferguson, 9 Woodbine Tce, Hexham, Northumberland NE46 3LE

■ Trio TS530SP tcvr with mic, Lowe's latest model in mint condx. Never used, £575. Trio 2200GX 2m portable, fully xtalled, with nicads, £75 ono. Must sell. Stuart. Tel: (0740) 20100, County Durham

■ Unused switch mode power supply. Advance 90 watt with case. 5V, 10 amp, plus 2 @ ±12V, 1.5 amp, £15. Advance 170 watt 5V 17 amp plus 2 @ 12V, 3.5 amp, £25. Also used BICC Boschert 180 watt of similar rating, £9. Astec 8151 unused 5V, 12V, −12V, −5V, £15. Small supply to power two disc drives and fit in floppy cabinet, £8. Might swop any of above. Control data, ½ height 80 or 40 track drive (double-sided), with case, & cables for BBC, £75. Shugart full height 40 track drive, £20. Hitachi 1.6Mbyte half height drive for IBM AT, etc, uncased £80. BBC 64K solidisk RAM board with 64K ROM slots. Also 5 discs of s/ware, £40. Lots of misc BBC bits & pieces. Might swop. Tel: (0423) 872045 (Harrogate)

■ Spectrum 128K computer plus several games and new cassette recorder, sell for £140.00 ono or exchange for general coverage (AM/USB/LSB) Rx WHY. Mr R McKinnon, 9 Brandy Wells, Kings Nympton, Umberleigh, Devon EX37 9SP

■ Scanner AR2001 25MHz, 550MHz, never been used, £50, no offers. Mr B Sheridan, 7 Hinton Rd, Childswickham, Worcs. Tel: Broadway 858878

■ Trio R1000 communications receiver, excellent condition, £170. Tel: Chelmsford (0245) 324781

WANTED

■ Service manual for W15U Pye Westminster, original or photocopy, also April 1986 edition of *Ham Radio Today*. Please write to Mr A Holmes, 61 Surtees St, Bishop Auckland, Co Durham DL14 7DJ

■ Info on best method of increasing the FM bandwidth (88-101MHz) of my Hacker Super Sovereign SW/MW/LW/FM receiver. Phone or write. All info acknowledged & postage refunded etc (88-108MHz desired). Mr L J Barrow, 46 Tweeds Muir Close, Fearnhead, Warrington, Cheshire WA2 0EL. Tel: (0925) 823481

■ 2 metre transceiver. Bill Doherty, 68 Shelbourne Road, Ballsbridge, Dublin 4

■ Yaesu FT77, FT707 or FT757GX. Must be mint condition, sensible prices please. Also want 70cm down to 2m converter, Microwave Modules MMC432/144 or similar. Please phone Luton (0582) 36961 office hours, ask for Bob

■ Radio-related software to suit Atari 800XL on cassette or listings. Will buy or exchange. Patrick Healy, 147 Old Youghal Road, Dillons Cross, Cork, Ireland

■ Bremi digital frequency counter type 18150 or similar. Fair price paid. G A Green, 44 The Roods, Warton, Carnforth, Lancs LA5 9QQ. Tel: (0524) 735296

■ Swap Trio 9130, boxed, mint, for CBM64 or 128 word processor, will consider other systems if offered. Cash adjustment if necessary. Must include suitable printer. Dave Newman G4CGZ QTHR. Tel: (01) 677 9309 after 7pm

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■ Sord or CGL M5 computer spares, add-ons etc, language modules, even games, any manuals WHY? Mike. Tel: (0933) 56074

■ HF Tx, 25 watts PEP minimum, tube unit, home-made or converted (AM only), unit should be xtal controlled and be able to operate between 4kHz and 8kHz. PSU-inverter or mains or both. No 807 self-exciter types please, without 'buffer stage'. Money limited to DHSS ('Dole'). Write BBMS c/o Caretaker, 185 Fleet Street, London EC4. Waiting time no problem. Collection by arrangement

■ 934MHz transceiver, working or not. Also wanted PA board for Reftec. M J Hale, Briar Cottage, Martley Road, Lwr Broadheath, nr Worcester. Tel: Worcs 641748

■ 405-line TV! Wanted, any information which may help in design and construction of a 625 to 405 line standards converter for use as a signal source for old TVs. If you are interested as well, and can help in this project, write to Andy Green, 8 Crescent Drive, Hillview, Waterford, Ireland

■ Belcom LS10ZL all-mode 10/11m transceiver wanted. High price paid for a nice example. Tel: (0241) 72273

■ Satellite dish or complete station or video recorder wanted to p/ex against my Trio 2m and 70cm dual band mobile TW-4000A. 9 months old. Never mobile. Lack of interest reason for sale, £325. Also Trio 2m slim mobile TM-201A, £195, both mint condition. Russ Pyne, 79 Highcroft Ave, Oadby, Leicester. Tel: (0533) 715160, if out (0860) 520589

■ Comms receiver, solid-state, mains up to 30MHz if possible. Also ATU unit. Call Mel on Lichfield (0543) 491320

■ Good condition HF Rx, + UHF or VHF scanner. Also wanted: 2m receiver in good working order. M Maccuish, 3 Burnside Place, Millpark, Oban, Argyll, Scotland PA34 4JZ. Tel: (0631) 65104

■ Circuit diagram or manual for AR88LF with diversity, set modified for C6N. Please state price. Copy OK. John Chambers, 16 Littegarth, Leicester, Leics LE2 6SJ

■ VCR/VHS PAL B/G; PAL I: SECAM B/G: plus IF adaptable SECAM L (eg, French system). I understand that Nordmende had a model 103. This model came out before their latest model, V-1035. Can anyone give details as to where I can get hold of this unit? Photocopy of catalogue with the 103 inside would be most welcome. Apart from that any VCR-VHS with PAL/SECAM Europe plus the UK system welcome. Letters only. Mike Evans, 120 Loughton Way, Buckhurst Hill, Essex IG9 6AR

■ Heathkit DX-40U original construction manual, must be in good cond. Also any articles reg'd building, modification and operation of this Tx. Would also welcome any original unused parts and spares. Fair price paid. *SWM* issues req'd. Dec 1983. May, June, July, Aug, Oct 1984. Feb, April, June 1985. March 1986. Again fair price paid, plus postage, for good cond copies. M Thomas. Tel: 01-551 4863, leave details etc, will contact

■ TV small screen monochrome set, must have multiband tuner, 5.5/6.0MHz sound facility and take power from external batteries. Facility for French system L reception would be preferable. Tandy 5in set would be ideal. Cash waiting for the right set. Phone Ian, Lincoln (0522) 694134

■ Lindsley Hood/Hart low noise tape deck kit, built or part-built. Ken Evan, Shelford Cottage, Redman's Lane, Melbury Abbas, Shaftesbury, Dorset. Tel: Shaftesbury 3515

■ Top Band (160m) tcvr, must have AM and CW at least. Anything considered. Also wanted Kenwood T-599S HF Tx. Any condition. Ring Peter G1TXI QTHR on Norwich (0603) 748338

■ Amstrad PC, PCB CAD, featured in this magazine December '86. Advice please! Loads OK and runs, but scrubs the screen when the line is printed. Also does not reverse the board. Cassette is available if necessary. Any advice would be helpful as fingers are wearing thin. Please any takers. Dave Jackson, 15 Devon Walk, Cottemore, Oakham, Leics LE15 7AP. Tel: Work (0572) 812241 ext 362/680

■ TV for band 3 or any equipment for Binner sporadic-E. Summerkamp TS788 DX 26-30, offer £150. Phone (0283) 221870

■ Pye PF1 pocket-phones Rx or Tx. Any condition. Spares also wanted, eg batteries, speakers, cases, circuits, manuals, etc. Please write as I am on the move. All letters answered. Simon Barnfather G6UZV, 62 Normoss Road, Normoss, Blackpool, Lancashire FY3 0AL

■ Lynx disc controller, without drive if possible. Around £20. Disc drive manuals for TEAC, Mitsubishi, NEC, etc. IBM or Clone motherboard and hardware. Med res RGB monitor for BBC. Might swop for drives. Tel: (0423) 872045

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Radio & Electronics World

The communications and electronics magazine

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

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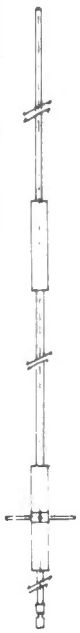

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Send for our FREE price list PL16 all we ask is a large SAE (24p stamp) (Overseas US $2 bill)
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Full details from
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COUNTY GUIDE

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

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

RADIO & ELECTRONICS WORLD COUNTY GUIDE ORDER FORM

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

print your copy here .....

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NUMBER OF INSERTIONS REQUIRED

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Double County Guide 3 ..... £94.00 ☐ 6 ..... £176.00 ☐ 12 ..... £316.00 ☐

PAYMENT ENCLOSED £ —

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

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

Registered No 2307667 (England)

C P I

ADVERTISERS INDEX

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

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

COLOUR AD RATES

colour rates exclude cost of separations

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

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Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
Apr 87	12 Feb 87	18 Feb 87	20 Feb 87	12 Mar 87
May 87	12 Mar 87	18 Mar 87	20 Mar 87	9 Apr 87
Jun 87	16 Apr 87	22 Apr 87	24 Apr 87	14 May 87
July 87	14 May 87	20 May 87	22 May 87	11 Jun 87

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.

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

COPY
Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
For illustrations just send photograph or artwork.
Colour Ad rates do not include the cost of separations.

Printed — web-offset.
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Above rates exclude VAT.
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Accounts will be opened for series rate advertisers subject to satisfactory credit references.
Accounts are strictly net and must be settled by publication date.

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

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

CONDITIONS
10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only.
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Price per pack is **£1.00.*** Order 12 you may choose another free. Items marked (sh) are not new but guaranteed ok.

1. 5 – 13 amp ring main junction boxes
2. 5 – 13 amp ring main spur boxes
4. 5 – surface mounting
5. 3 – electrical switches, white flush mounting
7. 4 – in flex line switches with neons
9. 2 – mains transformers with 6V 1A secondaries
10. 2 – mains transformers with 12V ½A secondaries
11. 1 – extension speaker cabinet for 6½" speaker
13. 12 – glass reed switches
17. 2 – ultrasonic transmitters and 2 receivers with circuit
19. 2 – light dependent resistors
25. 4 – wafer switches – 6p 2 way, 4p 3 way, 2p 6 way, 2p 5 way, 1p 12 way small one hold fixing and good length ¼ spindle your choice
28. 1 – 6 digit counter mains voltage
30. 2 – Nicad battery chargers
31. 1 – key switch with key
33. 2 – aerosol cans of ICI Dry Lubricant
34. 96 – 1 metre lengths colour-coded connecting wire
39. 1 – long and medium wave tuner kit
41. 8 – rocker switch 10 amp mains SPST
45. 1 – 24 hour time switch mains operated (s.h.)
49. 10 – neon valves – make good night lights
50. 2 – 12V DC or 24V AC, 3 CO relays
51. 1 – 12V 2 CO miniature relay very sensitive
52. 1 – 12V 4 CO miniature relay
54. 10 – rows of 32 gold plated IC sockets (total 320 sockets)
55. 1 – locking mechanism with 2 keys
56. 1 – miniature uniselector with circuit for electric jigsaw puzzle
60. 5 – ferrite rods 4" × 5/16" diameter aerials
61. 4 – ferrite slab aerials with L & M wave coils
63. 1 – Mullard thyristor trigger module
66. 1 – magnetic brake – stops rotation instantly
67. 1 – low pressure 3 level switch can be mouth operated
69. 2 – 25 watt pots 8 ohm
70. 2 – 25 watt pots 1000 ohm
71. 4 – wire wound pots – 18, 33, 50 and 100 ohm your choice
77. 1 – time reminder adjustable 1-60 mins clockwork
85. 1 – mains shaded pole motor ¾" stack – ⅛" shaft
89. 1 – mains motor with gear box 1 rev per 24 hours
91. 2 – mains motors with gear box 16 rpm
96. 1 – thermostat for fridge
98. 1 – motorised stud switch (s.h.)
101. 1 – 2½ hours delay switch
103. 1 – mains power supply unit – 6V DC
104. 1 – mains power supply unit – 4½V DC
107. 1 – 5" speaker size radio cabinet with handle
112. 1 – heating pad 200 watts mains
114. 1 – 1W amplifier Mullard 1172
115. 1 – wall mounting thermostat 24V
118. 1 – teak effect extension 5" speaker cabinet
120. 2 – p.c. boards with 2 amp full wave and 17 other recs
121. 4 – push push switches for table lamps etc.
122. 10 – mtrs twin screened flex white p.v.c. outer
124. 25 – clear plastic lenses 1¾ diameter
127. 4 – pilot bulb lamp metal clip on type
128. 10 – very fine drills for pcbs etc.
129. 4 – extra thin screw drivers for instruments
132. 2 – plastic boxes with windows, ideal for interrupted beam switch
134. 10 – model aircraft motor – require no on/off switch, just spin to start
137. 1 – 6½" 4 ohm 10 watt speaker
142. 10 – 4 BA spanners 1 end open, other end closed
145. 2 – 4 reed relay kits 3V coil normally open or c/o if magnets added
146. 20 – pilot bulbs 6.5V.3A Philips
154. 1 – 12V drip proof relay – ideal for car jobs
155. 3 – varicap push button tuners with knobs
169. 4 – short wave air spaced trimmers 2-30f
172. 10 – 12V 6W bulbs Philips m.e.s.
178. 3 – oblong amber indicators with lilliputs 12V
180. 6 – round amber indicators with neons 240V
181. 100 – p.v.c. grommets ⅜ hole size
182. 1 – short wave tuning condenser 50 pf with ¼" spindle
184. 1 – three gang tuning condenser each section 500 pf with trimmers and good length ¼" spindle
188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45min
193. 6 – 5 amp 3 pin flush sockets brown
195. 5 – B.C. lampholders brown bakelite threaded entry
196. 1 – in flex simmerstat for electric blanket soldering iron etc.
197. 2 – thermostats, spindle setting – adjustable range for ovens etc.
199. 1 – mains operated solenoid with plunger 1" travel
200. 1 – 10 digit switch pad for telephones etc.
201. 8 – computer keyboard switches with knobs, pcb or vero mounting
206. 20 – mtres 80 ohm, standard type co-ax off white
211. 1 – electric clock mains driven, always right time – not cased
216. 1 – stereo pre-amp Mullard EP9001
232. 2 – 12V solenoids, small with plunger
236. 1 – mains transformer 9V 1 amp secondary C core construction
241. 1 – car door speaker (very flat) 6½" 15 ohm made for Radiomobile
241. 2 – speakers 6" × 4" 4 ohm 5 watt made for Radiomobile
243. 2 – speakers 6" × 4" 16 ohm 5 watt made for Radiomobile
244. 1 – mains motor with gear-box very small, toothed output 1 rpm
245. 4 – standard size pots, ½ meg with dp switch
249. 1 – 13A switched socket on double plate with fused spur
266. 2 – mains transformers 9V ½A secondary
267. 1 – mains transformers 15V 1A secondary p.c.b. mounting
291. 1 ten turns 3 watt pot ¼ spindle 100 ohm
296. 3 car cigar lighter socket plugs
298. 2 15 amp round pin plugs brown bakelite
300. 1 mains solenoid with plunger compact type
301. 10 ceramic magnets Mullard 1" × 3/8 × 5/16
303. 1 12 pole 3 way ceramic wave charge switch
305. 1 tubular dynamic microphone with desk rest
308. 1 T.V. turret tuner (black & white T.V.)
310. 2 oven thermostats
313. 5 sub miniature micro switches
314. 1 12" 8 watt min fluorescent tube white
315. 1 6" 4 watt min fluorescent tube white
316. 1 round pin kettle plug with moulded on lead
453. 2 – 2½in. 80ohm loudspeakers
454. 2 – 2½in. 8ohm loudspeakers

FROZEN PIPES Can be avoided by winding our heating cable around them, 15 mtrs connected to mains cost only about 10p per week to run. Hundreds of other uses as it is waterproof and very flexible. Resistance 60ohms/metre. Price 28p/metre or 15m for £3.95.

CAR STARTER/CHARGER KIT

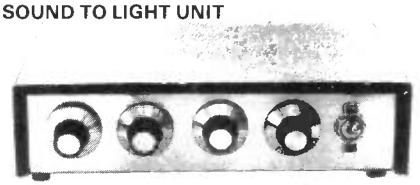
Flat Battery! Don't worry you will start your car in a few minutes with this unit – 250 watt transformer 20 amp rectifiers, case and all parts with data **£17.50** post £2

Ex-Electricity Board. **Guaranteed 12 months.**

VENNER TIME SWITCH

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

SOUND TO LIGHT UNIT



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

12 volt MOTOR BY SMITHS

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

25A ELECTRICAL PROGRAMMER

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

THIS MONTH'S SNIP

BENCH ISOLATION TRANSFORMER. Torroidal wound 400 watt but very compact. Has a separate 10V winding which can be added or subtracted to give fine voltage control. Normally £40, our price £10 plus £2 post, ref 10P9.

TANGENTIAL BLOWER HEATERS

We can supply:
1-2KW—qurte definitely the smallest tangential blow heater we have ever had, measuring approx. 6 × 6 × 4. This could be just the thing for a small bedroom or to fit under desk or table if you suffer from cold legs. In addition to normal heating functions if put into a simple enclosure this could be a pipe unfreezer (much safer than a blow lamp) possibly even a paint stripper, hair dryer or hand dryer. Price is £5, plus £1 post, ref 5P23.
2-5KW—width approx. 8" (plus motor), elements made up of two 1-2kw sections, so with switch supplied you can have 2kw, 1kw or cold blow. Over heat cut-out eleminates fire risk should fan stop or air flow be impeded. Fan blades are metal. Price £5 plus £1.50 post, ref 5P62.
3KW—width approx. 13" plus motor, element made up of 1kw and 2kw section, supplied with 4 section rocker switch, allowing 3kw, 2kw, 1kw and cold blow. Price £6.95 plus £2.00 post.
2KW D.I.Y. SPECIAL—if you want a really cheap tangential heater, this is your opportunity, made for 115v mains, to use it on 230v. Simply join elements in series, needs only simple on/off switch, as you will only have one heat level 2kw and no cold blow. Price £2 plus £1 pust, ref 2P66.
VERY LOW RUNNING COST—only a 300w element. So would cost only approx. 1½p per hour to run. Should be enough for an airing cupboard or a hot box for seed germination. Might even be enough to keep a damp corner dry. Normal construction approx. 4½" plus motor wide. Price £5 plus £1 post, ref 5P78.
500W–115V TRANSFORMER to isolate you or yours from mains to earth shock dangers. We are able to offer these transformers at less than the price of an auto transformer. Our price for the 500w mains to 115v isolation transformer is £10 plus £5 post, ref 10P6.
RESIN CURED FILLER/BUILDER/STICKER made by the famous Holts company, suitable for repairs, not only to car bodies but also to sinks and wash basins, water tanks, drain pipes and gutters, tiles, roofs, filling holes in walls and concrete, repairing cracks in gates, window frames, etc. etc. It is weather resistant and adheres well to metals, wood, concrete and some plastics. Special bargain price 2 large tubes for £1, ref 8D464
STEPPER MOTOR. By American Philips corporation. Step angle 7-5°. Coil resistance 27 ohms. Operating volts 10–14. Size approx. 2½" dia by 1¾" deep on a square mounting plate. This is in fact two bi-directional motors with P.M. rotors. Applying correct pulse causes a 7-5° step angle of spindle. Number of steps through which it rotates and a speed at which it rotates is determined by the applied impulses. Properly used this provides an ideal method of speed and position control. Brand new and unused price £5, ref 5P81.
BIG GLASS FIBRE SHEETS. Virtually unbreakable, size 4' × 3' approx. Flat, approx. 1/16" thick. Intended for pcb's but ideal for roof repairs, car port, greenhouse etc. £2 each, Minimum quantity we can despatch is 10. Carriage cost £6.50 per 10. £8.50 for 15.

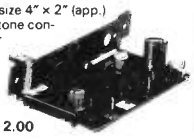
IONISER KIT

Refresh your home, office, shop, work room, etc. with a negative ION generator. Makes you feel better and work harder – a complete mains operated kit, case included. **£11.95** plus £2.00 post.

TELEPHONE BITS

Master socket (has surge arrestor – ringing condenser etc) and takes B.T. plug **£3.95**
Extension socket **£2.95**
Dual adaptors (2 from one socket) **£3.95**
Cord terminating with B.T. plug 3 metres **£2.95**
Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets **£11.50**
100 mtrs 4 core telephone cable **£8.50**

MINI MONO AMP on p.c.b. size 4" × 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 £12.00**

J & N BULL ELECTRICAL

Dept. E.E., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B/card orders accepted. Brighton 0273 734648. **Bulk orders:** write for quote.

£2 POUNDERS*

2P2 – Wall mounting thermostat, high precision with mercury switch and thermometer
2P3 – Variable and reversible 8-12v psu for model control
2P4 – 24 volt psu with separate channels for stereo made for Mullard UNILEX
2P6 – 100W mains to 115V auto-transformer with voltage tappings
2P8 – Mains motor with gear box and variable speed selector. Series wound so suitable for further speed control
2P9 – Time and set switch. Boxed, glass fronted and with knobs. Controls up to 15 amps. Ideal to program electric heaters
2P10 – 12 volt 5 amp mains transformer
2P12 – Disk or Tape precision motor – has balanced rotor and is reversible 230v mains operated 1500 rpm
2P14 – Mug Stop kit – when thrown emits piercing squawk
2P15 – Interrupted Beam kit for burglar alarms, counters, etc.
2P17 – 2 rev pr minute mains driven motor, ideal to operate mirror ball
2P18 – Liquid/gas shut off valve mains solenoid operated
2P19 – Disco switch-motor drives 6 or more 10 amp change over micro switches supplied ready for mains operation
2P20 – 20 metres extension lead, 2 core – ideal most Black and Decker garden tools etc.
2P21 – 10 watt amplifier, Mullard module reference 1173
2P22 – Motor driven switch 20 secs on or off after push
2P26 – Counter resettable mains operated 3 digit
2P27 – Goodmans Speaker 6 inch round 8ohm 12 watt
2P28 – Drill Pump – always useful couples to any make portable drill
2P31 – 4 metres 98 way interconnecting wire easy to strip
2P32 – Hot Wire amp meter – 4½ round surface mounting 0–10A – old but working and definitely a bit of history
2P34 – Solenoid Air Valve mains operated
2P38 – 200 R.P.M. Geared Mains Motor 1" stack quite powerful, definitely large enough to drive a rotating aerial or a tumbler for polishing stones etc.
2P43 – Small type blower or extractor fan, motor inset so very compact, 230V
2P46 – Our famous drill control kit complete and with prepared case.
2P49 – Fire Alarm break glass switch in heavy cast case
2P51 – Stereo amplifier, 3w per channel
2P55 – Mains motor, extra powerful has 1½" stack and good length of spindle
2P62 – 1 pair Goodmans 15 ohm speakers for Unilox
2P64 – 1 five bladed fan 6½" with mains motor
2P66 – 1 2Kw tangential heater 115v easily convertible for 230V
2P67 – 1 12v–0–12v 2 amp mains transformer
2P68 – 1 15v–0–15v 2 amp mains transformer
2P69 – 1 250v–0–250v 60 mA & 86.3v 5A mains transformer + 50p post
2P70 – 1 E.M.I. tape motor two speed and reversible
2P72 – 1 115v Muffin fan 4" × 4" approx. (s.h.)
2P75 – 1 2 hour timer, plugs into 13A socket
2P82 – 9v–0–9v 2 amp mains transformer
2P84 – Modem board with press keys for telephone redialler
2P85 – 20v–0–20v ½A Mains transformer
2P88 – Sangamo 24 hr time switch 20 amp (s.h.)
2P89 – 120 min. time switch with knob
2P90 – 90 min. time switch with edgewise engraved controller
2P94 – Telephone handset for EE home telephone circuit
2P95 – 13A socket on satin chrome plate
2P97 – mains transformer 24V 2A upright mounting
2P98 – 20m 4 core telephone cable, white outer
2P99 – 500 hardened pin type staples for telephone cable
2P101 – 15V mains transformer 4A upright mounting
2P105 – capillary type thermostat for air temperature with c/o switch
2P108 – mains motor with gear box giving 110rpm
2P109 – 5" wide black adhesive pvc tape 33m, add £1 post if not collecting

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There is a total of over 400 packs in our Baker's dozen range and you become entitled to a free gift with each dozen pounds you spend on these packs.

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£5 POUNDERS*

5P1 12 volt submersible pump complete with a tap and switch, an ideal caravan unit.
5P2 Sound to light kit complete in case suitable for up to 750 watts.
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5P6 12V alarm bell with heavy 6" gong, suitable for outside if protected from direct rainfall. Ex GPO but in perfect order
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5P18 – motor driven water pump as fitted to many washing machines
5P20 – 2 kits, matchbox size, surveilance transmitter and FM receiver
5P23 – miniature (appr. 2½" wide) tangential blow heater, 1-2kw
5P24 – ½hp motor, ex computer, 230V, mains operation 1450rpm. If not collect add £3 post
5P25 – special effects lighting switch. Up to 6 channels of lamps can be on or off for varying time periods
5P27 – cartridge player 12V, has high quality stereo amplifier
5P28 – gear pump, mains motor driven with inlet and outlet pipe connectors
5P32 – large mains operated push or pull solenoid. Heavy so add £1 50 post
5P34 – 24V 5A toroidal mains transformer
5P35 – modem board from telephone auto dialler, complete with keypad and all ICs
5P37 – 24 hour time switch, 2 on/offs and clockwork reserve, ex Elec. Board loading up to 50A. Add £1 post
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5P48 – telephone extension bell in black case, ex-GPO
5P51 – 200W auto transformer 230V to 115V torroidal
5P52 – mains transformer 26V 10A upright mounting, add £2 post
5P54 – mains motor with gear box, final speed 5rpm
5P58 – Amstrad stereo tuner FM and LM and S. AM
5P60 – DC Muffin type fan 18 to 27V, only 3W
5P61 – drill pump mounted on frame, coupled to mains motor
5P62 – 2½kw tangential blow heater, add £1.50 post if not collecting
5P73C high pressure mains operated gas or water valve with tube connection suitable soldering
5P74 6rpm 60W mains motor and gearbox with instant stop
5P79 30rpm 80 watt mains driven motor with gearbox
5P82 1 25rpm mains 60w motor with gearbox
5P84 1 delay time switch, adjust 0–20 seconds
7P1 1 instant heat solder gun—mains with renewable tip and job light
10P10 1 9" extractor fan 115V so supplied with adaptor

LIGHT CHASER KIT motor driven switch bank with connection diagram, used in connection with 4 sets of xmas lights makes a very eye catching display for home, shop or disco, only £5 ref 5P56.

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934 MHz £1

Each catalogue is packed full of info. and includes a £2 voucher.

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HIGH QUALITY BRITISH MADE
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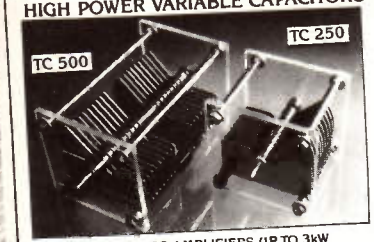

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TC500 Variable capacitor
CAPACITY:- 26-500 pF
VOLTAGE:- 7.8kV Max
SIZE:- 101 x 105 x 165mm
AIR GAP:- 2mm
£28 plus £2 p&p

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

29 MHz BASE ANTENNAS

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

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

SALUT 3/4 WAVE
Using a unique base hoop this antenna offers exceptional ground wave coverage on 10 FM
POWER:- 2kW
GAIN:- 4.5 dB
FREQ:- 28-30MHz
LENGTH:- 9.1 MTRS
£59
plus £4 p&p

2 MTR EQUIPMENT

2 MTR HANDHELD

CT1600 A superbly sensitive new handheld covering 142-149MHz
£179
- Repeater shift
- High/low power 1.5/0.5 Watt
- Thumbwheel selector

Each set supplied C/W re-chargeable battery pack and free mains charger unit.

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Full range of 144 MHz mobile amplifiers in stock see our Ham Catalogue.

RF AMPLIFIERS

All amplifiers except broadband models are tuned for 29.6MHz centre freq. Should you require a lower freq. i.e. 28.5MHz please state when ordering. Export models available for 26-30MHz.

MOBILE AMPLIFIERS

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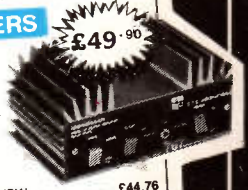
£49.90
76 Watts FM
INPUT:- 0.5-10 Watts
SWITCHABLE:- Class AB, Class C
SUPPLY:- 13.8 Volt
REMOTE CONTROL FACILITY



C.T.E. MOD 737 50W FM AM/SSB/CW	£44.76
C.T.E. MOD 767 80W FM AM/SSB/CW	£49.90
C.T.E. MOD 757 150W FM Broadband	£116.87
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ZETAGI B300 150W FM (2-30MHz)	£136.00
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MAINS OPERATED AMPLIFIERS

C.T.E. DC9 Solid State 150W FM (Broadband)	£199.11
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RECEIVE	70-700 MHz
TRANSMIT	70-500MHz
MAX POWER	500W
GAIN	3.5dB

WIDEBAND DISCONE RECEIVING ANTENNA
(3 Element) 70-500MHz £24.95

NEW BEARCAT H/HELD SCANNING RX. MODEL 100XL
£229
Receives 8 bands plus aircraft band. 16 Channels, priority keyboard lock and lighted display.
66-88 MHz 118-174 MHz 406-512 MHz

£209 **BEARCAT 175XL**
Base receiver covers:-
66-88MHz
118-174MHz
406-512MHz
with 16 channel memory/scan

BEARCAT DX1000
COMMUNICATIONS RECEIVER

£379
Direct access communications 10KHz-30MHz with 10 channel micro-processor controlled memory.

TEST EQUIPMENT

ZETAGI DL150
RF DUMMY LOAD AND POWER METER
£85.19
A very accurate unit for the service dept. or discerning enthusiast.
FREQ:- 0.5MHz-500MHz
POWER:- 150 Watt Max in 3 ranges 0-3, 0-15, 0-150W.

ZETAGI 500
SWR AND POWER METER
For the enthusiast who wants the very best. A twin meter unit with push button control for either 75 OHM or 50 OHM cable.
FREQ:- 3-200MHz
POWER:- Up to 2kW
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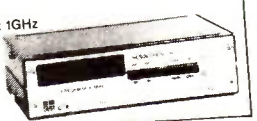
FD 1350 1.3GHz FREQUENCY COUNTER
FREQ:- 10Hz-1.35GHz
SENSITIVITY:- 43mV at 1GHz
DISPLAY:- 8 Digit
SUPPLY:- 9-12 Volt DC.
£139.53



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R.F. POWER AMP. WITH HARMONIC FILTER
INPUT:- 1-4 Watts
OUTPUT:- 25-30 Watts
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FREQ.- 26-30 MHz

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A superior low noise pre-amplifier for 29MHz FM operation. Variable gain -6dB's to +18dB's suitable for use with transceivers up to 25 Watts output
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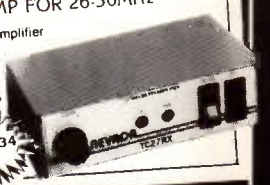

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