

Radio & Electronics

The communications and electronics magazine **World**

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**RTTY:
AN INTERFACE FOR
THE AMSTRAD**

**THE ST900:
A FRESH LOOK
FIFTY YEARS ON**

**ICOM IC04E:
THE IMPROVED MK2
VERSION REVIEWED**

**RX6-30 ANTENNA:
A MINI LOOP
FOR 5.5 to 32MHZ**



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THE HARNESS**

For Tomorrow's Radio Technology TODAY

BASE STATIONS

Good News for FT67 owners. Kenwood owners take note!
IMPROVED YAESU FT767 RWC/MK2 HF-UHF BASE STATION

We have now improved the synthesizer (see reviews) leading to better dynamic range by up to 20dB which now puts this transceiver in a class of its own! This modification is only available from RWC and is fitted FREE to all New units sold by us or we will modify any existing unit for £59.50 inc. return postage.

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FT767GX MK2/RWC

NEW



ICOM IC735

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* = Extended RX coverage available. call for details

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CITE1600 HVY SIM IC2EJ 2.5W 2MTR C/W CHRGR	£199.00
KENPRO KT400EE 2.5W 70CM C/W CHRGR	£199.00
*KENPRO KT200EE 2.5W (5W) 2MTR LCD C/W CHRGR	£199.00
KENWOOD/TRIO TH21E 2W 2MTRS. (WHILE STOCKS LAST)	£139.00

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FT690R/MK2 AS ABOVE C/W NICADS AND CHARGER	£425.00
FT290R/MK2 2.5W MULTIMODE IMPROVED RECEIVER	£395.00
FT290R/MK2 AS ABOVE C/W NICADS AND CHARGER	£429.00
FT290R/MK1 2MTR MULTIMODE SPECIAL PRICE	£329.00

MOBILES

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SUN 5/8 MOBILE ANTENNA C/W SO239 G/MOUNT	£299.00
*ICOM IC28E 25W SUPER MINI MOBILE FREE SUN	
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NEW

SCANNERS

YAESU FRG9600/RWC



FRG 9600

We supply the Yaesu FRG 9600 modified receiver for Government departments and professional users. We offer more options and facilities than any other company. We transform the basic unit by improving sensitivity and adding extra bands. No other scanner has this many options and models available. Call now for much more information. Overseas dealer required for post.

Modified Yaesu receivers, NOBODY can handle em like WE can!

YAESU FRG9600 RWC Mk1 60-895MHZ IMPROVED RECEIVER	£395.00
YAESU FRG9600 RWC Mk2 60-895MHZ ALL BAND CONNECTOR	£425.00
YAESU FRG9600 RWC Mk3 60-895MHZ MULTIMODE	£599.00
NEW YAESU FRG9600 RWC MK5 100KHZ-950MHZ ACTIVE F/END	£625.00 NEW
YAESU FRG9600 MK5A1 100KHZ-950MHZ PA4C ALL BAND COMPLETE	£699.00
100KHZ-950MHZ ALL BAND ALL MODE RECEIVING STATION	£851.00
ICOM ICR7000 35.2GHZ ALL MODE SUPER RECEIVER	£945.00
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REGENT YMX7000 SAME COVERAGE SAME MAKE AS AOR2002	£399.00
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MANUFACTURER'S MARKETS AND MODELS IN STOCK PLEASE CALL FOR DETAILS	
INCLUDED P&P BY COURIER DELIVERY	
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YAESU FRG8800/FRV8800 AS ABOVE WITH VHF CONVERTER	£659.00
ICOM ICR171 100KHZ-10MHZ A TOP CLASS RECEIVER	£738.00

NEW PRODUCTS

INTERNATIONAL MODEL 877R AIR-BAND RECEIVERS

This new tuneable receiver covers 52-174 Mhz as well as CB in three bands and is a cost effective alternative to handheld scanners. The receiver is fitted with a helical antenna and has good performance for a radio with this coverage. It is ideal for monitoring Air Band the two-metre and PMR/Marine bands as well as Band 2 FM Broadcast. A squelch control is also provided. Two versions are currently available.

Model 877R for use with Dry cells	£39.50
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DEALERS CALL FOR TRADE PRICES P&P £2.50

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INTRODUCTORY OFFER

RAYCOM PRODUCTS

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(Both above with case in ICOM BC 160 OR RAYCOM NC580)

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Trade and Dealer enquiries welcome. Call for more details. P&P £2.50 per order.

Business radio users call now!



NEW

ANTENNAS & ACCESSORIES

ICOM AH7000 SUPER DISCONE 25-1300MHZ INC POST	£79.00
NEW RAYCOM AIR BAND DISCONE 118-170 MHZ 6 ELEMENTS	£12.50
RAYCOM DISCONE 60-600 MHZ 8 ELEMENTS SO239 SOCKET	£27.50
SUN MOBILE 5/8 SO239 C/W SO239 MOULDED LEAD G/MOUNT	£22.50
G5RV 1/2 SIZE HF MULTIBAND HF ANTENNA (INC POST)	£15.00
G5RV FULL SIZE MULTIBAND HE ANTENNA (INC POST)	£17.50
G5KW/W3DZZ 7.1MHZ TRAP DIPOLE ASSY SO239/COAX FED	£23.50
G5KW/W3DZZ 7.1MHZ MULTIBAND AS ABOVE, BALANCED FED	£22.50
G5KW/W3DZZ 7.1MHZ 2X TRAPS, FOR SELF ASSY ANT	£9.95

Hundreds of other types of base and mobile antennas in stock. JAYBEAM, TONNA, MET. SUN, HOXIN, POPULAR MODELS IN STOCK.

NEW RWC are now appointed dealers for the West Midlands for Butternut, Cushcraft and MFJ products. Please ask for details of the range currently available.

MOD KITS

RWC MOD KITS, ANNOUNCEMENT

We apologize to customers waiting for various mod kits. Supplies of crystals and components are inconsistent and demand for kits varies. As there is occasionally a delay before we can send your kit of parts, please be patient. Rome was NOT built in a DAY! Kits still available: SANYO LC7137 SYNTHESIZER CB 10MTRS LCLDNT CB 10MTRS FT757GX MK1 FAST TUNING MOD STURNO COM713 PMR 2MTR KIT PYE A200 E BAND 50MHZ KIT call for technical details, prices and delivery.

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Most other products advertised in this magazine are available at RWC.

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Safety in the shack

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

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

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

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of this magazine are accurate, we assume no responsibility for any effect from errors or omissions.

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ON THE JOB

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We regret to inform readers that due to constantly rising production costs, and to enable us to maintain the high standard in *Radio & Electronics World*, the price of the magazine will be £1.45 from this issue. Turn to page 17 for your last chance to subscribe at the old rates

DATA FILE

PARAMETER	VALUES, WITH $\pm 6V$ SUPPLY		
	MIN	TYP	MAX
Supply voltage	$\pm 5V$		$\pm 12V$
Input impedance Input sensitivity (RMS)	5k Ω 10mV	10k Ω 1mV	
VCO Maximum frequency Drift with temperature Drift with supply volts		500kHz 330ppm/ $^{\circ}C$ 0.2%/V	1.5%/V
Triangle wave Output amplitude (p-p) Output linearity		2.4V 0.5%	3V
Square wave Logic - 1 output volts Logic - 0 output volts Rise time Fall time Output sink current Output source current	+4.9V	+5.2V -0.2V 20ns 50ns 1mA 10mA	+0.2V
Demodulated output Output voltage level (pin 7) Max output voltage swing Output voltage swing at 10% FM Total harmonic distortion Output impedance Offset volts (pin 6 to pin 7) AM rejection	4.0V 200mV p-p	4.5V 2V p-p 300mV p-p 0.4% 3.6k Ω 50mV 40dB	5.0V 1.5% 200mV

Fig 4 Main parameters of the NE565

frequencies, and is used to voltage control the VCO input. Thus, if the input frequency rises above that of the VCO, the detector's output also rises and automatically forces the VCO frequency to rise towards that of the input until locking occurs.

Note that in practice a small time delay is applied to this locking action, via the single-pole loop filter formed by C2 (connected between pins 7 and 10) and

the IC's internal 3k Ω resistor. Thus, if the input signal is noisy or juddery, or is frequency modulated (FM), the VCO locks to the *mean* frequency of the input signal and generates a 'clean' output at pin 4 or 5, and produces a demodulated FM output at pin 7.

Note that, when using the IC in practical circuits a small capacitor (about 1nF) should be wired between pins 7 and 8, to enhance circuit stability.

More details

Figure 4 lists the main parameter and characteristic details of the NE565. The IC is normally used with a split (positive and negative) power supply, which must be in the range 5 to 12 volts, but can also be used with a single ended supply in the range 10 to 24 volts.

The phase detector section of the IC has a typical input impedance of 10k Ω on each terminal, and the circuit can lock and track to input signals with amplitudes as low as 1mV RMS. Input signals should normally be ac coupled, but can be dc coupled if the dc resistances seen from pins 2 and 3 are equal and there is no dc voltage difference between the pins.

The IC's VCO is a very stable (typical drift with temperature is 300ppm/ $^{\circ}C$, and with supply voltage is 0.2%/V) wide-range type that provides excellent voltage-to-frequency conversion linearity (typically 0.5%).

The VCO provides a good TTL-compatible square-wave output (with typical rise and fall times of 20 and 50 nanoseconds respectively) at pin 4, and a highly linear triangle wave output at pin 9. Figure 5 shows the typical output waveforms obtained when using a split 12 volt power source.

The VCO's free-running frequency (f_0) is set by resistor 'R' wired between pin 8 and pin 10 (= V+); and by capacitor 'C' wired between pin 9 and pin 1 (= V-), and equals (in kHz) $1.2/4RC$ when R is in kilohms and C is in microfarads. R can have any value in the range 2k Ω to 20k Ω (optimum value is about 4k Ω), and C can have any value at all. In normal use, the NE565 will phase-lock to any input signal frequency that is within plus or minus 60% of the f_0 value; this is known as the circuit's 'lock range'.

The output section of the IC gives a demodulated output at pin 7, and pin 6 provides a dc reference voltage that is close to the dc potential of pin 7. If a

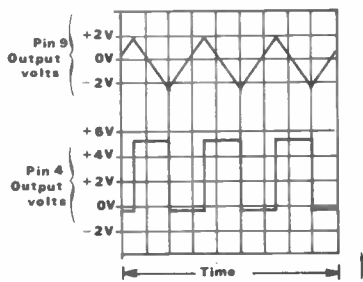


Fig 5 VCO output waveforms when using a $\pm 6V$ supply

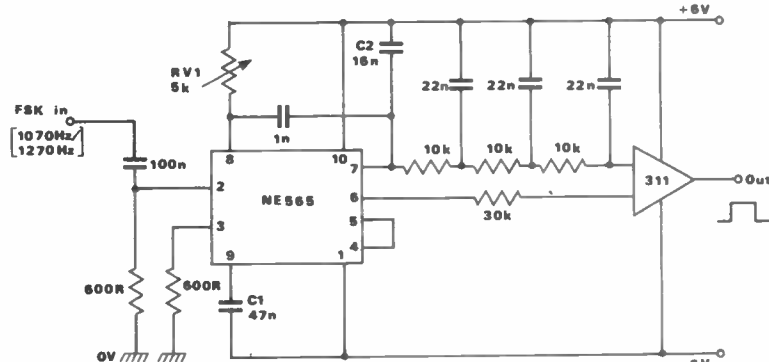


Fig 6 FSK demodulator circuit

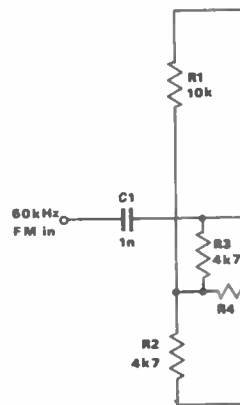
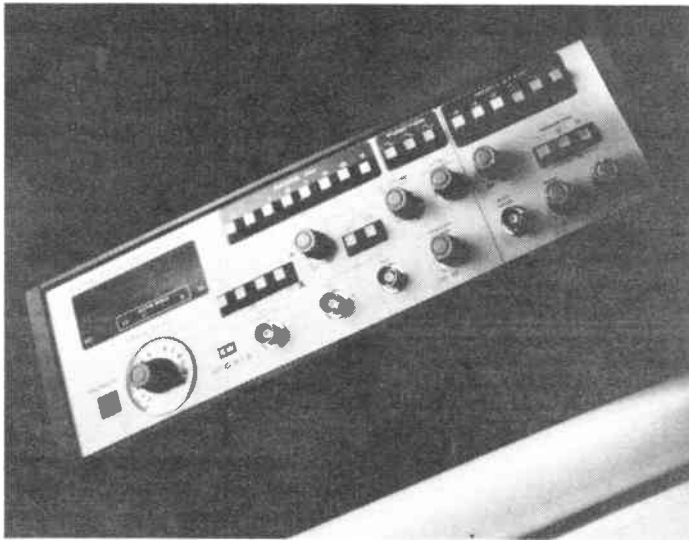


Fig 7 60kHz FM demodulator circuit

PRODUCT NEWS

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

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



FUNCTION GENERATOR

Flight Electronics has recently made available the GFG813, a flexible high specification function generator, with twin outputs and an integral digital counter.

In addition to the usual sine, square and triangle waves the unit supplies ramp and variable symmetry pulse options. Modulations include AM, FM, trigger, sweep, gate or burst. The on-board counter incorporates a clear six-digit LED display.

With a frequency range of 0.1 to 13MHz the unit offers a wide applications potential. The built in counter and twin outputs allow complex test

and measurement functions to be carried out using the GFG813 as the sole instrument. Areas of application will include TV/radio test and repair, educational establishments, laboratories, and production environments.

Main waveform amplitude is 20V peak to peak (open circuit) and 10V peak to peak into a 50 ohm load at 1kHz. Overall dimensions are 380 x 310 x 99mm. The GFG813 is priced at £795.

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

RESISTIVITY TEST SYSTEM

A resistivity test system from Dage gives accurate and low-cost measurement of V/I, Rs, ohms/square, and ohms/cm.

The Alessi CPS equipment provides a flexible test-bed with vacuum chuck, and 4-point probe head options. It is compatible with standard DVMs and constant current source instruments. A multi-position precision arm holds the test probe, which will give a guaranteed 50,000 test operations (typically 100,000).

The spring loaded universal pedestal permits testing of wafers of up to 4in diameter. The unit features 'true' vertical advance and fine adjustment, without 'scrubbing' displacement. A microswitch ensures correct probe tip contact prior to power on.

The flexibility of this system allows wafer developers to test a wide range of semiconductor shapes and sizes. Probe tip choice is wide allowing measurement of materials such as silicon slices/ingots, thin metallic sheets, and GaAs/GaPAs. Probe tip materials are tungsten carbide or osmium, various radii being available. A compression spring maintains even tip pressure and extends probe life.

The basic station is the CPS/1. Actuator with 2in

traversing plate and 3in vacuum chuck - CPS/2. Actuator with 4in plate and 4in chuck - CPS/4. The basic probe bodies are C4R and C4S.

*Dage (GB) Ltd,
Intersem Division,
Rabans Lane,
Aylesbury,
Bucks HP19 3RG.
Tel: (0296) 393200.*

UNIVERSAL MODULE

The P600 Universal Module supports the programming of EPROMs, EEPROMs, bipolar PROMs, PALs (including CMOS PALs and EPALs), FPLs, FPLA and FPGA devices.

All major manufacturers are supported in one module, ensuring that the user's programming requirements are met in a single unit without the expense of adaptors or personality cards.

The P600 module contains specific hardware/software to check the performance of the devices being programmed. Tests include variable voltage thresholds and vector testing. Preloading of registers and security fuses are supported.

The module features sophisticated software-driven pin drive circuitry coupled with a very fast processor which allows control over

voltage thresholds, current sensing/driving, slew rates and so on. This ensures precise programming and enables new devices to be added to the system with a minimum of delay.

The latest intelligent software is incorporated into the P600 to ensure fast programming and high yields. The software includes Quick Pulse (TM Intel) and Flashrite (TM AMD). Variable block programming is supported.

The module is self-calibrated with all programming voltages referenced to a single, precision band-gap, voltage reference. All vol-

tages are checked and adjusted to accommodate temperature, drift and so on. Full implementation of the JEDEC data transfer standard for programmable logic devices ensures that the P600 will support proprietary software such as PALASM, CUPL, PLAN etc.

Designed for use with the AP100 high performance programming system the P600 module is priced at £995.

*GP Industrial Electronics Ltd,
Unit E, Huxley Close,
Newnham Ind Est,
Plymouth PL7 4JN.
Tel: (0752) 342961.*



25MHz SCOPE

With solid performance, versatility and a low price tag, the type 3133 25MHz, dual trace oscilloscope offers good value for money. Available from ECW, the 3133 is manufactured by Crotech and has a full two year warranty. Among the features of the 3133 are a variable time base hold-off, a rise time of 14nS, X-Y modes, and add/subtract channel options.

Triggering is reliable up to 40MHz and there is an active TV trigger circuit; Z modulation is provided. The time base range is from 40nS/div to 0.2S/div and vertical sensitivity is 2mV/div. The CRT has a 10 x 8 division graticule which has 0 and 100% markings to simplify peak-to-peak waveform measurements.

In common with other models in the Crotech range, the 3133 has a triple output dc source and a built in dual component comparator for active and passive component evaluation.

ECW offers the Type 3133 at a mail order price of £380.65, including VAT and P&P.

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

RESISTIVITY METER

A new, UK designed surface resistivity meter is now being manufactured by Technotrend Ltd. The SRM30 is an easy to use instrument that measures both surface resistivity and resistance to ground. It is designed to provide quick, reliable measurements of conductive work surfaces, static dissipative materials and antistatic flooring.

The SRM30 uses an electrode system made from materials specially selected and engineered to give accurate measurements of surface resistivity from 10^5 to 10^{10} ohms, with a clear indication of whether a surface or material is conductive, antistatic or insulating. The instrument is of particular use in such static sensitive environments as

microelectronic component assembly areas, computer rooms, quality control, laboratories, hospitals etc.

The battery operated SRM30 is pocket sized, measuring 160mm x 90mm x 45mm and weighing 250g. The price is £275, plus postage and VAT.

*Technotrend Ltd,
Thomson House,
Farnborough Road,
Farnborough,
Hants GU14 7NU.
Tel: (0252) 373242.*

13.8V PSU

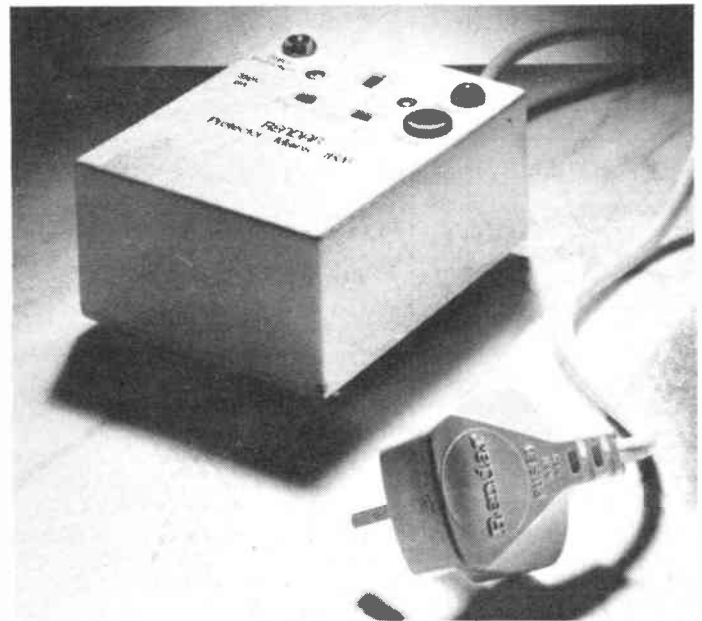
SMC have recently introduced three new models of their 13.8 volt dc power supplies. All have line regulation of less than 1% and RMS ripple of 2mV. These power supplies are suitable for amateur transceivers, laboratory, telecommunications, marine and general applications.

The smallest RU120406 is designed for a constant 4 amps, but will provide a surge to 6 amps.

The RS120810 is suitable for up to 8 amps constant and 10 amps surge. It is also provided with overvoltage protection, which is necessary when being used with very expensive equipment.

The SS122535 is suitable for 25 amps constant and 35 amps surge. It not only has overvoltage protection, but also has a pair of terminals for remote voltage sensing, allowing the power supply to adjust to maintain the constant voltage at load.

*SMC Ltd,
S M House,*



*School Close,
Chandlers Ford
Industrial Estate,
Eastleigh,
Hampshire SO5 3BY.
Tel: (0703) 255111.*

SPIKEBLOC

Rendar's Spikebloc protects any sensitive electronic equipment against damage resulting from lightning strikes and power supply 'glitches', such as electromagnetic pulses (EMP) and radio frequency interference (RFI).

The unit will protect microprocessor-based hardware, such as displays, computers and all memory-dependent equipment. Spikebloc simply plugs into the mains and has an output socket providing 'clean' power.

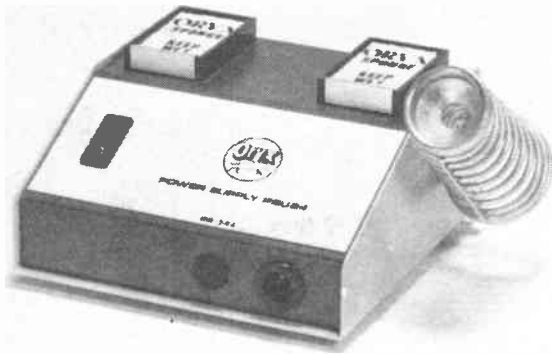
Spikebloc protects equipment against interference damage that could be per-

manent, and which may be inflicted by sources up to 100m away. The device is also cheap compared to the traditional protection units of similar performance. Surge diverters provide lightning suppression against surges up to 2500A (single stroke 8/20 microsecond characteristic lightning pulse equivalent to 60J). RF isolation is effective from below 1MHz to the VHF band.

The Spikebloc unit meets BS1363 and measures 122 x 96 x 55mm. Rated voltage is 250V, 50/60Hz. Two current ratings are available, 6 and 13A. Leakage current is 0.5mA maximum and temperature range is -25 to +85°C.

*Rendar Limited,
Durban Road,
South Bersted,
Bognor Regis,
West Sussex PO22 9RL.
Tel: (0243) 815811.*





POWER SUPPLIES

The Greenwood Oryx range of soldering iron bench stations and power supplies have recently undergone re-designing, to ensure ongoing quality of the products. The units are now capable of feeding all Oryx 24 volt or 50 volt irons, and also competitors' irons of the same voltage. Working off 115 volts, 220 volts – 240 volts ac and giving an output of 24 volts or 50 volts at 48VA, the PSUs are built in a metal case with primary and secondary circuits fused.

The units have an anti-static earth facility with isolated transformer to BS3535, complete with safety stand, tip cleaning sponge and illuminated on/off switch. The units are 160mm x 160mm x 80mm high, and prices can be found in the Greenwood catalogue, which is available from the address below.

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

PORTASOL 1MM TIP

A recently announced 1mm tip option for the Portasol gas powered soldering iron allows fine, delicate soldering work to be performed for all types of electronic and computer circuit servicing.

Now available from Free-trade (TEP) Ltd, the 1mm replacement tips will be useful to the field servicing engineer who needs the benefit of stable, adjustable temperatures of up to 400°C, simple refilling and freedom from mains sockets and trailing leads.

The tips are easily fitted and include the patented catalytic converter that generates heat

at the tip for maximum efficiency. Powered by gas cigarette lighter fuel, the Portasol has a variable power output, equivalent to an electric iron's output power from 10 to 60W. One filling of gas gives up to 60 minutes of continuous operation.

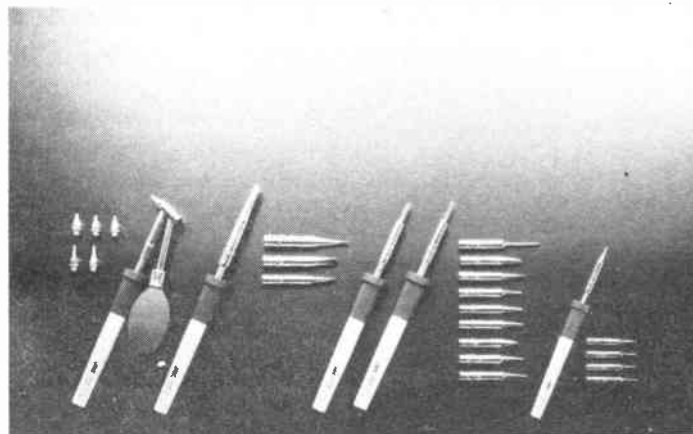
No larger than a felt-tip pen, the fully portable Portasol can be carried in a top pocket and has a clip-on cover with a built-in igniter.

*Free-trade (TEP) Ltd,
Moor Lane,
Witton,
Birmingham B6 7HH.
Tel: (021) 356 2582.*

ANTENNAS

C & S Antennas of Rochester launched two new products at the AFCEA Exposition in Brussels from October 21 to 23, 1987.

The first product was a new Maritime satellite antenna for use with Inmarsat 'C' and GPS terminals. This robust antenna was designed to suit marine or land-based environments, meet the Inmarsat pattern template and require no stabilisation. Trial models are now available, and electrically identi-



cal but mechanically improved lightweight production models will be available in quantity from April 1988.

The second product was a new micro computer controlled HF receiving and direction finding system incorporating a null steering capability which was designed by C & S Antennas.

This technically advanced system operates with any standard unmodified HF receiver in the band 2-30MHz. It utilises a compact and rapidly deployed circular antenna array of four wide-band active loop elements feeding a 4 x 4 Butler Matrix. Rapid DF bearing measurements can be performed and two independent deep nulls/beams can be steered in any azimuth direction.

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

FRG9600 RWC-MK5

RWC have now introduced a further improvement to the Yaesu FRG9600 series, with a new high dynamic range active mixer which provides up to 6dB further gain than the MK3 model. Also featured in the new converter is a multi-pole elliptical filter for better attenuation of unwanted signals, and also a new oscillator circuit for increased reliability and frequency accuracy. The price of the new Yaesu FRG9600 Mk5 is £625.00, plus carriage.

Existing owners of unmodified 9600s can have the Mk5 HF 100kHz-60MHz mod and the Mk2 (905-950MHz expan-

sion) fitted at a cost of £149.50, including return insured carriage.

The RWC FRG9600 series of receiver is now in use by both professional and private users in many countries, and the new modification kits are now available on a Yaesu dealer fitted basis along with the other Yaesu conversions, such as the FT767GX phase noise modification.

Please contact your dealer or RWC/Raycom Ltd for further information. In some cases the modifications can be fitted while the customer waits, subject to making the necessary appointment.

*R Withers Communications,
584 Hagley Road,
West Oldbury,
West Midlands B68 0BS.
Tel: (021) 421 8201.*



HAND PORTABLE

A new hand-portable radiotelephone designed for use in demanding environments has been launched by Storno. The rugged Stornophone 4000 which has only one moving part – the transmitter button, has an impact resistant case and a cast metal casing to protect the radio, and a membrane keypad that is designed to be simple to operate even when wearing protective gloves.

The Stornophone 4000 also has a digital keypad and a liquid crystal display which shows the channel selected, radio state indications and

the number dialled.

The digital keypad enables you to dial other people on the radio system just like an ordinary telephone. This means that users need not be disturbed by other people's conversations.

Another useful benefit of having a keypad is the ability to send pre-coded messages. This means that routine messages or status reports can be transmitted simply by pressing a button and, thanks to software control, such communications can be sent automatically.

All Stornophone 4000 radios are programmed to suit individual customer needs before dispatch. This programming covers radio frequencies, tone signalling systems, and individual and group identities. These specifications can easily be changed, however, by substituting a new personality PROM, if requirements change in the future.

The new rugged Stornophone 4000 is ideal for people working out of doors and on building sites, for example, where a closed radio system is often used.

*Storno A/S,
Artillerivej 126,
DK-2300, Copenhagen.
Tel: 010 451 576800.*

RADIO TO COMPUTER

This high-speed Mobile Radio Data Communications System provides two-way communications via radio to central computers, for staff in vehicles and people without immediate access to a

telephone line.

The system helps to speed up communications between staff in vehicles and the office, and reduces the risk of errors through garbled, forgotten or misunderstood messages which are always a possibility with speech communications.

The Mobile Radio Data System comprises three key components: a choice of mobile or portable data terminals; a data base station, which works in conjunction with the radio transmitting/receiving base station to provide RF modem and telephone communications, and a system controller which relieves the host computer of communications responsibility for each terminal.

The terminal has a built-in display, a separate keyboard and a logic unit. This modular construction allows for each component to be mounted in the best position to suit the particular vehicle type.

The built-in display can show up to 480 alphanumeric characters simultaneously, which means that the operator can read most important messages without the necessity to scroll back and forth, unless the data exceeds 12 lines in length.

To meet differing RF system requirements and varying customer needs, the mobile radio data system is offered with a choice of 4800bps or 1200bps.

*Storno A/S,
Artillerivej 126,
DK-2300, Copenhagen,
Denmark.
Tel: 010 451 576800.*



SCANNER COMPUTER

Readers who own an AOR2002 Communications Rx will be pleased to hear about the Aircastle 2002 Scanner Computer, which is the result of some very careful evaluation of the needs of the AOR2002 user, and the combination of many years of hardware and software expertise.

It is a stand-alone unit which runs off an external 9-12V dc supply and is connected to the AOR2002 by means of a ribbon cable. The unit is controlled by connecting any computer running an asynchronous scrolling terminal program to the built-in RS232 interface (this is virtually any computer, such as the BBC, Amstrad, Spectrum, C64, IBM PC, etc).

The unit contains a large number of built-in facilities and features, and no special software is required (other than as indicated above). Among these features are much faster scanning rates (up to 150 channels per second); in excess of 400 memories (8K RAM version) and 1000 on the RAM expansion option. There are individually programmed attributes for each memory, and the memory can be backed-up by fitting batteries (4 AA size). A unique 'offset' button monitors duplex transmissions; an extended frequency range is included, with all popular frequency bands supplied built in (including offsets where appropriate). Extended frequency step facilities exist (10kHz, 20kHz, 50kHz, 100kHz as well as 5kHz, 12.5kHz and 25kHz).

A powerful scanner control language which can be used to create many new features and programs is a useful facility, and the 2002 has A/D for accurate measurement of signal strength in 255 steps, and an extended priority channel monitoring system. The squelch control output drives a tape recorder on/off, and an optional Centronics interface to drive a printer is available. An optional internal RAM expansion (to 16K) is offered to extend memories, and special facilities are available as options for qualified users. The retail price is £169.99, all inclusive.

*Aircastle Products,
PO Box 78,
Bournemouth BH1 4SP.
Tel: (0202) 581089.*

COLOUR MONITOR

Vistek Electronics has announced that the recently introduced 6.5 inch colour picture monitor Type GM7216 is now in full production and is available with short delivery time.

This compact Grade 2 broadcast monitor is an ideal display unit for use in outside broadcast and similar applications where high picture quality is required, but space is restricted. As a free standing unit it occupies bench space less than nine inches wide and fifteen inches deep, while a pair of GM7216 monitors can be rack mounted side by side in an industry standard dual frame, occupying only 3U panel height.

Its range of operational

PRODUCT NEWS

facilities includes switch selection of pulse cross, underscan and monochrome modes, as well as the less common blue only display facility for critical saturation adjustment. The monitor features two composite video inputs, with the usual A-B switching, and one set of RGB inputs which can be used with separate sync input or composite green. Composite video and external-sync inputs feature bridged loop-through BNC connectors with switchable termination. For RGB inputs, where matched termination is essential for accurate colour balance, single-ended inputs with internal 75-ohm termination are provided.

In its standard form the monitor is fitted with a 625-line PAL decoder, but an optional NTSC decoder is available.

*Vistek Electronics Ltd,
Unit C,
Wessex Road,
Bourne End,
Bucks SL8 5DT.
Tel: (06285) 31221.*

FOUR-SPEED MODEM

A new high-performance 'four speed' modem has been launched by Modular Technology. Called the M7000-1234, the modem can be switched to 2400, 1200, 1200/75 and 300bps operating speeds as required, making it compatible with CCITT V21, V23, V22 and V22 bis stan-

dards.

This facility means that the M7000-1234 is the ultimate device for users wishing to access the broadest possible range of baud rates. Many extras have been incorporated into the modem, including auto dial; auto answer; auto disconnect; local and/or remote test facilities, and a long-term memory which enables it to retain configuration settings when turned off. The retail price is £495.

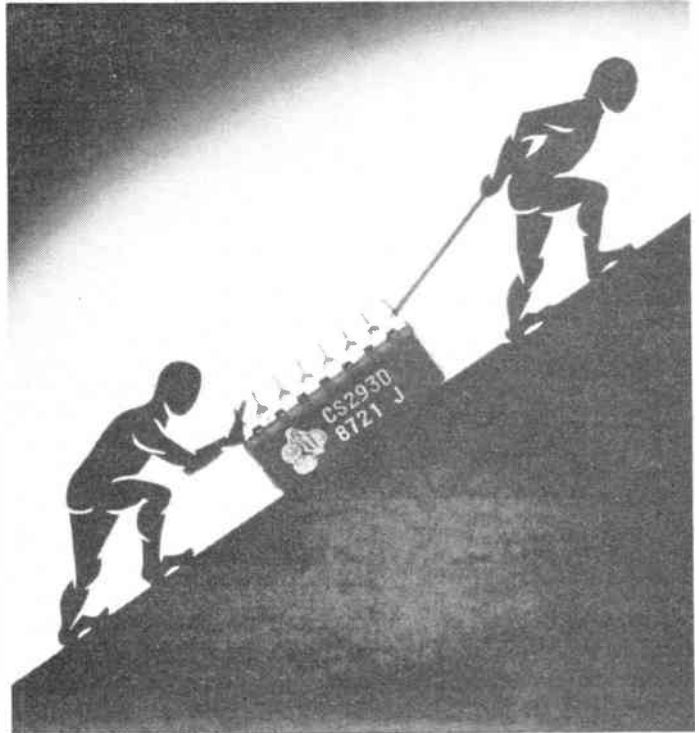
*Modular Technology Ltd,
Zygal House,
Telford Road,
Bicester,
Oxon OX6 0XB.
Tel: (0869) 253361.*

IC DRIVES

The CS293D is a new integrated circuit from Cherry Semiconductor, designed as a push-pull driver capable of delivering up to 600mA on each of four channels.

The circuit is suitable for use with the logic circuits in any systems requiring a 600mA output signal and current sink, even those with inductive loads.

Each of the four channels is controlled by a TTL-compatible logic input. A separate logic supply input is provided so that the circuit can operate from a lower voltage. This reduces power dissipation. For further reductions, the ground pins of the IC are soldered to a copper area on the printed circuit board or to



an external heatsink. The copper/heatsink is then connected to earth.

The full-bridge drivers each have an enable input which can turn off all four resistors. There are also output clamping diodes so that the CS293D can interface with inductive loads. The IC is available ex-stock in a 16-pin dual-in-line plastic power package.

*Clere Electronics Ltd,
Kingsclere,
Newbury,
Berks RG15 8NL.
Tel: (0635) 298547.*

TIME-BASE MODULE

An accurate 50Hz frequency reference for clock circuits of all types is provided by the K2545, a crystal time-base kit from ECW.

The time-base is designed to be an extension to digital clocks and any other time-controlled circuit, and neatly solves the problem of supporting a mains synchronous clock with a battery back-up circuit.

Using a 3.276800MHz crystal, the module generates a stable 50Hz output and comes complete with applications information that shows how it can be used with other digital timing products from ECW,

and with many other types of clock circuits.

Power requirement is 5 to 20V dc at 5mA. The K2545 50Hz crystal time-base kit is available from ECW by mail order at £20.38 including post/packing and 15% VAT.

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

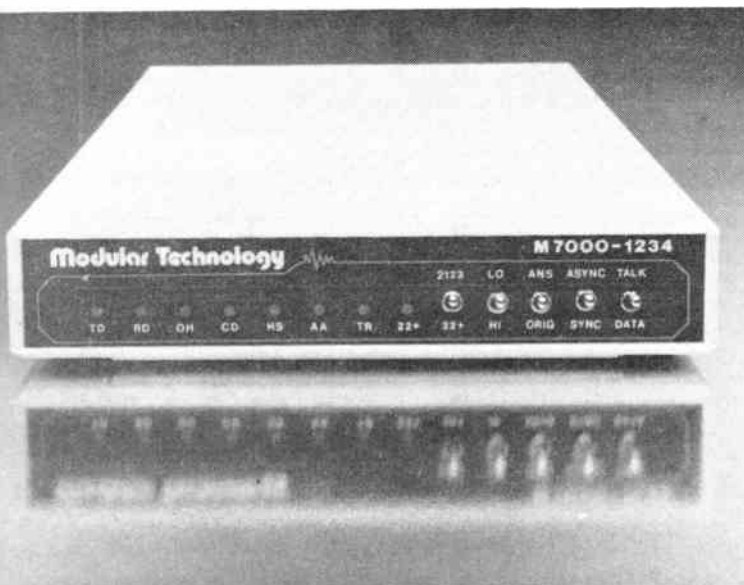
POWER-LINE FILTERS

A new range of power-line filters with built in fuse holders, the GG Series, has been introduced by Corcom.

The new filters are more effective than general purpose filters in applications where line-to-line and low-frequency line-to-ground noise has to be controlled—to bring equipment into compliance with FCC conducted-emissions standards, for example.

Models are available with one or two fuse holders, and current ratings of 3A or 6A. Maximum leakage current between line and ground is only 0.25mA at 120V ac, 60Hz, and 0.5mA at 250V ac, 50Hz.

Two models in the range, 3EGG1C and 6EGG1C, also



incorporate a separate ground-circuit inductor to isolate the equipment chassis from power line ground at RFI frequencies.

The filters are designed to meet UL, CSA and VDE standards, and approvals are currently in progress.

Corcom UK,
8 Westgarth Place,
College Milton North,
East Kilbride,
Scotland G74 5NT.

BEZELS FOR CRTS

Hero Electronics can now supply standard bezels and filters for a wide range of CRT displays. The bezels can be mounted from the front where they simply snap into the cut-out and are securely held. Rear mounting is also possible with the aid of double sided tape. Standard bezels are available, designed to be used with all popular size CRTs in the 5 to 20 inch range.

The bezels can be adapted

to non standard screen curvatures, and special colour bezels are also available.

Antiflex filters designed to reduce glare and eye strain and specifications are available on request.

Hero Electronics Ltd,
Dunstable Street,
Amphill,
Bedfordshire MK45 2JS.
Tel: (0525) 405015.

FILM RESISTORS

Tony Chapman Electronics have introduced JFW's new range of high power thick film resistors in the range of 10 ohms-10kohms. Included in the product line are 'think film resistors', which are mounted on a Beryllium Oxide substrate and exhibit excellent RF performance to 12GHz, with surface temperatures up to 250°C.

Applications include terminations for isolators/circulators and dummy loads for microwave transmitters.

Tony Chapman Electronics,
Hemnal Street,
Epping,
Essex CM16 4LS.
Tel: (0378) 78231.

SINGLE CAN NICADS

Tecnicad, the battery innovators have announced the launch of the first 3.6V single can Nickel Cadmium battery. It is also claimed to be the smallest, with the highest capacity. Type Z3A-15 is suitable for memory backup applications.

The battery has a typical capacity of 18mAh whilst being able to give a very stable discharge voltage. It is designed to function in temperatures of -20 to +50 degrees centigrade. With dimensions of 11.5mm diameter x 10mm high and a weight of 3.3g, this cell is suitable for use where space is at a premium. 1.2 and 2.4V versions are also available with dimensions of 11.5mm x 3.8mm and 11.5mm x 7mm



respectively. The above can all be supplied with PCB mounting, solder tags, axial leads and shrink sleeving.

Tecnicad Ltd,
20/22 Poole Hill,
Bournemouth BH2 5PS.
Tel: (0202) 294445/6/8.

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5mm LED, clear, lighting hyperbright (600mcd), red up to 200 times brighter (gives beam of light) 25p, 100/£20, 1000/£150

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

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.01, .015, .022, .033, .047, .068-4p, 0.1-5p, 0.15, 0.22-6p, 0.33, 0.47-8p

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100p to 8200p - 3p. .01 to .068 - 4p, 0.1 - 5p, 0.12, 0.15, 0.22-6p, 0.47/50V-8p

Subminiature ceramic plate capacitors 100V wkg vertical mountings. E12 series

2% 1.8 pf to 47 pf - 3p, 2% 56 pf to 330 pf - 4p, 10% 390p - 4700p 4p

Disc/plate ceramics 50V E12 series 1P0 to 1000P, E6 Series 1500P to 47000P 2p

Polystyrene capacitors 63V working E12 series long axial wires

10 pf to 820 pf - 3p, 1000 pf to 10,000 pf - 4p, 12,000 pf 22p

741 Op Amp - 20p, 555 Timer 55p

cmos 4001 - 20p, 4011 - 22p, 4017 40p

ALUMINUM ELECTROLYTICS (Mfda/Volts)

1/50, 2/2/50, 4/7/50, 10/25, 10/50 5p

22/16, 22/25, 22/50, 47/16, 47/25, 47/50 6p

100/16, 100/25 7p; 100/50 12p; 100/100 14p

220/16 8p; 220/25, 220/50 10p; 470/16, 470/25 11p

1000/25 25p; 1000/35, 2200/25 35p; 4700/25 70p

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0.1/35, 0.22/35, 0.47/35, 1.0/35, 3.3/16, 4.7/16 14p

2.2/35, 4.7/25, 4.7/35, 6.8/16 15p; 10/16, 22/6 20p

33/10, 47/6, 22/16 30p; 47/10 35p; 47/16 60p; 47/35 80p

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75/25mA 1N4148 2p, 800/1A 1N4006 6p, 400/3A 1N5404 14p, 115/15mA OA91 6p

100/1A 1N4002 4p, 1000/1A 1N4007 7p, 60/1.5A S1M1 5p, 100/1A bridge 25p

400/1A 1N4004 5p, 1250/1A BY127 10p, 30/45mA OA91 6p, 30/15A OA47 8p

Zener diodes E24 series 3V3 to 33V 400 mW - 8p, 1 watt 12p

Battery snaps for PP3 - 6p for PP9 12p

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Glass reed switches with single pole make contacts - 8p, Magnets 12p

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NEWS DESK

Goonhilly exhibition

BTI's decision three years ago to open Cornish satellite earth station Goonhilly to the public proved so successful, that in 1986 the company gave the go-ahead for a second initiative—the construction of a purpose-built permanent exhibition centre for the 60,000 plus people who now visit Goonhilly every year.

The station has been relaying satellite TV to the United States since the first historic Telstar broadcast in 1962. Goonhilly currently handles an estimated 100 million telephone, TV, data and facsimile transmissions annually. It is a vital link in the communications chain provided by the world's satellite organisations. Over the past three years, visitors have had access to a variety of telecommunications displays and exhibitions housed in temporary buildings on the site. However, last year BTI placed a contract for construction of a new, permanent exhibition centre in the shadow of Aerial One—one of the three pioneering earth aerials which launched the Telstar service. This 25.9m reflector dish now handles privately-leased TV news services for a number of US channels, and the British TV news distribution service VISNEWS.



Microcomputing Awards

Winners of the 1987 British Microcomputing Awards showed an exceptional level of functionality, and generally represented better value for money, according to the panel of judges. Specially-commissioned plaques for the nine awards, representing the personal computing industry's most significant recognition of achievement, were presented recently by celebrity William Rushton, at a gala dinner held at the Gloucester hotel in Kensington.

This year saw over 100 entries of a higher standard than ever, and the five judges had considerable difficulty deciding a clear winner in some categories. The judges placed innovation high on the list of criteria, together with ease of use, value for money, flexibility to interchange parts and expand or evolve.

Radio Frequency Review

A review of the non-defence use of the radio frequency spectrum has begun, in response to a recommendation of the Merriman Report of the Independent Review of the Radio Spectrum (30-960MHz) (Command 9000).

The review is being undertaken by Branch 1 of the Department's Radiocom-



munications Division, to examine amongst others the efficiency of current spectrum usage, the growth in usage and the technical and operational changes taking place or foreseen.

The frequency band 470MHz to 3400MHz will be the subject of the first stage of the review, which will run concurrently with the review now being undertaken by the independent Defence Spectrum Review Committee (DSRC). A joint report covering both reviews is expected to be issued during the summer of 1988.

Individuals or organisations, including manufacturers and radio user groups, wishing to submit written evidence or make available DSRC evidence, should send their submissions, before 31st January 1988, to: Ken Hutchinson, Spectrum Review Secretariat, the Department of Trade and Industry, Room 508, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

Those individuals or organisations who have submitted evidence to the DSRC and wish to make this available for the review of non-defence allocation, may do so. An indication to this effect should be made to the Secretariat, in writing, together with any further material.

Philips Herts transplant

Philips Telecom, formerly Pye Telecom, has won an order to supply the Hertfordshire Fire Brigade with a

new county-wide radio communications system.

The brigade's fleet will be equipped with Philips M293 two-way radios, which offer the benefit of tone-locking to provide protection against interference.

Five strategically sited vehicles will be fitted with a unique hard copy printout facility. This allows printed information from the control room to be transmitted directly to the scene of an incident where, for example, special instructions are needed to deal with problems such as hazardous chemicals.

Philips' latest microprocessor-based M87 control system will be used by any one of four operators at the Hertford headquarters, and wide area communication will be controlled over microwave radio links on strategically located hilltop sites.

For communications at the scene of a fire, 85 lightweight Philips 'pocketfones' and a transportable repeater have been supplied. The radio repeater will be especially useful for maintaining communications at incidents covering a large area. The pocketfones will also operate with existing fixed repeater systems in the Hatfield and Homesdale motorway tunnels.

The VHF AM radio system is required to satisfy the World Administrative Radio Conference's (WARC) decision to change the operating frequency for the fire service. The Home Office has allo-

cated frequencies to the brigade so that installation can be completed by the end of 1988.

Royal send-off

The Racal Telecommunications Group, which last week added radiopaging to its list of mobile communications services, has received a visit from His Royal Highness, The Prince Edward.

The visit was arranged after the Prince expressed to Racal an interest in mobile telecommunications, including cellular radio, paging and other services, and a wish to talk in some depth about the subject.

The Prince was given a preview of the Vodapage battle bus, a specially-fitted vehicle which is about to begin a 2,000 mile round-Britain tour to promote the new national paging service. The vehicle not only carries a full range of paging equipment, but also examples of all the telecommunications devices available from Racal.

The day started at Racal-Vodafone's computerised switching centre at Brentford in West London – the hub of the world's fastest growing cellular telephone service which already has 120,000 subscribers throughout the UK. His Royal Highness was shown how calls from all over the country are connected between the radio links to the subscriber, and the British Telecom network. He was also able to see the newly-

installed radiopaging equipment which will carry messages to service subscribers.

SPACE '87

The Space and Communications Division of British Aerospace played a major role in the most important space technology event yet held in the United Kingdom.

Space '87 was the largest exhibition totally devoted to the theme of space science and technology ever to be held in the United Kingdom.

The exhibition took place in the Brighton Centre and adjacent Metropole Hotel from October 12th to 15th, 1987 inclusive, and coincided with the 38th Congress of the International Astronautics Federation, held at the same venues.

The Congress, which was formally opened by Sir Raymond Lygo, chief executive of British Aerospace on Monday, October 12th, 1987, was attended by more than 1,000 of the world's leading space professionals and experts. During the Congress some 600 technical papers were presented and many discussions on the future of the space industry worldwide were held.

That these events took place in the United Kingdom at this time is particularly appropriate, with the British Government currently considering whether it should increase its financial support for future projects presently being defined within the UK

and Europe.

British Aerospace were represented on two stands at the exhibition. On its main stand in the Brighton Centre, the company were showing models with supporting graphics illustrating some of the advanced projects which the British National Space Centre has included in its Space Plan, submitted to HM Government last year. Most prominent on the stand was a 30ft long model of HOTOL, the revolutionary British Aerospace designed launch vehicle for the next century.

Light years ahead

A new piece of British high technology inventiveness, which will fit into an average jacket pocket, has the capacity to handle all the telephone conversations in progress in the world at any one moment – more than 700 million – simultaneously.

The chocolate bar-sized device is known as an optical switch and is the most advanced of its kind produced to date. Developed by researchers at the Caswell, Northamptonshire laboratories of the Plessey Company, the device is believed to be a number of years ahead of similar technology in Japan and the USA. It will be formally unveiled and put through some of its paces at the world's biggest telecommunications exhibition being held in Geneva, Switzerland, later this month.

Optical switches differ from electronic ones used in modern telephone exchanges in that they handle signals in the form of light energy rather than electrical energy – ie conversations are converted into pulses of light rather than electrical signals.

Transmission systems using light are already being installed in telephone networks, and some types have an almost limitless capacity to carry information.

Plessey is one of the acknowledged world leaders in this technology. In practice, though, there isn't a requirement for a single global telephone exchange, however small. Instead, the power of the Plessey switch will be needed in the very high capacity fibre optic net-

works of the future.

These networks will form the foundation of what experts have dubbed 'the wired society' of the 21st century. Such networks will allow people to tap into remote computers, receive and make video telephone calls, send electronic mail, read screen newspapers, play computer games, watch dozens of channels of high definition television, and shop, bank and even work, all without leaving their armchairs.

The traffic capacity required of exchanges in these networks will be unprecedented. A future high definition television channel, for example, may require a machine capable of working 4000 times faster than today's most modern telephone switches.

Small satellites

The Conference on small satellites held recently at Utah State University (USA) proved to be most interesting and stimulating to the 150-odd delegates from many aerospace organisations and many countries. The conference covered virtually all aspects of small, inexpensive satellites – missions, hardware, software, operations, communications, navigation, organisation and also alternative low-cost launch mechanisms. AMSAT and UoSAT were well represented, both in papers delivered on Phase 3 and UoSAT and in person by Vern Riportella, Dick Daniels, Dick Jansson, Gordon Hardman (USA), Junior Torres De Castro (Brazil) and Martin Sweeting (UK).

The conference highlighted the rapidly growing professional interest in small, relatively inexpensive satellites ('Lightsats') – and it was clear that AMSAT has led the field.

Happy birthday UoSAT-1

UoSAT-OSCAR-9 (UoSAT-1) has completed 6 years operation in orbit. UO-9 was launched from the WTR, Vandenberg Air Force Base, California on 6th October 1981 onboard a Delta 2310 accompanying a NASA Solar Mesosphere Explorer satellite. The spacecraft continues to per-



form well in orbit, supporting daily experiments on a weekly schedule under automatic control of the on-board computer.

UO-9 was launched into an initial 550km sun-synchronous polar orbit, and the effects of atmospheric drag were expected to cause the spacecraft to re-enter the Earth's atmosphere and burn up around 1986/7. However, the orbital decay experienced over the last few years has been considerably less than expected and UO-9 will probably remain in orbit until 1991/2. The spacecraft on-board electronic systems continue to perform without noticeable degradation – well beyond the 2 years expected at launch!

The UO-9 mission has not been without its problems though – primarily caused by shortcomings in the communications links and the unreliability of the on-board computer command interface to the telecommand subsystem. The effects of these limitations, however, has been largely overcome by the use of a sophisticated software diary for the on-board computer – originally developed for the later UoSAT-2 satellite!

Balloon project

AMSAT-UK has announced Project HART, a High Altitude Radio Transponder experiment. HART is designed to be flown on balloons, initially manned hot-air balloons. The first mission should take the experiment to an altitude of over 30,000ft from which it should be audible over a radius of several hundred miles. A pilot making an attempt on the woman's balloon altitude record has consented to take the 2.5kg HART experiment as ballast. The frequencies will be: uplink 435.040-050; downlink 145.840-850, (non-inverting); beacon 145.852MHz.

Transponder output power is 300mW. The beacon transmits callsign and serial number at 10wpm every 80 seconds, running 60mW. Aerials are more or less vertically polarised.

Unfortunately, the experiment has not yet been licensed and cannot be used

until a license is obtained. If the first flight opportunity is missed, another will be sought.

Updates will be provided on the AMSAT-UK 80 metre net (3.780MHz).

Third satellite

The European Telecommunications Satellite Organisation of 26 member states announces the entry into service over Europe of its third satellite as of November 1st, 1987.

The ECS 4 satellite, launched by Ariane on September 16th, successfully came through the acceptance tests last month. In view of the extremely positive results of these tests, the Director General, Andrea Caruso, declared himself to be very satisfied with the high degree of quality of the spacecraft just delivered to Eutelsat, and considers that it will be operated in the best possible conditions. In accordance with the arrangement between Eutelsat and the European Space Agency, which is responsible for procurement and launch of the first generation, Eutelsat notified its acceptance of the satellite to ESA. The spacecraft has thus become Eutelsat property and will be called Eutelsat I-F4.

On station at 10° longitude East, the satellite is now available to its users. Eight of its transponders will be used to transmit, in particular, domestic and international TV programmes, and domestic telecommunications traffic for Denmark.

Eutelsat now has three operational satellites in orbit, offering a capacity of more than 27 transponders. The next satellite will be launched next year and will be operational by autumn.

Megawatt radio source

Marconi Communication Systems has received an order from the United Kingdom Atomic Energy Authority Culham Laboratory for the second phase of a project connected with particle beam acceleration.

In the first phase Marconi was commissioned to provide a design specification for a one megawatt radio fre-

quency source and this was completed earlier this year. Culham Laboratory has now contracted the company to design the equipment, bringing the total value of the task to date to almost £750,000.

A third phase will be to construct, install and commission the equipment. The radio frequency source consists of a klystron, which is capable of delivering one megawatt, continuous wave, at 350MHz, a waveguide system for transmitting the power to the experiment or a test load, and a control and instrumentation package for the system. When operated at full power the klystron consumes approximately 1.4MW from a 90kV dc supply and requires a tonne of cooling water per minute.

Freecall

National Mobile Radio Limited, the company jointly owned by Motorola Ltd, British Telecom and National Radiophone Ltd, announced today that its new radio communications service will be operating before the end of December under the name 'Freecall'.

The 'Freecall' service will initially be available in London (anywhere within the M25), as well as Birmingham/West Midlands and Manchester/Merseyside.

The 'Freecall' network is aimed mainly at the business community and other existing users of mobile radio such as local authorities, health visitors etc. 'Freecall' uses an advanced trunked radio system manufactured by Storno Limited of Camberley and operates in the Band III frequencies released by the Government for business use.

National Mobile Radio Ltd says that over 25 companies have signed agreements to be 'service providers' (airtime retailers) for the 'Freecall' network, and a number of major customers have already agreed to transfer their existing mobile communications to 'Freecall' because of the service and flexibility offered by its trunked radio system.

IAF conference

The 38th meeting of the International Astronautics

Federation was held in Brighton (UK) recently, with several hundred delegates from virtually all countries. Associated with the meeting has been an impressive exhibition with exhibitors from aerospace organisations large and small worldwide. One of the most interesting exhibits was a model of the MIR space station at the Soviet stand.

The University of Surrey exhibited the engineering model of the UoSAT-2 spacecraft accompanied by a replica of the UoS groundstation and a display showing the range of spacecraft engineering activities undertaken at UoS. Much interest was shown throughout the week in UoSAT and its capabilities.

Martin Sweeting G3YJO presented a paper on cost-effective spacecraft engineering based on UoSAT, and Craig Underwood presented a paper on the role of satellites in education.

Privatising electricity

On October 21st the Centre for Policy Studies published a key paper on choice of ways to privatise electricity, by Allen Sykes and Professor Robinson (CPS £4.90 plus 30p p&p). Their theme is that liberalisation at every possible stage of generation and distribution (including the privatisation of coal) is the overriding determinant of the choice of the method of privatisation. They recommend an option which will inject genuine competition, introduce new management, establish effective but simple regulation and open the path to complete privatisation within the term of this Parliament.

Their scheme amalgamates the area boards into some five regional distribution utilities, of which the new CEBG will become a wholly owned, debt-financed subsidiary. These RDUs will have the duty, power and interest to establish competition in generating; they will be obliged by charter to ensure that the new CEBG sells off blocks of power stations to the private sector, and buys back power on long-term contracts based on competitive tendering.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

At the recent World Administrative Conference (WARC) in Geneva, the Mexican Government suddenly created panic amongst the radio amateur fraternity by requesting that the frequencies 430 to 440MHz be used for commercial land mobile use in their country. The request was made late in the afternoon of September 25th – a Friday – a time, if I can judge from some conferences I have attended, likely to ensure that the motion would slip through almost unnoticed!

This section of the 70cm amateur band is that used by amateurs for satellite and weak signal DX work. Mexican operation would be devastated if it were to be allowed for mobile radio users in the 435 to 438MHz range.

According to *Amateur Satellite Report* No 160, the AMSAT President, David Liberman XE1TU, reports that this suggestion has been under consideration for some time and has been fought in the Mexican Courts already. Now, he says, the proponents for the Mexican mobile radio proposal which include powerful economic factors – and the Mexican president – having so far failed in their proposals, decided to take them to WARC, with the hope of getting them ratified by that organisation. It is also reported that other Central and South American countries are watching the issue with much interest, as many of them would like to use this frequency for mobile use.

One difficulty for the anti-70cm mobile protagonists is that the band is allocated to Radiolocation on a primary basis and amateur radio on a secondary basis in IARU Region 2. IARU secretary David Sumner K1ZZ, said from his Connecticut home that IARU was taking the matter very seriously and was marshalling all available Region forces against the threat. He said all the actions possible were being taken by IARU officials in Geneva and he felt the prospects of defeating this proposal were good, and we have since heard that the proposal was, in fact, defeated.

Glasnost and amateur radio

Amateur Satellite Report No 160 also gives considerable attention to the Space Future Forum held in Moscow on October 4th and 5th. This meeting was sponsored by the Space Research Institute of the USSR and was timed to

coincide with the 30th anniversary of the launch of the first artificial earth satellite, Sputnik.

A team of NASA managers, scientists and astronauts attended the forum, along with representatives of space activities from other interested countries. As one of several private groups attending, AMSAT was invited to participate in support of a project called 'SatelLife'. This is a program originated by the Harvard University School of Public Health's Dr Bernard Lown, who is co-holder of the 1985 Nobel Peace Prize. 'SatelLife' is a program for advancing space telecommunication use in health information related projects. AMSAT is providing technical guidance for this program, based on its familiarity with small satellite capabilities and inexpensive ground terminals. As with similar programs, 'SatelLife' seeks a low cost approach to humanitarian telecommunications commensurate with its limited resources.

In addition to supporting the 'SatelLife' program, AMSAT are exploring the possibility of future co-operative amateur satellite projects involving some coalition of teams from America and Europe with Soviet teams. Some AMSAT officials saw this meeting as a window through which to explore possible implications of Glasnost on amateur radio.

Vern Riportella WA2LQQ, AMSAT's president and editor of *ASR* recently visited Moscow and had meetings with amateur radio personalities. We understand his meetings were very useful and friendly indeed, and augured well for co-operation between Soviet and American radio amateurs, particularly in the Space field.

Balloon flights

The AMSAT-UK Technical Committee, in a recent report, suggests that AMSAT-UK should get involved in balloon flown amateur radio payloads. It was felt that such payloads would provide an outlet for untapped technical talent, and give experience in the problems of design, construction and operation of hardware intended for launch and remote operation, to a wider field of volunteer workers than at present. Such balloon transponders would provide interesting operation for other amateurs.

There have been several similar balloon flown projects, carried out in different countries recently. One such was announced recently by Bill Brown WB8ELK, in the USA, from a site 40 miles south of Toledo, Ohio.

A helium filled, 5 foot diameter balloon carried an amateur radio payload, including a 100mW 2 metre CW tone modulated FM beacon on 144.34MHz and a 1 watt 70cm ATV transmitter on 439.25MHz transmitting an unmodulated video carrier. Future flights with a video camera are planned. The entire payload weighed between 2 and 3lbs. It was hoped the balloon would ascend to an altitude of 100,000 feet, during which time it would expand to a diameter of 25 feet. It would then burst and the payload would parachute to the ground. The descent phase was expected to last about 90 minutes, during which time it would have drifted about 60 to 100 miles. At maximum height, it was expected to have a working range of several hundred miles. Radio direction finding and optical tracking techniques would be used during the flight.

AMSAT-UK has been considering getting into a program along these lines. Your scribe, in his capacity of chairman of AMSAT-UK, produced such a program and submitted it to the Rolex 'Spirit of Enterprise' 1987 Awards scheme, where it received commendable mention. AMSAT-UK's secretary, Ron Broadbent G3AAJ, together with Richard Limebear G3RWL and Dave Rowan G4CUO got together and produced something more tangible, and G3RWL and G4CUO in due course produced some suitable hardware. This consisted of a transponder and a beacon. The transponder has an output of 300mW. The beacon transmitter gives its call sign and a series number at 10wpm every 80 seconds, running 60mW. The frequencies are: uplink, 435.040-050MHz; downlink 145.840-850MHz; beacon 145.852MHz.

An opportunity to fly this unit occurred when a pilot making an attempt on the Woman's Balloon Altitude Record, offered to take it up in her hot-air balloon some time around 9th October last. Unfortunately, the transmitter could not be licensed in time for this flight, but as it happened the flight did not take place due to adverse weather conditions. It is hoped that the licensing formalities will

be completed in time for a near future flight. Any ballooning enthusiasts amongst our readers who would like to participate in this project should get in touch with the writer.

Raynet in October storm

Not unnaturally, Raynet's services were in much demand during the weekend of October 16th to 18th last, when hurricane winds swept the south and east of England.

The RSGB's news broadcasts from GB2RS have given a good synopsis of these activities, and from which this report has been prepared.

The West Kent Raynet Group was called out to provide emergency communications in the Sevenoaks District Council's area, a central radio station being set up on the Friday at the Council's Emergency Centre, co-ordinating activities. A second fixed station was set up at the Works Depot. Twenty-five mobile stations were in action and in excess of 1,000 messages were handled during the emergency.

The Sussex Raynet Group were in action for the British Red Cross. They provided communications for teams engaged in the distribution of sheeting for damaged roofs, blankets for those

with no heating in their homes, and assisting with the movement of the homeless into sheltered housing.

The UoSAT Spacecraft Mission Control Station at the University of Surrey was hit by the storm, which severely damaged the VHF/UHF tracking antennas. Whilst the antennas were being repaired, control of the UoSAT satellites was transferred to a back-up command station at the home of Dr Martin Sweeting, the Mission Control Centre Director. The tracking antenna system was re-installed on the 23rd of October, thanks to the hard work of the UoSAT technicians.

Moscow space forum

More than 850 scientists, from the Soviet Union and 30 other nations, gathered in Moscow recently to exchange views on the future of space. Amongst these were a number of well known radio amateurs, including AMSAT representatives.

While this forum was not designed to cover amateur radio, matters which specifically took in topics covering the future of space activities and amateur radio did come up for discussion. These included such topics as the formation of an AMSAT/Soviet organisation similar to

those throughout the rest of the world, to be designated AMSAT-UA; the placement of an amateur radio packet digital repeater on the Mir Space Station, joint satellite construction projects involving AMSAT-UA and other international AMSAT Groups and the possible use of the UoSAT Digitalker in support of the forthcoming Soviet/Canadian Polar Expedition.

Small is beautiful

A conference on Small Satellites was held at Utah State University in the USA recently, at which 150 delegates from many aerospace organisations discussed the use of small satellites such as those developed by amateur radio organisations and the universities, for example, UoSAT. The conference covered virtually all aspects of small, inexpensive satellites; missions, hardware, software, operations, communications, navigation, organisation and alternative low-cost launch mechanisms. The conference highlighted the rapidly growing professional interest in small, relatively inexpensive satellites, such as those developed for amateur radio use. These are now designated 'Lightsats', and it is clear that AMSAT leads the field in this sphere.

REW

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A RTTY TERMINAL for the Amstrad computer

Tony Dean describes a terminal/interface for use with the CPC464/664/6128

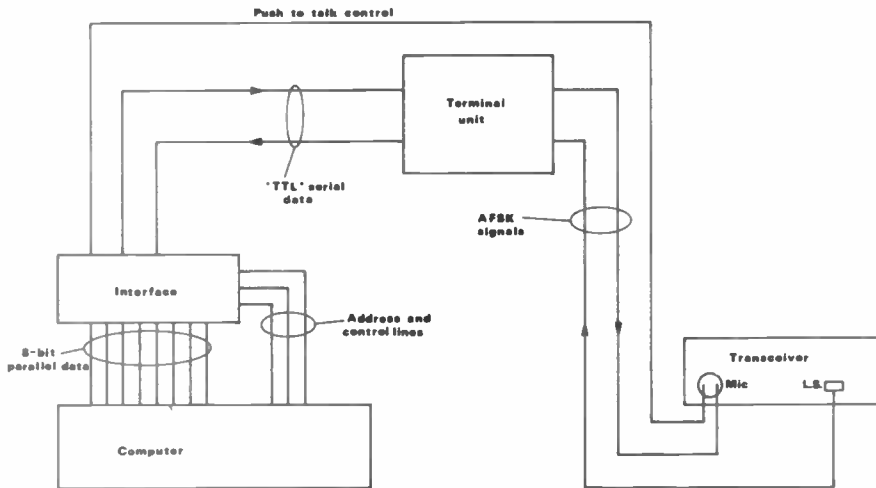


Fig 1 Block diagram of a typical RTTY station

This article describes a complete RTTY interface/terminal for use with the Amstrad CPC464/664/6128 range of computers. The interface and the terminal unit are inexpensive to build, yet are capable of excellent performance. Software to drive the complete terminal is available on tape or disk, the details of which are covered later.

The block diagram for a typical computer controlled RTTY station is shown in Figure 1 and, assuming that we already have the computer and the transceiver, the parts we then need are the computer interface and the terminal unit. In this article, these items have been described separately so that the constructor already owning a terminal need only build the interface (and vice versa). This approach also means that the interface is compact enough to be mounted directly onto the computer's expansion connector, thus minimising bus loading which would otherwise occur if an interconnecting lead were used.

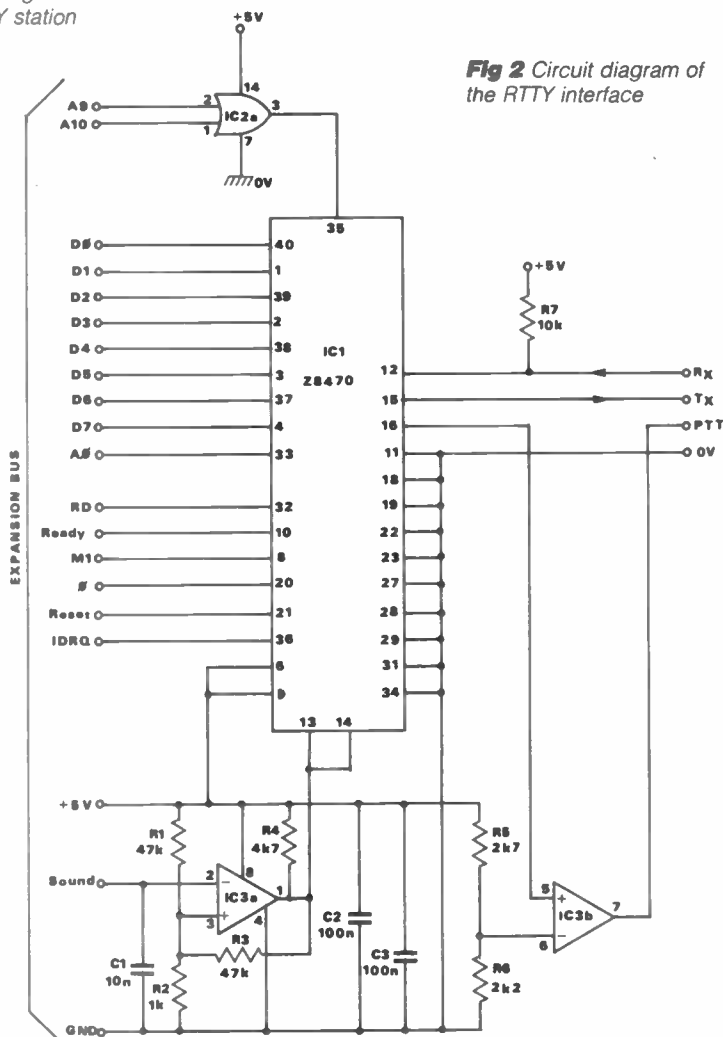


Fig 2 Circuit diagram of the RTTY interface

The interface

To allow a microcomputer to be used to send and receive RTTY, it is necessary to use a serial interface, which not only converts the serial data into parallel and vice versa, but transfers the data to and from the computer under program control. One such interface is discussed below, which is both simple and inexpensive to build.

Circuit description

The complete interface circuit diagram is shown in Figure 2. The first thing you may notice about it (apart from its simplicity) is that there are no presets to fiddle around with. This is because the baud rate is controlled by the program; but more about that later. The interface uses one channel of a Z80 DART (dual asynchronous receiver/transmitter), to perform the serial/parallel conversion, which requires only a Tx/Rx clock and a little address decoding.

As can be seen from the Amstrad handbook, the I/O map is used up to a large degree by the internal hardware, leaving precious few addresses for expansion purposes. Surprisingly, though, this is not a bad thing, because the way that the hardware uses the I/O space makes address decoding extremely simple. Each piece of hardware (eg the CRTC chip or PIO chip) has its enable fed by one of the upper eight

address lines (A8-15) and, since none of the internal devices use address line A10, this is available for expansion purposes.

The snag here, though, is that the disk interface is in fact classed as an expansion device, and uses A10 and A8 (going low) to select it, so we must use A10 combined with some other address line as our chip enable. IC2a decodes A10 and A9 low to provide the chip enable, resulting in the interface occupying I/O address &F9xx.

The value placed on the lower eight bits of the address bus tells the computer the type of device it will be communicating with, and is set to &E0 and &E1 by the program to indicate a user peripheral. Note that it is not necessary for the expansion device to respond to the lower eight bits, the computer decides the type of device purely on the value placed on A0 to A7 by the program. The outcome of all this is that the interface occupies address &F9E0 for data, and &F9E1 for control/status. For more details of the control and data registers, see the data sheet for the Z80 DART.

One of the most novel features of this interface is that the transmit and receive clocks are produced by the computer's sound chip. Comparator IC3a, with its high degree of schmitt action, cleans up the sound signal and converts it to TTL level to drive the DART's clock input. This arrangement provides a very accu-

rate and stable clock, considerably better (and cheaper!) than the more conventional 555 timer IC. Additionally, many different rates can be provided easily without the need for switches and presets. The only minor snag with this system is that the volume control on the computer will need to be turned down to eliminate an otherwise annoying whistle. (The level of the sound signal on the expansion connector is not altered by the volume control).

The push to talk control line utilises the DTR handshake output of the DART, which can be set or cleared under program control. IC3b converts the TTL level at this pin to the normal open collector output expected from a PTT output. This output will withstand up to 30 volts in the off condition, and will sink around 15 milliamps. Incidentally, don't

be tempted to derive the supply for a relay, or any other device from the computer's 5 volt supply, unless its loading is less than about 50 milliamps, since the power supply may not stand it.

Construction

Despite the simplicity of the interface, the use of a printed circuit board is strongly recommended, since even the slightest error on the computer's expansion connector could damage the interface and/or the computer. The artwork for a double sided PCB for the interface is shown in *Figures 5a and 5b*, the component layout is shown in *Figure 6*. To simplify assembly, the following procedure is recommended.

First drill all holes with a 0.7mm diameter, except those for the edge connector and terminal pins, which

Fig 3 Block diagram of the phase locked loop arrangement

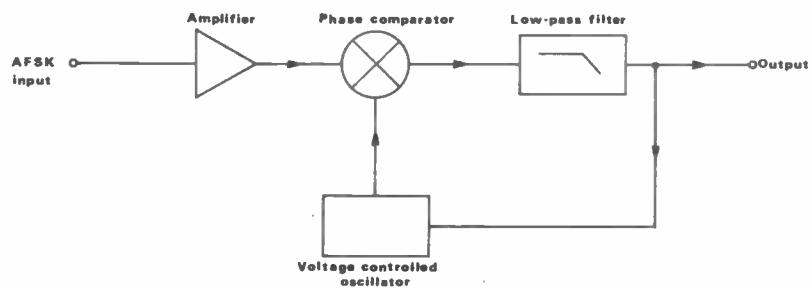
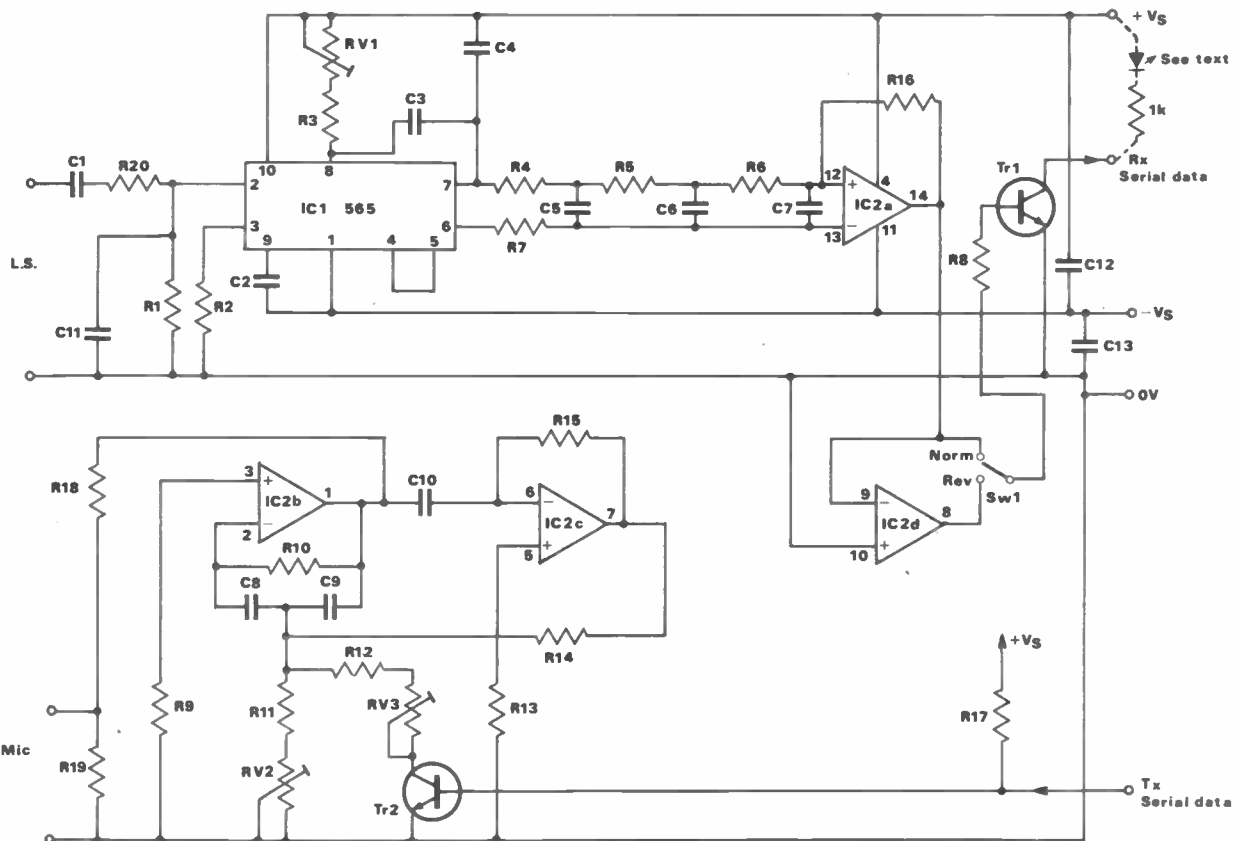


Fig 4 Circuit diagram of the RTTY terminal



RTTY FOR THE AMSTRAD

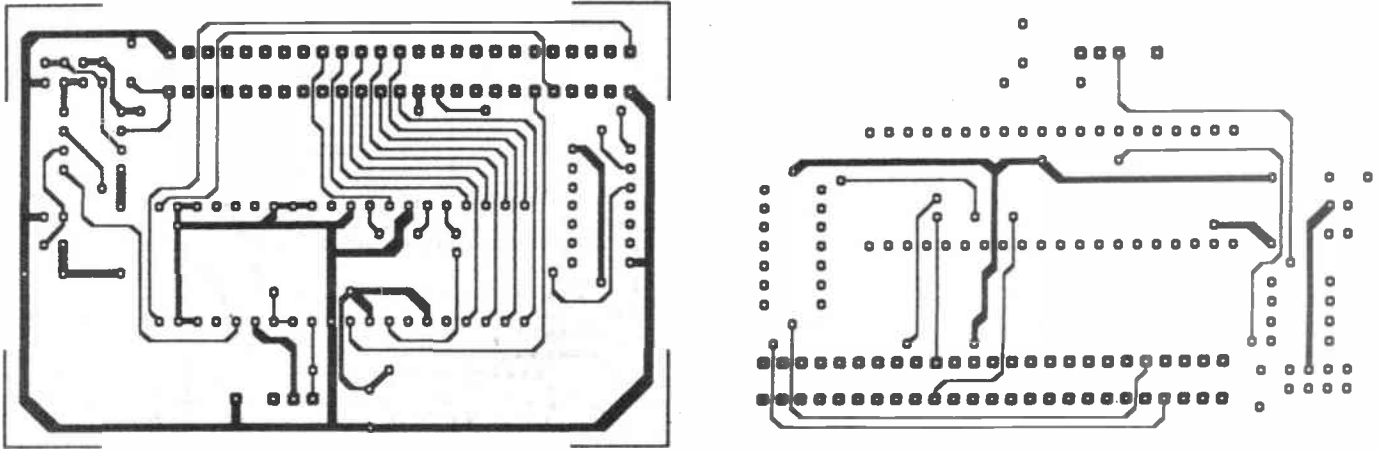


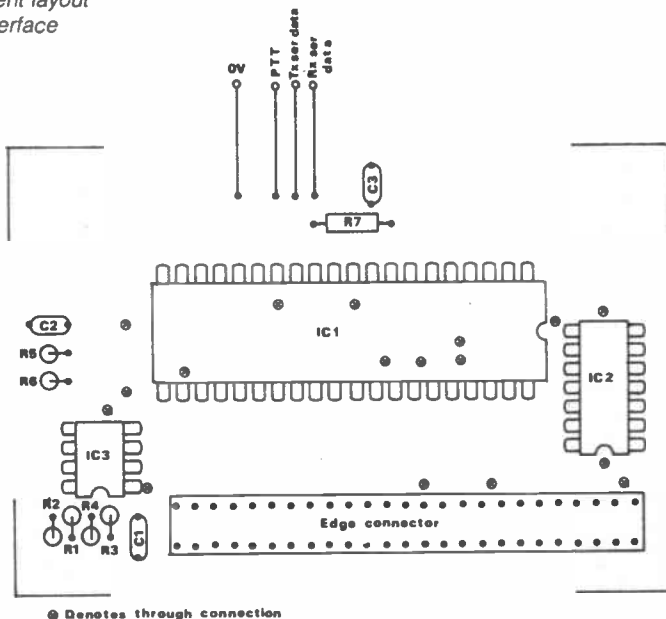
Fig 5 Both sides of the double sided PCB for the RTTY interface unit

should be 1.00mm. Use fine wire to connect between layers where indicated in Figure 6 by an 'x', soldering both sides. Next fit IC sockets for IC1, 2 and 3 (these need only be soldered on the copper side).

Fit all resistors and capacitors in their correct positions, soldering the longer of the leads of R4 and R5 on both sides of the board.

Finally, fit the edge connector on the component side. Insert the connector only enough so that the pins just protrude on the copper side - this ensures that the other components on the board will clear the rear of the computer when the interface is fitted. Ensure that the connector is nice and square to the board before commencing soldering. Three of the edge connector pins have tracks running on the component side, so don't forget to solder these. When all the soldering is complete, fit the ICs taking careful note of the orientation.

Fig 6 Component layout for the RTTY interface



Testing the Interface

When the interface is complete, and you are sure that the components are in the correct position, turn off the computer and fit the interface onto the expansion connector. Switch on the computer, and if the normal Amstrad start up message does not appear, switch off immediately and check the interface carefully. Make sure that all pins of the ICs are inserted correctly, and that one has not been bent whilst inserting. Also check for solder bridges, since some tracks are very close to others, and even the best of us can make mistakes.

When all appears well, type in and run the BASIC program shown below, which although not completely foolproof, will test the operation of the interface and give some indication of any faults. The program first ascertains whether the interface is responding to the correct address, then checks the transmit and receive buffers by sending a character and checking to see if the same

character is received. To do this test it is necessary to temporarily connect the Tx serial data and Rx serial data pins together.

If the 'Interface OK' message appears, the interface is ready for use, if it does not, check all connections, paying particular attention to the areas suggested by the error messages.

```

10 REM RTTY Interface test program
20 a=&F9E1:d=&F9E0
30 OUT a,&18
40 OUT a,4:OUT a,72
50 OUT a,3:OUT a,1
60 OUT a,5:OUT a,8
70 n=INP(a) AND 4:IF n=0 THEN 150
80 OUT d,21
90 SOUND 1,50,200,15
100 FOR i=1 TO 1000:NEXT
110 n=INP(a) AND 1: IF n=0 THEN
PRINT"Error check that TX and RX data
lines are joined":END
120 n=INP(d)AND 31
130 IF n<>21 THEN PRINT"Error-check
D0-D7 connections" ELSE
CLS:PRINT"Interface O.K.!"
140 END
150 PRINT"Error, check A10,A9,A0,
RD,IORQ,M1 connections"
    
```

Terminal unit

The terminal unit converts the TTL serial data from the computer into an AFSK (audio frequency shift keying) signal which is used to modulate the transmitter. When a 1 or mark is to be sent, the terminal produces a 1445Hz tone, and for a 0 or space produces a 1275Hz tone.

The terminal is also responsible for converting the received AFSK signal back into serial TTL data for the computer interface.

Circuit description

The circuit diagram for the terminal unit is shown in Figure 4, and to simplify the description, may be considered as two separate circuits as described below.

Interface Components List

ICs

IC1	Z80470	(Z80 DART)
IC2	74LS32	(quad 2 input OR)
IC3	LM393	(dual comparator)

Resistors

R1	47k	R5	2k7
R2	1k	R6	2k2
R3	47k	R7	10k
R4	4k7		

Capacitors

C1	10nF multilayer ceramic
C2	100nF multilayer ceramic
C3	100nF multilayer ceramic (Mullard CW series or equivalent)

Miscellaneous

50-way double sided PCB edge connector (wire wrap pins)

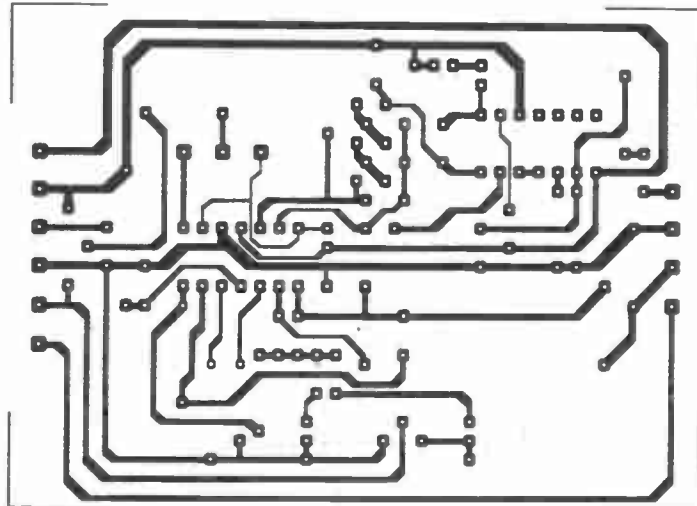


Fig 7 PCB layout of the RTTY terminal

1) The AFSK generator

The circuit uses two operational amplifiers as a tunable sinewave oscillator. IC2b is a high Q filter which removes almost all harmonics from the square wave signal produced by IC2c. The centre frequency of the filter, and hence the frequency of oscillation is determined by the expression:

$$f = \frac{1}{(2\pi C\sqrt{R_X R_{10}})}$$

Where $C = C_8 = C_9$ and $R_X = R_{11} + VR_2$

When the Tx serial data input is in the mark state, the network $R_{12} + VR_3$ is placed in parallel with $R_{11} + VR_2$ (since TR_2 will be saturated), thus shifting the frequency of the oscillator. The very high feedback resistor around IC2c ensures reliable starting of the oscillator, whilst R_{18} and R_{19} attenuate the signal down to microphone levels – in this case about 20mV RMS. The major feature of this type of oscillator, apart from its ease of tuning, is that it produces a very good sine wave signal, whose amplitude remains relatively constant over a range of frequencies. The circuit also shifts frequency with very little amplitude bounce. These features make it ideal for modulating applications where distortion and varying amplitude are troublesome.

2) AFSK tone decoding

The received AFSK signal is decoded using an LM565 phase-locked loop IC. The essential components of the phase locked loop are shown in Figure 3, and operation is as follows:

The amplified input signal is fed into one input of the phase comparator, whilst the output of the voltage controlled oscillator is fed to the other. The resultant output of the phase comparator contains a wanted dc component proportional to the phase difference, and an unwanted ac component of twice the input frequency caused by the phase comparison. The low pass filter removes

the ac component and the signal is then fed back to the VCO input in such a way as to drive the VCO to match the input frequency. Once the loop has locked, ie the VCO frequency is equal to the incoming frequency, the phase comparator output is then a dc voltage which is proportional to the incoming frequency.

The centre frequency of the VCO must be set to be reasonably close to the incoming frequency, otherwise the phase comparator may not be able to pull the VCO enough to cause the loop to lock. This centre frequency is determined by the values of C_2 , R_3 and VR_1 . The loop capacitor C_4 , used to filter out the ac component of the phase comparator's output, has been made deliberately smaller than the theoretical optimum value to ensure a fast response, since the PLL will have to lock onto an input whose frequency is changing rapidly. If this was not done, the loop could momentarily

lose lock and could take several cycles to re-lock. Additional filtering of the phase comparator output is provided by the three pole passive filter R_4 , R_5 , R_6 , C_5 , C_6 , C_7 . Note that this extra filtering is not in the PLL's control loop and thus has no effect upon its step response.

The output from IC1 is applied to comparator IC2a, which has a small degree of schmitt action (positive feedback) provided by R_{16} to ensure rapid switching free from jitter. The amount of positive feedback determines the 'dead band' of the terminal, which with the values shown is about 30Hz. This means that if the circuit is correctly set up with its centre frequency at 1360Hz, a mark tone of above 1375Hz and a space tone below 1345Hz will reliably operate the terminal. This means that signals from badly aligned RTTY stations (and there are some!) should be resolved with little difficulty. Also, it is possible to decode

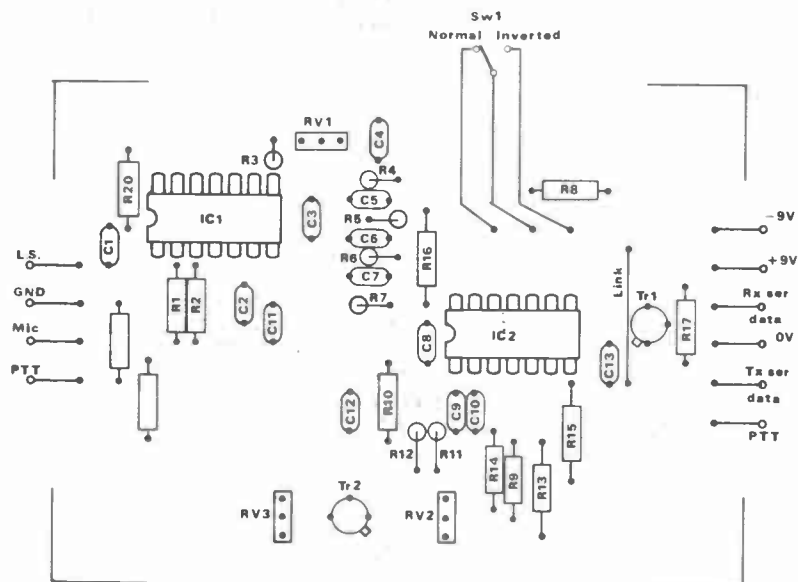


Fig 8 Component layout of the RTTY terminal

RTTY FOR THE AMSTRAD

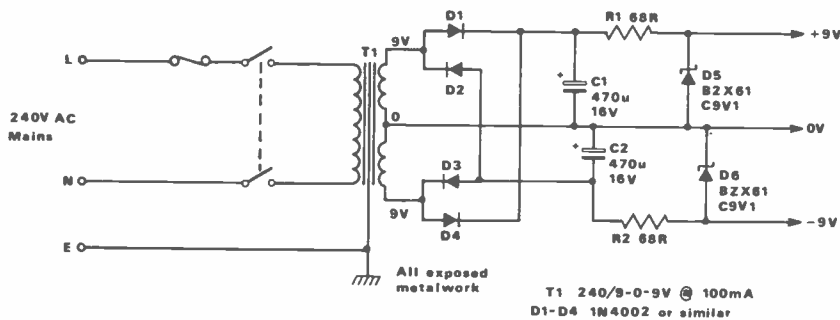


Fig 9 Suggested power supply for the terminal

the wider frequency shifts often employed by commercial transmissions without further adjustment.

The terminal does not require an anti-spacing circuit, since the output inherently goes to a mark state when no signal is present. Level inverting, normally required for commercial RTTY reception, is provided by IC2d which is used as a simple logic inverter. TR1 provides an open collector output which connects to the computer interface.

The terminal requires ± 9 volts, which could be obtained using two PP9 type batteries. However, the calibration of the PLL chip and the amplitude of the AFSK output are somewhat dependent on the supply voltage, so a simple stabilised supply is recommended (see Figure 9).

Construction

The PCB layout for the terminal is shown in Figure 7, the component layout

is shown in Figure 8. No special procedure need be followed when assembling the board, though it will be necessary to use sub-miniature capacitors and 0.25W resistors to fit the board correctly. This will mean that you can't use those components you salvaged from that old TV set years ago. Suppliers who stock these components include Farnell Electronic Components and RS Components, who now deal with orders from the general public.

Testing and setting up

During setting up, the terminal should be powered, but disconnected from the computer interface board. The AFSK decoder can be set up using the sound output of the computer as a convenient and accurate calibration oscillator. This is achieved simply by plugging the jack plug which normally connects to the transceiver LS socket, into the sound

jack on the back of the computer, since the terminal is sensitive enough to lock onto the signal produced at this socket.

Connect an LED with a 1k resistor in series, between +V and Rx serial data, as shown dotted in Figure 4. Set VR1 fully anti-clockwise and enter the following line to produce a 1360Hz tone which is midway between mark and space frequencies (1445/1275):

SOUND 1,46,30000,15

At this point the LED should be lit. Adjust VR1 slowly clockwise until the LED just goes out. Now cancel the sound by pressing DEL (this produces a short warning beep which flushes the sound queue), and type in and run the following short program which should turn the LED on and off alternately:

```
10 SOUND 1,43,20,15
20 SOUND 1,49,20,15
30 GOTO 10
```

Note: CPC464 owners will have to enter a value of 7 instead of 15 for the sound volume level. Note also that the user instructions for the CPC464 and CPC664 specify the wrong formula for calculating the sound frequency, resulting in an octave difference. The values given above will work on all models.

The setting of the AFSK generator requires the use of a frequency meter with a resolution of 1Hz or better. Connect the frequency meter across the AFSK output (mic) terminals and apply a temporary short between Tx serial data and 0 volts. Adjust VR2 to obtain a reading of 1275Hz \pm 2Hz. Remove the shorting link and adjust VR3 to obtain a reading of 1445Hz \pm 2Hz.

It is important to remove the LED and resistor from the Rx serial data pin prior to connecting to the interface. The terminal and interface are now set up and ready for use. Don't forget, whenever you are fitting the interface onto the expansion connector, always switch off the computer, otherwise serious damage could result.

Software

Because of the complexity of the software which controls the interface, it is thought that it is beyond the scope of this article. The software may be purchased from the author for £8.00 on tape and £10.00 on disk, which includes full operating instructions, and covers postage and packing.

To order your copy of the software send a cheque for £8 (for the tape) or £10 (for the disk version) made payable to S Dean to:
RTTY for the Amstrad, **Radio and Electronics World Magazine**, Sovereign House, Brentwood, Essex CM14 4SE.

Terminal Unit Components List

ICs

IC1 LM565 Phase Locked Loop
IC2 TL074 Quad Bifet Op-Amp

Transistors

Tr1, Tr2, BC109 or any general purpose small-signal NPN transistor

Resistors

R1 2k2	R11 470R	VR1 5k 25 turn (top adjustment)
R2 2k2	R12 1k	VR2 2k 25 turn (top adjustment)
R3 4k7	R13 10M	VR3 5k 25 turn (top adjustment)
R4 10k	R14 470k	
R5 10k	R15 10M	
R6 10k	R16 10M	
R7 33k	R17 10k	
R8 10k	R18 47k	
R9 180k	R19 680R	
R10 180k	R20 2k2	

All resistors 0.25W 5% or better

Capacitors

C1 100nF	C6 22nF	C11 33nF
C2 47nF	C7 22nF	C12 100nF Ceramic
C3 1nF	C8 10nF	C13 100nF Ceramic
C4 100nF	C9 10nF	
C5 22nF	C10 470nF	

All capacitors sub-miniature polyester (Dubilier MMP series or equivalent) unless otherwise stated

Miscellaneous

SW1 SPCO toggle or similar

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

A new repeater proposal has been submitted for the Hull area; we expect more details in due course. The latest issue of *CQ-TV*, the journal of the British Amateur Television Club, contains the second part of a series on building a repeater written by John Wood G3YQC. While most readers of this column will probably not have any intention of constructing their own 'box', the technology is fascinating.

In particular, it is instructive to see how the individual circuit elements of such a complex creation are quite simple in themselves. The skill is in putting them together and selecting circuits which operate under all conditions with all kinds of use (and abuse!). In case you don't see *CQ-TV*, you can receive all 100 pages of it free, four times a year, as a member of the BATC.

Joining in costs just £6 a year and you can get an application form for membership by sending an SAE to Dave Lawton G0ANO, Grenehurst, Pinewood Road, High Wycombe, Bucks HP12 4DD. Apart from this, the BATC is working on a booklet setting out all the experience collected so far on FM television; expect to see this on sale early in the new year.

Report from Rugby

As you know, we have been following the progress of the Rugby television repeater GB3RT from conception, through construction to the eventual licensing and operation (we hope!). Any other group considering establishing their own repeater will doubtless find this useful, and this column would be delighted to hear from them as well. We can all learn from each other...

GB3RT has been operational in attended (manned relay station) mode for some time now; 3,000 hours in all. The latest information received from the DTI showed that the licence application is still with the Frequency Planning Committee. It must, however, be nearing completion of that stage, having been with them for rather more than three months now. Let's hope our next report from Rugby will announce that the licence has arrived – it should be soon!

Another repeater

In the meantime, work continues apace. Although a completely new repeater is being built, the present one is not being modified in order that it may be used immediately the licence is received. The new box will contain many improvements; it will have an entirely new receiver, new logic circuitry and a new video processing system. The first-mentioned will incorporate a brand-new LMW preamplifier, kindly donated by

Bonex Ltd of Acton. John Wood G3YQC is in charge of the project, but it is a long-term one, and results are not expected immediately.

A new power supply has been purchased to replace the present one and provide capacity for expansion. Mike Wooding G6IQM has designed a carousel, for presenting a changing succession of EPROM displays when the repeater is not relaying other signals. At present this shows a selection of monochrome test-card and colour bar patterns; upon licensing additional data frames will be displayed.

Experiments have been continuing with the intercarrier sound. John is building and testing a new transmit IF generator and video modulator, featuring black level video clamping and better modulator linearity. It also has a 5.5MHz video filter and sound trap, as well as a 6MHz sound and video mixing circuit. Together with pre-emphasis this has improved picture and sound quality to a remarkable degree, and as a bonus, sound can now be recovered from pictures down to around P2 level. In addition, the aerials have been put up 12 feet, which has added half a P point to all reports.

All this construction has to be funded somehow and John G1GST in Sedgley has organised two fund-raising evenings. The first raised £85 each for GB3RT and the GB3UD repeaters, and thanks are due to the organiser and all who supported the events. So far, expenditure on GB3RT has come to £495, while income runs to £442 – the gap could have been a lot wider without donations from kind folk. Hardware and physical effort have been forthcoming from G1GPE, G6IKQ, G6GSG and G8DLX – well done.

Contest calendar

There are some changes in the contests for 1988, following an agreement reached with all our fellow ATV groups in Europe – one of the first tangible results of the formation of EATWG, the European ATV Working Group. It has been agreed that we will hold four joint contests during the year. One of these will be the International, which from now on will be an official International Amateur Radio Union (IARU) one.

This contest will be run each year by a different member country, in 1988 by Belgium, and in 1989 by the BATC on behalf of the RSGB. The advantage of running contests at the same time is that, conditions permitting (!), contacts into Europe may take place, as we will all be on the air at the same time. Rules for all these contests will remain as before,

except the International, which will be subject to IARU regulations (to be published later). Some times quoted are GMT, others are local time. The contests are as follows:

Winter Cumulative: Thursday, January 7th; Friday, January 15th; Saturday, January 23rd; Sunday, January 31st. 1900-2359GMT each session. All bands and modes.

Spring Vision Joint European: Saturday, March 12th; Sunday, March 13th. 1800 Sat-1200 Sun, GMT. Fast-scan TV, all bands.

May Day Microwave: Monday, May 2nd. 0001-2359 local time. 24cm and above.

Summer Fun Joint European: Saturday, June 11th; Sunday, June 12th. 1800 Sat-1200 Sun, GMT. Fast-scan TV, all bands.

IARU ATV (International): Saturday, September 10th; Sunday, September 11th. 1800 Sat-1200 Sun. Fast-scan TV, all bands.

Slow-Scan TV Autumn Vision Combined: Sunday, November 13th. 0001-2359 local time. Slow and fast-scan, all bands.

Winter ATV Joint European: Saturday, December 10th; Sunday, December 11th. 1800 Sat-1200 Sun, GMT. Fast-scan, all bands.

Shop window

A source of ASTEC tuner and demodulator modules is Satalite TV Services (yes, that's how they spell it!) of PO Box 26, Worksop, Notts S80 1XW. They are pleased to help TV enthusiasts looking for hard-to-find parts, so a call on (0909) 722437 might be worth it, if you are interested in these things.

If you have built the Cirkit/Cropredy TV test pattern generator, you should know that the Worthing TV Repeater Group have expanded their range of EPROMs to suit this handy unit. They also have a module which will enable it to produce colour pictures. An sae will bring details: write to R Stephens GB3VR, Treasurer, Toftwood, Mill Lane, High Salvington, Worthing, Sussex BN13 3DF.

405 line news

You may be asking yourself, whatever new can there be to report about 405 lines? It's dead, isn't it? Of course it isn't! On a recent visit to the new transport museum at Dover, I was very pleased to see that the volunteers there have preserved the old BBC channel 2 transmitter, together with a couple of monitors and other oddments.

All they need now is someone who can help them get it going again, probably at low level into a dummy load. The museum is housed in a pumping station in Connaught Road, in the shadow of Dover Castle and has plenty of road and rail

interest, as well as sundry collections of lift and telephone gear. It is closed for the winter but will reopen next spring.

Despite the end of 405 line broadcasting in the UK, interest shows no sign of dying. Several members of the BATC and the British Vintage Wireless Society keep pre-war and post-war sets in operation, while the Wireless Museum in Sydenham has a 625 to 405 line standards converter at its disposal. To provide a source of 405 line pictures you don't have to have one of these monsters; most people have some 405 line programme material on videocassette.

While perhaps the most appropriate video recorder would be the old Sony reel-to-reel machine sold in the mid-1960s (EMI Ltd was their agent in those far-off days), a VHS recorder is far more convenient. These recorders are concerned only with field frequency (which must be 50Hz), but the line frequency is transparent to them, as computer people say. So any VHS (or Beta or V2000) recorder can be pressed into service to record and replay 405 line material.

Trick them

If you are feeding the signal to a monitor, you will have no problems, and dual standard VHF/UHF 405/625 sets can be tricked into working in 405 line mode on UHF. If you have a VHF-only set it's not so easy: you will have to feed the video output of the VHS recorder into a VHF modulator and a circuit for one of these

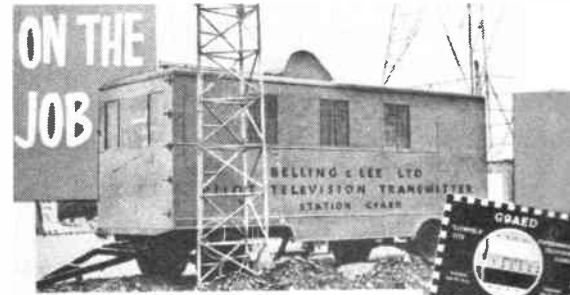
Some thirty years ago G9AED was transmitting its test signals to viewers anxiously waiting for the arrival of TV. Interest in the pioneering days of 405 line television is still strong and now you can hear the sound of station G9AED on audio cassette (see text)

appeared in *Television* magazine a couple of years back. Other sources of 405 line pictures are closed-circuit TV cameras or monoscopes and other test signal generators.

Associated Rediffusion, and all that

As things stand, there is not much 405 line programme material around on tape, and because of copyright restrictions it can only be circulated under certain conditions. One or two television publicity films are turning up in archives, though, and these will be telecined onto tape in due course. For armchair 405 line enthusiasts a 405 Alive group has been set up: as it has yet to circulate anything in return for its subscriptions I shall hold off publishing more details, but it will serve a need, and I wish it well. I also wish it would come up with the goods!

In the meantime, if anyone cannot wait to hear those old ITV and BBC callsigns and sound idents, I can supply a 90 minute audio cassette for £5 – write to me at 71 Falcutt Way, Northampton NN2 8PH. And before anyone writes in to correct me, I know that 405 line TV is not yet defunct in this country. A comprehensive



-40 hours a week!

Here is G9AED – the Belling Lee transmitter in Epsom. Test signals are being transmitted from our studios in the Epsom area. At the gateway L.T.A. may be seen in the background.

We can assure Midland dealers that our signals are not comparable with those at Coventry and if they are able to receive our signals, even unswitched, with maximum sensitivity, results will be satisfactory when L.T.A. comes on the air using their own 625 line and high precision G9AED with the test material screened from Birmingham and other by the National Grid, like

GET ON THE JOB – in the Midlands!

A full broadcast from the transmitter in Epsom. G9AED is now on the air, and the test signals are being transmitted from our studios in the Epsom area. At the gateway L.T.A. may be seen in the background. For more information on the L.T.A. transmitter, contact us at New York.

Remember that our signals are not comparable with those at Coventry and if they are able to receive our signals, even unswitched, with maximum sensitivity, results will be satisfactory when L.T.A. comes on the air using their own 625 line and high precision G9AED with the test material screened from Birmingham and other by the National Grid, like



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RF distribution system is still in use in the Palace of Westminster and the Houses of Lords and Commons. I wonder how long it will last . . .

An interesting letter on the subject of 934MHz arrived at *R&EW* recently; all feedback is welcome, and this reader's letter reminded me that we should not forget the newcomers in our midst.

Anyway, our reader in Pontefract writes: 'I spend a lot of my time out of my office, and I find there is an increasing need for me to be able to keep in touch with my office during these times. I cannot afford the high costs of cellular telephones, and I have been considering the possibility of using the 934MHz CB band for this purpose. But I have been unable to find out much about it. Not so long ago I was able to walk into any newsagent and take my pick of any number of specialist CB magazines, but they all seem to have disappeared off the face of the earth!

I was almost at the point of desperation of ever finding anything out when, almost by accident I picked up a copy of *R&EW* and noticed that you have a regular 934MHz feature. Can you assist me please in finding out more about 934MHz (the equipment, prices, suppliers and so forth), or put me in touch with someone who can? I enclose a stamped addressed envelope for your convenience. If I have understood your recent article, the band seems destined for a radical change in the near future.

NETWORK

934

Andy Emmerson G9BUP

Would I do better to wait for a while?'

Interesting questions, and ones we have not tackled for a while. Shame about the demise of the other magazines, but you came to the right place for advice anyway. Here goes . . .

Who's on the band today?

934MHz is a funny band. It was conceived as a substitute Citizens' Band and is generally called CB. Some people still call it Open Channel, its original name, as if it was something different from CB, and in a way they are right. 934 is probably closest to the original American concept of citizens' band, a low(ish) cost system of two-way radio open to all people without the need for special licensing or exams. Business, personal

or social use – all are allowed on 934, and in fact you find all sorts of people on 934. During the day you will find small businesses and taxis on the band, together with retired people and other folk at home for one reason or other. At night and weekends a different crowd come on – mainly people who want a chat but also the technical types and the DXers, people who get pleasure from making long-distance contacts.

It's not all true . . .

Contrary to rumour, moreover, there is room on the band for all these people, in fact it is probably one of the most under-used radio assets we have. Perhaps it doesn't receive enough publicity, and certainly you will seldom find all channels in use.

Deliberate interference by other users is rare; in a few areas there is trouble due to interference from cellular radio transmitters. For the kind of occasional use our reader mentions, 934MHz should be ideal.

The only snags to mention are the lack of privacy – anyone can listen in (and probably does!) – and the range is restricted to a few miles under normal circumstances. If you can live with these restrictions don't waste another minute! Go out and set yourself up for 934MHz.



A preamplifier such as this Nevada product will boost weak signals and make them more audible; it is remote controlled and can be switched off for listening to strong local stations. Note the solid N-type connectors and waterproof construction

Short range service

Our 934MHz system – we get very possessive about it! – uses the same UHF frequencies above the TV channels that cellular radio does, and operates with similar radio equipment and aerials. This means that the radio range or coverage is similar, the only difference being that your mobile or fixed radio will not enable you to make phone calls, but put you in touch with anyone listening locally. 934MHz is essentially a line-of-sight communication system: the better the transmitting aerial can 'see' the receiving one, the more likely the contact is to be successful.

Obstructions such as tall hills, deep valleys, gasholders, tall buildings and forests tend to block the radio waves. Mobile stations tend to fare worse than fixed stations with well-sited aerials and may have a range of 1 to 5 miles. Fixed bases will tend to do better, up to 10 or 20 miles.

Really well-sited and engineered operators will improve on this, up to 50 miles perhaps, and some people drive out to the top of hills to get the maximum range. During special weather conditions – the ones which bring foreign interference to our TV screens – the signals travel much further, say 200 miles or more and then the DXers have a field day.

Spilled for choice?

Where does one get the equipment, what do you need and how much does it cost? The first question is easy to answer: you can either try your local CB or amateur radio shop or patronise a larger distributor. Not all local dealers have an in-depth stock or knowledge of 934MHz and it may be better to try a national distributor – either pay a visit or deal by mail order. There are in fact only two firms in this category: Nevada Communications of Portsmouth and Selectronic of Canvey Island (addresses at the end). Both are reputable firms and

have been in the business since the beginning; they both issue illustrated catalogues and deal by mail order.

The choice of equipment is also straightforward: you need a transceiver and an antenna. If you are operating a base station you will also need an adequate power supply for the transceiver plus connectors and good quality coaxial cable to link the antenna to the radio (your dealer will advise you on both of these).

Antennas for mobile use already come with cable and connector fixed. If your base station is in a poor position, you will probably need a preamplifier to boost the received signal and make it more audible.

The choice of radio is made easy for you because there is now only one on the market, the Cybernet Delta-One. It is of excellent quality and can be used both mobile (in a vehicle) and at a fixed location. There was a hand-held portable on sale as well as other makes of mobile set: you may find these for sale second-hand, but unless they have a worthwhile guarantee they may not be as good value.

The choice of antenna depends on your intended use and you will best be guided by the dealer; for most purposes an omnidirectional 'collinear' is best, unless you propose to do a lot of DXing. In the latter case a 'beam' aerial, with gain concentrated in one single direction, would be more practical, but you will still need the omnidirectional one as well.

Unless you have separate cables coming down from each aerial and are prepared to do a lot of plugging and unplugging, you will have to buy a remote-controlled masthead switch to select the appropriate antenna. To rotate the beam to the desired direction, you will need a rotator – an electric motor which swings the beam under the control of a dial, marked with the signs of the compass, next to your radio transceiver.

And now the cost

Prices for 934MHz equipment tend not to vary much, and unless you enter the shop offering to pay hard cash in full, you are unlikely to find any discounts. The Delta-One transceiver is priced at £355, and a power supply around £15. Decent cable (don't economise, it's not worth it!) costs 90 pence a metre and the special plugs, £3 each.

Mobile antennas range from just over £20 for the very simple one to £44 for the very best, while for a base station the prices vary between £7.50 and £96.50 (expect to pay about £49, though). You can get a rotator for £40 but one costing £61 will work better and last longer. Economy is poor value in the long run at 934MHz. Good preamplifiers cost between £100 and £200, while the other accessories vary very widely and you would do best to arm yourself with the catalogues of the dealers mentioned.

The longer term

Because we are dealing with weak radio signals almost in the microwave region, careful installation is important. Not because of any health risk, but because we cannot afford to lose any of the signal. Everything outside must be made completely waterproof to avoid moisture getting in and causing corrosion, so all joints must be wrapped with soft sticky rubber tape called 'Coax Seal' – you can get this at any Tandy store. Most of the radio gear we use comes in from Japan and is of excellent quality and is beautifully made to last. But is the 934MHz band under threat?

Not in my view; a few scaremongers have misinterpreted government directives and are starting to preach doom and despondency. The facts of the matter are that the government has announced that it is considering a new kind of short-range personal radio service, based on a different technology.

There is no guarantee that this will be introduced, nor any firm indication when this might be (never if you believe me!). In any case, the government has stated that existing users will be considered in any new scheme. Therefore you can expect at least five more years' use of your radio, by which time you may well be considering buying a newer set anyway. Is 934MHz worth it? Yes!

Dealers – names and addresses

Nevada Communications,
189 London Road,
North End,
Portsmouth,
Hants PO2 9AE.
Tel: (0705) 662145.

Selectronic,
203 High Street,
Canvey Island,
Essex SS8 7RN.
Tel: (0268) 691481.

The RX6-30 Mini-Loop ANTENNA

by **RICHARD MARRIS G2BZQ**

The design target was simple. It was a tiny loop antenna, to sit on top of a general coverage receiver, with a view to pre-monitoring the 20 metre band for possible activity in the early hours. This was to get a quick answer before firing up the transceiver/ATU/antenna combination only to find that the band was dead.

All that was required of this antenna was a quick look at the 20 metre band and the adjacent 19 and 25 metre bands. You know – nothing complicated or expensive. The labour time guesstimate for the project was about one hour; using odd bits of wood, wire and coaxial lying around in the garage plus an old variable capacitor. Oh dear! How wrong you can be.

A VK was received loud and clear on 20 metre CW when testing the first lash-up model! Many hours were then spent building, testing, redesigning, rebuilding and retesting the little brute; as one improvement led to another, interest and enthusiasm increased.

Well, one thing led to another – the result was a small receiving loop antenna of 12in maximum width and just 16in height.

The measured frequency range on the final model was from 5.5MHz to 32MHz. In other words it would cover all HF amateur bands, plus HF broadcast bands and CB. It is emphasised that this is continuous coverage, without band switching arrangements!

Description and construction

Figure 1 shows a general front view, of the RX6-30 loop, with the tuning knob removed for clarity. Figure 2a gives details of the 'circuit', which consists of a 4 turn semi-spiral winding (L1), resonated to frequency VC1, which is a good quality airspaced 2 gang 500+500pF variable capacitor in a semi-balanced circuit. Alongside, and set back, is a one turn coupling turn (L2) fed to the Rx via C2 and 50 ohm coaxial cable. C2 is a 100pF silver mica capacitor. Figure 2b shows the polar diagram of the loop (see later for comments).

Regarding the L2/C2 coupling combination, it should be mentioned that this has to be somewhat of a compromise. For example, the *ideal* coupling required for say 30MHz differs considerably from that for 6MHz. The prototype used a 300pF variable capacitor for C2, and after a

number of practical tests, it was found that 100pF was a good compromise for the whole range. However, the coupling is a little too tight on the 28MHz band, resulting in a wider bandwidth, but this was accepted as there is little QRM on that band. Anyway, the 28MHz band is not used at G2BZQ.

However, it is suggested that the 100pF silver mica capacitor (C2) should be replaced by anyone seriously interested in using the 13 metre BC band, the 27MHz CB band and the 28MHz amateur band. The suggested replacement is a 150pF variable capacitor which can be 'twiddled' for optimum coupling from band to band.

The writer's RX6-30 loop uses 50 ohm coaxial cable, as the Rx has a 50 ohm antenna input impedance. If 70/80 ohm coaxial is used, then a different value of C2 or a variable capacitor should be tried.

The Rx I use has excellent RF amplification. However, if a receiver is used which has mediocre RF amplification, then it is suggested that an RF amplifier be inserted between the loop and the Rx. A wideband amplifier is readily made or obtained from a supplier.

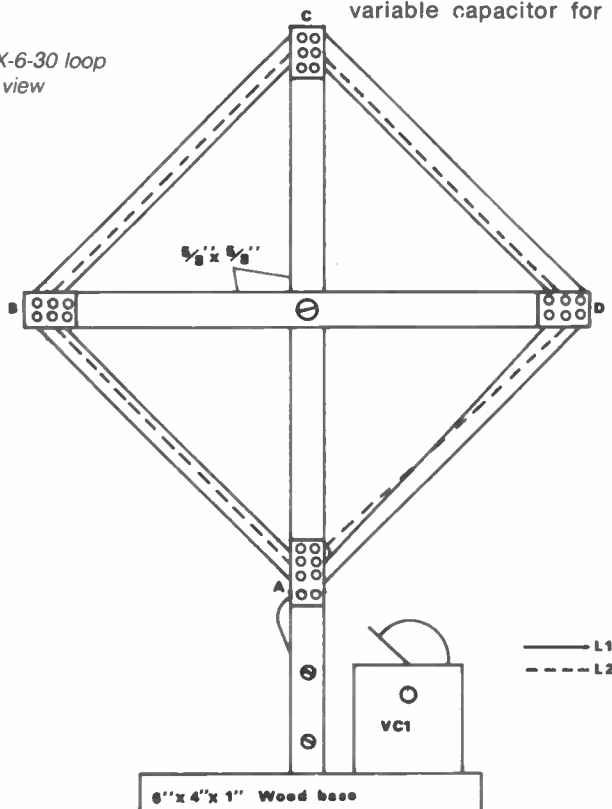
The construction of the loop is quite simple. It consists of a cross-boom assembly mounted on a small heavy wooden base, as shown in Figure 1. The cross-boom consists of two pieces of 1/2in x 1/2in timber, dovetailed and bolted together to the dimensions shown in Figure 3. The base consists of a piece of 1in thick wood x 6in wide x 4in deep. The boom-arm assembly is secured to the base using a 2in plastic bracket as shown in Figures 3 and 4.

Drilling

Four holes, marked ●, are drilled as shown in Figure 3, and are located on a level with the mid-hole of the insulator blocks, dead centre of the wood. The insulator blocks consist of 3 x 3 hole terminal blocks and a 1 x 4 way terminal block. The 3 way blocks are mounted at the ends of the boom-arms B, C and D (see Figure 1), and the 4 way block (A) is mounted equidistant down the vertical boom arm.

The insulator blocks are cut from standard polythene 12 way terminal blocks (1/2in wide), which have brass inserts with two grub screws. The brass inserts are at approximately 1/4in centres. The 12 way blocks are available at

Fig 1 The RX-6-30 loop
– front view



most DIY shops. Take a rule along to the shop, as there are sometimes several sizes on display. They are best cut to required sizes using sharp blades. Two 12 way blocks will be required.

VC1 is mounted on the base as shown in Figures 1 and 4. If a bottom secured type of VC is used, then it will be necessary to drill and countersink (from underneath) the necessary holes to secure VC1 to the base. Also, fit a 3 way terminal block as shown on Figure 4.

Suitable wire

The wire used for both L1 and L2 is 2mm o/d PVC covered flex. Single strand PVC covered wire should not be used as it 'kinks' during winding. The winding of L1 should be carried out with care. Firstly loosen all grub screws in the terminal block inserts, then solder one end of the flex to the rear fixed section of VC1 and feed the flex through the inner hole of terminal blocks A, as shown in Figure 1. Pull the wire tight and screw up the grub screws until they just 'bite' into the flex PVC covering, then feed the flex through the inner hole of blocks B, C and D. Pull the wire tight and tighten up the screws on all three blocks.

The flex is then threaded through hole No 3 of block A (counted from the inside and leaving No 2 clear). Tighten the wire and secure the flex with screws, then thread the flex through the outside holes (No 3) of blocks B, C and D, and tighten screws after making certain that the wire is tight. The last operation is to thread the wire through the outer hole (No 4) on the bottom block A. Tighten the wire and do up the screws.

At this stage it is important that there is no wire sagging anywhere, and if necessary terminal block screws should be loosened, whilst consecutively the wire is pulled tight and the screws retightened. Take the end of the wire to the front fixed section of VC1 and solder the connection.

For L2, start at the lower cross-boom and thread a piece of flex through the hole marked * on Figure 3, and then through the left, top and right boom arm holes (all marked * on Figure 3). Then push the end of the wire back through the first hole at the bottom, so that the two ends of the flex start and end at the same hole in opposite directions. Take the two ends over to the terminal block on the base (see Figure 4), tighten the wire and secure it to the screw inserts.

Connect up the coaxial cable and C2 as shown in the circuit (Figure 2a), and in Figure 4. The coaxial should be screwed to the base with a cleat, as shown in Figure 4. Fit a knob to VC1 and you are ready for testing.

Testing and results

The first thing to be considered is VC1, which is a 2 gang 500 + 500pF variable capacitor. The highest obtainable loop frequency depends on the minimum capacity of VC1, which depends on the type used. The best is the largest obtainable, with vanes well spaced and

the 'fixed' plates mounted on small ceramic insulators. Keep clear of the present day mini VC types used in transistor radios.

The two gang variable capacitors can be salvaged from old valve receivers, or can be purchased from J Birkett, who advertises in this magazine, at a current price around £1.60 each. If the VC is fitted with pre-set trimmers, then these *must* be completely removed.

If a salvaged VC is used then the biggest hazard is dust between the vanes which is very difficult to remove. Hair-dryers puffing and vacuum cleaners sucking make a very impressive noise, but achieve very little in removing dust from between the vanes of old VCs. Old dust apparently sticks to old dust and has a particular affinity for supersticking to old VCs.

If Confucius did not have a saying to cover the situation, then no doubt professors Parkinson and Murphy covered it in one of their laws.

Getting it out

The best method of dust removal is to open the vanes anti-clockwise to full extent, and insert strips of postcard between each pair of plates in turn. Remove the dust from the card after each

insertion, otherwise you are only moving the dust around. Rough card is better than the glossy type.

The frequency range of the loop can also be affected if the specified dimensions are not adhered to, or if the loop windings are not tight and with short leads to VC1. A careful check should be made of these points.

After connecting the loop to the receiver, the following testing steps should be taken:

Tune the Rx to a point between 6 and 7MHz, where a loud BC station can be heard, or a station sending continuous CW. Rotate VC1 for maximum signals. There should be a very noticeable tuning peak. Turn the loop through 90 degrees for peak signal.

Tuning

Depending on conditions, tune the Rx to the highest active frequency between 14 and 28MHz. Rotate VC1 for maximum signals. Turn the loop through 90 degrees for peak signals (see later comments re directivity).

Next tune around the bands on the Rx, re-resonating VC1 and rotating the loop. This will give you the 'feel' of its use and also check that it is resonating to a peak on all bands.



Fig 2a The RX6-30 Loop circuit

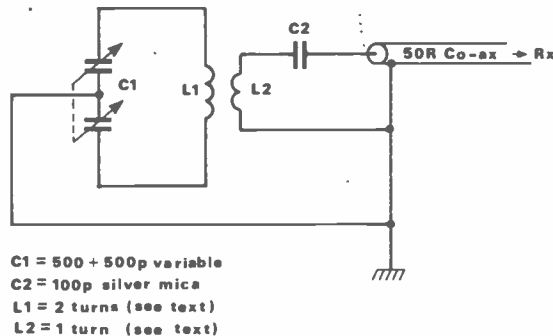
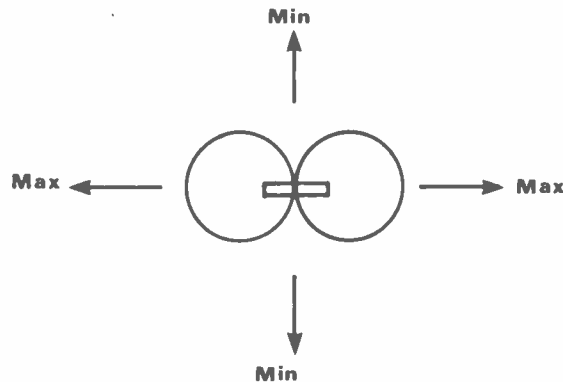


Fig 2b The RX6-30 Loop polar diagram



RX6-30 MINI-LOOP

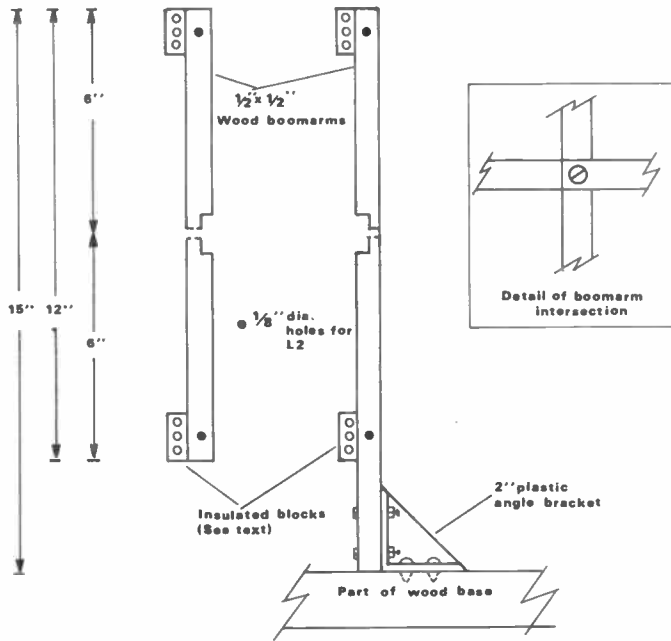


Fig 3 RX6-30 Loop details of boom arms

The operations mentioned above will establish that the receiver/loop combination is working and ready for more precise testing.

The frequency range of the G2BZQ model in general use, covered from 5.5 to 32MHz (54 to 9.3 metres). There are two alternative ways of checking the frequency range of the loop:

- (a) Use a signal generator with a short wire radiator - I use a BC221 for testing loops initially. A short piece of wire is vertically attached to the output terminal of the BC221, which is placed about 4 feet away from the loop. This will provide a tiny mini-range radiated signal for use in co-ordination with a calibrated general coverage receiver. If only an amateur bands receiver is available, then all bands between 7 and 28MHz can be checked using the same procedure. Both types of Rx are used at G2BZQ with equal success.
- (b) If a 'captive' signal source is not

available, then the frequency range of the loop can be checked against BC and amateur stations. This may take a little time at the high end of the frequency range, above 21MHz, due to conditions and/or lack of signals. A point to remember is that there are usually CB signals to be heard between 27 and 28MHz, which is getting close to the upper frequency limit of the loop.

The selectivity of the loop is sufficiently good that a slow motion drive is advisable, especially at the higher frequencies. There is little point in calibrating the knob/dial, as it is only necessary to rotate VC1 for maximum noise to arrive at resonance.

Loop antennas have directional or nulling properties, as shown in Figure 2b. Maximum signals will be received 'off the ends' of the loop, and minimum signals or null off the long sides. This can readily be determined when using an LF loop. However, on the HF bands it is not

quite as simple as that! Signals received may be ground wave signals or sky wave signals, and the latter arrive at various angles.

The predictable results are that this loop can be used to reduce or eliminate local amateur and BC signals by rotation of the loop, thus making it easier to receive the wanted signals. This can easily be checked with a BBC World Services station at around 6MHz, or a local 7MHz amateur station.

Prevailing conditions

Also, depending on the operating frequency and prevailing conditions, ground wave signals over varying (and considerable) distances can often be reduced by loop rotation. For example, the writer has found that Russian amateur stations on 7, 14 and 21MHz can often be nulled out (and at other times they cannot!).

Sky wave signals arrive at various angles and via various paths. This subject is well covered in good antenna handbooks. The nulling of the loop on sky wave signals becomes unpredictable, especially as the frequency increases. Often various degrees of nulling can be achieved and it is presumed that this depends on the angle at which the signal 'hits' the antenna and surrounding large structures near the QTH.

Substituting the RC6-30 mini-loop for a conventional antenna immediately produces a very noticeable reduction in general ambient noise. This, in itself, would make it worthwhile. It can also receive DX (see above). Furthermore it greatly reduces man-made noise; much of this, being electrical, is directional. For example, noise from the electrical house wiring can be reduced or eliminated by a simple rotation of the loop. Additionally, interference from electrical storms is directional and can be nulled unless, of course, the storm is very near.

On the circuit (Figure 2a) an optional earth connection is shown. In practice the writer has found that connecting an earth makes no noticeable difference to the performance. However, somewhere a situation might exist where an earth might (?) improve results. There is no harm in trying one anyway.

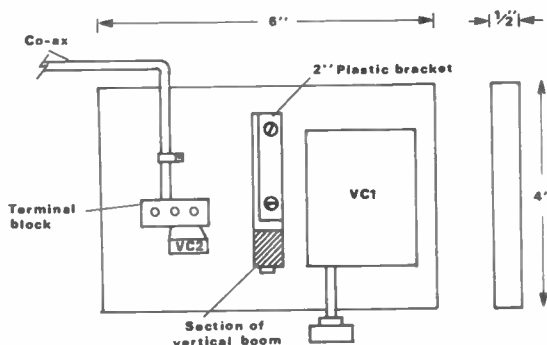
Conclusion

It can be seen that this tiny loop antenna can greatly assist in 'fishing out' weak DX signals from QRM/QRN as well as giving a general improvement in the reception of entertainment reception on the short wave band and it should prove of interest to both the SWL and Txer.

Final

And all that was originally required was a simple mini-antenna to stick on the Rx for band condition monitoring!

Fig 4 RX6-30 Loop - detail of wooden base



SPECTRUM WATCH

by John Andrews

Aspace-based microwave sensor, which identifies tropical storms sooner than existing warning systems, has been installed on a US Air Force weather satellite. The imaging sensor, built by the Hughes Aircraft Company, can see into and through clouds, giving forecasters a view of the intensity of a storm for the first time; previous designs of satellite could see only the tops of clouds.

SSMI is the name given to the four feet-long sensor, which detects microwave energy emitted by the earth and atmosphere. It will detect and measure wind speeds over the ocean, determine the amount of moisture in the ground and over mountain snow packs, note ice coverage and, for the first time, determine from space where it is raining over land. Existing weather satellites can only use visible and infra-red images of the tops of clouds to chart weather patterns. However, since the portions of storm clouds that are not producing rain are transparent in microwave energy, it is now possible to observe the underlying rain structure and to guess the intensity of energy released in storms.

The US Air Force's Global Weather Centre will use the sensor's data for agricultural weather applications, aircraft routing and refuelling, storm reconnaissance and communications management. The US Navy's Fleet Numerical Oceanography Centre will measure wind speed on the sea's surface and the thickness of ice for ship routing.

Microwave TV - It's on/off again

The Cable TV Authority has made an about-turn, according to *Fintech New Media Markets*, and decided to ask the Government to allow cable TV programmes to be 'broadcast' by local microwave transmitters. The change of policy reflects the industry's concern that cabling the country is moving at a snail's pace, and only nine of the 21 cable TV franchises so far awarded are yet operational.

The cause of the delays is of course financial: the investment to dig up the streets to lay cable is considerable and MMDS (multipoint microwave distribution service) would allow 10 to 12 channels to be sent over the air to homes in a several mile radius of the transmitter. The idea is that MMDS should be allowed only in existing cable franchise areas, with a time limit imposed so that it will eventually be replaced by a full cable network.

In the meantime MMDS would enable operators to offer a service in all of their area, while the work of cabling the outlying parts went on. This would reduce the initial cash outflow, as well as bringing in full income from the start. The system could also bring additional

viewing choice to rural areas which might never be cabled.

There are a number of snags to consider, however. Microwave propagation is hindered by 'shadows' and not all homes will be able to receive the signals. The transmitting and receiving equipment is expensive and not readily available here, while the frequencies will have to be released by their existing user, which may not be simple.

Channel conundrum

One of the reasons why cable TV has been so long taking off in the UK, is the very adequate over-the-air television programming we receive. With the establishment of Channel Four it was thought that four UHF channels were the maximum the spectrum could support, but the introduction of extra channels in France has disproved this conventional wisdom. The success, too, of Channel Four and an increasingly competitive BBC have led the ITV companies to ask for a second channel of their own.

To squeeze a fifth channel into an already crowded UHF band will not be easy; it will have to use existing transmitter sites and aerial polarisation so that viewers can use their existing aerials. Because channels and antennas are 'grouped', the new channel cannot be at the other end of the UHF band from those already in use at any given transmitter location, nor is it permissible to cause co-channel interference in nearby (or not-so-nearby) districts. So where will the extra channels be found?

Smart folk among us will have noticed that channels 35 to 38 are not used in Britain or in neighbouring countries, and that in some districts at least these might offer a solution to the frequency shortage. Easier said than done, though. Exactly because these channels are not used for broadcasting, most home computers, TV games and video recorders use channel 36 for their output channel, and broadcasting on channel 36 would cause a lot of problems.

Three of the channels are used in some areas for radio-navigation or, more prosaically, airport radar. The blips and buzzes every six seconds already cause TV interference in some districts and until these radars are replaced with new equipment on other frequencies, channels 35 to 37 cannot be turned over to broadcasting. Channel 38 is allocated to Jodrell Bank and the Mullard Radio Observatory at Cambridge and is used for observing pulsars. These weak signals would be wiped out by any TV broadcasting on the same channel, putting an end to more than 20 years' research. So, the proponents of Channel Five or ITV-2 seem to have a tough task ahead in finding a home for their transmissions.

Bypass in space

In Britain we have an alternative to British Telecom in the form of Mercury Communications Ltd: Mercury is actively selling private circuits and its own STD or long-distance service. From your BT phone you can dial into Mercury and route your trunk call to many destinations over their wires, at a lower cost.

In the USA such 'bypass' telephone services are commonplace; there are several competing long-distance companies and the 'regular' telephone companies are feeling the pinch. Now, however, a second threat is becoming reality - networks in space. Tridom Corporation and GTE Spacenet are collaborating to provide a \$10 million satellite-based data communications system for Prudential-Bache Securities.


Prudential-Bache's New York headquarters will be linked with more than 300 branch offices across the United States, and the stockbroking firm expects to save 40 per cent of its annual communications bill. As well as data transfer, video training and teleconferencing will be carried on the system, which operates at Ku band (14/12GHz).

Solar-powered telephones

The use of solar power for radio communications is not new - even in murky England solar power is used to trickle charge batteries for radio data telemetry systems used by water boards. Until now, however, solar power has not been used for private telephones in western Europe. Recently, though, solar powered telephones have been launched in the south of France, where the new power system (a panel of photoelectric cells) will augment existing batteries. Solar phones are seen as having considerable potential in areas where demand is heavy but intermittent. Calls are transmitted over radio links to the nearest telephone exchange, up to 20 miles away.

Communications trivia

High technology has been applied to telecommunications in Canada, where the KC Beariphone is now being marketed. A combination of loud-speaking telephone and teddy bear, the Beariphone has eye movements and a flapping jaw, which are synchronised with the loudness of the incoming call's speech. The phone includes full-sized keypad and works on both touch-tone and conventional loop-disconnect lines.

If your desires are a little more prosaic, then the Phone-E Tenna is for you. Priced at \$19, it mounts on your car rear window with a peel and stick adhesive pad, and comes with a 12-page manual. It does very little, though, apart from increasing your status, as it is nothing more than a mock cellular antenna! 

WHAT TO DO WHEN THE BATTERY RUNS OUT?

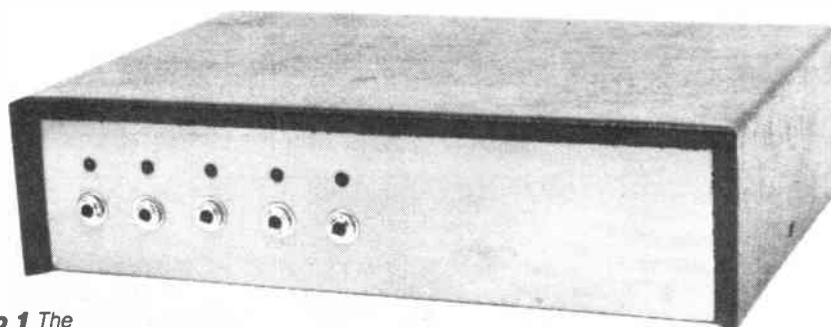


Photo 1 The finished 12V supply

Terry Weatherley suggests that you build up your supplies – and tells you how.

Picture the scene: you are in your shack – it is warm, cosy and late. You turn on the gear and tune to two metres, and there in the noise is a signal. You switch in the pre-amp: you are rather proud of this, as it is homebrewed from a circuit in *Amateur Radio*, and it is self powered and contained in a little box. Suddenly, you hear it... it's a 9H4 and he's calling your square! You swing the beam... the signal peaks and dies. The battery in the pre-amp has let you down. You must find another, quickly! You frantically unscrew the fixing screws, plug in and – nothing. Another dead battery, and this one is leaking. So you swab out the box, and raid the harmonic's portable stereo – there is no battery – you used it last time!

Now what? You think of the all night garage. Pete won't let you down. Ten minutes later you discover that the all night garage isn't and Pete has. You hammer on the door. 'Pete! The band's open!' 'go away, I'm not' shouts Pete. You roar home frustrated, then you have a brainwave. You remove the battery from the car, wire it up and – the band closes.

A battery plant?

What you need is either a battery plant at the bottom of the garden, or a 12 volt supply. You decide eventually on the power supply. You turn the pages of *Radio and Electronics World* and you find this article, which describes a cheap and easy way to build a regulated 12 volt supply. You thank *R&EW* and *WDI*.

The circuit is shown in *Figure 1*. It is conventional, and is based around the

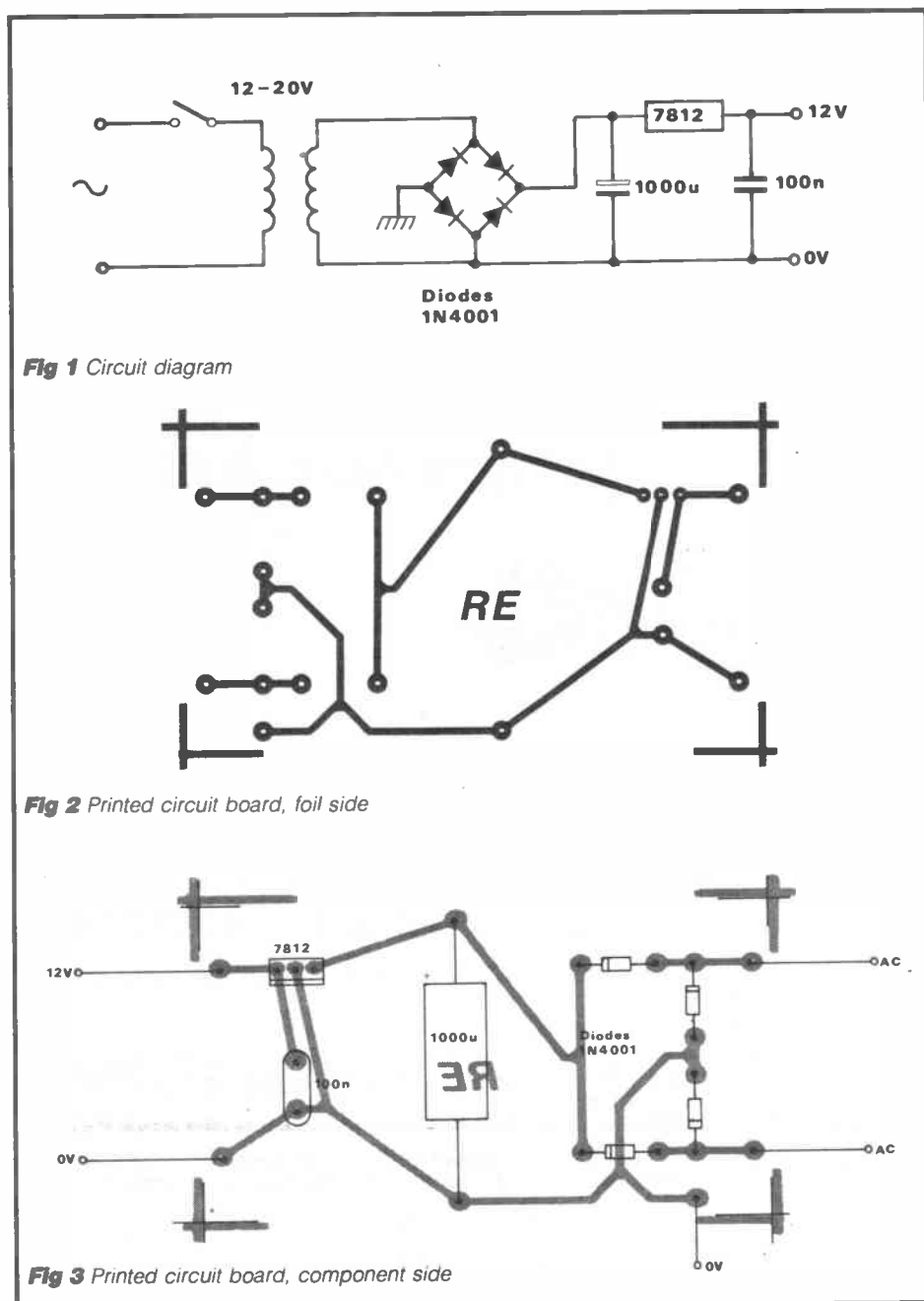
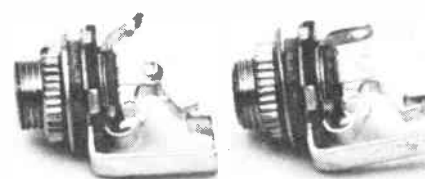


Fig 1 Circuit diagram

Fig 2 Printed circuit board, foil side

Fig 3 Printed circuit board, component side

Photo 2 Left: the modified socket
Right: normal socket



7812 regulator chip. The transformer can be anything between 12 and 20 volts, it depends more on the size of your box than anything else. Once the transformer has been found, the working voltage of the capacitors can be established (63 volts is ideal for any suitable transformer). With a heatsink, the regulator will pass 1 amp.

It is possible to build up the circuit on a tag strip, but a printed circuit board is easy to draw with an etch resist pen. A suitable board is drawn in *Figure 2* and the placement is shown in *Figure 3*.

As can be seen from *Photograph 1*, the unit has a number of outlets via 3.5mm jacks. A red LED lights when the socket is in use. This is useful and is the result of modifying the socket so that the normally closed switch is changed to normally open by careful bending. *Photograph 2* shows a modified socket on the left and the normal socket on the right.

Figure 4 shows the LED circuit. The wiring behind the sockets is shown in *Photograph 3*.

All the accessories to be powered from the supply are fitted with 3.5mm jacks and when power is required, they are plugged in. The unit is short circuit protected and should prove invaluable in your shack.

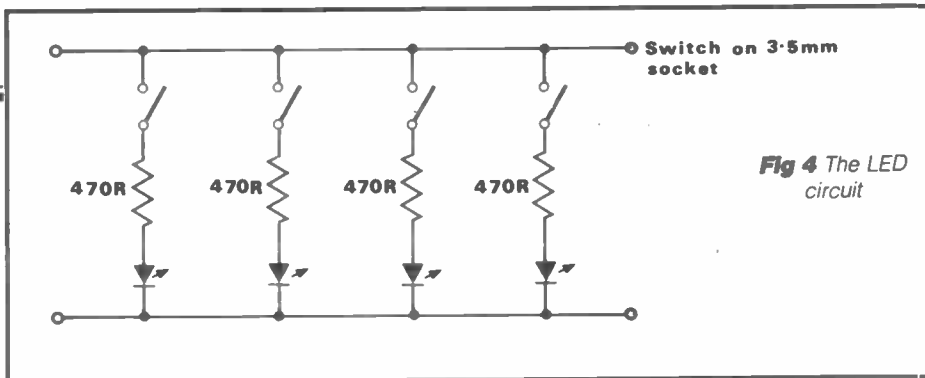
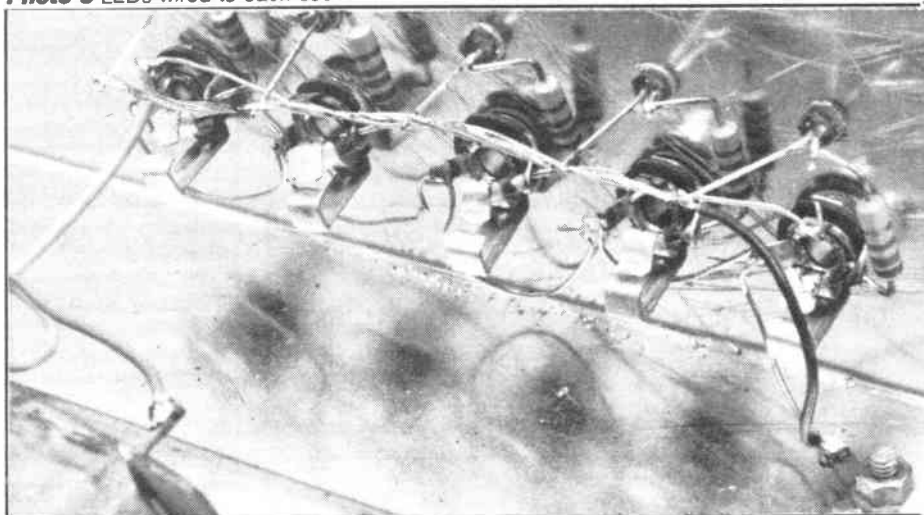


Fig 4 The LED circuit

Photo 3 LEDs wired to each socket



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DATA FILE . . .

Ray Marston takes a look at the NE565/567 range of Phase Locked Loop (PLL) IC circuits, focusing on the NE565 general purpose PLL IC and the NE566 function generator IC and their applications

In the last two editions of *Data File* we explained the basic operating principles of modern Phase Locked Loop systems, took a detailed look at the 'usage' details of that popular, highly versatile and readily available CMOS PLL IC type 4046B, and finally went on to look at a large selection of practical applications of this device. In the present edition of *Data File* we continue the PLL theme by looking at the operating details and applications of the type NE565/567 range of PLL ICs manufactured by Signetics.

NE565/567 ICs

The Signetics Corporation manufacture a family of Phase Locked Loop ICs and associated devices. The three best known members of this family are the NE565 general purpose PLL IC, a fairly simple device that can be used in a variety of signal demodulating and locking applications, the NE566 function generator IC, which can be used in a variety of waveform generator applications, and the NE567 tone decoder IC, a specialised PLL device intended purely for use in tone decoding/switching applications. In this edition of *The File* we concentrate on the first two of these devices; we will give a full description of the NE567 in next month's edition.

NE565 basics

The NE565 is a conventional PLL IC that can directly operate over the frequency range 0.001Hz to 500kHz, and is housed in a 14 pin DIL package with the outline and pin notations shown in *Figure 1*. *Figure 2* shows the block diagram (and a few essential external components) of the device's circuitry. As can be seen, the IC houses a voltage controlled oscillator (VCO), a phase detector and an amplifier and low-pass filter component within the single package.

Note that the NE565 is not as versatile as the 4046B described in an earlier edition of *The File*, since the voltage control input terminal of its VCO section is permanently tied to the amplifier output via the internal 3k6 filter resistor, and is thus not readily available for external 'control' use. This IC is thus useful in signal demodulation and signal tracking applications, but (unlike the 4046B) is not recommended for use as a

general-purpose signal generator.

Figure 3 shows the basic signal tracking or FM demodulation application diagram of the NE565 when used with a split 12 volt (+6V and -6V) power supply. In normal use, the external signal that is to be tracked or demodulated is connected to input pin 2 of the phase detector, and unused input pin 3 is signal grounded; the pin 4 output terminal of the VCO is connected to the phase detector's pin 5 input terminal, thus completing the phase locked loop: the free-running frequency (f_0) of the VCO is adjusted via the R-C network connected to pins 8 and 9 so that it corresponds to the mid value of the external input signal.

Under the above conditions the VCO frequency can lock to that of the input signal. This can occur because (when the 'lock' condition is feasible) the mean dc level of the phase detector's amplified output is directly proportional to the difference between the input and VCO

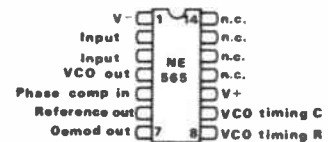


Fig 1 Outline and pin notations of the NE565 PLL IC

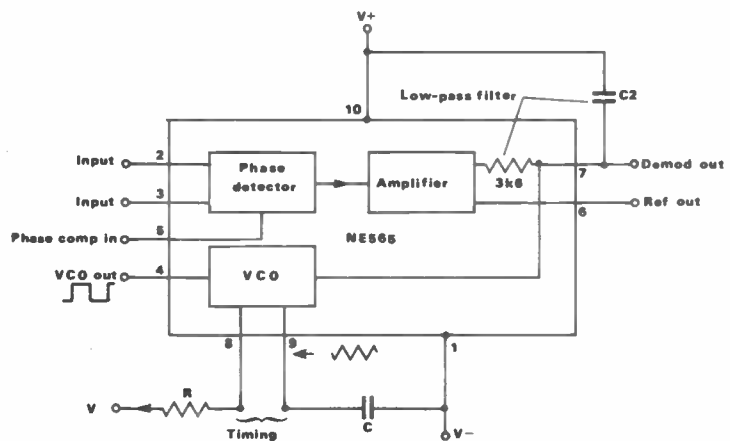


Fig 2 Functional block diagram of the NE565

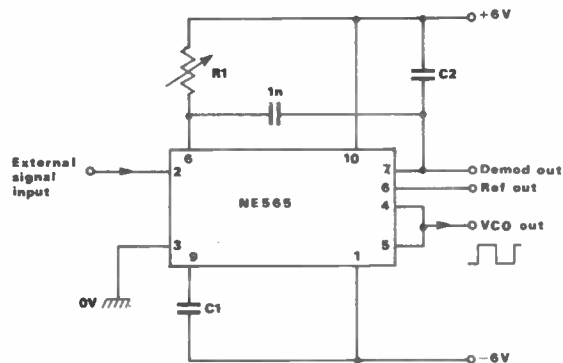


Fig 3 Basic signal tracker/FM demodulator application diagram

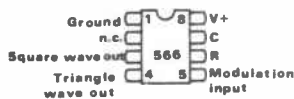


Fig 8 Outline and pin notations of the NE566 function generator IC

resistance is wired between pins 6 and 7 the gain of the IC's output stage can be reduced with little change in the dc voltage level of the output. This allows the lock range to be decreased to as low as 20% of f_0 , with little change in the f_0 value.

FSK demodulator

Frequency shift keyed (FSK) signals are widely used in binary-data communication systems. At the transmitter the binary signals are used to generate a continuous two-tone carrier signal, with a 'mark' or logic-1 state represented by one tone, and the 'space' or logic-0 state represented by another tone. In the receiver the two-tone carrier is converted back to a binary signal via a precision tone switch or FSK decoder.

Figure 6 shows how the NE565 can be used as an FSK decoder of a 1070Hz/1270Hz input waveform. As the signal appears at the input, the loop locks to it and tracks it between the two frequencies, with a corresponding dc shift at the output.

Loop filter C2 has a small value to eliminate overshoot on the output pulse, and a three-stage RC ladder filter is used to remove carrier components from the output; this filter has a band edge roughly half way between the maximum FSK keying rate (300 baud or 150Hz) and twice the input frequency (about 2200Hz). The filter output signal is made logic compatible by connecting a 311 voltage comparator between the output and pin 6 of the loop. The free-running

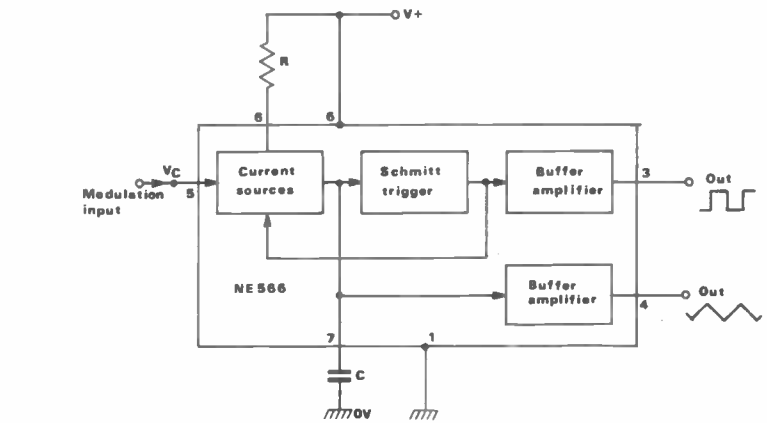


Fig 9 Functional block diagram of the NE566

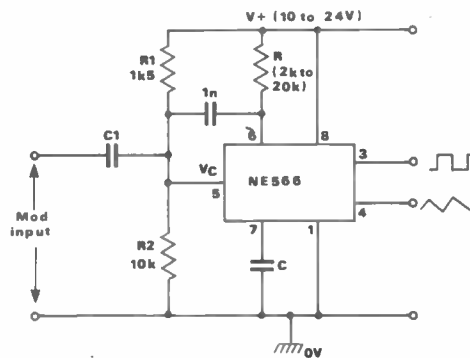


Fig 10 Sample fixed frequency applications circuit

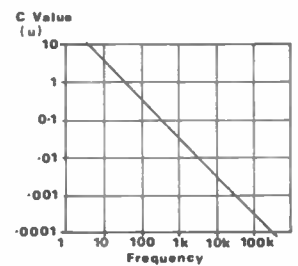


Fig 11 Frequencies given by Fig 10 at various 'C' values when RE4K

frequency of the VCO is adjusted with RV1 to give a slightly positive output voltage when a 1070Hz input signal is applied.

Note that the input connection of this circuit is typical for cases where a dc voltage is present at the source and a direct connection is thus not allowable. Both input terminals are returned to ground with identical resistors (in this case the values are chosen to give a 600 ohm input impedance).

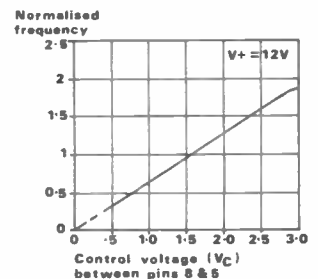


Fig 12 Normalised frequency of the Fig 10 circuit as a function of control voltage

Single-ended supplies

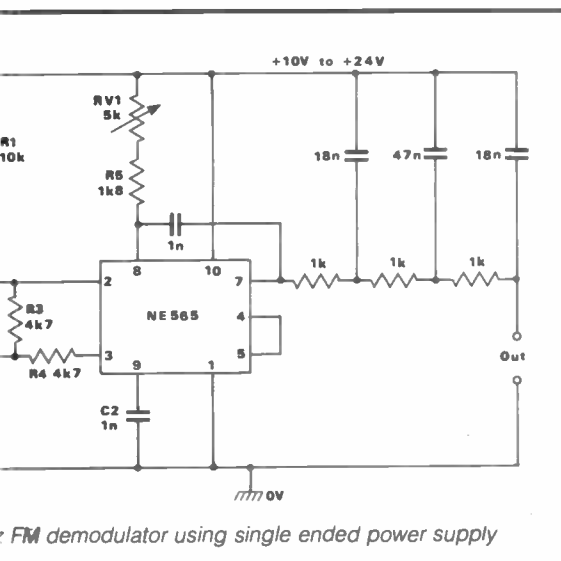
To conclude this look at the NE565, Figure 7 shows how the IC can be connected as a 60kHz FM demodulator that is powered from a single-ended 10 to 24 volt supply. Here, a resistive voltage divider (R1-R2) and R3 and R4 are used to apply a balanced bias voltage to the two input terminals (pins 2 and 3), and the 60kHz FM signal is ac-coupled to input pin 2. The VCO's free-running frequency is set to 60kHz via R5-C2 and RV1, and the decoded output signals are fed through a three-stage low-pass filter to minimise the effects of unwanted noise signals.

NE566 basics

The NE566 is a general purpose wide-range voltage-controlled function generator IC, that simultaneously gener-

ates very stable high-quality square and triangle output waveforms, at fixed or variable frequencies, up to a maximum of about 1MHz; these waveforms can easily be frequency modulated (FM) or frequency shift keyed (FSK) by an external signal via a voltage-control input terminal.

The NE566 is an easy device to use. It is housed in an 8 pin DIL package with the outline and pin notations shown in Figure 8. Figure 9 shows the device's block diagram, plus a few essential external components, and Figure 10 shows a simple 'fixed frequency' application circuit for the device, which can be powered by a single-ended or split



FM demodulator using single ended power supply

PARAMETER	VALUES WITH $\pm 6V$ SUPPLY		
	MIN	TYP	MAX
Supply voltage	10V		24V
VCO Maximum frequency Drift with temperature Drift with supply volts Control terminal input Z FM distortion ($\pm 10\%$ deviation) Sweep range		1MHz 200 ppm% 2%V 1M Ω 0.2% 10:1	1.5%
Triangle wave output Impedance Voltage Linearity	2V p-p	50 Ω 2.4V p-p 0.5%	
Square wave output Impedance Voltage Duty cycle Rise time Fall time	5V p-p 40%	50 Ω 5.4V p-p 50% 20ns 50ns	60%

Fig 14 Main parameters of the NE566

supply voltage in the range 10 to 24 volts.

In essence, the NE566 is simply a voltage controlled oscillator (VCO) with buffered outputs. As can be seen from Figure 9, the VCO section is actually made up of a pair of voltage-controlled current sources that are used to linearly charge or discharge an external timing capacitor, and a schmitt trigger, which is used to flip the current sources when the

capacitor voltage reaches pre-set levels. Thus, a linear triangle wave is generated across the capacitor, and a high quality square wave is generated at the schmitt trigger output; these waveforms are fed to the outside world via simple buffer amplifiers.

More details

The NE566's operating frequency is determined by an external resistor and capacitor and by the voltage applied to its control terminal. The resistor must have a value in the range 2k Ω to 20k Ω ; the capacitor can have any value, and the control voltage must be in the range 75% to 100% of the IC's supply voltage value.

The frequency can thus be varied over a ten to one range via the resistor, it can be varied or modulated over a similar range via the control voltage. Thus, in the simple application circuit of Figure 10, the IC is wired as a fixed frequency FM waveform generator; note that a 1nF capacitor is wired between pins 5 and 6, to enhance circuit stability.

The operating frequency of the NE566 is roughly equal to $2(V+ - V_c)/RCV+$. Put in a simpler way, Figure 11 shows the span of operating frequencies given at different C values by the Figure 10 circuit when R has a value of 4k Ω ; the frequency varies from 5Hz at 10 μ F to about 200kHz at 100pF. Figures 12 and 13 show how, when the C value is fixed, the frequency varies when the control voltage or the R value is varied.

Figure 14 lists the main parameter values of the NE566. Note that both output waveforms are available at a very low impedance level (about fifty ohms). Figure 15 shows the typical shapes and voltage levels of the output waveforms when using a 12 volt supply.

Finally, to complete our look at the NE566, Figure 16 shows some modifications that can be made to the basic Figure 10 design to convert it into a wide range 3 band FM generator. Here, the frequency is fully variable via RV1, and is switch variable via range selector SW1, and the triangle and square wave output levels are fully variable via RV2 and RV3. The waveforms can be frequency modulated by applying the modulation waveform to pin 5 via C1; note that R3 is used to raise the circuit's input impedance to about 22k Ω .

Next month

In next month's edition of *Data File* we will take a detailed look at the NE567 tone decoder IC.

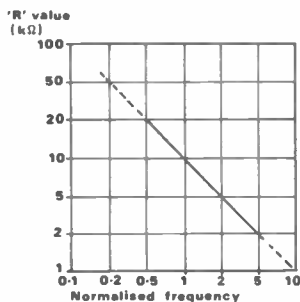


Fig 13 Normalised frequency of the Fig 10 circuit as a function of 'R' value

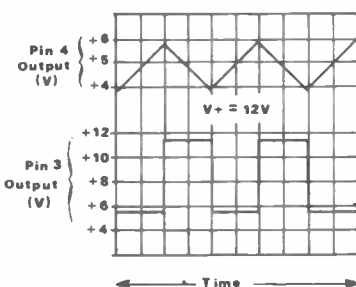


Fig 15 VCO output waveforms

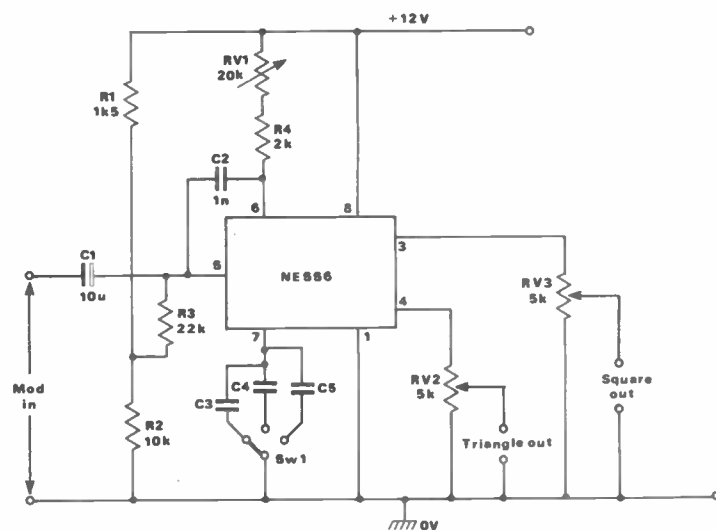


Fig 16 Wide-range 3 band FM generator

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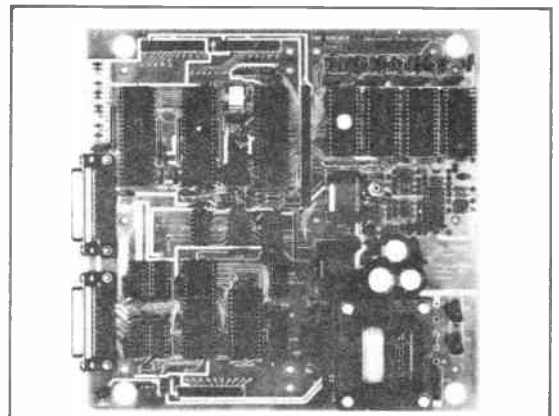
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The Icom IC04E



The Icom IC04E is one of a number of 430 to 440MHz FM only hand-held transceivers available in the UK from the major amateur radio equipment manufacturers. This transceiver has not received the popularity of the other offerings, possibly due to an aggravating loss of repeater shift in the older samples of the rig. With the recent introduction of a Mk2 transceiver, there are now two rigs called the IC04E and whilst they are identical externally, they differ in those items that the writer found most annoying in the old style rig. Hopefully all of the old style rigs have now been sold, but the reader will need to find out whether he or she is being offered the old rig on the secondhand market.

The simplest way to do this is to put the rig into repeater shift mode and prove its operation by watching the display when transmitting, as the shifted frequency will appear on the display. Now press the up '# hash' and then the down '* star' keys that will bring the original frequency back onto the display. Finally, press the PTT again; the new rig will still have the shift during transmit – the old one will not.

In this article I have initially reviewed the older rig and reviewed the much improved Mk2 rig's amendments at the end. Although an old rig by some standards, the introduction of the Mk2 makes it interesting to look again at the IC04E as the introduction of the new micro transceiver will still leave the IC04E as the only 70cm keyboard hand-held in the Icom range.

The earlier rig

The rig arrives in a two part sleeved polystyrene box in which the main radio, the battery pack, wall battery charger, antenna, belt clip with fixing screws, earphone, wrist strap, three plugs and the instruction book are packed. The packaging is very uninspiring, but belies the quality of the rig it protects and obviously does an adequate job as the rig arrived without a blemish. On receipt the battery is normally discharged and will need 15 hours charging before use.

The charger is fitted with a shaver type two pin plug and, as no adaptor is provided, the new owner will need to make the necessary arrangements. The battery pack can be detached from the rig for charging, and this gives a good opportunity to read the instruction book while still keeping hold of the rig. One very nice touch is that the battery pack is fitted with a charge indication LED. A simple way to check that the battery is charging rather than finding later that one of the plugs is not pushed fully home.

The battery supplied is the BP3 unit which gives 250mA hours at 8.4V. The most interesting point at this stage is that

the rig can be run from an external 13.8V power supply (the limits are 5.5 to 16 volts) through one of the plugs supplied, and does not need the battery attached during external powered operation.

This also means that it doesn't need an additional power supply unit to convert the 13.8V from the external supply or a car battery to a voltage usable by the rig.

The transceiver is 166mm high by 65mm by 35mm, including the BP3 power pack, and weighs 515g. The flexible antenna is an additional 166mm. Looking at the front, the LCD display is at the top left hand side with a 16 key keyboard labelled 0 to 9 and A, B, C, D, * (star), # (hash). Below this is the speaker grille and the built-in electret microphone. On the left hand side are the function switch; the toneburst switch, which sends carrier and tone when pressed without needing the PTT to be pressed as well; the PTT switch; and, at the bottom of the main rig, the battery pack release catch. The function switch allows most of the keyboard to have second functions.

The top panel has the BNC socket for the antenna, push buttons for display illumination and output power level, the squelch and on/off/volume control, and three sockets for external power input, microphone input and earphone output. At the top on both sides there are rings for fitting the wrist strap, depending on the users preference.

The display packs a lot of information into a small space and the top line of characters is of necessity rather small, in fact too small to read easily. This top line has the + or - for the repeater shift, T for transmit, S in scanning, L with the keyboard lockout set, and Δ the low battery indicator. Below this is the frequency readout, consisting of a small 4, the M for 'memory in use' appearing above it. In memory use the 4 disappears and becomes the memory number, followed by a large 3, three large digits and a final small 75, 50 or 25 as appropriate. At the bottom is a line of dots that act as an S meter or power out meter.

The IC04E is a synthesized transceiver, actually covering 430.0125 to 439.9875MHz with ten memories numbered 0 to 9, and with scanning facilities that can be set to either 25 or 12.5kHz steps. Power output can be set to 500mW or 2.5W with the standard battery, but at the high setting the power output rises to 5W with a supply above 13.2V. Any valid frequency can be set into the VFO directly (Icom call it the dial mode) from the keyboard, only the scanning needs the step size to be preset.

Frequency entry is very easy, in fact too easy, because if one of the numeric keys is accidentally touched the rig immediately treats this as the megahertz

a review by David Sylvester G4TJG

digit of a new frequency unless the lockout is set. I rather prefer the system where the new frequency has to be pushed into the VFO with an additional key, rather than the direct acting system used here. The lockout can be set by pressing the function and the D keys together, and unset by the same keys in a toggling action. In this dial mode the rig's new frequency is set by pressing three numeric keys; these are treated as the MHz and 100kHz for the first two, but the last key sets the remainder of the frequency (ie 327 will set a dial frequency of 433.2750MHz, 326 will set 433.2625MHz). Any error in pressing the keys will recall the original frequency on the display. The handbook lists the rest of the final key options.

When a new frequency is set, the repeater shift must be set every time, as any action in the dial mode loses the shift; even the use of the up and down keys. In fact the ease with which this rig loses the repeater shift is probably its most annoying point. However, this annoyance of shift loss is tempered by the fact that any repeater shift can be set. If you really want any offset over the 10MHz range, it can be set in 12.5kHz steps, so an offset of 5.5125MHz is a valid offset and will be acted upon. Silly as this may seem, it does have its uses when the rig is taken abroad, as it can cope with any of the continental repeater shifts. A reverse repeater button is included, and this is a good addition for checking on the repeater input.

Having commented on the repeater shift loss, it should be noted that any of the ten memories will hold both the frequency and its own shift, and that these memories can be scanned, recalled or written to, as is to be expected from such a rig. There is a second programmed scanning mode, in that a band of frequencies using the memories 0 and 9 as the lower and upper limits can be scanned. With memory 0 set to 433.000 and memory 9 to 433.500, all of the repeater channels and the simplex calling channels can be covered continuously. Once again, in programmed scan the repeater shift disappears, which makes it difficult to come back to a call quickly, though in memory scan there is no problem.

While scanning any signal will stop the scan until it disappears, rather than waiting for a short time and then continuing. In memory scan, pressing the C key will increment the memory number by 1, and if this frequency is clear the scan will resume. The rig can be set into a priority memory recall state so that a favourite channel held in memory 1 can be checked every 6 seconds, and the D key acts as a call button, in that the operating conditions in memory 1 are recalled immediately.

The use of channel 1 for both is a serious limitation. Memories 1 to 6 can only have the repeater shift that is held in memory 1, while memories 7 to 0 can have separate shifts stored as well as the frequency. But, of course, memory 1 is fixed to the call-priority channel conditions and memories 0 and 9 are taken by the scan limits, which is not very helpful.

On the subject of the handbook, this is the usual mixture of English written by the Japanese and takes some reading if the full benefit is to be obtained. The book covers the other options in the IC04 range: the A and AT as well the E version tested. There is a short troubleshooting section and a block diagram of the circuit, the full circuit diagram being enclosed as a separate sheet with the main book.

On air

All reports received whilst using the rig have been good, both on the 500mW and 2.5W output power from the standard power pack and with a 13.8V external supply. Reception has also been good, but with only 2.5 watts output you will not be able to work all you can hear, although with UHF you can never tell what will happen until you try. I feel that the PTT switch-on is rather heavy and has caused an aching finger on even short transmissions, but this may just be a stiff switch on this sample of the rig. There is a good click between receive and transmit. The battery size is a very difficult subject, as increased capacity must incur an increase in weight. There are an additional 6 power packs to choose from, so Icom obviously appreciate that the power-to-weight equation has very much an individual solution.

With its standard pack the rig is nicely balanced in my opinion, and is adequate for the task it is asked to do. It helps, of course, to use the 500mW output as much as possible, as this reduces the current drain by well over half that on the 2.5W output. With a fully charged standard pack the writer has found that the radio will run for roughly 3½ hours before the battery requires recharging, including some short QSOs on the 500mW output level. For longer monitoring, or for use in a car the fact that a 13.8V battery or power supply can be used directly is a real help. During extended use with an external supply, Icom recommend that the battery pack be removed as it charges up when the external power is used and the NiCads could be overcharged, shortening their life.

The audio output is adequate for normal environments, although when the rig is worn on the belt it is rather quiet. The HM9 speaker microphone or the HS10SA or HS10SB headsets will

help here, but were not tested. One of the headsets and a power amplifier could turn the rig into a simple mobile station, providing you don't want to change repeater frequency whilst on the move. Small portable rigs of this type are ideal for taking aboard on business or holiday trips, and this rig scores in that it will accept any repeater shift and so can easily cope with the + and -1.6MHz, -4.6MHz, +7MHz and +7.6MHz shifts that exist in Europe, using the single VFO available. If used in one small area, then memory scanning overcomes the repeater shift loss problem and in any new area the programmed scan is good, but the shift loss really does slow down a response to a call possibly sufficiently to lose a contact. All in all however, the rig is simple if frustrating to use, easy to carry, and once its quirks are understood, will become a good companion.


The Mk2 rig

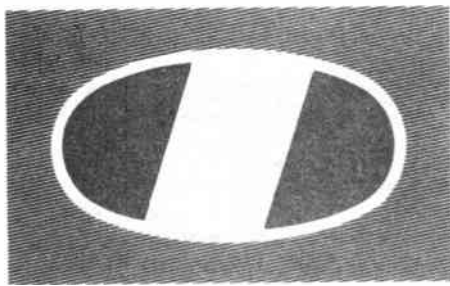
The Mk2 version of the rig changes a good but annoying transceiver into a very nice piece of equipment indeed. Gone is the major criticism of the repeater shift loss when using the up and down keys, or when new frequencies are set via the keyboard. The Icom engineers have obviously taken a good hard look at the rig and eliminated all of the aggravating points, while leaving all its good points alone. In most areas the new rig remains identical to the earlier model. None of the points criticised above remain and now the repeater shift has to be deliberately cancelled. In the UK the 1.6MHz shift is first set using function and 7 (shift) and then typing 1, 6, 0. This value is then remembered and is turned on and off with function and # (shift positive), and cancelled only by the same function # action.

The programmed scan limits move to memories, 5 and 6, but now the call and priority frequency have separate memories, 3 and 4 respectively. The use of the new memory numbers allows memories 7 to 0 to be released to hold separate repeater offsets from those in use through the shift function. Incidentally, in this rig the PTT switch seems much lighter than in the earlier type, so this problem may have been with the first unit alone.

The new Icom IC04E has promise as a useful member of the Icom range and will hopefully shrug off its uninspiring image, especially in face of the new offerings that are coming onto the market. In its new guise the rig certainly deserves to be a success.

Acknowledgement

The author would like to thank Icom UK, Sea Street, Herne Bay, Kent CT68LD for the opportunity to test the rigs. 



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IC-2E 2 metre Thumbwheel Handportable

This popular handheld from ICOM is still available. For those amateurs who require a straightforward and effective FM transceiver the IC-2E takes some beating. Frequency selection is by means of thumbwheel switches (with 5Khz up switch) simplex or duplex facility. Power output is 1.5 watts or low 150 milliwatts (2.5 watts possible with BP5A battery pack).

IC-02E/04E 2 metre and 70cm Keypad Handportable

These direct entry CPU controlled handhelds utilise a 16 button keypad allowing easy access to frequencies, memories and scan functions. Ten memories store frequency and offset, these handhelds have an LCD readout and power output is 2.5 watts or low 0.5 watt. 5 watts is possible with the IC-BP7 battery pack or external 13.8v DC.

IC-12E 23cm Handportable

Similar in design and style to the 02E/04E this 1296Mhz handheld utilises ICOM's experience in GHz technology gained by the excellent IC-1271E base station. Power output is 1 watt from the standard BP3 nicad pack, external 13.8v DC powering is available to the top panel jack. With the growing number of repeaters on 23cm the IC-12E makes it an ideal band for ragchew contacts.

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IC-28E, 2m FM Mini-mobile.

This 2 metre band transceiver is just 140mm (W) x 50mm (H) x 133mm (D) and will fit nearly anywhere in your vehicle or shack. Power output is 25 watts or 5 watts low power and is supplied complete with an internal loudspeaker.

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

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

Options include IC-PS45 13.8v 8A power supply, SP8 and SP10 external speakers, HS15 flexible mobile microphone and PTT switchbox.



IC-3200E, Dual-band transceiver.



If you are a newly licensed or just undecided about which band to first operate, then the ICOM IC-3200E is just the answer. This is a dual-band (144-146/430-440MHz) F.M. transceiver ideally suited for the mobile operator. The IC-3200E has a built in duplexer and can operate on one antenna for both VHF and UHF, and with 25 watts of

output power on both bands (the low power can be adjusted from 1 to 10 watts) you can never be far from a contact whether simplex or 2m/70cm repeater.

The IC-3200E employs a function key for low priority operations to simplify the front panel and a new LCD display which is easy to read in bright sunlight, 10 memory channels will show operating frequencies simplex or duplex, and four scanning systems memory, band, program and priority scan.

IC-48E, 70cm. FM Mini-mobile.

This 70cm. band transceiver is so small that it will fit almost anywhere in your vehicle or shack. Power output is 25 watts or 5 watts low, the IC-48E is supplied complete with an internal loud-speaker. The large front panel LCD readout is designed for wide-angle viewing with an automatic dimmer circuit to control the back lighting of the display for day or night operating. The front panel of the IC-48E is straightforward to make mobile operation safe and easy. The IC-48E contains 21 memory channels with duplex and memory skip functions. All memories and frequencies can be scanned by using the HM15 hand mic provided.

IC-48E options include the PS45 13.8V. 8 amp power supply, SP8 and SP10 external loudspeakers, HS15/SB mobile flexible microphone and PTT switchbox.

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CAR MAKERS LOOSEN

THE HARNESS

James Fletcher looks into new methods of car wiring, and finds that the microprocessor is likely to squeeze out miles of it.

If you have ever been unfortunate enough to have a wiring fault on your car it won't have taken you long to work out that finding the fault is far from easy since the wire that you are tracing soon disappears with dozen of others into a complex wiring harness. The wiring harness makes for easy installation of a large number of complex connections when the car is first manufactured, and can be installed into the bare body-shell by unskilled labourers, or even robots, without any knowledge of electricians. Colour-coded wires of appropriate sizes emerge from the harness at the places where switches, lights and other electrical accessories are to be connected.

Although the harness system is undoubtedly efficient from the manufacturers' point of view, a modern harness contains a good deal of heavy gauge copper wire which makes it a fairly heavy and bulky component as well as being costly to manufacture. To facilitate the initial installation, the wiring harness is usually divided into at least two sections, one section being typically in the engine compartment and the front of the car, the other section containing the wiring for the rest of the car. The two parts are joined by multi-way connectors on the bulkhead, and these connectors are invariably weak points as far as reliability is concerned.

It is not surprising, therefore, that car manufacturers are showing interest in an alternative method of wiring which considerably reduces the amount of wire, and leads to far fewer connections.

At its simplest, such a system requires just three wires to be installed in a sort of ring-main around the perimeter of the car. *Figure 1* shows how two of the wires carry the supply current and the earth return, and the third wire forms a 'bus' carrying a stream of computer data. The three wires are looped in and out of the various electrical devices, such as lights, windscreen wipers and indicators, small

electronic decoder modules being fitted at the appropriate points.

When a switch on the dashboard is pressed in order to switch on the side lights, for example, a microprocessor generates an appropriate burst of code, which passes all around the ring-main. This data is ignored by all the decoder modules except those connected to the side lights, which recognise the code addressed specifically to them, and switch the power through to the side lights accordingly.

When the switch for the direction indicators is operated, a different coded

message is sent around the bus wiring system, to be recognised by the appropriate decoder module and then acted upon.

A practicable system of this type is necessarily a little more complex than this initial description indicates, but National Semiconductor have now developed a set of integrated circuits ideally suited to use in cars. *Figure 2* shows how their system uses a master control computer chip to generate the various control codes, and a series of slave chips which respond to the instructions from the master controller.

The COP1430 chip is a four-bit microprocessor with sufficient capacity to act as the master controller, and built-in UART (universal asynchronous receiver-transmitter) facilities allow it to communicate at speeds of up to 9600 baud with up to around 28 slave modules. A command from the master to any one or more of the slaves, which are installed at various connection points, or 'nodes', around the car, is sent as a sequential series of pulses that follow the well established UART format of one start bit followed by 8 data bits and then one stop bit.

The slave units are built around the COP413L, another 4-bit microcontroller, which comes complete with an 8-bit directional input-output port and a serial expansion port. In order to reduce the density of the data that is transmitted along the bus wire, the master controller can address the slaves individually, or as a group or class. A class consists of a group of slaves which have common functions, so that all the appropriate lights can be switched on with just one command, eliminating the need to send large amounts of data for those occasions when hazard warning lights need to be energised, or all the fog lamps need to be illuminated.

Inputs to the system are via a keyboard, which provides all the usual switch functions that you would expect in a

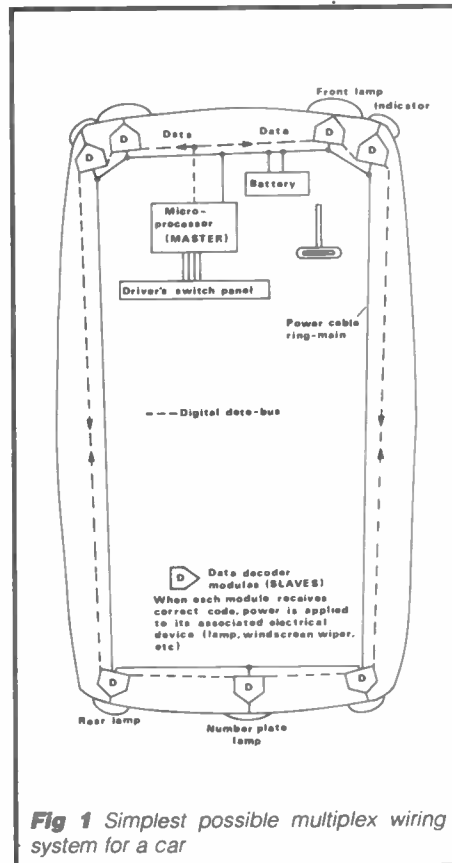


Fig 1 Simplest possible multiplex wiring system for a car

car. However, traditionalists shouldn't despair, it should be quite possible to replace the keyboard with a set of chrome toggle switches set in a mahogany dashboard on the more up-market models!

The car's instrument cluster is connected to the system via one of the standard slave modules. Signals from sensors around the car, such as temperature, oil pressure, and fuel level are multiplexed into the data bus wire, and the master processor can keep its eye on all the car's systems and take the necessary action. If a bulb fails, or the oil temperature rises, this information will be brought to the driver's attention on a display screen that is controlled by yet another National Semiconductor chip, the NS455 terminal management processor.

For those of you who are beginning to wonder how expensive all this digital electronics is going to work out, I should perhaps say that the COP413L chip currently sells for around 70 pence in quantity. If car manufacturers were to start using this type of system in earnest, costs could come down much further until the total cost of an integrated electronic multiplex system could be less than that of today's harness. **REW**

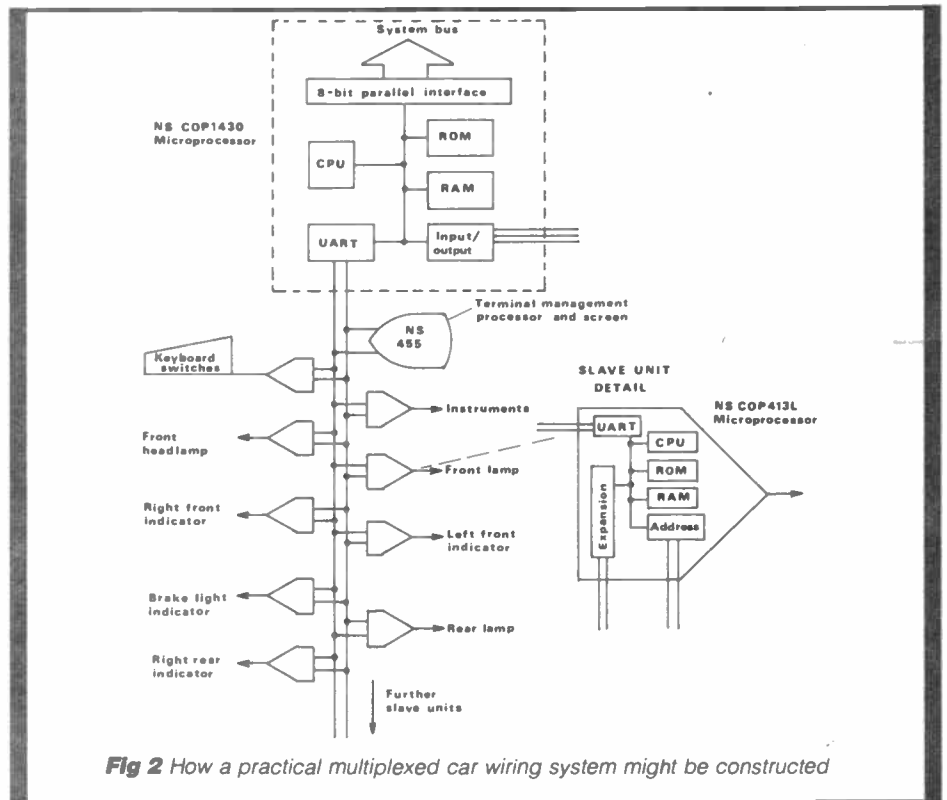


Fig 2 How a practical multiplexed car wiring system might be constructed

NEXT ISSUE

Radio & Electronics

The communications and electronics magazine **World**

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Brian Kendal G3GDU continues his series with a look at Primary Ground Radar and how it works

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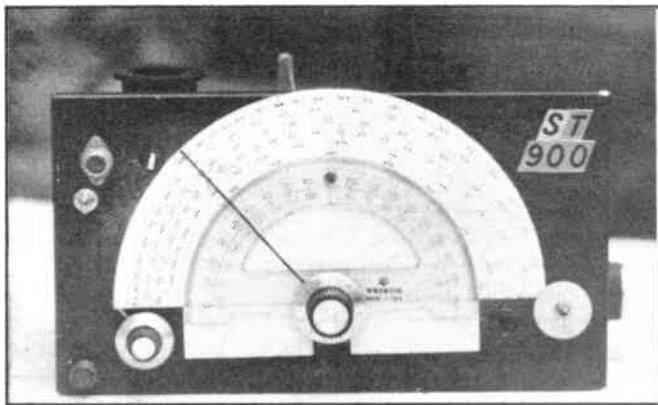
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THE ST900 – 50 YEARS ON



Osborne Postle G3EPZ details the construction of a modern-day ST900, which was originally designed by the respected Mr John Scott-Taggart W6TC and launched in 1937 as a home constructed set offering world-wide reception to the radio enthusiast

The interest shown by *Radio and Electronics World* readers in the article *ST800 – Antient and Modern* published in the December 1986 issue, prompts a description of the later receiver titled above. The ST900 was the last of those well-known receivers designed by Mr John Scott-Taggart. Launched in 1937 it was a home constructed set offering world-wide reception to the radio enthusiast.

The present receiver, made fifty years later, retains the basic conception of the original, but the valves, plywood, high and low tension batteries and loud speaker have been discarded in favour of a conventional metal panel and chassis, transistors and headphones. As can be seen in the photograph, the ST900 is a small, self contained, general purpose receiver covering a wide frequency range with little or no bother to set up.

The most striking feature on the original ST900 was the use of plug-in

coils and rejection of toggle type on/off switches. To discard the 'fiddling' associated with plug-in coil insertion, Mr Scott-Taggart persuaded British Television Supplies Ltd, the coil manufacturers, to provide a locating spigot on the coil bases, similar to those on International Octal valves.

These ensure correct coil location – even 'blindfold', and they were called BTS 'One Shot Coils.' His choice away from switched coils was no doubt a result of the desire to ensure top class performance in short wave reception. General public short wave listening in those days was in its infancy and switched coils were believed to be less efficient than plug-in coils at high frequencies; a point made years later by *QST's* editor Mr Ed Budlong in July 1957 when he praised the selection of plug-in coils for their HBR series of amateur communication receivers.

He wrote, 'The coils used by W6TC are

wound on 1½in diameter polystyrene forms, they are probably better coils than are found in any band switching receiver.' The abandonment of switches in favour of wander plugs and sockets probably arose from experiences gained with the combined switch/potentiometer units of that time, which after some use often deteriorated to a noisy volume control and indifferent switch action.

Earlier innovations

As with his earlier receivers, Scott-Taggart used innovations to aid the reception task of a straight receiver in handling the increasing congestion that was encountered on the long and medium wave bands. Amongst the foremost of these was his 'triple extraction unit: a three station (one long and two medium wave), aerial wavetraps which can be very useful, even today in quelling a noisy local broadcaster. Another feature used to aid multi-station recep-

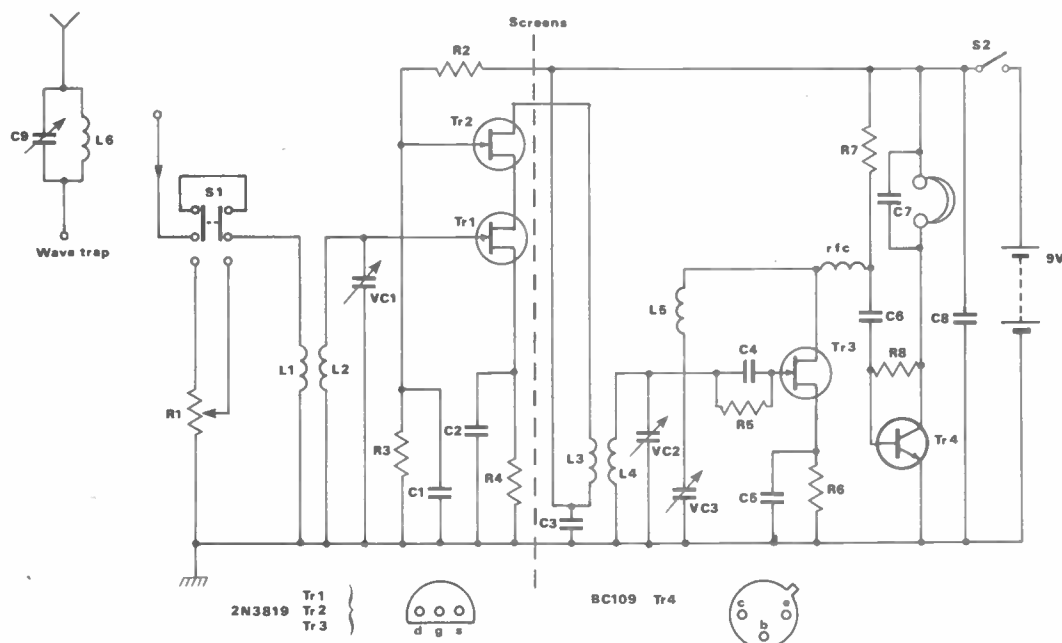
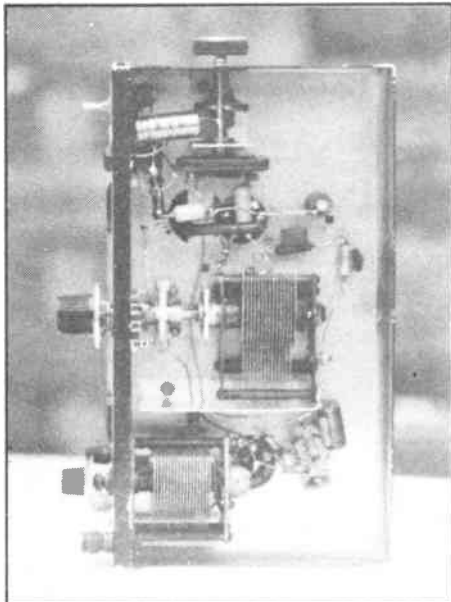


Fig 1 ST900 – Fifty years on – circuit diagram



Photograph 2 ST900 underside view

RANGE	TURNS			FORMER	PITCH
	Primary	Gate	Reaction		
150kHz-300kHz	400 estimated	480 estimated	90 estimated	BTS	9 piles
500kHz-1.6MHz	Denco Green Range 2			Raymart	-
1.5MHz-3.9MHz	8	32	7	Raymart	16 tpi
3.5MHz-12.5MHz	5	10	4 1/4	BTS	14 tpi
6.5MHz-27.0MHz	2	4	2	BTS	14 tpi
10.5MHz-30.0MHz	1 1/4	2	2	BTS	14 tpi

Wire gauges: 32swg cotton covered for long wave coils
 22swg enamelled for home wound gate and reaction coils
 26swg enamelled for primary windings
 20swg enamelled for gate and reaction windings on BTS formers
 32swg cotton covered for primary windings on BTS formers

Note: As an alternative to long wave coil winding, a pair of Denco Green Range 1 coils could be used

Table 1 ST900 – fifty years on – coil data

tion was his so called 'X' reaction. This was simply radio frequency stage reaction as well as the conventional detector stage facility. For this a separate triode valve and reaction condenser were used. Finally, the original model had an exceptionally large tuning dial and pointer, on to which one marked the exact tuning position of a given station to enable easy return to any of the multitude of stations whose names were printed thereon. This he christened his 'Spot-on dial'.

All components of the assembled receiver were screwed on to a 16in x 12in

metaplex plywood panel, which was set at a convenient slope for ease of tuning, and the constructor was aided by a full-size blueprint that was presented free in *Popular Wireless*, October 30th, 1937, or costing 1/- for separate purchase.

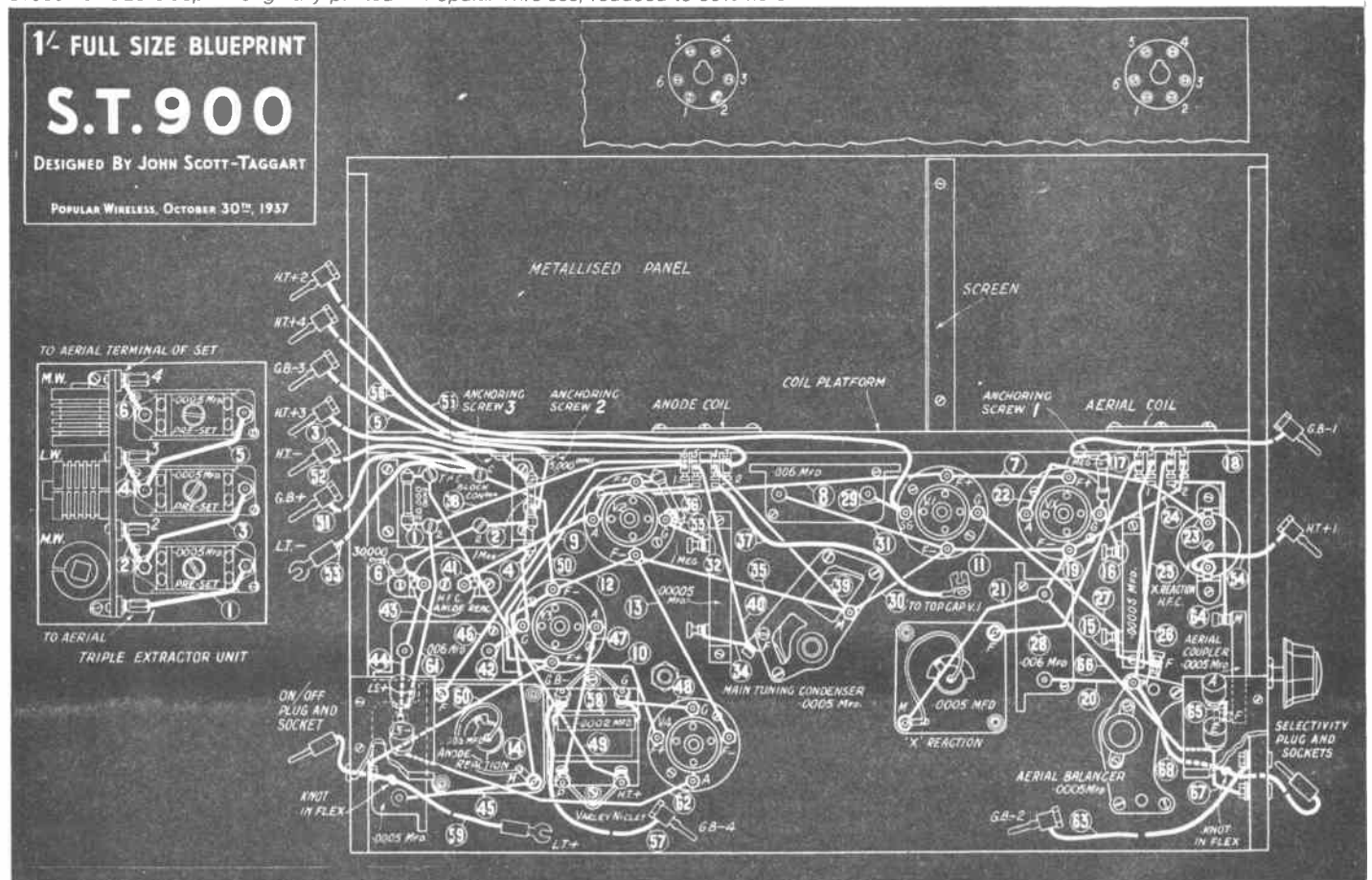
ST900 – Fifty years on

As may be seen in the photographs, all the major components that characterised the original set have been used – ie the plug-in coils, the JB and Polar type tuning condensers, a Graham Farish Litlos reaction condenser, and a single wavetrap extraction unit for Droitwich on

long waves. Three FETs and one transistor replace the valves and a nine volt pentorch battery pack supplies the power. Figure 1 shows the circuit used is a cascode RF stage, a leaky-grid detector and a single transistor stage for headphone reception. Credit for parts of the circuit is acknowledged as follows: to Mr R A Penfold for the aerial input attenuator, to Mr T Bailey for the cascode RF stage, to Mr G C Dobbs for the LF stage and the classic leaky-grid detector and reaction circuit which I suppose go back as far as Mr Reinartz himself.

Life started for the panel and chassis

ST900 Full size blueprint originally printed in *Popular Wireless*, reduced to 30% here



as a 29 × 15 × 7.5cm aluminium box – with holes. The lipped lid formed a very sturdy front panel and the deep box portion easily housed the components (see photographs 1 and 2).

The most critical item of assembly is the placing of the main tuning condenser, which has to be very carefully sited so that the sweep of the moving vanes does not extend outside the confine of the chassis depth. A small slow-motion ball drive and a flexible

coupling complete the main tuning control, and the JB condenser is rigidly fixed to the underside of the chassis by a stout aluminium bracket.

The calibrated portion of the dial extends outwards from a large school-type geometry protractor, with an 11cm pointer to indicate the frequency setting for each coil range. Other items which are attached to the panel are the RF stage tuning condenser (aerial balance control in ST language), the on/off switch

and the headphone jack socket, placed on the lower right hand side. The higher left hand portion of the panel houses the aerial input socket, the attenuator potentiometer and its by-pass switch, whilst at the extreme lower left hand side there is an earth connection terminal.

The reaction control knob is placed around the corner on the right hand side of the chassis; the slow motion drive and comfortable placing of a control that is in constant use when tuning allow stable and docile onset of reaction – an important facet for the successful operating of any straight tuned receiver.

Extended range

A small screen has been fixed between the two tuning condensers to help ensure isolation between the respective stages, and a much more important one can be seen above deck to remove interaction between the two tuning coils. The coil bases are placed to allow short direct connections with their respective tuning condensers, and the extended high frequency range obtained with the BTS coils is indicative of the lowered minimum stray capacities attained thereby, compared with that experienced with the original layout and wiring. The six pentorch battery pack is secured with two clips and a rubber band, whilst the 25K potentiometer used as an attenuator, having no screw fixing, is super glued to the back of the front panel.

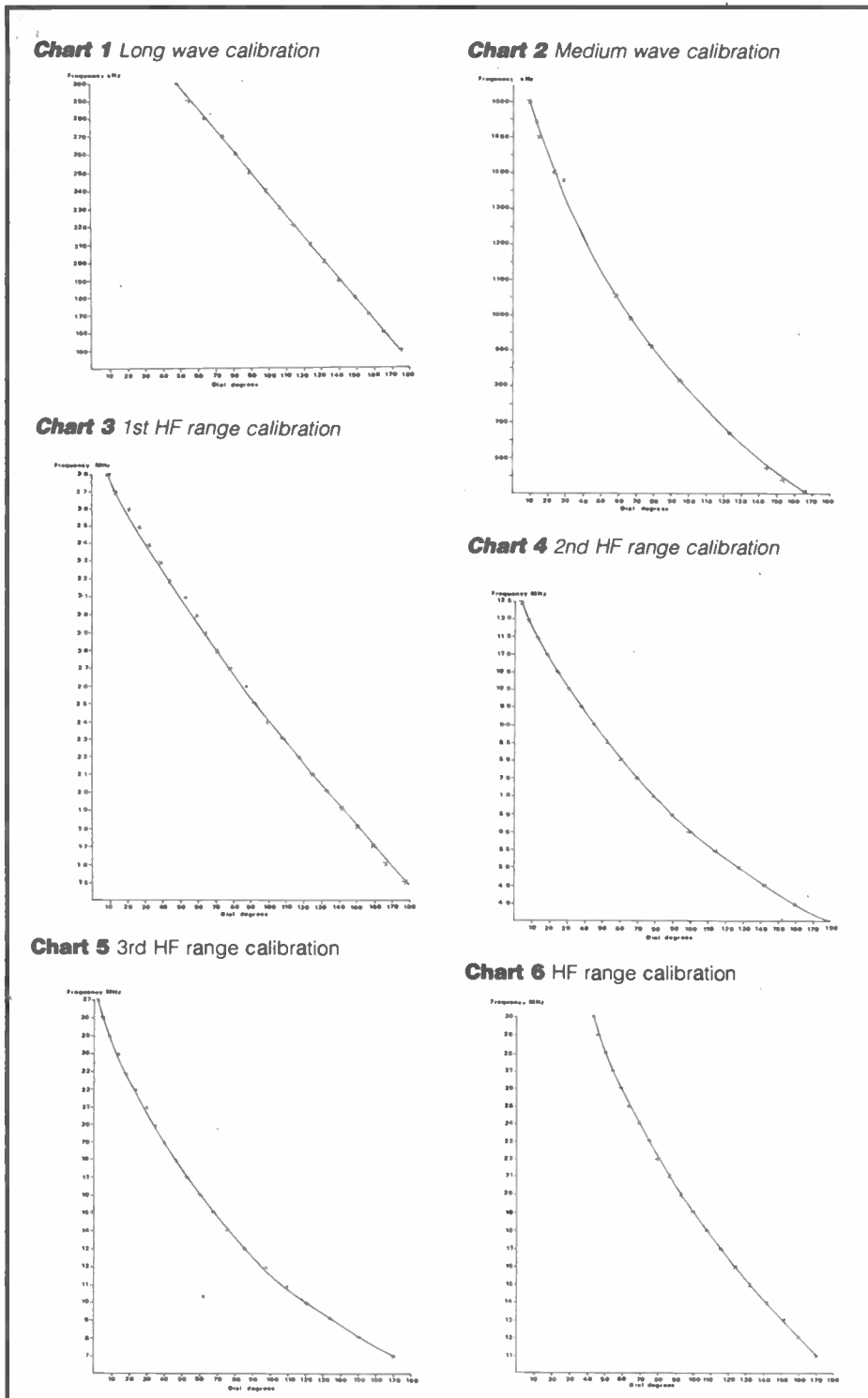
The twelve coils

In all, twelve coils are used to cover from 150kHz to plus 30MHz. Of these, four have been home wound to extend the original ST900 limit of 70 metres up to the high frequency end of the medium wave band, including both the eighty and one sixty metre wave bands and the so-called tropical broadcast bands of ninety and one-twenty metres. Details of all the coils are given in *Table 1*.

The inside coil connections of the six pin coil base to the respective windings are shown in *Figure 2* – as viewed from the pins side of the coil.

Although the original design used X reaction as an added gain device, this feature has not been included in the present circuit. This is because, as with the ST800, a modicum of RF interaction is evident as the two tuning circuits are brought to resonance. This very slight trait is advantageously controlled by the slow motion tuning of the stage's condenser, allowing the detector stage to be loaded just enough to stem the onset of incipient oscillation and thereby act as a clarifier for SSB speech and a pitch control for CW.

Charts 1 to 6 are plots of the frequency range of each coil set, from which the regular frequency settings have been determined and marked on the dial. For accurate intermediate settings a trans-



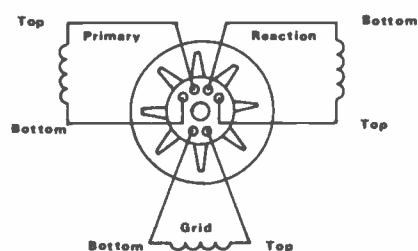


Fig 2 Coil pin connections. Windings anticlockwise when viewed from base

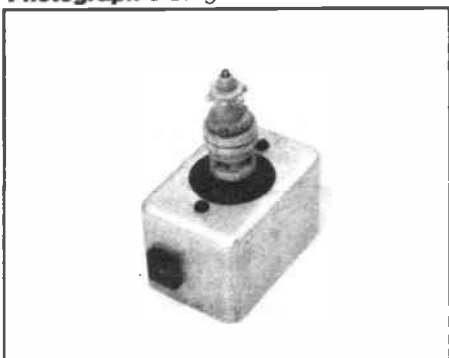
position from the frequency ordinate to abscissa degrees on the appropriate chart will enable a correct setting to be made with the main tuning condenser. Checks can always be made by reference to the standard frequency transmissions that are constantly available.

Some further points

Expert constructors will be aware of the relatively large capacity of the main tuning condenser specified by Mr Scott-Taggart. For long and medium waves as well as the low frequency short wave bands it is ideal, but above about 12MHz it does lead to very critical tuning. On the other hand, however, the choice does provide wide frequency coverage with each coil set and with the skill that is always required for successful straight receiver tuning, even 28MHz amateur stations can be logged, but they do require very delicate fingers on the tuning knobs. Indeed, as may be seen from the highest frequency scale, calibration has not been extended beyond 30MHz, this being the limit of sensible tuning with the specified condenser. But as the set is intended to be a duplicate of the original ST design, no attempt has been made to remove that particular shortcoming.

Readers should note the use of an earth terminal. Although the set will work quite well without an earth – indeed above 3.5MHz there is no need for one – on the long and medium wave and Top Band, coil sensitivity is improved significantly with an earth connection. Another point on long wave operation relates to taming the BBC Droitwich transmitter. The device for eliminating the spread of

Photograph 3 Longwave extractor unit



this station over less strong adjacent ones is the wavetrap shown in *Photograph 4*. The circuit shown as part of *Figure 1* comprises a Denco Green Range 1 coil, parallel tuned by a compression trimmer. The procedure adopted requires the offending station to be first tuned on the receiver and then silenced by adjustments of the coil core and trimmer of the wavetrap. By inserting the device in the aerial lead whenever the long waveband is in use, it will permit reception of other stations free of interference from our own friendly giant.

Coil substitutes

Of the twelve coils needed to span the frequencies quoted, eight are original BTS types, whilst the other four are of Raymart manufacture. However, because the original two medium wave band coils had found employment elsewhere, it was necessary to make provision for Denco Green Range 2 coils to be used to tune that band. These coils fit easily inside Raymart formers and they can be fixed by passing the threaded portion through the hole provided in the middle of the coil base, having made the necessary coil conversion connections as shown in *Figure 2*. Also, the extra capacity of the tuning condenser above the 300pF recommended by Denco now extends the range of these coils to just below the 500kHz frequency.

On both the long and medium wavebands, however, the gain of the cascode front end may be excessive and need the use of the attenuator to stop squegging at the high frequency end of the bands. Further protection from the malady on medium waves (if it occurs) can be had by fixing a small 100pF fixed condenser between the drain end of the reaction winding and earth. This will also aid the smoothness of the reaction control on the band.

On short waves the attenuator is useful in reducing night-time noise and QRM, and when not in use can be bypassed by using the double pole two way switch situated just below the aerial input. The original need for placing such a switch was merely to fill in an ugly hole unkindly made by the box makers! But in practice it is useful for helping weak signal reception by making a direct connection between the aerial and the primary winding of the RF tuning coil. Finally, readers should note that in the coil table only an estimated number of turns is listed for the long wave band coil. This is because attempts at turn counting with that particular set of coils had to be abandoned, it being obvious that the wire's insulation was being ruptured during the unwinding exercise.

Conclusion

An assessment of the success of any project ultimately will relate to its behaviour in use. And whilst nowadays it

is usual for a host of figures and charts to be given as evidence in this connection, in the present case, apart from coil calibration charts, no such data has been collected.

Suffice it to say that I am confident that the majority of what is available on the air within the span of this little receiver will be heard.

Always bearing in mind that it is a straight tuned radio frequency set, and as such needs that rather special skill of being tuned alongside incipient reaction to achieve full potential. That is exactly how it was fifty years ago and it will be found to be no different today!

Components

Resistors

R1	25k wire wound potentiometer
R2	33k
R3	33k
R4	5k
R5	20M
R6	2k
R7	5k
R8	2M

Capacitors

VC1	500pF
VC2	500pF
VC3	500pF
C1	4nF
C2	0.1µF
C3	50nF
C4	100pF
C5	10nF
C6	0.1µF
C7	3nF
C8	2µF
C9	500pF compression trimmer

Inductances

L1	Primary winding
L2	Gate winding – RF stage
L3	Inter-stage winding
L4	Gate winding – detector stage
L5	Reaction winding
RFc	2.5mH choke
L6	Wavetrap winding – Denco Green range 1

Miscellaneous

Headphones	2k per ear piece
2 Slow motion ball drive units	
1 Flexible coupler	
2 Six pin coil bases Eddystone No 964	
1 Double pole two way switch	
1 On/off switch	
BTS, Raymart, and Denco coils	
6 Pen torch batteries	
1 9 volt pen torch type battery case	
Knobs, terminals, screws, panel and chassis.	

Total current consumption = 4.7mA

MEDIUM WAVE



DXING

by Steve Whitt

As you read this there are only a few days left till Christmas is upon us, so if you are hoping for a new receiver, or even for some good DX conditions now's the time to let Santa Claus know! Perhaps he'll reserve a copy of the forthcoming *World Radio TV Handbook* for you.

World Radio TV Handbook

Undoubtedly the most vital reference book for any DX shack (for either the MW or the SW listener), is the *World Radio TV Handbook* published by Billboard. The 1987 edition is still in the shops, but the new 1988 version is just being compiled and I am informed that it should be available by January 1988. This year the *WRTH* retailed from bookshops at £17.95, but as yet I do not know the price for 1988. Even if there is no price rise, this is quite an expensive book, but a number of radio clubs usually band together to obtain a specially negotiated pre-publication price for their members and it would probably be worth joining such a club for this reason alone – the saving on the book price could cover the cost of club membership.

If you are interested, try contacting the Secretary of the British DX Club, at 54 Birkhall Road, Catford, London SE6 1TE (mainly a SW club, but it also covers MW and VHF) or the Medium Wave Circle (Club Secretary) at 137A Hampton

Road, Southport, Merseyside PR8 5DY (this specialises in Medium and Long Wave radio).

Great circles

As the DX signals come pouring in, I'm sure you'd like to know how far away the station you're listening to actually is. If you have a world globe and a piece of string, you could measure the distance – provided the string doesn't stretch of course! There is, however, a rather more scientific way to calculate the Great Circle distance provided you know the latitude and longitude of your location and that of the station.

Let's call the location of the receiver Lat(r), Lon(r), and that of the transmitter Lat(t), Lon(t).

Firstly, make sure that co-ordinates are converted from degrees and minutes into decimal fractions of a degree. And also convert latitude north of the equator into (+) and that south into (-). Thus for example 103° 45'S is converted into -103.75°. Similarly, longitude is defined so that East of Greenwich is (+) and West is (-).

The first move is to determine the difference in longitude between the two locations (ΔL) – it is important to note that there are two possible values, depending on which way round the world the signal is travelling. For the MW DXer, the long path need not be considered, so

make sure that ΔL is always taken as the smaller value. Now with a pocket calculator handy, it's time to plug the numbers into the following equation: distance (km) = $111.12 \times \arccos [\sin \text{Lat}(r) \times \sin \text{Lat}(t) + \cos \text{Lat}(r) \times \cos \text{Lat}(t) \times \cos \Delta L]$

To help clarify matters, let's work through an example. Consider the case of reception of Radio Globo from Rio de Janeiro here at my Ipswich location.

Rio: 22° 53'S, 43° 17'W becomes -22.88°, -43.28°, and Ipswich: 52° 03'N, 1° 10'E becomes +52.05°, +1.17°, therefore $\Delta L = 44.45^\circ$, and working through the numbers gives the distance as 9376.6km; not a bad bit of MW DX!

More English in Europe

Last month I highlighted some European stations that regularly broadcast programmes in English, either for overseas listeners or for Anglophiles living locally.

This month, we move a bit further south to examine similar stations operating around the southern rim of the Mediterranean. All the stations listed aim their programmes at local audiences but the keen DXer may be able to pull in their signals (Algeria is easily heard in the UK).

Curiosity corner

One of the problems facing a broadcaster is deciding where to locate the transmitter. Although the station's target audience probably live close together in a city or town, it is likely that the station will not be able to site the transmitter or its aerials in the centre of population. Nowadays, the station operator is faced with planning or zoning regulations which restrict the erection of large aerials, and the lack of cheap land needed for large MW aerials and their associated earth mats. Thus, with the exception of some operations established many years ago, broadcasting stations are forced to build out of town. This can create problems with the availability of power, access for repairs and connections back to city centre studios.

Without power there is no way that the station will run, and getting electricity or diesel fuel to remote locations can be unreliable and costly. Radio KHX in Prescott, Arizona has found a novel solution to the problem and has become the first solar powered station in the USA. At the same time, high on the tallest hill in Curacao (an island in the Caribbean), Radio Hoyer claims to be the first in the world.

The big wind

Nobody will forget the scenes of devastation that greeted them when they woke up on the morning of Friday 16th October. Hurricane strength winds had wreaked havoc across southern England, and the whole of London was without electricity. Waking up without power – and in places without water, the public turned to radio and TV for information and guidance, only to find

Table 1 Southern Mediterranean stations broadcasting in English

Country/Station	Frequency kHz	Transmission Time (UTC)	Notes
Algeria RTA Algiers	981	1900 – 2000	News & pop music show
Israel (offshore) Voice of Peace	1539	24 Hrs	pop music format
Jordan R Jordan	855	0530 – 2200	
Lebanon VoF Lebanon	963//1476	0630, 0730, 0830, 0930	News summary
Libya SPLAJBC Tripoli	1484	1600 – 1800	Foreign news

that many stations were off the air or were unable to cope with the situation.

In East Anglia all TV was off for a couple of days, BBC Essex lost power to two of its transmitters as did Capital R and LBC in London. Several stations, including the BBC World Service at Orfordness, lost aerials.

Between listening to the RAF VOLMET weather station on short wave (which also was forced off the air for a period), local emergency services (which were saturated with calls from the public) and the maritime distress frequency of 2182kHz (some coast stations were still working but had lost all telephone lines), I managed to 'DX' a few MW local stations. For example, under normal circumstances Capital Radio dominates 1548kHz in southern England, but with it off air I was able to catch BBC Cleveland from Middlesbrough and Radio Forth in Edinburgh, both of whom were lucky to be well away from the heart of the storm.

Of the stations that did weather the storm, two stood out on account of their thorough response to the disaster. BBC R Kent and R Orwell both deserve praise for their efficient handling of a vast amount of information and for service to the public. R Kent, who in fact came on

air at least a couple of hours early on that fateful Friday morning, have a well deserved reputation for handling emergencies. Sadly that cannot be said of the main ILR stations in London which, when power was restored, tried to continue with almost normal programming despite the fact that London had been brought to a standstill.

Finally, the most outstanding survivor of the storm must be Radio Caroline on the Ross Revenge, twenty miles out in the North Sea, who not only managed to hold anchor but stayed on the air for most of the time.

Newsdesk

Eire: The radio scene here keeps changing so fast that it's almost impossible to keep up to date, but the most recent changes include:

738kHz - Independent R, Mayo has a new powerful signal, heard over Dublin's Energy 103.

864kHz - Big M Radio in Castleblaney has been here since early October ex-1413kHz. Programmes are in parallel to 954kHz.

1044kHz - Carlow Community R is new since October - it was heard in Blackpool.

1170kHz - Telstar Community R has

dropped this channel, but 1197 is in normal use.

At the moment, two of the strongest signals in England at night are Big M on 864kHz and North West Community Radio (NWCR) on 1008kHz.

Finland: YLE Radio Finland continues to interfere with R Caroline on 963kHz but the 600kW of power seems to vary considerably in strength day to day.

United Kingdom: After a long absence Sunshine R, Ludlow (community radio for Shropshire) has returned to the air on a frequency of 1017kHz. It has been logged as far away as Reading and Blackpool. The address is announced simply as Sunshine Radio, Ludlow. In a similar vein, the Merseyside area is proving to be a hotbed of pirate activity with the following stations currently active: 936kHz, R Atlantis, weekends; 1350kHz, North Coast R, daytime; 1242kHz, R Merseywaves, Fri-Mon; 1400kHz, Liverpool Pirate R, Sat pm.

In stark contrast, in London the only pirate still on MW, left behind by the mass exodus to VHF-FM, is R Memphis, on 1260kHz Sunday mornings with nostalgic Rock and Roll music.

I'm afraid that wraps up proceedings for another month, so till we meet again - keep on tuning that radio dial!



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Latest Literature

ELECTRICAL AND ELECTRONIC ENGINEERING PRINCIPLES

by J O Bird

This booklet is presented as a 'ready reference guide' to the most common quantities, units, symbols, definitions, formulae and circuit diagram symbols used in the field of electrical and electronic engineering.

Over 150 graphical symbols have been selected from BSI 3939, parts 2-13, 1985.

This booklet will be most valuable to students and staff in colleges, polytechnics and universities, as well as technicians and engineers in industries involved in electrical and electronic engineering.

Longman Scientific and Technical. £2.95.
ISBN 0-582 41399-0

THE EARLY DAYS OF RADIO BROADCASTING

by George H Douglas

A title to make any ham's eyes light up—as well they might, for this is a most enjoyable tale, meticulously researched and extremely well-written.

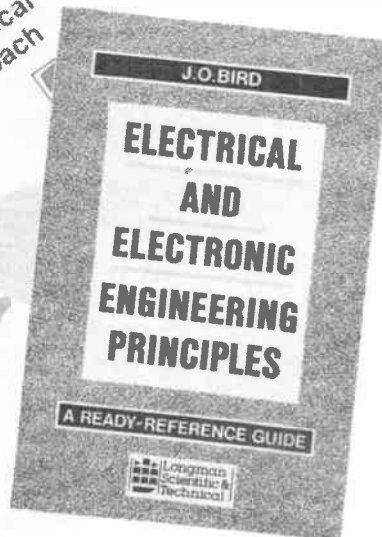
This lively story begins with a very human account of the discoveries of Hertz, Maxwell and Marconi, and then concentrates on the pioneering days of broadcasting in America.

It is fascinating to see the development of radio through American eyes, and something which any G is bound to find enlightening. A collection of well presented facts and little known anecdotes, this book is hard to put down. Readers will be delighted to read about the history of KDKA, which in the halcyon days of uncluttered radio bands, was heard throughout the world.

Any radio enthusiast would love to own this book, although it is not cheap. Perhaps leaving this review prominently displayed might entice someone to drop it in the right Christmas stocking?

Bailey Bros and Swinfen Ltd,
£25.95. ISBN 0-89950-285-7

Backwell Scientific Publications
Computer Science Texts
J O Bird
occam programming:
a practical approach



ELECTRONICS AND ELECTRONIC SYSTEMS

by GH Olsen

The inexorable assimilation of electronics into fields which were previously outside its influence has created a need for a new kind of text; one that can be used by non-specialists such as physicists, chemists and mechanical engineers; that does not assume a previous extensive background in the subject, but at the same time requires a basic knowledge of physics and mathematics.

This wide-ranging book answers these demands nicely, keeping a sensible balance between examination-type material and the kind of information required for an introductory account of the subject.

Primarily intended for first and second year undergraduates reading electronic engineering, physics and physical electronics, and students on TEC courses at levels 3,4 and 5, the book takes a careful look at many aspects of electronics.

Passive components, networks and circuit theory are dealt with initially, and many of the familiar theorems

and terms are explained, with diagrammatic assistance.

Analogue electronics is then introduced, with semiconductor devices, transistors, ICs and diode applications being examined; the text concluding with a review of digital electronics. A most impressive 400 pages.

Butterworth Scientific Ltd,
£19.95. ISBN 408 01369 9.



A TUTORIAL INTRODUCTION TO OCCAM PROGRAMMING

by D Pountain and D May

The aim of this tutorial is to introduce the reader to concurrent programming using the occam language. Examples of programs are given, and the novel concepts employed by occam are discussed.

Occam is a powerful and expressive calculus which bears a special relationship with the INMOS Transputer—occam is the assembly language of the transputer and conversely, the transputer is described as a 'hardware occam process'.

Since the authors do not expect that all readers will be professional programmers, they do not assume an extensive knowledge of other high-level languages. They do, however, assume a familiarity with the general concepts of computing; it is not a manual for the novice.

As an aid to the reader, passages are signposted with various codes emphasize the importance or difficulty of the concepts involved.

This book will be a valuable teaching aid for professional engineers and system designers wishing to use occam systems.

BSP Professional Books,
ISBN 0-632-01847-X

A TUTORIAL INTRODUCTION TO
OCCAM
PROGRAMMING
DICK POUNTAIN AND DAVID MAY

```
PAR i = 0 FOR 4  
PAR j = 0 FOR 4  
P(i, j)
```

OCCAM PROGRAMMING – A PRACTICAL APPROACH

by J Kerridge

Yes, another book on occam – but this one chooses a very different approach, as it is intended for those who have been taught or use sequential programming languages such as Pascal, Cobol, Fortran and BASIC.

While dealing mainly with the Inmos programming system for the IBM PC, using occam I, the book's applications are more general and can be used for the development and use of occam programs in general.

The book uses situational examples of the uses to which occam can be put, thus justifying its title by dealing firstly with practicalities.

Blackwell Scientific Publications, £30 hardback, £14.95 paperback. ISBN 0-632-01659-0

SYSTEMS & CONTROL ENCYCLOPEDIA

In over 5600 pages, the encyclopedia represents the first up-to-date overview of the key disciplines that are at the centre of the new industrial and information revolutions involving computer control, robotics and automation. This comprehensive new reference work provides information on what systems thinking comprises and how it is being used to understand and address a wide spectrum of diverse problems ranging from, for example, the control of servo-mechanisms to applications of space technology, or from understanding biological/environmental systems to controlling national economies.

The Encyclopedia contains over 1600 articles written by over 900 authors and edited by a team of 60 specialist subject editors – all of whom are regarded as pre-eminent in their respective fields. The articles review and provide concise treatments of an enormous range of subject matter and cover systems and control in the widest possible sense, treating the theoretical concepts as well as their applications. The

latter are technological (ie process industries such as chemicals, paper and cement, and engineering systems such as power generation, distribution, etc), semitechnological (ie where human beings interact in the system, such as road traffic networks, environmental systems, robotics, energy systems) or nontechnological (ie socio-economic systems, management systems, etc). In each case the role of computers as system components is particularly emphasized.

Pergamon Press, £1600 ISBN 0 08 028709 3

BATTERY CODE

As part of a major initiative to promote battery safety in the UK, the newly-formed British Battery Manufacturers Association have issued guidelines for safer battery use.

The guidelines highlight two areas for concern: the swallowing of small button cell batteries, mainly by children under two years, and possible fire or explosion, if batteries are severely misused or abused.

Reported incidents are rare – under 40 per annum compared with over 400 million batteries sold – and the majority of these involve swallowing.

The Code calls on parents to keep button cells out of the reach of children and to ensure that the battery compartments of toys and other items, such as watches, calculators and hearing aids, are secure.

Misuse of all batteries, including button cells, can lead to leakage, or in extreme cases even fire or an explosion. Batteries should be disposed of in normal household waste and should under no circumstances be heated or burned.

Similar problems can arise accidentally through incorrect fitting of batteries in equipment. Bad design of battery compartments – common in some imported toys – can make it difficult for consumers to decide which way round to insert the batteries.

Everyone knows the importance of keeping children away from power points, open fires and cookers; yet many parents do not realise that batteries can pose a threat, however slight, and the manufacturers hope the code will raise general awareness.

Copies of the Battery Safety Code are available free from the BBMA, 7 Buckingham Gate, London SW1E 6JS

SEMICONDUCTOR ENGINEERS DIGEST

For design engineers, the mechanical and electrical details of more than 500 products are given in International Rectifier's new 100-page manual. This is available free.

Covering semiconductor power devices from rectifier diodes to solid state relays and gate-turn-off thyristor drive modules, the manual features every level of device from OEM products to high reliability and fully approved MIL specification devices.

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

Livingston technical sales

An 8-page application note entitled Understanding Power Line Disturbances is available free from Livingston Technical Sales.

The booklet is one of a series which seeks to enhance awareness of the dangers posed by mains disturbances to users of microprocessor and IC-based equipment, and to propose effective counter-measures.

A detailed analysis of the types of disturbances which may occur and their effects on electronic equipment leads to delineation of a 'safe area' in terms of amplitude and duration. The guidelines will be of assistance to designers of equipment and to those responsible for pre-installation site surveys in eliminating the risks of equipment malfunction due to power line problems.

LTS stocks a range of

equipment for determining the nature and eliminating the effects of power line disturbances.

Livingston Technical Sales Limited, Livingston House, 2-6 Queens Road, Teddington, Middx TW11 0LR. Tel: 01 977 0055.

Flight electronics

Flight Electronics announces the launch of its sixth annual catalogue of electronic instruments and educational systems.

The 44-page full colour catalogue, given free of charge, presents Flight's rapidly expanding range of high quality, low cost instrumentation plus many state of the art developments in microprocessor education.

Half of the new catalogue is devoted to oscilloscopes, intelligent frequency counters, audio/RF generators, distortion meters, curve tracers, ac millivoltmeters, hand-held DMMs and a new digital IC tester.

Flight's education products fill the remainder of the catalogue. New offerings include a Transputer training system which offers software development with a transputer module, BBC/IBM assembler, interface and supporting manuals. The increasingly popular 68000 training system has a new 68020 upgrade, and a 68881 maths processor option.

IBM users can now build and test boards, before finalising the PCB design, with a breadboarding system that interfaces with the IBM PC.

The already wide range of PC interface and control boards has been further expanded.

BTEC (Business and Technical Education Council) students will be able to take advantage of the new signature analyser, a low-cost system for use on fault-finding courses.

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

Solartron Instruments

Solartron Instruments has issued a new, illustrated brochure for its 7061 and 7062 high-speed 7½-digit DVMs.

The 20-page booklet contains background information on the measurement technology which makes these instruments among the fastest precision systems voltmeters on the market, with transient capture facilities superior to a digital storage 'scope. Coverage is also given to the problem-solving capabilities of the 7061 and 7062. Facilities built in to speed and simplify execution of complex measurements include an 18-channel scanner, 8000-reading memory, realtime clock and fast alarm output as well as advanced measurement processing to provide fast, point-of-measurement decision making for process control applications.

Features such as electronic auto-calibration and digital filtering for low-level stability, are also highlighted.

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

Rohde & Schwarz

Number 118 of the technical house journal *News from Rohde & Schwarz* again introduces a number of new items: the very economical test station TSIC for in-circuit and functional tests, the audio analyzer UPA (first introduced on the market in 1985) with new performance features, the new EMF family of test receivers for TV Bands I, III, IV/V and for the IF and CATV ranges, the compact and economical 20kW UHF TV transmitter NT425 (with tetrode), and the two-channel up/down converter UX001 for the conversion of intermediate frequencies.

Other items being introduced are the extremely flat central control and display unit GB607 for up to 31 avionics instruments, the compact rotatable log-periodic antenna system AK451 for 5 to 30MHz, the new

option CMT-B10 for selective level measurements using radiocommunication tester CMT, and new automatic test systems for chip capacitors and inductors, for intermodulation measurements and for audio and video recorders. The application note centers on gate array tests using the logic analysis system LAS, the test hints describe the determination of transmission loss by reflection measurement, and the R&S patent deals with passive frequency multipliers. The final article discusses the question: Electronic instruments – rent or purchase?

*Rohde & Schwarz,
Pressestelle,
Mühldorfstrasse 15,
D-8000 München 80*

Electroplan

A new 64-page catalogue from Electroplan Rental lists an expanded range of equipment available on short- or long-term hire.

Equipment from some 60 major manufacturers includes new instrumentation and computer products, notably an extended range of Hewlett Packard equipment, and datacomms test equipment from Fireberd and Digilog. Computer products from IBM include the new Personal System/2 range. Radiocomms signal generation and test equipment from Marconi, Philips function and pulse generators, and Brüel and Kjaer sound and vibration test equipment are examples of the general-purpose and highly-specialised solutions provided by Electroplan's comprehensive, up-to-the-minute inventory.

Of potential interest to a broader market is Electroplan's own EPiTAG IBM PC-based Barcode/Labeling system, which can provide individually-designed labels in an almost unlimited variety of sizes and styles.

The catalogue details Electroplan's attractive rates for rental periods down to one week, and discount schemes for longer-term rental. The company's purchase option

plan provides the opportunity for purchase after an initial rental period.

For a free copy of the catalogue please write to the sales and marketing manager at Electroplan.

*Electroplan Rental,
PO Box 19,
Orchard Road,
Royston,
Herts SG8 5HH.
Tel: (0763) 47251.*

Cirkit

Cirkit's new catalogue for 1987/88 is presented in a different style to previous editions, and includes many new lines, such as an RF power head and three bench PSUs.

Cirkit has introduced volume discounts on small quantities to suit constructors – on packs of five, ten or twenty-five instead of the more customary hundreds.

A competition has been included by popular demands, with a 600MHz frequency counter as first prize, along with some very useful runners-up prizes.

The catalogue costs £1.20, and is available from most branches of W H Smiths or direct from the company.

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

Department of Trade and Industry

The DTI has just produced the annual report for 1986/7. Doubtless some amateurs will be interested in the information within its tasteful metallic blue covers, if so, the place to write to is the Information and Publicity Section Library, Room 605a Waterloo Bridge House, Waterloo Road, London SE1 8UA. An interesting leaflet is enclosed, giving telephone numbers related to specific areas of enquiry.

Not much is actually said about radio amateurs, the section being squeezed onto the same page as the CB news, but mention is given to the 50MHz review and the band extension at 70MHz, and details are also given of DTI plans for the rest of the spectrum.

Siemens

Siemens components new catalogue gives details of the company's latest products – the new ADMA coprocessor, and the SIRET – a 1000V bipolar transistor. Details are also given of the Siemens components service; the catalogue concludes with a brief explanation of benchmarks.

*Siemens Ltd,
Windmill Road,
Sunbury on Thames
Tel: (09327) 8569*



DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

As anticipated, a fall-off in Sporadic-E activity during September signalled the end of the main season. Despite this, a few short-duration openings were present on various dates throughout the month.

Apart from the exceptional tropospheric signals from late August which lingered into September, the only other period worthy of note occurred during the 20th and 21st when high-level French and Belgian DX appeared. The PM5544 test pattern from various Canal Plus stations in Band III was noted here at Derby in snow-free colour at 0400 on the 21st! It makes a welcome change viewing unscrambled French broadcasts, despite the early hour.

Late summer surprise

September 17th proved an unusual day for Sporadic-E reception in Band I. At lunchtime the Italian news programme from RAI (*Telegiornale*) on channel 1B appeared. A search through the other Band I channels revealed a simple test card on 1A bearing the letters 'tva'

immediately above a horizontal grey-scale.

The lettering style was very similar to TVE's logo, where the letters are linked at the top. The frame and line syncs were extremely weak, a characteristic which has also been noted by other DXers, but during programmes. The reception does confirm that TVA still use channel 1A, as well as the new channel below E2 which was mentioned last month. Shortly after this had faded, a weak PM5544 test card popped out of the snow via MS (meteor-shower propagation). This was probably RTE-1 (Eire) from the Gort transmitter.

Mystery

Also on September 17th, an early evening opening produced Spanish signals on E2 and E4. These were first noticed shortly after 1800BST. However, on E3 an Arabic language programme was in progress which was at first assumed to be an educational programme from Portugal, since the signal quality was not unlike single-hop Sporadic-E. The lecturer was very dark-

skinned and wore white headgear.

Chris Howles at Lichfield was receiving this too, and he commented that VITS were absent from the frame bar, implying that it might be something exotic. It later transpired that during the same opening Ray Davies, at Happisburgh in Norfolk, resolved a programme of African origin on channel E2 while only TVE-1 from Spain was present on E3. According to Ray, the E2 signal peaked to the south, south-east, and the vision was very smeary, making it very reminiscent of a typical Zimbabwe signal often seen in the UK some years back during high sunspot activity. To add to the mystery, we've heard that transmissions from Ghana and Nigeria were identified in the UK on channel E3 during the same opening, accompanied by a French-speaking station on E2.

DX-TV log for September

This month we are featuring a log report submitted by Bob Brooks of South Wirral. All times are BST.

01/9/87: MTV-1 (Hungary) on channel R1

PHOTO FILE ● PHOTO FILE ● PHOTO

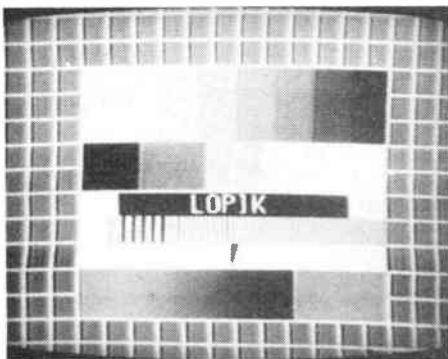


Fig 1 FuBK test card from the Netherlands with transmitter identification

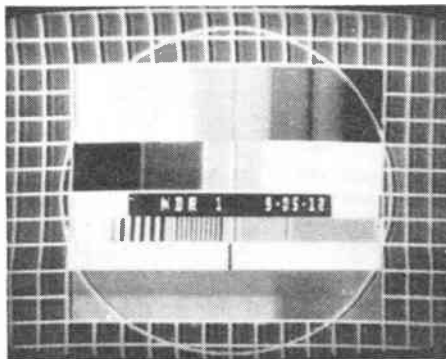


Fig 2 Test card radiated by Norddeutscher Rundfunk in West Germany



Fig 3 Closedown caption used by Television Suisse Romande, Switzerland

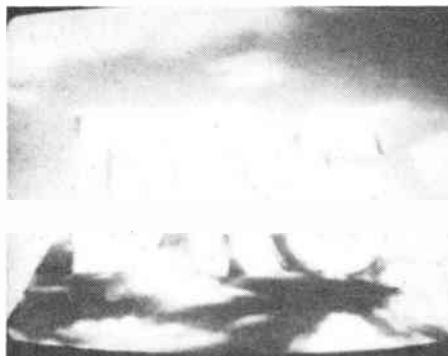


Fig 4 Identification caption radiated by the Swiss German-language service, SRG

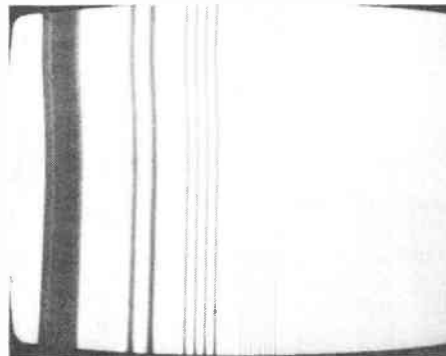


Fig 5 Multi-burst pattern occasionally transmitted after closedown by TST



Fig 6 Swiss Italian-language clock caption from TSI in the Ticino

with the 'MTV-1 BUDAPEST' PM5544 at 0748 and opening clock at 0751 – a film followed; RAI (Italy) IA on PM5544 at 0759; TSS (Russia) on channel R1 with the UEIT electronic test pattern at 0920; SVT-1 (Sweden) E4 at 1045 showing the 'TV1 SVERIGE' PM5534.

02/09/87: TVE-1 (Spain) E3 with a popular music programme at 1129.

04/09/87: TVP (Poland) R1 'Domator' film at 0920; TVE-1 E4 interview at 1240; CST (Czechoslovakia) R1 with the 'RS-KH' EZO test pattern at 1336.

17/09/87: RAI IB cookery programme at 1222; Unidentified cartoon on channel E2 at 1605; TVP R1 film at 1615 followed by a jazz programme at 1617, which was also present on channel R2. Reception was via Sporadic-E.

20/09/87: Canal Plus (France) L5 on programmes (tropospheric DX reception).

21/09/87: NOS-1 (Netherlands) E4 showing the 'PTT NED 1' PM5544; ARD-1 (West Germany – 1st network) E4 logo; BRT (Belgium-Flemish language network) E10 on 'BRT TV1' PM5544; Canal Plus (France) channel L5 with programmes. All DX occurred via tropospheric propagation.

Reception reports

Channels in Band III and UHF were awash with DX stations on September 1st in Leeds, if the logs of Mark Dent and Kevin Jackson are anything to go by! No fewer than 25 West German stations were logged throughout the day. Mark's best reception occurred at 0515 on channel E7 from Sender Freies Berlin – a 'first', in actual fact.

Further south, Carl Ashton and Jason Wright of Sheffield have enjoyed an eventful month. The Icelandic PM5544 test card was seen on five occasions during September, on the 13th, 14th, 18th, 24th and 26th. The 13th brought in test cards from Spain, Iceland, Russia, Czechoslovakia, West Germany, Switzerland and Sweden in Band I. On the same day the Danish 'DR DANMARK' PM5534 test card appeared in Band III on channel E10 via tropospheric propagation.

Another outstanding day was the 21st, when eleven countries were logged, most of which were showing a test card. A photograph of a mystery analogue clock caption was enclosed with their log report. The picture shows what appears to be a fence at the bottom of the screen with a white clock face positioned towards the top right-hand corner of the screen.

Closer examination reveals the letters 'UR' in the lower left-hand corner which were very difficult to decipher at first. The 'UR' is an abbreviation for 'Utbildningsradion', an identification which appears between Swedish programmes for schools.

Bob Brooks of South Wirral hasn't

missed much DX during the month as his log, featured this month, shows. Much of the reception was in colour with PAL and SECAM signals present several times.

Major Rana Roy of Bikaner in India advises that Doordarshan Kendra, the Indian TV service, is now using a modified FuBK pattern for test transmissions. The new test card was inaugurated on June 23rd.

Rana comments that DX conditions this year have been down on other seasons. It would seem that long-distance reception, which we in Europe would term exotics, has been lacking. During one opening a blank PM5544 was seen on channel E3 which Rana suspects was Abu Dhabi.

Finally, in this section, we would like to thank all the DX-TV enthusiasts who have contributed details about their reception during the year. We look forward to hearing from all of you again in 1988. In the meantime, the authors would like to wish everyone a Happy Christmas, and good DXing in the New Year.

Wintertime DX

DX reception in Band I via Sporadic-E is still possible throughout the winter months, although at a much reduced level. It goes without saying that patience is required to capture some of these smaller openings which may only last a minute or two compared with the all day variety experienced during the main Sporadic-E season. It often pays to leave a receiver running on, say, channel R1 or E3 where there are a fair number of stations operating. There is a tendency for an upsurge in activity over the Christmas period, with some openings resembling summer ones.

Meteor showers can also assist DX signals. In fact, reception is possible via meteor-shower propagation (MS) every day of the year. Much of the reception will consist of short bursts or 'pings' caused by reflection from an ionised trail, generated when meteor particles burn up on entering the Earth's upper atmosphere. Pictures may appear briefly, remaining only a second or two, but often their origin can quickly be deduced, especially if a test card or caption is received. At certain times of the year, activity can reach a peak. These dates are reasonably predictable and reference can be found in many astronomy books. Two excellent peaks will

occur during the reign of this issue of *Radio & Electronics World*. The Geminids will produce activity during mid-December and, on checking through the logs of previous years, the 14th seems to have been the most active. The Quadrantids peak in early January, normally on the 3rd or 4th.

Both these showers can generate sustained activity throughout Bands I and II with signals occasionally resembling patchy Sporadic-E. Reception is also possible on channels in Band III, especially the lower channels E5, E6 and R7. Russia, Czechoslovakia, Norway, Sweden, Finland, Denmark and Austria are some of the most frequently identified countries.

DX-TV Magazine

TeleRadio News is published bi-monthly, and is available to radio and TV DX enthusiasts by subscription only. It contains logs and photographs, free adverts for subscribers, technical articles, news about the latest in the TV scene around the world, plus the chance for DXers to contact other enthusiasts. Issue 31 was distributed during October and the next edition should be available in mid-December.

Some back issues are available and a leaflet will be supplied upon request by sending an 18p stamp or one IRC. The annual subscription rate is only £6.00 and back copies are available at £1.50 each including postage in the UK, or surface post world-wide.

The A5-format magazine is available from HS Publications, 7 Epping Close, Derby DE3 4HR. A wide range of DX-TV items is also produced by this company, and an info-pack will be sent upon request.

Non-Swiss TV relays

There are many low-power transmitters located within Switzerland, relaying programmes from services originating in neighbouring countries. Programmes from West Germany, Austria, Italy and even France are also relayed in certain areas. Note that in the Ticino, Tele-Monte-Carlo can be received via Italian relays.

The most powerful relays are as in *Table 1*. ARD-1 is the West German 1st Network; ZDF is the West German 2nd Network; RAI-1 is the Italian 1st Network and ORF-1 is the Austrian 1st Network.

Table 1

Sedrun (Graubünden)	E22 ARD-1	E25 ZDF	E33 ORF-1	A11 1kW
Celerina (Graubünden)	E60 ZDF	E62 ORF-1	E68 RAI-1	A11 3.2kW
Ausserberg (Rhône Valley)	E33 ARD-1	E35 ZDF	E48 ORF-1	A11 1kW
Gebidem	E58 ARD-1	E62 ZDF	E65 ORF-1	A11 10kW

New DX-TV converter

A new version of the popular D100 DX-TV converter system is now available from HS Publications. The original version is out of production; this has been superseded by a design with an extended Band I range (Band II TV) thus allowing coverage of channels R3, R4, R5 and IC.

Of special importance to DXers is the switchable IF bandwidth, which reduces spreadover effects from adjacent channels when operated in its narrow-bandwidth mode. Operating with reduced bandwidth also allows the weaker stations to be resolved easily - these are often lost in the noise with commercially available TVs.

The D100 is also available with a sound take-off circuit to feed a domestic FM radio, thus allowing accompanying sound from any of the four intercarrier systems, namely 4.5MHz (USA), 5.5MHz (Western Europe), 6.0MHz (UK/Eire) and 6.5MHz (Eastern bloc). Both units can be used with virtually any domestic TV receiver which covers the UHF band.

The price of the standard version is £77.99 (fully inclusive of postage and packing), with the extra sound take-off circuit the price is £89.99. Further details are available by sending a stamped-

addressed envelope to: HS Publications, 7 Epping Close, Derby DE3 4HR.

Service information

West Germany: The SAT-1 relay in Berlin entered service towards the end of August using channel E25 with an ERP of 25kW. An increase to 125kW is forecast over the coming months. SAT-1 and RTL-Plus are expected to commence broadcasting in Hamburg early in 1988 from two transmitters. SAT-1 will be relayed on channel E46 with an ERP of 15kW and RTL-Plus on E48 with an ERP of 10kW. Regional programming will take place on both channels. Similar broadcasts in Schleswig-Holstein are expected.

Finland: YLE TV-3 transmissions have now commenced from Helsinki/Espoo on channel E24 with an ERP of 40kW. Transmissions from Jyväskylä on E35 and Tampere on E59 should, by now, be in operation with ERPs between 600 and 1000kW. Lahti on channel E51 is expected to enter service during the summer of 1988. 'Kolmotelevisio' is the name of the TV company.

Italy: The Italian teletext service 'Televideo' is aired daily by RAI-1 and RAI-2. The regional Italian service, RAI-3, is also undergoing tests with 'Televideo' but without regional variations. Tests

using stereo sound over RAI-3 have also commenced.

The familiar 'RAI' identification which appears in the bottom right-hand corner of the screen has undergone a change since October 5th. The anti-pirate ident now includes the actual service name so the full inscriptions are RAI UNO, RAI DUE and RAI TRE.

The Italian breakfast-time programme called Uno Mattina is still radiated by RAI-1, but only during the winter. The private station 'Telemarket' has been received on channel IB during the last Sporadic-E season. Transmissions have also been identified on channel E2, and the new frequency at 47.685MHz which was mentioned last month.

Switzerland: The Italian-language network of TSI and the French language network, SSR, are now transmitting teletext. Both test cards carry a band of text at the bottom of the screen to advise viewers of the new service.

Malta: Class A licence holders are now permitted the use of the 6 metre band, using 50.00-52.00MHz.

This month's Service Information was kindly supplied by Gösta van der Linden (Rotterdam), the Benelux DX Club (Netherlands) and David Bocca Corsico Piccolino (Vigevano, Italy).

NEW FROM YOKO MODEL F6/I VHF/UHF SYSTEM B/G/I/L Operation £95.00



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It's restyled too, featuring a sleek black monitor look and with rotary drum continuous band tuning. A telescopic whip antenna is situated at the rear, together with a 75 ohm coaxial aerial input socket.

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Stocks of this new receiver have just arrived from the Far East, - so don't delay, order today and maximise your loggings.

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

Surplus Sale

Wirral and District Amateur Radio Club is holding its first meeting of the year on January 6th in the D and W Railway Inn, Meols, thus putting themselves on the right track for the rest of 1988.

The club's AGM is on January 13th, and, being an active bunch, there is yet another meeting on January 20th at the Pensby Hotel, Pensby. Then, on the 26th, the club is holding its surplus equipment sale - without a doubt, there will be a good turnout of members hoping for a bargain!

Club meetings are normally held on the second and fourth Wednesdays in each month at Irby Cricket Club, Mill Hill Road, Irby. For information about forthcoming club events, contact the club secretary, Gerry G8TRY on (051) 630 1393.

Film fun

Chelmsford Amateur Radio Society's monthly meeting for January is to be a film and video show, held as usual on the first Tuesday of the month, January 5th. As yet, we have no info on the subject matter, but doubtless it will come as a pleasant surprise - I've got the popcorn and ice cream ready...

Club meetings are held at the Marconi College, Arbour Lane, Chelmsford, from 7.15pm. To find out more, contact Roy G3PMX or Ela G6HKM on (0245) 360545.

Errata

A small mistake was found in the Loopstick Technology article in our November issue. Figure 1 should read L2 (L1+MW).

Ant-hology

An interesting new magazine came our way recently - the third edition of the Tiger Antenna Magazine. Brought

out by Ant Products, the mag is looking forward to a circulation of over 1,000 with its latest production, a figure which has deservedly increased with each issue, having constructional and informative articles as well as various antenna facts. Hmm, sounds like competition!

More windy tales

Those interested in the 'Oscars' may have noticed that Oscar-9 was off the air from 14-19 October. This was due to the high winds which swept across southern England, taking with them the Mission Control Station's antennas (as luck would have it, the dish tracking system, which was not damaged, is being refurbished and was out of commission).

Fortunately, satellite command was subsequently taken over by G3YJO, and after some extremely hard work by all concerned, the tracking system was repaired by October 23rd.

SOS

The campaign for an amateur radio novice licence is gathering force, with a recent newsletter from the secretary, Ian Abel G3ZHT.

The novice licence is intended to attract the youth of today to the hobby, a difficult task in this era of sophisticated communications equipment - most of which no longer requires the hard study necessary to pass the RAE.

According to the newsletter, the novice licence would employ simple, home made, low powered equipment, running less than 5 watts and using Morse code only. The frequencies used would be in a CW portion of the 28MHz band, which is currently under-used. The cost of a transceiver kit would be about £15. Sounds good, apart

from having to learn Morse - all I can say is - -.-. -.-.!

A social start

Felixstowe and District Amateur Radio Society is holding a social on January 11th - a convivial way to welcome the new year.

On January 25th, Sam Jewell G4DDK will be giving a talk on transverters. All lectures and social meetings take place at 8pm in the Scout Hut, Bath Road, Felixstowe, unless otherwise specified. Further details can be obtained from Paul G4YQC on (0473) 642595, daytimes.

Chatty club

Rugby Amateur Transmitting Society is feeling talkative this month, and is holding its New Year's Natter Night slightly belatedly on January 5th.

On January 12th the club is having a Constructors Corner evening - with only three months to go to the judging of the construction competition, this is an opportunity to get some help and advice.

The club meets every Tuesday at 7.30pm at the Cricket Pavilion outside Rugby Radio Station - visitors and new members are always welcome. For more information, please contact Kevin Marriott G8TWH.

Design on the Tyne

Newcastle University are arranging a short course on practical gate array and semi-custom design, to be held from April 11-15th at the University.

Anyone interested in attending should contact Val Adams, Centre for Continuing Education, The University, Newcastle upon Tyne NE1 7RU, tel: (091) 232 4950. Haway, man... a little extra information for prospective attendants - the Long Bar is highly recommended (sigh).

Worked all Britain

Bury Radio Society is having a talk on January 13th on the Worked all Britain award; the speaker will be J Amer G0ALQ.

As usual, club meetings are held every Tuesday in the club room at the Mosses Youth and Community Centre, Cecil Street, Bury, with

the main meeting on the second Tuesday of the month. Information can be obtained from M L Jamil G1VQE, the club's publicity officer.

Edgware on air

Edgware and District Radio Society is holding its AGM on January 14th, but becomes more informal later in the month with an evening on the air on January 28th. Listen out for them!

The club normally meets on the second and fourth Thursdays of each month at 8pm at the Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware. The club net is at 10pm on 1978MHz every Monday. For more information about club events please contact Ian G4IUZ on Hatfield 65707.

Rabbit, rabbit...

Worksop Amateur Radio Society must love to chat - looking at its club programme, every other week is a natter night! In January these fall on the 12th and 26th, and doubtless there will be plenty to catch up on after the Christmas break.

A return quiz against Maltby ARS is planned for January 19th - wonder who won the first match? Doubtless all concerned will be putting on their serious thinking caps whatever the previous result.

The club doesn't say where it meets - maybe you just listen for the sound of voices as you search... In any case, contacting Kevin Fox G4MDQ on (0909) 566724 would probably help - he is the club's publicity relations officer. He *must* know where the club meets!

Bring your own...

There must be some fit and strong members in Coventry Amateur Radio Society - their meeting on January 8th is a computer night, and they urge members to bring their own if possible... the local hospital will be busy dealing with hernia cases for months unless we add the caution - don't bring the office mainframe unless you can hire a fork lift truck...

January 15th brings a night on the air and Morse tuition, and a talk and demonstration on Packet radio is provi-

sionally planned for January 22nd.

January 29th is the date of the annual dinner. Breaking those New Year's resolutions to diet so soon? Quite right too!

CARS meets every Friday at 8pm at Baden Powell House, 121 St Nicholas Street, Radford, Coventry, and further information can be obtained from the club secretary, Jon G4HHT on (0203) 610408.

Hello to St Helens

A warm welcome is extended to St Helens and District ARC, who sent us an info sheet – for the first time, I believe. Other clubs take note, we do appreciate it when you take the time and trouble to send us your news and views, and we like nothing better than to be able to tell everyone about what your club is doing.

Having said that, St Helens ARC is still compiling a diary of events and will send it on, but they have told us that they meet weekly on Thursdays from 7.45pm at the Community Resource Centre, Old Central Secondary School, College Street, St Helens – opposite the main police station (must be a law abiding lot).

Morse tuition is available before meetings if required, and the man to contact for details is Derek Ainscough G1OMY on (0744) 818455.

Look, Martians!

MARS – the Midland Amateur Radio Society have let the cat out of the bag – they sent us a photo to show what a motley crew they are – well, being 'Martians', they would be, wouldn't they?

Most encouragingly for us YLs, there are now two ladies on the committee, but oddly enough, despite all this added efficiency, no programme for the New Year is forthcoming... the reason? They are waiting for the effects of the Christmas party to wear off... If you really want to know, you could always contact Tom G8GAZ and hope that he's feeling human again.

The club does have an address on this planet. Unit 5, Henstead House, Henstead Street, Birmingham B5 6QH –

is this a new address, or was that the HQ that was due to become a pile of rubble? Going on the club's track record, this one will probably fall down soon in any case!

Quiet, please

The G-QRP Club celebrates Hogmanay with the last day of the '87 Winter Sports (for non-Scots, that is January 1st).

The club will also be extremely busy on January 23rd and 24th, with their OK/G activity weekend, when they will be around on all sorts of interesting frequencies, including 3560kHz and 18MHz if open.

To join the club (which produces an impressive mag called *SPRAT*) contact David Jackson G4HYY and make the right low-powered noises at him.

A tiring talk

Verulam ARC has an activity evening planned for Tuesday, January 12th, and on Tuesday 20th, Gerald Stancey G3MCK will give a talk entitled 'Standing Waves' – someone find the poor things a chair...

The club meets on the second and fourth Tuesdays every month from 7.30pm at the RAF Association Headquarters, New Kent Road, off Marlborough Road, St Albans, and further information is available from Hilary G4JKS on St Albans 59318.

Elections

The following clubs have elected new club officers: Wimbledon and District Radio Society – new chairman Peter Horbaczewskyj G4ZXO; hon secretary David Love G4RBQ. Worksop ARS – secretary, Carolee Gee G4ZUN; chairman George Pool G0DKQ, PRO Kevin Fox G4MDQ. Basingstoke ARC – secretary Jim Arnott G1WKK. NEWS

Why not write and tell us about your club? Your news could be here next month. Just send details – dates, meeting places etc to our editorial address (p3).

NOTES FROM THE PAST

In recent years there has been a widespread belief that the appeal of TV would become so powerful that sound radio would inevitably be superseded, except for the few without the means or those without access to the programmes.

Conversely, there are signs that many viewers are reverting back to their former listening habits once the flush of novelty wears off. After a few months even the less discriminating viewer tends to look-in only when the programmes *might* interest him or there is nothing particularly attractive on sound radio.

Disregarding the sports events and the purely spectacular items, vision adds but little to the sound. Often it actually detracts from it. As a viewer since the early days I must admit that I have found few TV entertainment programmes which have given me so much pleasure as many of the sound programmes have. In fact, I can hardly remember getting a good laugh out of TV and only too often find myself acutely embarrassed by TV artists trying to be funny. On sound radio, nonsensicality can be twisted by one's imagination into readily acceptable situations which become even funnier as they pass into absurdity. Comic adventures are not the only form of entertainment more amusing on sound only. Many plays and talks take on a vivid reality, creating scenes in the listener's imagination infinitely better than anything that can be put on in the TV studio.

Just lately we have had some outstanding steam radio programmes – perhaps inspired by the competition of TV. They have certainly made me wonder if TV comedy, in particular, has any future. It certainly has little past.

Rivalry

Many older listeners will recall something of the liveliness and enthusiasm which the pioneers of broadcasting infused into the early programmes. Often the material was poor, the timing faulty and the announcements facetious, but it certainly had an atmosphere and air of mutually friendly enjoyment.

Something of the same spirit re-appeared at the beginning of regular television in 1936. Gerald Cock, who was then running it, realised his new baby needed presentation with a friendly approach, and together with a small band of enthusiasts managed to infect viewers with something of the very real pleasure they derived from what they were doing. You could almost feel that you were participating in it, and not being merely allowed to watch it.

SHORT WAVE NEWS

FOR DX LISTENERS

By Frank A Baldwin

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

Having dealt with some of the Indian transmitters operating on the low frequency bands in the previous two issues, the attention of interested readers is now drawn to this update of Bangladesh, Burma, Pakistan and Sri Lankan stations on and near the 60 metre band (**4750 to 5050**).

Bangladesh

The sole representative on the band from this country is on **4980**. Here in the UK during our autumn and winter periods the signals from the 100kW Radio Bangladesh in the capital city Dhaka are often heard. The transmitter is scheduled on the air in Bengali from 1130 to 1715 but features newscasts in English at 1530 and 1705.

Burma

The Burma Broadcasting Service, Rangoon, provides a Nationalities Programme which caters for those who speak the various languages of the country. This service is radiated on **4725** and is sometimes heard by DXers based here in the UK during our winter periods. BBS Rangoon is on the air with a power of 50kW from 1030 to 1445 (Saturday and Sunday until 1545) during the months of January, February, May, June, September and October. During March, April, July, August, November and December the programmes are aired from 1030 to 1545 (Saturday and Sunday until 1445). The languages spoken are Arakan, Chin, Kachin, Kaya, Mon, Pwo Karen, Sgaw Karen, Shan and Burmese. The language sequence is altered on a regular basis.

For the avid DXer there is the Burmese Armed Forces station at Taunggyi which has been recently reported by an Asian listener on a new frequency of **6570**. This represents a change from the previous channel of **5060**, where it transmitted the Home Service in Burmese and minority languages from

1030 to 1330, with a power of 1kW. The schedule remains, but the power is now thought to be 10kW.

Pakistan

Commencing at the low frequency end of the band, Radio Pakistan may be heard on **4780**, on which channel it is listed to radiate the Home Service in Urdu from 1300 to 1600 but has, according to one source, been heard commencing the transmission with an English news bulletin at 1300. The power is 100kW and the frequency is likely to vary slightly to **4779** on occasions. Radio Pakistan on this channel is often reported by European DXers.

Around **4790**, the transmissions emanating from Azad (Free) Kashmir Radio may be heard, claiming to be located in Trarkhel. In fact, it is located in Islamabad, the location of Trarkhel being totally unknown to all except those who make the claim! The transmitter carries the Home Service in Urdu and Kashmiri from 1200 to 1415 and from 1430 to around 1805, but includes a newscast in English from 1600 to 1610. The power is 100kW, the frequency being subject to slight variations from nominal. The seemingly interminable Trarkhel choral anthem is a feature of the sign-off.

PBC (Pakistan Broadcasting Corporation) Karachi on **4815** carries the Regional Service from 0215 to 0545 and from 1400 to 1900. The power is 10kW and, like the above mentioned transmitter, it is often entered into the log-books of DXers world-wide.

Not so often featured in listeners reports are the signals from PBC Quetta. It transmits the Regional Service on **4878.8** from 0045 to 0400 (Friday until 0345), and from 1745 to 1800 with a power of 10kW.

Azad Kashmir Radio, Islamabad, appears again on **4980**, on which frequency it radiates the Home Service in Urdu and Kashmiri from 0045

to 0430. The power is 100kW. On **5010** the seldom heard PBC Islamabad features a news bulletin in English, read slowly from 0230 to 0245. The power is 100kW and the frequency can vary to **5009**.

Sri Lanka

SLBC (Sri Lanka Broadcasting Corporation) Colombo, not often heard here in Europe, operates on **4870** with the Commercial Service in Sinhala from 0000 to 0230 and from 1030 to 1730, the Educational Service in English being from 0235 to 0628. The power is 10kW.

The National Service in Sinhala from Colombo is on the air from 2330 to 0230 (Saturday and Sunday until 0730) and from 1030 to 1730 Monday to Friday inclusive. The power is 10kW and the frequency is **4902**. This station is often heard and reported by European and UK DXers.

On **4940** Colombo is on the air with the Commercial Service in English from 0000 to 0230 and from 1100 to 1730 at 10kW. The Commercial Service in Tamil from Colombo is featured from 0000 to 0300 and from 1030 to 1730 on **5020**, with a power of 10kW. The last two Sri Lankan stations mentioned are rarely heard here in Europe.

ON THE AIR

Using the information below, you should be able to tune into a number of exotic stations on the short wave bands.

AFRICA

Kenya

The Voice of Kenya, Nairobi on **4885** at 2102, OM with a talk in vernacular, announcements, choral rendition of the National Anthem and off at 2110. This was a transmission in the National Service, scheduled from 1830 to 2010/2110.

Seychelles

FEBA (Far East Broadcasting Association) Mahe on **11760** at 1750, YL with a religious talk followed by the

station mailing address, organ music and off at 1804 at the end of an English transmission to East Africa, timed from 1731 to 1804 (Saturday and Sunday until 1824).

Angola

Radio Nacional, Luanda on **3355** at 0411, jazz music USA style followed by songs and announcements in Portuguese. It goes off suddenly, without the National Anthem, at 0415. At 10kW, Radio Nacional on this channel is scheduled to operate in Portuguese from 1800 to 0530. The frequency can vary and is an alternative to **3410** variable.

South Africa

SABC (South African Broadcasting Corporation), Johannesburg on **4880** at 0417, local pops, announcements of anniversary events and listener's birthday, all in English. With a power of 100kW, Radio Five programmes are aired from 0300 to 0520 and from 1555 to 2200.

Tanzania

Radio Tanzania, Zanzibar on **3339** at 1807, OM with a newscast in English of both local and world events. Programmes are mainly in Swahili, the schedule being from 0300 to 0500 and from 1430 to 2000. The power is 20kW.

CENTRAL AMERICA

Costa Rica

Radio Reloj, Irazu on **6005.5** at 0235, OMs with a discussion in Spanish, this programme also being logged in parallel on **4832**.

Cuba

Havana on **6035** at 0408, YL with a newscast followed by the station identification during an English programme for Central America scheduled from 0400 to 0600.

Havana on **6090** at 0401, YL with a news bulletin, the station identification and a news commentary in the English transmission to North America timed from 0000 to 0600.

Honduras

La Voz Evangelica, Tegucigalpa on **4820** at 0257, OM with a religious talk in Spanish followed by some organ music. At 5kW, this one is on the air from 1100 to a variable closing time around 0500.

NORTH AMERICA

Alaska

KNLS Anchor Point on **11820** at 0900, chimes interval signal, OM with the station identification in English and address for reports, the schedule and programme preview.

KNLS Anchor Point on **11930** at 1003, YL with announcements, piano jazz music during the English programme for South East Asia, timed from 1000 to 1100.

SOUTH AMERICA

Bolivia

Bolivian stations continue to occupy the writer's interest. The following are some which have been recently logged but not reported in these columns of late.

Radio Santa Ana in Santa Ana de Yacuma on **4648.8** at 0457, folkloric songs and music in the local style. At 1kW, Radio Santa Ana normally programmes in Spanish from 2130 to around 0200 but on this occasion was on an extended schedule, probably in celebration of some local event.

Radio Abaroa, Riberalta on **4712** at 0246, OM with a talk in Spanish. Radio Abaroa is on the air from 1100 to around 0400 with a power of just 0.5kW.

Radio Nuevo America in the capital city of La Paz on **4794.9** at 0335, OM with a talk in Spanish which included several mentions of Quito, Ecuador. The schedule of this 1kW transmitter is from 2200 (variable to 2000) to around 0400 (Sunday from 1000 to 2245).

Colombia

La Voz de Yopal, Yopal on **5050.1** at 0025, YL with folk songs then OM with the full station and Caracol Network identification in Spanish, this being followed by some announcements and then more folk songs complete with guitar backing. La Voz de Yopal is on the air in Spanish from 1100 to 0100. The power

is 1kW and the frequency can vary to **5049.5**.

Ecuador

Radio Centinela del Sur, Loja on **4889.7** at 0256, songs and music, OM with the station identification at 0300, announcements and promotions, some with echo-effect, then YL with more folk songs, all in Spanish. With a power of 2kW, this one is on the air from 1100 to around 0400.

Radio Catolica National, Quito on **5055** at 0544, OM with a religious talk in Spanish having a muted classical music background, OM with a hymn, announcements and then suddenly off without the National Anthem at 0600. Radio Catolica Nacional is scheduled in Spanish from 1100 to 0300 varying to 0600. The power is 9kW.

Peru

Radio Tawantinsuyo, Cuzco on **4910.4** at 0109, folkloric songs and music in the Andean manner. The schedule is from 0900 to 0300 with a power of 5kW.

Radio Tropical, Tarapoto on **4936.1** at 0337, announcements and promotions in Spanish, YL with a folk song. Radio Tropical has a power of 1kW and radiates from 0930 to 0400.

ASIA

Afghanistan

Radio Afghanistan, Kabul on **4775** at 1828, OM with a talk, some songs and local-style music in the Dari programme for Europe, timed from 1730 to 1830. The Kabul City Service is from 1230 to 1530. Radio Iran Toilers programmes in Farsi are broadcast from 1530 to 1730.

China

Radio Beijing on **4883** at 1637, YL with a talk in Russian followed by choral songs. Programmes in Russian are broadcast from 1300 to 1400, 1500 to 1700 and from 2200 to 2400. The power is 50kW.

Radio Beijing on **7770** at 2034, songs and local music with announcements in the Home Service 2 which is on this channel from 2000 to 2300 and in parallel on **9030**.

India

AIR Hyderabad on **4800** at

1535, YL in English with a newscast mainly of local affairs. AIR Delhi was also logged the same afternoon on **4860** at 1538, in parallel.

AIR Madras on **4920** at 0052, OM with songs in vernacular together with Indian orchestral music accompaniment.

AIR Delhi on **4990** at 0018, OM with a talk in the Tamil programme. Also logged in parallel on **3905**.

SOUTH EAST ASIA

Indonesia

RRI Palembang, Sumatra on **4855.8** at 1613, YL with songs in Indonesian and kronchong music. The schedule is from 0900 to 1600/1700 and from 2200 to 0115 (Sunday until 0700) and the power is 10kW.

RRI Bukittinggi, Sumatra on **4911** at 1539, OM announcement, songs, repeated chimes interval signal at 1559, announcement and then a newscast in Indonesian at 1600. The power is 1kW, the schedule being unknown at the time of writing.

Malaysia

Kuching, Sarawak on **4950** at 1515, play theatre, OM announcements and then a talk in English, YL with announcements in English, a rendition of the National Anthem and off at 1600.

PACIFIC

Australia

VL8A Alice Springs on **2310** at 1840, OM with time check announced as 'Northern Territory time is ten past four' then an Elton John song. Also logged in parallel on **2325**. This was a transmission in the Northern Territory Service which is on the air from 0728 to 2228 with a power of 50kW.

CLANDESTINE

Radio Caiman on **9960** at 0217, YL with a talk in Spanish, some dance music, then more talk, mostly about Cuba, OM with the station identification. The schedule is from 0000 to 0330, all in Spanish. The transmitter is thought to be located in Guatemala.

Iran's Flag of Freedom Radio on **7080** at 1707, OM with a harangue in Farsi (Persian). Subjected to the inevitable jamming, this clandestine radiates from 1630 to 1830 on this frequency.

Radio Voice of Ethiopian Unity on **11180** at 1857, songs, music and announcements, some pipe instrumental music then OM with a tirade in Amharic. Also heard in parallel on **9430**.

NOW HEAR THESE

Radio Candip, Bunia, Zaire, on **5066.3** at 1914, announcements in French, pops, OM with a talk in French, announcements, the National Anthem and off at 2001. At 10kW, Radio Candip operates in French, vernaculars and Swahili from 1300 to 1915/2000.

Radio Mozambique, Maputo, on **4865.3** at 1811, songs with guitar music then announcements in Portuguese. Maputo operates on this channel from 1500 to 2205 with a power of 25kW.


Radio Nacional, Luanda, Angola on **4952.8** at 1839, songs and music then OM with a talk in Portuguese. The schedule is from 1800 to 0530 and the power is 10kW.

NOW LOG THESE

RRI Ujung Pandang, Celebes, Indonesia on **4753** at 1602, OM with a newscast in Indonesian, YL with a short talk, OM with a song and then off at 1610. The schedule is from 2055 to 0030 with irregular broadcasts from 0855 to 1605/1625. The power is 20kW.

Kalamabad, Iran on **3779.3** at 1910, OM with a talk in the Turkish Foreign Service with many mentions of Iran, then some rousing martial music. The programme heard is timed from 1830 to 1930, the power being 100kW. Transmissions are usually blotted out by radio amateur SSB transmissions which, on the occasion reported here, were absent from this frequency.

Radio Madagasikara, Antananarive, Madagascar on **4960.5** at 0015, OM and YL with a discussion in Malagasy, OM with announcements at 0030 followed by some music in the local manner. The current schedule is uncertain but Radio Madagasikara has been reported closing at 0400. The power is unknown.

With most of the foregoing low frequency station reports, only those scheduled times most likely to be heard by listeners here in the UK have been included. 

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■ Etch resist tweezers, new, 3 £1. Cleaning liquid for cassette and all tape heads, £1 per bottle. Self-tapping screws, mixed, 100 for £1.50. Credit card calculator, £2. Learn hypnosis cassette tape, £3. Quality micro switches, 250V 10 amp, £2.50. Coiled stereo lead, free, £1 post. Quality clock module, green fluorescent display, £13.50. LED clock, 1in x 2½in, complete with holder, £5. Typhoon diving fins, large, to fit over wet suit, boots new, £10. Some photographic items including photos and models' clothes. Send SAE for list by post. Mr D Martin, 6 Downland Garden, Epsom, Surrey KT18 5VY

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■ Scopex 4D25 double beam oscilloscope, £110 plus carriage. Linstead M2B electronic millivoltmeter, £15. Heath audio wattmeter type AW1V, £15. May also have advance 240 double beam scope for sale - Phone for details. Several parallel keyboards (Cherry), £20 each. D Russell, 9 South Beach Road, Ardrossan, Ayrshire KA22 8AX. Tel: (0294) 64144 evenings.

■ Stock of rare and older type valves. Some new, some ex equipment, to be sold as one lot. Enquiries from overseas buyers welcome. Mr Shaw, 86A High St, Poole BH15 1DB. Tel: (0202) 680500

■ Magazines...any offers? *Personal Computer World* Jan '83 to Oct '85 and some more recent ones. *Electronics & Computing Monthly* Oct '82 to Jan '86. *Radio & Electronics World* Nov '81 to

present time, 55 copies, some missing. *Practical Computing* Nov '85 to Jan '87. *Computing Today* Nov '78 to Aug '84 with only Dec '80 missing; this is a full set of this magazine. *Electronics Today International* Jan '84 to present time. Prefer that buyer collects if possible. Contact C G Dixon, Kyrles Cross, Peterstow, Ross-on-Wye HR9 6LD or Tel: (0989) 62715

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■ QRT sale, Advance AF sig gen H1, with manual, £15.00. Bradley electronic multimeter dc-1500 MHz with probes & manual, £18.00. S G Brown prof h/phones, £5.00. 2mtr mobile whip & pod, £3.00. Rascal mobile handheld ptt mic, £3.00. Mobile 12V PSU for scanner Rx's, Bearcat, SX200N etc, £5.00, 4 off h/duty Tx. Ae insulators, £3.00. Approx 100ft of RG14A Tx 0.5in coax, £5.00. Approx 50ft of 300 ohm ribbon cable, £3.00. BA/metric ratchet socket set, £4.00. 13A 6skt. distribution block, £5.00. Box of useful components, meters, PSU modules, clean PCB, resistors caps etc, £5.00 the lot. G4FZG QTHR, Tel: (0242) 580329

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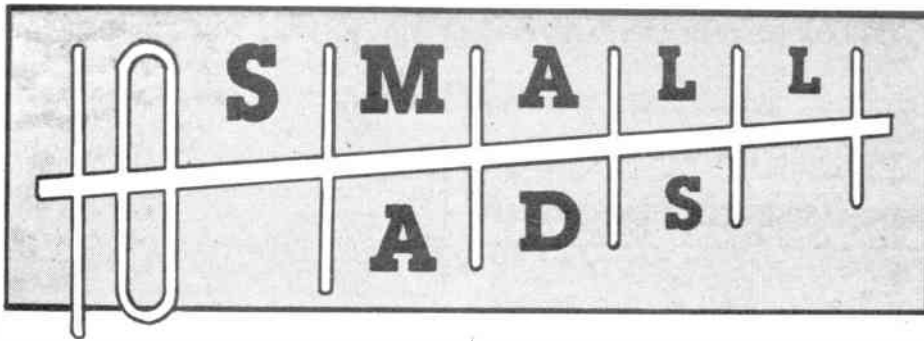
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42 ELM GROVE, SOUTHSEA, HANTS

**COME AND BROWSE
BEFORE YOU BUY**

GWM RADIO LTD

40/42 PORTLAND ROAD, WORTHING
SUSSEX. TEL: 0903 34897

RECEIVERS: RA17

Racal Communications RX 500KHz-30MHz
£175 plus car. Eddystone 730/4 480KHz-
30MHz Xtal filter etc £110 carriage extra
sae for further info. Oscilloscopes SE
Labs. SMIII Solid State portable AC mains
or external DC supply dual trace 18MHz
bandwidth £175 carriage extra. Electronic
multimeter type CT471 by Bradley RF
Voltages up to 1000MHz AC/DC volts 12mV
to 1200V in 12 ranges, AC/DC current 12µA
to 1.2A in 12 ranges. Plus resistance
ranges. Input resistance 12MΩ high ranges
supplied with leads plus 50 and 75 ohm
unterminated RF probes £28 inc p&p.

HANDY WALKIE TALKIES

Private crystal controlled frequency and long range. Comprises
features used in transceivers costing more than £70 each. Uses 2 x
9V cells. Complete satisfaction or refund. Only £34.99 pair incl.
(normally £39.99). Immediate delivery. Send cheque/PO to:

XENON ELECTRONICS

(Dept NEW), 24 Wharfedale Street, Barnsley, S Yorks S70 6BP

TURN YOUR SURPLUS

IC's TRANSISTORS etc. into cash, immediate
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CONTACT:

COLES-HARDING & CO

103 South Brink, Wisbech, Cambs

TEL: 0945 584188

Est Over 10 years

JAYCEE ELECTRONICS LTD

JOHN GM30PW

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Open: Tues-Sat 9-5

Quality secondhand equipment in stock. Full
range of TRIO goodies. Jaybeam - Microwave
Modules - LAR.

PSSS....

ALL THE SUPER
BARGAINS ARE
ON THE
INSIDE-FRONT
COVER OF THIS
MAGAZINE!!



**PROFESSIONAL
ELECTRONICS TECHNICIANS**

Short re-training courses (3 week)

VCR SERVICING

MSC GRANT AID PAYABLE TO EMPLOYERS (ATS GRANT
50% OF FEES). UNEMPLOYED MAY BE ELIGIBLE FOR FULL
JTS GRANT AID

HIGH PRACTICAL CONTENT ON ALL COURSES

BTEC ONC AWARDS

NEXT COURSES COMMENCE 11th JANUARY 1988

TELEVISION AND VIDEO. COMPUTER TECHNOLOGY.
TELECOMS. PROGRAMING

The LONDON ELECTRONICS COLLEGE Dept REW
Brompton Institute

Penywern Road, London SW5 9SU

Tel: 01-373 8721 PRESTEL*2115495

THE SCIENTIFIC WIRE COMPANY

811 Forest Road, London E17, Telephone 01-831 1588

ENAMELLED COPPER WIRE

SWG	1lb	5oz	4oz	2oz
8 to 34	3.63	2.09	1.10	0.88
35 to 39	3.82	2.31	1.27	0.93
40 to 43	6.00	3.20	2.25	1.61
44 to 47	8.67	5.80	3.49	2.75
48	15.96	9.58	6.38	3.69

SILVER PLATED COPPER WIRE

14 to 30	9.09	5.20	2.93	1.97
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TINNED COPPER WIRE

14 to 30	3.97	2.41	1.39	0.94
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Fluxcore
Please add 15% VAT. Orders under £3 add 50p.
SAE for list of copper and resistance wire.
Dealer enquiries welcome.

**COUNTY
GUIDE**

RATES
BOXES ad sizes
20mm x 59mm single
40mm x 59mm double

Total	Ad space	3 issues	6 issues	12 issues
prepayment	single	£47.00	£88.00	£158.00
rates	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

.....
.....
.....

NUMBER OF INSERTIONS REQUIRED

Single County Guide 3 £47.00... 6 £88.00... 12 £158.00...
Double County Guide 3 £94.00... 6 £176.00... 12 £316.00...

PAYMENT ENCLOSED

£ —

Cheques should be made payable to Radio &
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)

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Radio & Electronics World

The communications and electronics magazine

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES		series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
61 x 90	1/8 page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	1/4 page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	1/2 page	£305.00	£290.00	£275.00	£245.00
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	series rates for consecutive insertions		
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
128 x 186 or 263 x 90	1/2 page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

SPECIAL POSITIONS	
Covers:	Outside back cover 20% extra, inside covers 10% extra
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 thru	
Jan 88.....	12 Nov 87.....	18 Nov 87.....	20 Nov 87.....	10 Dec 87.....	
Feb 88.....	10 Dec 87.....	16 Dec 87.....	18 Dec 87.....	14 Jan 88.....	
Mar 88.....	14 Jan 88.....	20 Jan 88.....	22 Jan 88.....	11 Feb 88.....	
Apr 88.....	11 Feb 88.....	17 Feb 88.....	19 Feb 88.....	10 Mar 88.....	

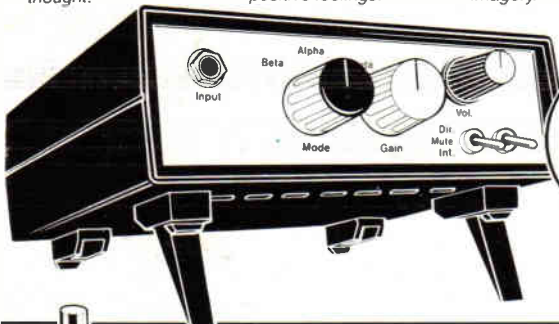
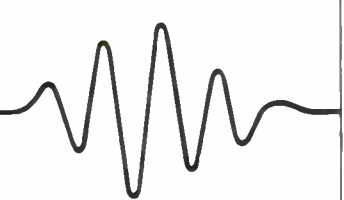
CONDITIONS & INFORMATION	
<p>SERIES RATES Series rates also apply when larger or additional space to that initially booked is taken. An ad of at least the minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be repeated if no further copy is received. A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received. Display Ad and Small Ad series rate contracts are not interchangeable.</p>	<p>-If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken. COPY Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations.</p>
<p>Printed — web-offset. PAYMENT Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by publication date.</p>	<p>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. Ads accepted subject to our standard conditions, available on request.</p>
<p>FOR FURTHER INFORMATION CONTACT Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE. (0277) 219876</p>	

Are we about to create a race of Supermen?

Brainwave

β BETA – Concentration, problem solving, active thought. **α ALPHA** – Relaxation, pleasure, tranquility, positive feelings. **θ THETA** – Imagination, creativity, hypnotic imagery.

monitor



BRAINWAVE MONITOR PARTS SET ONLY
£29.90
+ VAT

The ETI Brainwave Monitor must be the most astonishing project ever to appear in the pages of an electronics magazine. It will allow you to hear your brainwaves and judge the relative levels of various types. It will also help you to control your mind more effectively, to be at peak performance in all situations.

Doesn't my mind work perfectly well when left to its own devices?

If you've ever been confused, unsure of yourself, shy, unable to pass exams or to impress people at interviews, you know perfectly well that it doesn't. Your mind (and everybody else's) is full of bad habits, inappropriate responses, feelings of inadequacy all pulling you down. Why should you put up with it?

Mind training sounds like hard work!

It can be. If you want to do it the hard way, go and study under a Zen master for fifty years or so. You'll get there in the end! With the brainwave monitor it takes no effort at all. Just the opposite in fact – trying is the one thing you mustn't do!

How do I start?

At first you use the monitor's internal indicator to exercise your mind. In direct mode you improve the time percentage; in integrate you concentrate on the amplitude. After that, the choice of direction is yours. With the Alpha Plan you can reach the core of your personality to root out the weakness and replace it with inner strength. Otherwise you can just enjoy the feelings of pleasure and clear headedness that alpha training brings, or the creativity and imagery of the theta state.

A friend told me I can use brain power to control lights and things. I can't believe it!

As a matter of fact, you can do more than that! The interface sockets on the monitor allow you to turn lights on and off, control toys and electrical gadgets, play computer games... all with your mind! Are we about to create a race of Supermen? Only time will tell.

The Brainwave Monitor is featured in the September, October and November 1987 issues of ETI. The approved parts set contains: two PCBs, all components including three PMT precision amplifiers, shielded box for screening the bio-amplifier, attractive instrument case with tilting feet, controls, switches, knobs, plugs and sockets, leads and materials for electrodes, full instructions for assembly and use.

Parts are available separately. We also have a range of accessories, professional electrodes, books, etc. Please send a stamped, self-addressed envelope if you just want the lists. Otherwise, an SAE + £2 will bring you lists, construction details and further information.



SILVER SOLUTION

This powerful silver plating compound must be the greatest revolution in electronics since the IC! Just wipe on with a cloth to plate PCB tracks, connectors, wire, component leads, etc. with a layer of pure silver!

Essential for:
• RF circuits
• Top flight Hi-Fi
• Bio-electronic circuits and electrodes.

LARGE BOTTLE (150ml) SILVER SOLUTION £11.20 + VAT*
N.B. The solution will plate brass, copper, etc. but not to steel or pre-plated components.



THE ALPHA PLAN

Can you really train your brain to think more effectively?
Can you really achieve peak performance in things you're not good at?
Can you really overcome fear, shyness, uncertainty?
And can you do it all without really trying?

Dr. David Lewis's famous Alpha Plan has all the answers. It was recently investigated by a QED television documentary (Alpha – How to Succeed Without Really Trying). And the conclusion? It works!

Dr. Lewis's book 'The Alpha Plan' is yours for only **£2.50** (no VAT)
Your future is waiting.

Complete Parts Sets for ETI 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 muddied, 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 £4.90! + VAT
*Note: the toroid and VDR supplied are superior to the types specified in the article.



KNIGHT RAIDER

FEATURED IN ETI, JULY 1987

The ultimate in lighting effects for your Lamborghini, Maserati, BMW or any other car (or that matter). Picture this: eight powerful lights in line along the front and eight along the rear. You flick a switch on the dashboard control box and a point of light moves lazily from left to right leaving a comet's tail behind it. Flip the switch again and the point of light becomes a bar, bouncing backwards and forwards along the row. Press again and try one of the other six patterns. An LED display on the control box lets you see what the main lights are doing.

The Knight Raider can be fitted to any car (it makes an excellent fog light) or with low powered bulbs it can turn any child's pedal car or bicycle into a spectacular TV age toy!

The control box parts set consists of case, switches, LEDs, PCB, components, hardware and instructions. The sequence board includes PCB, ICs, power FETs, components, hardware and instructions.

KNIGHT RAIDER CONTROL BOX ONLY £6.90 + VAT*
KNIGHT RAIDER SEQUENCE BOARD ONLY £13.90 + VAT*



MATCHBOX AMPLIFIER

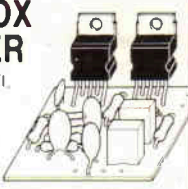
FEATURED IN ETI, APRIL 1986

No ordinary amplifiers these. When our first customers took an interest, it was for the diminutive size (both modules will fit in a matchbox!), the total disregard for power supplies and speaker impedances, and the impressive power output from these little amplifiers. When they re-ordered, it was for the sound quality.

Two amplifier modules were described, both based on the powerful L165V IC. The single IC version will deliver over 20 Watts with a suitable speaker and power supply. The bridge version can provide up to 50W! Although the specified supply voltage and speaker impedance must be used to achieve maximum power, both modules are quite happy to work from any voltage between 12V and 32V and will accommodate any type of speaker. The bridge version is ideal for giving a boost to car hi-fi systems, driving two 4 Ohm speakers in parallel on each channel for best effect.

Both designer-approved parts sets consist of a roller tinned printed circuit board and all components. The L165V ICs are also available individually, with a free mini data sheet giving specifications and suggested circuits.

SINGLE IC MATCHBOX AMPLIFIER SET (20W into 4 Ohms) £6.50 + VAT
BRIDGE AMPLIFIER SET (50W into 8 Ohms) £8.90 + VAT
L165V IC with data £3.90 + VAT



POWERFUL AIR IONISER

FEATURED IN ETI, JULY 1986

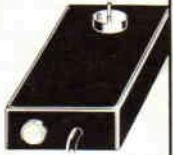
Ions have been described as vitamins of the air by the health magazines, and have been credited with everything from curing hay fever and asthma to improving concentration and putting an end to insomnia. Although some of the claims may be exaggerated, there is no doubt that ionised air is much cleaner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



PROJECT BOX

PROJECT CASE WITH PP3 BATTERY COMPARTMENT

ONLY £2.60! + VAT*



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 + VAT

RUGGED PLASTIC CASE

suitable for mains conditioner and mains controller.

ONLY £1.65 + VAT



SPECIAL OFFER

Our best selling ioniser kit is now available with an elegant white case.

WHITE IONISER PARTS SET ONLY £9.80! + VAT

Prices shown are exclusive of VAT, so please add 15% to the order total. UK postage is 50p on any order. Carriage and insurance for overseas orders £1.50. Please allow up to 14 days for delivery.

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FOUNDERS HOUSE REDBROOK MONMOUTH GWENT