

Radio & Electronics

The communications and electronics magazine **World**

USER REVIEW:
WXSAT WEATHER
SATELLITE STATION

UP IN THE AIR:
SECONDARY
SURVEILLANCE RADAR

ATTENUATORS:
COMPUTING WITH
THE AMSTRAD PCW

CONSTRUCTION:
LONG RANGE
LW RECEIVER





RAYCOM for: Scanners, Handhelds, HF, VHF and UHF Transceivers, Receivers. Before you purchase anything, call us last! For that special deal!

YAESU  **SONY**

International House, 963 Wolverhampton Road, Oldbury, Warley, W Mids B69 4RL

Tel: 021-544 6767 (PBX)

STOCKTAKING SALE

Now that RAYCOM has taken over Ray Withers Communications, our annual stock check has revealed excess stock levels on many lines. We are therefore offering the following items at unbelievable prices. All equipment is new unused with full warranty. The following items are offered on a first come first served basis, some items are end of lines and cannot be repeated, hence the low prices.

ACT NOW TO AVOID DISAPPOINTMENT.

Please add p&p £5.00 or carrier £10.00.

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RAYCOM 6E Discone Antenna (air band + VHF)	£19.50	£10.00
SO239 Guttermount assy. C/w 6 mtrs RG58CU	£12.50	£10.00
YAESU FT77 120W PA Unit (1-30MHz .5W input)	£149.00	£75.00
YAESU Horn Relay Unit with 555 Timer IC	£12.50	£4.50
YAESU YD844A 600 ohm/50K Desk Mic	£39.95	£19.95
RAYCOM 13.5V 5A Power Supply Unit	£29.50	£22.50

Please send large SAE for: Bargains List, Used List, Scanner Catalogue, or any other Information/Leaflets.

Full range of SONY Receivers now in stock, RAYCOM now appointed SONY dealers. SONY products post free.

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SPECIAL CLEARANCE PYE W15FM Dash Mount Westminsters, 15W 3 ch, ideal for conversion to 2 mtrs/ Packet Radio. Supplied as seen untested, with copy of conversion details @ £37.50 inc post.

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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.

Cover Photographs

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Bottom - a testing time for the Harrier GRS on the antenna test range turntable at Bristol - details next month

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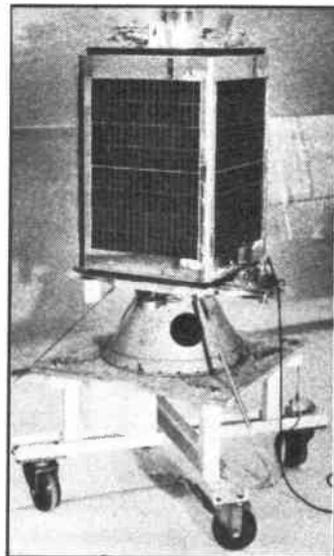
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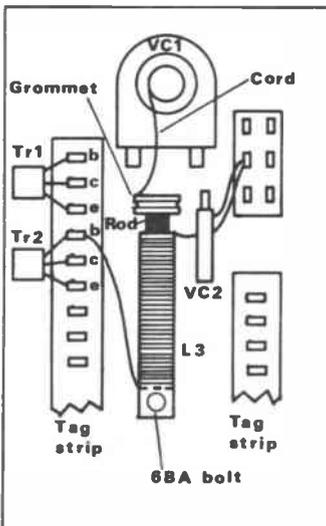
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PRODUCT NEWS

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

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

30MHz DUAL TRACE SCOPE

With dc to 30MHz bandwidth and 11.7 rise time, the Type 3337 dual trace oscilloscope can display the rising edges of rapidly changing waveforms. This unit, available from ECW, is ideal for maintenance and servicing, as well as laboratory and educational establishments. Its display is enhanced by the inclusion of a built-in signal delay line that operates on both channels and provides sufficient delay to capture fast leading signal edges.

Input sensitivity is 5mV/div and the two inputs can be algebraically added or subtracted. X-Y operation is possible. The timebase range is from 40ns to 1s/div with triggering to 50MHz. The trigger circuit gives a reliable display with ac/dc coupling,

composite trigger and single shot modes.

The Type 3337 is fitted with a bright, 10kV 5-inch CRT that gives a clear image for performing measurements and signal analysis. Offered with a two-year guarantee, the Type 3337 costs £425.00, excluding VAT.

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

SINGLE FUNCTION INSTRUMENTS

New from ITT Instruments is the MX series of single function instruments, suit-

able for a wide range of applications.

The range comprises the MX029 voltmeter, the M039 ammeter and the MX038 centre zero ammeter. A major feature of these instruments is that they can be used in dedicated applications, thereby avoiding the need for a more complicated, more expensive multimeter.

The MX series is easy to use and has just two input terminals and a single slide switch on the side for all ranges displayed on the dial. The dial has large, clearly divided colour scales and an anti-parallax mirror, enabling the measured value and the chosen range to be viewed from the same angle.

Other features include an accuracy of 1.5% dc and 2.5% ac, a range overlap with a ratio of 3 to 1 for the current ranges up to 10A, and overload protection.

Measuring just 170 x 127 x 44mm and weighing only 400g, the MX series is ideally suited for use in small working areas. It is ruggedly constructed to withstand the harshest conditions and is fitted with a rubber shock absorber for added protection.

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

60MHz OSCILLOSCOPE

The Kenwood CS1065 three channel oscilloscope with delayed timebase is now available ex-stock from Thurlby Electronics. An alternate sweep function allows simultaneous display of main and delayed waveforms on each channel, thereby enabling up to six traces to be displayed.

Sensitivity of 5mV/div is available up to 60MHz with 1mV/div up to 20MHz, which enables observation of complex low level signals. The rectangular, dome mesh, post accelerator type CRT fea-

tures high intensity and high resolution with 12kV accelerating potential. A maximum sweep speed of 5ns/div is achieved using the x10 magnification and a signal delay line gives approximately 20 nanoseconds (ns) visible delay on the screen. This feature gives accurate observation and measurement of the leading edge of high frequency signals.

Vertical axis sensitivity and timebase accuracy are guaranteed to within ±3% over a temperature range of +10 to +35°C and up to 85% relative humidity. A second (B) timebase provides magnification of an intensified portion of the main (A) waveform. The trace separation control can shift the B waveform down four divisions with respect to the A waveform.

A useful feature is the trigger fix mode, whereby the trigger level automatically tracks the amplitude of the waveform to maintain trigger without the need for adjustment. Other features include variable hold-off, single shot, vertical axis signal output and automatic syncing of video signals using a special video clamping function.

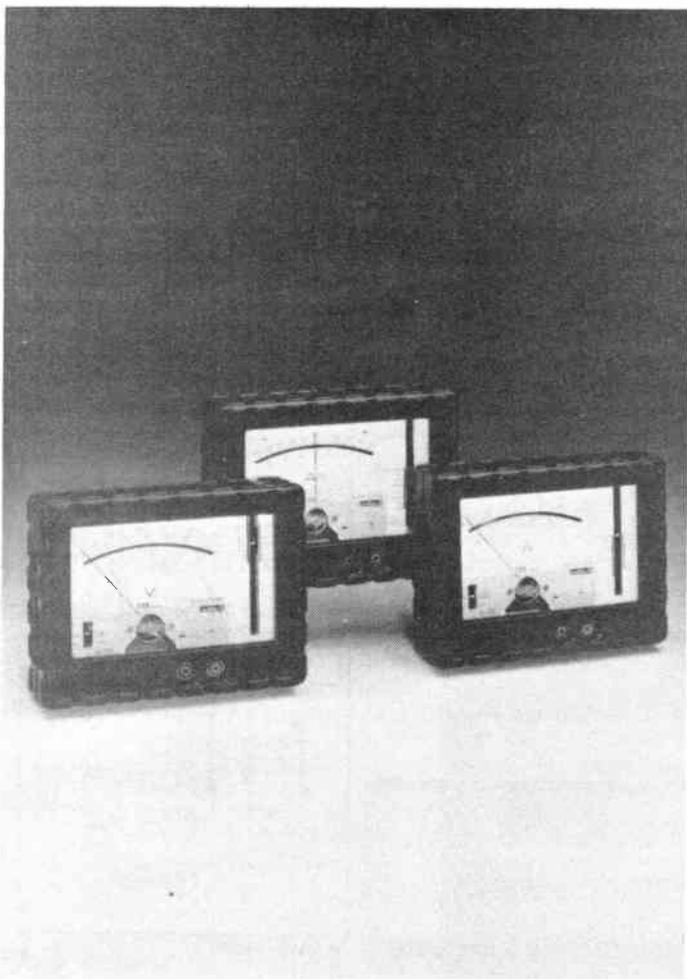
The CS1065 comes complete with two probes and costs £795.00 + VAT.

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

DIGITAL FUNCTION GENERATOR

The new, low cost GFG-2D digital function generator from Flight Electronics offers five different waveform outputs.

The instrument generates sine, triangle and square waveforms which are push-button selectable. A separate terminal provides TTL pulse and CMOS outputs. A built-in counter allows outputs to be modulated by applying a signal voltage to a dedicated



input terminal. The large 0.5in LED display provides clear 4-digit indication of output levels. Seven push-buttons split the frequency range, which spans 0.2Hz to 2MHz.

The compact unit provides a cost-effective and flexible waveform generation source. The output modulation facility is useful for RF applications. Amplitude is 20V peak-to-peak (open circuit) and 10V peak-to-peak (into a 50 ohm load). A dc offset facility is provided. Overall dimensions are 284 x 237 x 85mm.

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

LOW COST SCOPE

The Kenwood CS8010 digital storage oscilloscope (pictured below) is now available from Thurlby Electronics. The product includes many features previously unavailable in an oscilloscope at this price.

The sampling rate of 10MHz enables easy observation of single shot events and transients. Each channel includes an 8-bit resolution A/D converter and a 2048 word memory. Pretriggering enables observation of events occurring before the trigger point. In the storage mode the trigger point can be set at the left edge of the screen.

A 10x magnification function allows expansion of the waveform even after storage, a useful function for detailed waveform observation. High speed writing at 100ns per

word is possible into both channels simultaneously.

Also included is a cursor measurement system which measures voltage, time, frequency, ratio and phase difference. The on-screen readout allows clear unambiguous presentation of measured data plus set-up conditions. The 'real time' and 'stored' function permits comparison of real time and stored waveforms.

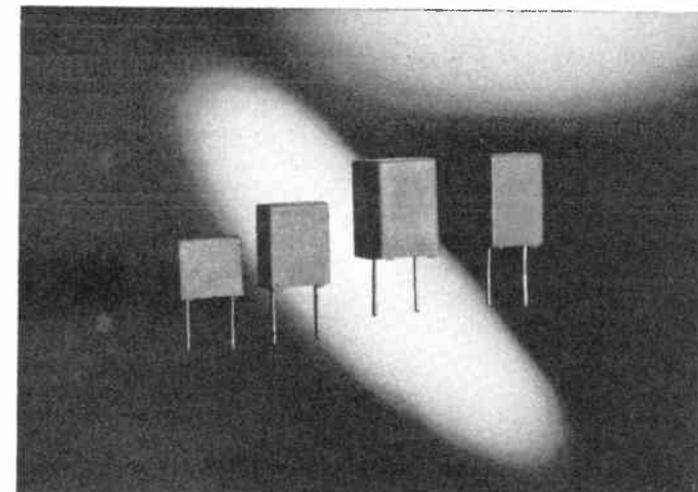
As with a conventional 20MHz real time oscilloscope, the capabilities of the CS8010 include 1mV/div sensitivity, X-Y function and T-V line and frame triggering. The CS8010 costs £1195 + VAT.

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

MONOLITHIC OP-AMPS

The CLC400 and CLC401 amplifiers from Comlinear give a choice of low gain (CLC400) and high gain (CLC401) characteristics and are well suited to all types of precision analogue equipment design in ADCs and DACs, line driving, IF processing and general amplification. Applications include instrumentation, ATE, radar, EW systems, communications equipment, digital radio, medical electronics, electronic imaging and computers/peripherals.

Performance figures for the CLC400 include a gain from ± 1 to ± 8 and a bandwidth of 200MHz. Rise time for a 0.5V



SIEMENS CAPACITORS

The Siemens B32529 encapsulated polyester capacitor range has been extended. It covers from 1000pF (0.001 μ F) to 1.5 μ F, and the full range is available from RR Electronics.

These 5mm pitch self-healing units are encapsulated in a flame-retardant plastic case to UL94 V-0, epoxy-sealed for humidity resistance. The voltage range is 63V dc (40V ac) with an IEC climatic category

55/100/56. The range conforms to CECC 30401-043.

The device has spacers for better solderability. Leads are parallel and tinned. The units are suited to space-saving assembly at high packing density on any PC board.

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

input step is 1.6ns with a slew rate of 700V/ μ s. The high gain CLC401 has a ± 7 to ± 50 gain range and a 150MHz bandwidth. For a 2V step, rise time is 2.5ns and slew rate is a fast 1200V/ μ s. Both types share an output drive capability of ± 3.5 V and 50mA. Capacitive loads can be driven happily and the power dissipation is 150mW.

Packaging options are an 8-pin plastic DIP (available now), with standard and Hi-Rel hermetically sealed ceramic 8-pin DIPs, dice and surface mount versions. Both amplifiers are overload and short circuit protected and remain stable without the use of external compensation components.

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

FLUSH MOUNT BEZELS

New from Highland Electronics is a range of flush mount bezels which are suitable for

use with the Swisstac range of 18 x 24mm size switches, push-buttons and pilot lamps.

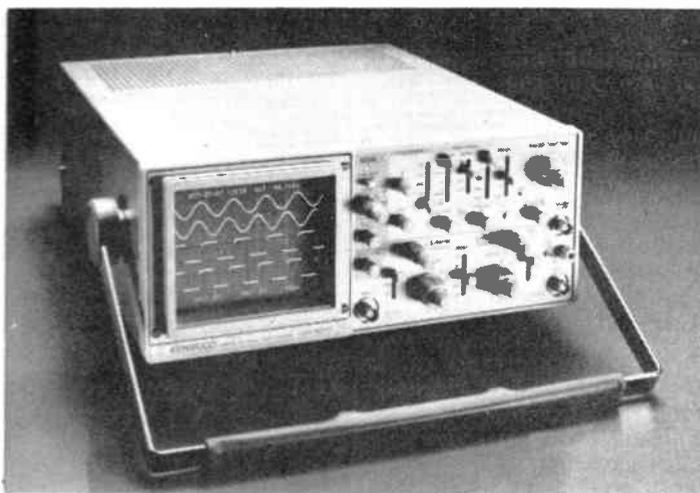
With low profile, the bezel enhances the readability of engravings on the panel between the switches and offers improved protection of the frame against damage and accidental operation.

The bezels comprise a grey or black Celanex front frame with a stainless steel mounting bracket. A new range of transparent lenses, compatible only with the flush mount bezel, can be supplied in orange, red, green, blue, white and yellow.

*Highland Electronics Ltd,
Albert Drive,
Burgess Hill,
West Sussex RH15 9TN.
Tel: (04446) 45021.*

DOUBLE-BALANCED MIXERS

With a frequency coverage from 1 to 18GHz, LO power rating from +7 to +16dBm and a choice of six package styles, the Triangle double-balanced mixer series from Anglia Microwaves Ltd offers a highly



efficient solution to virtually any RF circuit requirement.

More than 70 different models are available, including wide and narrow bandwidth versions. For example, customers can select from several types in the 8 to 16GHz range: 8 to 16, 8.5 to 9.6 or 9.3 to 9.7GHz. Each model has low conversion loss, VSWR and high isolation figures.

There are three power bands: Low Level, with LO ratings from +7 to +10dBm; Medium Level, with LO up to +13dBm; and High Level, up to +16dBm. Package options are circular and square drop-ins, and SMA versions with male or female connectors.

Anglia also supplies double-balanced mixers to meet customers' special requirements. Combinations of RF, LO and IF frequency ranges may be specified to give optimised performance in the customer's particular application.

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

ILLUMINATED SWITCHES

IMO Electronics have introduced a new range of UK-manufactured illuminated push-button switches, indicators and key switches.

With a matt finish to complement any panel design, the switches have silver inlaid contacts and high pressure switch action. This ensures negligible bounce, accuracy of sequencing and renders them suitable for low voltages and currents.

All the switches share a uniform behind panel dimension regardless of whether double or single pole, or momentary/alternate switch action. Their terminals are suitable for faston, solder or PCB assembly.

The anti-glare buttons come in a choice of 6 colours, and may be easily legended either by direct engraving techniques or by the insertion of printed film behind the diffuser.

The lamps, from IMO's range of miniature long-life

filament devices, are available in seven voltages from 6V to 240V ac.

*IMO Electronics,
1000 North Circular Road,
Staples Corner,
London NW2.
Tel: 01-450 6444.*

CIRCULAR CONNECTORS

Highland Electronics have recently introduced the R series of circular connectors, featuring a screw coupling. Each connector comprises a UL-94-VO precision engineered housing fabricated in nickel-plated copper alloy with fibreglass reinforced thermoplastic inserts.

A choice of three termination styles is available – straight, solder pin and crimp. Cable entries are to DIN 46320 and are neoprene multiple split seals. Plugs and sockets are fully interchangeable and have gold contacts.

The R series is offered in a choice of five body styles. Options include 9, 12 and 16 pin configurations and three possible coding positions. Chassis and in-line versions are available with or without cable entry gland and protection caps. Polarisation is also available as an option.

Other features include a rated current of 7.5A for a 1mm contact and 16A for a 2mm contact, IP65 protection and an operating temperature range of -40°C to +100°C. The contact resistance is 2.5 or 3.0mΩ, dependent on the plating.

*Highland Electronics Ltd,
Albert Drive,
Burgess Hill,
West Sussex RH15 9TN.
Tel: (0446) 45021.*

PERSONAL SCANNER

The Microscan hand-held PC personal scanner from AMS features a 105mm wide scanning head and produces dithered half tones. The new system delivers extremely good copies of photographs (half tones and grey scans), logos and signatures, as well as text and other images at a resolution of 200 DPI. It will retail at £249 + VAT.

The scanner includes software running under the Digi-



tal Research Gem Environment to cater for programs such as Ventura and Gem DTP, while AMS is also including scanning software under Microsoft Windows for Aldus Pagemaker, and an MS-DOS facility for art programs such as PC Paintbrush, Dr Halo and numerous others.

Specifications of the AMS Microscan are as follows: scanning width – 105mm, 840 dots per line; resolution – 200 DPI horizontal and vertical; scanning modes – B/W and dithered half tones; interface – half card for IBM PC-XT-AT plus compatibles; software – MS-DOS, MS Windows, DR Gem.

*Advanced Memory Systems,
166-170 Wilderspool Causeway,
Warrington WA4 6QA.
Tel: (0925) 413501.*

CIRCUIT ANALYSIS

Number One Systems' popular PC circuit analysis package, Analyser II, has been the subject of a major revision to include analysis of microwave strip lines and transmission lines.

This addition will offer design engineers at RF and higher frequencies the facility of rapid evaluation of designs that include these elements for gain, phase, input and output impedance, and group delay.

Circuit designs may still include active and passive components such as transistors, FETs, amplifier blocks, R, C, L and transformers. Expensive test and measuring equipment can be

avoided, as well as continued breadboarding during circuit development.

Results of the analysis are presented in tabular or graphic form so the user can spot and measure response peaks and notches, phase reversals and impedance changes where matching is important.

Transmission lines are modelled as ideal loss-free lines specified by the characteristic impedance, the length and the percentage velocity factor. Each line has three connections: input, output and common.

Strip lines are modelled as ideal loss-free lines separated from a single continuous common surface by a layer of dielectric. The line is specified by its input, output and common nodes, and by the width of the strip, its length, the thickness and the relative permittivity of the dielectric.

Analyser is supported by free updates for 6 months, and a telephone query hotline. The operating system is PC-DOS or MS-DOS. The analyser has a 192K minimum memory and uses 5¼in discs. The cost of the analyser is £195 plus VAT.

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

FLEXIBLE PROGRAMMER

The GP XR16, a cost effective, high-volume EPROM/

EEPROM programmer, is now available from STC Instrument Services. The sophisticated design, which combines specialised circuitry with a comprehensive self-checking facility, allows simultaneous support for up to 16 of the latest devices.

Ruggedised for industrial use, the system incorporates ultra-fast algorithms, including Quick Pulse (INTEL) and Flashrite (AMD), and is designed to support 24, 28, 32 and 40-pin EPROMs and EEPROMs up to 1Mbit and beyond.

The XR16 is expandable for device support and throughput, offering a choice of 4 plug-in modules which allows the handling of 8 or 16 devices with either 32 or 40 pins. In addition, the 32-pin module supports 24 and 28-pin devices.

Set programming for 8, 16 and 32-bit data is standard, whilst a split data bus on the 32-pin module provides a 50% improvement on programming times compared to conventional programming systems. Other features include a comprehensive menu-driven editor, a one-key production mode for speed and flexibility, a 2 x 40 character LCD, internal fault diagnosis and simple interfacing via the RS232 or Centronics ports.

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

MEMORY CARD

Hero Electronics have announced the addition of the 128Kbyte SHB3112B1A to the company's range of CMOS SRAM memory cards. Others in the series are 32K and 64Kbyte types, with a 256Kbyte planned for introduction shortly.

All cards are in the standard credit card format of 54x85.6x3mm, and incorporate a two-part connector which offers high contact reliability. The card operates from a single 5V ± 10% supply, and is designed to ensure high resistance to static discharge.

Memory cards obviate the

need for floppy disc drives in many applications, and the smaller size allows use in hand-held instrumentation, computer or communications equipment. Significant cost reductions have already been made on the 32Kbyte, which was introduced only six months ago.

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

MATHCAD

New MathCAD Version 2.0, introduced by MathSoft International, not only understands mathematics and solves problems, it also has the capability to solve simultaneous equations.

This computer program is already widely used by electronic/electrical engineers, designers, draughtsmen, accountants, statisticians and academics.

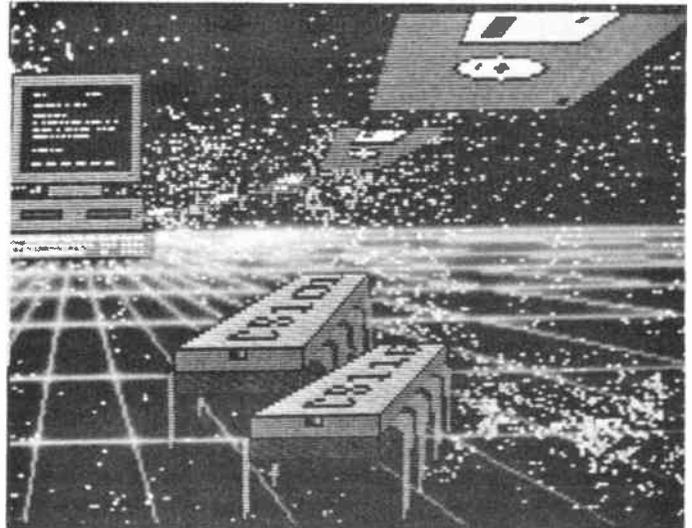
All of the features of the previous MathCAD V1.1 are included in the new release. These include over fifty built-in functions, automatic plotting with logarithmic scaling and handling complex numbers.

Units of measurements, fast fourier transforms and calculus operators are also retained as standard.

Other features of the new MathCAD V2.0 include solving any number of simultaneous linear and non-linear equations and inequalities, with any number of unknowns; expanded plotting capabilities, with automatic axis scaling and histograms, and performance enhancements which result in most applications being two to four times faster.

MathCAD V2.0 operates on IBM PC, XT, AT and PS/2 or compatibles with 512K RAM and DOS 2.0 or later. The cost of MathCAD V2.0 is £345 + VAT and is available directly from MathSoft International and leading dealers throughout the UK.

*MathSoft International Ltd,
Freepost,
Tamworth,
Staffs B79 7BR.
Tel: (082786) 239.*



AMPLIFIER CIRCUITS

The CS-101A and CS-116 from Cherry Semiconductor are high performance differential amplifier circuits, designed for use as a preamplifier for the magnetic servo head of a Winchester disc drive. The CS-116 has a 50MHz bandwidth and is specifically for thin film heads. The CS-110A has a bandwidth of 30MHz. Both ICs will operate from 8.3, 10.0 or 12.0V.

Operating at 8.3V, the CS-

116 is compatible with IBM 3370 and 3380 system requirements. The CS-101A is compatible with IBM 3340 system requirements. Both are available in an 8-pin plastic DIP package or a 10-pin flatpack. The CS-101A is also available as an SO-8.

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

LIFELONG PARTNER

The AR Environmental Partner is a full-range loudspeaker system with a four-inch polypropylene-coned woofer and 1 1/4 inch liquid-cooled tweeter. It is housed in a wedge-shaped cast aluminium case, finished in scratch-resistant black.

The versatility of these loudspeakers makes them ideal in the home. Their angular shape enables them

to be fixed in corners, on the floor pointing upwards, or on the wall held by swivel brackets.

They can even be stacked or mounted on car roll-bars, using the integral bracket for fixing to 1 1/4 inch tubing. They are also weather-resistant and can be mounted in sheltered out-of-doors positions. Sensitivity is 88dB for one watt and they are suitable for use with amplifiers rated at



PRODUCT NEWS

between 7 and 75 watts per channel.

The suggested retail price of the Environmental Partners is £149.99 per pair.

*Teledyne Acoustic Research,
High Street,
Houghton Regis,
Dunstable,
Beds LU5 5QJ.
Tel: (0582) 867777.*

SMALL ANTENNA

APL Antennas have recently introduced a new 3dB gain cellular antenna. This new high performance antenna gives less than half the wind load of APL's previous 900 series model.

It is for use on a glass-mount or standard body-mount and comes in matt black.

*APL Antenna Products Ltd,
Gatehouse Way,
Aylesbury,
Bucks HP19 3DB.
Tel: (0296) 42445.*

DISCONE ANTENNA

South Midlands Communications have recently launched a new wideband discone antenna, the DSC77.

The new antenna covers frequencies from 70 to 700MHz, with a gain of 3.5dB. It is designed for use either in receiving or transmitting up to 500 watts pep.

The top centre disc, cone

and elements are all manufactured from high grade aluminium alloy. The elements screw directly into the cone and disc to prevent them vibrating loose in the wind. A stub mast of 1½in diameter is supplied with the antenna, as well as a mast clamp to fit a 1¼ to 2in mast. The stub mast protects the input connector from the ingress of moisture.

The antenna is available from most specialist shops, at a cost of £55.75 including VAT.

*South Midlands
Communications Ltd,
S M House,
School Close,
Chandlers Ford Industrial
Estate,
Eastleigh,
Hants SO5 3BY.
Tel: (0703) 255111.*

SOCKET STRIPS

Rainford Racks has recently launched a range of 13 amp and IEC socket strips. In total, 30 models are available.

The strips fit standard racks and cabinets, and can also be mounted on desks and work-tops or used as trailing sockets.

Housed in ribbed extruded aluminium, the socket strips are light, yet strong. They come in various lengths, with up to 10 ways (13A type) or 15 ways (IEC type). Mains filters and circuit breakers are an optional extra.

The circuit breaker models have an earth leakage trip and come complete with both 16A and 32A circuit breakers. A simple wiring modification selects the desired rating.

Mains filter models give up to 60dB attenuation of mains-borne interference. The 13A strips come in straight and angled versions. The angled type has its socket outlets offset left or right-handed to eliminate cable kinks.

*Rainford Racks Ltd,
Mill Lane,
Rainford,
St Helens WA11 8LS.
Tel: (074488) 4721.*

LINEAR POWER

Recently introduced by Cirkit Distribution, the Bulgin 5 watt encapsulated EP linear power supplies are designed for mounting directly onto printed circuit boards. They measure 3.5 × 2.5 × 1.2in (89 × 63 × 32mm) and feature industry standard footprint pin-outs.

The power supplies are housed in ABS boxes which are encapsulated with flame retardant polyurethane and fitted with two M3 bushes for mechanical support.

Available with two input ranges (210 to 250V ac and 100 to 120V ac), they cover most popular voltages in single, dual and triple format. Custom requirements can easily be catered for with 1-3 outputs and 6 watt as the maximum load.

The design provides 3.75kV RMS input to output isolation with all outputs being short circuit protected.

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

POWER SUPPLY

STC Instrument Services has introduced the BNOS PR Series of 19in rack-mounted power supplies which offer full RF protection.

The PR Series is based on the popular BNOS P range and provides power up to 600W continuous. The series offers output voltages in three ranges: 2-7V, 10-15V and

20-30V, with output currents up to 40A.

An automatic shutdown facility ensures protection against short circuit, overvoltage, and overcurrent. The series features stability of better than 0.01% for 10% line change, 50Hz input frequency, 240V input voltage (ac), 500µV at maximum continuous output, and incorporates Power On LED indication.

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

RETROFIT BATTERIES

PMS Instruments have in stock an extensive range of low cost, high quality Mercury Retrofit Batteries from Alexander Manufacturing Ltd. Although designed primarily for the Bio-Medical and Laboratory Industries, they have many applications in other areas.

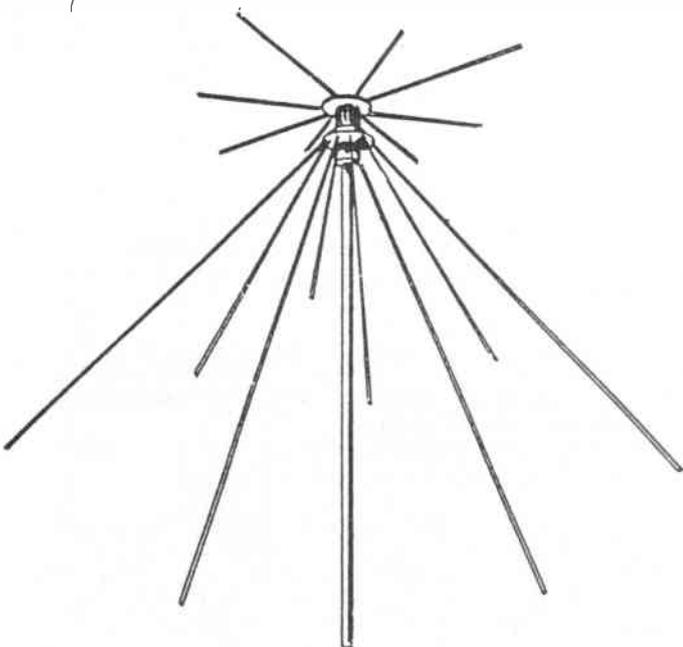
These products vary in size from 0.47mm to 1.36mm in diameter, and in length from 0.63mm to 3.9mm, with a power capacity from 1.4V/1000mAh to 8.4V/720mAh. This range can cater for almost every battery requirement from hearing aids and paging to small portable instrumentation.

*PMS Instruments Ltd,
Waldeck House,
Reform Road,
Maidenhead.
Tel: (0628) 38036.*

PROGRAMMABLE PSUs

The Thurlby PL-GP range of fully programmable power supplies offers high performance at low cost.

All models in the range can be controlled via the IEEE488 (GPIB) bus and they send back measured values of actual current flowing to give talker/listener operation. The range comprises models with output ranges of 0-15V/0-4A and 0-30V/0-2.2A, with twin versions of both available. All models can be used on the bench or mounted in a 19in rack with the optional rack mount kit.



Both voltage and current can be independently controlled via the bus to resolutions of 10mV and 10mA. Full service request facilities are incorporated with serial and parallel poll modes. Each supply is fully floating and can operate in constant voltage or constant current mode with automatic crossover. The twin supplies can be operated in series or parallel to provide higher voltage and current levels. Remote sensing terminals, damping and high resolution digital meters for reading both voltage and current are provided as standard.

A local/remote switch on the front panel enables control to be manual via front panel potentiometers or via the GPIB bus.

Line regulation is less than 0.01% of maximum output for a 10% line change and load regulation is less than 0.01% of maximum output for a 90% load change. Ripple and noise are less than 1mV and for constant current less than 1mA.

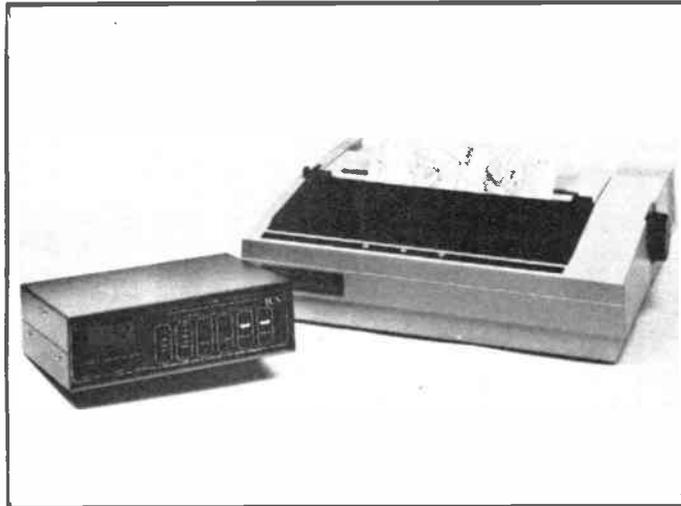
The PL-GP single supplies cost £445 + VAT and the twin supplies cost £650 + VAT.

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

COMMUNICATION TESTERS

The Comtest Series 200 range consists of three models: the 212, 225 and 250. They are designed with function and convenience in mind and are complete data communication troubleshooters for engineers, computer salesmen and those who install, repair or use RS232C/V24 equipment.

The state of the interface is easy to read, as the breakout system, monitors and signal description are all on the same line. The line monitors show signal strength and function without battery power. The pulse trap/current loop option for all Series 200 models enables the user to display short pulses impossible to detect with standard monitors. The current loop function makes it possible to



WEATHER FAX

ICS Electronics Ltd recently announced the availability of a low cost package for weather facsimile, Navtex and radio teletype reception.

For £399.95 inc VAT, ICS will provide their enhanced FAX-1 decoder, a mains power supply, an Epson compatible printer, all connecting leads, paper and a ribbon. The user must plug the cable supplied into the extension loud-speaker socket of any HF SSB communications receiver to obtain detailed weather maps, satellite cloud pictures, navigational warnings

and news bulletins.

The FAX-1 incorporates a built-in tuning indicator and timer, and is fully automatic in operation. No computer skills are needed to operate it.

The system components are available separately if required, and ICS can also offer a complete dc-powered marine system with inbuilt Navtex receiver. This permits concurrent Navtex and facsimile reception.

*ICS Electronics Ltd,
PO Box 2,
Arundel,
West Sussex BN18 0NX.
Tel: (024 365) 590.*

test short haul modems.

The testers can break and crosspatch all 25 lines by means of the dual in-line switch, the jumper cables and the contacts on both sides of the switch.

Model 212 offers all functions needed to locate RS232 interface problems, it monitors the 12 most important lines and has one extra undedicated monitor to test secondary signals.

Model 225 monitors all 25 signals and has cable and parallel test capabilities.

Model 250 monitors all 25 signals on both interfaces and has convenient null modem switching and the pulse trap option built in as standard.

The Comtest Series 200 testers are housed in a sturdy ABS plastic case and the contact system is gold-plated. Each model comes with jumper cables and user manual.

*M-Trade (UK) Ltd,
PO Box 35,
London SW1W 8TX.
Tel: 01-730 0681.*

BRIGHTSTAR EXPANSION

BrightStar have announced plans to expand the configuration of the BrightStar transatlantic system.

The main feature of the new system is a dual-channel operation allowing access to Washington or New York and on into North America, or Washington or New York into Europe simultaneously using the 332.5 satellite.

The core system will operate between Washington, New York and London and in the near future will expand into Europe.

The main gateways in each area are as follows:

- 1) Washington DC, BrightStar TOC at Washington International Teleport.

- 2) New York, AT&T Switching Centre in New York (NR).
- 3) London, BrightStar TOC Park Royal (as before).

The only change regarding price is that customers will be billed for line costs incurred in Washington or New York unless they have made special arrangements, and this will be the responsibility of the customer.

*BrightStar,
Visnews House,
Cumberland Avenue,
London NW10 7EH.
Tel: 01-965 6511.*

SATELLITE RECEIVER

A new Paltec GS-2 satellite receiver has been introduced by Tratec as a successor to the A-1000.

The receiver features a lifetime memory back-up, 99 channels and 99 positions, MAC output and all parameters are individually store-able.

The GS-2 also has an auto-focus mode, the eye catcher, in which the positioner will focus automatically at the chosen satellite position. There is also an auto-timing feature.

*Tratec BV,
PO Box 385,
3900 AJ Veenendaal,
The Netherlands.
Tel: (8385) 21984.*

DIM-WITS

A fully protected dimmer/controller kit, the K613, handles mains voltages of up to 5A is available from Electronic & Computer Workshop.

The dimmer is a high Q device that adjusts the power supplied to a load with minimum hysteresis. This makes it suitable for dimming lights, adjusting ac motor speed and the output of heating elements, etc.

The K613 is offered at a mail order price of £14.33, including VAT and posting/package.

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



PHONE
0474 60521

P.M. COMPONENTS LTD
SELECTRON HOUSE,
SPRINGHEAD ENTERPRISE PARK, SPRINGHEAD ROAD,
GRAVESEND, KENT DA11 8HD

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966371
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INTEGRATED CIRCUITS

AN103	2.50	LA4430	2.50	AL1327Q	1.10	TA7609P	3.95	CA760	2.50	TDA4050	3.95
AN124	2.50	LA4461	3.95	SN7474	2.95	TA7611AP	2.95	CA800	2.50	TDA4600	2.50
AN124	2.50	LA4461	3.95	SN7474	2.95	TA7629	2.95	CA800	2.50	TDA8500	3.15
AN140	2.50	LC7130	3.95	SN7423	2.95	TA7629B	3.95	CA800	2.50	TDA8500	3.15
AN236	1.95	LC7131	5.80	SN76110N	0.85	TA7629A	2.95	CA800	2.50	TDA8500	3.15
AN239	2.50	LC7137	5.80	SN76115N	1.25	TA7629B	3.95	CA800	2.50	TDA8500	3.15
AN240P	2.50	LM823K	4.95	SN76131N	1.20	TA7629C	2.95	CA800	2.50	TDA8500	3.15
AN247	2.50	LM824N	0.45	SN76226DN	1.00	TA7629D	2.95	CA800	2.50	TDA8500	3.15
AN280	2.50	LM3808	1.90	SN76227N	1.05	TA7629E	2.95	CA800	2.50	TDA8500	3.15
AN282	1.95	LM3808B	2.95	SN76228N	2.95	TA7629F	2.95	CA800	2.50	TDA8500	3.15
AN284	2.50	LM383T	2.95	SN76533N	1.65	TA7629G	2.95	CA800	2.50	TDA8500	3.15
AN271	3.50	LM390N	3.95	SN76650N	1.10	TA7629H	2.95	CA800	2.50	TDA8500	3.15
AN301	2.95	LM1011	3.15	SN76650N	1.10	TA7629I	2.95	CA800	2.50	TDA8500	3.15
AN303	2.95	LM155L	2.95	SN76650N	1.10	TA7629J	2.95	CA800	2.50	TDA8500	3.15
AN313	2.95	M51513L	2.90	STK011	7.95	TA7629K	2.95	CA800	2.50	TDA8500	3.15
AN315	2.95	M51521L	1.90	STK014	7.95	TA7629L	2.95	CA800	2.50	TDA8500	3.15
AN316	3.95	M53705	1.90	STK015	6.95	TA7629M	2.95	CA800	2.50	TDA8500	3.15
AN331	3.95	M53712	2.00	STK018	7.95	TA7629N	2.95	CA800	2.50	TDA8500	3.15
AN342	2.95	M53756	2.50	STK025	11.95	TA7629O	2.95	CA800	2.50	TDA8500	3.15
AN362L	2.50	MC1307P	1.00	STK032	7.95	TA7629P	2.95	CA800	2.50	TDA8500	3.15
AN612	2.15	MC1310P	1.95	STK078	11.95	TA7629Q	2.95	CA800	2.50	TDA8500	3.15
AN652	3.95	MC1495	3.00	STK085	8.95	TA7629R	2.95	CA800	2.50	TDA8500	3.15
AN710	3.50	MC1327Q	0.95	STK145	7.95	TA7629S	2.95	CA800	2.50	TDA8500	3.15
AN7145	3.50	MC1349P	1.75	STK433	5.95	TA7629T	2.95	CA800	2.50	TDA8500	3.15
AN7145M	3.95	MC1350P	1.75	STK435	7.95	TA7629U	2.95	CA800	2.50	TDA8500	3.15
AN7150	2.95	MC1351P	1.75	STK437	7.95	TA7629V	2.95	CA800	2.50	TDA8500	3.15
AN7151	2.50	MC1359	1.95	STK439	7.95	TA7629W	2.95	CA800	2.50	TDA8500	3.15
BA521	3.75	MC1357	2.35	STK461	11.50	TA7629X	2.95	CA800	2.50	TDA8500	3.15
CA1352E	1.95	MC1358	1.85	STK463	11.50	TA7629Y	2.95	CA800	2.50	TDA8500	3.15
CA3086	0.45	MC1496	1.75	STK0015	7.95	TA7629Z	2.95	CA800	2.50	TDA8500	3.15
CA3123E	1.95	MC1723	0.50	STK0029	7.95	TBA560Q	1.45	CA800	2.50	TDA8500	3.15
CA3131EM	2.50	MC3357	2.75	STK0039	7.95	TBA560Q	1.45	CA800	2.50	TDA8500	3.15
CA3140S	2.50	MC3401L	2.80	TA7072	2.65	TBA561R	2.50	CA800	2.50	TDA8500	3.15
CA3140T	1.15	MC14106P	2.95	TA7073	3.50	TBA673	3.50	CA800	2.50	TDA8500	3.15
ETT610	2.50	MC14516C	7.00	TA7108P	1.50	TBA720A	2.45	CA800	2.50	TDA8500	3.15
HA1137W	1.95	ML231B	1.75	TA7120P	1.85	TBA750	2.95	CA800	2.50	TDA8500	3.15
HA1156W	1.80	ML232B	2.50	TA7120P	2.50	TBA750Q	2.95	CA800	2.50	TDA8500	3.15
HA1306	1.95	ML233B	2.50	TA7130P	1.80	TBA800	0.95	CA800	2.50	TDA8500	3.15
HA1322	1.95	ML239	2.95	TA7137P	1.00	TBA810AS	1.95	CA800	2.50	TDA8500	3.15
HA1339A	2.95	M5M5807	8.75	TA7146P	1.50	TBA810P	1.65	CA800	2.50	TDA8500	3.15
HA1366W	2.75	SAA1025	7.25	TA7176AP	3.95	TBA820M	0.75	CA800	2.50	TDA8500	3.15
HA1377	3.50	SAA1251	4.95	TA7193P	2.95	TBA820Q	1.45	CA800	2.50	TDA8500	3.15
HA1406	1.95	SAA5010	5.35	TA7204P	2.15	TBA820Q	1.45	CA800	2.50	TDA8500	3.15
HA1451	1.95	SAA5020	8.75	TA7205AP	1.15	TBA820Q	1.45	CA800	2.50	TDA8500	3.15
LA1201	0.95	SAB3210	3.50	TA7206	1.95	TBA820Q	1.45	CA800	2.50	TDA8500	3.15
LA1230	1.95	SAB3210	3.50	TA7206	1.95	TBA820Q	1.45	CA800	2.50	TDA8500	3.15
LA3201	0.95	SA55708	1.75	TA7222AP	1.80	TBA820Q	1.45	CA800	2.50	TDA8500	3.15
LA4101	0.95	SA850	2.85	TA7227P	4.25	TBA990	1.49	CA800	2.50	TDA8500	3.15
LA4102	3.95	SA8590	2.75	TA7228P	1.95	TBA990Q	1.49	CA800	2.50	TDA8500	3.15
LA4140	2.95	SL901B	7.95	TA7310P	1.80	TA7310P	1.80	CA800	2.50	TDA8500	3.15
LA4403P	1.95	SL917B	6.95	TA7313AP	2.95	TA7313AP	2.95	CA800	2.50	TDA8500	3.15
LA4420	3.50	SL1317B	1.90	TA7314P	2.95	TA7314P	2.95	CA800	2.50	TDA8500	3.15
LA4422	2.50	SL1327	1.10	TA7321P	2.25	TA7321P	2.25	CA800	2.50	TDA8500	3.15

SEMICONDUCTORS

AA12	0.25	BC182B	0.10	B0237	0.40	BF493	0.35	MRF453	17.50	TV106	1.50
AC126	0.45	BC183	0.10	B0242	0.60	BF495	0.23	MRF454	26.50	TV106/2	1.50
AC127	0.30	BC183L	0.09	B0246	0.75	BF497	0.25	MRF455	17.50	ZFR112	16.80
AC128	0.35	BC184LB	0.09	B0247	0.60	BF499	0.23	MRF475	2.95	2N1100	6.50
AC128K	0.32	BC204	0.25	B0379	0.45	BF499	0.23	MRF477	14.95	2N1308	1.50
AC141	0.28	BC207B	0.25	B0410	0.65	BF499	0.23	OC16W	2.50	2N1711	0.30
AC141K	0.34	BC208B	0.25	B0434	0.65	BF499	0.23	OC23	3.95	2N2219	0.25
AC142K	0.45	BC212	0.09	B0436	0.45	BF499	0.23	OC25	1.50	2N2626	0.55
AC178	0.25	BC212L	0.09	B0437	0.75	BF499	1.75	OC26	1.50	2N2905	0.40
AC178K	0.31	BC213	0.09	B0438	0.75	BF499	1.75	OC28	8.50	2N3053	0.40
AC187	0.25	BC213L	0.09	B0510	0.95	BF499	0.35	OC29	2.50	2N3054	0.90
AC187K	0.28	BC214	0.09	B0516	0.75	BF499	0.35	OC30	0.75	2N3055	0.52
AC188	0.25	BC214C	0.09	B0520	0.65	BF499	0.35	OC42	1.50	2N3072	0.12
AC188K	0.37	BC214L	0.09	B0534	0.45	BF499	0.35	OC44	1.25	2N3073	0.12
AD142	2.50	BC237B	0.15	B0535	0.45	BF499	0.35	OC45	1.00	2N3074	0.12
AD143	2.50	BC238	0.15	B0538	0.65	BF499	0.35	OC70	1.00	2N3705	0.20
AD149	0.70	BC239	0.15	B0575	0.95	BF499	0.35	OC71	0.75	2N3706	0.12
AD181	0.50	BC251A	0.15	B0587	0.95	BF499	0.35	OC72	2.50	2N3708	0.12
AD182	0.50	BC252A	0.15	B0588	0.95	BF499	0.35	OC75	1.50	2N3709	0.12
AF106	0.50	BC258	0.25	B0597	0.95	BF499	0.35	OC81	1.00	2N3773	2.75
AF114	1.95	BC258A	0.39	B0695	1.50	BF499	0.35	OC82	1.90	2N3792	1.35
AF121	0.80	BC284	0.30	B0698	1.50	BF499	0.35	OC139	12.50	2N4427	1.95
AF124	0.85	BC300	0.30	B0701	1.25	BF499	0.35	OC171	4.50	2N4444	1.15
AF125	0.35	BC301	0.30	B0702	1.25	BF499	0.35	OC200	4.50	2N5294	0.42
AF126	0.65	BC303	0.25	B0707	0.90	BF499	0.35	OC201	8.50	2N5296	0.45
AF127	0.65	BC307B	0.09	B0X32	1.50	BF499	0.35	OC205	10.00	2N5298	0.50
AF131	0.40	BC314	0.20	B0X53B	1.85	BF499	0.35	OC208	1.45	2N5485	0.45
AF150	0.80	BC328	0.10	BF15	0.30	BR101	0.40	R2009	2.50	2N5485	0.45
AF176	1.95	BC337	0.10	BF19	0.65	BR103	0.55	R2010B	1.45	2A329	0.95
AF239	0.45	BC338	0.09	BF127	0.39	BR303	0.85	R2322	0.55	2A715	0.55
AU106	0.95	BC347A	0.13	BF154	0.20	BRC4443	1.15	R2343	0.65	2SC495	0.50
AY102	2.95	BC461	0.35	BF177	0.38	BRY39	0.48	R2420	2.45	2SC496	0.50
BC107A	0.11	BC478	0.20	BF160	0.27	BW64	0.25	RCA18029	0.85	2SC784	0.75
BC107B	0.11	BC522	0.10	BF173	0.22	BSX60	1.95	RCA18181	0.85	2SC785	0.75
BC108	0.10	BC547	0.10	BF158	0.22	BT100A/2	0.85	RCA18181	0.85	2SC789	0.55
BC108B	0.12	BC548	0.10	BF178	0.25	0.85	RCA18334	0.90	2SC931D	1.95	
BC109	0.10	BC549A	0.10	BF179	0.34	BT106	1.40	RCA18335	0.85	2SC937	0.95
BC109B	0.12	BC550	0.14	BF180	0.29	BT116	1.20	RCA16572	0.85	2SC1034	4.80
BC109C	0.12	BC557	0.08	BF181	0.29	BT119	1.15	S2060D	0.95	2SC1098	0.50
BC114A	0.09	BC558	0.10	BF182	0.29	BT120	1.65	SK5E5F	1.45	2SC1106	2.95
BC115	0.95	BC539/10	0.30	BF183	0.29	BU105	1.95	T6021V	0.45	2SC1124	0.80
BC116A	0.55	BC733A	19.50	BF184	0.35	BU108	1.85	T6027V	0.45	2SC1182	0.95
BC116B	0.50	BD115	0.90	BF185	0.28	BU124	1.25	T6029V	0.45	2SC1172Y	2.20
BC117	0.19	BD124P	0.59	BF194	0.11	BU125	1.25	T6036V	0.55	2SC1173	1.15
BC119	0.24	BD131	0.42	BF195	0.11	BU126	1.90	T9002V	0.55	2SC1307	2.95
BC125	0.25	BD132	0.42	BF197	0.11	BU204	1.55	T9011V	0.75	2SC1364	0.80
BC139BC	0.20	BD133	0.40	BF198	0.16	BU205	1.30	T9015V	2.15	2SC1413A	2.90
BC140	0.31	BD135	0.30	BF199	0.14	BU208	1.39	T9034V	2.15	2SC1449	0.80
BC141	0.21	BD136	0.30	BF200	0.40	BU208					



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A SELECTION FROM OUR

STOCK OF BRANDED VALVES (Contd)

Table listing various valve types and their prices, including models like DL35, DL36, DL37, etc., and prices in pounds and pence.

Table listing various valve types and their prices, including models like VR1050-30, VR1500-30, VR1500-30, etc., and prices in pounds and pence.

Table listing various valve types and their prices, including models like 4-250A, 4-400A, 4-400A, etc., and prices in pounds and pence.

Table listing various valve types and their prices, including models like 3P1L3, 3P1L4, 3P1L4, etc., and prices in pounds and pence.

NEWS DESK

Battery survey

The latest market survey on batteries, carried out by Euro-monitor, has concluded that long-life alkaline batteries are gaining a larger share of the battery market at the expense of zinc carbon and saline batteries.

The market is divided into four sectors: zinc carbon batteries, alkaline-manganese batteries, silver or mercury oxide specialist batteries and nickel-cadmium rechargeable accumulators.

The number of batteries sold in France, Italy, the UK, the USA and West Germany is estimated in the report at 3.9bn in 1986, a substantial increase on the figure for 1985.

The US market has grown by 42%, with US consumers overtaking the French in 1986 as the biggest per capita consumers of batteries. The United Kingdom and West German markets grew by 14% and 17% respectively, while the French market shows particularly rapid growth in the market share of longer-life alkaline batteries, which are approaching maximum penetration in the US.

The coincidental growth of the alkaline battery sector and the growth in high-drain applications is likely to encourage closer co-operation between battery manufacturers and producers of portable electronics and electrical equipment. This has already begun to happen with the launch of Kodak's 9V lithium battery in conjunction with the production of applications for its use by Black & Decker.

The trend towards alkaline batteries is strong among younger consumers who tend to purchase a larger proportion of high-drain battery driven products, such as personal stereos and portable hi-fi equipment.

In the less well developed European markets there is scope for the continual

growth in alkaline batteries, particularly in Italy where they account for less than a quarter of unit sales.

The expected growth in the rechargeable battery sector has more immediate significance, according to the report, and is already evident in the UK and US markets. In time this development is expected to dominate the market as a whole.

Market Direction Report 11.15 'Batteries' is available in its complete form on request to Euromonitor Market Direction, 87-88 Turnmill Street, London EC1M 5QU. Tel: 01-251 8024.

Satellite TV lecture

A lecture for the public entitled 'Satellite TV: A Larger Diet From Small Dishes' is to be held at the Royal Society on Tuesday 12th April at 6pm.

The speaker is Dr J R Forrest, F Eng, who is the Director of Engineering at the Independent Broadcasting Authority. Dr Forrest will discuss the three new television channels to be launched in Britain next year, and the influence these will have on the pan-European Satellite Services and the fibre-optic grid. The lecture will address the technology, politics and structure of future broadcasting.

Tickets for the lecture will not be issued and seats cannot be guaranteed. All are welcome, although parties of six or more should inform the Society beforehand. For more information, write to The Royal Society, 6 Carlton House Terrace, London SW1Y 5AG, or telephone 01-839 5561 ext 219.

Residual current devices

The Institution of Electrical Engineers (IEE) has spoken out in the wake of recent publicity promoting the use of residual current devices (rcd), noting with considerable concern the assertions that total or complete safety

is assured by their inclusion in electrical installations.

An Institute spokesman emphasised that placing sole reliance for shock protection on residual current devices is fundamentally wrong. People must not be misled into a belief that whatever the state of their electrical installation and equipment, an rcd will provide complete protection.

An rcd of the correct type can give additional protection against dangerous electric shock if electrical equipment is faulty or develops a fault in service. However, there are circumstances, for example if contact is made simultaneously with the phase and neutral conductors, where no protective device will be effective. Electricity must be treated with respect and applied and used correctly. This is the only true safeguard.

The recognised standard for electrical installations in the UK is the *Regulations for Electrical Installations* (The Wiring Regulations) published by the IEE. These are accepted as providing standards of safety not exceeded anywhere in the world.

Blinded by science

Obscurity has, in the past, been a problem for the National Listening Library. Now there are many more people who know that books on cassette are available not only to the blind, but to anyone who due to physical handicap, illness or learning difficulties is unable to read a book.

The charity, which is based at 12 Lant Street, London SE1 1QH (tel: 01-407 9417) offers a postal library of 2,000 titles and a range of aids designed to make life easier and more pleasant for people with different disabilities. The most recent addition is the induction loop, for users of hearing aids. Library members can either buy one at a 50% subsidised price or receive DIY instructions.

Volunteers, both to service the Library's specially designed tape-players and to produce home-made induction loops, would be greatly welcomed. If you know of anyone who might benefit by having talking books, tell

them about the Library—don't let it return to its former obscurity.

Radio testing

C & S Antennas of Rochester in Kent claim to have the best facilities in the country for testing radio antenna systems.

Based at Cooling between the rivers Medway and Thames on a 10 acre site, the permanent test range is used by broadcasting authorities and the Ministry of Defence. It is also available for use by mobile radio equipment manufacturers and network operators for private testing purposes.

The CSA facilities at Cooling include a vehicle turntable capable of supporting a three ton vehicle. The turntable is fitted with a fleving jib for measurement of elevation radiation patterns. There are also a wide variety of masts and towers for mounting antennas and a thirty metre rotatable tower which is capable of supporting large structures, and each structure is provided with computer-interfaced azimuth-rotation control.

The range offers testing facilities from 500kHz to 2.5MHz and other microwave bands subject to site calibration. Facilities for far-field measurement incorporate a laboratory fitted with the latest test equipment. Customers can also bring their own specific test equipment if preferred.

CSA's own team of experienced engineers and riggers is available to provide assistance or to carry out trials under customer supervision.

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

Phase 3C

AMSAT has launched a campaign to tell the amateur radio community how to make use of the Phase 3C after its launch.

Informative articles will be published in all the domestic ham radio magazines and AMSAT are looking for potential authors to contribute to this high profile project.

If you are interested in writing an article on the

Phase 3C, AMSAT are providing a useful package to help you. It consists of information on technical specifications, recommended typical ground station requirements plus a stock of photographs and tables. Unfortunately, these packages are in short supply so authors must promise in advance to write on an agreed topic.

Suitable topics for articles include: Phase 3C operating practices, bandplans, schedules, ground stations, orbital topics and spacecraft hardware.

Due to the limited time available, prospective authors are asked to call AMSAT HQ immediately on 301-589-6062. Leave your name, call-sign and telephone number and arrangements will be made as soon as possible.

UoS phone service

Two telephone lines are currently available at the University of Surrey, giving recorded messages with orbit data and news, on (0483) 61707 for UoSAT-1 and (0483) 61202 for UoSAT-2.

The Mission Control Centre is reviewing the use and continued support of this service – if you use it or anticipate using it, write UoSAT a brief note indicating the nature of service you would find most useful (eg, recorded messages giving orbit equator crossings, keplerian data, s/c news or a computer bulletin board, etc) – the service may have to be discontinued due to rising costs!

Phase-3

The Phase-3C satellite has completed its program of testing in Marburg, West Germany. After some last minute fine-tuning, the satellite will soon be prepared for shipment to Paris and then on to the airport at Cayenne, French Guiana. From there it will be trucked by special vehicle to the ESA launch site at Kourou.

Phase-3C will be launched on the first Ariane-4 rocket from the ELA-2 – designated flight V-22. There will be three satellites aboard V-22; in addition to AMSAT's Phase-3C, there will be the METEOSAT and PANAMSAT

spacecraft. The V-22 launch will take place on or about April 15th at about 12:30UTC.

As the countdown proceeds, AMSAT planners are organising a major launch support project to bring the excitement of the live launch countdown to AMSAT members and members-to-be across the globe.

The AMSAT Launch Information Network Service, ALINS, will provide extensive pre-launch, launch countdown and post-launch coverage on a world-wide radio and telephone hook-up.

Recall of Taylor DMs

Taylor Electrical Instruments Limited are asking all owners of Taylor digital multimeters, models TD22 and TD23, to return them to the company for a slight modification to be made.

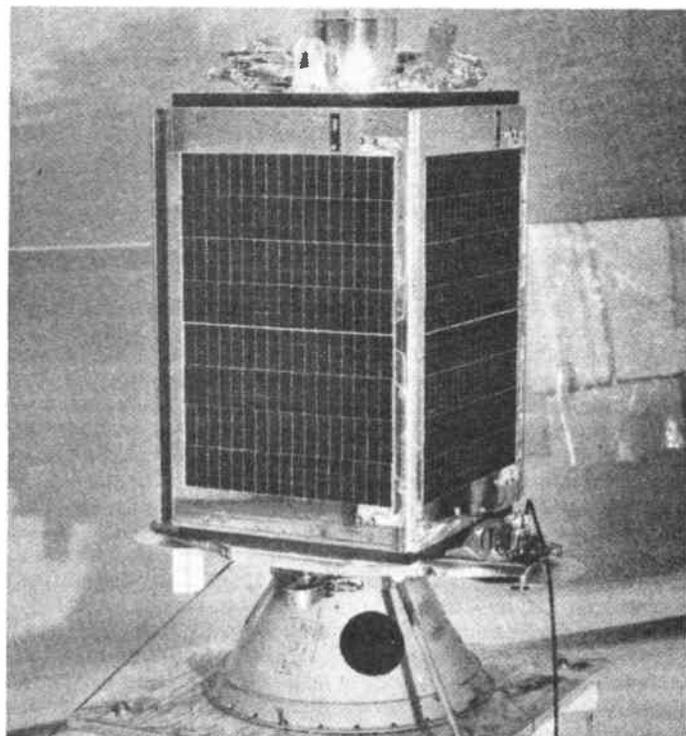
A potential fault has been identified which could result, in certain circumstances, in the screw which fixes the battery cover of the instrument becoming 'live' and therefore dangerous to the user.

The modification will be carried out free of charge and modified instruments will be returned as quickly as possible. Instruments should be returned to Taylor Electrical Instruments Ltd, Parts and Service Centre, Archcliffe Road, Dover, Kent CT17 9EN, with packages clearly marked on the outside 'for modification'.

Design award winners

Twenty-two companies have won 1988 British Design Awards for products ranging from a quiet road sweeper and a computer software flight planning programme, to a revolutionary electronic guitar and an instrument to detect glaucoma.

Awarded annually by the Design Council, the British Design Awards are recognised as Britain's premier awards for product design. They are judged by specialist independent panels in these seven categories: engineering products; engineering components; motor industry products; medical equipment; computer software; durable consumer and contract goods;



UoSAT-C

There is an opportunity for an experienced RF engineer to work at the University of Surrey alongside the UoSAT team on UO-C.

Anyone interested should contact Dr Martin Sweeting at the UoSAT Spacecraft Engineering Research Unit, University of Surrey, Guildford, Surrey GU2 5XH.

and decorative consumer products.

The manufacturers and designers of the winning products will be presented with their awards by HRH The Duke of Edinburgh at a ceremony to be held in April.

Many of the 1988 awards have gone to small companies. Proving that the best audio equipment is not always made abroad is the Huntingdon based company of Boothroyd Stuart Ltd, which has won an award for its advanced Meridian digital audio system.

AB Electronic Products from South Wales has won an award for its microprocessor control system for the Jaguar XJ6 series cars.

Another high technology and world-beating machine that has won a 1988 British Design Award is the Precision Implant 9000 machine by the Implant Division of Applied Materials in Horsham, Surrey which enables silicon chips of a uniformly high quality to be mass produced on a scale not previously possible.

Finally, one of the most glamorous winners is the Ford Sierra RS Cosworth – a car with race track capabilities but designed as an 'executive express for the road'.

Peace of mind

The Amateur Radio Maintenance Service – ARMS – was specially devised by an operator of many years' experience. It offers complete cover against the costs of repairs (including parts, labour and carriage) in return for an annual fee, based on a small percentage of the current new retail price of the equipment.

However, this is not an insurance policy.

A quotation will be sent by return if you send details of the equipment you would like cover for, including make, model, number, year of manufacture and whether it is for home use only or mobile/portable use.

For further information, write to ARMS, Freepost, Ormskirk, Lancs L39 3AB.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

Way back in 1913, when there were no televisions, no computers, no electronic communications as we know them today and certainly no amateur radio, there appeared in the magazine *English Mechanic* a letter from one Rene Klein. This letter drew attention to the fact that there was no wireless club in London. As an experimenter in the newly emerging techniques of wireless communication, he felt that the creation of such a club would be a great boon to the many other experimenters in and around London, enabling them to share their experiences and help each other in the problems they encountered.

A number of readers of Rene Klein's letter responded and a meeting was held at Klein's home in Hampstead on 5th July 1913. Shortly afterwards the Wireless Club of London was formed. Two months later, just before WW1 broke out, this became the Wireless Society of Great Britain. After the war, it became the Radio Society of Great Britain. This year, the RSGB is celebrating its 75th anniversary.

The main events will take place in late July, starting with the National Convention at Birmingham's National Exhibition Centre. This will be a three-day event on Friday, Saturday and Sunday, 15th to 17th July. There will be a large trade exhibition, a display of amateur radio equipment through the 75 years and social events. A special 75th anniversary luncheon will be held on the first day of the convention.

During the following week events will transfer to London, where the RSGB's headquarters in Potters Bar will be open for visits to enable members to see how the Society operates and what work is involved. This will be on Tuesday, Wednesday and Thursday, 19th to 21st July. There may be a chance for members to operate the Society's HQ station, using the callsign GA75HQ and GB75HQ.

This will be followed on Friday 22nd and Saturday 23rd by a data symposium, which will be held at Harrow School, London. It is hoped to provide a comprehensive lecture programme and a number of demonstrations of all the various forms of data communications in use by radio amateurs. Sunday 24th July has been designated 'Families and Activities Day', for which various activities likely to appeal to families and

groups are being planned.

On the following Thursday, 28th July, the Society will host an International Satellite Seminar at the University of Surrey's Space Engineering Centre at Guildford. On Friday, Saturday and Sunday, 29th to 31st July, this year's AMSAT-UK colloquium will be held at the same location. The meetings on the Friday will be for space engineers only and will be strictly by invitation. This aims to help meaningful discussion as to future policy and planning in the amateur satellite field.

At the time of writing, some of the events require finalising and the RSGB will be publishing a special 4-page pull-out programme and booking forms with costs of accommodation, etc in due course.

Young amateur award

The Department of Trade and Industry (DTI) has arranged an award to be presented in recognition of a major contribution made by young radio amateurs to the art of radio communication.

This award is one of the Department's initiatives to celebrate the 75th anniversary of the RSGB. The prize, £250 and a day out to view the work being done by the DTI's Radiocommunications Division, will be awarded to the person judged to have made an individual contribution of outstanding merit in any area of amateur radio, and who is under the age of eighteen by the closing date of March 31st 1988.

The objectives of the award are to demonstrate the DTI's interest in promoting technological awareness and education and to draw attention to the many aspects of amateur radio in the minds of the public. This will hopefully encourage more young people to take advantage of the privileges and benefits of this unique activity. Nominations should be sent as soon as possible to the Secretary, RSGB, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JE. Envelopes should be marked 'Young Amateur of the Year'.

Virus infected computers!

Glancing casually over the front page of my daily newspaper, scanning the headings for something interesting to read, I could hardly believe my eyes

when I read 'Viruses Invade Computer Games!' Had it been April 1st, I'd have thought it was a leg-pull! Its author had used such words as 'infect' and 'a lingering illness', where something more scientifically correct might have been better if his intention had been solely to give an accurate indication of this latest example of the 'hacker's' art!

It seems that someone has come up with some software which distorts the magnetic properties of computer program discs and this distortion can be passed from one disc to another on contact. They are ruined instantly, 'inducing a lingering illness'. This 'illness', it is claimed, 'can spread from disc to disc like wild-fire!' When an 'infected' disc is inserted, the electronic virus aims for the computer's random access memory. Then, when another disc is inserted, the virus appears sooner or later to have been copied on to it. The latest type of virus appears on screen with the message 'Something wonderful has happened - your machine has come alive!'

It reminds me of a story told by a friend about his computer. It had some software which, if a fault developed in the computer, could be played through and would indicate where the fault was. If it failed to find the fault a message came up on the screen: 'There is no fault in your computer!' Helpful advice!

Avoidance of such electronic 'viruses', however, is easier than preventing virus infection in human beings. You just switch the computer off!

Raynet honour

Doug Willies, the well-known Raynet County Controller for Norfolk, has just been honoured by the St John's Ambulance Brigade on his recent retirement from Raynet (the amateur radio emergency radio communication network).

Doug was a founder member of Raynet, which was formed in 1953 after the extensive floods which occurred that year.

The Norfolk branch of Raynet has around 200 volunteer members and provides emergency radio communications for the Police, Red Cross, St John's Ambulance Brigade and the County Emergency Planning Officer. He was made a Serving Brother of the Order of St John for his work within this sphere.

A warning

One of the more pleasant uses of amateur radio is for expatriate Britons to keep in contact with their friends at home.

During a QSO between one such station in Spain and contacts in his home town, a discussion arose as to the whys and wherefores of withholding one's QTH from the amateur radio callbooks. It is very irritating when you look up a station's callsign to find 'Particulars withheld at licensee's request'.

The reasons why some folk do this have been aired in the amateur radio press from time to time, but I do not recall anyone pointing out the *dangers* of doing this before. The above mentioned QSO was particularly interesting to the writer because, during the course of it, the amateur in Spain recounted a personal experience of his. He has told of the episode in letters to one or two amateur radio magazines in this country, but, he says, it needs as much publicity as possible.

It appears that, being an Englishman living in a very popular tourist location in Spain, he gets quite a number of visiting amateurs looking him up – usually without prior warning. Sometimes the visitors turn out to be most unwelcome. On one occasion, a rather plausible chap turned up at his QTH saying he had a UK G6 licence. On checking his callsign in the *RSGB Callbook*, the particulars of this G6 call were entered as 'Particulars

withheld'. After the usual courtesies he asked if he could borrow an HF rig, which was spare. This was lent to him and it subsequently transpired that he had borrowed an antenna from another UK amateur resident in Spain and money from yet another. He finally left Spain in a hurry!

He was eventually traced to France where he had repeated the process, even managing to defraud the police, one of whom was a French amateur! So unless you have very good reasons for withholding your particulars, it's better to put your name and address into the callbook. You are less likely then to have your call pirated – or worse.

Phase 3C

One of AMSAT-UK's objectives is to raise money to help in the satellite development programme. This they have been singularly successful in doing. They recently donated £10,000 to help with the re-equipping of the Satellite Control Centre at the University of Surrey. They have also made considerable donations to AMSAT-DL and to AMSAT in the USA for the construction of earlier satellites, and now they have made the largest contribution in this field of their activity by donating £13,500 to help with the cost of transporting the Phase 3C satellite to its launch site at Kourou and providing the ancillary equipment required for its launch.

Whilst the amateur radio aspects of the

UoSAT satellites are pretty well-known, the extent to which they have been used by schools and technical colleges is less so. There are about 1,000 such establishments making use of the facilities provided by these satellites. Not only do these experiments provide a much more attractive classroom exercise than might be obtained from the more traditional ways of teaching, but they are leading to an improved interest in scientific and technical subjects, and students are going on to take degree courses at university level.

Skitrek

The Russian/Canadian Skitrek's latest date for their departure is, at the time of writing, around the beginning of March. Their cross-polar trek is expected to last about three months.

An information pack about the expedition and the communication and navigational aspects using amateur radio is available from Richard Ensign N8IWJ, AMSAT Science Education Advisor, 421 North Military, Dearborn, MI, 48124, USA.

FO13 delay

The second of Japan's amateur radio satellites, FO13 or JAS 2, which was planned to be launched some time in 1988, will not now be ready until 1989. It was to have been a replica of JAS 1, but may now have increased solar panels and other improvements. 

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ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

The British flag will be waving at this year's Dayton Hamvention, the USA's largest amateur radio get together. This three-day national event in Dayton, Ohio spreads its trade stalls and open-air flea market over a ten acre site, which rather puts the NEC Birmingham into the shade.

Speciality modes take over hotels and hold lecture programmes, and their specialist magazines often open hospitality suites there. ATV is no exception and in fact separate hotels this year will minister unto the slow-scan and fast-scan contingents. Yes, they do things bigger over in the USA!

Whether they do it better is another matter; certainly they do it differently. Apart from a few repeaters, technical development is a little behind European practice and, although 24cm is just beginning to be exploited, much of this new activity is low powered AM and destined to remain short-range. In the mid-West, where settlements are further apart, people are looking into FM.

There are more commercial transmitters and receive converters on the market, but there is no technical support. Neither are there non-commercial supplies of printed circuit boards, or of hard-to-find parts such as the British Amateur Television Club offers here. There is also a dearth of handbooks such as the BATC's publications on SSTV, micro-computer projects and video techniques for beginners.

For this reason the British are invading America this year, taking with them supplies of all the goodies mentioned above. The BATC has signed an agreement with an American representative, the respected Don Miller W9NTP, who will handle membership applications and sell the BATC's supplies. A two-man team will try to sell the British way of doing ATV and, well, we shall see what happens! You'll read it here first...

Advance warning

Britain's only annual ATV convention

and rally takes place this year on 24th April at the Post House Hotel, Crick (near Rugby). This spot is very close to junction 18 on the M1 motorway (about 300 yards east), about an hour from London and conveniently placed for the Midlands. Watling Street (the A5) passes nearby as well.

Visitors using public transport should take an Inter-City train to Rugby Midland. There are a few buses but a taxi would be a more realistic proposition for the five mile journey. One visitor always walks, though!

The hotel usually offers special half-price deals to guests who have come for the BATC convention - telephone (0788) 822101 for details. If you decide to stay over night, you will find the bar crowded with ATVers during Saturday evening, so you can speak your other language (ATV) then.

The formula is the successful one of years gone by, which has attracted visitors from Holland, France, Belgium, Switzerland and Germany (the Swiss are coming again this year!). Lots of trade stands (mainly the smaller firms with video-related equipment), a giant bring-and-buy stall, demonstrations of television equipment and techniques plus a lecture programme. There is also the biennial general meeting of the BATC this year. Everything opens at 10am and the real bargains tend to go early, so come in good time!

For ATVers this event is the only rally where you can be sure of finding video equipment to make your journey worthwhile, yet there is enough of general radio and electronic interest to attract all comers. There is plenty of car parking space (if you come early) and being a hotel in the country there is room for children to wander in safety (a fun castle is also planned). There is a licensed restaurant (booking advised) as well as a pub and an all-day buttry/bar/coffee shop, so you should not starve or die of thirst! If it's fine, you could try picnicking

in the grounds, of course.

The BATC intends to have a stand at other rallies during the year. Though things are not absolutely definite yet, watch out for us at the RSGB VHF Convention, the Lincoln Hamfest, the Sussex Mobile Rally and possibly the RSGB's National Exhibition at the Birmingham NEC and their Woburn Mobile Rally. We expect to be at the autumn Leicester thrash at the Granby Halls, too, and this time we should have the saleable goodies with us!

Prestel and repeater news

For a long time an ATV database has been included in Prestel, the online information service of British Telecom. The service provides all the latest news, reports on the status of repeaters and verifications of convention dates. A recent change around meant that the BATC's section has had to move, together with the rest of ClubSpot of which it formed a part.

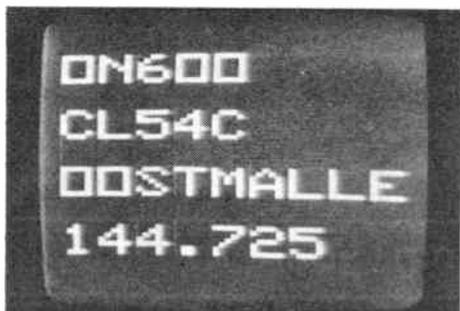
ClubSpot has now been absorbed in Micronet, meaning that if you do not subscribe to this section of Prestel you will no longer be able to see us. Sorry about that, but since we get these pages for nothing, there was little we could do. If nothing else, it gives you more reason to subscribe to Micronet, where you will find lots of other amateur radio and personal computing interest.

The licence for GB3RT, the Rugby repeater, is expected any day now, while those for GB3ET (Emley Moor, Yorks) and GB3NV (Nottingham) are being processed at the DTI. If GB3RT is licensed in time for the Crick show on 24th April, it will be piped round the hotel.

The end of amateur video

There is one big difference between amateur video and professional productions and that's in picture quality. Until now, the kind of video cameras and recorders used by hobbyists were no

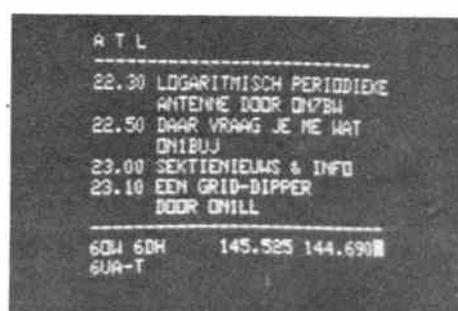
Belgian screen shots



ON600: Computer-generated display



ON4JS: Traditional caption card



ON6VAT: Schedule

match for those of the broadcasters, and only rarely would tape shot by amateurs be accepted by the major TV stations. Now things are changing.

Video-8 and, even more so, Super VHS (S-VHS) have caused this: Video-8 gives very acceptable pictures and S-VHS can match the quality of U-Matic. As a result, local TV stations and some of the major networks in the USA are now accepting material shot on consumer video formats for use on air.

S-VHS has not yet hit our shores (it should do later this year), but it promises to make all existing home video equipment look like toys.

Ardell Hill, director of operations and engineering for WXFL-TV, a local station in Tampa, Florida, was interviewed on this subject in *World Broadcast News*.

'If you take an image shot with a high-quality professional camera on S-VHS,' Mr Hill is quoted as saying, 'I don't think you'd be able to tell the difference between that picture and one shot with a comparable quality camera on 3/4 inch'.

Of course, this does not mean that the BBC and ITV companies are now going to ditch their 3/4 inch and 1 inch equipment over night.

However, the new technology will enable good pictures to be taken in emergency situations such as plane crashes and natural disasters, when regular news crews with full-blown equipment cannot be on the scene in time.

It will also mean that viewers will have a better chance of selling material they

have shot on their own equipment to the big stations.

Last year a British doctor on holiday in Moscow happened to be standing in Red Square when the young German, Rust, landed his plane there. The doctor had been shooting home movies on his VHS Camcorder and his footage was purchased by NBC and flashed to the world by satellite. The ABC channel also uses video-8 in some programmes now.

Last word

Remember WB8ELK's ATV-in-a-balloon experiment? We reported that the balloon was tracked for several miles and then disappeared out of sight.

Strangely enough, it was found in a nearby cornfield, so it must have floated back to its launch site. Weird. 

Awelcome phone call from Clive G9BWZ, near Stroud in Gloucestershire, brings the message that 934MHz activity is very much alive and kicking in his neck of the woods. Every night two or three nets can be heard in progress on the air. Four new stations have come on the air in his area; to an extent they have taken the place of other stations who have gone QRT for one reason or another.

One of those reasons is that people have taken the RAE and abandoned 934MHz for the rival delights of two metres or another of the amateur bands. Why not keep both bands? Anyway, it means that some 934 rigs have come on the market at attractive prices and have popped up again elsewhere.

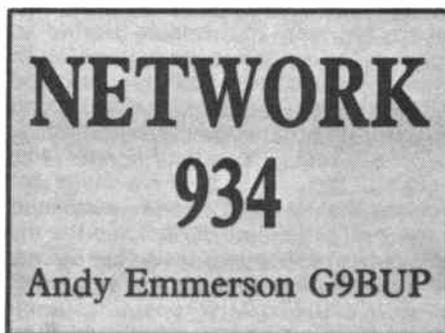
Clive's antenna take-off is not too brilliant in some directions, being shielded by hills. To the south he has no difficulty in getting out and he keeps up a regular sked with his QSO partner Reg on Guernsey. This is definitely DX with a capital D – about 260km – yet most nights they get through. Incidentally, the 'big signal' station on Jersey, run by Barry JY808, has left the air.

Experience with antennas

Clive has tried out several designs and makes of antenna, but his favourite is the Tonna. It is well made and has low wind-resistance. In fact, Clive finds it trouble free and the best value on the market, and I agree!

Loop yagis look a bit more impressive and have some advantages, but performance tends to go off in the rain. The mechanical construction of some on the market tends to corrode badly and seems unable to stand up to the weight of our larger feathered friends. This is not intended as criticism of the design itself, nor of *all* makes of loop yagi, but some of the flimsier ones seen in the shops are none too brilliant.

Using his Tonna, Clive has no difficulty in hooking up with Carmarthen (150km) under flat conditions, while in last autumn's lift he managed to work stations on the Isle of Dogs and the north Kent coast, directions normally barred to him by the local landscape. In his opinion



934MHz is definitely very lively – in fact in terms of band occupancy or QSOs per megahertz, the 934MHz band is used much more than 70cm.

Now there's a thought...

New products for 934

Yes, two new products and British made as well. Jako Electronics of Shirley, near Southampton, is a new brand-name, though the brains behind it are not. I think I had better rephrase that! Let's just say the Jako people have been involved with 934MHz since the start.

The offering is the CAS-A2 coaxial antenna switch, looking like the usual Japanese products but at a lower price and to the same performance specification. Jako describe it as a high quality, weatherproof coaxial antenna switch, featuring low insertion loss and N-type connectors (naturally).

It can be used up to 1000MHz, so it will be ideal for 934MHz as well as the 70cm amateur band and commercial use. It can handle 150 watts of RF power (but don't try switching while you're transmitting please!) and the insertion loss at 934MHz is quoted as 0.25dB, which is negligible. It comes with a V bolt and saddle clamp, which will fit masts of up to 2in in diameter. The three N-type connectors are silver-plated and just a single power feed/control wire is needed (10 metres of wire are supplied).

Power supply requirements are a flea-sized 80 milliamps at 11 to 14 volts and Jako offer switches and power supply units if you don't want to use existing equipment. Comprehensive fitting instructions are given, which mention

the need to waterproof all cable/connector joints with self-amalgamating tape. All in all, a competent and workmanlike product sensibly priced at £59 retail.

A lower cost version, fitted with SO-239 connectors and rated for use up to 185MHz is available at £39. This would be fine for two metres, 27MHz CB and HF amateur bands, though not for 934MHz. In case you're asking what the purpose of these switches is, they are most useful when you have both a collinear and a beam antenna. The collinear with its all-round coverage is fine for local hook-ups and contacting a mobile which may be changing location all the time.

For DX work, though, you will want to concentrate on one direction only, and for this you need a beam antenna (perhaps one of those Tonna yagis). Some people run a separate feeder from the shack to each antenna and have either a switch next to the rig or else they unplug one feeder and connect up the other when changing aerials. These schemes are not ideal though, and running a single feeder out of the shack and up the mast is usually simpler than having to deal with two. A single downlead is also the only way of using a single masthead preamplifier.

Time files

This year I shall have been on 934MHz for six years and I was by no means in at the beginning – are there any readers who reckon they were? I thought we could take a quick look at the early days and note how far we have come since then.

You will probably remember a lot of interest in citizens' band in the late 1970s, sparked off mainly by American films. People started to use 27MHz AM equipment, illegally of course. The pressure was mounting for the Government to legalise the situation which has been described as the country's largest ever consorting group of law breakers.

In 1980 the authorities realised that CB was not going to go away, and published a booklet called *Open Channel – a discussion document*. This agreed with the concept of a short-range personal radio system, but fell short of calling it

NETWORK 934

CB. Instead the authors named it Open Channel, a name which survived only in the trading titles of a few companies. Everyone else, including the Government after a while, called it CB.

Included in this document was the proposal that the new Open Channel service should use a UHF frequency, 928MHz, which would avoid any risk of interference to domestic radio and TV reception. For obvious reasons, this frequency did not appeal to the existing 27MHz users and indeed many 'well informed' technical people pronounced that radio did not and could not work at 928MHz.

In the end a good old British compromise was reached, under which a 27MHz service was permitted (but on FM rather than AM) and a UHF band was also made available, at 934MHz.

To begin with, there was no equipment on the market for 934MHz, though magazines predicted the arrival of dual-bander sets. Early in 1982, however, the first commercial rig appeared on the market, the little Reftec MTR-1. Several of the CB magazines (yes, there were lots of titles then!) ran feature articles on 934MHz, complete with colour pictures of the Reftec transceiver.

Supplies of this rig were less easy to

find, though. The manufacturer had difficulty in producing enough sets to meet the demand as well as having problems with one distributor. I remember I had to drive 50 miles to buy a rig, and even then I had to accept a second-hand demonstration set.

Rogues and vapourware

Articles made optimistic predictions about range and coverage of the new band, though there was some doubt over the sensitivity of the Reftec rigs. There were not many people on the air and it was a year before I made a single contact on 934MHz! Jeff Smith of Reftec showed a prototype hand-held rig, and advertisements for long yagi beams started to appear. The antennas themselves often didn't materialise, though, and the 934MHz market was beset by rogues and second rate products in those early days.

During 1983, Fred Judd - who was holding the test and development licence G9BTN on 941.9MHz - published a two-part article in *CB Radio* on the ins and outs of repeaters, including details of a fascinating scheme for a national network of 934/936MHz repeaters. (Amazingly, the same article was re-published without change two years later in *Citizens' Band* - by this time 936MHz had

been allocated to cellular radio).

The magazines started publishing the names of 934MHz 'breakers' looking for contacts on the air, and the first DX record (135 miles) was claimed.

Several 'vapourware' products (existing only in the mind of the advertiser) caught the attention of potential users, but one which did get sold (in small quantities) in 1984 was Grandstand's LS83 transverter, which turned a 27MHz rig into a 934MHz one. Too bad it wouldn't talk properly to a Reftec! Two British made dual-banders were advertised too, the Uniace Minster and the Warlock, but heaven knows if they ever existed in fact; I never saw one.

Sanity came in 1985, when the first Japanese made transceiver arrived on our shores. One was excellent and is still on sale, and the other was, shall we say, variable and is not. In the same year this magazine published its first treatment of 934MHz equipment and our sister title, *Amateur Radio*, had an appreciation of recommended equipment by Angus McKenzie G3OSS. Following these two initial articles, *Network 934* became a regular feature and the rest is history!

That's it for this month. Still no QSL cards; what about yours and your activity report?

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A LONG RANGE LONG WAVE RECEIVER

by Richard Marris G2BZQ

The concept of designing and using receivers and antennas for long range long wave reception will possibly be greeted, by many, with sheer astonishment. After all, as everybody (?) knows, there is nothing much heard except BBC 4 and Radio Luxembourg and that's your lot! Or is it?

In actual fact the LW band is teeming with activity. There are many European BC stations, but to these BC stations in N Africa and the Near East, Asiatic Russian BC stations right across to Siberia and across to the Pacific coast, worldwide marine and aircraft beacon navigational stations, weather and information stations *plus* the 1750 metre USA amateur lower power Tx band can be

added. In all this you can find AM, MCW, CW and other modes.

Many modern transistor radios do not even include the LW band. The latest *Wireless World* wallchart of frequency allocations shows the LW band, covering from 148.5kHz (2020 metres) to 283kHz (1052 metres). However, there are USSR lowish power stations up to about 400kHz (750 metres) apparently relaying programmes.

There is a bandplan for LW BC stations of 9kHz spacing, which is very much infringed. Also, under many of the higher power stations, such as BBC 4, there are lower power local stations, many located in eastern Europe, but quite a number elsewhere. In the case of BBC 4, on 1500

metres, it is unfortunate that even when the BBC 4 programme packs up around midnight, the station seems to spend the rest of the 24 hours with the overseas programme and/or test signals. In between times it is sometimes possible to hear other low power minnows on the same frequency, eg between 5.30 and 5.50am in the morning – especially when it is dark.

To listen and search the LW band had always meant the writer employing receivers used for other purposes, entailing various connecting and disconnecting procedures, so it was decided to organise a receiver solely for LW reception. It would need to have high RF gain, plus facilities for using external

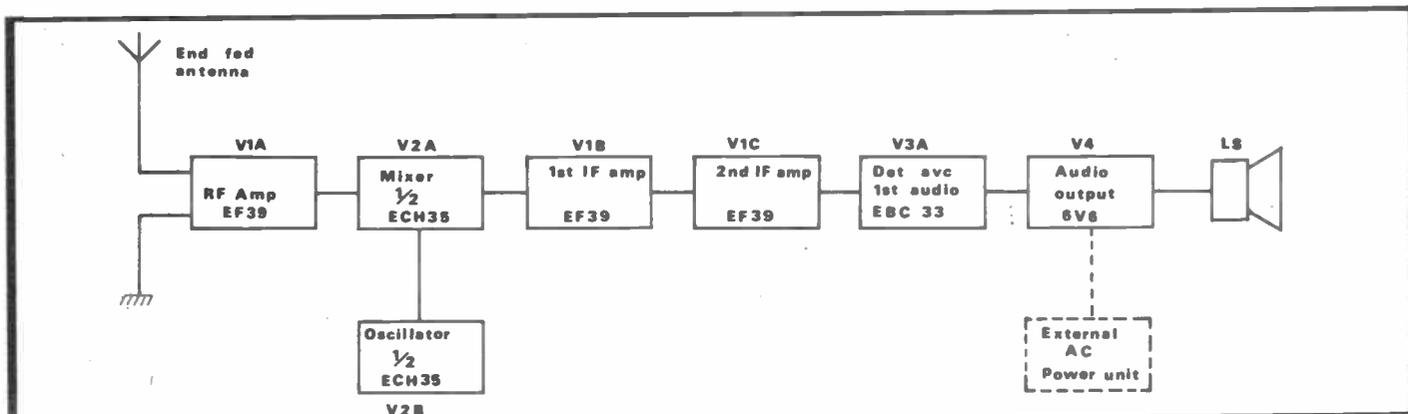


Fig 1 The PCR receiver – original block diagram

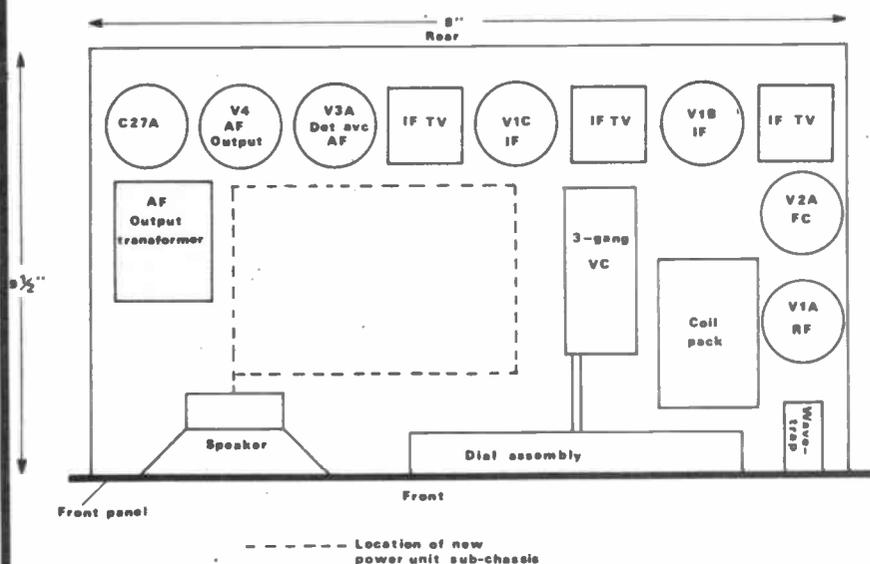


Fig 2 Chassis layout – top view

loop antennas, and must not be fitted with an internal ferrite rod antenna. It also had to be repairable and modifiable at the QTH.

The choices were:

1. Buy a new one. Well, there are not many good ones about and those few are quite expensive. Most have in built ferrite rod antennas.
2. Find an older communications Rx, such as an AR88LF, the HRO or Mercury – excellent, not expensive, but very large and very heavy, and although very repairable they are not easy to modify.
3. Try and find an older type Rx with the major components well spaced out to facilitate anticipated modifications and easy repairs – the result would be a 'cocktail' of old and new.

The 'cocktail' idea was adopted in the shape of a PCR receiver. The PCR was made by PYE and appeared in the 1940's. They are all valve and come in several guises:

1. Type PCR, PCR1, PCR2 (with variations): 800-2100 metres; 190-570 metres; 6-18MHz.

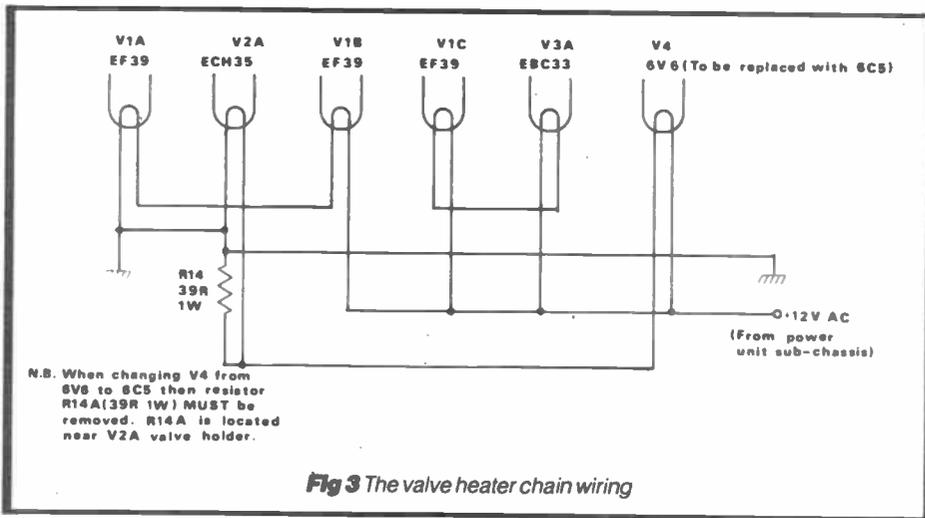


Fig 3 The valve heater chain wiring

2. Type PCR3: 190-570 metres; 2.3-7.5MHz; 7-23MHz.

Obviously the PCR3 is not suitable.

To make life even more interesting variations appeared, presumably to fill special needs.

The PCRs were lively receivers and originally came with an external ac power unit plus other supply units. Many PCRs were released from active service, mostly without the external ac power unit. Some have since been modified with an internal ac PSU. Some models had an internal speaker and two extension speaker sockets. The chief components are well spaced, and therefore ideal for modifications. All valves are readily available from advertisers, and the slow motion dial has a reduction ratio of about 70:1.

Two PCRs were purchased via the Free Classified Ads:

1. No 1 was an unmodified PCR – dirty but intact – for £10. Its metal case was missing. It had a built-in speaker, and no internal or external ac power unit. This is how you usually find them.

2. No 2 had been modified with an internal power unit. It cost £20, and was very heavy because of its steel case and a large mains transformer.

No 1 was selected for the present exercise and No 2 confined to the garage for future projects.

The result is, after modifications, a long range LW receiver, with MW DX facilities (east coast N America has been received) and useful SW monitoring facilities (6-18MHz). The block circuit diagram of this Rx is shown in Figure 1. A full circuit diagram is available from the Vintage Wireless Company for £3. It consists of 4 x A4 size photocopies which, if carefully cut, can be taped

together into one large circuit of the PCR2. The circuit differences between the various models are minimal, and mostly consist of tone control circuit variations and the inclusion of an Rx internal or external speaker.

Therefore, for the purpose of this article, circuits only appear for those stages where changes are made, and additional circuitry. Anyone embarking on this project would be well advised to get the full circuit.

A careful study and survey of the Rx and the circuit indicated that the following action/modifications/additions would be needed:

1. Give the Rx a thorough clean after first removing the dust.
2. Check for breakages and disconnections.
3. Design and build a small inbuilt ac power unit sub-chassis.
4. Reduce the audio output of around 5 watts (with internal speaker and two external speaker sockets) to around 1 watt. Add headphone 'plug-in/LS off' facilities. After all, who in the dead of night needs 5 watts of audio to wake up the household and neighbours?
5. Provide an AVC 'on/off' facility.
6. Provide BFO facilities for unmodulated beacons and CW.
7. Design and build an antenna matching unit (AMU) to facilitate the use of a 50 ohm terminated loop antenna in lieu of the existing end fed wire antenna facility.

All very simple if approached step by

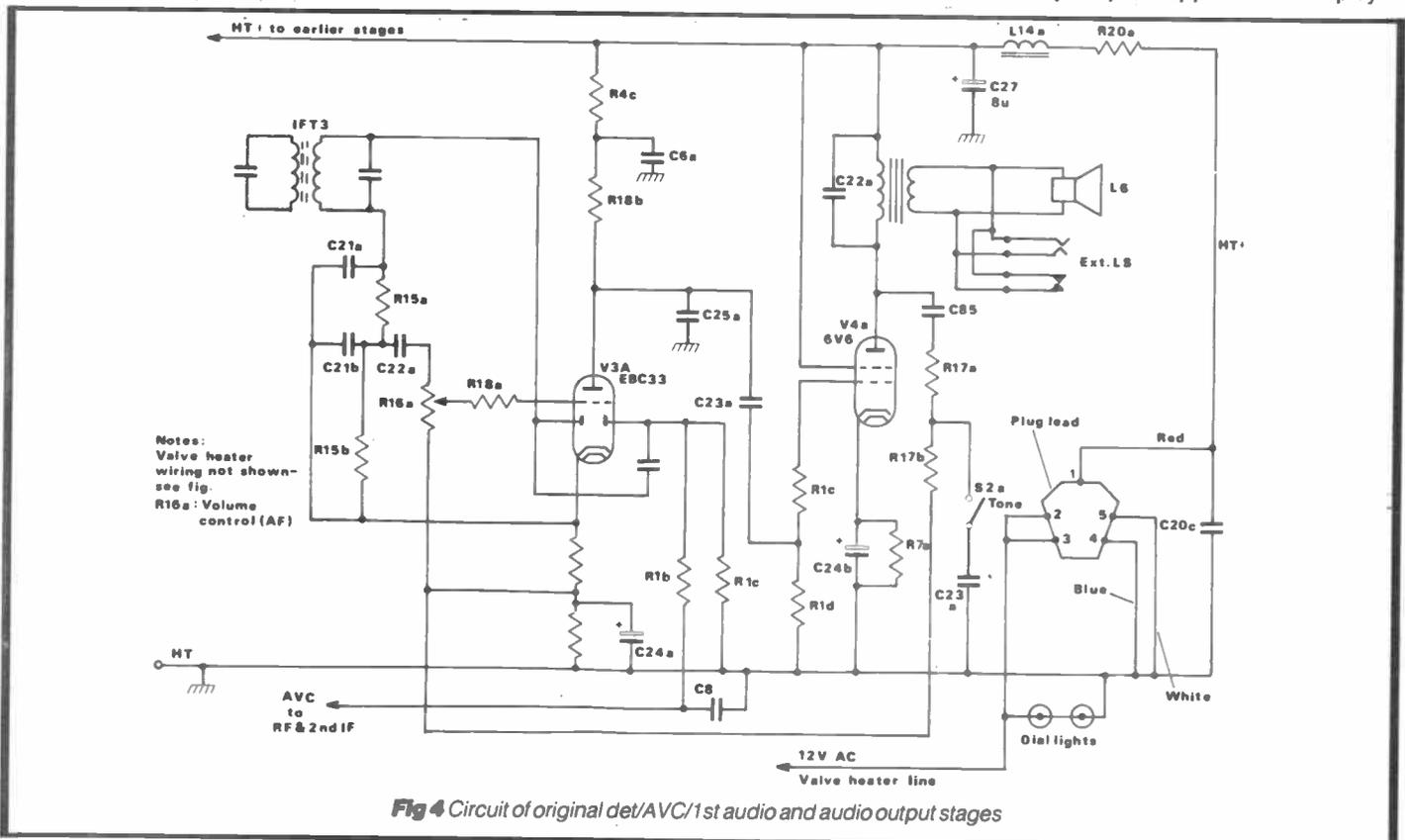


Fig 4 Circuit of original det/AVC/1st audio and audio output stages

step – one move at a time! *Figure 2* shows a top view of the chassis layout, *Figure 3* is the valve heater chain wiring. The octal valve heaters are wired into a series/parallel arrangement to operate from 12.6 volts ac or dc. All valves have a 6.3 volt 0.15 amp ac heater rating, except for the output valve (V4) (6V6), which takes 0.45 amps. V4 heater (0.45 amps) is wired in series with V1A (0.15 amps) with a 39 ohm loading resistor (R14A) wired across the V1A heater. Total consumption is just under 1 amp at 12.6 volts ac.

It should be noted that all circuit references are as they appear on the original circuit diagram.

Figure 4 shows the circuit of the detector/AVC/1st audio and AF output stages (V3A and V4A) before modification. It will be seen that the HT and heater supply is fed via a plug/socket lead which comes out from the left hand bottom corner of the front panel. It is a large typical services ugly plug/socket cable affair.

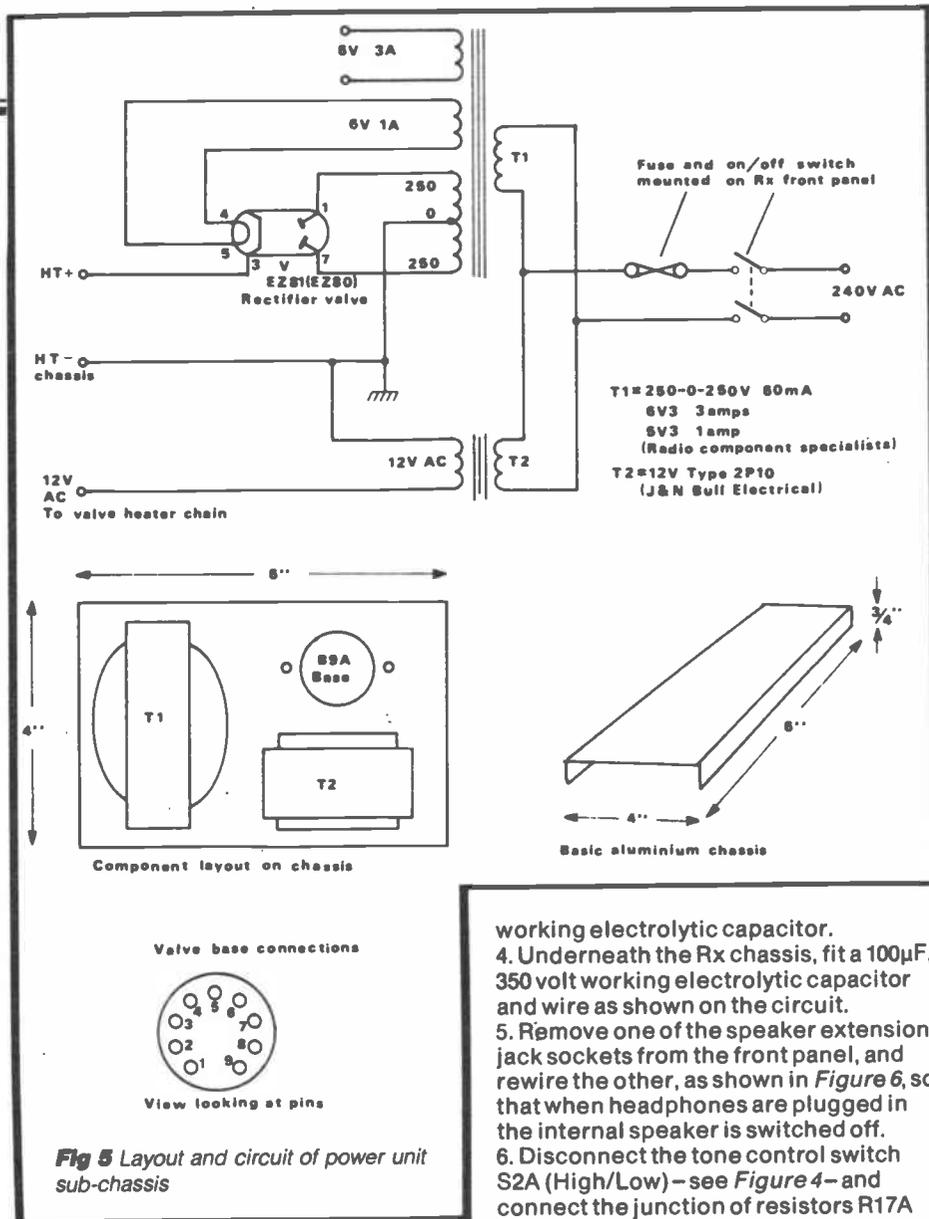
AC power unit sub-chassis

This new chassis is intended to be ultimately fitted, with a couple of screws, onto the main Rx chassis in the rectangular space indicated with dotted lines on *Figure 2*. As can be seen from *Figure 5*, the circuit of this unit is very simple. It consists of a simple aluminium 6in x 4in chassis with two 3/4in sides bent down at 90°. Onto this are mounted the two mains transformers T1 and T2 plus a B9A valve socket for the rectifier valve.

The actual transformers used (and suppliers) are shown adjacent to the circuit. Some readers may already have suitable transformers. The HT transformer is under-run, which means that it runs 'cool' and has spare voltage capabilities for any future additions. T2 is a 12 volt 5 amp ac transformer and has to supply the valve heater chain, the dial lights and anything which may be added later; it also runs 'cool'. Hot transformers, in enclosed cabinets, can produce RF oscillator drift and other overheating problems, so they are not recommended.

The rectifier valve can be either type EZ80 or EZ81. They are both readily available from advertisers at under £1 each. The EZ81 was selected because it is more robust. If you have an EZ80, then use it – it is satisfactory. The pin connections of the EZ80 and EZ81 are identical, and are shown in the 'Valve Base Connections' diagram, as seen from underneath the B9A valveholder (ie looking at the valve pin ends).

The main fuse and DPST on/off switch shown on the circuit are mounted on the Rx front panel in the bottom left hand area – see *Figure 7*. The Rx dial illumination bulbs indicate when the Rx is switched on. The necessary HT smoothing is located on the main Rx



chassis, and is a modification of the existing one. Good quality 2 amp PVC covered flex should be used for all wiring connections taken from this sub-chassis to the main Rx. Red was used for HT, yellow for the 12V ac, black for HT and earth (ie in addition to the sub-chassis being bolted to the main Rx chassis metalwork). 2 amp mains cable was used for connecting the transformers to the fuse and switch, robustness, reliability and safety being the watchwords!

Modifications

Figure 6 shows the revised circuit and should be compared with the original circuit in *Figure 4*. The following modifications are required and are marked:

1. Remove the 6V6 valve from V4A socket and replace it with a 6C5 triode valve. No wiring change is needed to the valve socket.
2. Change R7A from 470 ohms to 1000 ohms (1/2 watt). This will mean that this stage will now only draw about 8 milliamps at just under 300 volts HT.
3. Replace C27A with a 32µF, 350 volt

working electrolytic capacitor.

4. Underneath the Rx chassis, fit a 100µF, 350 volt working electrolytic capacitor and wire as shown on the circuit.

5. Remove one of the speaker extension jack sockets from the front panel, and rewire the other, as shown in *Figure 6*, so that when headphones are plugged in the internal speaker is switched off.

6. Disconnect the tone control switch S2A (High/Low) – see *Figure 4* – and connect the junction of resistors R17A and R17B (both 15k) to C23A.

7. Switch S2A is now used to switch the AVC on/off. It is connected to the switch and the junction of resistors R1B (470k) and C8P (0.1µF) to earth. The switch can be relabelled 'AVC ON/OFF'.

8. Fit a double pole ON/OFF mains rated toggle switch to the front panel, as shown in *Figure 7*, with a fuseholder located to the right of the switch. Wire both to the power supply unit sub-chassis.

9. Later it was found that, due to sheer old age, the LS reproduction was a bit rough, so it was replaced with one of the same diameter taken from a defunct transistor radio.

Testing

After carefully rechecking the wiring accuracy and ensuring that the earth pin on the mains plug is connected to the chassis/earth, a piece of wire should be connected to the aerial terminal. Turn the audio gain control to about 75% clockwise, select the LW band and tune to BBC 4 on 1500 metres. Switch on the Rx (the dial lights should be illuminated), and after a short warm up period Radio 4

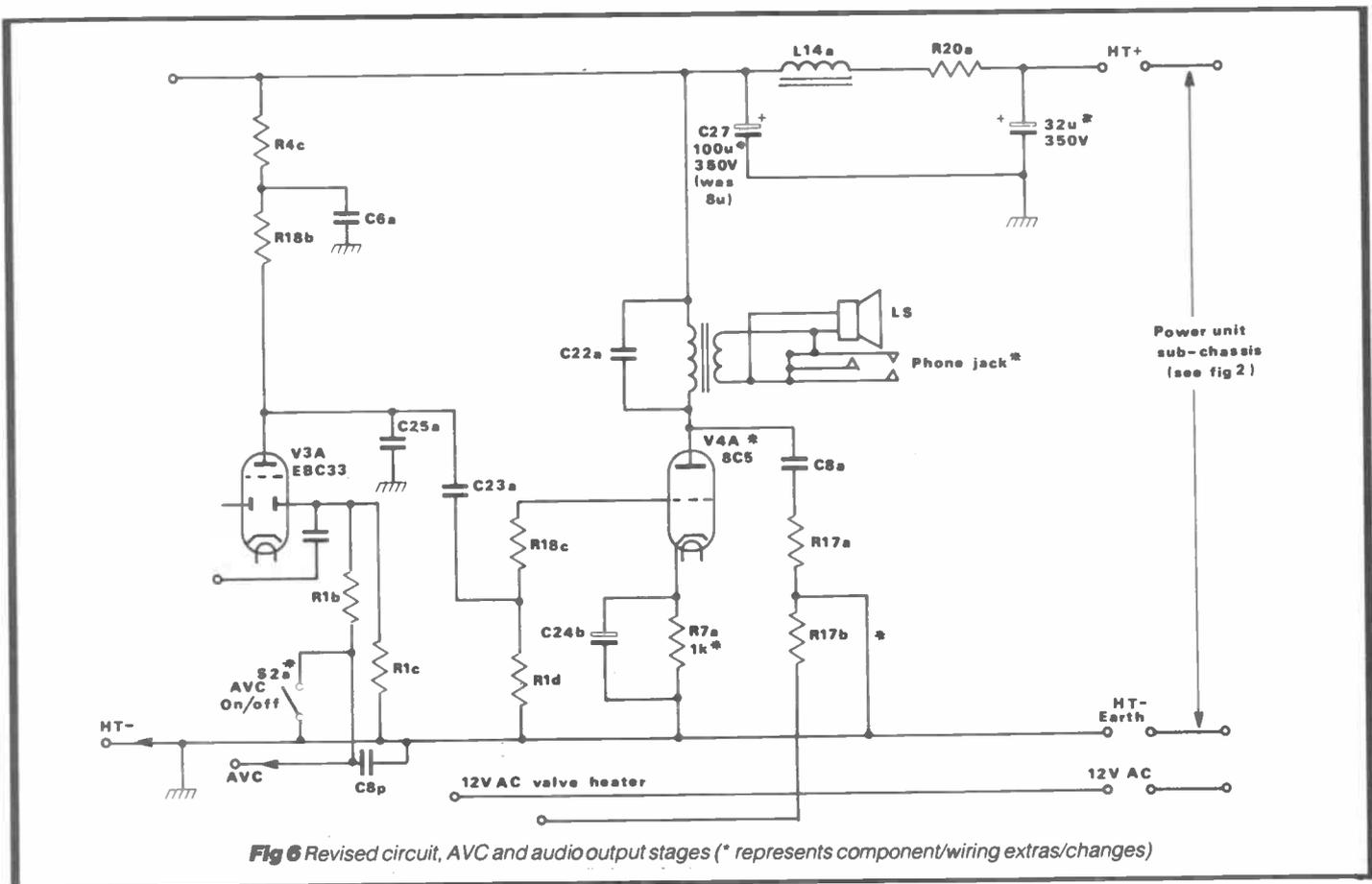


Fig 6 Revised circuit, AVC and audio output stages (* represents component/wiring extras/changes)

should be heard loud and clear. Check that the MW and SW bands are working.

The HT voltage should be measured at the most convenient point, which is between the audio output transformer primary and the chassis. On the writer's Rx this was 290 volts, but anything between 160 and 320 volts should be OK. Consequently, if it is ever necessary to replace any capacitors, they must have a minimum working voltage of at least 350 volts.

The IF frequency is 465kHz and is difficult to adjust, so should definitely be left alone. The writer's measurement with a crystal reference source was

467kHz! Not bad after over 40 years.

The LW, MW and SW band ranges were also checked and were remarkably close to the dial readings (which are in metres on LW and MW and in MHz on SW). If an accurate signal source is not available, then spot checks can be made against stations of known frequency/wavelength.

BFO facility

A BFO is sometimes required for LW beacon and CW reception, and should be injected with the AVC 'off'. The writer uses a BC221 with a probe near the antenna input to measure the frequency

of strange stations. A ± 1 kHz movement of the BC221 dial beats with the beacon or CW station signal, ie a simple primitive BFO at RF frequency. For anyone interested, a more conventional BFO circuit is shown in the Maxi-Q (Denco) Technical Bulletin DTB4, which uses a Maxi-Q, BFO transformer. The 6.3 volts needed for the valve heater could be taken from the spare 6 volt winding on T1. There is also a design for a transistor BFO using a Maxi-Q coil. The voltage for this circuit could be taken from across R7A (8 volts dc) - see Figure 6.

Ongoing options

If the reader intends to use this Rx with a long wire end fed antenna plus earth, then no further modifications are needed. If, however, the reader really wants to get into the DX, then a good loop antenna is essential. The loop will eliminate/reduce other station interference, directional static and man-made electrical noise. It is therefore necessary to modify the existing RF/antenna input circuit as shown in Figure 8.

The wavetrap should be removed (see Figure 2 for location) and a phono socket fitted (see Figures 2 and 7), it is also necessary to use a LW/MW loop antenna matching unit. The following loops can be used with this RX:

- 1 The Mini-Loop Antenna on MW (R&EW November 1986).
- 2 The LW Rod Loop DXer (R&EW March 1987).
- 3 An existing wire antenna for SW monitoring.

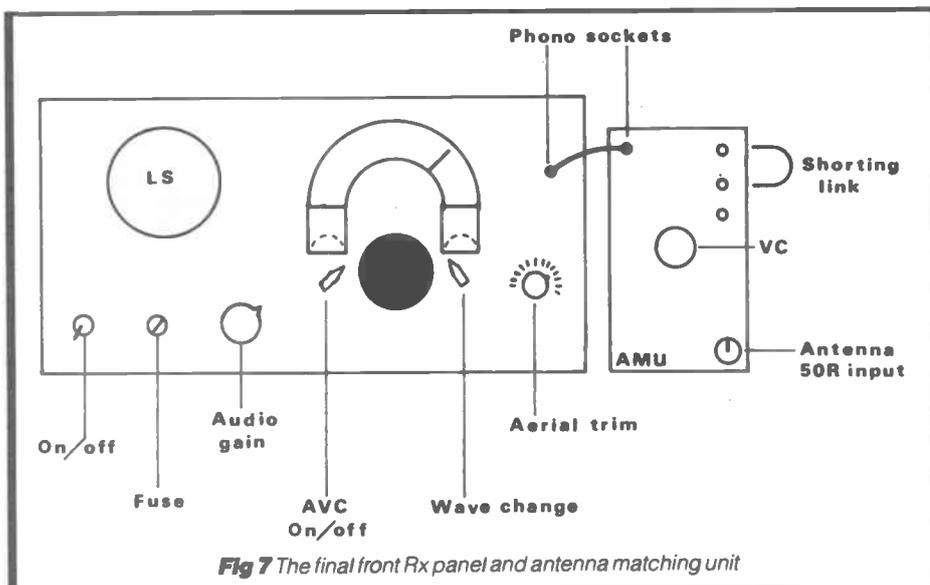


Fig 7 The final front Rx panel and antenna matching unit

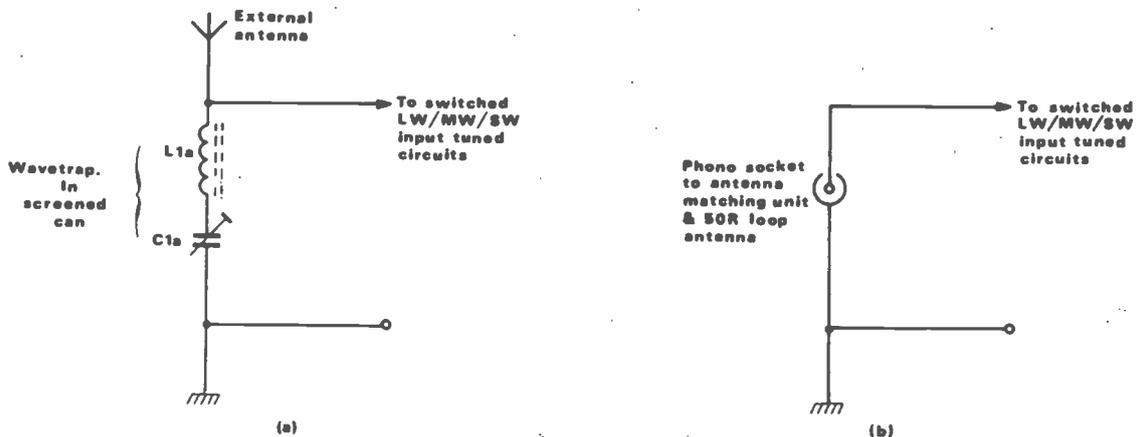


Fig 8 Revised antenna input arrangement for loop (50Ω)

LW/MW loop AMU

The trouble with LW/MW receivers designed for use with end fed long wire aerials is that the input impedance is generally considered to be between 300 and 600 ohms, with 400 ohms being the generally accepted figure. A further problem is that, in practice, there is a difference in the Rx input impedance from one end of the band to the other. This does not really matter for general BC reception from high power stations within a few hundred miles. However, the above does produce problems when trying to use such a receiver with a loop antenna for long distance reception, as loops usually terminate at 75 or 50 ohms impedance. There are various ways of matching the low impedance loop to these receivers, but again, even if this is done accurately at one end of the band, there will be a mismatch at the other end. This does not matter much for entertainment reception, but it is not acceptable for long range reception where it is absolutely essential that the low impedance loop is matched correctly at all frequencies at the Rx end. Textbooks being of no help, experiments were tried, with various variable arrangements to completely cover LW and MW in one simple matching unit.

The resulting design (see Figure 9) is a variation of our old friend the L-network, usually met on the SW bands to match end fed assorted wire antennas to a transmitter with 50 or 75 ohms input impedance. The LW/MW AMU has an L-match turned the other way round from that normally found in HF Tx/Rxs (ie the

loop has 50 ohms impedance and the Rx has a much higher input impedance). The circuit shows that the AMU consists of an inductance (L1 plus L2) mounted on a ferrite rod. L1 and L2 and the ferrite rod are commercially available at low cost. The rod is cut down to 3½in with a junior hacksaw. The coils are mounted at ¼in from each end of the rod, wired in series and sealed in position with hot candle wax. The rod ends are supported by plastic mounting clips. The 1000pF variable capacitor is made by wiring both sections of a 2 × 500pF VC in parallel.

Socket SKT1 is a phono socket, from which a 6in long coaxial lead is taken to the Rx. Socket SKT2 is the usual coaxial socket, into which is plugged the 50 ohm coaxial feedline from the loop. Banana sockets SKT 2, 3 and 4 are, in effect, taps, into which the shorting link (plugs PL1 plus PL2) can be inserted. The AMU works from the HF end of the MW band to well over 2100 metres (142kHz) below the LF end of the LW band. The whole inductance, L1 plus L2, can be used, or L1 or L2 can be shorted out with the plug shorting link.

The 1000pF variable capacitor, plus combinations of L1 and L2, enable any of the loops to be matched into various

LW/MW receivers designed for using higher impedance end fed antennas, irrespective of the actual input impedance. The control VC is not critical when tuning the Rx and loop, but when peaked to the impedance matching point, gives a dramatic increase in signal strength.

The whole AMU is mounted on a vertical circuit board panel, 7in high × 3in wide, and stands alongside the Rx, being connected to it with a short 6in coaxial lead. The AMU can be used for connecting loops to other MW/LW receivers currently requiring end fed antennas.

Conclusion

This 'cocktail' LW long range Rx uses loop antennas very effectively. Its MW-DX facilities are useful and its SW monitoring facilities are used for quick checking of band conditions and activity. Many of the ideas and modifications used can be adapted for 'cocktailing' other similar receivers.

Remember

Mains and HT voltages can HURT! They can also be LETHAL! The utmost care should be exercised.

- SKT 1: phono socket
- SKT 2/3/4: banana socket
- SKT 5: coaxial socket
- PL1/2: banana plugs
- VC: 2 gang by 500pF variable capacitor, 1000pF
- L1: type MWC2 coil (Circuit)
- L2: type LWC1 coil (Circuit)
- F: ferrite rod FRA (Circuit) cut to 3½in long
- 2 × rod mounting clips FRPC (Circuit)

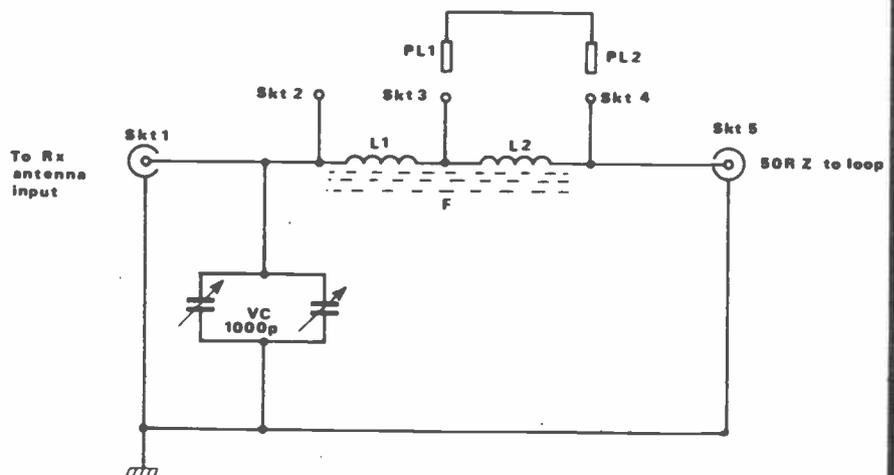


Fig 9 The LW/MW antenna matching unit

A SIMPLE AM/FM TUNING HEAD

With optional doubling as a portable receiver
by Sir Douglas Hall

This article describes a very simple AM/FM tuning head design which is easy and cheap to build. It will give good results with an external amplifier or, as will be described later, with an internal amplifier which makes the tuner double up as a portable receiver. The FM coverage is of VHF Band II, and the medium wave band is covered on AM. It will be assumed that the would-be constructor has some previous experi-

ence, but this need not mean that he has necessarily built an FM tuner before.

In a previous article, which described a short wave receiver and was published in the December 1987 edition of this magazine, I pointed out that my Spontaflex circuit was used. I said that this circuit could be used in various forms to suit the broadcast bands, the short wave bands and FM signals in the VHF Band II.

Figure 1 shows the basic circuit for

reception of FM signals. It is very similar to the short wave version, but with a different form of reaction control and with different component values. Although the circuit is so similar, its way of functioning as an FM receiver is different from that used when receiving AM signals.

The signal is applied to the emitter of Tr1, which amplifies as a common base device and passes the signal to Tr2 which is in the Spontaflex configuration. Here it amplifies the signal as a common collector amplifier; Tr2 is kept gently oscillating at the central frequency of the incoming signal.

Oscillation takes place through the Colpitts configuration, the capacitor across the diode, in conjunction with the internal capacitances of Tr2, acting as a capacitance tap into the tuned circuit. The signal, being frequency modulated, has a variable frequency depending on the modulation. The local oscillation will lock to this signal, and the amplitude of the local oscillation will vary, becoming less as the incoming signal becomes out of tune with the fixed tuned circuit. The frequency modulation is therefore changed to amplitude modulation, and the resulting signal is detected by the diode, the result being amplified again by Tr2 as a common base audio amplifier.

The signal then passes back to Tr1, which gives further amplification as a common emitter amplifier with some negative feedback due to the resistor in the emitter circuit, which cannot be bypassed as it is also the load for the incoming FM signal. Five stages have taken place with the use of only two active devices. The degree of oscillation is controlled by varying the current passed through Tr2. R7 produces a Vernier effect over the central part of the track.

Figure 2 shows the configuration for the broadcast band. In this case, Tr1 acts as a common collector amplifier and the signal then passes to Tr2, which acts as a further common collector amplifier, a super alpha effect being brought about which results in a very high input impedance for the incoming signal. As a result, internal capacitances in Tr1 are very low, and the medium wave band can be covered by a tuning capacitor of only 100pF. This results in an unusually high inductance/capacitance ratio for the

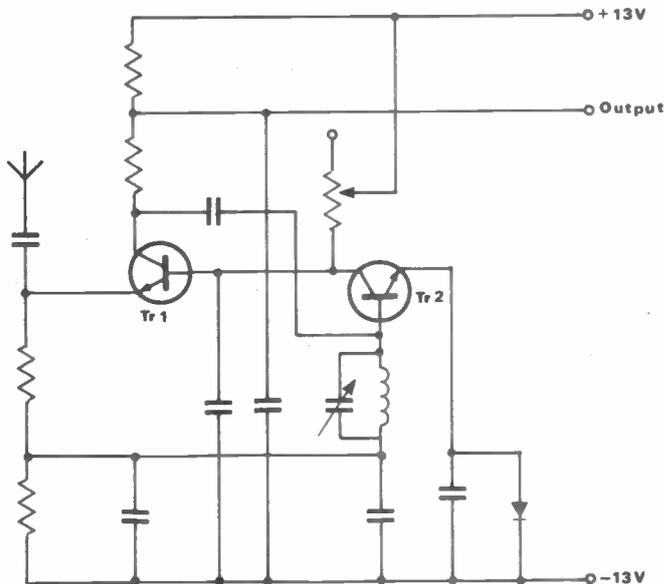


Fig 1 Basic circuit for reception of FM signals

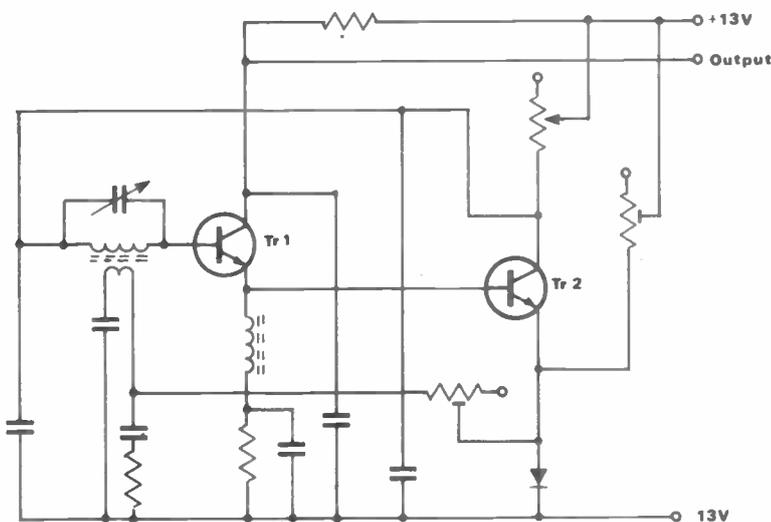


Fig 2 Circuit configured for the broadcast band

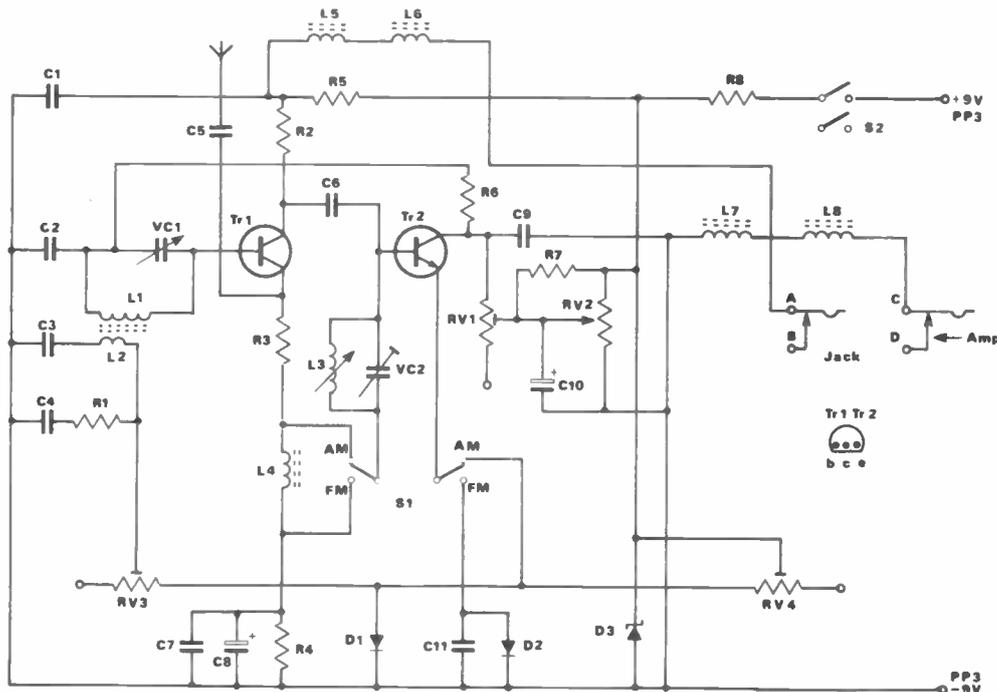


Fig 3 Method by which the two previous circuits can be combined

tuned circuit, providing a very high degree of sensitivity and selectivity.

As in Figure 1, detection takes place and the signal is then amplified in audio form by Tr2 and passes back to Tr1 for further amplification by the common emitter method. Feedback takes place through a coil coupled to the tuning coil, and is controlled by varying the collector current passed by Tr2, as in the FM circuit.

Figure 3 shows how the two circuits described can be combined using the same two transistors in each case, wave change being obtained by use of a simple two pole two-way slide switch. One of these poles is used to change over the diodes. For the VHF band, a high impedance, low capacitance diode is needed. On the medium wave band a low impedance diode will function, and this allows for greater AF amplification by Tr2, as the gain given by a common base amplifier varies in inverse proportion with the impedance of its input load.

The VHF coil consists of 4 turns of wire of about 24swg - 'wiring up wire' of the solid variety will do nicely - wound on a sleeve with an internal diameter which makes an easy fit for a piece of 3/8in ferrite rod, 1in long. The sleeve should be about 2in long, and can be made by cutting a piece of Fablon 2in wide and 3in long, leaving all the paper backing on except for 1/2in at one of the narrow ends. Wrap it, not too tightly, around the rod, using the uncovered strip to seal the tube. The rod should ride smoothly inside, but without wobbling.

A piece of 3/8in dowling, 3/8in long, is inserted at one end, and the coil is then wound with four evenly spaced turns,

starting 3/8in from one end and finishing 3/8in from the other end. The dowling is drilled through the sleeve, and the coil is then secured to the panel with a 6BA bolt and nut. The nut at the end of the spindle through VC1 is then removed, and two washers are placed over the spindle.

A short length of nylon cord is trapped between the washers by the nut and then wrapped over them. The other end of the cord passes through a grommet of a suitable size to grip the cord over the end of the rod. The length of the cord which is passing through the grommet is then adjusted so that, with the vanes of VC1 fully closed, the rod is as low in the coil as the grommet will allow. Then, as the vane of VC1 is opened, the rod will be slowly pulled out of the coil, and tuning by variable inductance will take place, as in Figure 5.

Figure 5 shows the suggested positioning of the major components carrying VHF currents, as it is important to keep the wiring short. Wiring and layout details are left to the constructor, but it would be useful to have an extension rod on VC1 to remove hand capacitance effects on weak VHF signals. The method used in the prototype is shown in Figure 4.

This arrangement also allows for a telescopic aerial to be arranged at about 45°, although one which suits both horizontally and vertically polarised signals without the need to buy a rather expensive, and sometimes rather rare, swivelling type of aerial, can of course be used if available.

The space created as a result of the use of an extension rod, and the way the telescopic aerial is mounted, leaves

room for a small internal amplifier complete with 6in by 4in speaker, fitted to increase the usefulness of the apparatus. If this is to be done, it is wise to fit VR2 with a short extension rod and coupler and mount it as shown in Figure 4, on a bracket, which can be made from a small piece of aluminium or even plywood. This will keep the hands well away from the metal of the speaker and amplifier battery, which may find themselves charged with eddy currents that, at VHF, cannot be removed by earthing and which can cause annoying hand capacitance effects. These eddy currents may even appear in the metal

AMPLIFIER COMPONENTS

Resistors

All fixed resistors, 10% 1/4 watt

R9	10k
R10	1k
R11	220k
VR5	1k preset

Capacitors

C12	0.1µF polyester
C13	1nF ceramic
C14	0.01µF polyester

Semiconductors

Tr3	BC308C
Tr4	BC168C
D4, 5, 6	silicon, ie 1N194

Loudspeaker

LS 6in by 4in (see text)

Inductor

T1 Tandy 273 1381 (see text)

AM/FM TUNING HEAD

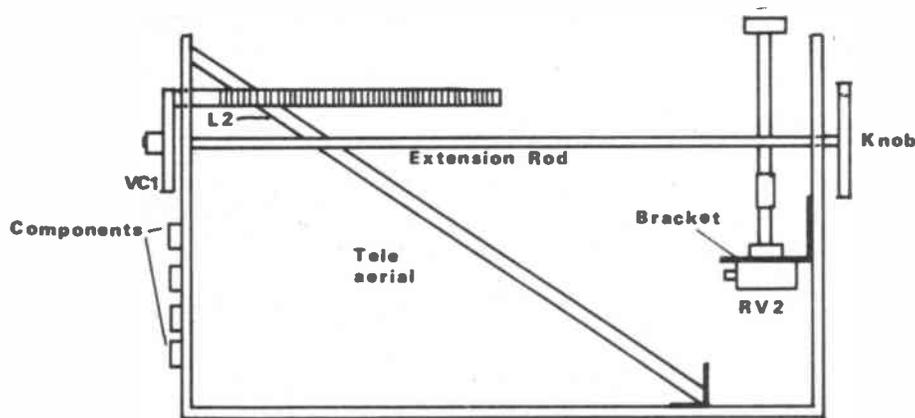


Fig. 4 Side view, showing extension rod fitted to VR2

casing of VR2 – hence the recommended extension rod.

The medium wave coil L1 consists of 130 turns of 34swg enamelled wire, close wound on a 3/8in ferrite rod, from 4 to 5 inches in length. If a 6in rod is obtained, 1in may be snapped off for the VHF rod, after filing a notch. L2 has 10 turns of the same wire wound about 1/2in away from the main coil's 'earthy' end.

It will be seen from Figure 3 that there are two capacitances in parallel at one point, C7 and C8. This is because some electrolytic capacitors offer quite a high impedance at VHF. It will also be noticed that there are two 4.7mH chokes in series, in each of the output leads of the tuner. These are to prevent the tuner being earthed when connected to a mains-driven amplifier, which has the effect of removing the useful directional effect of the ferrite rod aerial, and introduces too large a signal on medium wave, with a consequent loss of selectivity.

To set the tuner up, switch first to VHF. Set VC1 to half-way and, starting with VR1 at the half-way position, see whether

advancing VR2 will produce a slight hiss at a particular position, which will indicate that oscillation is taking place.

If necessary, adjust VR1 until that state of affairs occurs, with VR2 set about two thirds of the way towards maximum. Then adjust VC2 so that the three BBC stations come in with VC1 at about the half-way setting. (VC1 is not operative at VHF but, as stated before, its adjustment acts as a drive for the variable inductance tuning at VHF). Re-set VR1 if that should prove necessary. Stations should be tuned in with the receiver oscillating gently. There will be two possible settings on either side of a central setting, at which there will be severe distortion. Sometimes one setting gives better results than the other.

Next, switch to medium wave. Adjust VR3 and VR4 for the most satisfactory combination of settings for good results. Reducing the value of VR3 increases the feedback effect, while reducing the value of VR4 lessens it. If VR4 is reduced too far there will be a severe loss of selectivity. C4 and R1 help to keep the critical setting for VR2 at a constant position throughout the tuning scale on medium wave, which ideally will be about two-thirds of the way to a maximum setting, as for VHF. It is legitimate, though probably not necessary, to experiment with the value of C4.

Most of the components used for the tuner are widely available from many suppliers, including Electrovalue, of 28 St Judes Road, Englefield Green, Egham who, incidentally, stock a suitable Dilecom tuning capacitor for VC1. This is probably the best component to use owing to its shaped vanes, which prevent crowding of stations at the end of the scale near minimum capacitance. But Radio Component Specialists, of 337 Whitehorse Road, Croydon, Surrey, are currently advertising a 100pF solid dielectric component at a modest £1.50 and this can be used, though it has straight line capacitance characteristics, which will make tuning tricky at the high frequency end of the scale.

Brian Reed, of 161 St John's Hill,

Clapham Junction, London SW11, can supply the semiconductors and the tubular trimmer for VC2. Maplin, of PO Box 3, Rayleigh, Essex, can supply an inexpensive telescopic aerial, 925mm long, and also a suitable ferrite rod. I have not fitted a reduction drive, though one could be used, especially when listening to VHF. These are now expensive items, but a ball drive from the spares box would be easy to fit at the knob end of the extension rod. A 6mm

TUNER COMPONENTS

Resistors

All fixed resistors, 10% 1/4 watt

R1	560
R2	1k
R3	100
R4	3k9
R5	5k6
R6	10k
R7	22k
R8	1k
R9	10k
R10	1k
R11	220k
VR1	47k preset
VR2	100k wire or bonded
VR3	2k2 preset, carbon
VR4	22k preset

Capacitors

C1	1nF ceramic
C2	1nF ceramic
C3	0.01µF polyester
C4	1.5nF ceramic
C5	22pF ceramic
C6	1pF ceramic
C7	1nF ceramic
C8	100µF 10V electrolytic
C9	1nF ceramic
C10	2.5µF 10V electrolytic
C11	6.8pF ceramic
VC1	100pF solid dielectric
VC2	10pF tubular preset

Inductors

L1, 2, 3	(see text)
L4	2.2mH choke, Siemens
L5, 6, 7, 8	4.7mH choke, Siemens

Semiconductors

TK1,2	2N3663
D1	OA10
D2	OA81
D3	Zener, 7.5V 400mW

Switches

S1,2

Miscellaneous

6in by 3/8in ferrite rod
Telescopic aerial
1/2in jack, mono switched
Extension rod
Knobs, plywood, screws, bolts, nuts, tag strips, Fablon, etc

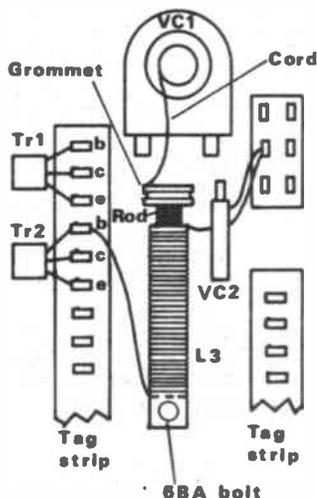


Fig. 5 Positioning of major components

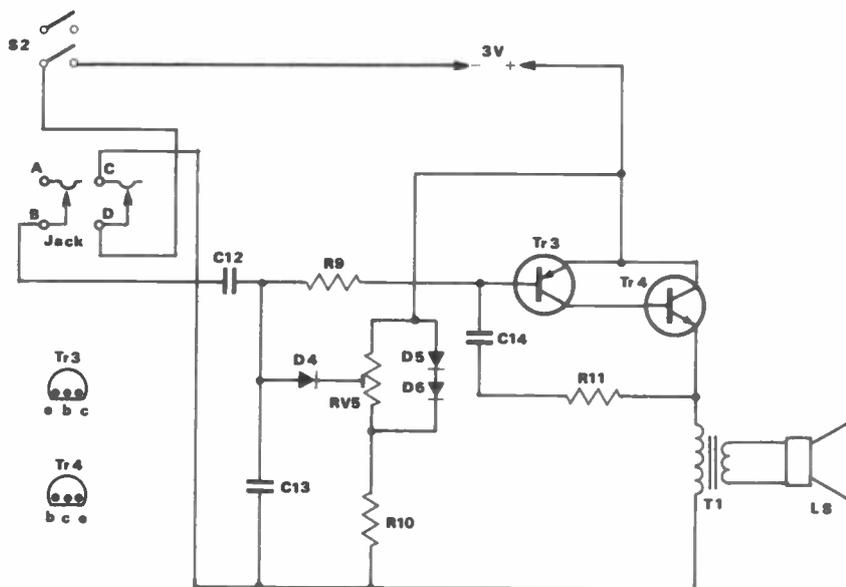


Fig 6 Circuit diagram of sliding bias amplifier

knitting needle makes a good extension rod. It should be made of plastic and not metal.

To return to the internal amplifier, many may wish to build a tuner only, but I have found the apparatus useful as a portable receiver and have incorporated the amplifier shown in theoretical form in Figure 6. It is a sliding bias amplifier, described in one of my articles in this magazine's predecessor many years ago. It uses two large 1½ volt cells for power, which it can deliver to the tune of about 100mW. Standing bias is set by the position of the positive end of D4 on the potentiometer VR5, across which D5 and D6 stabilise the voltage.

Part of any incoming signal is rectified by D4, which makes the base of Tr3 more negative so that the collector current is increased; this increase is in proportion to the amplitude of the incoming signal. The circuit functions, therefore, in a similar way to a Class B amplifier, though in fact Class A amplification is taking place. To set it up, first ensure that no

signal is being received by the amplifier.

Set the slider of VR5 to the end connected to D6, and then adjust VR5 until 7mA is passed by Tr4. If the specified transformer is used for T1, this will be represented by a voltage of 0.05V across its primary. Otherwise, a meter can be inserted in one of the battery leads. The small current passed by Tr3 can be ignored. After about 20 hours use, when the battery voltage will have settled down, it is useful to check the setting of VR5, which can be left alone after this.

There is a snag, however, in that the specified transformer is no longer easily available. What is required is a transformer with a primary having a direct resistance of about 7 ohms, a secondary to match an 8 ohm (or 4 ohm if appropriate) speaker, and a ratio of about 4 to 1 for an 8 ohm secondary, or about 6 to 1 for a 4 ohm secondary. Advanced constructors will, no doubt, wind their own component.

The alternative is to use a speaker of

from 15 to 35 ohms speech coil resistance, without a transformer, and with a 9V battery for power. Tr4 will need to be a BFY50, 51 or 52 to handle the extra power. This will provide greater output power than the specified arrangement but, as the largest battery which can be accommodated will be a PP7, economy will suffer.

Suitable 6in by 4in speakers with 4 ohm, 8 ohm, 15 ohm or 25 ohm speech coils are available from Radio Component Specialists. Brian Reed stocks the semi-conductors.

The case can be a simple affair, consisting of a top, with suitable holes for the knob of VR2 and the telescopic aerial, a front, with a cut-out for a speaker, and a back. The two ends and the base are already there as part of the chassis.

In conclusion

A final note on operation. When listening to AM signals, the most sensitive and selective setting for the reaction control will normally be just short of the oscillating point.

However, if attempts are made to receive a weak signal close in frequency to a very strong signal, increased selectivity (accompanied by a slight drop in sensitivity), can be obtained by pushing the tuner into a gently oscillating condition, by means of a small increase in reaction.

The apparatus will then operate as a homodyne, and very accurate tuning will be needed to avoid whistles and distortion. However, the interfering signal will probably disappear, or at least be much reduced in nuisance value.

When listening to FM signals the tuner is operating as a type of FM homodyne in any case and, as stated earlier, it is necessary for the reaction to be set for a gently oscillating condition for the proper reception of signals. An excellent description of the method of operation of a homodyne for AM signals was given by M Slifkin and G Abbott in the December 1987 edition of this magazine.

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DATA FILE

Ray Marston looks at practical audio processing ICs in this first part of a new mini-series

An audio processor can be defined as any circuit that takes an audio input signal and generates an audio output that is directly related to, but not necessarily the same as, that signal. The processor may, for example, simply invert the original signal and/or provide it with a fixed amount of voltage gain, as in the case of a linear amplifier. Alternatively, it may give it an amount of gain that varies with the signal frequency, as in an active filter circuit, or it may provide it with an amount of gain that varies with the mean amplitude of the signal, as in a non-linear amplifier, an expander/compressor circuit or a so-called 'constant volume' amplifier, etc.

Practical examples of all these types of processor circuit will be described over the next few months in this new audio processing circuits mini-series.

In this instalment we will deal with general purpose linear amplifier circuits based on readily available operational amplifier (op amp) ICs. Later parts of the series will deal with active filter circuits, operational transconductance amplifier (OTA) ICs (which can be used in a variety of voltage controlled amplifier, or VCA, applications, etc), and a variety of non-linear amplifiers and dedicated VCA ICs and their application circuits.

Note that dedicated audio preamplifier and power amplifier ICs are not

described in this mini-series, since they have already been dealt with in great detail in previous issues.

Op amp basics

The best known and most versatile type of audio signal processing IC is the ordinary op amp, which can be simply described as a high gain direct-coupled voltage amplifier 'block' that has a single output terminal but has both inverting and non-inverting high impedance input terminals, thus enabling the device to function as either an inverting, non-inverting, or differential amplifier. Figure 1a shows the circuit symbol of the conventional op amp.

Op amps are very versatile devices. When coupled to suitable feedback networks they can be used to make precision ac and dc amplifiers, active filters, oscillators, and voltage comparators, etc.

They are normally powered from split supplies (as shown in Figure 1b) with +ve, -ve and common (zero volts) supply rails, enabling the op amp output to swing either side of the zero volts value and to be set at zero volts when the differential input voltage is zero. They can, however, also be powered from single-ended supplies, if required.

Note that the output signal voltage of an op amp is proportional to the differential signal voltage between its two input terminals and, at low audio frequencies, is given by

$$e_{out} = A_0(e_1 - e_2),$$

where A_0 = the low frequency open loop voltage gain of the op amp (typically 100dB, or $\times 100,000$), e_1 = the signal voltage at the non-inverting input terminal, and e_2 = the signal voltage at the inverting input terminal.

Thus, an op amp can be used as either a high gain inverting ac amplifier, by grounding its non-inverting terminal and feeding the input signal to its inverting terminal via C1 and R1, as shown in Figure 2a, or as a non-inverting ac amplifier, by reversing the two input connections, as shown in Figure 2b, or as a differential amplifier, by feeding the two input signals to the op amp, as shown in Figure 2c. Note in the latter case that if identical signals are fed to both input terminals the op amp should, ideally, give zero signal output.

The voltage gains of the Figure 2 circuits depend on the individual op amp open loop voltage gains and on the actual frequencies of the input signals. Figure 3, for example, shows the typical frequency response graph of the well-known type 741 op amp. Note here that the device gives a low frequency (below 10Hz) voltage gain greater than 100dB, but that the gain falls off at a 6dB/octave

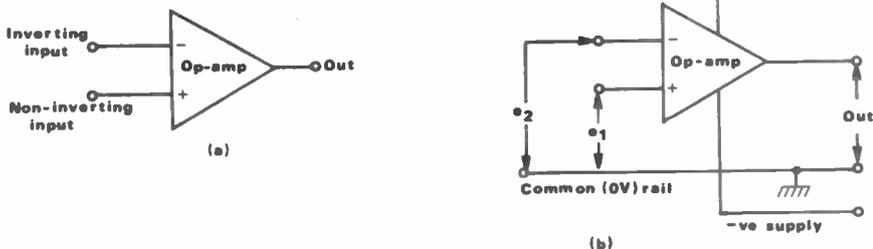


Fig 1 a) symbol and b) supply connections of a conventional op amp

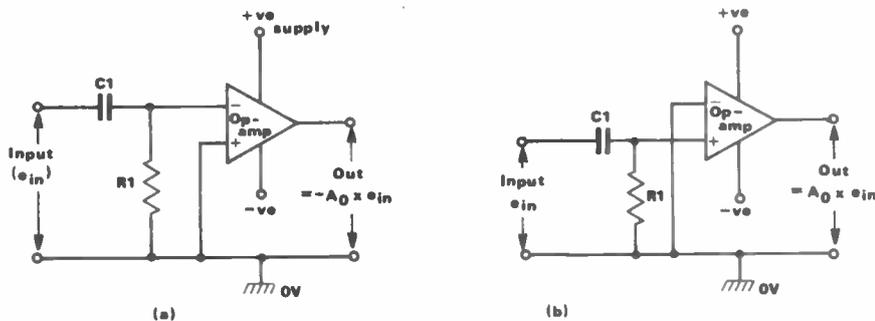


Fig 2 Methods of using the op amp as a high gain open-loop ac amplifier (above, and below left)

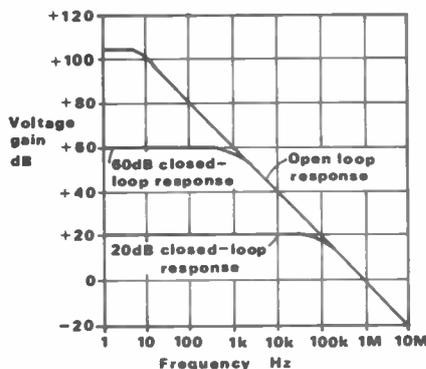
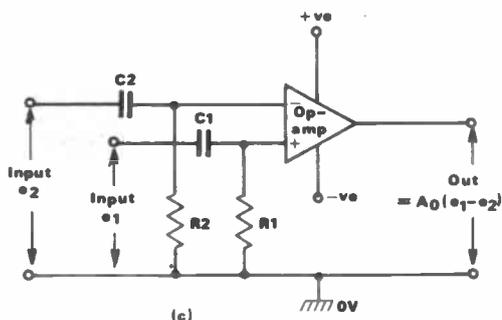


Fig 3 Typical frequency response curve of the 741 op amp

(=20dB/decade) rate at frequencies above 10Hz, eventually falling to unity (0dB) at an f_T 'unity gain transition' frequency of 1MHz. This graph is typical of most modern op amps, although individual op amp types may offer different values of low frequency gain and f_T .

Closed loop amplifiers

The best way of using an op amp as an ac amplifier is to connect it in the closed loop mode, with negative feedback applied from output to input as shown in the circuits of *Figure 4*, so that the overall gain of each circuit is precisely determined by the values of the external feedback components, almost irrespective of the individual op amp characteristics (nb this is provided that the open loop gain, A_o , is large relative to the closed loop gain, A).

Note from *Figure 3* that the signal bandwidth of such circuits approximately equals the IC's f_T value divided by the circuit's closed loop voltage gain value. Thus, the 741 gives a bandwidth of 100kHz when the gain is set at $\times 10$ (=20dB), or 1kHz when the gain is set at $\times 1000$ (= 60dB).

Looking at the closed loop ac amplifier circuits of *Figure 4*, *Figure 4a* shows the op amp wired as a fixed gain inverting ac amplifier. Here, the voltage gain (A) is determined by the ratios of R_1 and R_2 and equals R_2/R_1 , and the circuit's input impedance equals the R_1 value; the circuit can thus be easily designed to give any desired gain and input impedance values.

Note in the above circuit that, although R_1 and R_2 control the gain of the complete circuit, they have no effect on the voltage gain of the actual op amp, so the signal voltage appearing at the output is A_o times greater than that appearing on the op amp's input terminal. Consequently, the signal current induced in R_2 is A_o times greater than that caused by the input terminal signal alone, and this terminal thus acts as though it has an impedance of R_2/A_o connected between the terminal and ground, ie like a low impedance 'virtual ground' point.

Returning to *Figure 4*, *Figure 4b* shows how to connect the op amp as a fixed gain non-inverting ac amplifier. In this case, the voltage gain equals $(R_1+R_2)/R_2$. The input impedance, looking into the input terminal of the op amp, approximately equals $(A_o/A)Z_{in}$, where Z_{in} is the open loop input impedance of the op amp. This impedance is shunted by R_3 , however, so the input impedance of the actual circuit is less than the R_3 value.

Note that the above circuit can be made to function as a precision ac voltage follower by wiring it as a unity gain non-inverting amplifier, as shown in *Figure 4c*, where the op amp operates with 100% negative feedback. In this

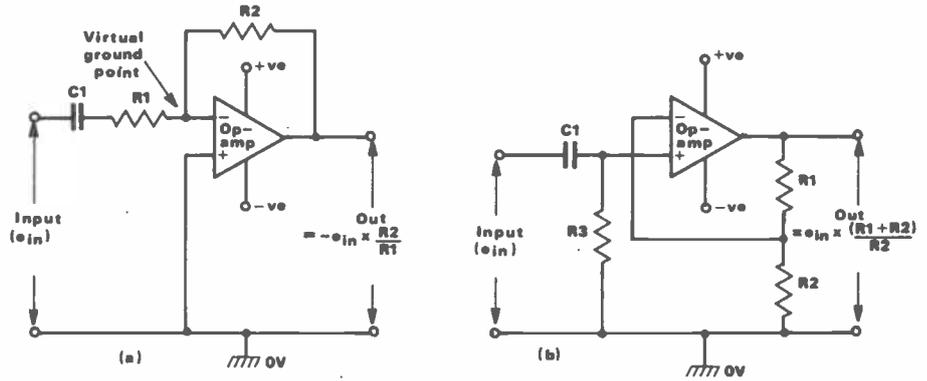


Fig 4 Closed loop ac amplifier circuits:
a) inverting ac amplifier

b) non-inverting ac amplifier

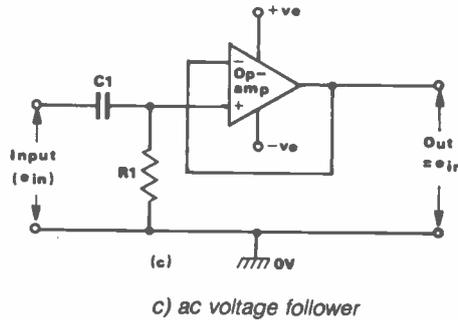


Fig 5 Outline details of popular 'single' op-amp types (see table for parameters)

circuit, the input impedance of the op amp is very high, approximating $A_o \times Z_{in}$, but is shunted by R_1 , which thus determines the circuit's input impedance value.

Practical op amps

Practical op amps are available in a variety of types of integrated circuit construction (bipolar, MOSFET, JFET, etc), and in a variety of types of packaging styles (plastic DIL, metal can TO5, and so on).

Some of these packages house two or four op amps, all sharing common supply line connections. *Figure 5* gives the parameter and outline details of eight popular 'single' op amp types, all of

which use a standard type 8-pin DIL (dual in-line) packaging.

The 741 and NE531 are bipolar types. The 741 is a very popular general purpose type featuring internal frequency compensation and full overload protection on inputs and output. The NE531 is a high performance type with a very high output slew rate capability. An external compensation capacitor (100pF), wired between pins 6 and 8, is needed for stability, but can be reduced to a very low value (1.8pF) to give a very wide bandwidth at high gain.

The CA3130 and CA3140 are MOSFET-input op amps that can operate from single or dual power supplies, can sense inputs down to the negative supply rail

DATA FILE

value, have very high input impedances (1.5 million megohms) and have outputs that can be strobed. The CA3130 has a CMOS output stage; an external compensation capacitor (typically 47pF) between pins 1 and 8 permits adjustment of bandwidth characteristics. The CA3140 has a bipolar output stage and is internally compensated.

The LF351, 411, 441 and 13741 are JFET type op amps with very high input

impedances. The LF351 and 411 are high performance types, while the LF441 and 13741 are general purpose types that can be used as direct replacements for the popular 741. Note that the LF441 quiescent current consumption is less than one tenth that of the 741.

Linear amplifier circuits

Figures 6 to 12 show a variety of ways of using op amps to make practical linear

amplifier circuits. Note that although type 741 op amps are specified in the diagrams, any of the op amp types listed in Figure 5 can be used in these circuits.

Figure 6 shows the op amp wired as an inverting ac amplifier with a $\times 10$ overall voltage gain. Note that the pin 3 non-inverting input terminal is tied to ground via resistor R3, which has the same value as R2 in order to preserve the dc balance of the op amp.

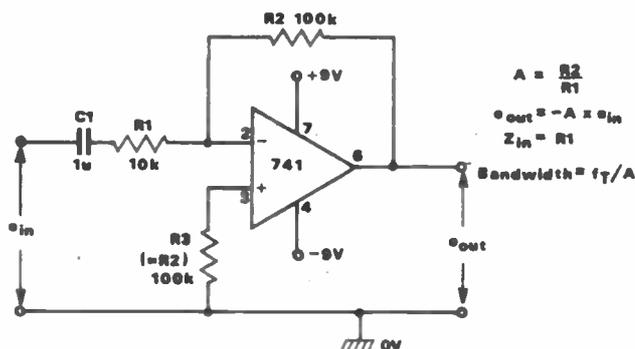


Fig 6 Inverting ac amplifier with $\times 10$ gain

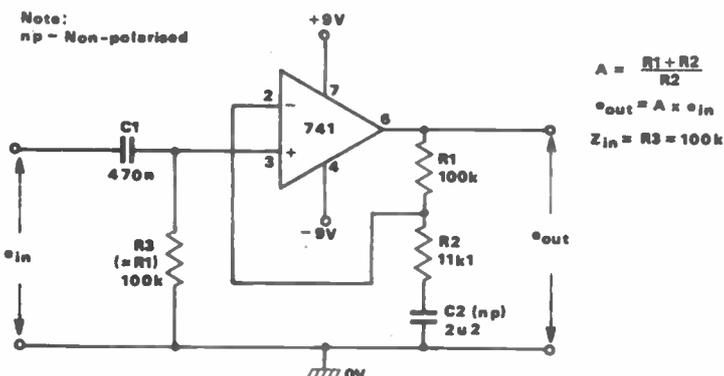


Fig 7 Non-inverting ac amplifier with $\times 10$ gain

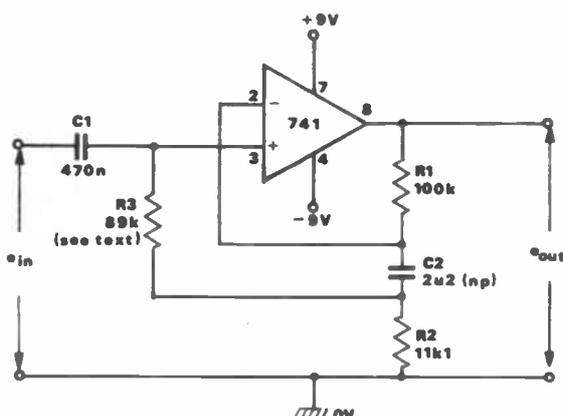


Fig 8 Non-inverting $\times 10$ ac amplifier with 50M input impedance

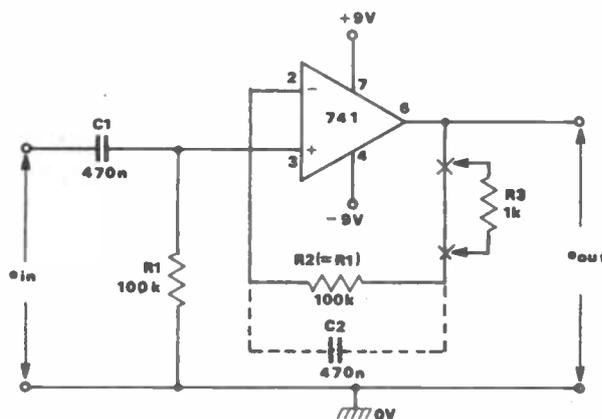


Fig 9 ac voltage follower with 100k input impedance

PARAMETER	BIPOLAR OP AMPS		MOSFET OP AMPS		JFET OP AMPS			
	741	NE531	CA3130E	CA3140E	LF351	LF411	LF441	LF13741
Supply voltage range	$\pm 3V$ to $\pm 18V$	$\pm 5V$ to $\pm 22V$	$\pm 2V$ to $\pm 18V$ or $5V$ to $16V$	$\pm 2V$ to $\pm 18V$ or $4V$ to $36V$	$\pm 5V$ to $\pm 18V$			
Supply current	1.7mA	5.5mA	1.8mA	3.8mA	800µA	1.8mA	150µA	2mA
Input offset current	1mV	2mV	8mV	5mV	5mV	0.8mV	1mV	5mV
Input bias current	200nA	400nA	5pA	10pA	50pA	50pA	10pA	50pA
Input resistance	1MΩ	20M	1.5TΩ	1.5TΩ	1TΩ	1TΩ	1TΩ	0.5TΩ
Voltage gain, A_o	106dB	96dB	110dB	100dB	88dB	106dB	100dB	100dB
C_{mnr}	90dB	100dB	90dB	90dB	100dB	100dB	95dB	90dB
f_T	1MHz	1MHz	15MHz	4.5MHz	4MHz	4MHz	1MHz	1MHz
Slew rate	0.5V/µs	35V/µs	10V/µs	9V/µs	13V/µs	15V/µs	1V/µs	0.5V/µs
8 pin DIL outline	b	a	c	c	b	b	b	b

Figure 7 shows the op amp connected as a non-inverting ac amplifier with an overall $\times 10$ voltage gain. Note that R1 and R2 are isolated from ground via C2; at normal operating frequencies C2 has a low ac impedance, so voltage gain is still set by the R1 and R2 ratios, but the op amp's inverting terminal is subjected to 100% dc negative feedback via R1, giving the circuit excellent dc stability. For optimum biasing, R3 has the same value as R1.

The op amp's input impedance, looking directly into pin 3, is several hundred megohms, but is shunted by R3, which reduces the circuit's input impedance to a mere 100k.

Figure 8 shows how the above circuit can be modified to give a 50 megohm input impedance. Note that the C2 position has changed, and that the low end of R3 is taken to the C2-R2 junction,

rather than directly to ground. The ac feedback signal appearing on this junction is virtually identical to the pin 3 input signal, so near-identical signal voltages appear on both ends of R3, which thus passes negligible signal current.

The apparent impedance of R3 is thus raised to near infinity by this 'bootstrap' feedback action. In practice, this circuit's input impedance is limited to about 50 megohms by PCB leakage impedances.

Note in Figure 8 that, for optimum biasing, the sum of the R2 and R3 values should equal R1, but that in practice the R3 value can differ from the ideal by up to 30%, enabling an actual R3 value of 100k to be used if required.

Voltage follower circuits

An op amp non-inverting ac amplifier will function as a precision ac voltage follower if designed to give unity voltage gain, and Figure 9 illustrates some of the design possibilities of such a circuit, which has 100% negative feedback applied from output to input via R2. Ideally, R1 (which determines the circuit's input impedance) and R2 should

have equal values, but in practice the R2 value can usually be varied from zero to 100k without significantly influencing circuit accuracy.

If an op amp with a low f_T value (such as the 741) is used, the R2 value can usually be reduced to zero. Note, however, that high f_T op amps tend towards instability when used in the unity gain mode, and in such cases stability can be assured by either giving R2 a value of 1k Ω , or by replacing it with a 1k Ω and 100k resistor wired in series (as shown in Figure 9), with a 470nF capacitor wired across the 100k resistor to reduce its ac impedance.

If a very high input impedance is wanted from an ac voltage follower it can be obtained by using the configuration shown in Figure 10, in which R1 is 'bootstrapped' from the op amp output via C2, so that the R1 impedance is increased to near infinity. In practice, this circuit will usually give an input impedance of about 50 megohms from a 741 op amp, this limit being set by the leakage impedances of the op amp's IC socket and the PCB.

If even greater input impedances are needed, the PCB area surrounding the

op amp input pin must be provided with a printed 'guard ring' that is driven from the op amp output, as shown, so that the leakage impedances of the PCB, etc, are also bootstrapped and raised to near infinite values.

In this case, the Figure 10 circuit will give an input impedance of about 500 megohms when using a 741 op amp, or even higher if an FET-input op amp is used. Figure 11 shows an example of a guard ring etched on a PCB.

An audio mixer

When describing the basic inverting amplifier circuit of Figure 4a I pointed out that its voltage gain equals $R2/R1$; it thus follows that the signal currents flowing in R1 and R2 are always exactly equal (but are opposite in phase), irrespective of the R1 and R2 values.

If this circuit is modified as shown in Figure 12, where four identical input networks are wired in parallel, it follows that the signal current flowing in feedback resistor R6 will inevitably equal the sum of the input signal currents flowing in resistors R1 to R4, and that the circuit's output signal voltage is thus proportional to the sum of the audio input signal voltages. It also follows that if (as in the diagram) the input and feedback resistors have equal values, the circuit will give unity voltage gain between each input and the output.

It can thus be seen that the Figure 12 circuit actually functions as a unity gain 4-input (or 4-channel) audio mixer that gives an output equal to the sum of the four input signal voltages. If desired, this simple circuit can be converted into a practical audio mixer by feeding each input signal to its input network via a 10k 'volume control' pot.

If desired, the circuit can be made to give a voltage gain greater than unity by increasing the value of feedback resistor R6, and the number of available input channels can be increased (or reduced) by adding (or deleting) one new C1-R1 network for each new channel.

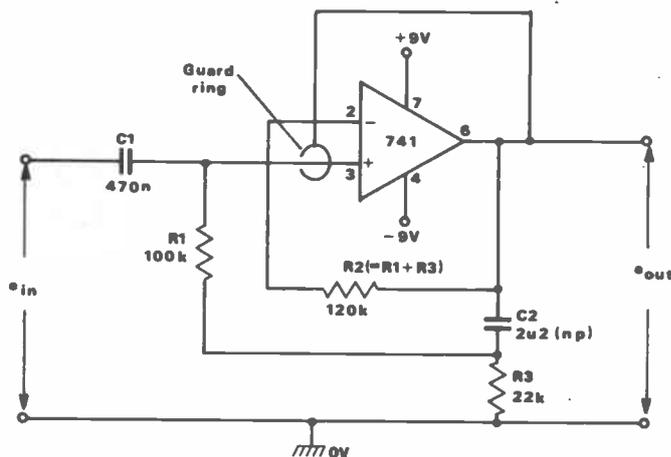


Fig 10 ac voltage follower with 50M input impedance without the guard ring, or 500M with the guard ring

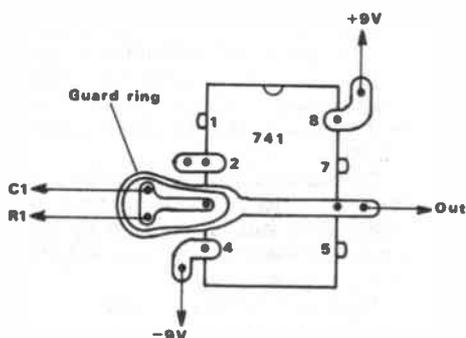


Fig 11 Guard ring etched on a PCB and viewed through the top of the board

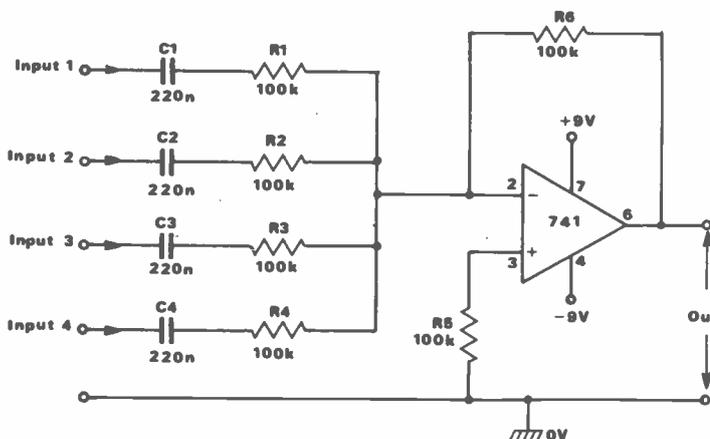


Fig 12 Four-input audio mixer

ATTENUATORS

By A M Tucker

This program is written in Hisoft Pascal 80 for the Amstrad PCW, and is developed from the Basic program by Jeff Howell and Brian Kendal in the November 1984 issue. The same

formulae are used, but the arithmetic has been changed around in places. A choice of four configurations is available (see diagram on the facing page).

For practical details of construction,

readers may refer to the original article. After a choice of type has been made, the program asks for the input and output impedances in ohms, then for the minimum attenuation (greater than zero), the attenuator step and the maximum attenuation. The required resistance values for each step are then listed. If at any stage the resistance values are impractical, a message 'Configuration not possible' is shown.

Owners of PCWs with other Pascal compilers should encounter no difficulties, provided floating point routines are included, except perhaps for 'INCH', which is similar to 'INKEYS' but only allows character input.

Two other points are worth mentioning. I notice that I have called one variable 'type'. This is a reserved word in upper case typing, but my compiler does not object (in this program anyway!) to its use in lower case. The second point concerns the use of 'Writeln' where 'Write' would seem to be sufficient. The PCW has a counter which keeps track of the cursor position and is reset by a carriage return. The counter has a maximum count of 255, so if this is exceeded by, say, a series of 'WRITE' commands, the cursor returns to the beginning of the next line, no matter how one tries to prevent it. Making sure that 'Writeln' is used at frequent intervals prevents this. The same trouble can occur in Basic, where there are a number of PRINT commands terminated in a semicolon, perhaps in a FOR...NEXT loop.

Owners of other machines may have problems with the escape codes. ESC E + ESC F are equivalent to 'CLS'; ESC f and ESC e disable and enable the cursor blob; ESC K clears a line (note that the K can be tagged on to following text); ESC Y (y,x) positions the cursor and ESC J clears from the cursor to the bottom of the screen.

I should be happy to send PCW owners a copy of the compiled program on receipt of a formatted disc with at least 7K free space, a stamped self-addressed padded envelope for its return, and £1 in first/second class stamps, cash or cheque, as a donation to the Royal Commonwealth Society for the Blind.

If there is a further 8K free, I will also include a program to find how to make up a resistor value by using two in parallel. The address is: A M Tucker, Coombe Barton, 18 North Street, Charminster, Dorchester, Dorset DT29QZ.

```
PROGRAM ATTR;
(*%C-%*)

LABEL 99;

VAR
  esc,ans,typechr : CHAR;
  a,low,high,step,range,type : INTEGER;
  n,r,r1,r2,r3,i,j,zin,zout : REAL;

PROCEDURE loc(x,y:INTEGER); (*Position cursor*)
BEGIN
  WRITE(esc,'Y',CHR(32+y),CHR(32+x));
END;

PROCEDURE T;
BEGIN
  r3:=zin/i; r2:=zout*j-r3; r1:=zin*j-r3;
END;

PROCEDURE Pi;
BEGIN
  r3:=zout*i; r2:=r3/(j*i-1); r1:=1/(j/zin-1/r3);
END;

BEGIN
  esc:=CHR(27);

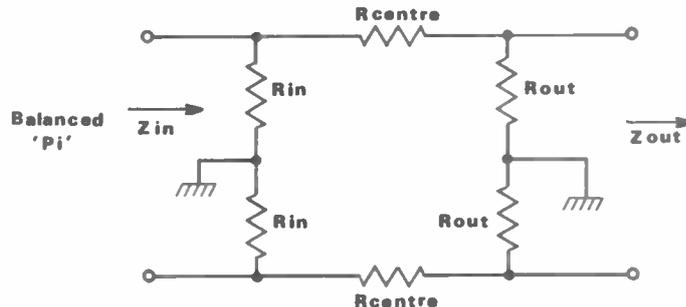
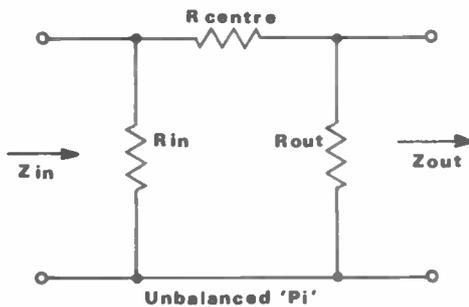
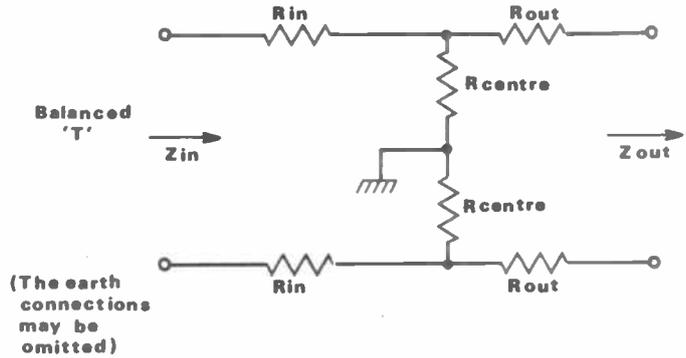
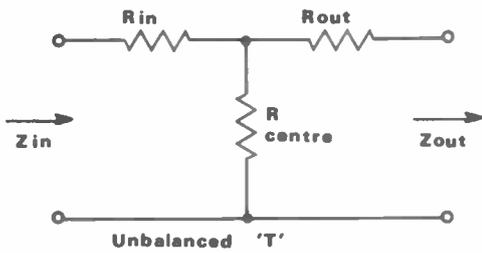
  WRITE(esc,'E',esc,'H',esc,'f'); (*Clear screen & delete cursor*)
  Writeln('ATTENUATOR NETWORK DESIGN':55); Writeln;
  Writeln('1. UNBALANCED-T NETWORK':54);
  Writeln('2. UNBALANCED-Pi NETWORK':55);
  Writeln('3. BALANCED-T NETWORK':52);
  Writeln('4. BALANCED-Pi NETWORK':53);

  REPEAT
    loc(30,28);Writeln('Select network (1-4)');
    REPEAT typechr:=INCH UNTIL typechr IN ['1'..'4'];
    type:=ORD(typechr)-48;
    loc(29,type+1);Writeln('x'); loc(5,28);
    WRITE('Enter input and output impedances (ohms) [with space between]:- ');
    READ(zin,zout); loc(5,28);
    WRITE(esc,'KEnter db range: low, step & high [with spaces between] :- ');
    READ(low,step,high); loc(5,28);Writeln(esc,'K');
    loc(14,8);Writeln('Attenuation Input res. Centre res. Output res. ');
    Writeln('db Ohms Ohms Ohms':68); Writeln;

    a:=low; r:=zin/zout; IF type>2 THEN BEGIN zin:=zin/2; zout:=zout/2; END;

    REPEAT
      IF a=0 THEN GOTO 99;
      n:=SQRT(EXP(LN(10)*a/10)*r); i:=n*n-r; j:=(n*n+r)/i; i:=i/2/n;
      IF ODD(type)=TRUE THEN T ELSE Pi;
99 : IF (a=0) OR (r1*r2*r3<0) THEN Writeln('Configuration not possible':44)
      ELSE Writeln(a:20,r1:17,2,r3:16,2,r2:16,2);
      a:=a+step;
    UNTIL a>high;

    loc(30,28);Writeln('Another network ? (y/n)');
    REPEAT ans:=INCH UNTIL ans IN ['y','Y','n','N'];
    IF ans IN ['y','Y'] THEN
      loc(0,8);Writeln(esc,'J');loc(29,type+1);Writeln(' ');
    UNTIL ans IN ['n','N'];
    WRITE(esc,'E',esc,'H',esc,'e');
  END;
```



The figures above show the attenuations

SECURITY

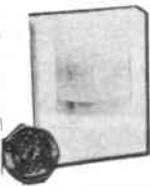
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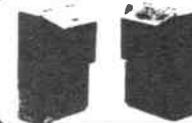
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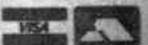
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SECONDARY SURVEILLANCE RADAR

BY BRIAN KENDAL G3GDU

AVIATION ELECTRONICS Part Five

In my last article, I described primary radar. Efficient as this may be, however, it has certain disadvantages, for although it will indicate that a target is present, that is all it will show.

There is no means of identifying the target and hills, tall buildings, rain and certain types of cloud will produce returns which may mask a wanted target. These problems are largely overcome by the use of Secondary Surveillance Radar.

The problem of identifying a radar target was anticipated as early as 1935

when the use of radar was first proposed in a paper by Sir Robert Watson Watt.

Soon after the first returns were received at the experimental site at Orfordness, an experiment was carried out in which a half wave dipole at the radar frequency was strung between the

struts of the target aircraft, and the centre was alternately short and open circuited. The theory was that, as the aircraft at that time were made predominantly of wood, the wire dipole with the centre short circuited would greatly enhance the return, but when the centre was open circuited the return would be reduced. It was thought that the fluctuating strength of the radar return would readily identify friendly aircraft. Unfortunately, this did not prove successful, but it did lead to the development of a simple transponder for the same purpose.

Known as IFF (Identification Friend or Foe), this equipment, or its successors, have been carried on all RAF aircraft since that time.

The principle of the original equipment was that a pulse of RF on about 200MHz was radiated simultaneously with the main radar pulse. This was received by the airborne equipment and triggered a transmitter, which sent a pulse several times longer than that of the main radar. This was received by the ground station and displayed on the main radar display. The effect was that returns from friendly aircraft showed up as a much thicker target than those not equipped with IFF.

The next development was that, instead of just sending a single pulse, the aircraft replied with a series of coded pulses which could provide more positive identification.

In the period after the war, primary radar gradually became an essential aid to air traffic control and, with increasing traffic levels, identification became a serious problem.

At first, aircraft were requested to perform a 90 degree turn to the left or right for identification, but later an automatic VHF direction finder was used

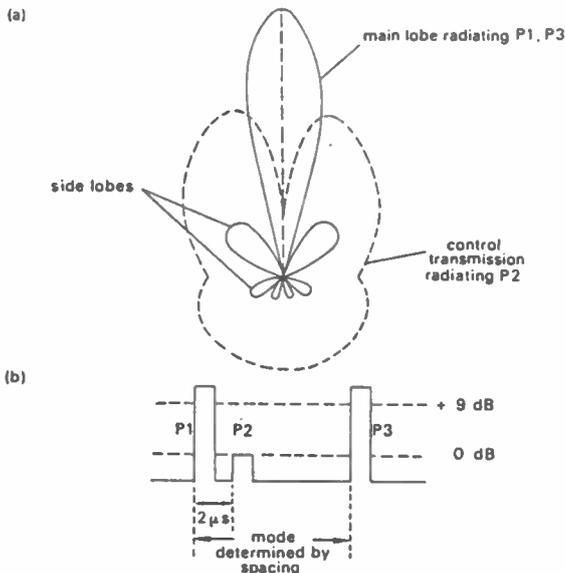


Fig 1 SSR radiated (a) horizontal polar diagrams, (b) interrogate pulse pattern

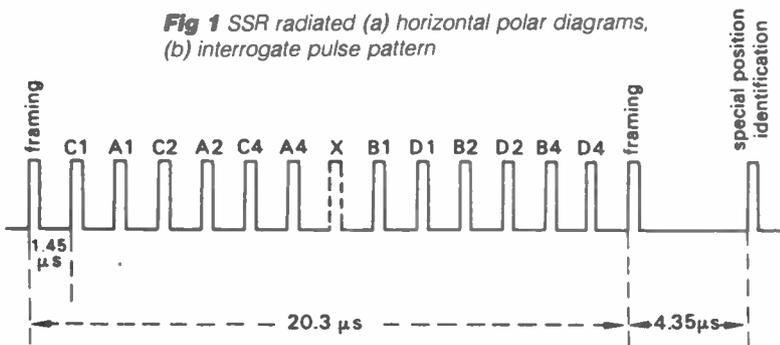


Fig 2 SSR reply pulse patterns

Table 1 Definition of SSR modes by P1 to P3 spacing

Mode	P1 to P3 spacing (μ s)	Application
A	8 ± 0.2	ATC
B	17 ± 0.2	ATC
C	21 ± 0.2	Pressure altitude
D	25 ± 0.2	Unassigned

to correlate a radar return with the R/T transmission.

In the meantime, however, considerable development work had taken place and the International Civil Aviation Organisation had agreed the parameters for a civil form of IFF, to be known as Secondary Surveillance Radar (SSR).

Secondary Surveillance Radar

International agreement defined that the post-war SSR system should operate on L band with all ground stations (interrogators) operating on a frequency of 1030MHz, with the aircraft replying on 1090MHz.

The wartime development of IFF had shown that secondary radar has four main advantages over primary:

- 1) The transmitter need be of only relatively low power compared with primary radar equipment.
- 2) The returns, not being dependent on reflection but consequent to a transmission from the aircraft, are of superior signal strength and improved reliability.
- 3) The returns from the aircraft may be coded to pass information to the radar station.
- 4) As transmissions from the aircraft are used, the system cannot be degraded by weather returns.

These very advantages, however, gave rise to a series of problems. As the overall efficiency of the system was much higher, aeriels tended to be as small as possible so that they could be mounted on top of the associated primary aerial.

As anyone who has used a beam knows, all aeriels produce sidelobes, and the smaller the aerial the stronger these are. Furthermore, small aeriels radiate wide main lobes.

The sidelobes could interrogate the aircraft transponder as well as the main lobe, whilst the wide main lobe could cause poor target definition. Further problems were caused by the aircraft replying to interrogation pulses reflected from mountains or even high buildings.

But as the aircraft could provide a coded reply, how was the ground station to indicate to the aircraft which question it wanted answering? This was the next problem.

These setbacks have been gradually overcome by a combination of aerial design and signal processing techniques.

The Interrogation

The means for requesting specific information from the aircraft and overcoming difficulties due to sidelobes were determined in the basic concept of the SSR interrogation.

This comprises three pulses, designated P1, P2 and P3. Each of the pulses is 0.8 microsecond wide and the leading edge of P2 is 2 microsecond after that of P1. The position of P3 is variable, for reasons which will be given later.

P1 and P3 are radiated on the main beam of the array and P2, known as the SLS (Side Lobe Suppression) control transmission pulse is radiated omnidirectionally at such an amplitude that it is equal to, or stronger than, the strength of the strongest lobe of the aerial radiating P1 and P3. Furthermore, the level of P2 is arranged to be at a level lower than 9dB below the radiated amplitude of P1 within the desired arc of interrogation.

The design of the aircraft transponder is such that no reply will be given unless P1 exceeds P2 by at least 9dB, and if P2 exceeds P1 the transponder will be muted for thirty-five microseconds. This effectively eliminates any possibility of interrogation by sidelobe radiation.

As previously mentioned, the position of P3 is variable, this being the means by which the ground station indicates to the aircraft which information is required in the reply. This can be in one of four positions, either 8.0, 17.0, 21.0, or 25 microseconds after the leading edge of P1, these being known as Modes A, B, C and D respectively.

The reply

On receiving a valid interrogation, the aircraft transponder will radiate two framing pulses spaced 20.3 microseconds apart, between which, at 1.45 microsecond intervals after the first framing pulse, are the information pulses, of which up to thirteen may be present. These comprise four groups of three pulses and an additional position, designated X, which is at present unused.



A Corsor 'hog trough' aerial. This type is now being superseded by LVA aeriels (photo: Corsor)

The three pulses in each group correspond to values of 1, 2 and 4, enabling numbers from 0 to 7 to be coded in binary notation. Thus, with four groups, the numbers from 0000 to 7777 may be coded in Binary Coded Octal (BCO), corresponding from 0 to 4096 in the more common decimal notation.

The meaning of these codes is entirely dependent on the SSR mode in operation. For example, a Mode A reply represents the aircraft identification as allocated by air traffic control, whilst Mode C reply is completely automatic, giving an altitude readout from a pressure capsule within the equipment.

I mentioned earlier that, compared with the primary radar, the beam is relatively wide. In order to determine the

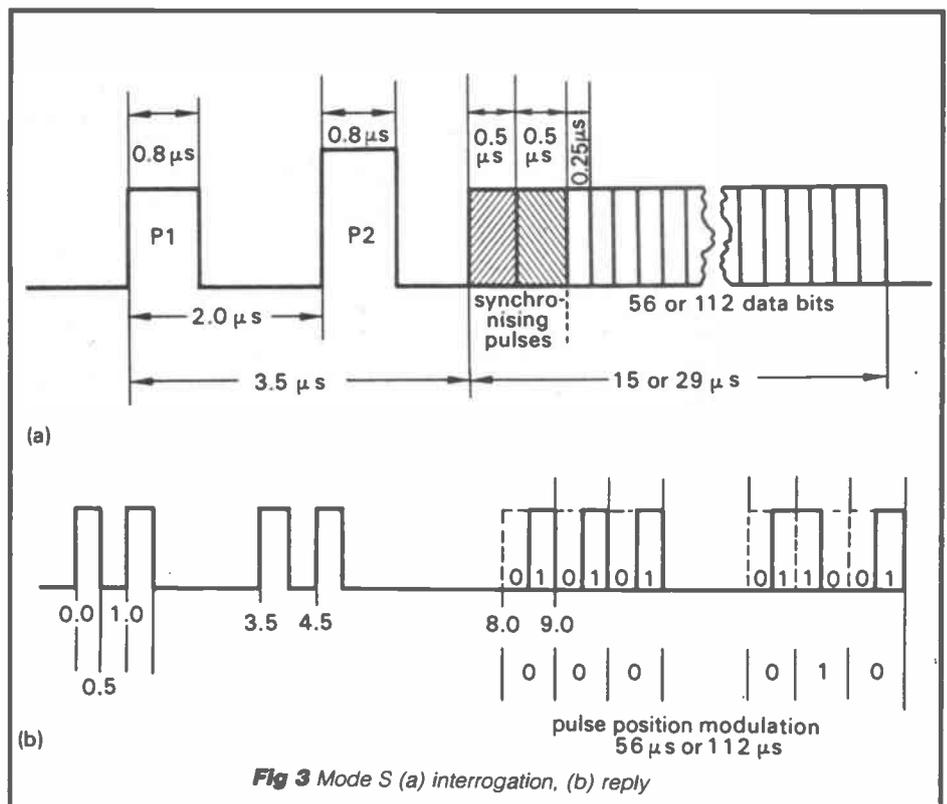
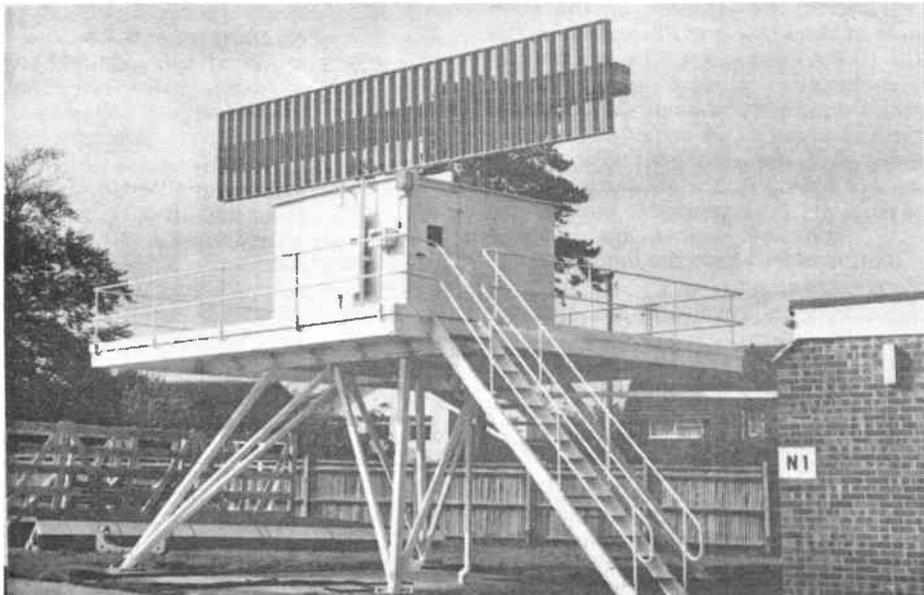


Fig 3 Mode S (a) interrogation, (b) reply

Secondary Surveillance Radar



An LVA aerial (photograph courtesy Cossor)

position of the target, the signal processing equipment derives a mean position for the target as it is illuminated by successive strikes from the interrogator. This is known as the Sliding Window method.

Unfortunately, for a number of reasons, the strength of the return is not necessarily constant and the derived position may be inaccurate. If this happens on a number of successive aerial rotations, the track of the target may appear to be an irregular zig-zag, even though the aircraft is flying a perfectly straight course.

This effect is known as track wander and was a problem for many years. Recently, however, the monopulse technique has been introduced which largely eliminates this effect.

With this technique, on reception, the radar aerial is effectively divided into two halves from which two separate

outputs are derived, one corresponding to both parts in phase (sum) and the other, antiphase (difference). These are fed to separate receiver chains, the phase and amplitude of the outputs being compared to derive the off-bore-sight bearing of the target.

As the bearing of the target is derived for every interrogation instead of only the first and last of each aerial rotation when using this method, a very considerable improvement in accuracy results compared with the Sliding Window.

LVA aeriels

Another disadvantage of using relatively small aeriels is that the beam is very wide in the vertical plane. Consequently, a proportion of the signal hits the ground and is reflected. This combines with the direct radiation and may interfere with the vertical polar diagram, causing heavy lobing. As the aircraft

passes through successive lobes and nulls, returns vary widely in strength and may be lost altogether from time to time.

This problem has been largely overcome by the use of Large Vertical Aperture (LVA) aeriels. In these, the height of the aerial is in the order of six wavelengths, resulting in a considerable reduction in vertical beamwidth, the effect being to reduce ground irradiation and consequent lobing effects. All current LVA aeriels are capable of Monopulse operation.

Signal processing

As all SSR interrogators and transponders operate on the same frequency, it is quite possible for an aircraft to be simultaneously interrogated by more than one radar station. Under such circumstances spurious returns, known as 'fruit', would be displayed at each of the radar displays.

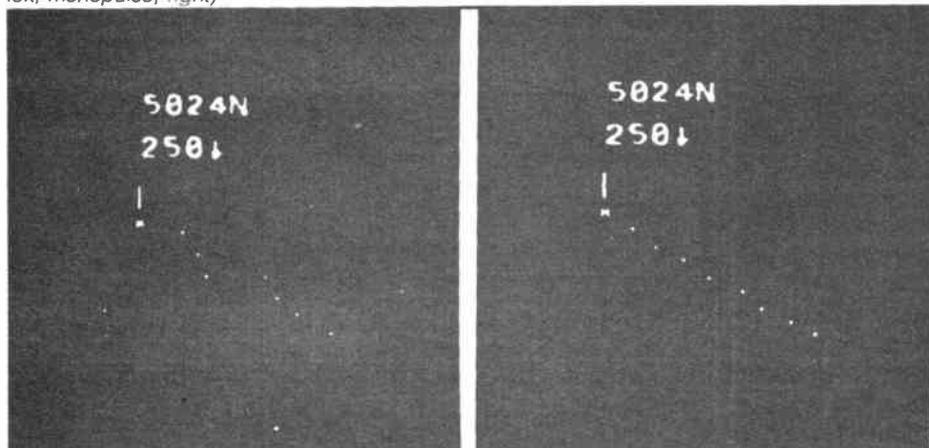
Circuits are therefore included at each station to eliminate any of these returns which may be present. The method used is a pulse to pulse comparison of returns. If valid, a return will appear sensibly at the same range for each scan. By comparing several scans, a pattern is established and the equipment can readily derive the valid plots. Not surprisingly, this equipment is known as the 'defruiter'.

At remote radar stations, the plots are then converted from bearing-range format into a digital word representing the position in Cartesian co-ordinates together with the coded aircraft reply. These are then transmitted by landline to the Air Traffic Control Unit or Centre.

Mode S

Effective though present SSR may be, its capacity to handle traffic is obviously limited. Although this point has not yet been reached, it will happen in extremely busy airspace within the foreseeable future, for even now London Air Traffic Control Centre is handling approaching a million aircraft movements per year.

The photographs clearly show the reduction in track-wander, by use of monopulse (sliding window, left; monopulse, right)

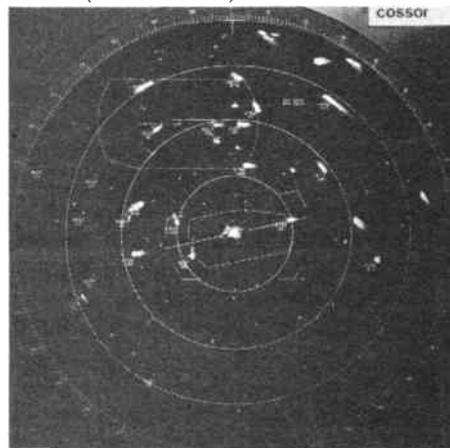


Conventional SSR

Cossor monopulse SSR

(Simultaneous plots of a real aircraft)

The end result – a high definition radar display showing both primary and secondary radar returns (Photo: Cossor)



Secondary Surveillance Radar

This problem was recognised over fifteen years ago and development work took place both in the United States and in the United Kingdom. In the US, the system was known as Discrete Address Beacon System (DABS) whilst in the UK it was called Address SElective SSR (ADSEL).

In 1974, both countries joined in a series of discussions, with the result that both systems were made compatible and further development was on a co-operative basis. The system is now called Mode S.

In this, the ground equipment operates on the same frequencies as SSR. Monopulse techniques are invariably employed, resulting in an accuracy of bearing in the order of five minutes of arc. Improved transponder design is predicted to result in a ranging accuracy of approximately 100ft.

In addition to the Mode S operation, the ground interrogator will also radiate standard SSR modes for aircraft not specially equipped.

The mode S interrogation differs from standard SSR because P2 is of greater amplitude than P1. This is followed by two synchronising signals and a data stream of either 56 or 112 bits. As this will include the aircraft identification, only

one aircraft will reply at any one time.

The aircraft reply begins with a synchronising preamble of two pairs of 0.5 microsecond pulses, followed by a data block of 56 or 112 bits using pulse position modulation.

From time to time, the ground station will transmit a special interrogation known as SSR/Mode S ALL CALL. This takes the form of a normal SSR interrogation with an additional P4 pulse radiated 1.5 microseconds after P3. P4 will be ignored by SSR-only equipped aircraft, who will give a normal SSR reply. Mode S transponders will recognise P4 as a roll call request and will reply with an 'all call' response, comprising the aircraft identity and the capability of the onboard equipment.

Initially, two main advantages will accrue from the introduction of Mode S. As aircraft will only reply when they are specifically interrogated, many spurious emissions will be eliminated, thus giving the system the capability of handling far higher traffic levels.

Secondly, there is sufficient capacity allocated within the aircraft address data block to enable every aircraft in the world, within the foreseeable future, to have a discrete identification.

The uses to which the data handling

capability of the system may be put have not, as yet, been standardised. This may well include much of the information which is, at present, given over the already overcrowded VHF R/T channels, thus providing additional benefits.

Mode S is not as yet in common use, but trial equipment has been fitted in several British aircraft and has been on test for several years. Furthermore, all the SSR equipment currently being installed in the United Kingdom's current radar re-equipment programme use Monopulse, are fitted with LVA aerials and are capable of being upgraded to Mode S operation when required.

In my next article I shall describe the operation of an Air Traffic Control Centre, how the primary radar and SSR signals are processed and displayed, and how these combine with the R/T networks which I described in my first article.

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USER REVIEW

THE SPACETECH WXSAT

WEATHER SATELLITE RECEIVING STATION

by Ken Michaelson G3RDG

Having run an efficient FAX system giving printouts of weather transmissions on the HF bands for some years, I enjoyed reviewing this complete high specification weather satellite system based on the BBC computer. The system receives and displays pictures transmitted from the orbiting satellites in the frequency range 136-138MHz. As supplied it is suitable for working with the BBC 'B' computer and consists of a receiver, a BBC interface, an EPROM, a BBC software disc, a ROM and a test tape. A circularly polarised crossed dipole with reflectors and masthead preamplifier are supplied as standard.

The receiver under scrutiny is the well-known Martelec MSR20 VHF receiver. It measures approximately 230mm (9in) wide by 65mm (2.5in) high by 133mm

(5.5in) deep. The case is in two 'U' shaped halves, the lower one containing the PCB and switches, etc, with the top 'U' acting as a cover. The lower half is finished in gloss black enamel while the top piece is covered in black Rexine. The lettering channel indications and control knobs are in yellow.

The receiver is a high performance, dual conversion job providing coverage of the numerous orbiting satellites which transmit signals in this band. It features very low noise, automatic adjustable audio mute, automatic cassette recorder switching and electronic crystal switching. A scanner facility and a signal strength meter are available as optional extras, although neither were fitted to the review unit. There is a brief specification of the MSR20 in the table.

In order to achieve good quality pictures, a receiver must have low noise, high sensitivity and adequate bandwidth. This model differs slightly from most scanning receivers in that it has a 50kHz bandwidth. This is because the transmitted signal has an FM deviation of ± 17 kHz, and a further 4kHz is necessary to take account of the Doppler shift of the passing satellite. The data would be seriously degraded if this bandwidth were reduced, but unnecessary noise would be introduced if the bandwidth

were increased beyond 50kHz.

The receiver has good front end sensitivity, provided by two stages of RF amplification, using a BF981 MOSFET and a 3SK88 MOSFET in that order. The local oscillator is of standard Colpitts design, running at about 14MHz. The six channels which are available are selected electronically by applying a current to one of the switching diodes. Only two channels were available on the review receiver, NOAA 9 on 137.62MHz and NOAA 10 on 137.5MHz. Each of the crystals can be trimmed by adjustment of individual trimming capacitors.

The second IF is produced within IC1, an SL6601, and the amplified signal is then demodulated by the on-board phase locked loop detector, passing through a lowpass filter to the TBA820M audio amplifier via the volume control. The loudspeaker provides an ample audible output of about 500mW. The SL6601 chip also features a noise mute output on pin 6 which goes 'low' in the presence of a strong signal. This facility is used to provide three things:

- Audio muting of the loudspeaker output
- Automatic cassette recorder switching
- A 'stop' signal for the scanner (optional).

The 'mute' threshold is adjusted using a preset control and incorporates a dropout delay of about 2.5s to loss of sync when the signal fades temporarily. A relay is used to switch on a cassette recorder when remotely recording a satellite pass; a second pair of contacts on the relay is used to open circuit the audio signal path to the TBA820M amplifier in the absence of a signal.

The SL6601 IC has a signal strength output on pin 4. This can be utilised to operate an optional signal strength module, which was not supplied with the review unit. There is also provision on the board for a 12 volt power supply to be fitted; all that is needed is a mains transformer.

The next unit is the interface. Its purpose is to enable the user to display live pictures on any BBC computer - with the exception of the Compact - whilst they are being transmitted from polar orbiting satellites. The case is of the

MSR20 SPECIFICATIONS

RF bandwidth	2MHz (136-138MHz)
IF bandwidth	50kHz
IFs	10.7MHz (1st IF) 300kHz (2nd IF)
Image rejection ratio	>100dB
Sensitivity (12dB quieting) (fully quieting)	0.15 μ V 0.6 μ V
Audio output (8 ohm load)	500mW
Supply voltage (direct)	9-15V
(via regulator)	14-20V
Supply current (with $V_s = 12V$) (dependent upon relay state)	125-165mA



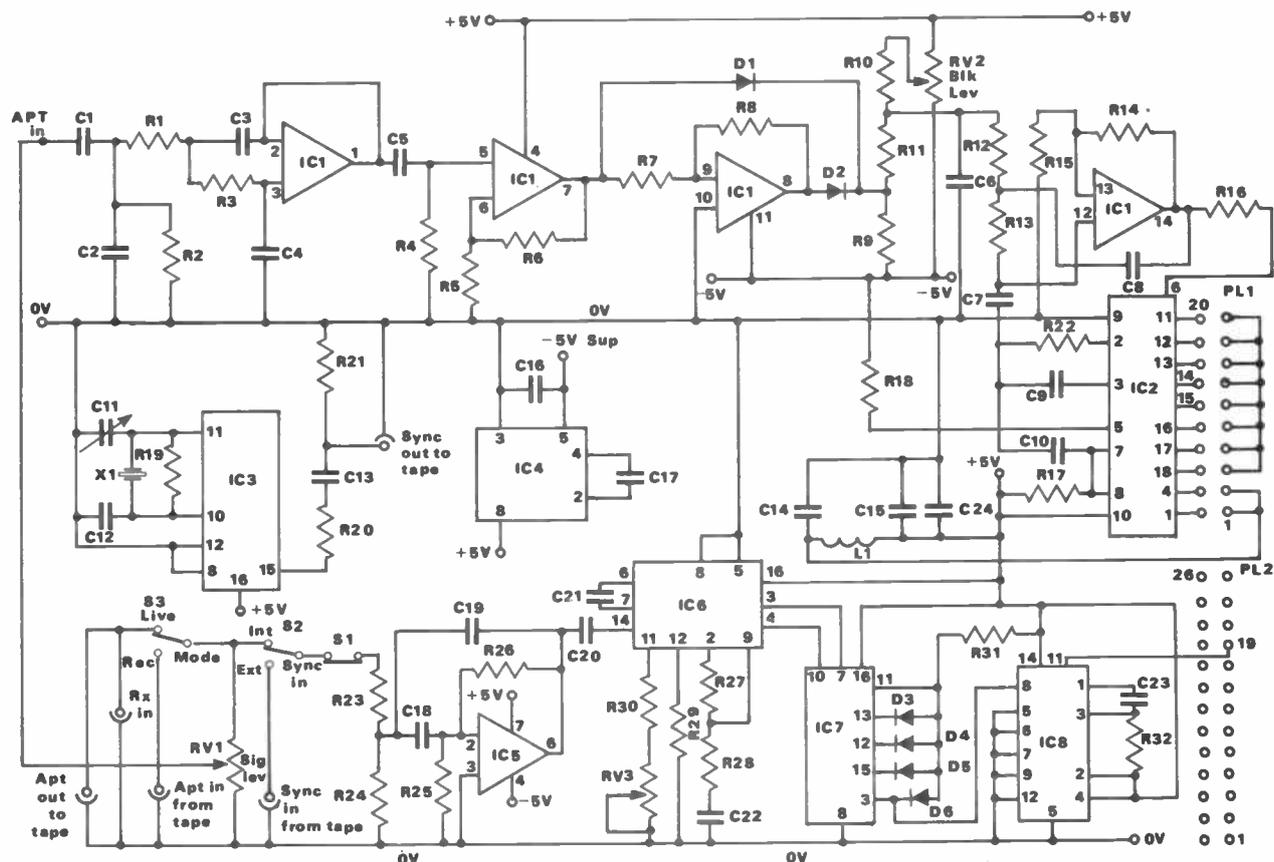


Fig 1 MS520 WXSAT interface circuit diagram

same design as the receiver. It has six controls on the front panel, two 'LEVEL' pots (white/black), two 'MODE' switches (live/tape), 'SYNCH' (int/ext) and two push-on switches labelled 'SLIP' (left/right). It measures 155mm (6.1in) wide by 50mm (2in) high by 110mm (4.4in) deep and can comfortably sit on top of the MSR20 receiver.

The operator is able to set it up for operation with the test tape provided. The interconnections are relatively straightforward. Three lengths of cable are provided, one having a 5-way 180 degree DIN plug at one end and three phono plugs at the other: white (signal), yellow (remote tape switching) and red (which is spare, and may be used for an external speaker). The DIN end of this cable plugs into the rear panel of the MSR20 receiver.

At the rear of the interface case two lengths of ribbon cable emerge, one being a 20-way with a female IDC plug on the end fitting into the 'user' port of the BBC. The other is a 26-way with a similar plug to be inserted into the printer port of the machine. At the same time the white lead from the receiver is plugged into the 'RX IN' socket of the interface. Here, one of the other two cables comes into use. It is a twin lead and has 3.5mm plugs fitted at either end, coloured red and black.

This is used to connect from the 'tape

in' and 'tape out' sockets at the rear of the interface unit to the 'mic' and 'ear' sockets of the tape recorder. I used a normal Thorn-EMI mono tape recorder with 'mic', 'ear' and 'remote' sockets, and now the yellow phono plug on the DIN lead (which has the necessary 2.5mm plug on the end) is plugged into the remote socket of the recorder.

The next operation is to install the ROM into the BBC computer. Care must be taken to ensure that all the pins are inserted in the socket and not bent over underneath. The ROM can be inserted into any empty socket with the notch orientated in the same direction as the other ROMs. The utility disc is then placed in the disc drive and loaded into the Beeb by pressing 'SHIFT-BREAK'. The software can also be supplied on cassette. It is not necessary to use the utility disc at all if you don't want to get too involved.

The ROM has many powerful features; all you need to do is connect up the hardware as mentioned above and then type '*DECODE<RETURN>'. The screen will then clear and a picture will start to build up from the bottom, line by line.

I first used the test tape, playing the pre-recorded 'grey scale' and moving the MODE switch to 'tape' and the SYNCH switch to 'int'. It is necessary to temporarily remove the remote plug

from the tape recorder, otherwise the cassette motor will not run. The black and white levels can then be adjusted by means of the controls on the interface until a satisfactory graduation from black to white across the picture is achieved. The controls might require slight adjustment later, depending on which satellite is being received.

Since the review receiver only contained crystals for the two channels NOAA9 and NOAA 10, I only had to press function key F5 (for NOAA satellites) and F6 (for X1 zoom), followed by F1 to start. One has to remember to change the mode switch from 'tape' to 'live'; I forgot the first time! If a mono tape recorder is used, the SYNCH switch has to be left in the 'int' (internal) position.

I am fortunate in having a copy of the Satfoot program, which gives a graphic display of satellite footprints. This is the area of the Earth's surface from which the satellite is visible at any given moment. The program can display up to ten satellites at the same time in addition to the sun. All that is necessary is to enter, from time to time, updated orbital parameters (known as Keplerian elements, these are published by RIG and AMSAT-UK periodically). With the use of this program, I was able to determine the time that either NOAA9 or NOAA 10 would be in range for reception.

Having checked the orbital parameters

in the program, I ran it and noted the necessary information. That being done, I waited, setting up the hardware without using the utility disc but just pressing '*DECODE<RETURN>'. In due course, the signal from the approaching satellite opened the squelch and the tones were heard. Immediately the cassette recorder started running and the picture rec'd up line by line from the bottom of the screen.

It was obvious after the first few lines that I had started with the edge of the

picture somewhere towards the middle of the screen, so using the left SLIP button I moved the picture over until the edge was in the correct position. The unit then functioned until the screen was full, building up a complete picture.

When the frame was full (this takes about four minutes) the BBC gave a beep. I then disconnected the recorder and restarted it using F1. A restart can be achieved without clearing the screen using either F0 or Exit using SHIFT F9.

A few words about the ROM itself. It

adheres to the standard BBC service ROM format. This means that the collection of routines are accessible via '*' commands. To see what is available, one just types '*HELP WXSAT'. One can use the abbreviation '*H.WX.' to achieve the same result. There are fifteen routines available, in addition to Spacetech's help line used to get information about the unit. Having started operation by keying in '*DECODE', the default condition sets up the status of: NOAA satellite (120

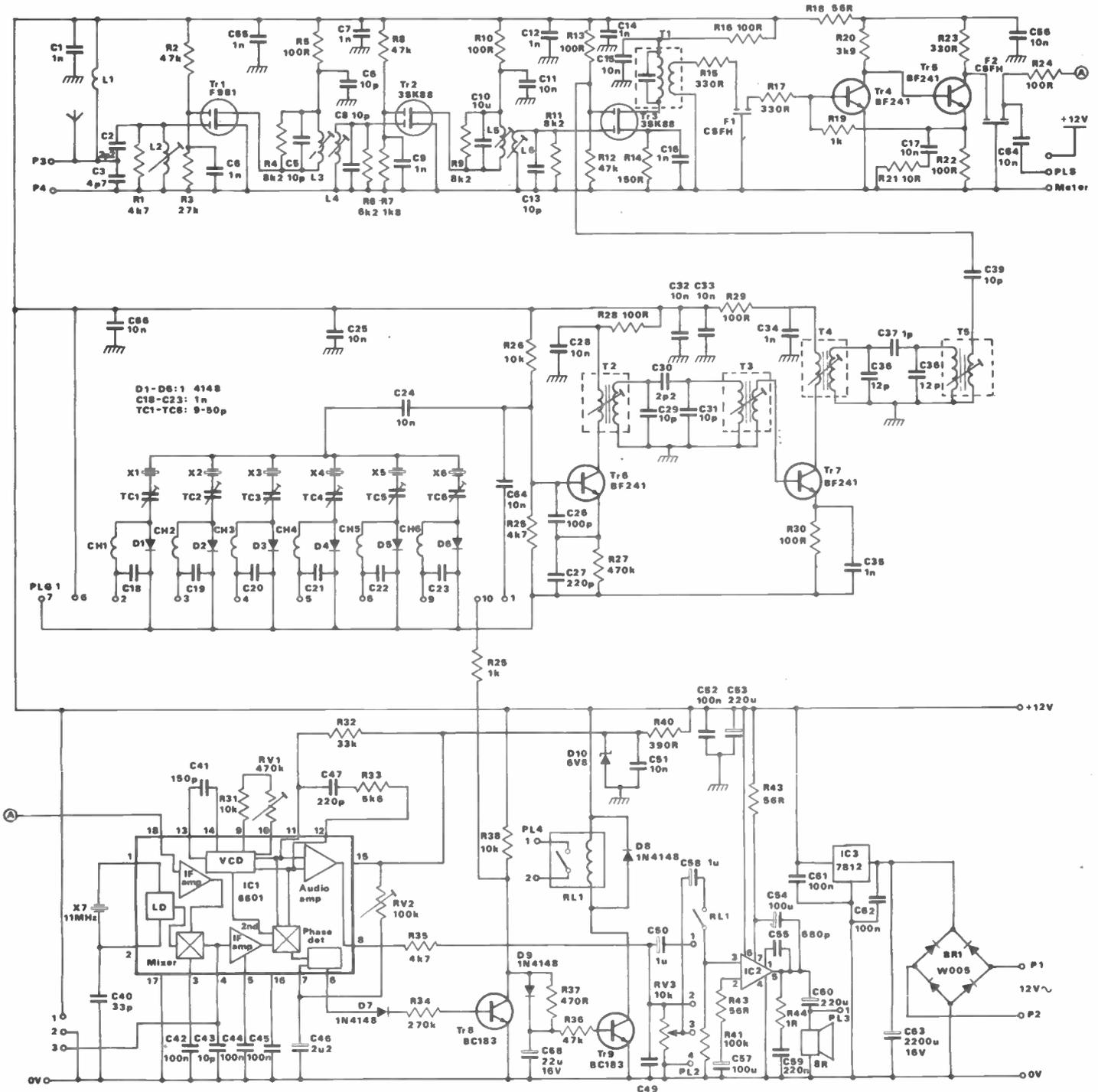


Fig 2 MSR 20 weather satellite receiver circuit diagram

lines/min), true colours (not inverted), south to north pass, go (ready to decode not waiting on pause), visible light grey scale and X2 zoom.

All these commands can be reversed by the ***** commands in the ROM. For example, the default status of the decoder is to translate visible light frames as a positive image (clouds are white, the sea is dark, etc). This will mean that an infra-red picture will show hot as black and cold as white. A true thermal scale gives black as cold and white as hot. Typing ***IR** will ensure that an infra-red picture is decoded in the correct sense. Or another example, ***METEO** (***MET**), changes the line rate from 2Hz (120 lines/minute used by NOAA) to 4Hz (240 lines/minute used by METEOSAT and METEO/COSMOS). Again, ***SIDESCROLL** (***SID**) allows a graphics screen to be rapidly scrolled in any direction using the arrow keys.

It would take some considerable time to become familiar with the fifteen commands available from the ROM, but in addition to these there are 34 other different facilities available. The majority of these are displayed on the function key strip. Any picture can be saved to disc and recalled by pressing **CTRL F0** (marked 'Load picture').

We now come to the utilities disc. This complements the WXSAT ROM but, as I have mentioned, is not necessary for its operation. It is loaded by pressing **SHIFT/BREAK** and one is presented with a menu on the screen showing four options: **DECODE**, **GRAPHICS**, **EXIT** and **PREPARE NON-WX FRAME**.

By pressing the space bar each option is highlighted in turn, and options are chosen by pressing **RETURN**. Selecting **Q** or **ESCAPE** at any time brings the main menu back. If the **DECODE** option is chosen, a second menu is displayed,

the space bar highlighting each in turn. When **RETURN** is pressed the decoder status changes according to which option is currently selected. The status line is displayed along the top of the screen in mode 2, and any alterations to it are shown immediately.

The **GRAPHICS** option, selected from the first menu, enables the operator to draw outlines, latitude, longitude, isobars, etc and also to add text and/or grid overlays to the picture. All the features are accessed by single key presses. There are eighteen different routines available, and they are described in detail in the manual. The routine which operates a 'cross-hair' cursor for drawing can be used either with an AMX mouse (plus ROM) or a joystick, giving 'pen down' or 'pen up' commands with either **D** or **U**.

The unit will plot a temperature gradient scaled over the whole screen for 256 conversion levels (for IR pictures it is proportionately scaled, the peaks being the high temperatures). One can either load a picture from disc by pressing **L**, when a catalogue will be presented asking for a file name, or save a picture by pressing **S**. In this case you will also be asked for a file name, not exceeding seven letters.

Incidentally, it is much better if the picture is saved to a disc other than the utilities disc, so that no over-writing takes place.

T will allow you to write text on the picture, and **P** calls an Epson screen dump. If you have a more elaborate screen dump, such as Printmaster, and you wish to use it, then **Y** is pressed. First, however, you will have to load the program WXSAT, list 'line 3192' and insert whatever the call command for your own printer dump is, such as ***GDUMP** for the Printmaster. Then save WXSAT to

disc and every time **Y** is pressed your own dump will be called. Finally, **Q** will return you to the main utilities menu.

I have used the WXSAT receiving station for a number of weeks and have been able to display very satisfactory pictures. I have used both colour and monochrome monitors, and there is no doubt in my mind that a monochrome one gives a far better picture, due to the fact that the picture is really a difference in grey scales.

I have been tied, of course, to NOAA 9 and NOAA 10 as they were the only channels in the receiver. The scanner option was not included in the review equipment, but in my opinion it would have made copying the transmissions much simpler, and would be a necessary option if more channels were fitted. As it was, I was dodging from one channel to the other hoping that I wasn't missing a pass.

My impressions of the WXSAT receiving station are somewhat conflicting. On the one hand, it comprises a complete weather satellite receiving station with many options (routines) available, but these routines need to be studied and digested in order to achieve good results from the unit. However, the fact that a relatively inexpert operator can just call the ROM up by typing ***DECODE** and carry on from there makes it extremely good value for money and suitable for many beginners.

Conclusions

I have reviewed four different makes of weather satellite receiving stations in the past two years, varying in price from £400 to around £800, but this one must surely beat the lot. A more expert operator will be able to make use of the utilities disc, and even use the ROM commands from within his/her own program to process the digitised pictures – this gives some idea of the flexibility of the basic program.

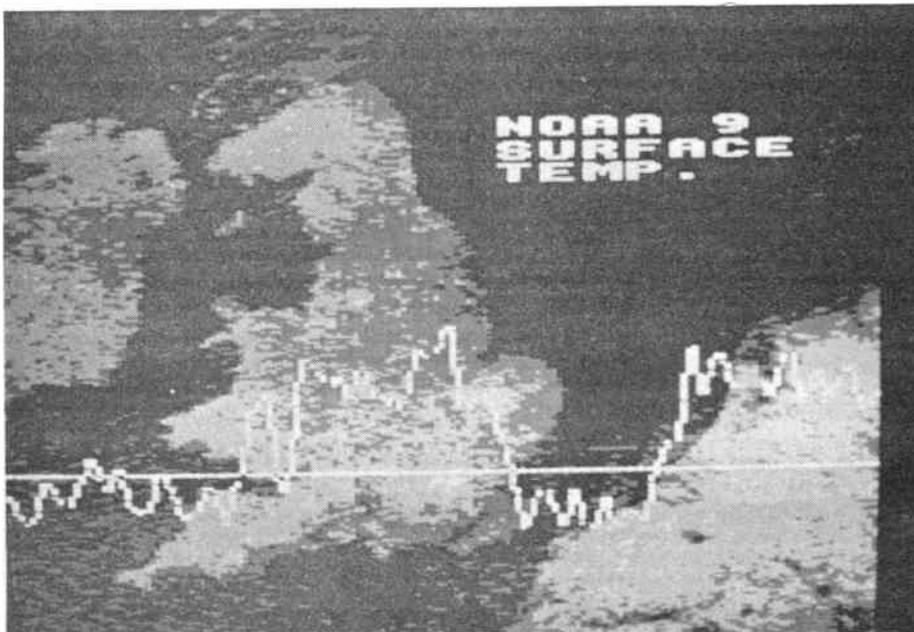
I feel that the units offer the most reasonable way, in terms of cost, of entering the exciting world of satellite reception and endorse them thoroughly. The price of the MSR20 receiver and interface (both available as ready-built units), utilities disc, ROM, test tape, antenna and all cables, together with the explanatory manual, is £209.35 at the time of going to press.

Thanks are due to LE Hornby, Spacotech, 21 West Woods, Portland, Dorset DT5 2EA, tel: (0305) 822753 for the loan of the equipment for this review.

Addresses

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 .01, .015, .022, .033, .047, .068-4p, 0.1-5p, 0.15, 0.22-6p, 0.33, 0.47-8p
Mylar (polyester) capacitors 100V working E12 series vertical mounting
 1000p 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% 1.6 pf to 47 pf - 3p, 2% 58 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 5p
 741 Op Amp - 20p, 555 Timer 22p
 cmos 4001 - 20p, 4011 - 22p, 4017 40p
ALUMINIUM ELECTROLYTICS (Mkds/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 6p; 220/25, 220/50 10p; 470/16, 470/25 11p
 1000/25 25p; 1000/35, 2200/25 35p; 4700/25 70p
Submin, tantalum bead electrolytics (Mkds/Volts)
 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, 22/16 20p
 33/10, 47/6, 22/16 30p; 47/10 35p; 47/16 60p; 47/35 80p
DIODES (piv/amps)
 75/25mA 1N4148 2p, 800/1A 1N4008 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 - 6p, 1 watt 12p
 Battery snaps for PP3 - 6p for PP9 12p
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MORE ADVANCED POWER SUPPLY PROJECTS

by R A Penfold

Mr Penfold, vying with Isaac Asimov for the title 'most prolific author', has produced a follow up to his earlier book entitled *Power Supply Projects*.

Since the second title is a continuation of this theme it is assumed that the reader either has a reasonable knowledge of power supplies or has read the earlier book.

Despite this warning, in-depth knowledge of electronic circuit design is not a prerequisite, and both the practical and theoretical aspects are examined in some detail.

Not all of the circuitry examined could be classified as being genuinely advanced; some topics covered are recent developments which could not be included in the original publication, such as three-terminal adjustable voltage regulators.

Switched mode power supplies are covered, and are treated very sensibly. Mr Penfold's vast experience in the field is reflected in his ability to judge the best use for the item under discussion.

Other subjects pursued include precision regulators, dual tracking regulators and computer controlled supplies. This book is a worthy sequel to its predecessor.

*Bernard Babani Ltd, £2.95.
ISBN 0-85934-166-6*

BASIC AND LOGO IN PARALLEL

by S J Wainwright

This is an interesting comparison: two languages derived from others in the 1960s with the intention of providing a more user-friendly version of the original. The difference is that BASIC comes ultimately from Fortran and Logo descends from LISP, the powerful AI language.

The contrast between the applications of the two languages is highlighted. For

those who already use BASIC, Logo is both fascinating and unusual. Turtle Graphics, for instance, is a thought-provoking concept which is obviously an integral part of Logo, although the processes involved go far beyond this engaging idea.

Clearly, the differences between the two languages are considerable, but this text compares them by juxtaposing particular functions. For example, arithmetic in BASIC is discussed, followed by a section on arithmetic in Logo; thus rather than attempting to teach one language and then the other, the reader's understanding of both systems is developed simultaneously – hence the title.

The BASIC discussed is BBC BASIC Z80, the version which runs on Z80 based machines such as Torch and Tatung Einstein computers. This language was selected because it is a modern version of BASIC, using procedures to which parameters can be passed and within which local variables exist, making it more suitable for comparison with Logo.

Digital Research Inc's Dr Logo is the version of Logo referred to in the text. It is most interesting to be able to make this kind of direct comparison between two such useful languages, and this inexpensive book will clearly be a great help to anyone needing to deal with both of these at the same time.

*Bernard Babani Ltd, £2.95.
ISBN 0-85934-171-2*

Number One Systems Ltd

Number One Systems has just produced the first edition of a newsletter which explains the full range of this versatile company's products.

Best known for 'Analyser', the circuit analysis package, the firm also has a thriving electronics and consultancy arm, where 'Analyser' was



originally evolved to meet in-house needs.

Two new software packages are now available, called 'Z-Match' and 'First Edition'. Z-Match uses enhanced Smith Chart methods to find solutions to RF design and analysis problems – versions are available for the BBC micro and IBM PC. A PCB designer is also available now, called 'Lintrack'. First Edition is a text editor designed to be used by programmers.

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

Schlumberger Instruments

A new manual detailing how an engineer may use an IBM PC to communicate with and control Schlumberger Instruments' 3530 Series of Orion data loggers has been published.

The illustrated 54-page manual describes a software program which enables an Orion data logger to operate under the control of an IBM PC.

The publication highlights software features which enable the user to use the IBM PC to send commands to an Orion logger; display or print measurement data direct from Orion; save

measurement data from Orion to a disc file; and also how to display or print saved data.

There is a description of how to install and get the data logger up and running using the IBM PC, as well as explaining the various communications and display facilities available.

The manual is available from Schlumberger Instruments on request, with a demonstration copy of the program from a local data acquisition sales engineer.

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

ITT Instruments

ITT Instruments has published a six-page, full-colour brochure on the MX40 series of professional hand-held autoranging digital multimeters, which offer a rugged design combined with a range of advanced measuring features.

The brochure provides full technical information on the MX40 series. The major features of the instruments are presented in a clear, easy to understand format whilst the electrical characteristics are given in tables. One page of the brochure is devoted to

the probes, ac current clamps, and shunts for dc current, all of which extend the ranges, and functions of the multimeters.

The brochure is well illustrated, with plentiful photographs, many of which illustrate the features of the MX40 series of hand-held digital multimeters.

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

David Bisset Ltd

A new brochure entitled *Product Guide: Communications Testing* is available from David Bisset Ltd. This shows a comprehensive range of instruments for testing communications apparatus and computer networks. It includes testers for data communications (both digital and analogue), instruments for testing telephones, telecommunications line monitors, cable testers, factory test equipment and field servicing diagnostic testers.

Hard-to-find communications instruments are featured, including fax line monitors, telecommunications line simulators, hand-held protocol analysers for computer networks, dial testers, DTMF (multi-frequency) testers, wow-and-flutter meters and BERT/BLERT (bit and block error rate) modem testers.

New products in the guide are the menu-driven audio test set, model ATS-2, for measuring the quality of communications lines; the updated data communications test set, model CTS-3 with V.35 BERT adaptor (for high speed international links); extended ASYNC test facilities for PC communications and asynchronous systems; the LAN cable fault locator and a range of hand-held instruments for maintenance or installation of telecommunications cables and equipment.

The product guide aims to help network users,

communications managers, service engineers, network controllers, purchasing managers (since it includes prices) and technical support engineers in public utilities, local authorities, education and communications companies.

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

Highland Electronics

A new 282-page catalogue has been produced by



Highland Electronics, which gives details of the company's extensive range of electromechanical, interconnection and display products.

Product categories in the new catalogue include beacons, illuminated push-button switches and indicators, keypads, dual-inline switches, digital and rotary switches, input/output modules, multiple-screen indicators, lamps and LEDs, insulation-displacement and industrial connectors, audible buzzers and alarms, modular alarm systems, axial fans and rail-mounted terminals.

Selection data and

applications information is also included.

Highland Electronics Ltd,
Albert Drive,
Burgess Hill,
West Sussex RH15 9TN.
Tel: (04446) 45021.

Schlumberger Instruments

A full colour brochure for Schlumberger Instruments' new 1202 structural analyser describes how the instrument offers complete facilities for four-channel modal analysis in a single compact, rugged package.

suited to problem-solving applications in the field but powerful and versatile enough for the laboratory.

Schlumberger-Solartron,
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British Aerospace

BAe's in-house technical journal *Aerospace Dynamics* was originally produced to assist technical communication in the company and to promote technical recruitment. To that end, distribution has been mainly to BAe staff, universities and higher education establishments. It has also been a feature of the magazine that articles are written by employees working in the subject area, mainly in their own time.

The increasing number of requests for the journal from people who are outside these categories but still interested in the technical activities of British Aerospace, has made the company realise that a slightly wider circulation would be useful.

This is a fascinating magazine, and well worth enquiring after.

British Aerospace PLC,
11 Strand,
London WC2N 5JT.
Tel: 01-930 1020.

NEC Electronics

A collection of technical papers on ASIC design has been published by NEC Electronics in an A4 magazine format. Covering CMOS, ECL and BiCMOS technologies, the papers are fully supported by tables, charts and illustrations.

The 30-page book is free upon request to both existing and potential ASIC engineers. Enquiries should be directed to the address below.

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Although not strictly medium wave, the long wave band (150kHz-290kHz) is often lumped together with the former under the term medium frequencies. It is now a relevant time to revisit this band, since a number of significant frequency changes have recently taken place.

The 1979 World Administrative Radio Conference (WARC) decided that the arrangement of channels in the LF band should be standardised along the same lines as those on MF; that is all channels should be harmonic multiples of 9kHz. It was decided that the first five LF channels (originally 155, 164, 173, 182 and 191) would move in 1986 to 153, 162, 171, 180 and 189kHz respectively. The next five channels were due to shift on February 1st this year and the remaining five are scheduled to move in exactly two years' time.

Checking the LW band in January revealed that even two years after the first frequency shift not every station was adhering to the agreed plan. Most significantly, the French language station Europe 1 kept its 2000kW German-based transmitter on the non-standard frequency of 183kHz. It was, therefore, not entirely surprising to find the central portion of the LW band suffering from more interference when I checked it on February 1st.

The most apparent problem was a distinct heterodyne interfering with BBC R4, which had moved from 200 to 198kHz whilst other stations had remained unaltered.

This case exemplifies the necessity for an internationally agreed bandplan, which should minimise interference if all parties agree to follow the rules. Currently, the modified LW band is arranged as in the table.

Although a loop aerial would be a desirable accessory for listening to LW stations, it is perfectly possible to get good reception from a portable radio, using the directional properties of the internal ferrite rod aerial to optimise reception from a particular direction. Well, what can you hear? The table is a fairly comprehensive summary of sta-

MEDIUM WAVE



DXING

by Steve Whitt

tions in Europe, North Africa and the USSR which operate on the band. Outside this area the LW band is not generally used for broadcasting. As a guide to what you'll hear, I've highlighted those stations which I received using just the internal aerial with my portable Sony ICF2001D.

Signals on the LW band behave much like their counterparts on the MW band, and during daylight hours propagation is via the ground wave, which is augmented by a sky wave signal at night. If you recall the item on MW propagation in this column a while back, you'll remember that the lower the frequency is, the greater the range of the ground wave signal. It is for this reason that the BBC can provide coverage of most of the UK for its 198kHz Radio 4 service from just one transmitter (extra transmitters are needed to ensure coverage of Scotland). In addition, propagation via the sky wave is subject to less fluctuation than for MW signals.

Consequently, it is possible to provide good reception over large areas throughout the day and night.

The principal drawbacks associated with LW broadcasting are two-fold. Firstly, there is only a limited amount of

radio spectrum available – in fact, only 15 channels – which restricts the number of users, and secondly the long wavelengths involved (1000-2000 metres) require the use of either massive (and expensive) aerials or smaller, less efficient aerials and very powerful (and expensive) transmitters.

'World Radio TV Handbook'

Back in the January issue I mentioned the forthcoming 1988 edition of this most valuable book. I was surprised by the speed with which the *WRTVH* became available, since copies were being delivered in February. This is considerably earlier than in previous years, when publishing and distribution delays were the norm. In terms of layout, the new edition is very similar to previous years, but this year the specialist articles cover the subjects of receiver specifications and active antennas. Both articles are thorough and well worth reading.

News desk

United Kingdom: On January 19th Douglas Hurd, the Home Secretary, announced in Parliament plans for a major change to broadcasting in the UK. He intends to authorise three new national independent broadcasting networks and up to 300 local commercial/community radio stations. This will probably result in the BBC having to surrender some MW frequencies.

Additionally, it is intended to deregulate the existing ILR stations. The IBA will have less control over the ILR stations and a new radio authority will be set up to oversee all these changes and radio broadcasting in general. It is unlikely that these changes will be implemented before 1989, but they have already had significant impact on the development plans of both the BBC and the IBA.

The IBA originally intended to advertise 6 more ILR franchises during 1988 (of a total of 11 approved by the Home Office), but only two will now definitely go ahead.

The remainder will be treated individually. The franchises for Eastbourne/Horsham and Cambridge/Newmarket have been advertised and, if

kHz	STATIONS	NOTES
153	Algeria, West Germany*, Norway, Romania, USSR	
162	France*, Turkey and USSR	Still off channel
171	Morocco* and USSR*	
177	East Germany*	Still off channel
180	Turkey and USSR	
183	West Germany*	Moved Feb 1988
189	Italy, Sweden* and USSR	Still off channel
198	Poland, UK* and USSR (ex 200kHz)	Moved Feb 1988
200	Algeria*	Moved Feb 1988
207	Morocco* and USSR* (ex 209kHz)	Still off channel
216	Norway* and USSR (ex 218kHz)	Moved Feb 1988
218	Monaco*	Moved Feb 1988
225	Poland* (ex 227kHz)	No change
234	Luxembourg* and USSR* (ex 236kHz)	No change
245	Denmark*	No change
254	Algeria*, Finland and USSR	No change
263	Bulgaria, East Germany and USSR	No change
272	Czechoslovakia* and USSR	No change
281	USSR	

(* = heard at Ipswich during Feb '88)

DX-TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

In addition to that annual institution, *The Wizard of Oz*, there were a few other events which kept DX-TV enthusiasts glued to their screens during December. Checking back through the logs over the last few months has revealed plenty of intense periods of tropospheric enhancement, with several minor lifts too. Tropospheric DX was in the limelight again during December with a lift on the 5th and 6th, followed by a much larger and more intense one on the 23rd. The latter was indeed a welcome Christmas bonus with many significant examples of DX signals. We even had a report of Poland in Band III, which is considered to be a fairly rare visitor to the UK.

A few small sporadic-E openings materialised during the first half of the month but the anticipated late December ones just didn't seem to happen.

Quick bursts

Meteor shower DX via the Geminids over the mid-December period proved bitterly disappointing when compared

with results from other years. At Derby, some activity occurred early on December 14th, commencing with a brief glimpse of a PM5544 test card on channel E5 in Band III at 0654GMT. Band I activity consisted of the GTE test pattern from Spain at 0656GMT and the Norwegian 'NORGE MELHUS' PM5534 pattern at 0853. Both of these signals appeared on channel E2.

Christmas crackers

Where did all the BBC's enthusiasm evaporate to this Christmas in producing the traditional Christmas captions? It seems that all the effort was made by Dutch TV. In the top rectangle of the 'PTT NED-1' PM5544 test card, Christmas greetings in many different languages (including English) were sequentially superimposed.

Talking of test cards, the West German Hessischer Rundfunk FuBK has undergone some interesting changes. On December 23rd, the digital clock was seen superimposed *below* the central identification block rather than in its

usual place across the colour bar portion of the pattern.

Other observations during the tropospheric opening on the 23rd included almost a full complement of Dutch NED-3 outlets on test, showing the FuBK with transmitter information. The following were received: Lopik E30, Roermond E34, Wieringermeer E42, Smilde E44 and Markelo 51.

DX-TV log for December

The reception log for December has been kindly submitted by Simon Hamer of New Radnor in Powys:

06/12/87: NED-1 (Netherlands) with PM5544 seen over several channels; WDR-1 (Westdeutsches Fernsehen - West Germany) on channels E9 (Langenberg) and E11 (Teutoburger Wald) - reception was identified by the clock caption; DDR-1 (East Germany) on channels E11 and E12 showing programmes with corner identification; RTBF-1 (Belgium - French language network) on channel E8 (Wavre) with the PM5544 test pattern; BRT-1 (Belgium - Flemish language

PHOTO FILE ● PHOTO FILE ● PHOTO

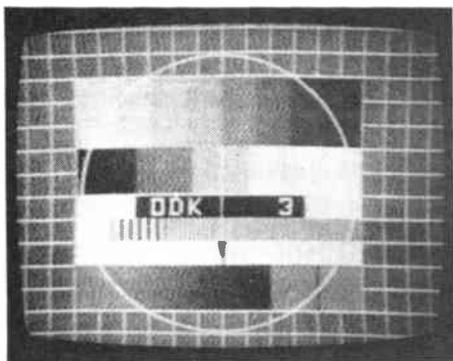


Fig 1 FuBK test card from the Czech CST-1 network, received on channel R10 (Pizen)



Fig 2 CST-1 announcer photographed during last November's tropospherics on R10

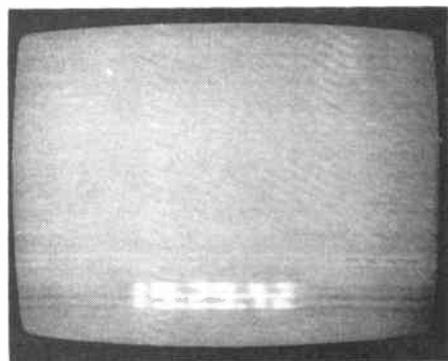


Fig 3 CST-1 clock caption noted in Band III. An analogue clock is also used

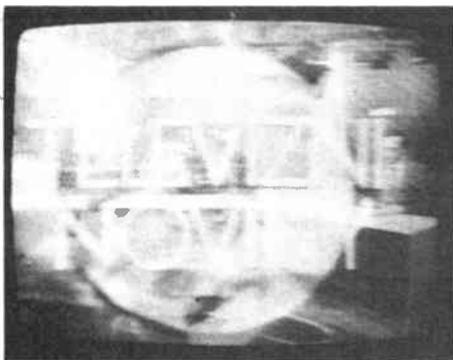


Fig 4 Televizni Noviny news programme from Czechoslovakia

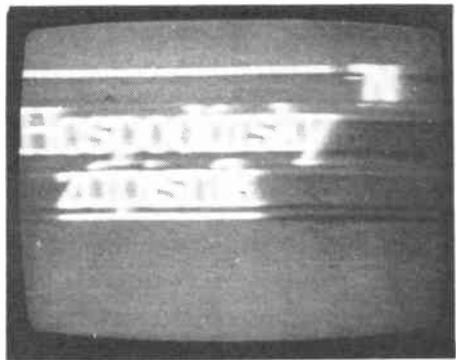


Fig 5 Caption received from CST-1 during the evening's news programme

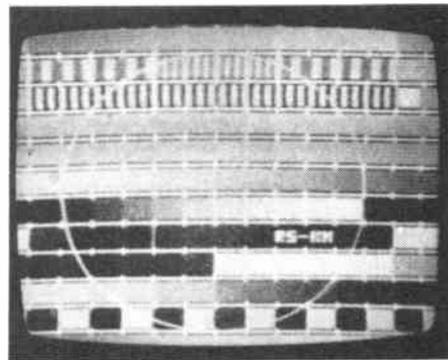


Fig 6 RS-KH electronic test card received on channel R35 from a CST-2 outlet

network) on channel E10 (also Wavre) showing the 'BRT-1' PM5544; TDF Canal Plus (France) on Band III channels L5, L7, L8 and L9; RTE-1 (Eire) on channels B, D, F and H; RTE-2 on channels G, I and J; RTL Plus (Luxembourg) on channel E7 from the Dudelange transmitter; DR (Denmark) with the 'DR DANMARK' PM5534 test pattern on channels E5 and E10.

07/12/87: SVT-1 (Sweden) with the 'KANAL 1' PM5534 test pattern on channel E2; NRK (Norway) E2 showing the PM5534 pattern with 'NORGE GREIPSTAD' transmitter identification; TVP-1 (Poland) R1 showing the dark background PM5544 test card; DR E3 on 'DR DANMARK' PM5534 from the Fyn transmitter; RUV (Iceland) on channel E4 radiating the 'RUV ISLAND' PM5544 test pattern. All reception via sporadic-E.

13/12/87: TVE-1 (Spain) on channel E2 with the GTE test card via sporadic-E.

16/12/87: NRK E3 with the 'NORGE BAGN' PM5534; NRK E4 with the 'BREMANGER' PM5534.

22/12/87: TDF Canal Plus L5, L6, L7, L8 and L9; TDF (tf1, A2 and FR3) on channels L21, L22, L23, L25, L28, L29, L35 and L37; NED-1 E4, E5, E6, E7 and E29; RTBF-1 E8; BRT-1 E10; RTL in French on channel E27.

23/12/87: NED-1 E4, E5, E6, E7, E29, E39 and E50; NED-2 E27, E45 and E54; NED-3 E34 with the FuBK test pattern showing the 'ROERMOND' transmitter identification; unidentified colour bars on channel E44 at 0730GMT; BRT-1 on E2 (Antwerp low power relay), E10, E43 and E49; BRT-2 on E46, E55 and E62; RTBF-1 radiating the PM5544 on channels E3 (Liège), E8, E11 and E52; RTBF-2 on channel E42 with the 'TELE 2' PM5544; RTL-Plus showing a Western film; DR on E7 and E10 with a Danish language programme; SVT-1 on channel E8 (Emmaboda) with the 'KANAL 1' PM5534 test pattern; TVP-1 on channel R8 (Katowice, Bialystok or Koszalin) showing the dark background PM5544; NRK on channels E5, E8 and E9 showing 'Dagsrevyen'; WDR-1 airing the FuBK test pattern on channels E9, E11 and E30; NDR-1 (Norddeutscher Rundfunk) E10;

ZDF (Zweites Deutsches Fernsehen) on channels E21, E24, E27, E30, E34, E35 and E37; WDR-3 E39, E40, E45, E46, E48, E53, E55, E57, E58 and E60; NDR-3 showing the 'NDR 3 HMBG' FuBK on channels E53 and E57; DDR-1 showing the test card on channels E11, E12, E27 and E37; DDR-2 on channel E34 from Brocken; RTE-1 channels B, D, F, H, I, 29 and 40; RTE-2 G, H, I, J, 33 and 43; TDF Canal Plus on channels L5, L6, L7, L8, L9 and L10; TDF (tf1, A2 and FR3) on channels L21, L22, L23, L24, L25, L27, L28, L29, L34, L35, L37, L38, L45, L48, L60, L61, L62 and L65.

Reception reports

Band I activity consisted chiefly of Scandinavian DX reception throughout December for Bob Brooks of South Wirral. On the 3rd and 4th, Norway was in evidence with the PM5534 test pattern displaying 'NORGE TELEVERKET' and 'BREMANGER' identifications on channel E4. Swedish signals on channels E2, E3 and E4 were noted on December 8th and 12th, all identified by the test card, while on the 1st, the Polish PM5544 was spotted (perhaps *noticed* would be a better word!) on channel R1.

Tropospheric DX was detected on the 6th with RTBF-1 on E8 and also Canal Plus on L5. Belgium appeared again on the 23rd with transmissions from the Dutch NED-1 service present during the same opening. A smaller lift on the 14th procured West Germany in Band III, while from the west Bob received RTE-1 on channel H from the Kippure transmitter.

Simon Hamer of New Radnor reports an exciting month with many new stations to add to his log. The 23rd proved the most exciting day with at least three surprises, namely Belgium E2, Poland R8, Sweden E8 and several Band III Norwegian outlets.

Mystery reception

The reception of the low power Belgian E2 outlet for BRT-1 is rather a mystery. This is the third time in a matter of only weeks – could it have increased in power? There are three high power transmitters sharing channel R8 in Poland, namely Katowice, Bialystok and Koszalin. The latter is the most likely to have been received, because it is the nearest outlet to all the others logged during the opening.

At lunch-time on December 5th, John Bray of St Neots telephoned to report the reception of the Swedish test card on channel E42. A quick flick through the UHF band here in Derby proved fruitless, although an extremely weak PM5544 test pattern was located on channel E10 in Band III when the aerials were beamed to the north-east. Unfortunately, there was no further improvement in signal level, so its origin remains a mystery.

The East German UHF outlet at Brocken on channel E34 was seen on the

CST-2 NETWORK

Map ref	Transmitter	Channel	Pol	ERP
39	Košice-Město	R21	H	2kW
35	Modrý Kameň	R21	H	100kW
38	Rožnava	R22	H	100kW
6	Klatovy	R22	H	100kW
26	Gottwaldov	R22	H	100kW
16	Hradec Králové	R22	H	600kW
30	Trenčín	R23	H	300kW
17	Trutnov	R23	H	1000kW
10	Praha-Město	R24	H	100kW
41	Košice	R25	H	600kW
19	Mikulov	R26	H	300kW
9	Praha	R26	H	1000kW
28	Bratislava	R27	H	1000kW
18	Rychnov Nad Kněžnou	R28	H	100kW
15	Třebíč	R28	H	300kW
32	Námestovo	R29	H	100kW
20	Brno	R29	H	600kW
37	Poprad	R30	H	600kW
24	Ostrava	R31	H	600kW
12	Liberec	R31	H	100kW
3	Plzeň	R31	H	600kW
8	Vimperk	R32	H	
34	Banská Bystrica	R32	H	600kW
36	Lučenec	R33	H	300kW
22	Olomouc	R33	H	300kW
11	Ústí Nad Labem	R33	H	600kW
5	Plzeň-Město	R34	H	100kW
23	Nový Jičín	R34	H	100kW
20	Brno-Město	R35	H	100kW
7	Sušice	R35	H	100kW
31	Zilina	R35	H	680kW
1	Cheb	R36	H	100kW
21	Jeseník	R36	H	600kW
40	Bardějov	R37	H	100kW
27	Borský Miluláš	R37	H	100kW
25	Frydek/Místek	R37	H	300kW
2	Jáchymov	R38	H	300kW
29	Nové Město	R39	H	600kW
13	České Budějovice	R39	H	600kW

CST-1 NETWORK

Map ref	Transmitter	Channel	Pol	ERP
24	Ostrava	R1	H	100kW
9	Praha	R1	H	150kW
13	České Budějovice	R2	H	100kW
28	Bratislava	R2	H	150kW
40	Bardějov	R4	H	1kW
32	Námestovo	R4	H	1kW
21	Jeseník	R4	H	10kW
37	Poprad	R5	H	70kW
6	Klatovy	R6	H	1.6kW
16	Hradec Králové	R6	H	100kW
41	Košice	R6	H	100kW
2	Jáchymov	R7	H	2kW
10	Praha-Město	R7	H	3.5kW
34	Banská Bystrica	R7	H	100kW
12	Liberec	R8	V	30kW
7	Sušice	R9	H	1kW
33	Ružumberok	R9	H	1kW
35	Šturovo	R9	H	1.5kW
20	Brno	R9	H	150kW
30	Trenčín	R10	V	1.5kW
3	Plzeň	R10	H	100kW
17	Trutnov	R11	V	0.2kW
14	Jihlava	R11	H	5kW
31	Žilina	R11	V	30kW
29	Nové Město	R12	V	1.5kW
11	Ústí Nad Labem	R12	V/H	100kW
27	Uherský Brod	R21	H	8kW
4	Domažlice	R24	H	100kW
1	Cheb	R26	H	100kW
26	Gottwaldov	R41	H	9.5kW

6th by Chris Howles of Lichfield. The electronic test pattern with 'DDR-2' ident was being shown at the time.

Notes on propagation

Joop Prosée of the Netherlands has written commenting on the many long haul signals received by enthusiasts from Canada and the Middle East, supposedly via multi-hop sporadic-E. Joop comments that the maximum distance attainable for sporadic-E reception is 5000km, and propagation consisting of more than a double-hop is considered impossible. Understandably,

he feels that some of the 6m amateur reception from North America last summer, with distances in excess of 6500km, could be aided by other forms of propagation similar to TEP or LDE (Long-Delayed Echo).

Alternatively, such reception could be a combination of different modes of propagation, such as tropospheric assisted sporadic-E reception. Joop reckons that this could apply to the many instances of Jordanian DX, because anticyclonic weather conditions which exist in the Mediterranean area for most of the year result in tropospheric

enhancement. In other instances only single-hop sporadic-E may occur, caused by a shallow refraction angle, despite the long distance involved.

Joop also comments on the enthusiastic stories found in various magazines which suggest that the next F2 season is 'knocking on our front doors'. Scientists expect the sunspot maximum to occur in 1991, four years after the minimum. Apparently, the 1979 maximum occurred 3 years after the minimum. Joop says that the longer the time period between the minimum and maximum sunspot count, the weaker the maximum will be. The trend since the early thirties certainly suggests that exceptional F2 activity, with a high MUF, occurs only every 22 years. He concludes that there are strong reasons to believe that the next peak will prove a disappointment, with the MUF rarely rising above 47MHz.

Service information

West Germany: The upper region of the UHF band between channels 61 and 69 is to be used by private TV services in the near future. The preparation is going more quickly than expected and the first transmissions could take place at the end of this year or early in 1989.

Two more private TV transmitters for SAT-1 and RTL-Plus broadcasts have entered service in the Schleswig-Holstein region. These are:

Network 1 (SAT-1) Garding on channel E25, 6kW. Süderlügum on an unknown channel, 5kW.

Network 2 (RTL+) Garding on channel E58, 6kW. Südelügem on channel E56, 5kW.

Westdeutsches Fernsehen has introduced a new logo for the ARD-3 network. It is now 'WEST 3'. However, the identification on the test pattern remains the same as before, namely 'DBP WDR 3' or 'WDR 3'.

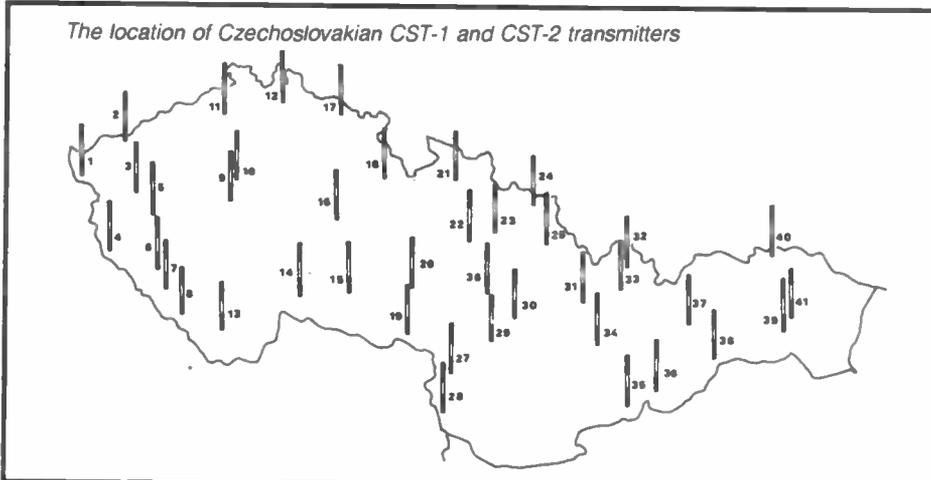
Netherlands: The Dutch 3rd TV network will officially come on-air on April 4th. Most main transmitters are already showing test transmissions and the sequence is as follows:

From 0745-0800GMT the FuBK test card without the circle is shown incorporating the transmitter location; for example, 'WIERINGERMEER', 'LOPIK', etc. This is followed by an FuBK test card with a circle and the identification 'AVVC-HVS'. From 0800 until 1600GMT the PM5544 test card is radiated with 'PTT NED 3' in the lower black rectangle, although occasionally the FuBK with transmitter identification is screened.

A teletext service called 'NOS TT' is available via the new network. When the service was undergoing tests, page headings were in the English language. Now they are in German, so page 100 is shown as 'S 100' (Seite 100).

This month's service information was kindly supplied by Gösta van der Linden (Rotterdam) and the Benelux DX Club (Netherlands).

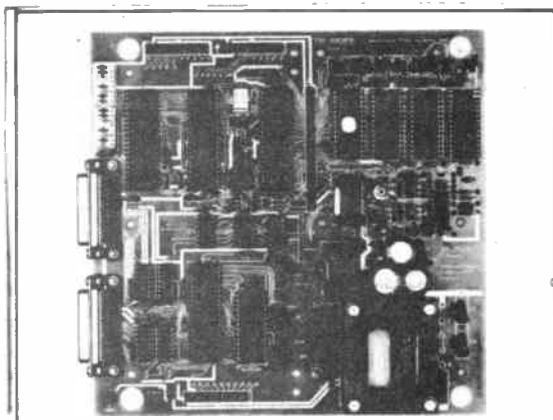
The location of Czechoslovakian CST-1 and CST-2 transmitters



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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

To err is human

Ahem. One always likes to make mistakes in style, and apparently the West Devon Repeater Group (eagle-eyed lot!) have spotted a few in our recent item about their situation.

Fortunately the club has contacted the chap who implemented their aerial design – not G3VEH (who was the actual designer) as stated in the previous article. The poor chap was probably sitting quite innocently at home when our faithful reader (!) came baying to his door claiming the finder's reward. What fun...

The club secretary is now Trevor G3ZYY, not G4KXQ, and G1VKZ, whose name was mentioned hopefully as a contact, is just a blameless author of an article. Fame for a day!

Please direct enquiries of all sorts to Trevor, at 46 Beatrice Avenue, Saltash, Cornwall PL12 4NG. Membership is only £3 per year renewable on the date of joining, and lots of goodies will come your way when you do become a member. Incidentally, the group has made a tiny mistake-ette itself – calling us OM. Last time we looked we were YLs – easy mistake to make...

Princetown rally

Staying in the same neck of the woods, the Dartmoor Radio Club's annual mobile rally is to be held at Princetown Hall on Monday, May 2nd, from 10.30am to 5pm. The local repeater groups will be there – if you see WDRG, say hello for us!

Also in attendance will be the usual traders and Raynet; there will be bring-and-buy stands and refreshments – all for a small entrance fee. Parking is plentiful, and talk-in is on S22. A particularly scenic day out, we think.

For details, contact Dave Stokes G1YPB at 322 Tavy House, Duke Street, Devonport, Plymouth, Devonport, Plymouth, Devon P11 4HL, or phone (0572) 551955.

From bard to verse

Reading and District ARC, having acquired a talented scribe in the shape of David Silvester (sometime author in these hallowed pages), is now sending us wonderful newsletters. Shakespeare beware!

The first brings news of an appointment – the club has a new secretary, Mike Anthony G4THN. Details are given of the club's main meeting for the month – a junk sale on March 29th, which will take place at the White Horse pub, Emmer Green, Reading.

Yes, we know that this is the April issue, but for those eager beavers who snap the magazine up hot from the presses, March 29th is still to come. Which just goes to show that the early bird gets the junk. What a moral!

Reading and District ARC meets on alternate Tuesdays, from the above date, at the White Horse pub – everyone is welcome. For further details, contact the club secretary, Mike, on (0734) 774042.

Paddington takes off

We have had news from darkest Peru – or could it be Paddington College Amateur Radio Society? Deprived of their aunt Lucy during term time and being too over-worked to have tea and biscuits with Mr Gruber, they have turned to the airwaves.

In fact, this is their second year, and the club has decided to open its membership to all radio amateurs and SWLs. Don't forget the blue duffle coat and marmalade sandwiches, though, as a quick flick through the club newsletter *Bearest Fax*

reveals a startling penchant for crawling around on rooftops. At times like that, the old marmalade sarnie comes in handy.

What with impromptu antenna erecting sessions and frantic Txing from the Biology lab, this sounds like an interesting club to join!

The club meets from 7pm on the first Wednesday of each month at Paddington College, Paddington Green, London W2, and to find out the grizzly facts you should contact Don G1UCT on 01-723 3847, after 7pm. Life without the club could become unbearable...

Pecked pippers

Tongue twisters are the order of the day at the Midland Amateur Radio Society, as John Harris G8HJS is going to talk about chassis bashing on April 18th. Try saying that after you've had a few!

As regular readers will know, this club is more active than a volcano, and a detailed explanation of the multitude of goings-on would fill a small novel. Suffice members to say that it meet *three times a week*, though the venue is still in doubt as far as we know.

To find out details of meetings, which start at 7.30pm, or classes, which start at 7pm, contact Norman G8BHE on (021) 422 9787. Prepare to be exhausted!

Love IRTS

This heading is the Editor's fault, folks – the Grand Personage is obviously getting interested in corny titles. We didn't realise they were infectious...

The object of this mysterious title is the Irish Radio Transmitters Society, which produces a regular newsletter with all the latest info from EI.

A new man is in charge of the printed stuff – Charlie EI2EM. Rod EI7DF, who has very ably overseen this newsletter for two years, has decided to concentrate on operating. Making cutting comments over the air, mayhap? Txing with tonsillectomy included?

Anyway, the best of luck to Rod, and Charlie; remember that the newsletter needs

material from members – you too could become an author!

To find out more about the IRTS, write to PO Box 462, Dublin 9.

Spectrum watch

The Bristol Radio Society is fooling about with frequencies this month – Steve Walsh G8KVV of Hewlett Packard will be hosting an RF test equipment evening.

There will be a short talk and demonstration, followed by an opportunity to test your rig on a spectrum analyser. The moment of truth approaches...

The club's meetings are held every month on the last Monday, at 7.30pm in the Small Lecture Theatre, Queens Building, University of Bristol. For further information, please contact Dr C Newton, 13 Ridge Close, Portishead, Avon BS20 8RQ.

Mercury rally

On to things nautical now – the Royal Naval Amateur Radio Society is holding its annual mobile rally on June 12th. The rally site is HMS Mercury, near Petersfield, Hants.

This popular rally tries to cater for the whole family; besides the multitude of goodies for the radio amateur, toys, novelties and costume jewellery will also be for sale.

There will be rides and amusements for children, exhibitions and demonstrations of crafts, do-it-yourself archery, vintage steam machines and fire engines, and lots more.

Talk-in will be on two metres and 70cm, and all details can be obtained from Cliff G4UJR on (0703) 557469.

Smashing time

Things are hatching in the Wirral and District Amateur Radio Club – April 27th brings a Great Egg Race. Visions of hard-boiled amateurs scrambling to poach ideas from each other – these are the yolks, folks!

Earlier in the month, the members will be holding a film night – on April 13th. All meetings take place at the Irby Cricket Club, Irby Mill Road, Irby, Wirral, at 8pm. For further information, please

contact Alan G1XYP, on (051) 677 7517.

Crossed wires

How many members of Binstead Amateur Radio Society does it take to change a lightbulb? Hopefully just one after Mike G0EHR's lecture on basic house wiring on April 25th.

If you have a short fuse when it comes to the electrical foibles of your house, or if you are feeling ambitious and fancy trying your hand at re-wiring, then this could be your chance to become enlightened.

The lecture starts at 7.30pm and will be held at 'Brickfields', Newnham Road, Binstead, Isle of Wight. So why keep yourself in the dark? Contact Bob G0ISB, 29 Dubbers, Godshill, Isle of Wight for more information.

TARS AGM

'Torbay or not Torbay? that is the question. Whether it is nobler in the mind to suffer the slings and arrows of the Annual General Meeting...'

Yes, Torbay Amateur Radio Society's AGM will be held on April 25th at 7.30pm. The society also boasts a packed schedule of events and lectures which take place at the English China Clay Social Club, Highweek, near Newton Abbot.

New members and visitors are always welcome. One incentive might be the club stations which operate on both HF and VHF; the other is definitely the licensed bar. Bob McCreadie is the man to contact if you are interested, on (03646) 233.

Stay(a)Wakefield

If you're in the Wakefield area, there's no excuse to be bored. North Wakefield Radio Club offers some sort of entertainment every week.

This month, Mike G3JME is prepared to teach you all you ever wanted to know about cavity wavemeters on the 7th, the club is on the air with the callsign G4NOK on the 14th, there is a visit to Leeds Poly's computer room on the 21st and the month is rounded off nicely on the 28th with the monthly meeting.

For more details, get in touch with Steve Thompson

G4RCH on Leeds 536633. The club meets every Thursday from 8pm onwards at the White Horse Public House, Fall Lane, East Ardsey.

Happy birthday

Many happy returns to the Barry College of Further Education Radio Society, which will be 21 years old this year. The celebrations for this month include a video film presentation entitled 'The Story of Electrons' on April 14th and a tape slide presentation 'DXpedition to St Pierre et Miquelon Island' to be shown on the 28th.

There are many more treats in store (though, sadly, no jelly and ice-cream is offered). If you would like to know more about the programme of events, which includes lectures, demonstrations, club outings, activities and social functions, write to Dr Kevin Johnston GW4BCB, Barry College of Further Education, Colcot Road, Barry, South Glamorgan CF6 8YJ.

Coventry insomniacs

If at the end of this month you notice a lot of people with dark rings under their eyes wandering the streets of Coventry, it would be worth having a bet (with a non-R&EW reader, of course) that they are members of Coventry Amateur Radio Society.

These insomniac amateur radio enthusiasts will have spent three sleepless nights on the air on the 1st, 8th and 22nd of April.

A mini lecture evening is also planned for the 15th, and the (indoor) direction finding contest will be held on the 29th.

If you are interested in attending any of these events or fancy losing some sleep during the nights on the air, get in touch with club secretary Jonathan Ward G4HHT on Coventry (0203) 610408.

Rugby rally

Satellite TV is coming to the Crick Rally this year, as well as all the usual lectures, demonstrations, trade stands and ideal opportunities to pick up a few bargains.

The rally, organised by the British Amateur Television Club, will be held on Sunday

Notes from the Past

Amateur radio in the fifties

Secret Society

I was pleased to see that the Administrative Committee of IARU recommended to the plenary assembly that it should declare its sympathy with the radio amateurs of Austria in that the restoration of their transmitting licences is still withheld. True, there are quite a number of OE amateurs to be heard on the air, but they are nevertheless 'pirates' despite a pre-war call. When I was in Austria I could not quite get the system they use in sorting out their own call signs to avoid duplication. Apparently, it works out all right, each area working as a cohesive body in such matters. Indeed, the speed and efficiency of the liaison within and between the groups once or twice literally shook me.

They QSL too, but, of course, no address other than the town or district appears on the card. What is equally important, they get the cards sent to them. In all call books you will find the Austrian QSL Bureau shown as 'care of RSGB'. Cards sent via that means, like the Canadian Mounties, get their man. The Austrian amateurs are grateful for, and will long remember, this service.

Underground

Amateur radio in Austria has all the romance of a secret society and a friendliness and camaraderie that is really heart-warming. You simply find one amateur and he links you up with the man from whom he gets his QSL cards, and he in turn puts you in touch with 'sub-managers' of whatever districts you intend visiting. Thus you find yourself looking for George - except that George isn't his real name but simply his radio name. His real name is Anton. He in turn introduces you to Ed. Ed's proper name is Josef, and so on. A bit perplexing at first, but I found I soon got used to it.

24th April at the Northampton/Rugby Post House Hotel, just up the road from exit 18 of the M1 motorway.

You can catch up on the socialising in the bar and restaurant, and admission to the whole event is free. If you would like more details, contact Trevor G8CJS on (0532) 670115.

The rules

Fareham and District ARC members are about to learn that there is more to measurements than just feet and inches...

The demonstration on 13th April is concerned with radio measurements as a follow-up to the lecture of the same name which took place on 30th March.

If you are interested in attending this demonstration or the lecture on HF aerials on 17th April, make sure you contact club secretary Alan Chester G3CCB on (0329) 288139.

The club meets every Wednesday at 7.30pm in the Portchester Community Centre, Westlands Grove, Portchester, Hampshire.

SHORT WAVE NEWS

FOR DX LISTENERS

By Frank A Baldwin

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

Brazilian stations abound on the 60 metre band (**4750 to 5060**), those relatively easy to receive being sometimes reported by short wave listeners. DXers in the main tend to forage for those buried deep in near, or co-channel, interference for most of their transmission periods, or patiently await the onset of favourable conditions or a clear channel. The latter occurs when other Latin American transmitters vacate the respective frequencies at the termination of their schedules.

On the 60 metre band, European listeners are provided with a much better chance of logging Brazilians than that provided by the 90 and 120 metre bands, details of which were published in our previous issue.

It will be noted from the following that some Brazilian stations are co-channel. Whilst causing the minimum, if any, interference in so vast a country, where these transmissions are intended solely for local consumption (being radiated via an omni-directional aerial at relatively low powers), such a twinning presents the DXer with an additional difficulty: that of correctly deciphering station identifications announced in the same language, Portuguese, and often simultaneously. Should the reader be a newcomer to the hobby, resort should be made to those frequencies on which a singular Portuguese language transmission is apparent.

Start here

To get the flavour, as it were, of a Brazilian transmission on the band, it is suggested that readers first tune to **4805**, where signals from Radio Difusora do Amazonas in Manaus are frequently heard by UK listeners. At 5kW it operates from 2030 to around 0200, the close-down time being variable.

Regularly reported on **4755** are the signals emanating

from Radio Educacao Rural in Campo Grande. With a power of 10kW, it is on the air in Portuguese from 0700 through to 0400 (Saturday until 0500). Co-channel, however, is another Brazilian. Radio Difusora do Maranhao, Sao Luiz, works around the clock but, with a power of 2kW, it is obviously less reported by European DXers than Radio Educacao Rural.

Another frequently heard Brazilian is Radio Rural, Santarem on **4765**. The schedule is from 0800 to 0300 with a power of 10kW. However, trouble may ensue for the unwary in that on or near this channel is the Brazilian station Radio Nacional, Cruzeiro do Sul, a Radiobras station which varies slightly with respect to frequency. Its power is 10kW, the schedule from 0900 to 0400. Listen for this one therefore after the Radio Rural sign-off at 0300 to the 0400 close-down of Radio Nacional.

On **4775** is the rarely heard Radio Portal da Amazonia in Cuiaba, from where it transmits around the clock with a power of 1.5kW. Co-channel, however, is the 1kW Radio Congonhas, Congonhas (ex **3385**), which is on the air from 0900 to 2200.

Brazilian co-channel problems are also apparent on **4785**. The oft reported 5kW Radio Ribamar, Sao Luis, which transmits from 0800 to 0300 and sometimes to 0400, shares this frequency with the lesser heard 1kW Radio Caiara in Porto Velho, scheduled from 0800 to 0400 with an occasional 0500 sign-off.

The seldom heard 1kW Radio Difusora, Aquidauana is listed on **4795** from 0800 to a variable sign-off around 0300.

Radio Difusora Londrina operates from 0800 to 0300 daily with a power of 10kW on **4815**, but is co-channel with fellow Brazilian Radio Nacional Tabatinga at 10kW, the latter working from 1000 to 0300 (Saturday and Sunday around the clock).

Not often heard, owing to

other Latin American co-channel occupants, is Radio Educadora, Braganca on **4825**. At 5kW it is on the air from 0900 to 0200.

Easily and regularly logged are the signals of Radio Nacional de Manaus, Manaus on **4845**, probably not surprisingly as the power is 250kW. The schedule is from 1030 to close-down at 0215, although this is variable to 0400.

There are two seldom heard Brazilians operating on **4865**, the first being the 5kW Radio Verdes Florestas, Cruzeiro do Sul, operating from 2300 to 0300 (Sunday until 0200), and the second being the 1kW Radio Sociedade, Feira de Santana, which closes at 0300.

Radio Nacional, Boa Vista is on **4875**. At 10kW, it transmits from 0930 through to 0315 but on occasions to 0400. Co-channel is the more often heard Radio Jornal do Brasil in Rio de Janeiro radiating from 0900 to 0500 with a power of 10kW. The 5kW Radio Difusora Acreana in Rio Branco on **4880** is a regular visitor to many listening posts here in the UK. It operates from 0900 to 0400. The often logged Radio Clube do Para in Belem is on **4885**, at which frequency it transmits from 0800 to 0400 at 5kW. On **4905** another Brazilian co-channel problem is evident. The 5kW Radio Relogio Federal, Rio de Janeiro closes at 0330 and is easily identified by its transmission of time signal pips superimposed on programme material. The 1kW Radio Araguaia in the town of that name closes at 0300.

Regularly heard is Radio Anhanguera in Goiania at 10kW on **4915**. Scheduled around the clock, it is now reportedly closing around 0700. The co-channel Radio Nacional in Macapa is not so often logged. At 10kW, it closes at 0300. On **4945** the Radiobras station Radio Nacional in Porto Velho signs off at 0200 (Sunday at 0100) and has a power of 50kW, being regularly heard here in the UK.

The 1kW Radio Poti, Natal, closes at 0400 but can vary to **4962**, whilst Radio Alvorada, Parintins at 5kW signs off at 0200. For a Portuguese language transmission from Radio Poti, listen after 0200. Radio Brasil Central, Goiania, has a 24-hour schedule on, or near, **4985**, the frequency being variable. The power is 10kW and it is regularly heard in the UK.

The 2.5kW Radio Cultura, Campos, closes around 0400 on **4955**. Also on or near this frequency is another Brazilian in the shape of Radio Marajoara, Belem. At 10kW, it signs off at 0300, but can vary to **4955.4**.

In Teresina, Radio Pioneira is on the air from 0700 to 0400 at 1kW. The frequency is **5014.6** and it is regularly reported by European DXers. Radio Jornal de Transamazonica, Altamira, is scheduled from 0800 to 0200 at 5kW on **5025**, but this can vary to **5027**. Also on **5025** is Radio Borema in the town of that name, being active from 0800 to 0430 with a power of 1kW. The former is that most often listed in SWL reports. Yet another Brazilian now reported on this channel is the 5kW Radio Morimoto in Ji-Parana, schedule unknown.

The 2.5kW Radio Aparecida, Apariceda, transmits from 0800 to 0300 on **5035** but is only occasionally heard in the UK. In Belem, the now reactivated Radio Cultura do Para on **5045** radiates from 0800 to 0300 with a power of 10kW, but does sometimes work around the clock. The rarely heard 1/5kW Radio Continental, ex-Radio Maua, Rio de Janeiro, is on **5055** from 0800 to 0300.

AFRICA

Angola

Emisora Regional da Huila on **4820** at 2015, a talk in Portuguese with several mentions of Savimba, this being followed by some martial music then the station identification as Radio Nacional. Radio Nacional, Luanda was

SHORT WAVE NEWS

heard at 1953 on **4952**, a talk in Portuguese being followed by the station identification at 2000.

Chad

N'Jamena on **4918** at 1930, announcements then play theatre in French. At 2156 retune, some announcements, identification, choir, then an orchestral rendition of the National Anthem and off at 2200. At 100kW, N'Jamena is on the air in French and vernaculars from 0500 to 0730 (Sunday until 0600) and from 1600 to 2200 (Saturday until 2300).

N'Jamena has also been heard on **4905** at 0454 with the interval signal, orchestral National Anthem, then a choir with a patriotic song, only to be wiped out by a jamming transmission, presumably emanating from Libya.

Kenya

The Voice of Kenya, Nairobi on **4885** at 1851, OM with a talk in vernacular including mentions of Angola, Zambia and Zimbabwe. Six pips at 1900 were followed by the station identification and a newscast in vernacular. At 100kW, Nairobi transmits in vernaculars and Somali from 0200 to 0600 (Sunday from 0330 to 0600) and from 1400 to 2000 (Saturday until 2110) in vernaculars and English.

Mali

Bamako on **4783.8** at 2400, OM with the station identification in French then a martial band with the National Anthem. At 18kW, Bamako radiates in French and vernaculars from 0600 to 0800 Monday to Saturday and from 1800 to 2400 daily.

Niger

Niamey on **3260** at 2200, YL with announcements in French then a choral version of the National Anthem. Voix de Sahel is scheduled in French from 0530 to 0700 and from 1630 to 2300 with a power of 4kW.

Nigeria

Lagos on **3266** at 2235, piano jazz music then a pop song in English. Lagos on this channel operates in English and vernaculars from 0430 to 1045 and from 1700 to 2305 with a

power of 50kW.

Rwanda

Kigali on **3330** at 1942, OM with a news bulletin in French. The schedule is from 0300 to 0600 and from 0900 to 2100 (Sunday from 0300 to 2100) at 5kW.

Swaziland

Trans-World Radio, Manzini on **3200** at 1934, OM with a USA taped religious talk in the English programme timed from 1900 to 2015. The power is 25kW.

CENTRAL AMERICA

Costa Rica

Radio Reloj, Irazu on **4832** at 0735, OM with the full station identification, YL with announcements, songs in Spanish. This 3k transmitter is on the air from 2200 to 1000.

Radio Impacto, San Jose on **5030** at 0042, OM and YL with local news items in Spanish mentioning Samoja and Costa Rica, with the station identification following at 0048.

SOUTH AMERICA

Brazil

Radio Cultura do Para, Belem on **5045** at 0730, OM announcements in Portuguese, a song, cock crow and more announcements then folkloric songs and music. At 10kW, the schedule is Monday to Friday from 0700 to 0300 (Saturday and Sunday from 0800 to 0400).

Ecuador

Radio Quito, Quito on **4920** at 0440, OM with a newscast in Spanish, various promotions, then the station identification as Radio Quito, La Voz de la Capital.

Peru

Radio Tacna, Tacna on **6570** at 2253, OM with a sports commentary in Spanish, the daily schedule being from 0900 to 0500 and the power at just 0.2kW.

Venezuela

Radio Capital, Caracas on **4850** at 0656, OM with the station identification followed by a programme of local pops in Spanish. This 1kW station is on the air from 1000 to 0400 (Saturday and Sunday around the clock),

being regularly heard here in the UK.

ASIA

China

Zhejiang PBS, Hangzhou on **2475** at 2248, a seemingly interminable talk in Chinese.

Guangxi PBS on **5049.7** at 1541, OM with announcements then a programme of lovely songs sung by a YL.

India

AIR Simla on **3223** at 1605, OM with a talk in Hindi. AIR Guwahati on **3235** at 1600, announcements, OM with a talk in vernacular, songs and music. AIR Kurseong on **3355** at 1550, YL with a talk in English about local affairs. AIR Delhi on **3365** at 1553, in parallel with Kurseong. AIR Delhi on **4860** at 1538, YL in English with news of local events. AIR Delhi on **4990** at 0035, songs and music, announcements in Tamil, also in parallel on **3905**.

Taiwan

A relay of WYFR on **6300** at 2341, hymn 'Onward Christian Soldiers' in English, YL with announcements in Chinese then a bible reading in English, read at slow speed. All in a programme for China timed from 2300 to 2400.

North Yemen

San'a on **4853** at 0300 when signing on, OM with the station identification, orchestral rendition of the National Anthem and news headlines followed by recitations from the Holy Koran, all in Arabic. Previously inactive, this one was first heard in early January, but at that time listed by the writer as unidentified. Radio San'a is on the air in Arabic from 0300 to 0730 (Friday until 2100) and from 1500 to 2100. The power is 20kW.

SOUTH-EAST ASIA

Indonesia

RRI Sibolga on **5256.3** at 1522, OM with a talk in Indonesian, the transmission being wiped out by interference a few minutes later. The 1kW RRI Sibolga is scheduled in Indonesian from 1000 to 2200 and from 2300 to 0100.

North Korea

Radio Pyongyang on **2849.8**

at 1533, orchestral music then OM with a talk in Korean. At 120kW, this one operates in Korean from 2000 to 1800.

Laos

Savannakhet on **7383.7** at 1328, OM with a talk, announcements, YL with some songs, plucked string music, announcements in Lao and off without the National Anthem at 1358. Logged on several occasions.

Mongolia

Ulan Bator on **4080** at 2242, OM with a talk in Mongolian, YL with announcements, the station identification and a newscast at 2300.

Thailand

Bangkok on **9655.5** at 1230, chimes interval signal, OM with the station identification 'This is HSK9 Radio Thailand', an announcement of the parallel **11905** channel, all in English, then into the announced Kmer programme for Cambodia.

DIAL SEARCH

The fifth edition of *Dial Search*, the listener's checklist and guide to European broadcasting, published biannually, is now available at booksellers at £3.25 or direct from the publisher, George Wilcox, 9 Thurrock Road, Eastbourne, East Sussex BN20 9NF, at £3.60 post paid (overseas £4.00 or 18 IRCs).

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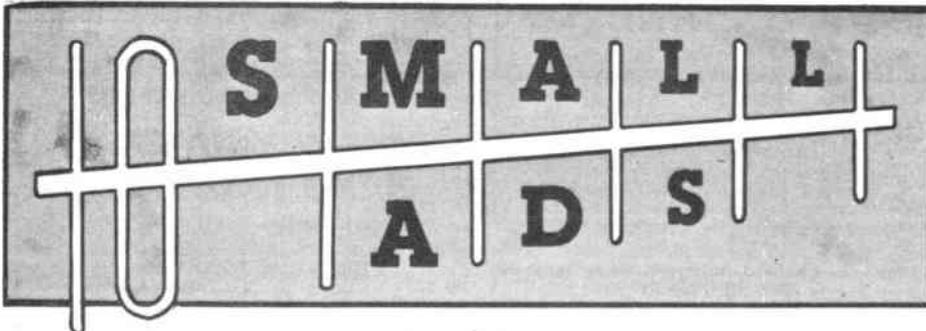
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Valves (especially types PY4, PY25, KT66 and equivalents) klystrons, transistors, RF plugs, valve amplifiers eg quad, Radford leak 5/9/60, Decoia and associated speakers eg Tannoy 15 inch, and associated record decks eg Garrard 301, Thorens TD124 Mark II.

**ALSO, WE SUPPLY TO TRADE AND INDUSTRY,
VALVES, KLYSTRONS, TRANSISTORS**

BILLINGTON VALVES

**39 HIGHLANDS RD, HORSHAM WEST,
SUSSEX RH13 5LS. PHONE 0403 864086
FAX 0403 210108 TELEX 87271**

**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

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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
The communications and electronics magazine **World**

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 81 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 384	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
267 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 thurs	
May 88	12 Mar 88	23 Mar 88	25 Mar 88	14 Apr 88	
Jun 88	14 Apr 88	20 Apr 88	22 Apr 88	12 May 88	
Jul 88	12 May 88	18 May 88	20 May 88	9 Jun 88	
Aug 88	16 Jun 88	22 Jun 88	24 Jun 88	14 Jul 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.</p> <p>COPY Except for County Guides copy may be changed monthly. No additional charges for typesetting or illustrations (except for colour separations). For illustrations just send photograph or artwork. Colour Ad rates do not include the cost of separations.</p>	<p>Printed — web-offset.</p> <p>PAYMENT Above rates exclude VAT. All single insertion ads are accepted on a pre-payment basis only, unless an account is held. Accounts will be opened for series rate advertisers subject to satisfactory credit references. Accounts are strictly net and must be settled by publication date.</p> <p>FOR FURTHER INFORMATION CONTACT Radio & Electronics World, Sovereign House, Brentwood, Essex CM14 4SE (0277) 219876</p>	<p>Overseas payments by International Money Order. Commission to approved advertising agencies is 10%.</p> <p>CONDITIONS 10% discount if advertising in both Radio & Electronics World and Amateur Radio. A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p>



£1 BAKERS DOZEN PACKS

Price per pack is £1.00 * Order 12 you may choose another free. Items marked (sh) are not new but guaranteed OK.

- 1 - 513 amp ring main junction boxes
- 2 - 513 amp ring main spur boxes
- 5 - 3 flush electrical switches
- 7 - 4in flex line switches with neons
- 8 - 2 80 watt brass cased elements
- 9 - 2 mains transformers with 6V 1A secondaries
- 10 - 2 mains transformers with 12V 1/2A secondaries
- 11 - 1 extension speaker cabinet for 6 1/2" speaker
- 12 - 5 octal bases for relays or valves
- 13 - 12 glass reed switches
- 14 - 4 CQP 70 photo transistors
- 16 - 4 tape heads, 2 record, 2 erase
- 17 - 1 ultrasonic transmitter and 1 ditto receiver
- 18 - 2 15000 mfd computer grade electrolytics
- 19 - 2 light dependent resistors
- 20 - 5 different micro switches
- 21 - 2 mains interference suppressors
- 22 - 2 25 watt crossover units 2 way
- 23 - 1 40 watt 3 way crossover unit
- 28 - 1 16 digit counter mains voltage
- 30 - 2 Nicad battery chargers
- 31 - 1 key switch with key
- 32 - 2 humidity switches
- 34 - 96 x 1 metre lengths colour-coded connecting wires
- 36 - 2 air spaced 2 gang tuning condensers
- 37 - 2 solid dielectric 2 gang tuning condensers
- 38 - 10 compression trimmers
- 41 - 6 Rocker Switches 10 amp mains SPST
- 43 - 5 Rocker Switches 10 amp SPDT Centre Off
- 44 - 4 Rocker Switches 10 amp DPST
- 45 - 1 24 hour time switch mains operated (sh)
- 46 - 1 6 hour clock timeswitch
- 48 - 2 6V operated reed switch relays
- 49 - 10 neon valves - make good night lights
- 50 - 2 x 12V DC or 24V AC, 4 CO relays
- 51 - 1 x 12V 2C 0 very sensitive relay
- 52 - 1 12V 4C relay
- 55 - 1 locking mechanism with 2 days
- 56 - Miniature Uniselector with circuit for electric gigaw
- 57 - 5 Dolls' Houses switches
- 60 - 5 ferrite rods 4" x 5/16" diameter aerials
- 61 - 4 ferrite slab aerials with L & M wave coils
- 62 - 4 200 ohm earpieces
- 63 - 1 Mullard thyristor trigger module
- 64 - 10 assorted knobs 1/4" spindles
- 65 - 5 different thermostats, mainly bi metal
- 66 - Magnetic brake - stops rotation instantly
- 67 - Low pressure 3 level switch
- 69 - 2 25 watt pots 8 ohm
- 70 - 2 25 watt pots 1000 ohm
- 71 - 4 wire wound pots - 18, 33, 50 and 100 ohm
- 73 - 4 3 watt wire wound pots 50 ohm
- 77 - 1 time reminder adjustable 1-60 mins
- 78 - 5 5 amp stud rectifiers 400V
- 85 - 1 mains shaded pole motor 3/4" stack - 1/4 shaft
- 86 - 2 5" ali fan blades fit 1/4" shaft
- 87 - 2 3" plastic fan blades fit 1/4" shaft
- 88 - Mains motor suitable for above blades
- 89 - 1 mains motor with gearbox 1 rev per 24 hours
- 91 - 2 mains motors with gearbox 16 rpm
- 93 - 4 11 pin moulded bases for relays
- 94 - 5 B7G valve bases
- 95 - 4 skirted B9A valve bases
- 96 - 1 thermostat for fridge
- 98 - 1 motorised stud switch (sh)
- 101 - 1 2 1/2 hours delay switch
- 103 - 1 6v mains power supply unit
- 104 - 1 4 1/2 V mains power supply unit
- 105 - 1 5 pin flex plug and panel socket
- 107 - 15" speaker size radio cabinet with handle
- 109 - 10 1/4" spindle type volume controls
- 110 - 10 slider type volume controls
- 112 - 1 heating pad 2000 watts mains
- 114 - 1 1W amplifier Mullard 1172
- 115 - 1 Wall mounting thermostat 24V
- 118 - 1 Teak effect extension 5" speaker cabinet
- 120 - 2 pcb with 2 amp full wave and 17 other recs
- 122 - 10 mtrs twin screened flex white pvc outer
- 132 - 2 plastic boxes with windows, ideal for interrupted beam switch etc
- 155 - 3 varicap push button tuners with knobs
- 188 - 1 plastic box, sloping metal front, 16x95mm, average depth 45mm
- 243 - 2 speakers 8" x 4" 15 ohms 5 watt made for Radiomobile
- 266 - 2 mains transformers 9V 1/2A secondary split primary so OK also for 11V
- 330 - 2 6V 0.6V mains transformer .3a pcb mounting
- 350 - 40 double pole leaf switches
- 365 - 1 7uf 660V 50hz metal cased condenser
- 453 - 453 - 2 2 1/4 in 60 ohm loudspeakers
- 454 - 2 2 1/4 in 8 ohm loudspeakers
- 453 - 1 mains operated relay with 2 sets c/o contacts
- 464 - 2 packets resin filler/sealer with cures
- 465 - 3 5A round 3 pin plugs will fit item 193
- 466 - 4 7 segment led displays
- 470 - 4 pc boards for stripping, lots of valuable parts
- 498 - 4 1000uf 25V axial electrolytic capacitors
- 504 - 1 Audax PM 8" speaker 15 ohms 5 watt rating
- 515 - 100 4BA 1 1/2" cheesehead plated screws and 100 4BA nuts
- 541 - 1 pair stereo tape head as in cassette recorder/players
- 546 - 1 bridge rectifier 600V international rectifier ref 3SB100
- 548 - 2 battery operated relays (3-6v) each with 5A c/o contacts 2 pairs
- 553 - 2 lithium 3V batteries (everlasting shelf life)

5A BATTERY CHARGER KIT all parts including case only £5 add £1 postage.

OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's dozen range and you can become entitled to a free gift with each dozen packs.

A classified list of these packs and our latest 'News Letter' will be enclosed with your goods and you will automatically receive our next news letter.



THIS MONTHS SNIP

3 1/2 floppy Disk Drive, made by the Chicon Company of Japan. Beautifully made and probably the most compact device of its kind as it weighs only 600g and measures only 104mm wide, 162mm deep and has a height of only 32mm, other features are high precision head positioning - a single push loading and eject - direct drive brushless motor - 500K per disc - Shugart compatible interface - standard connections - interchangeable with most other 3 1/2 and 5 1/4 drives. Brand new with copy of makers manual. Offered this month at £28.50 post and VAT included

CASE - adaptable for 3 or 3 1/2 FDD has room for power supply components price only £4 includes circuit of PSU Our Ref 4P8.

POWER SUPPLY FOR FDD - 5V and 12V voltage regulated outputs complete kit of parts will fit into case 4P8 price £8 or with case £11

MULLARD UNILEX AMPLIFIERS

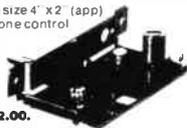
We are probably the only firm in the country with these new in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules - ie Mains power unit (EP9002) Pre amp module (EP9001) and two amplifier modules (EP9000) all for £6.00 plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

CAT STARTER/CHARGER KIT

Fearfully Don't worry you will start your car in a few minutes this unit - 250 watt transformer 20 amp rectifiers case and all parts with data case £17.50 post £2

MINO MONO AMP

Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new perfect condition offered at the very low price of £1.15 each, or £13 for £12.00.



LIGHT BOX

This when completed measures approximately 15 x 14" The light source is the Philips fluorescent 'W' tube. Above the light a sheet of fibreglass and through this should be sufficient light to enable you to follow the circuit on fibreglass PCBs. Price for the complete kit that is the box choke starter tube and switch and fibreglass is £5 plus £2 post order ref 5P69.

TANGENTIAL HEATERS

We again have very good stocks of this quiet running instant heat units. They require only a simple case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1 2kw 2kw, 2.5kw and 3kw. Prices are £3 each for the first 3 and £6.95 for the 3k. Add post £1.50 per heater if not collecting.

CONTROL SWITCH enabling full heat, half heat or cold blow with connection diagram 50p for 2kw 75p for 3kw

FANS & BLOWERS

5 £5 - £15 post 6" £6 + £1.50 post
4" x 4" Muffin equipment cooling fan 115V £2.00
4" x 4" Muffin equipment cooling fan 230/240V £5.00
9" Extractor or blower 115V supplied with 230 to 115V adaptor £9.50 - £2 post

All above are ex computers but guaranteed 12 months 10" x 3" Tangential Blower New Very quiet - supplied with 230 to 115V adaptor on use two in series to give long blow £2.00 - £1.50 post or £4.00 - £2.00 post for two

9" MONITOR

Ideal to work with computer or video camera uses Philips black and white tube ref M24/306W Which tube is implosion and X-Ray radiation protected. VDU is brand new and has a time base and EHT circuitry. Requires only a 15V dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only £16 plus £5 post

LOW COST OSCILLOSCOPE

Kit to convert our 9" monitor into an oscilloscope with switched time bases to allow very high and very low frequency waveforms to be observed and measured. Signal amplitudes from as low as 10mV and as high as 1kV can easily be observed and measured. Ideal for servicing also for investigating TV, radio and audio circuits.

Kit containing all the parts for the conversion and the power supply to operate from mains £25 our ref 2P53

TELEPHONE LEAD

3mtrs long terminating one end with new BT flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price £1 ref BD552 or 3 for £2 ref 2P164

COMPACT FLOPPY DISC DRIVE EME-101

The EME-101 drives a 3 1/2" disc of the new standard which despite its small size provides a capacity of 500k per disc which is equivalent to the 3 1/2" and 5 1/4" discs. We supply Operators Manual and other information showing how to use this with popular computers BBC Spectrum Amstrad etc. All at a special snip price of £27.50 including post and VAT. Data available separately £2. refundable if you purchase the drive

POWERFUL IONISER

Generates approx 10 times more IONS than the ET1 and similar circuits. Will refresh your home, office shop workroom etc. Makes you feel better and work harder - a complete mains operated kit case included £11.50 - £3 P&P

J & N BULL ELECTRICAL DEPT RE, 250 PORTLAND ROAD, HOVE BRIGHTON, SUSSEX BN3 5QT

MAIL ORDER TERMS: Cash, PO, or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B/card orders accepted. Brighton (0273) 203500.

NEW ITEMS

Some of the many described in our current list which you will receive with your parcel

POWERFUL 12v MOTOR - was intended for the Sinclair electric car. Rated approx 1 1/2hp £15 Ref 15P8

BURGLAR ALARM BELL - 6 gong-OK to fix outside in the rain and shelter - mains operation £8 Ref 8P2

AGAIN AVAILABLE - 12 mini fluorescent tubes - Price £1 each Ref BD314

POWER PACK OF AMPLIFIER CASE - Size approx 10 x 8 1/4 x 4 3/4 plated steel - with ample perforations for cooling. Front panel has on/off switch and EEC mains inlet plug with built-in RF filter - undoubtedly a very fine case which would cost at least £50 from regular sources, our price is £5 each and £3 post. Ref 5P111

MINIATURE BCD THUMP WHEEL SWITCH - Matt black edge switch engraved white on black - gold plated make before break contacts - size approx 25mm high 8mm wide 20mm deep - made by the famous Cherry Company and designed for easy stacking - Price £1 each Ref BD601

EDGE METER - miniature, whole size approx 37mm x 13mm 100 uafsd - centre zero scaled 0 to -10 and 10 to +10 Price £1 each. Ref. BD602

24hr TIME SWITCH - 16A c/o contacts - up to 6 on/off per day - cased intended for wall mounting Price £8 Ref 8P6

CAPACITOR BARGAIN - axial ended - 4700uf or 25v Jap made Normally 50p each but you will get 4 for £1 Ref 613

CLEANING FLUID - Extra good quality - intended for video and tape heads - regular price £1.50 per spray can - our Price - 2 cans for £1 Ref BD604

DON'T FREEZE UP! - We have had the strongest winds for over 200 years and who knows we may be in for the coldest winter, so if you have not already protected your water pipes you should do so now - our heating wire would protect the pipes well do this and will only about 50p per week to run - 15 metres (minimum length) to connect to 230/240v mains! Price £5 Our Ref 5P 109

FREED ELECTRIC FAN - an unusual fan more like the one used by Madame Butterfly, than the conventional type, it does not rotate. The air movement is caused by the two vibrating arms. It is American made, mains operated, very economical and causes no interference. So it is ideal for computer and instrument cooling. Price is only £1 each Ref BD605

SPRING LOADED TEST PRODS - heavy duty, made by the famous Bulgin company. Very good quality. Price four for £1. Ref BD599

CURLY LEAD four core, standard replacement for telephone handset, extends to nearly two metres. Price £1 each Ref BD599

TELEPHONE BELLS - these will work off our standard mains through a transformer but to sound exactly like a telephone, they then must be fed with 25Hz 50v. So with these bells we give a circuit for a suitable power supply. Price 2 bells for £1. Ref: BD600

ULTRA SENSITIVE POCKET MULTIMETER - 4k ohms per volt - 11 ranges - carry one of these and you be always ready to test a/c/d/volts to 1000, DC milliams and have an ohms range for circuit testing - will earn its cost in no time. Price only £7. Ref 7P2

BLOW YOUR ROOF OFF 140 watt speaker systems - new type you must not hide! They have golden cones and golden surrounds and look really 'bootiful' 12 Woofer, Midrange and Tweeter and comes with a crossover at a special introductory price of £49, carriage paid. Two sets for £95 carriage paid! 140W Woofer only £35 carriage paid

SWITCH MODE PSU Mains input 2 output plus 5v at 3.5 amps plus 12v at 1.5 amps. Very compact (6 1/2" x 4" x 2"), ideal for driving 1 or more floppy discs. Regular price around £30. Our price only £10 brand new. Ref: 10P34

APPLIANCE THERMOSTATS - spindle adjust type suitable for convector heaters or similar price 2 for £1 Ref: BD582

COMPUTERS

Big consignment of computers expected in mid Jan, various makes and numbers, write or phone for details

NOVEL NIGHT LIGHT - plugs into a 13A socket. Gives out a surprising amount of light, certainly enough to navigate along passages at night or to keep a nervous child happy. Very low consumption, probably not enough to move the meter. Price £1 Ref BD563

CASE WITH 13A PRONGS - to go into 13A socket nice size and suitable for plenty of projects such as car battery trickle charger speed controller, time switch, night light, noise suppressor, dimmers etc Price - 2 for £1 Ref BD565

SPEAKER EXTENSION CABLE - twin 0.7mm conductors so you can have long runs with minimum sound loss and for telephone extensions or burglar alarms, bells, intercoms etc 250m coil only £3 plus £1 post. Ref: 3P28

ALPHA-NUMERIC KEYBOARD - this keyboard has 73 keys with contactless capacitance switches giving long trouble free life and no contact bounce. The keys are arranged in two groups, the main area field is QWERTY array and on the right is a 15 key number pad, board size is approx 13" x 4" - brand new but offered at only a fraction of its cost namely £3, plus £1 post. Ref: 3P27

TELEPHONE EXTENSIONS - it is no legal for you to undertake the wiring of telephone extensions. For this we can supply 4 core telephone cable 100m coil £8.50. Extension BT sockets £2.95. Packet of 500 plastic headed staples £2. Dual adaptor for taking two appliances from one socket £3.95. Leads with BT plug for changing old phones 3 for £2

MODULAR SWITCH - Panel mounting highest quality and ideal where extra special front panel appearance is required, can be illuminated if required dpdt and latching. Price - 2 for £1 Ref: BD567

WIRE BARGAIN - 500 metres 0.7mm solid copper tinned and pvc covered. Only £3 - £1 post. Ref: 3P31 - that's well under 1p per metre and this wire is ideal for push on connections.

INTERRUPTED BEAM KIT - this kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components - relay photo transistor, resistors and caps etc. Circuit diagram but no case. Price £2. Ref: 2P15

3-30V VARIABLE VOLTAGE POWER SUPPLY UNIT - with 1 amp DC output intended for use on the bench for experiments students inventors service engineers etc. This is probably the most important piece of equipment you can own (After a multi-range test meter). It gives a variable output from 3-30 volts and has an automatic short circuit and overload protection which operates at 1.1 amp approx. Other features are very low ripple output a typical ripple is 3mV pk pk 1mV rms. Mounted in a metal fronted plastic case this has a voltmeter on the front panel in addition to the output control knob and the output terminals. Price for complete kit with full instructions is £15 Ref 15P7

TRANSMITTER SURVEILLANCE (BUG) tiny easily hidden but which will enable conversation to be picked up with FM radio. Can be housed in a matchbox all electronic parts and circuit Price £2 Ref: 2P52



BIPAK BARGAINS



THE UNDISPUTED PACK KING FOR OVER 20 YEARS, we offer you the very best in Electronic Components and Semiconductors that your money can buy. Look at our lists and prices, they are unbeatable in value and quantity and you always have our "Satisfaction or money back guarantee". For 1988 we offer more and more Super Value Packs. All goods advertised in stock at time of going to press. Please note our new mail order address: **BIPAK, PO BOX 33, ROYSTON, HERTS, SG8 5DF. Telephone orders: 0763-48851.**

Pak No	Qty	Description	Price
RESISTORS			
VP1	300	Assorted Resistors, mixed values and types	£1.00
VP2	300	Carbon Resistors 1/4-1/2 watt, preformed mixed	£1.00
VP4	200	1/2 watt Resistors, mixed values and types	£1.00
VP16	50	Wirewound Resistors, mixed watt values	£1.00
VP140	50	Precision Resistors, 1% tolerance	£1.00
VP180	100	1 and 2 watt Resistors, assorted values	£1.00
VP287	100	Close tolerance Resistors 0.5-2%, 10-910 ohms mixed	£1.50
VP288	100	Close tolerance Resistors 0.5-2%, 1K-320K mixed	£1.50
VP289	100	Metal oxide high stab Resistors, 1/4w 2% mixed values	£1.50
CAPACITORS			
VP5	200	Assorted Capacitors all types	£1.00
VP6	200	Ceramic Capacitors all types	£1.00
VP9	100	Assorted Polyester/Polystyrene Capacitors	£1.00
VP10	60	2200 Capacitors, metal foil, mixed values	£1.00
VP11	50	Electrolytics, all sorts	£1.00
VP12	40	Electrolytics, 47mf-150mf mixed volts	£1.00
VP13	30	Electrolytics, 150mf-1000mf mixed volts	£1.00
VP14	50	Silver Mica Caps, mixed values	£1.00
VP15	25	10/250v Min. Layer Metal Caps	£1.00
VP18	25	Tantalum Bead Caps, assorted values	£1.00
VP22	4	1000uf 50v Electrolytics	£1.00
VP192	30	Min. Electrolytics, mixed values 47mf-1000mf 6/16v	£1.00
VP193	6	Sub Min. Electrolytics 2 x 1000/2200/3300mf 10/16v	£1.00
OPTOS			
VP24	10	125' clear lens showing Red LED's	£1.00
VP25	10	Mixed shape and colour LED's	£1.00
VP26	15	Small 2' Red LED's	£1.00
VP27	15	Large 2' Red LED's	£1.00
VP28	10	Rectangular 2' Red LED's	£1.00
VP27	25	Opto Special Pack. Assorted, super value	£3.00
VP130	6	RED 7 Seg. CC 14mm x 7.5mm RDP FN0353 LED Display	£2.00
VP131	6	GREEN 7 Seg. CA 5' LDP XAN6520 LED Display	£2.00
VP134	6	RED Overflow 6' 3x CA 3x CC 6530/50 LED Display	£2.00
VP133	5	GREEN Overflow 6' CA XAN6530 LED Display	£2.00
VP138	20	Assorted LED Displays. Our mix with data.	£5.00
VP197	1	Pair Opto Coupled Modules	£0.60
VP149	4	LD7078 LED Displays CA	£1.00
VP203	15	Triangular shaped LEDs, mixed colours	£1.00
VP204	10	Large Green LED's 5mm	£1.00
VP205	10	Small Green LED's 3mm	£1.00
VP206	10	Large Yellow LED's 5mm	£1.00
VP207	10	Small Yellow LED's 3mm	£1.00
VP208	10	Large LED's clear showing Red, 2'	£1.00
VP212	4	OR212 Light Dependent Resistors	£1.00
VP242	3	Tri-colour LED's 5mm dia, 5mA 2v, R.G.Y.	£1.00
VP243	3	Tri-colour LED's Rectangular 5mm R.G.Y.	£1.00
VP266	10	Orange LED's 5mm large	£1.00
VP267	8	Stackable LED's Rectangular mixed R.G.Y.	£1.00
VP268	15	LED Panel Mounting Clips, metal and plastic 3-5mm	£1.00
VP269	1	Red Flaming LED's	£1.00
VP284	2	Opto-Isolator IL74-4N27, single	£1.00
VP285	1	Dual Opto-Isolator ILD74	£1.00

Pak No	Qty	Description	Price
DIODES & SCRS			
VP29	30	Assorted volt Zeners 50mw-2w	£1.00
VP30	10	Assorted volt Zeners 100v coded	£1.00
VP31	10	5A SCR's 706 50-400v	£1.00
VP32	20	3A SCR's T066 up to 400v uncoded	£1.00
VP33	100	Sil. Diodes like IN4148	£1.00
VP34	200	Sil. Diodes like OA200/BAX13-16, 40v 200mA	£1.00
VP35	50	1A IN4000 Diodes, all good, uncoded, 50v min.	£1.00
VP49	30	Assorted Sil. Rectifiers 1A-10A mixed volts	£1.00
VP141	40	IN4002 Sil. Transistors, 1A 100v, preformed pitch	£1.00
VP142	4	40A Power Rectifiers, silicon, T048 300 PIV	£1.00
VP143	5	BY187 12KV Sil. Diodes, in carriers, 2.5MA	£1.00
VP184	3	4A 400v Tracs, plastic	£1.00
VP187	10	SCR's 800MA, 200v, 2N5064 plastic, T092	£1.00
VP194	50	0A91 point contact germanium Diodes, uncoded	£1.00
VP195	50	0A91 point contact germanium Diodes, uncoded	£1.00
VP196	50	0A70-79 detector germanium Diodes	£1.00
VP197	50	0A90 type germanium Diodes, uncoded	£1.00
VP198	40	BA248 Sil. Diodes, 350v 2A, fast recovery	£1.00
VP222	20	3A Stud Rectifiers, 50-400v, assorted	£1.00
VP274	12	SCR's (Thyristors) 1A 100-400v, T0-39	£1.00
VP275	3	4A 400v SCR's, T0220, TIC106D	£1.00
VP276	5	SCR's standard type, 5-16Amp to 400v	£1.00
VP277	4	Tracs 2Amp 400V T0-39	£1.00
VP278	4	6Amp 1000v plastic Silicon Rectifiers	£1.00
VP283	3	Diac BR110, triac trigger	£1.00

Pak No	Qty	Description	Price
TRANSISTORS			
VP38	100	Sil. Transistors, NPN plastic, coded, with data	£3.00
VP39	100	Sil. Transistors, PNP plastic, coded, with data	£3.00
VP47	10	Sil. Power Transistors, similar 2N3055, uncoded	£1.00
VP48	5	Pairs NPN/PNP plastic Power Transistors, 4A, data	£1.00
VP50	60	NPN Sil. Switching Transistors, T0-18 and T0-92	£1.00
VP51	60	PNP Sil. Switching Transistors, T0-18 and T0-92	£1.00
VP60	100	All sorts Transistors, NPN/PNP	£1.00
VP150	20	BC183B Sil. Transistors, NPN 30v 200mA Hfe240 - T092	£1.00
VP151	25	BC171B Sil. Transistors, NPN 45v 100mA Hfe240 - T092	£1.00
VP152	15	T1590 Sil. Transistors, NPN 40v 400mA Hfe100+ T092	£1.00
VP153	15	T1591 Sil. Transistors, PNP 40v 400mA Hfe100+ T092	£1.00
VP154	15	MPS45 Sil. Transistors, PNP 80v 800mA Hfe50 - T092	£1.00
VP155	20	BF955 Sil. Transistors, NPN eqvt BF184 H.F. T092	£1.00
VP156	20	BF495 Sil. Transistors, NPN eqvt BF173 H.F. T092	£1.00
VP157	15	ZTX500 series Sil. Transistors, PNP plastic	£1.00
VP158	15	ZTX107 Sil. Transistors, NPN eqvt BC107 plastic	£1.00
VP159	15	ZTX108 Sil. Transistors, NPN eqvt BC108 plastic	£1.00
VP16	25	BC183L Sil. Transistors, NPN 30v 200mA T092	£1.00
VP162	5	SJE4551 Sil. Power Transistors, NPN 80v 4A Hfe20+	£1.00
VP163	2	NPN/PNP pairs Sil. Power Transistors like SJE4551	£1.00
VP164	4	2N6289 Sil. Power Transistors, NPN 40v 40mA Hfe30+	£1.00
VP165	6	BF733 NPN Sil. Transistors, 80v 5A Hfe50-200 T039	£1.00
VP166	5	BF734 NPN Sil. Transistors, 100v 5A Hfe50-200 T039	£1.00
VP167	1	BUY69 NPN Transistors, T03 VC5 500 10A 100v Hfe15+	£1.00
VP168	10	BC478 eqvt BC071 PNP Sil. Transistors T018	£1.00
VP169	10	BXS21 eqvt BC094 NPN Sil. Transistors 80v 50mA T018	£1.00
VP170	10	Assorted Power Transistors, NPN/PNP coded and data	£1.00
VP171	10	BF355 NPN T0-39 Sil. Transistors, eqvt BF258 225v 100mA	£1.00

MINIATURE CARBON FILM RESISTORS 1/4 & 1/2 WATT 5% Resistance values from 10hm - 10meg ohms. Available in lots of 100 pieces per value. To order state R100 1/4 watt or R200 1/2 watt, plus resistance required, eg R100 1K - 1/4 watt. BIPAK price per 100 pieces R100 £1.00 per pack. R200 £1.30 per pack

Pak No	Qty	Description	Price
TRANSISTORS			
VP172	10	SM1502 PNP T0-39 Sil. Transistors 100v 100mA Hfe100+	£1.00
VP200	30	0C71 type germanium AF Transistors, uncoded	£1.00
VP201	25	0C45 germanium RF Transistors	£1.00
VP261	4	Programmable Unijunction Transistors, MEU22	£1.00
VP270	10	FET's UHF/VHF Amplifiers, switching & choppers data	£1.00
VP271	10	FET's general purpose like 2N3819-2N5457, data	£1.00
VP272	10	MOS-FET's Signetics, SD304	£1.00
VP290	15	MPSA06 Sil. Transistors, NPN 80v 500mA HFE50 - T092	£1.00
VP428	10	AC128K PNP Germanium Transistor, 1A 32v	£1.00
VP429	10	AC176K NPN Germanium Transistors, 1A 32v	£1.00
VP430	4	2N3055 Sil. Power Transistors full spec	£2.00
VP431	25	PNP Sil. Transistors, T0-39 like 2N2905A	£1.00
IC'S			
VP40	40	TTL I.C.s all new gates - Flip Flop - MSI, data	£4.00
VP20	20	Assorted I.C. DIL Sockets, 8-40 pin	£2.50
VP59	20	Assorted I.C.s linear, etc all coded	£2.00
VP209	12	74LS00	£2.00
VP210	12	74LS74	£2.00
VP211	10	CD4001B	£2.00
VP212	10	CD4011B	£2.00
VP214	10	CD4069B	£2.00
VP215	10	741P 8 pin	£2.00
VP216	10	555 Timers 8 pin	£2.00
VP223	50	Asst 74 TTL I.C.s ALL GATES new & coded our mix	£6.00
VP224	100	7400-7465 7400-7455 TTL I.C.s ALL GATES new & coded our mix	£10.00
VP282	1	Prog. Sound Gen. Chip, AY-3-8912	£3.00
VP291	1	Z80ACPU Microprocessor 40 pin DIL	£2.00
VP292	1	Z80AP1 Parallel Interface Controller, 40 pin DIL	£2.00
VP293	1	Z80CTC Counter Timer Circuit, 28 pin DIL	£3.00
VP294	1	Z732D 32K Eprom	£3.00
VP295	1	6821P Peripheral Interface Adaptor (PIA)	£1.50
VP296	6	LM324 14 pin DIL Quad Op-Amp	£2.00
VP297	5	CA3130E MOS-FET I/P CMOS O/P Op-Amp	£2.00
VP298	3	MC1310P Stereo Decoder, 14 pin DIL	£2.00
VP299	8	CA3085 Pos. Volt. Regulator, 1.7v - 46v, 8 pin T05	£2.00
VP400	2	27128 128K Eprom	£2.50
VP401	2	LM317T Adjust. Voltage Regulator, 1.5A	£1.00
VP402	1	2114 4K Static Ram	£2.00
VP403	1	TA7024 Audio Amp I.C. 4.2w, 13v, 2-4 ohms	£1.00
VP404	1	TBA481 Audio Power Amp 4.5w	£1.50
VP405	8	CD4011B	£2.00
VP433	6	CD4017B	£2.00
VP434	10	CD4024B	£2.00
VP435	10	CD4028B	£2.00
VP7413	4	7413 Dual NAND Schmitt Trigger, 4-input	£1.00
VP7440	4	7440 Dual 4-input, Positive-Nand Buffer	£1.00
VP7470	4	7470 And-gated Positive-edge-triggered Flip-Flop preset	£1.00
VP7480	4	7480 Gated full Adder	£1.00
VP7481	4	7481 16-bit Random Access memories	£1.00
VP7484	4	7484 Decade Counter	£1.00
VP7491	4	7491 8-Bit Shift Register	£1.00

Pak No	Qty	Description	Price
I.C.S			
VP7492	4	7492 Divide by 12 Counter	£1.00
VP7493	4	7493 4-bit Binary Counter	£1.00
VP7494	4	7494 4-bit Shift Register	£1.00
VP7495	4	7495 4-bit Shift Register	£1.00
VP7411	4	7411 Dual J-K Master Slave Flip-Flop	£1.00
VP7414	4	7414 BCD - Decimal Decoder/Driver	£1.00
VP7415	4	7415 1 of 8 Data Selectors/Multiplexers	£1.00
VP74151	4	74151 Dual J-K Master Slave flip-flops	£1.00
VP74164	4	74164 8-bit Parallel Output Serial Shift Registers	£1.00
VP74167	4	74167 Synchronous Divide Rate Multipliers	£1.00
VP74174	4	74174 Hex D type Flip-Flops	£1.00
VP74181	4	74181 Arithmetic Logic Units/Function Generators	£1.00
VP74193	4	74193 Synchronous Up/Down Clock Counters Binary	£1.00
VP74279	4	74279 Quad S-R Latches	£1.00
BPX6	1	TTL Data Book 74 Series, inc. LS. Complete with Pin out diagrams, 7400-7470. TTL exchange guide. Function selection guide and explanation of function tables. NO VAT	£1.00
BPX5	1	IC555 PROJECTS BOOK (timer), 167 pages. Over 50 project circuits to build and other information on IC555 Timers. Plus FREE with our compliments 3x IC 555 Timer, worth £1.00. Special offer price just £2.95. NO VAT	£1.00
BPX4	1	INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE, Babani Publishing's latest edition BP95, plus FREE with our compliments, 10 popular Silicon Transistors, worth £1.00. Special offer price just £3.50. NO VAT	£1.00

Pak No	Qty	Description	Price
MISC.			
VP17	50	Metres PVC single strand Wire, mixed colours	£1.00
VP18	30	Metres PVC multi strand Wire, mixed colours	£1.00
VP19	40	Metres PVC single multi strand Wire, mixed colours	£1.00
VP22	200	30 Inches total Copper Clad Board	£1.00
VP23	10	10mm Track Slider Pots, 100K Lin	£1.00
VP42	10	Black Heatinks, fit T03 and T022 drilled	£1.00
VP43	4	Power Fin Heatinks, 2x T03 2x T066	£1.00
VP44	15	Assorted Heatinks, T01/3/5/18/20	£1.00
VP56	100	Semiconductors from around the world, mixed	£4.00
VP82	1	Electronic Buzzer, 3v 25MA	£0.95
VP83	1	Electronic Buzzer, 6v 25MA	£0.95
VP85	1	Electronic Buzzer, 12v 25MA	£0.95
VP86	1	TECASBOTY Components Pack, semiconductors, caps, wire, etc	£8.00
VP87	1	Telephone Pick-up Coil with 3.5mm jack plug	£1.25
VP88	1	1/10w Speaker with 3.5mm jack plug	£1.45
VP107	1	Piezo Buzzer, miniature, 12v	£1.25
VP108	1	Piezo Buzzer, miniature, 240v	£1.25
VP113	1	Coax Antenna Switch, 2 way	£4.50
VP114	1	Coax Antenna Switch, 3 way	£4.75
VP115	1	High Pass Filter/Suppressor, CB/TV	£0.50
VP116	1	Low Pass Filter, VHS/TV bsnd	£3.00
VP122	1	Precision Morse Key, fully adjustable	£1.85
VP144	4	100K Lin multi turn Pots, ideal var. cap tuning	£1.00

Pak No	Qty	Description	Price
VOLTAGE REGULATORS			
VP8	1	amp 7805-12-15-18-24	35p each
VP9	1	amp 7905-12-15-18-24	40p each