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BUILD AN AUDIO AMPLIFIER WITH THE LM380

SONY ICF 7600 RX AND NEW VHF WAVEMETER REVIEWED

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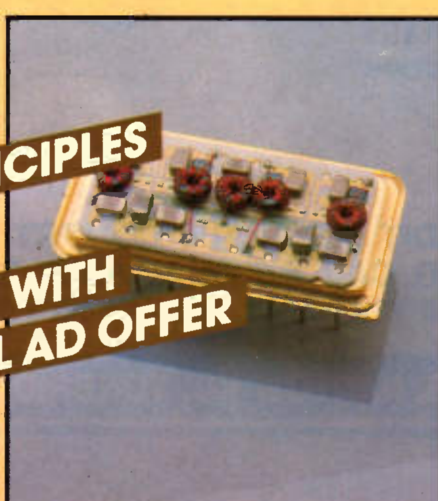

AMATEUR RADIO WORLD

Radio & Electronics World
The communications, electronics & computers magazine

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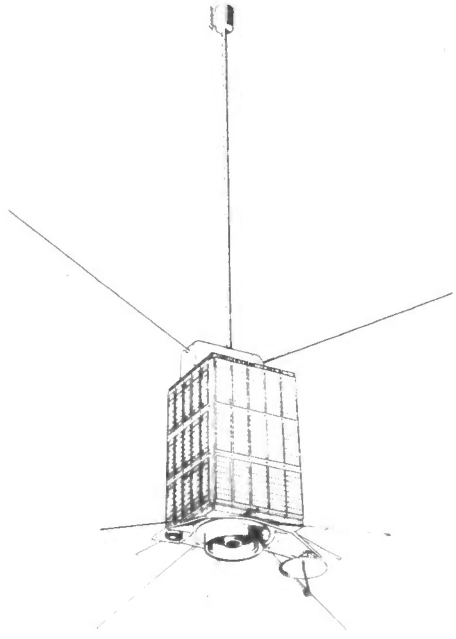

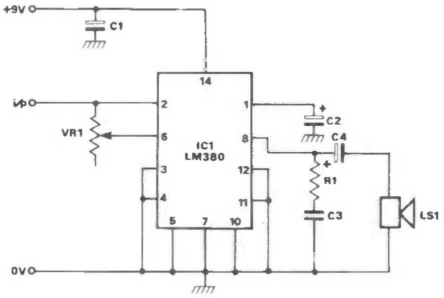

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PRODUCT NEWS

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

AUTORANGING LCD MODULE

The Pantec Division of Carlo Gavazzi (UK) Ltd has introduced a low cost LCD module that is designed for the portable and panel instrumentation markets.

The DMU 1404 offers full autorange facility on five ranges of DC voltage from 200mV to 500V. In addition, the meter unit will measure DC amps from 2mA to 2000A depending on external shunt. Accuracy, at 20°C ± 5°C is ±0.5% of reading, ± 2 digits, and temperature drift is 400ppm/°C.

The module incorporates a 3½ digit, 10mm LCD and featuring autopolarity, overrange indication, selectable decimal point and automatic indication of mV, V, mA and A symbols. It operates from a ±1.5V DC supply, and is designed around a directly bonded CMOS device which provides a high degree of reliability with a typical power consumption of only 5mW. The dimensions are 80 x 40 x 23mm.

Pantec, Carlo Gavazzi (UK) Limited, 162–164 Upper Richmond Road, Putney, London SW15 2SL (Tel: 01-785 9022)

NEW CATALOGUE

The new 'Supercat' Electronics Catalogue will be issued for the first time in January 1984 and is completely *FREE*. The Winter issue contains more than 100 test and measuring instruments, leads, connectors, accessories and kits.

This new Direct Mail catalogue will be of real interest and use to the hobbyist, enthusiast, education and small industrial user as well as general industry and research. This issue contains multimeters, both digital and analogue, oscilloscopes, signal sources including video and TV, power supplies, communication and logic test equipment, attenuators, frequency meters, field strength meters, meggers, general test sets, kits, connectors, leads and accessories. Supercat is free and issued every four months.

The second issue due in the Summer of 1984 will offer the reader a real choice of price, specification, method or ergonomics and will have new products and new product areas.

Supercat Electronics Ltd, PO Box 201, St Albans, Herts AL1 4EN (Tel: 0727 62171)

NEW MAPLIN CATALOGUE AVAILABLE

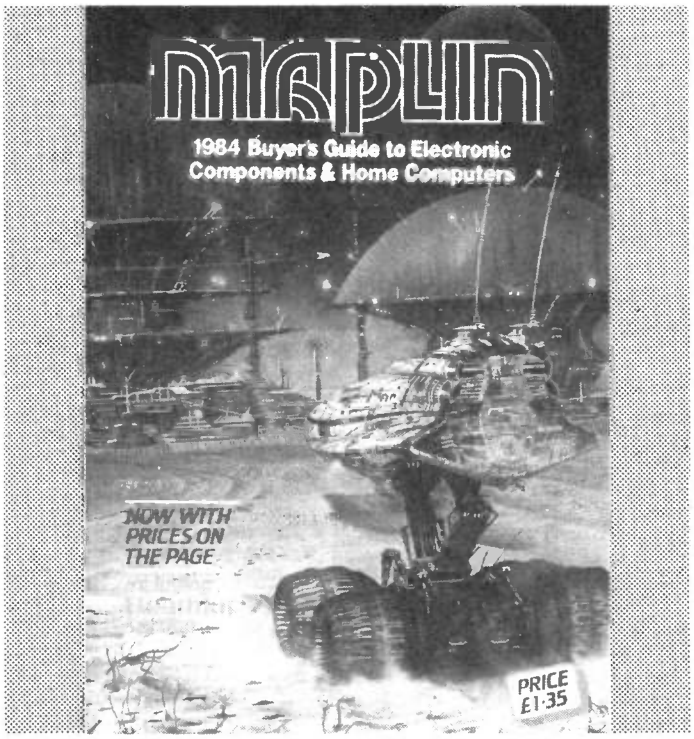
The 1984 edition of the *Maplin Buyer's Guide to Electronic Components and Home Computers* is now available. This catalogue, which has become an established industry guide, now features nearly 500 pages – an increase of 20% over 1983. This reflects the ever extending range of products supplied by Maplin.

A major feature of the new catalogue is the recently introduced range of fully documented kits and educational courses from 'Heathkit'. The kits range from security alarms, digital clocks, personal weather stations and micro programming courses to the world's most user-friendly robot 'Hero I'. Other kits included in the 1984 Maplin catalogue is the 'Matinee Organ' which offers scope for reproducing such sounds as a flute, cello or clarinet in a variety of tempos including waltz, slow rock or Bossa Nova.

The 37 pages of book listings and 60 pages of computer products reflects the ever increasing growth in these areas. On 'special offer' is a comprehensive range of Atari micro software.

Unlike previous editions, the 1984 Maplin Catalogue lists prices alongside the products on each page.

The Maplin 1984 Catalogue, £1.35 (£1.65 to include p&p) is available from Maplin, Rayleigh, and Maplin stores in Birmingham, Hammersmith, London, Manchester, Southampton and Southend or branches of W H Smith.



QTH LOCATOR

This package contains five locator programs. Each cover the 676 squares north and east of 'UA' square. Each input is 'dumped' to the printer so saving memory space, however duplicate callsign entry will be detected. Up to 7000 contacts can be stored on a 48K Spectrum.

The presentation of information is in the following form:-
QRA PLUS – places the operators QTH at the centre of the screen and displays a pointer in the correct beam heading, with distance and points scored for each contact at the bottom of the screen.
With the remaining programs an outline map is drawn of the appropriate area with the two QRA's joined by a line. These programs can be tailored to individual requirements.

Distances are calculated via the Great Circle Route and the points are scored by RSGB Contest Rules. The serial number and running total of points scored are displayed in inverse video. This program will be of use to all amateurs using VHF and requiring a reliable QRA program with the bonus of a

SPRING HAS SPRUNG!

Ambit's Spring '84 catalogue brings all the parts you need for electronics, radio, audio and computing to your front door.

There's details about an exciting new range of kits and modules being launched into the UK in conjunction with the leading German hobby supplier; full information on our two new regional sales counters in Portsmouth and Broxbourne; new low cost instruments from Black Star -plus all your old favourites:

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200 North Service Road, Brentwood, Essex
telephone (0277) 230909

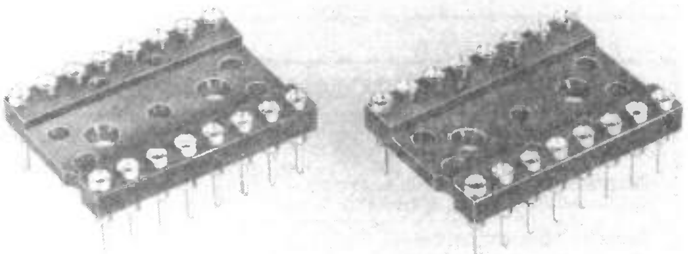
Sales counters at: Park Lane, Broxbourne, Herts
Burrfields Road, Portsmouth

hardcopy printout. Price is £5.00 inc. VAT & p&p.

Scarab Systems, 30 Stafford Street, Gillingham, Kent.

16-PIN COLLET SOCKET

LED or LCD Displays or other devices on 0.500 row-to-row spacing can be mounted with Aries Electronics new 16-pin collet socket. Low-



insertion-force collet sockets are used and are available with solder tail or 2- or 3-level wire wrap pins. Collet sockets with gold contacts and gold body or tin body are in a blue Valox low profile body with a notch for polarization or pin identification. 6- through 14-pin on 0.500 centres are also available (contact factory for details). For applications requiring a raised socket above the PCB, an elevator type is available (as special) to raise the socket as much as 1.250ins.

Aries Electronics, Inc, PO Box 130, Frenchtown, NJ 08825. Tel: (201)996-6841

COMPACT VIDEO MONITOR

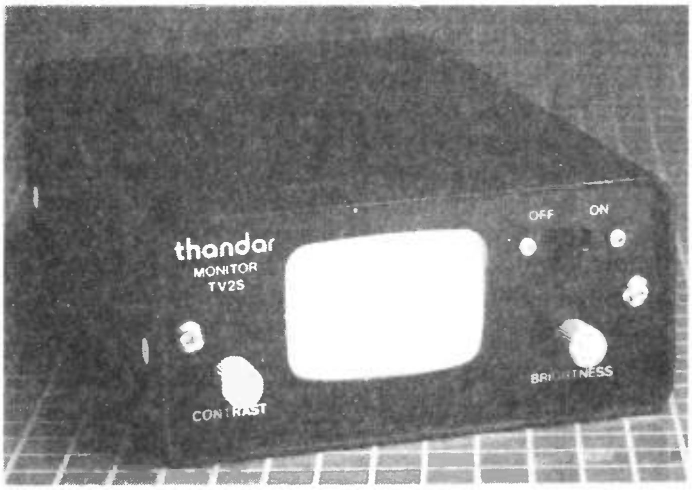
Now available from Thandar Electronics Limited is a lightweight, low-power miniature monochrome video monitor. TV2S operates from a standard 1-volt composite video signal via a 75-ohm BNC connector.

Self-contained in an attractive aluminium case (150 x 105 x 49mm), this monitor is designed to be used in applications where space is of prime importance. Desk-mounted security surveillance or closed circuit television camera viewfinder are typical examples.

TV2S utilises a high resolution 50mm (2 inch) diagonal CRT giving a usable viewing area of 40 x 30mm. Stable picture lock is ensured by the use of phase locked line and injection locked oscillators. Front panel controls are provided for brightness and contrast in addition to on/off. Rear controls include 525/625 switch, 75Ω bridge facility, focus and line and field control.

Fitted with internal re-chargeable Nickel Cadmium batteries, the monitor can also be powered from an external regulated 5 to 7 volts DC power supply or from an unregulated 12-volt DC source through the AC adaptor/charger supplied.

Mains adaptor/chargers for 117-, 220- and 240-volt operation are available as optional accessories.



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

PIN DIODE SWITCH

A new PIN diode switch, manufactured by ADE, is now available fom Nore Microwave and has the following electrical characteristics. VSWR 1.2 : 1, bandwidth 50 to 200MHz but usable up to 1GHz with negligible degradation of characteristics. Insertion loss 0.5dB, input power +10dBm, switching time less than one microsecond and the isolation is 50dB.

The switch is configured with four inputs and one output and its control voltage is +10V at 5 milliamps.

Nore Microwave Limited, 36 Towerfield Road, Shoeburyness, Essex, SS3 9SH. Tel: 03708 4255.

CAST WAVEGUIDE BENDS CATALOGUE

Now available from MM Microwave Limited, a new fully illustrated catalogue featuring their extensive range of waveguide bends.

MM Microwave design, manufacture and test a wide range of radar and telecommunications components and subsystems. The company have been approved to defence standard 05-24 and facilities include a fully equipped research and development department for components and subsystems, computerised design, computer controlled machine tools and excellent microwave test facilities.

All waveguide bends in the catalogue have been manufactured by lost wax investment casting and have been specifically designed to suit the process. As a method of manufacture, investment casting is particularly viable in the telecommunications and defence industries where components are generally highly complex, and often small in size. The use of castings ensures uniform thin walls, close tolerances, good surface finishes and reduces the risk of intermodulation.

The catalogue details waveguide bends from frequencies 2.6GHz to 40.0GHz and designs are based upon USA/British MIL specs. Sections on manufacturing tolerances, flange drilling, finishes and

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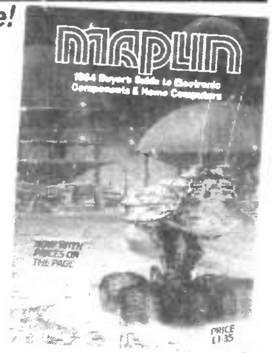
NEW 1984 MAPLIN CATALOGUE

Now with prices on the page!



The new Maplin Catalogue for 1984 is 20% bigger — a massive 480 pages packed with data, circuits and pictures. Take a look at the completely revised Semiconductor section, the new Heathkit section with lots of brand new and original kits, the Computer section with lots more software for Atari, BBC, Commodore 64, Dragon, Sord, Spectrum and VIC20, and the hundreds of fascinating new products spread through the catalogue.

As always, the Maplin Catalogue is tremendous value for money and now has prices on the page! Pick up a copy at any branch of W.H.Smith or in one of our shops for just £1.35 or send £1.65 incl. post to our Rayleigh address. On sale now.

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Mail Order: P.O. Box 3, Rayleigh, Essex SS6 8LR. Tel: Southend (0702) 552911. • Shops at: 159-161 King Street, Hammersmith, London W6. Tel: 01-748-0926. • 8 Oxford Road, Manchester. Tel: 061-236-0281. • Lynton Square, Perry Bar, Birmingham. Tel: 021-356-7292. • 282-284 London Road, Westcliff-on-Sea, Essex. Tel: 0702 554000. • 46-48 Bevois Valley Road, Southampton. Tel:0703 25831.
All shops closed all day Monday

electrical specifications are all included, in addition to enquiry/order information.

All products detailed in the catalogue comprise a standard range and are available from stock.

MM Microwave Limited,
Kirkbymoorside,
North Yorkshire,
YO6 6DW.
Tel: 0751 31955.

YIG TUNED FILTERS

Wave Devices, the Covent Garden based microwave distributor, is now featuring yttrium iron garnet (YIG) tuned bandpass filters amongst their product range. These current-tuned filters, the AFP series, are compact lightweight, high Q devices for the 2-8, 8-18 and 2-18GHz frequency bands. They are available in two, three and four sphere configurations and offer minimum 3dB bandwidths of 20MHz, with bandwidths in excess of 500MHz available to special order. All versions feature low insertion loss, approximately maximally-flat phase response and minimum +10dBm RF limiting levels, combined with the excellent tuning linearity of YIG filters.

The YIG resonator is made up of a properly oriented YIG sphere, a small loop of wire for coupling the RF field into and out of the sphere, and an electro-magnet to provide the constant magnetic field. These elements are positioned so that the orientation of the magnetic field and of the RF field will cause an energy exchange when the RF energy is applied to the coupling loop, and will thus provide energy storage at the desired frequency. The unloaded Q of the YIG sphere is in the 8000 to 9000 range (depending on dopants), although it is reduced in the practical YIG resonator by the proximity of metal and the necessary close coupling of the RF loop.

These YIG filters, manufactured by Avantek, the Santa Clara based microwave company, are an excellent choice as preselectors for super-heterodyne receivers and related instruments such as spectrum analysers. This AFP series of bandpass filters can be made to track extremely closely with YIG-tuned local oscillators over the full tuning range, and they provide substantial rejection of image frequencies and second harmonic mixing products. The availability of Avantek YIG bandpass filters with a 500MHz 3dB bandwidth extends the advantages of the tracking preselector to specialized wide-IF receivers. Another application is to use the filters to select and pass only the desired harmonic of VCO/comb generator combinations in a transfer oscillator or of fixed oscillator/comb generator combinations in heterodyne converter systems in microwave frequency counters. Like the YIG tuned oscillator range, the filters are available with drivers to enable operation with analogue-voltage signals or digital inputs from either TTL or CMOS logic.

COMPONENTS CATALOGUE

Now available from Semicomps Limited is their new winter edition, 20-page catalogue containing over 1,500 branded components for the electronics and allied industries.

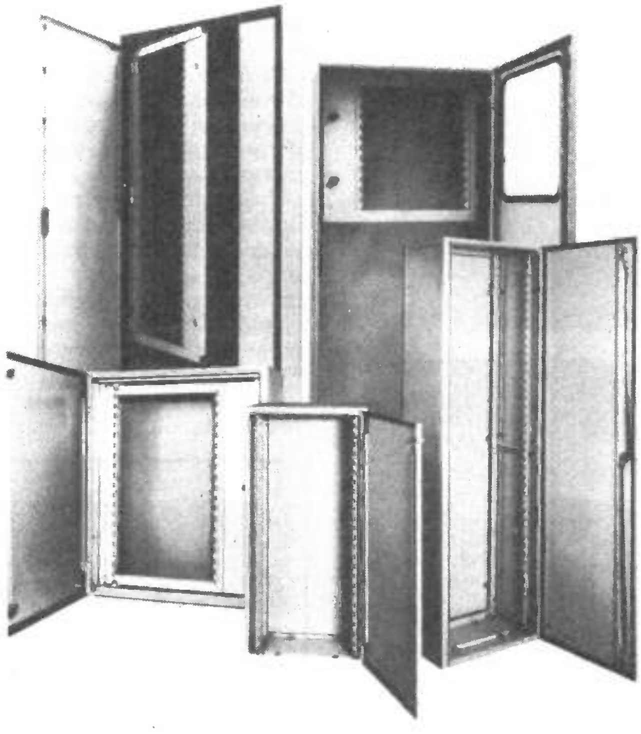
Among the components available is a wide range of semiconductor products from renowned companies including Ferranti, GI Microelectronics, GI (UK), Lucas and Teledyne. Other products in the catalogue include resistors, resistor networks, potentiometers, multiway and flat cable connectors, IC sockets, switches and key boards, fans and multimeters, plus a wide range of production aids such as anti-static materials and ultra-sonic cleaning equipment.

Semicomps Limited,
Halifax Road,
Keighley,
West Yorkshire,
BD21 5HR.
Tel: 0535 67921.

CABINETS

At past Electrex Exhibitions, Sarel Limited has taken the opportunity to show exactly what is meant by the claim of ex-stock enclosures. Their increase in popularity means that they will be displaying a range of enclosures that will meet almost every requirement visitors to the show might have.

They specialise in providing enclosures ex-stock for use in a wide variety of situations – from the Computer room to dirty, wet and corrosive environments. Many ranges will be shown in aluminium, steel, hot press moulded glass fibre reinforced polyester, Bayblend, Makrolon etc, varying in size from 100 x 100 x 50mm to 2-metre-high enclosures which may be built up into suites. Sarel's comprehensive range of enclosures offer degrees of protection from IP 43 (ventilated) to IP 68 (totally dust tight and submersible to 1.8 metre depth).



A standard range of ex-stock models; 27, 33, 39 and 45U in depths of 600 and 800mm is available, whilst for large orders the flexibility of the construction method allows models of virtually any size to be made.

For users requiring shorter versions of these new products, the *XIXIN* Micro is available. Using the standard front and rear frame extrusions but with a fixed top and base, it is available in 12 and 13U heights, 700 and 800mm deep, and 18 and 24U heights, 600, 700 and 800mm deep.

This very attractive product should be of particular interest to Mini and Micro Computers O.E.M.'s. One special accessory is a vinyl covered 'desk' top for office use where the user may wish to use the cabinet as a printer stand.

Where corrosion or weight are likely to be a problem then the recently introduced AP/UP and APM ranges of aluminium enclosures provide flexible solutions. A huge variety of sizes are possible from wall mounting (surface of flush mount) to 2-metre-high free standing units.

Sarel look forward to meeting visitors to their stand and believe that many of them will be pleasantly surprised.

Sarel Limited,
Cosgrove Way,
Luton.
Tel: Luton 20121.

LCD MODULES

RIFA announce the introduction of a series of personalised electronic LCD modules which have been devised to provide user-specified display solutions at an economical price.

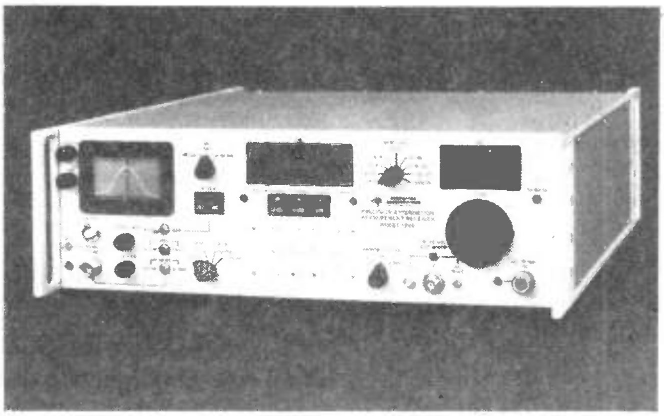
These new electronic LCD modules, from RIFA, combine the display and drive electronics in one, compact package. They allow the user to specify the individual display pattern and required best viewing angle, and to choose from a range of four specific sizes of viewing area within the minimum and maximum limits of 20 x 9.5mm and 62.2 x 16.8mm, respectively. Five display colours are available, and positive or negative (reversed) display image may be specified, together with three sizes of viewing cones. Further, three different operational temperature ranges and five types of electronics, for static and multiplex drive for serial data input, are also available. The modules may incorporate optional backlighting.

RIFA AB, Market Chambers, Shelton Square, Coventry. Tel: (0203) 27259

ATTENUATION MEASUREMENT RECEIVER

The American Micro-Tel Corporation has now made its Model 1295 precision attenuation measurement receiver available to the British market through their UK agents Chapman Electronics (TCE). A special feature is its AFC system which eliminates the retuning usually necessary with the connect-disconnect cycle associated with many attenuation measurements.

Completely self-contained, the unit offers accurate manually or computer controlled measurement of insertion loss – up to 100dB – of output attenuators of signal generators up to -110dBm and other fixed variable devices. The basic receiver covers a range of 0.01 to 18GHz with the option of extending the range to 18 to 40GHz. The instrument features an internal scratch-pad calculator and positive electro-mechanical and computer controlled AFC. The facilities enable fast simple calibration functions to be carried out.

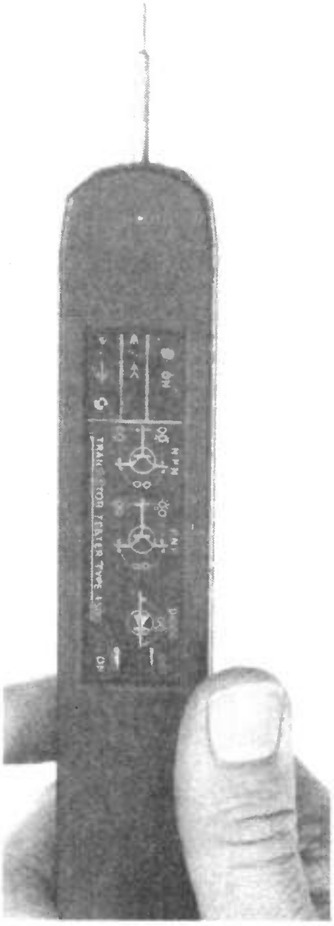


The internal CRT displays the IF signal and serves as a convenient tuning aid for manual operation and also to verify the proper and accurate operation of the instrument in all modes. The receiver can be manually tuned to near the frequency of the source, the electro-mechanical AFC then taking over to complete the tuning cycle.

TCE, Hemnal Street, Epping

HAND-HELD TRANSISTOR TESTER

A new addition to *Osborne Electronics* 4000 series of hand-held test units is the model 4500 transistor tester. Completely self contained, the unit simplifies and speeds the task of checking the PN junctions of discrete semi-conductors whether in or out of circuit.



Unlike 'desk top' test instrumentation, the Model 4500 is a completely self-contained unit measuring just 32 x 22 x 100mm and weighing 75 grams. It readily rests between thumb and forefinger and features an integral series of LED's which indicate the junction status.

PNP or NPN transistors, diodes and open- or short-circuit junctions can be instantly identified by the Model 4500 and its operation remains reliable even when parallel circuit values approach 270 ohms or 33 microfads. Operation is simplicity itself, the two test probes are connected across the junction to be checked and the junction state is immediately displayed.

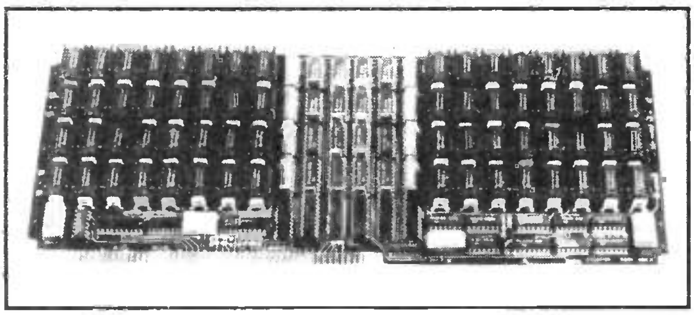
The unit's integrated circuitry ensures a very long battery life.

Osborne Electronics, Ryde, Isle of Wight. Tel: 0983 63622

ONE MEGABYTE BOARDS

Protek has just added One Megabyte Memory Boards to its range of Hewlett-Packard enhancements. The WHQT-8 board, which has been developed by Eventide in the States, offers a dramatic memory expansion of 1,048,576 bytes of RAM for HP 9826 and 9836 computers. This is over four times the capacity of the largest memory board previously available.

The board is internally plugged into the computers, but uses none of the back-plane slots, unlike conventional boards. Instead, it uses the 'OEM' special expansion card slot within the HP 9826 and 9836, leaving the back-plane slots completely free for installing ROM-based languages, I/O interfaces and other peripherals.



Protek Electronics, 22 Sussex Street, London SW1V 4RW Tel: 01-834-3602

DIGITAL MULTIMETER

The Pan 2101 is a full auto-ranging digital multimeter, with a 3½-digit LCD, and has an input impedance of 10MΩ AC-DC and features automatic display of symbols, functions, polarity, decimal point and overrange. Auto ranges are from 200mV – 1000V DC, 2 – 600V AC, resistance 200 – 2,000kΩ, and lower power resistance 2kΩ – 2,000kΩ. With AC-DC current measurement from 200mA – 10A, all ranges are protected (except 10A) up to 250V AC-DC. Other specifications include continuity test, overrange indication and zero adjustment.

The unit has a battery life of 300 hours continuous operation, weighs approx 270g and measures 155 x 85 x 30mm. It is supplied with carrying case and a spare fuse.

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

LOGARITHMIC VOICE PROCESSOR TYPE DB24

Slade Electronics Ltd. have designed and are producing a voice processor (Type dB24) which is intended to interface between a transceiver's existing standard dynamic microphone and the transceiver's microphone connector. It is energised from the existing power supply. The photograph shows the processor attached, via its bracket, to the side of a CB transceiver. There is a choice of bracket fixing positions on the rear of the processor to suit rigs of various shapes and sizes.

The voice processor uses the latest electronic

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We hope to open a component shop in the next few weeks in the South Birmingham area, please watch press for details.

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23 Regency Gardens, Yardley Wood Birmingham B14 4JS. Tel: 021 474 4638

THE NEXT ISSUE OF

Radio & Electronics World

ON SALE
9 MARCH 1984

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The communications, electronics & computers magazine

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This method of advertising is available in multiples of a single column centimetre — (minimum 2cms). Copy can be changed every month.

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ADVERTISERS INDEX

New improved Radio & Electronics World — The communications, electronics & computers magazine

ADVERTISING RATES & INFORMATION

ABC membership approved pending first audit Jan-Dec 1984

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	1/8 page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	1/4 page	£160.00	£150.00	£145.00	£125.00
128 x 186 or 263 x 90	1/2 page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

COLOUR AD RATES

colour rates exclude cost of separations

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
128 x 186 or 263 x 90	1/2 page	£420.00	£395.00	£375.00	£335.00
297 x 210	1 page	£810.00	£760.00	£730.00	£650.00

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DEADLINES

*Dates affected by public holidays

issue	colour & mono display ad	small ad	mono artwork	on sale
Apr 84	9 Feb 84	15 Feb 84	17 Feb 84	9 Mar 84
May 84	15 Mar 84	21 Mar 84	23 Mar 84	13 Apr 84
June 84	9 Apr 84*	16 Apr 84*	18 Apr 84*	11 May 84
Jul 84	10 May 84	16 May 84	18 May 84	8 Jun 84

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.
If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

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Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
For illustrations just send photograph or artwork.
Colour Ad rates do not include the cost of separations.

Printed — web-offset.

PAYMENT
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 the 15th of the month following invoice date.

FOR FURTHER INFORMATION CONTACT
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(0277) 219876

Overseas payments by International Money Order.
Commission to approved advertising agencies is 10%

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Direct-Access Keyboard Tuning of 22,884 Frequencies

£229.95

Available 15th January, 1984
Covers 68-88 MHz VHF-Lo, 144-148 MHz Ham, 108-136 MHz AM Aircraft, 138-144 MHz, 148-174 MHz VHF Hi, 380-450 MHz Ham, 450-470 MHz UHF-Lo, 470-512 MHz UHF-Hi

Realistic PRO-30. A full-feature, microprocessor-controlled scanner with extended frequency coverage – in a compact size you can carry wherever you go! Scan up to 16 of your favourite channels continuously, or search a selected frequency range for new or unpublished channels. Scan and Search in two speeds. Two-second Scan Delay, selectable for each channel prevents missed replies. Lockout feature temporarily bypasses unwanted channels. Big LCD display shows channels and frequencies being monitored or progammed as well as the status of the channels. Priority function monitors your favourite frequency while you listen to others. Frequency-tracking front end assures top sensitivity on all bands. Squelch control eliminates noise between messages. Has jacks for external antenna and earphones. With flexible antenna. 7½×2$\frac{11}{16}$×1$\frac{13}{16}$". Requires six "AA" batteries or mains or DC adapter. Memory backup requires four silver-oxide batteries. **£229.95**

Mains Adapter **£6.99**
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BEARCAT SCANNERS

BC-100FB **£345.00**
Hand held 16 channel programmable

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(with air band)
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40 Channels
AM/FM
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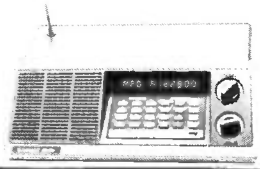

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DRAKE R7A

General Coverage Receiver

OUR BEST EVER!
60-Channel Programmable Receiver for Home or Car

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Bands: VHF-Lo 68-87 MHz; FM Broadcast 88-107 MHz; VHF-Air AM 108-136 MHz; Ham 138-148 MHz; VHF-Hi 148-174 MHz; 410-450 MHz; UHF-Lo 450-470 MHz; UHF-Hi 470-512 MHz.

Realistic PRO-2003. No crystals to buy - direct keyboard entry of 20,584 frequencies. Use the search circuit to find new channels. When you find one that sounds interesting, store it in memory. Zeromatic® circuit assures accurate signal tuning every time. Has a 2-speed scan and search, Scan Delay, individual channel-lockout, priority function and variable squelch control. Large easy-to-read display shows channel number, frequency, function and mode.
Built-in speaker, telescopic antenna, plus jacks for headphone and external speaker. 3⅛ × 11½ × 9". With operating manual, mains operation of 12VDC negative ground. Memory backup requires 9v battery. £259.95

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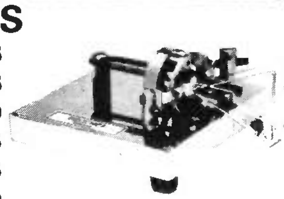
ZA-1A Balun	**£20.95**
ZA-2A Balun	**£24.95**
ZY-2 CW Audio Filter	**£57.50**



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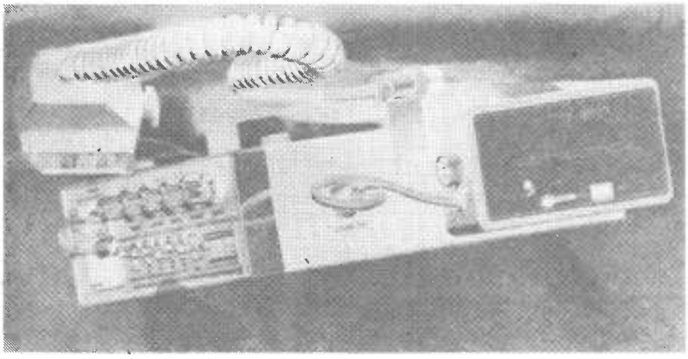


component technology and works on the principle of non-linear (logarithmic) amplification of the voice signals from the microphone. The minor voice fluctuations containing word consonant information, which can be so easily mis-heard over difficult and noisy channels, are amplified to a far greater degree than are the naturally occurring high peak vowel sounds.

The dynamic range of the dB24 processor is greater than two decades of fluctuation in voice pattern level. At the lower-end threshold of 3mV microphone signal, the processor gain is approximately 24dB and this gain reduces logarithmically to 0dB at 200mV. At 750mV the processor attenuates at -2½dB. This operational principle is very powerful in that channel signal-to-noise ratio is greatly improved but without the consequent generation of major harmonic distortion. This property improves distance communication at a given signal strength significantly while not unduly impairing voice quality.

In contrast more conventional techniques, using linear amplification, clipping and filtering (whether performed at the baseband or via HF elevation) often introduce high level harmonics which in some cases badly distort the voice to an extent which nullifies the benefits of processing.

Other techniques involving different variations of AGC or compressor sometimes introduce unacceptable settling time constant limitations. With the dB24 the gain control is instantaneous.

The dB24 voice processor is equally suitable for professional, Licensed Amateur or Citizens Band communications use. Mobile communications in particular benefit greatly from this form of processing.

Slade Electronics Ltd
20 James Road
Dartford, Kent DA1 3NF.

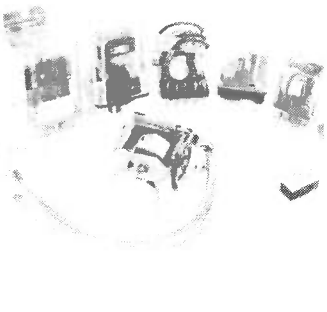
NEW RELAYS

Nine relay types from Pye Electro Devices are now available from Verospeed and the range includes pcb mounting, plug-in and screw fixing units with ratings up to 30 amps.

The pcb mounting range consists of the series 21 relay which has full British Telecom approval. It is a DIL packaged, flux resistant relay capable of switching 1.25A ac/dc at 125V ac, 150V dc. Other pcb types include series 22 miniature low profile, two pole changeover relays and general purpose SPCO and DPCO ac relays.

Plug-in types and appropriate base units include miniature, continental/cradle and general purpose, heavy duty relays, Also available is a range of plug-in octal and 11 pin relays.

Two screw fixing types are featured in the range. These are the series 62 two-pole open relays and the series 64 heavy duty 30A single pole type for 240V ac or 24V dc operation.



Verospeed, Stansted Road, Boyatt Wood, Eastleigh, Hants SO5 4ZY.

NEWS

Micro City '84 exhibition

Micro City '84, the fourth staging of the Bristol exhibition of computers, business systems and communications equipment, has experienced the strongest-ever start in terms of exhibitor bookings, with many of the prime sites already committed.

The exhibition, which is widely acknowledged as the most important business computer exhibition taking place outside London or Birmingham, is being held at the Bristol Exhibition Complex on May 15-17, 1984.

Already, exhibitor bookings are 40 per cent up on the same time last year, and include many of last year's exhibitors who have taken the same or larger stands at Micro City '84.

Micro City '83 attracted more than 100 companies of all sizes, including market leaders IBM, British Telecom, ITT, Hewlett-Packard, DEC, Thorn Ericsson, ACT, Wordplex and ICL. A total of 6,060 business people visited the three-day event.

Mr Stephen Hybs, Managing Director of organising company Tomorrow's World Exhibitions Limited, is confident that Micro City '84 will provide the strongest stage so far for leading companies to present their products and services to the business community in the South West of England and Wales.

'Micro City is the only established exhibition of its kind in the region,' he said. 'Business people in this area now automatically choose Micro City as the one event where they can assess, compare and buy the latest business computer products.'

An added attraction will be the 'Offices of the Future' exhibition of commercial furniture, furnishings and business equipment relevant to exhibits on display in the main halls of Micro City '84. The popularity of this feature, which made its debut at Micro City '83, has prompted the organisers to devote an entire hall to Offices of the Future at Micro City '84

For further information contact Steve Hybs, Managing Director, on 0272 292156/7, or Ken Harrison, The Steve Harper Company Ltd on 0272 298399.

New AMD product manager

Hawke Electronics Limited, the prominent electronic components distributor, announces the appointment of Pat Myers (32) as Product Manager for its Advanced Micro Devices franchise.

Pat, whose hobbies include jogging and practical electronics, was formerly Product Manager at Barlec/Richfield. His task at Hawke will be to market AMD's technically advanced range of commercial and proprietory chips. Pat Myers is married and has two children.

Hawke Electronics is part of the Lex Service group.

Hawke Electronics Limited, Amotex House, 45 Hanworth Road, Sunbury on Thames, Middlesex., Tel. 01-979 7799.

Certification for precision capacitors

RIFA have announced that they have received certification for their PFE 225 and PHE 425 precision capacitor families, the first producer to obtain CECC certification for capacitors of this class.

Similar in their design and construction, the PFE 225 and PHE 425 series of miniature film capacitors together cover a range of capacitance values from 47pF to 135nF. They are extremely compact, and are ideally suited to applications in which high component packing density is an important factor. Originally designed for incorporation into L-C filters using RM5 and RM6 ferrite cores, the PFE 225 and PHE 425 series are also suited for use in a variety of timing and high frequency coupling and decoupling circuits.

RIFAAB, Market Chambers, Shelton Square, Coventry. Tel: 0203 27259.

Chapman Electronics wins new Micro-Tel assignment

Continued investment in laboratory back-up services has enabled Chapman Electronics (TCE), the Epping-based electronic instruments and components company, to capture the valuable European test and repair business of the US Micro-Tel Corporation. Micro-Tel, whose products include microwave signal generators and receivers and test and measurement instruments, is at present involved in a number of major projects in Germany and France.

Says TCE manager and marketing executive Peter Snelling, 'Our policy of updating and expanding not just our distribution handling systems but also our technical capabilities was a key factor in winning this Micro-Tel business. Our laboratory is already approved by Ministry of Defence to defence standard 05-24 and involved in the repair and calibration of many other types of microwave instruments and devices'.

TCE has been marketing the US company's equipment in the UK since 1971 and from its own stocks has been able to offer the British customer a fast repair turnround. In 1984, TCE together with Micro-Tel personnel will be making two demonstration tours to show the manufacturers latest systems to its main British customers, which include MoD and Government research establishments and leading microwave technology electronic companies in this country. Chapman Electronics, located some 15 miles north east of London, will be using its fast links to both Heathrow and Gatwick airports to operate the new service to Micro-Tel customers on the Continent.

AMPTE Spacecraft at Bristol for specialised testing

British Aerospace Dynamics Group, Bristol Division, have tested the British scientific spacecraft AMPTE (Active Magnetic Particle Tracer Explorer) in the electromagnetic test facility at Bristol.

The work, which has taken three weeks, measured the emissions from the spacecraft to determine their effect upon the spacecraft's on-board experiments, and also established the susceptibility of the spacecraft electronics to radio frequency energy from sources on the spacecraft, the launch vehicle and earth-based transmitters.

AMPTE has been developed jointly by the Science and Engineering Research Council's *Rutherford Appleton Laboratory,* to whom British Aerospace are under contract, and the *Mullard Space Science Laboratory* of University College, London.

AMPTE is one of three spacecraft that will form a completely revolutionary scientific mission to investigate how solar-wind ions penetrate the barrier of Earth's geomagnetic field and how they and other particles sometimes become accelerated resulting in aurorae at high latitudes. The British spacecraft will be launched sandwiched between a spacecraft from Germany and one from the United States.

On separation, the spacecraft will be placed into different orbits, the British and German satellites into a highly eccentric orbit (18.5 Earth radii) into the solar wind and positioned a few hundred kilometres apart while the United States satellite will take up a low eccentric orbit (9 Earth radii). In operation, the German satellite will release quantities of lithium and barium atoms into the solar wind upstream from Earth and into the outer magnetosphere. The positive ions, which will result, will serve as tracers for detection later by the United States satellite patrolling closer to Earth. During one of the releases, particles will be forced to stream back by the solar wind briefly forming a comet-like object over the Eastern Pacific, during which time the German AMPTE satellite will be in the head of the comet and UK AMPTE satellite will be in the tail.

The function of the AMPTE project is to extend still further this new approach of using the solar wind and magnetosphere as a plasma physics laboratory. The experiments are a natural extension of sounding rocket

NEWS

and other experiments including the Skylark rocket high-latitude campaigns of 1973 and 1976 and complementary to the European Space Agency satellites GEOS 1 and 2 for which British Aerospace was prime contractor.

Giotto takes shape

British Aerospace announce comprehensive electrical and electromagnetic tests have been successfully completed on the full-scale electrical engineering version of the GIOTTO spacecraft in the Electromagnetic Compatibility Test Facility at British Aerospace Dynamics Group at Bristol. GIOTTO will intercept Halley's Comet when it approaches the ecliptic plane of Earth in 1986.

Another important aspect of the tests was to confirm that no unacceptable electromagnetic compatibility problems would arise between the separate systems when operated in their various modes.

The Electromagnetic Compatibility Test Facility at Bristol in which the electrical performance of GIOTTO was checked, is one of the largest and best equipped in Europe. It has an electromagnetically screened circular test chamber 14 metres in diameter and 12 metres high, with an access entry 2.5 metres square. Tests can be conducted in radio-frequency environments ranging from 0.1Hz to 18GHz. Test sequences and measurements and the presentation of results are under direct computer control.

The electrical engineering model of GIOTTO is the second version of the spacecraft to be employed in the development programme. The first was a structural model which was successfully integrated and tested by Dornier System GmbH. The protoflight vehicle is the third and final version which will be launched by an Ariane 1 vehicle from Kourou (French Guyana) in July 1985.

Besides being prime contractor the Space and Communications Division is also responsible for the design and manufacture of the electrical cable harness for the spacecraft, together with assembly, system integration and testing of both the GIOTTO electrical engineering model and the GIOTTO spacecraft itself.

GIOTTO is to be delivered to the European Space Agency in January 1985, which will conduct the launch and the in-orbit operations. The British Aerospace consortium will provide technical support to these activities.

Further details of GIOTTO in the April issue of *R&EW*.

VALVE INFORMATION

Our January 84 issue contained information ('Alive and Well') that the M-O Valve Company marketed the KT66, KT77 and KT88 valves and also mentioned that the company would assist in tracking down components for use in valve circuits. The company have advised us that this information is not entirely correct and is superseded as follows:-

The KT66 valve is no longer manufactured but some literature is available for information *only*. The KT77 valve (a beam tetrode) replaces the earlier EL34 (pentode) and the KT88 is available for larger power outputs. Literature is available for both of these valves. The company may have information on components that are used in circuits that they have published but do not offer a service for tracking down components. Anyone requiring the valve literature should apply to M-O Valve Company, Brook Green Works, London, W6 7PE.

We are advised by Mr N Covington that anyone with problems in obtaining high-voltage capacitors, valve sockets, HT transformers, etc may contact him and he will try to assist. Please send a sae. His address is 25 Ridge Road, Letchworth, Herts. Please do not address these enquiries to the M-O Valve Company.

QUESTIONS & ANSWERS

Do you have any technical or practical questions that you would like an expert answer to?
A selection of readers' questions will be answered each month on this page. We regret that we cannot enter into individual correspondence with readers
Write to Q & A, ***Radio & Electronics World,*** Sovereign House, Brentwood, Essex, CM14 4SE

Cymar Q-Meter

Frank Henry, referring to Cymar Q-meter (Jan 84 issue) asks:-

I am puzzled by above. What does Cymar mean for a start?

This Grandfather is always keen to brush up on how 'to suck eggs' – could have been getting it wrong for years.

S2 is listed as 1-pole 4-way. The circuit shows it as such. The attractive photo of front panel indicates 5-way (four plus open-circuit position) and the text confirms this requirement.

Using the Q-meter – I should have thought instructions would mention need to plug in inductor under test before attempting to set up.

If, having followed appropriate procedure and returned to final 'READ' position, meter reads full scale, then, presumably, Q is 250 if one is on 250 setting of Q-range switch. But suppose the final reading is only half full-scale – is the Q 125? In other words is the meter deflection proportional to the Q ? This can only be the case if the amplifier is linear. Is it?

At frequencies of 1MHz and 8MHz and inductors of 150μH and 2μH respectively, Q values of about 100 and 50 could be expected. If my arithmetic is correct, this implies resistive loss of around 9 ohms and 2 ohms respectively. But with Q-range switch set at '100' position the instrument itself has introduced 2.5 ohms (R7 plus R8) into the resonant circuit. As this is of the same order as the actual resistive losses of the inductor under assessment it reduces its apparent Q.

Dare I suggest that an inductor showing Q of 100 on Q-range setting of 100, would show higher Q on 250 setting? (because only R8 in resonant circuit instead of R7 plus R8). Mr Francis can verify or disprove this so quickly with his Cymar at hand?

P.S. RCA here, and in the States, are out of print on information on the device used in above, 2N3819 – can you help?

The reference to Cymar arose because of references to secrecy made by friends. A typical comment being to a 'cloak' of secrecy. Since a Cymar was a loose robe worn by women to cover and/or hide other clothes or state of undress it seemed an apt title.

The comment referring to S2 is correct and the parts list is in error. The original meter had one variable position, 3 fixed positions and one open circuit position. For those who have used a four-way unit it should be pointed out that the O.C position is not strictly necessary.

The instructions for use of the unit did not mention the insertion of the coil, since it is assumed that one cannot measure coil inductance without the physical presence of an inductor to be measured. Another avoidance of the 'egg sucking' variety.

Regarding the question of amplifier linearity, although the amplifier is linear the detector is not, therefore if the reading is less than ¼ FSD I suggest you change down a range. Obviously the meter used must also be linear or the problem is further aggravated.

I agree that the resistive divider gives some errors due to the inherent resistance. The only answer is to reduce the values of the resistive divider. Although this is possible it will eventually start to place a strain on the driver. The values used were deemed to represent a good compromise between available drive power, available components, and cost.

For data on the 2N2819 why not approach Teledyne who also make this transistor.

Data sheets for ICs

S J Cowie writes:-

I am building a touch tone selcall unit and would like to use the IC's used in Graham Leighton's DTMF signalling system in *R&EW* July 1983. Is it possible for you to let me have the output connections for 2 by 8 operation and the address of any firm that retails these devices (MV8862 & MV8865). I have tried the major suppliers to no avail.

Try Celdris, 37 Loverack Road, Reading, Berks (0734 565171) or Maplin Electronic Supplies Ltd, P O Box 3, Rayleigh, Essex (0702 552911). Obtain the Data Sheets from the suppliers in order to get the output connections for 2 by 8 operation.

AMATEUR RADIO WORLD

Compiled by Arthur C Gee, G2UK

The much anticipated Columbia Space Shuttle amateur radio transmissions have now come and gone – and looking back on them, one can say the results were interesting, even if at times the 2-metre band sounded like the Tower of Babel! As far as the ground stations were concerned, there seemed to have been a complete lack of appreciation as to what should be done. Plenty of publicity had been given to the procedure to be followed. Normal QSO technique was not to be used; instead, as was clearly pointed out, to enable as many folk as possible to 'get a look in', W5LFL was to transmit on a number of frequencies at specified times and listen for replies. Earth stations would then give their call signs only, which were to be acknowledged by W5LFL. True, the number of frequencies to be used was fairly complex, varying with the part of the earth the spacecraft was over, and this no doubt led to some of the confusion. The general opinion of the exercise was that as far as Europe was concerned it was Bedlam!

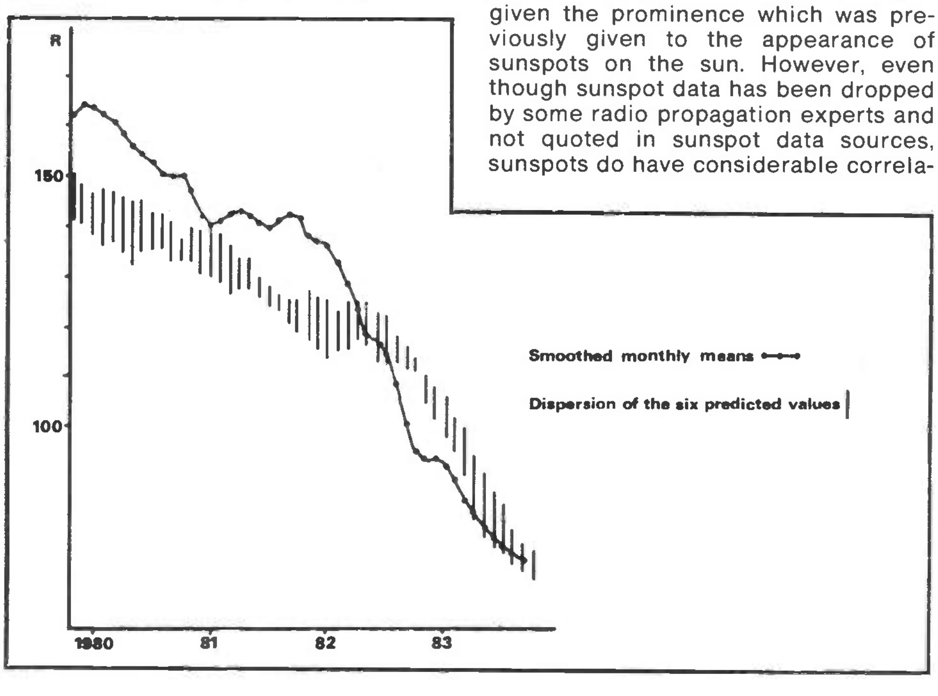
However, the exercise *was* an experiment and no doubt next time, things will improve with the experience of the first one to go on. One thing that can be said about it; it certainly got some very good publicity for amateur radio from the media. The TV coverage of the *RSGB HQ* station was excellent and many local papers gave coverage to the activities of their local radio amateurs in the project.

The sunspot cycle

Solar activity affecting radio propagation conditions has for decades been correlated with the sunspots visible on the surface of the sun. Recently, however, attention has been given to what are termed *coronal holes*. The corona is the outermost region of the sun's atmosphere. It does in fact emit some light, slightly less than that from the full moon, but because of the brightness of the sun it is invisible except at the time of a total eclipse of the sun – when the light from the sun's face is blotted out by the moon's shadow and the light of the corona can then be seen in all its spectacular beauty. The invention of the coronagraph in 1930 by Lyot, enabled the corona to be studied in daylight from high altitude observatories and, since the advent of coronagraphs carried on space craft such as Skylab provides better seeing conditions, much more has been learnt about this part of the sun's atmosphere.

The appearance and extent of the corona varies with the solar cycle. At sunspot minimum it is fairly symmetrical, with long streamers extending outwards. At maximum sunspot times, the corona becomes brighter and more evenly spread over the whole disc of the sun. The streamers appear to follow the pattern of the sun's magnetic fields.

Coronal holes indicate areas of weak magnetic field, where the lines of force do not form closed streamers going from active areas of one polarity to areas of the opposite polarity. Instead, they span out into interplanetary space, diverging rapidly as they do so, so that the angular size of a coronal hole appears greater with increasing distance from the sun. From these coronal holes, streams of electrified particles are projected, which form the 'Solar Wind'. It is these streams of solar particles which affect our ionosphere, hence our radio propagation conditions, and consequently their presence on the sun's surface has been given the prominence which was previously given to the appearance of sunspots on the sun. However, even though sunspot data has been dropped by some radio propagation experts and not quoted in sunspot data sources, sunspots do have considerable correlation with coronal holes and data relating to sunspots is still useful. Routine observation of sunspots can be carried out by amateur solar observers and can be interestingly correlated with radio propagation conditions by radio amateurs. In this feature in the December 1982 issue of *R&EW*, we reproduced a graph showing how the current solar cycle is decreasing. We now reproduce a further graph, just released by the *Sunspot Index Data Centre* in Brussels, illustrating how this trend is continuing.



Solar Factual Data is given out on the RSGB News Bulletin broadcasts on Sunday mornings and it was interesting to hear recently that there were no sunspots visible over a period of days from November 26th to 28th last, the first time this was reported since 1979.

Satellite news

At the time of writing, the Russian satellites have been much reduced in activity, in order to save battery usage. They are at the moment, spending much time in the earth's shadow, so that their batteries are feeling the effects of low charging rates. RS5, 6, 7 and 8 are sending code telemetry giving battery voltages only – they send the letter 'D' followed by a number which seems to vary from 78 to 85. Occasionally a full telemetry frame is sent, but their transponders are for the most part shut down. It is thought that this state of affairs will continue for January and possibly February, by which time they will be into longer periods of sunshine, when it's hoped they will return to their previous operational status. The Russian satellite '55' is still to be heard, sometimes giving a very strong signal. UOSAT is going very well, the digitalker going very well. Oscar-10 needs a lot of perseverence to work into and a lot of expensive gear too. More of that later. What is needed badly is a replacement for the old faithful OSCAR-8!

Grenada

From the RSGB News Bulletin – a news sheet circulated with *Radio Communications* – we gather that the only news source from the island in the early stages of the invasion was KA2ORK/J37. To permit him to pass traffic which was considered essential, the State Department in Washington waived the usual limitations on third-party traffic. ARRL HQ stations W1AW and W1INF provided television and radio stations with live material. Many individual amateur radio stations were overwhelmed with reporters wanting to listen to the traffic and ARRL's General Manager said that the US Government were 'pleased and satisfied' with the role played by amateurs. KA2ORK/J37 was on the air for 48 hours. He also handled health and welfare traffic for relatives.

Sony ICF 7600 Receiver Review

We haven't yet got Sony to send the service data for the ICF 2002 described in the January issue – but we did get the ICF 7600 service manual instead.

There's an old saying in this business that goes something like: 'the early bird gets the bag of worms'. This syndrome is apparent when trying to get information on products that have only just been released – and is generally most desperate when pursuing a press release from the HQ of a multinational corporation via one of its less well-informed local offices.

Another good way of creating mayhem with some manufacturers is to get one's spies to purchase one of their newer products from one of the areas favoured with the first taste of their new products. Attempts to procure the service manual for the ICF2002 appear to have struck the usual chord but paradoxically, the ICF2002 (under its European guise of ICF7600D) has been spotted on display in a local Comet warehouse. The most apocryphal example of this attitude sampled to date was when IBM UK was 'phoned a few days after the famous 'PC' was launched in the USA....

'We have no plans to market this product in the UK or Europe' the man said in a very irritated and abrupt manner (perhaps he thought it was a call from another journalist trying to beg a freebie). IBM are now rumoured to be turning out 60,000 a week from their Scottish assembly facilities. With sales success like that, who needs PR?

Nevertheless . . .

The ICF7600 has, for some time, been standard issue to the traveller who has no faith in hotel radio distribution systems to keep him in touch with the BBC World Service and the myriad of other interesting signals that rampage across the ether. Since about 1978 to be precise, and it's still one of the most reliable and effective small portables that you can buy.

The performance is well up to the expectations of the broadcast listener, and the synthesised ICF2002 is basically a cross between the ICF7600 and the ICF2001 which was described in some detail a year or so ago.

Example of excellence

Sony produce service manuals that probably set the standard of excellence that others strive to achieve. If you are reasonably unscrupulous and you want to start up a plant making counterfeit consumer electronic equipment, a collection of Sony service manuals will set you up with everything you need by way of designs, blueprints, layouts and engineering drawings. Just add $100,000,000 capital investment, and you're away...

Failing that, a browse through the design philosphy and practice of Sony will provide the enthusiast and professional alike with a very powerful insight into the excellence in consumer electronic engineering that has long since banished the competition that once existed within these shores.

Circuit comments – off we go . . .

The block diagram *(Figure 1)* is a concise and familiar superhet. The redesigned section around the FM IF stage reveals that even Sony can have second thoughts, probably prompted by the familiar problem of overloading an FM IF stage by leaving the selectivity a little too late.

The main circuit diagram *(Figure 2)* reveals a circuit that can easily be emulated by the enthusiast wanting to gain experience through practice (there's still some of us left). Starting at the audio stage, here's a classic circuit designed to make the most of a low-voltage supply, coupled with a miserly quiescent current. Squeeze this into a layout with E-line transistors and ⅛th watt resistors, and you've got an ideal audio stage for any portable equipment.

Note the diode supply protection when using the external DC power jack. The Q11/Q12 complementary output stage is placed directly across the supply rail, and would probably not survive reverse polarity. Always protect supply polarity in this way unless you have a substantial interest in the repair trade.

Frequency modulation section

The FM section (the top row) is not particularly unusual – but the neutralisation of the RF stage by the feedback winding on L2 is probably the element that makes it all possible: many simple FM portables only tuned either the input or output of the RF stage due to the notoriety of the stability problems that arise when the input and output of a bipolar amplifier stage are tuned to the same frequency. A small sniff of out-of-phase signal fed back to the base of the stage will suppress instability whilst permitting best matching for noise and gain.

A small portable can fairly assume that the antenna will not be taxing the strong signal performance too severely. The converter (mixer) stage at Q2 continues this theme by using a common emitter stage that provides the best gain for least power consumption, but draws a veil over strong signal performance. The local oscillator for FM (Q4) appears to deliver its drive to the mixer using mutual coupling between the tank coil

SONY ICF 7600

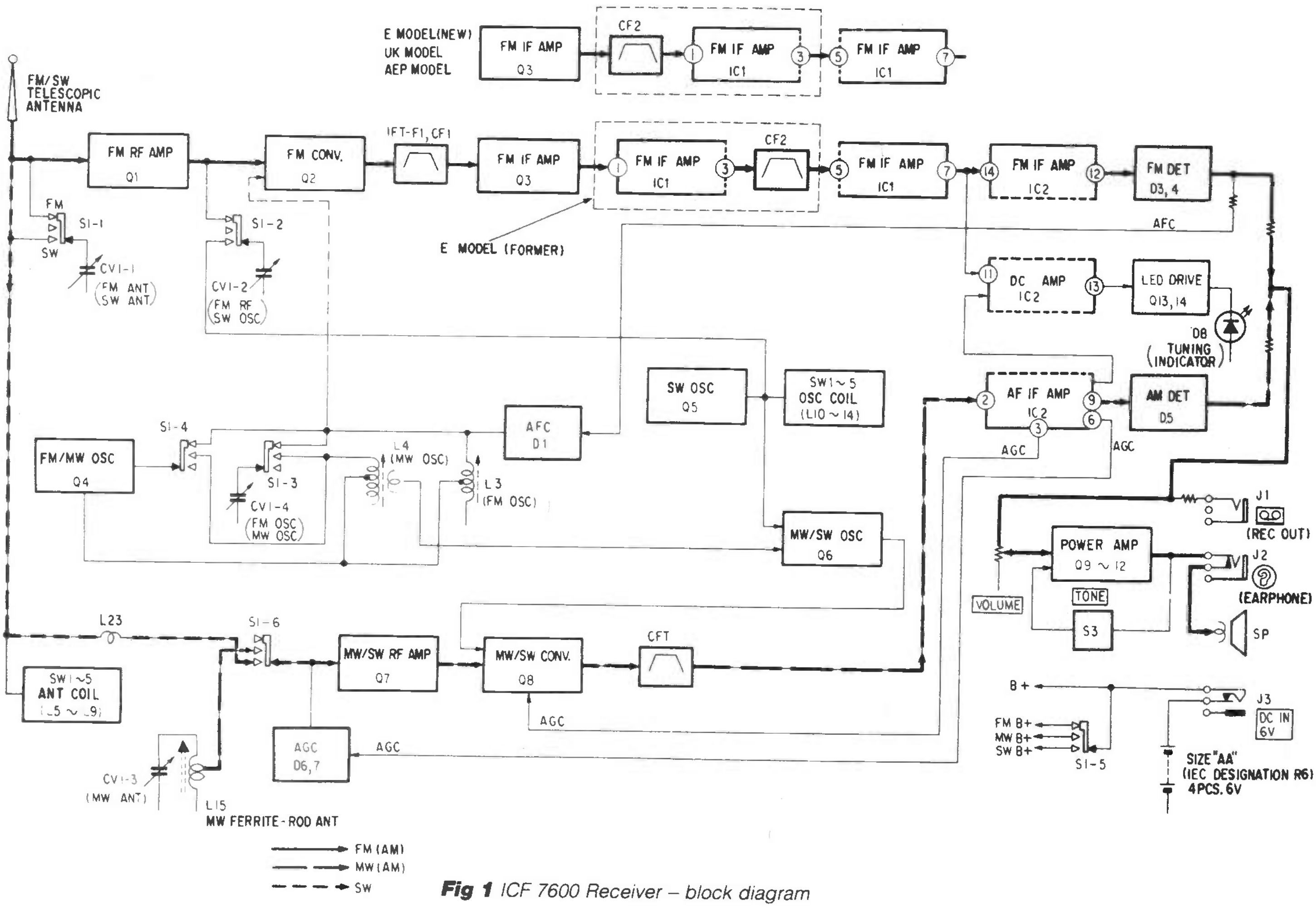


Fig 1 *ICF 7600 Receiver – block diagram*

(L3) and the choke on the mixer base, L16. These are quite close on the board layout, and since there is no more direct connection, this must be it! Common emitter mixers require very little drive if delivered via the base, and experience shows that using capacitor coupling can frequently create more problems with the effects of strong signals pulling the oscillator and so forth.

The IF stage uses a thermistor (TH1) to compensate for the substantial variations of gain experienced at temperature extremes. The IC stage uses a CX161 which my book says is a Sony house special. The following combination stage, a CX162 is obviously another – there weren't many 4V AM/FM IFs around the general market back in 1978, although the subsequent passions for 8mm-thick radios has spawned a few more. Note that the LED tuning indicator signal is sniffed from the output of IC1, indicating that most amplitude variations are limited out by the time the signal emerges from pin 12 of IC2. The LED tuning indicator is a simple yet effective affair built on Q13 and Q14 that also provides tuning information for AM signals.

The FM detector is a very familiar sight: a straightforward ratio detector – the DC component of which provides AFC control of the FM oscillator via D1 without the option of switching it out of circuit. Before leaving the FM section, there's no reason why the tuned circuits, cannot be scaled and adapted to provide coverage of either airband or 2m.

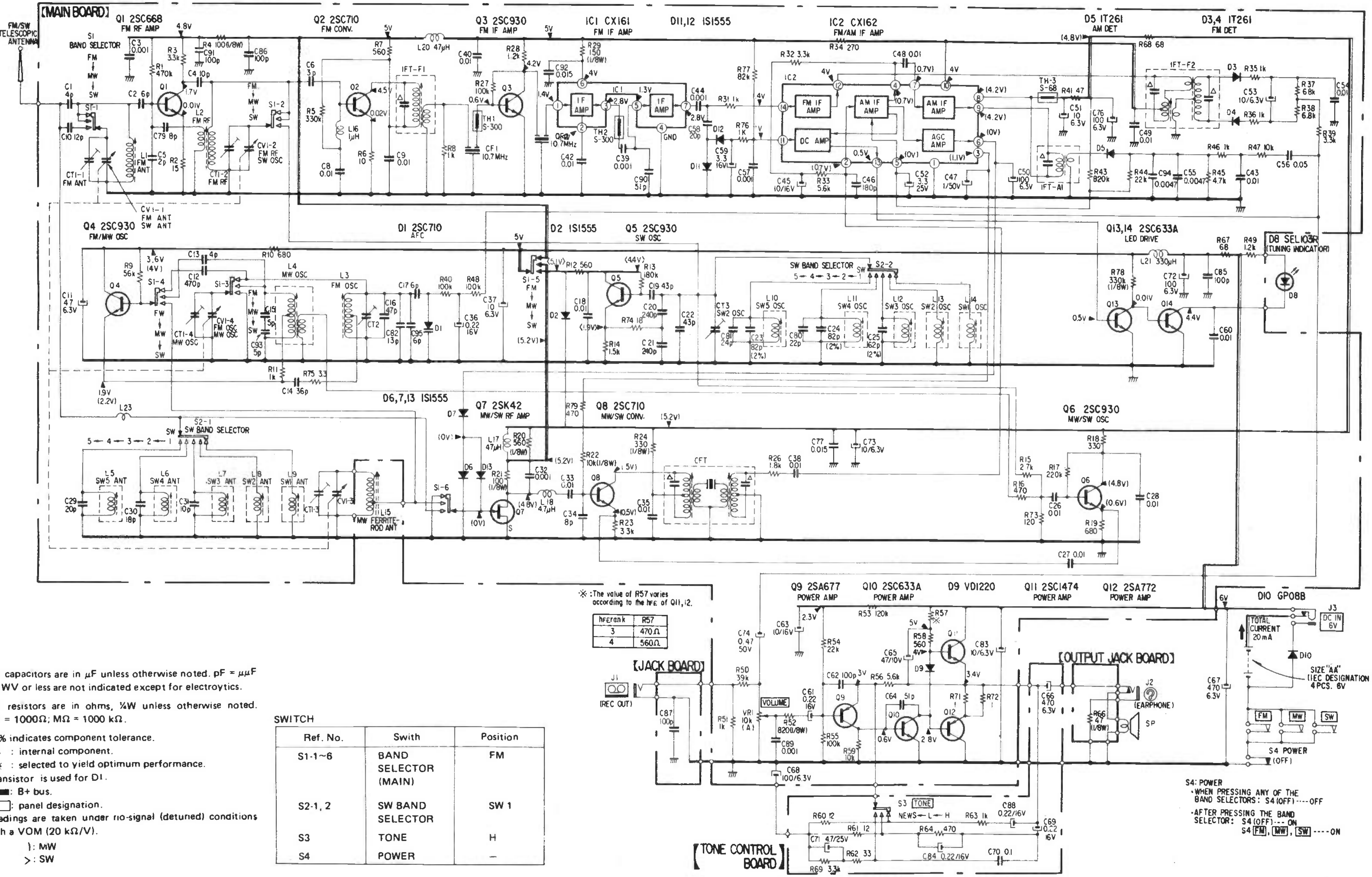
Amplitude modulation section

The medium Wave and Short Wave oscillators (Q4 and Q5 respectively) are kept separate for a good reason. The MW oscillator tunes a much wider (relative) frequency range using the familiar base/emitter feedback coupling. Great for tuning (525+455) kHz to (1605+455) kHz, but a rather tedious process to switch reliably over a number of short-wave ranges since it involves two 'hot' connections per band, and relatively little residual capacitance so that the effects of capacitance on the switching leads will tend to be accentuated.

Q5 forms the SW local oscillator using a Colpitts configuration that does not permit the same wide range tuning due to the increased residual capacitance across the tank circuit – but then 3:1 tuning is of little use over the short scale available. This approach enables Sony to switch a single 'hot' connection when selecting the SW oscillators and provide a bandspread resolution for the cramped SW broadcast frequencies. The output of the AM and SW oscillators isn't switched, since Q6 provides the function of a combiner and buffer: an unbuffered SW oscillator would wobble around far too readily in sympathy with the signal fading. The AM mixer is another common emitter configuration – but this one uses the preferred injection technique via the emitter. Remember that a lot of signal appears at the emitter in such stages (that would usually be grounded by a capacitor in an amplifying stage), and this makes the oscillator buffer all the more essential.

The AM RF stage uses an FET, which again assists in the simplicity of switching only one 'hot' point per band. AGC is applied in a novel manner via the diodes D6, D7 & D13. The AGC signal itself is supplied from the first IF amplifier, with the actual IF AGC derived from the detector diode. Note that the detector diode is faintly forward biased via R43 to maintain good linearity at low signal levels. Also note the relatively complex signal de-emphasis after detection – R44, C94, C55 etc. – and don't overlook the feedback tone control shaping on the audio amplifier selected by S3.

Unlike many sets that merely switch a capacitor across the audio level pot to provide a degree of muffle, Sony don't duck the issue but go to town with the



Note:

- All capacitors are in μF unless otherwise noted. pF = $\mu\mu F$ 50 WV or less are not indicated except for electroytics.
- All resistors are in ohms, ¼W unless otherwise noted. kΩ = 1000Ω; MΩ = 1000 kΩ.
- ±2% indicates component tolerance.
- △ : internal component.
- ※ : selected to yield optimum performance.
- Transistor is used for D1.
- ▬▬: B+ bus.
- ▭: panel designation.
- Readings are taken under no-signal (detuned) conditions with a VOM (20 kΩ/V).
  - ( ): MW
  - < >: SW

SWITCH

Ref. No.	Swith	Position
S1-1~6	BAND SELECTOR (MAIN)	FM
S2-1, 2	SW BAND SELECTOR	SW 1
S3	TONE	H
S4	POWER	—

***Fig 2** ICF 7600 Receiver – circuit*

real thing, with a genuine feedback bandpass shaping circuit contained on the tone control board. The IF filter isn't state of the art by current standards, but then, there's always room for improvement somewhere, isn't there?

Setting the standard

How is it that Sony manage to charge £70 for a portable radio that apparently does the same as one from Hong Kong costing around £15? The enviable reputation built by Sony for quality and reliability is an amazingly bankable feature of their marketing.

Sony also manage to plough on with models that have a lifespan that is considerably longer than the erstwhile UK industry seemed able to achieve – and it's all down to investment and *R & D*. Bemused British consumer electronic companies concentrated their efforts on trying to compete with Hong Kong when a more enlightened industrial policy might have encouraged them to invest in the means of competing with quality from the Japanese.

Multiple stores and electrical retailers did their part to encourage UK industry to cut its own throat by demanding ever cheaper products to compete with the cheapest oriental offerings – and those UK makers who have survived have only done so by sticking their brand names on imported merchandise.

I can do that....

I'd hope that many of you reading this review have wondered why an enterprising British manufacturer could not have produced and marketed a design of the concise simplicity of Sony's ICF7600. (Yes, I know Sony now have their own exemplary manufacturing operations in Britain, but that's primarily an EEC import regulation convenience, and the profits do not ultimately underwrite British industrial performance).

That's a good question – probably best answered by comparing the extensive world-wide marketing, service and distribution established by Sony through careful planning and longterm strategies with the type of ad-hoc business offered by the current UK electrical goods trade. The moral of this tale is that the best technical ideas and the best production technologies are not worth a light unless the means of getting them to the consumer are equally efficient and thoroughly planned. The extreme example is the US market where first-time visitors are frequently surprised by the tackiness of the fabric of the place – slick marketing and high pressure techniques have built a nation trained to live with transitory consumables (or should that read disposables?). The marketing is well ahead of the quality in many instances.

First-time visitors to some of the more laid back European nations such as Germany, Sweden and Denmark find the opposite prevails: the quality of average household goods exceeds expectations based on UK standards, and there is a better balance between the quality and the marketed image. The UK manufacturers' dilemma has been compounded by the 'instant' US marketing influence on the UK public available through the common language and similar institutions. We appear to be getting the worst of both worlds: a taste for inferior produce, and the loss of our own ability to market successfully in our own right.

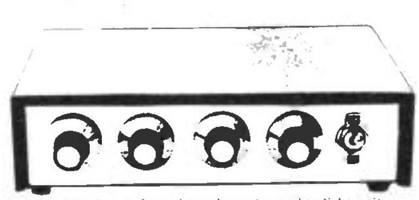
So if you reckon that there's not too much to producing a radio with around £10 worth of bits that sells for nearer £70, the first thing you need to do is go and set up distribution in 25 countries. It's terribly easy – there's lots of help from government agencies, all sorts of people are just dying to act as your exclusive agent. And you don't necessarily need to hire the German equivalent of John Cleese to punt your product. In fact, a silly walk paraded before the consumer of the Fatherland could be misconstrued rather badly!

Write and let us know how you get on, we'll be watching the financial page for your progress.

PREVIOUSLY ADVERTISED STILL AVAILABLE

Tape punch and reader	£22.50
Bench isolating transformer 250 watt	£7.75
BOAC in-flight stereo unit	£1.50
Drill assortment 4 each 25 sizes between .25mm & 2.5mm	£11.50
Battery condition tester, less box	£1.75
Nicad chargers, mains	£0.75
Flourescent inventor 13 watt from 12v	£3.50
Ten digit stitch pad-pb phone etc.	£1.95
Uniselector 2 pole 25 way	£4.60
Water valve mains operated	£2.50
Counter 6 digit mains operated	£1.15
ditto 12v resettable	£3.45
Double glazing clear PVC sheet, 23½" wide-per running ft.	£0.15
Locking mechanism with 2 keys	£1.15
Magnetic Clutch	£4.50
Mouth operated suck or blow switch	£2.30
Solenoid with slug 8 - 12v battery op.	£1.82
ditto 230v mains	£2.30
Timer Omron STP NH 110v AC Coil	£6.90
Key switch with 2 keys dp mains	£1.75
Air valve mains operated	£3.75
Latching relay mains operated	£3.50
Dry film lubricant aerosol can	£0.65
Coin op switch, cased with coin tray	£4.60

8 POWERFUL MODEL MOTORS (all different)
for robots, meccanos, drills, remote control planes, boats, etc. £2.95.



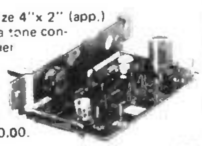
Complete kit of parts for a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is £14.95 in kit form or £25.00 assembled and tested.

12 volt MOTOR BY SMITHS
Made for use in cars, etc. these are series wound and they become more powerful as load increases. Size 3½" long by 3" dia. They have a good length of ¼" spindle — **Price £3.45.**
Ditto, but double ended £4.25.
Ditto, but permanent magnet £3.75.

EXTRA POWERFUL 12v MOTOR
Probably develops up to ¼ h.p. so it could be used to power a go-kart or to drive a compressor, etc. £7.95 + £1.50 post.

THERMOSTAT ASSORTMENT
10 different thermostats. 7 bi-metal types and 3 liquid types. There are the current stats which will open the switch to protect devices against overload, short circuits, etc., or when fitted say in front of the element of a blow heater, the heat would trip the stat if the blower fuses; appliance stats, one for high temperatures, others adjustable over a range of temperatures which could include 0 - 100°C. There is also a thermostatic pod which can be immersed, an oven stat, a calibrated boiler stat, finally an ice stat which, fitted to our waterproof heater element, up in the loft could protect your pipes from freezing. Separately, these thermostats could cost around £15.00 however, you can have the parcel for £2.50.

MINI MONO AMP on p.c.b., size 4"x 2" (app.)
Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of £1.15 each, or 10 for £10.00.



— BARGAIN OF THE YEAR —
The AMSTRAD Stereo Tuner.
This ready assembled unit is the ideal tuner for a music centre or an amplifier, it can also be quickly made into a personal stereo radio — easy to carry about and which will give you superb reception.

Other uses are as a "get you to sleep radio", you could even take it with you to use in the lounge when the rest of the family want to view programmes in which you are not interested. You can listen to some music instead.

Some of the features are: long wave band 115 – 270 KHz, medium wave band 525 – 1650KHz, FM band 87 – 108MHz, mono, stereo & AFC switchable, tuning meter to give you spot on stereo tuning, optional LED wave band indicator, fully assembled and fully aligned. Full wiring up data showing you how to connect to amplifier or headphones and details of suitable FM aerial (note ferrite rod aerial is included for medium and long wave bands. All made up on very compact board.

Offered at a fraction of its cost: **only £6.00** + £1.50 post + insurance.

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REVERSIBLE MOTOR with control gear Made by the famous Framco Company this robust motor is approx 7½" long, 3½" dia. 3/8" shaft. Very powerful, almost impossible to stop. Ideal for operating stage curtains, doors, ventilators, etc. Even garage doors if properly balanced. Offered complete with control gear as follows:
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1 manual reversing & on/off switch
1 circuit diag. of connections
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2 limit stop switches
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Why not make your greeting card play a tune? It could play 'Happy Birthday' 'Merry Christmas', 'Wedding March', etc, or 'Home Sweet Home', etc. Wafer thin 3 part assemblies, for making cards musical. Mini microchip speaker and battery with switch that operates as the card is opened. Please state tune when ordering. Complete, ready to work £1.25.

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Ex-Language Teaching School. Second, but we understand these are in good order; any not so would be exchanged. The deck is standard with normal record, replay facilities and an additional feature is tape rev counter. Nicely finished in teak type box. We have 30 only of these. Price £8.50 each + £3 carriage.

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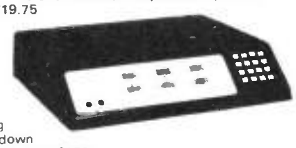
Plug and Wall socket — 4 pin or 5 pin	£3.45
Plugs only 4 pin or 5 pin	£1.15
Modern desk telephone	£7.50
Heavy black old type	£5.50
External bell unit	£6.50
Bell ringing power unit	£4.50
Pick up coil	£1.15

STABILISED POWER SUPPLY (Mains Input)
By LAMDA (USA) — Ideal for computer add-ons, d.c. output. Regulated for line volts and load current. Voltage regulation .1% with input variations up to 20% — load regulation 1% from no load to full load — or full load to no load. Complete in heavy duty case — Models available: 5v - 9A £23. 12v - 1.5A £13.25. 15v - 1.2A £13.25. 24v - 2A £23.

PRESTEL UNIT — brand new and complete except for 7 plug in IC's — Price: £19.75 + £2.00 p&p.
Note: British Telecom may not connect this equipment as there is no manufacturer to guarantee it, however it is well worth buying for its immense breakdown value — sold originally at over £150.



FROZEN PIPES. Can be avoided by winding our heating cable around them — 15 mtrs connected to mains costs only about 10p per week to run. Hundreds of other uses as it is waterproof and very flexible. Resistance 60 ohms/metre. Price 28p/metre or 15 m for £3.95

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50 THINGS YOU CAN MAKE
Things you can make include Multi range meter, Low ohms tester, A.C. amps meter, Alarm clock, Soldering iron minder, Two way telephone, Memory jogger, Live line tester, Continuity checker, etc. etc., and you will still have hundreds of parts for future projects. Our 10Kg parcel contains not less than 1,000 items - panel meters, timers, thermal trips, relays, switches, motors, drills, taps, and dies, tools, thermostats, coils, condensers, resistors, neons, earphone/microphones, nicad charger, power unit, multi-turn pots and notes on the 50 projects.
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MINI-MULTI TESTER Deluxe pocket size precision moving coil instrument, Jewelled bearings - 2000 o.p.v. mirrored scale.
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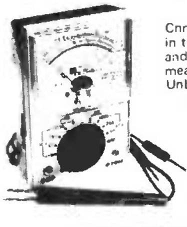

FREE Amps range kit to enable you to read DC current from 0 - 10 amps, directly on the 0 - 10 scale. It's free if you purchase quickly, but if you already own a Mini-Tester and would like one, send **£2.50.**

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All stocks must go from one of our big warehouses. 10,000,000 items, everything from AERIALS to ZENER will be cleared at fantastically low prices - if you are a manufacturer you can save yourself a fortune - send for our Sale List, not for small buyers as minimum order £100.

EXTRACTOR FANS — MAINS OPERATED
Woods extractor.
5" — £5.75, Post £1.25.
6" — £6.95, Post £1.25.
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4"x 4" Muffin 115v. £4.50. Post 75p.
4"x 4" Muffin 230v. £5.75. Post 75p.
All the above ex-computer, those below are unused.
4" x 4" £8.50. Post 75p.
9" American made £11.50 post £2.00.
Tangential Blower 10x3 air outlet, dual speed £4.60. Post £1.50.

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by British Solartron, as used in best blow heaters. 2Kw approx 9" wide £5.95, 3Kw either 9" or 12" wide (your choice) £6.95 complete with 'cold' 'half' and 'full' heat switch, safety cut out and connection dig. Please add post £1.50 for 1 or £2.30 for two.

2.5 Kw KIT Still available: £4.95 + £1.50 post.

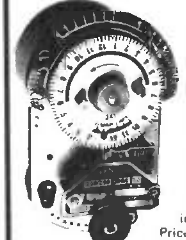
MINIATURE WAFER SWITCHES
2 pole, 2 way — 4 pole, 2 way — 3 pole, 3 way — 4 pole, 3 way — 2 pole, 4 way — 3 pole, 4 way — 2 pole, 6 way — 1 pole, 12 way.
All at 25p each.

BLEEP TONE These work off 12v and have an unusual and pleasant bleep 69p each.

CONNECTING WIRE PACK 48 lengths of connecting wire, each 1 metre long and differently colour coded, a must for those difficult interconnecting jobs. 85p the lot.

RED LEDS 10 for 69p. 100 for £5.75. 1000 for £52.

IN LINE SIMMERSTAT Ideal heat controller for soldering iron and many other hand-held appliances. £2.30. 10 for £17.25.



VENNER TIME SWITCH
Mains operated with 20 amp switch, one on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only £2.95. These are without case but we can supply a plastic case - £1.75 or metal case - £2.95. Also available is adaptor kit to convert this into a normal 24 hr. time switch but with the added advantage of up to 12 on/offs per 24 hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is £2.30.

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Refresh your home, office, shop, work room, etc. with a negative ION generator. Makes you feel better and work harder — a complete mains operated kit, case included.
£11.95 plus £2.00 post.

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COMMUNICATIONS BUILDING BLOCKS

IF AMPLIFIERS-2

LINEAR IF'S FOR AM AND SSB

Intermediate frequency amplifiers tend to be the Cinderella circuits of communications design. Designs can range from the very basic to the outlandish and still provide a similar perceived performance, why?

Not-so-linear IF systems

Most HF receiver designers are obsessed (rightly so) with a commodity known as linearity. Without linearity, any form of communication that uses amplitude variation as the means of impressing the information on the radio signal (AM/SSB/MCW) means less when it arrives at the loudspeaker than when it left the transmitter.

This is not to say that there are not acceptable techniques for varying the linearity of a signal within the bounds of communication engineering: effects such as AGC (auto gain control) and ALC (auto level control) are essential features in circuit design where there is finite dynamic range – or signals with AC swing exceeding the available rail voltages will simply top and bottom out against the available supply voltages. *(Figure 1).*

However, although the plot of input signal level against output signal level is anything but 'linear' where AGC is applied, such functions are employed to ensure the relative linearity of the signal – and to save the receiver operator from having to wind the volume control back and forth across 120dB in order to keep the audio output level constant. Thus AGC performs the dual function of providing a constant relative audio output level for signals of equivalent modulation characteristics but differing RF carrier levels – carrier derived AGC.

The absence of a carrier signal in SSB transmissions means that the RF carrier signal and the resulting audio signal are in direct proportion to one another, and so the AGC can be derived from either source. The popular view has been to use the audio derivation of AGC – although it is actually difficult to see how the signal could be anything but audio derived since the first thing a carrier AGC circuit does is to rectify the RF to abstract the DC and LF information.

However, in SSB reception, the SSB must first be mixed with the local oscillator at the IF frequency in the product detector to achieve an understandable audible result. In some cases the stray BFO injection can cause errors on low level AGC signals detected in 'carrier' mode – although there is little evidence of this in most modern receivers.

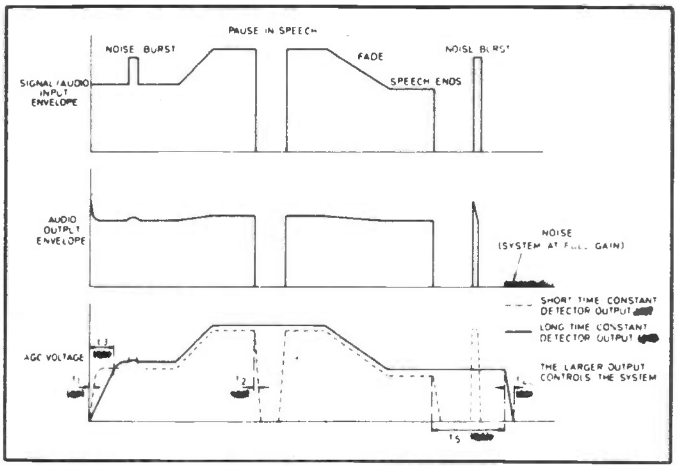

Fig 1 *Dynamic response of a system controlled by SL620C or SL621C AGC generator*

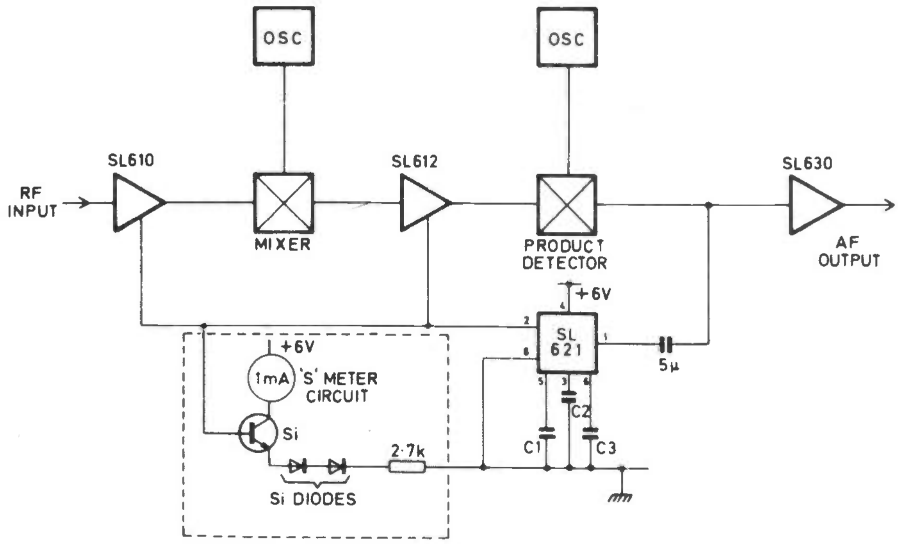

Fig 2 *SL621C used to control SSB receiver*

The ready willingness to adopt audio derived AGC is largely due to the easy implementation in the shape of Plessey's SL1621 *(Figure 2).* The ease with which this IC can be programmed to vary the attack, hold and decay characteristic is the ultimate in 'convenience' products for communications engineers.

Fast food for designers: chips with everything?

You may wonder why magazines like *R&EW* spend time extolling the virtues of using ICs in communications circuits, when if you prise open the handbook of the average Japanese rig, there are relatively few ICs in the signal proces-

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AN214Q	3.88	SN76533N	1.60	TBA641BX1	4.50	UPC1156H	4.20
AN715Q	2.90	SN76650N	1.05	TBA651	2.80	UPC1158H	0.78
CA3065	1.75	SN76660N	0.75	TBA673	2.40	UPC1163H	0.98
CA4031P	2.88	SN76666N	0.80	TBA700	2.85	UPC1181H	1.60
CA4102	3.30	STK015	6.50	TBA750	2.80	UPC1185H2	3.75
CA4250	3.50	TA7108P	3.20	TBA800	1.60	UPC1212C	1.30
CA4400	2.98	TA7120P	2.20	TBA810P	1.10	UPC1230H	3.90
CA4422	3.07	TA7129AP	3.65	TBA810S	1.20	UPC1350C	4.25
LC7120	5.33	TA7130P	1.65	TBA820	1.60	UPC1367C	3.40
LC7130	5.26	TA7172	1.80	TBA890	3.88	UPC1378H	4.40
LC7137	5.16	TA7193	6.50	TBA920/Q	3.00	UPC2002H	2.80
LM380N	0.80	TA7172P	1.80	TBA950/2A	3.05		
LM1303N	2.52	TA7176	2.50	TBA970	4.05		
HA1151P	3.12	TA7202P	4.18	TBA990	1.88		
MC1307P	1.85	TA7204P	1.86	TCA160C	3.90		
MC1310P	1.85	TA7205AP	1.50	TCA270S	4.00		
MC1312P	2.25	TA7208P	3.25	TCA270SA	4.02		
MC1327P	1.75	TA7210P	.50	TCA800	3.10		
MC1330P	0.83	TA7222P	1.88	TCA940	1.90		
MC13449P	1.85	TA7223P	3.68	TDA440	3.80		
MC1350P	1.20	TA7227P	5.60	TDA1002	1.90		
MC1351P	2.50	TA7310P	1.80	TDA1003A	5.50		
MC1352P	1.50	TA7609P	4.28	TDA1004A	2.90		
MC1357P	.88	TA7611AP	2.88	TDA1006A	2.40		
MC1358P	1.30	TAA263	2.46	TDA1035S	4.50		
MC1496L	1.15	TAA310A	2.68	TDA1044	4.30		
ML231B	2.10	TAA550	0.50	TDA1170S	3.00		
ML232B	2.10	TAA570	1.99	DA1190	3.50		
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C-mos555	0.88	TAA630S	3.90	TDA1327A	1.66		
NE556	0.80	TAA661B	1.70	TDA1352A/B	1.56		
SAA1024	5.35	TAA700	2.80	TDA1412	1.20		
SAA1025	8.40	TAA840	3.38	TDA2002	2.80		
SAS560A	2.50	TAD100	2.80	TDA2020	4.60		
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SAS570S	1.85	TBA120A	1.00	TDA2140	5.90		
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SAS590	2.82	Q,T,U,UQ	1.32	TDA2523	3.50		
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SL432A	4.00	TBA231	1.45	TDA2540	3.80		
SL901B	5.20	TBA281	2.65	TDA2541	3.80		
SL917B	6.25	TBA395	1.20	TDA2560	3.50		
SL1327Q	1.10	TBA480Q	1.50	TDA2571A	2.50		
SN76003N	2.44	TBA400	2.30	TDA2581	3.20		
SN76013N	1.90	TBA510	2.60	TDA2590	3.20		
SN76023ND	2.90	TBA510Q	2.60	TDA2591	2.98		
SN76033N	2.45	TBA520/Q	1.60	TDA2593	2.98		
SN76110N	1.12	TBA530/Q	1.30	TDA2610	3.20		
SN76115N	2.00	TBA540/Q	1.40	TDA2611A	1.94		
SN76131N	1.65	TBA550/Q	1.52	TDA2640	2.90		
SN76226DN	1.80	TBA560C	1.70	TDA2680	3.40		
SN76227N	1.10	TBA560CQ	1.60	TDA2690	3.50		
				TDA3950/A/B	2.60		
				UPC554C	1.32		
				UPC557H	0.90		
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				UPC575C2	3.20		
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				UPC1025H	2.90		

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100V	0.28
200V	0.32
400V	0.40
600V	0.50
800V	0.58
3A 100V	0.52
200V	0.55
400V	0.61
600V	0.67
800V	0.60
6A 100V	0.66
200V	0.68
400V	0.74
600V	0.80
800V	0.86
10A 50V	2.20
100V	2.24
200V	2.35
400V	2.50
600V	3.50
5A 50V	2.05
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200V	2.40
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This 3-pin Adaptor fits directly into 13A socket. Complete with lead & 3.5mm. Jack plug. Ideal for radios, TV games, cassette recorder etc. 9V 500mA. **£2.50 incl p/p & VAT.**

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RESISTOR KITS — each value individually packed

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1/2W pack 5 each value E12—2R2 to 1M 365 pieces	3.00
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VDRs etc

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01/	0.28
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E798CD	
/A258	0.25
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P115	
P354 all	0.23
E299DH	
/P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53 all	0.20
VA1055s/56s/66s/67s all	0.23
VA1074	0.20
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VA1091	0.29
VA1096/97/98 all	0.20
VA1103	0.32
VA1104	0.66
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VA865	1.20
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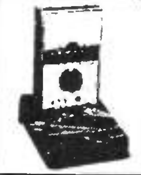

Russian type U4324 – (200,000OPV)
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AC Volts: 3, 6, 15, 60, 150, 300, 600, 900,
AC Curr M/A: 0.06, 0.6, 6, 60, 600, 3000
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16	pin	0.11	1.00/10
18	pin	0.14	1.60/10
22	pin	0.21	1.95/10
24	pin	0.25	2.25/10
28	pin	0.30	2.75/10
40	pin	0.34	3.10/10

Dil to Dil

14	pin	0.30	2.75/10
16	pin	0.32	2.90/10
18	pin	0.34	3.10/10

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16	pin	0.34	3.10/10

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AC127	0.30	A B or C	0.12	BC303	0.32	BD375	0.32
AC128	0.30	BC113	0.14	BC307	0.10	BD410	0.76
AC128K	0.34	BC114	0.12	BC308A	0.10	BD434	0.68
AC132	0.55	BC115	0.12	BC323	0.99	BD436	0.68
AC141	0.26	BC116	0.15	BC327	0.14	BD437	0.76
AC141	0.26	BC117	0.22	BC328	0.14	BD438	0.76
AC141K	0.40	BC118	0.17	BC337	0.12	BD439	0.68
AC142	0.26	BC119	0.30	BC338	0.12	BD507	0.48
AC142K	0.48	BC125	0.12	BC350	0.14	BD508	0.53
AC151	0.45	BC140	0.28	BC440	0.30	BD509	0.54
AC152	0.45	BC141	0.42	BC441	0.32	BD510	0.48
AC176	0.28	BC142	0.30	BC461	0.32	BD517	0.56
AC176K	0.46	BC143	0.30	BC547	0.12	BD520	0.66
AC187	0.26	BC147	0.08	BC548	0.12	BD699	1.25
AC187K	0.40	A or B	0.10	BC549	0.12	BD707	0.88
AC188	0.28	BC148	0.08	BC550	0.18	BDX18	2.35
AC188K	0.40	A or B	0.10	BC550C	0.18	BDX32	2.10
ACY40	0.88	BC149	0.09	BC557	0.12	BF115	0.32
AD142	1.10	BC157	0.10	BC558	0.12	BF117	0.54
AD143	1.10	BC158	0.10	BCX34	0.27	BF119	0.82
AD149	0.96	BC159	0.10	BCY70	0.15	BF120	0.38
AD161	0.42	BC160	0.30	BCY71	0.17	BF123	0.40
AD162	0.42	BC161	0.30	BCY72	0.18	BF125	0.42
AD161/AD162	0.98	BC168B	0.12	BCZ10	1.68	BF127	0.38
AF106	0.48	BC169C	0.10	BCZ11	1.45	BF152	0.16
AF114	2.10	BC170	0.14	BD124P	0.80	BF154	0.23
AF115	2.10	BC170B	0.12	BC130Y	0.68	BF157	0.40
AF116	2.10	BC171	0.10	BD131	0.34	BF158	0.22
AF117	2.10	BC171	0.10	BD132	0.34	BF159	0.24
AF118	0.85	A or B	0.08	BD131/BD132	0.95	BFR160	0.23
AF121	0.62	BC172	0.08	BD135	0.32	BF167	0.30
AF124	0.48	A or B	0.12	BD136	0.36	BF173	0.25
AF125	0.48	BC177	0.20	BD137	0.36	BF177	0.42
AF127	0.48	BC178A	0.22	BD138	0.38	BF178	0.30
AF139	0.68	BC182	0.08	BD139	0.38	BF179	0.32
AF178	0.68	A B or C	0.09	BD140	0.38	BF180	0.35
AF239	0.68	BC182L	0.09	BD144	160	BF181	0.35
AF279S	0.72	A B or C	0.09	BD145	1.82	BF182	0.32
AL100	2.50	BC183	0.09	BD150A	0.51	BF183	0.32
AL102	1.88	A B or C	0.10	BD159	0.65	BF184	0.32
AL113	2.20	BC183L	0.06	BD160	1.65	BF185	0.32
ASY80	1.75	A B or C	0.12	BD165	0.45	BF194	0.08
AU110	1.40	BC184	0.10	BD175	0.60	BF195	0.10
AY102	4.32	A B or C	0.10	BD182	1.00	BF196	0.10
BA102	0.34	BC207	0.15	BD183	1.10	BF197	0.10
BA110	0.67	BC208	0.16	BD184	1.20	BF198	0.14
BA121	0.40	BC212	0.09	BD201	0.72	BF199	0.16
BA129	0.38	A B or C	0.10	BD202	0.87	BF200	0.48
BA148	0.16	BC212L	0.08	BD204	0.80	BF222	0.48
BA154	0.08	A B or C	0.10	BD222	0.80	BF224	0.20
BA155	0.10	BC213	0.09	BD225	0.86	BF224J	0.16
BA156	0.08	A or B	0.10	BD232	0.45	BF240	0.20
BA157	0.28	BC213L	0.10	BD233	0.60	BF241	0.26
BA164	0.14	A or B	0.10	BD234	0.62	BF244	0.26
BB104B	0.52	BC237	0.11	BD235	0.63	BF244A	0.28
BB105B	0.30	BC236	0.12	BD236	0.63	BF244C	0.24
BB105G	0.48	BC239	0.14	BD237	0.66	BF245A	0.26
BB110B	0.42	BC251	0.12	BD238	0.56	BF254	0.15
BC107	0.10	A B or C	0.14	BD241	0.60	BF256	0.40
A or B	0.12	BC301	0.30	BD243A	0.80	BF257	0.32

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
BF258	0.30	BT101/300	1.15	BYX36/150	0.22	TIP32	0.40
BF259	0.32	BT101/500	1.25	BYX36/600	0.28	TIP32C	0.60
BF262	0.30	BT102/300	1.35	BYX48/300	0.72	TIP33A	0.63
BF263	0.30	BT102/500	1.65	BYX49/300	0.47	TIP34A	0.72
BF270	0.30	BT106	1.50	BYX55/350	0.29	TIP41C	0.46
BF271	0.26	BT108	1.30	BYX55/600	0.33	TIP42A	0.52
BF273	0.18	BT109	1.18	BYX71/600	1.18	TIP47	0.60
BF274	0.32	BT116	1.25	BYZ12	0.42	TIP110	0.88
BF323	0.92	BT119	3.62	C106D	0.80	TIP2955	0.60
BF336	0.26	BT120	3.60	E1222	0.40	TIP3055	0.60
BF337	0.26	BT121	3.02	E5024	0.30	TIS43	0.32
BF338	0.26	BT138/600	1.30	GET872	0.48	TIS88	0.40
BF355	0.42	BT151/560R	0.90	ITT44	0.04	TIS90	0.25
BF363	0.82	BT151/300R	1.15	ITT2002	0.11	TIS91	0.28
BF367	0.24	BTY79/400R	2.80	ME0402	0.20	ZTX108	0.12
BF371	0.27	BU100A	2.30	ME0404/2	0.24	ZTX109	0.12
BF422	0.38	BU104	2.00	MEU21	0.60	ZTX212	0.28
BF450	0.38	BU105	1.20	MJ400	1.25	IN4001	0.05
BF457	0.33	BU105/02	1.56	MJ2955	0.90	IN4003	0.05
BF458	0.36	BU108	1.80	MJ3000	1.98	IN4004	0.06
BF459	0.44	BU124	1.75	MJE240	0.60	IN4006	0.07
BFR39	0.22	BU126	1.25	MJE340	0.54	IN4007	0.07
BFR40	0.22	BU133	1.80	MJE370	0.88	IN4148	0.05
BFR41	0.22	BU204	1.35	MJE520	0.48	IN5400	0.12
BFR51	0.30	BU205	1.30	MJE2955	0.99	IN5402	0.15
BFR61	0.32	BU206	1.70	MJE3055	0.70	IN5405	.16
BFR62	0.28	BU208	1.55	MPSLO1	0.28	IN5406	0.18
BFR88	0.34	BU208A	1.63	OA47	0.10	IN5408	0.20
BFR90	1.72	BU208/02	2.05	OA90	0.08	IS920	0.08
BFT41	0.38	BU326S	1.75	OA91	0.09	2N697	0.55
BFT43	0.36	BU407	1.65	OA95	0.18	2N706A	0.33
BFW10	0.79	BU407D	1.80	OA200	0.06	2N2904	0.28
BFW44	0.76	BUX80	3.70	OA202	0.15	2N2906	0.24
BFX29	0.28	BUY20	1.76	OC25	2.10	2N2926G	0.10
BFX30	0.30	BUY69A	2.60	OC26	1.70	2N3053	0.22
BFX80	3.56	BUY69B	1.98	OC28	1.50	2N3054	0.56
BFX84	0.24	DBY101	0.48	OC29	2.47	2N3055	0.45
BFZ85	0.26	BY118	1.10	OC35	1.75	2N3702	0.10
BFX86	0.26	BY122	0.68	OC36	1.75	2N3704	0.10
BFX87	0.26	BY126	0.12	OC42	0.72	2N3708	0.10
BFX89	0.65	BY127	0.10	OC42K	1.40	2N3772	1.90
BFY50	0.21	BY133	0.16	OC44	0.72	2N3773	2.70
BFY51	0.21	BY135	0.25	OC45	0.58	2N3904	0.16
BFY52	0.21	BY164	44	OC71	0.50	2N3906	0.16
BFY57	0.40	BY179	0.66	OC72	0.52	2N5294	0.48
BFY90	0.90	BY182	0.87	OC81	0.68	2N6107	0.71
BFY90S	1.34	BY184	0.40	OC200	2.45	2N6126	0.68
BR100	0.20	BY187	0.72	OC202	2.20	2SB337	1.60
BR101	0.44	BY189	4.75	ORP12	0.85	2SC1172Y	2.90
BR103	0.58	BY198	0.44	R2008B	1.50	2SC1173Y	0.82
BRC443	1.76	BY199	0.47	R2010B	1.52	2SC1302	1.40
BRY39	0.38	BY206	0.24	SHG1.5	0.40	40251	0.95
BRY56	0.42	BY207	0.24	TAG1/100	1.40	40361	0.58
BRY61	0.86	BY210/400	0.25	TAG3/400	1.78	40362	0.50
BSS17	0.56	BY210/600	0.26	TIC44	0.40	40411	3.72
BSS27	0.92	BY210/800	0.30	TIC45	0.46	40530	0.80
BSX19	0.34	BY223	1.20	TIC46	0.48	40673	0.80
BSX20	0.34	BY227	0.26	TIC47	0.70	40964	1.54
BSX59	0.62	BY229	0.30	TIC106A	0.70		
BSX76	0.29	BY238	0.68	TIP30A	0.46		
BT100A/02	0.94	BYX10	0.24	TIP31C	0.54		

VOLTAGE REGULATORS

Type	Price (£)
78L05	0.30
78L08	0.30
78L12	0.30
78L15n	0.30
78M05	0.50
78M08	0.50
78M12	0.50
78M15	0.50
78M24	0.50
7805	0.55
7808	0.56
7812	0.55
7815	0.65
7818	0.55
7824	0.55
7905	0.65
7912	0.65
7915	0.65
7918	0.65
7924	0.65
CA3085	0.95
723C	0.36
LM317K	3.50

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2n2F 1500V DC	60p
2n2F 600V AC	24p
3n6F 1700V DC	60p
4n7F 1500V DC	60p
10nF 1000V DC	22p
10nF 500V AC	80p
15nF 300V AC	30p
22nF 300V AC	32p
100nF 1000V DC	46p
470nF 1000V DC	60p

HV Disc Ceramic (†)

1kV 1.5nF	18p
3kV 1.5nF	20p
8kV 10, 47, 82, 100, 120, 150, 180, 200, 220pF	30p
270, 300pF	39p
10kV 1nF	67p

VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.85
ECC82	0.65
ECC83	0.75
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.90
ECH81	0.75
ECH84	0.76
ECL82	0.76
ECL86	0.98
EF80	0.65
EF86	1.65
EF183	0.75
EF184	0.75
EH90	0.54
EL34	2.50
EL84	0.69
EL509	6.50
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	0.65
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.26
PCF200	1.55
PCF801	1.45
PCF802	0.85
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	0.90
PCL86	0.58
PCL805/85	1.35
PD500	3.76
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	1.20
PL508	2.40
PL509/519	5.95
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.30
UCL82	1.70
6J5GT	1.75
6SJ7	2.20
30FL12	1.60

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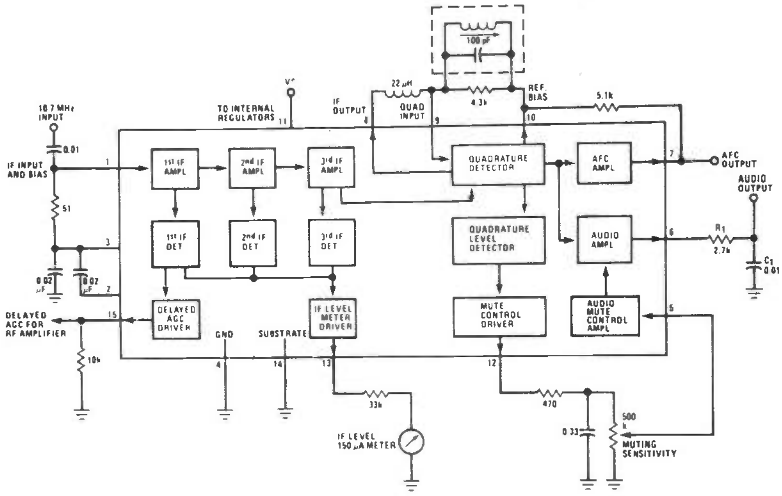


Fig 3 (a) Block diagram LM 3089

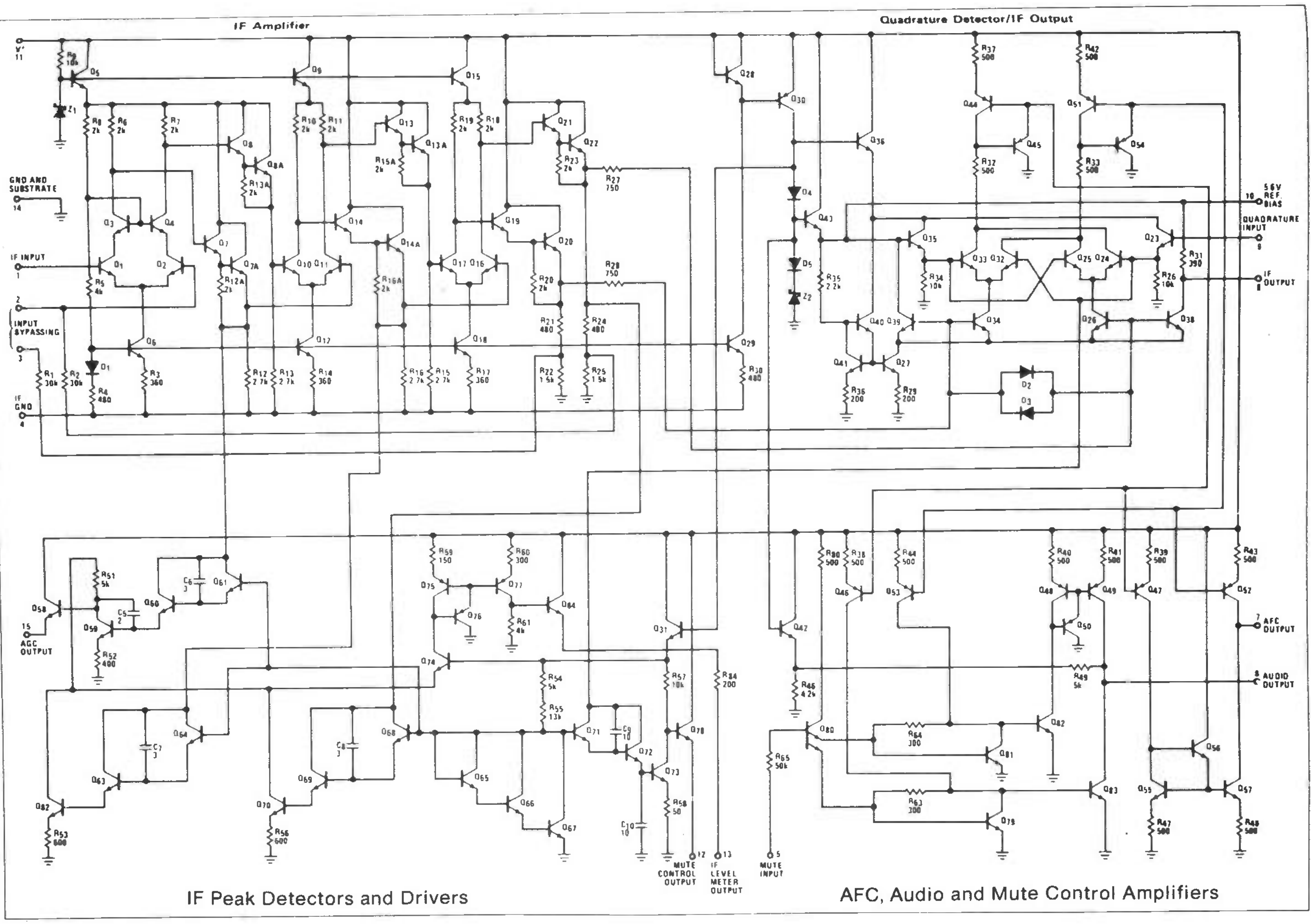


Fig 3 (b) Circuit diagram LM3089

sing path. By way of a small digression, we'll explain why this is generally so.

The short answer is cost and insularity: it's generally been cheaper to mass produce without the use of ICs, and the Japanese have had some very discouraging import tariff restrictions on the use of things like the SL600/SL1600 series. The design and debug costs of a receiver that will be produced by the thousand are quickly amortised down to a relatively minor proportion of the turnover – in something like a military radio where quantities are lower, (and cost generally not too much of a problem), the convenience of using ICs is more attractive.

The longer answer is that radio engineers tend to be a particular breed who prefer to keep total control of the design – and undesirable things going on inside ICs are generally beyond redemption without a major rethink of the circuit design and layout. The newer generations of designers are tending to take the convenience route and the designs are not actually showing any signs of suffering from this approach.

Don't forget the old guard of radio design was brought up on a good dose of

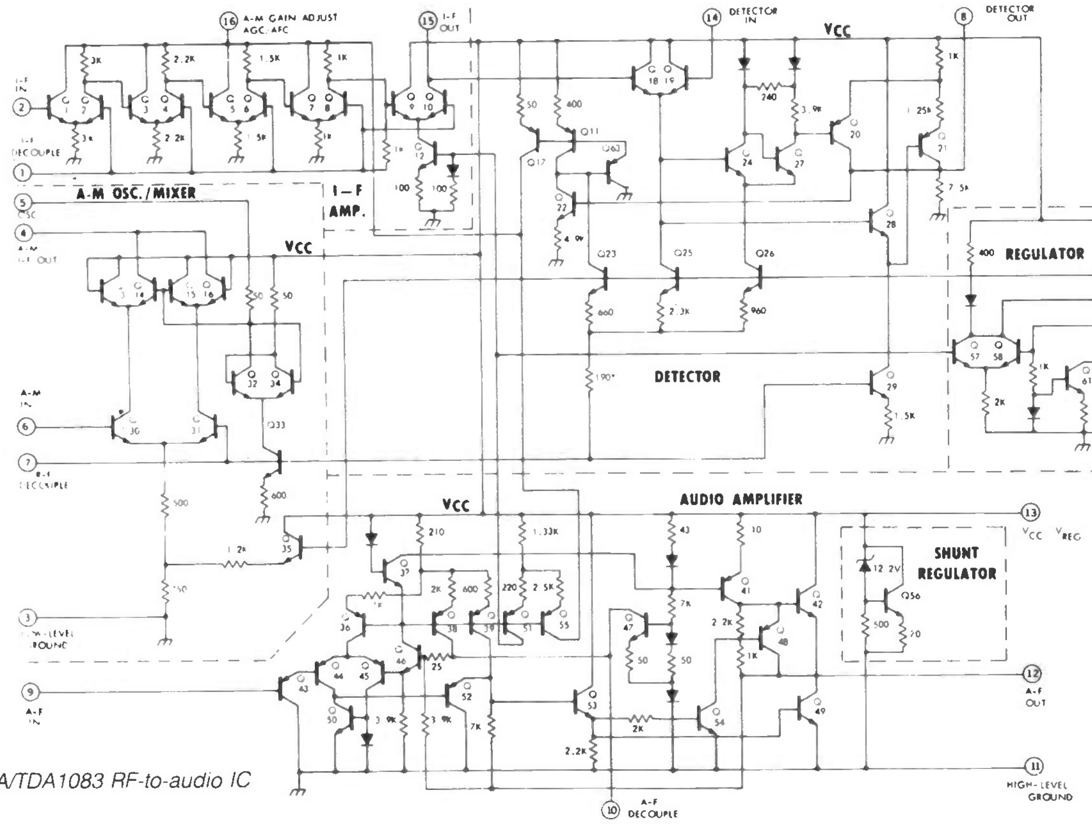


Fig 4 *ULN/2204A/TDA1083 RF-to-audio IC*

military surplus where the concept of availability for decades was part of the spec. Many linear IC manufacturers have shown an alarming tendency to drop radio designs after a couple of years (National Semiconductor's LM373/374 family being a favourite example) – and whilst this need not concern the enthusiast and experimenter (who has probably moved on to something newer and more exciting anyway) it certainly causes grief in the factories where the sets are being turned out as a commercial venture.

Having said all that, the moment you start to look into building blocks for FM and NBFM, the answer is simply 'chips with everything', and not much evidence of anything else but IC solutions.

Non-linear IFs

If there's a reader of *R&EW* who has yet to see an MC3357/MC3359 or CA3089/CA3189 application described, then we would be very surprised. These devices and their evolutionary descendants have swept the board in FM communications for nearly the past 7 years, since it is so much easier to determine the standards and requirements of FM communication systems.

Figures 3(a,b) gives the low-down on the CA3089E (courtesy of the National Semiconductor clone the LM3089). The blocks within the IC are the direct descendants of techniques first seen in devices like the TAA661B and ULN2111.

The long-tailed pair limiting amplifier is virtually 'standard' and the quadrature demodulator is reproduced in a variety of variants in most FM receiver ICs, and in other guises such as mixers and product detectors.

The AGC output is for the benefit of the pre-mixer and mixer stages of the receiver where squarewaves are not required due to the problems associated with intermodulation arising from the harmonics of the input signal mixing with the harmonics of the oscillator signals. The signal must be kept between the supply rails to avoid clipping, and AGC is the means of doing this.

ICs without an AGC facility generally end up having one added externally if they are to be used in serious communication applications – the MC3357 AGC can be derived from peak detection of a sniff of the IF from the output of the second mixer stage (after the IF filter). Some degree of amplification prior to the peak detection is required if the AGC is going to operate at a point before that where the second mixer itself would give up under the strain of overload.

Limiting amplification should only be considered after the final frequency conversion, or you will end up with more final frequencies being converted than originally bargained for, courtesy of Mr Fourier.

Limited SSB

One of the more intriguing areas for amateur experimentation is the question of using an FM IF IC for SSB reception. Really.

Experiments using the CA3089E revealed that the concept of injecting the local oscillator at pin 9 produced good 'communications' quality audio at the audio output (pin 7). It wasn't HiFi, nor did the mute functions of the IC operate correctly – signal level and AGC detection were largely operational. One of the best methods of injection was via a secondary winding of the 'ex' quadrature coil. About 50-100mV.

The fact that it works shouldn't really be that surprising. After all, the main technique applied is a form of (nearly) logarithmic compression brought about through the limiting process. As mentioned, a quadrature demodulator and a product detector have a great deal in common.

Flushed with success, experiments with the ULN2204/TDA1083 complete RF to audio IC *(Figure 4)* injecting via the coil on the secondary of pin 14 off the IC works just as well, and provides the added bonus of low voltage and current consumption, and on board audio into the bargain.

A more daring experiment that used the IC in its AM mode, took the AM oscillator mixer, ran the oscillator at IF and used the mixer stage as the product detector fed with the SSB from the output of the IF at pin 15, maintaining peak detection facilities for the purposes of AGC on the IF gain block!

This rather more ambitious project came to grief over the problem of leakage of the BFO into the IF strip, thus supressing the AGC action. More persistence and a double-sided layout could well resolve the problem and turn in a particularly neat SSB IF, detector and AF communications subsystem.

The trick is to find your way around the insides of the IC in question and not merely take the manufacturer's stated functions as the end of the matter. They're usually only the beginning for the avid dabbler.

Modifying the PYE PF1 Pocketfone Receiver for VHF Operation

This modification of the Pye PF1 Pocketfone receiver by A K Whatmore and B J Dennis produces a small, rugged unit that is ideal for Raynet or similar operation on 144MHz

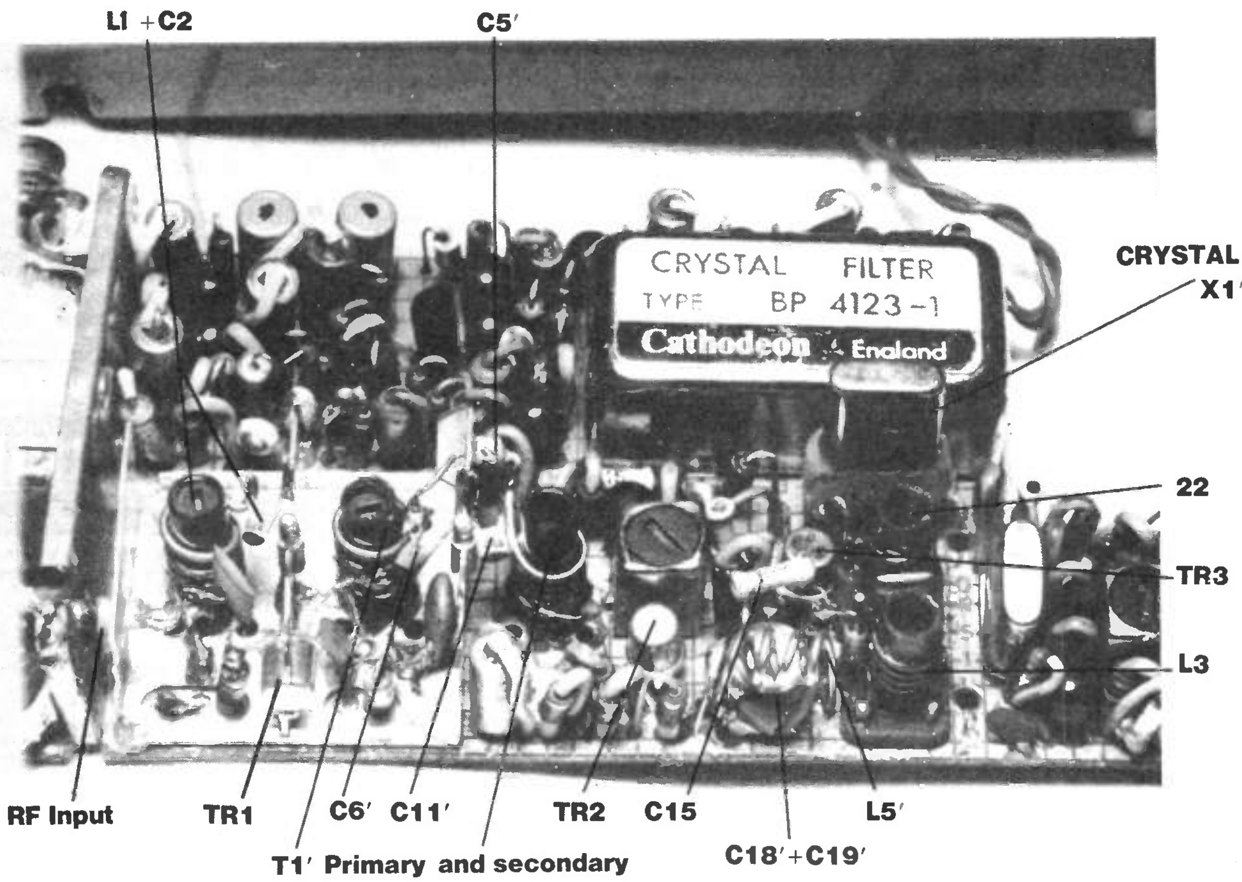


Fig 1 *The receiver after modification*

Anyone who has attempted to use the PF1 on 433MHz will be aware of its somewhat disappointing performance. Even when used in conjunction with a 5-watt base station using a high gain antenna, five to six miles is the best range that can be expected in a rural area; in town the range is considerably less.

It was this poor performance and the need for a small 144MHz portable receiver which prompted the authors to modify the PF1. Basically, the modifications can be divided into two parts:

(1) The retuning of the front-end and mixer stages,

(2) Modification of the oscillator and multiplier.

Type of oscillator

The original PF1 unit uses a 5th overtone crystal at around 90MHz and a diode multiplier to produce 450MHz. In order to operate on 2 metres the oscillator is modified to accept 3rd overtone crystals in the 44-45MHz range. With this arrangement the diode multiplier is retained and the output circuit is tuned to 134-135MHz.

The retuning of the front-end and mixer stages is accomplished by replacing the UHF parallel tuned circuits with similar VHF circuits.

Practical details

(1) Remove two 4 BA bolts to split the plastic case.

(2) Unscrew four 10 BA nuts to remove silver-plated case (screening).

(3) Locate C2, C6, C11, unscrew their six 10 BA securing nuts and bolts, and discard the capacitors.

(4) Unsolder the tuned circuit assemblies, T1 (primary and secondary) and L1.

(5) If necessary, drill out capacitor adjusting holes to accommodate bases of 4mm coil formers.

MODIFYING THE PYE PF1

COMPONENT DETAILS

L1[1] . . .4.5 turns, 4mm diameter, 22 SWG; taps at 2 and 3 turns from earthy end.

T1[1] . . .Primary — 4.5 turns, 4mm diameter, 22 SWG; tap at 3 turns from HT supply end.
Secondary — 4.5 turns, 4mm diameter, 22 SWG; tap at 2 turns from earthy end.

All above formers fitted with VHF–type adjustable dust–iron core.

L5[1] . . .4 turns, 3mm diameter, 26 SWG; tap at 1 and 3 turns, no dust–iron core.

X1[1] . . .Crystal Type WW962, supplied by *Webster Electronics, Rose Mills, Hart Bridge, Ilminster, Somerset TA19 9QA*

Note: *All capacitors (except C18[1]) are fixed ceramic types. Those marked[1] are adjusted during alignment by varying their orientation.*

(6) Fit three coil formers complete with coils L1' and T1' which replace L1 and T1 (refer to Parts List).
(7) Fit replacement capacitors C2', C6' and C11'.
(8) Connect tappings on to L1' and T1' coils and fit C5'.
(9) Remove 2.2pF capacitor C3 from between collector and base of oscillator TR3.
(10) Fit 47pF capacitor (Cc) between emitter and base of TR3 on underside of board.
(11) Remove and discard 15pF capacitor (C8) and 2k7 resistor (R74) from oscillator collector coil (L3).
(12) Fit 70pF (C8') across collector coil (L3).
(13) Rewind frequency adjustment coil, L2, if necessary to 8 turns.
(14) Remove and replace L5, C18 and C19 with L5', C18' and C19'.
(15) Remove existing crystal and fit replacement.

When these modifications have been carried out, the PF1 is ready for alignment.

Retuning

First disable the battery-saver circuit. This is done by shorting out R51 (33k) on the underside of the board. This will result in a constant roar from the receiver as the volume control is advanced, in place of the usual ticking. To facilitate tuning, the silver-plated aerial is unsoldered from the PTFE feedthrough and is replaced with a coaxial cable and socket.

A strong local signal should now be introduced to the unit via the station antenna. L2 and L3 are first adjusted for best quieting. If a 10.7MHz frequency standard is available, L2 should be adjusted for zero beat. Alternatively, L2 should be adjusted for best received audio. C18' is now adjusted for best quieting.

The front-end should now be aligned in the same manner as above, i.e. by adjusting L1' and T1' for best quieting, and reducing the incoming signal as and when necessary by movement of the station antenna. L1' is fairly flat in its adjustment, however, T1' should peak quite sharply. When no further improvement can be achieved (it is worth running through the stages several times) the station antenna should be replaced by 19in of plastic-covered wire of a suitable size to feed through the plastic grill. L1' can now be adjusted again on a weak signal. Alignment is now complete and the short-circuit across R51 can be removed to restore the battery saver.

Half a dozen PF1s have been modified to date and so far all of them come up to the following specification:

f_{mod} 1kHz
Δf 5kHz
0.3μV PD gave greater than 12dB S/N ratio

When modified, the units made an inexpensive and rugged monitor receiver ideal for Raynet or similar operation. They have given very satisfactory results when operated some 30 miles from the beacon. The whole modification can be made for less than £15.

MODIFICATION PARTS LIST

Existing Component	Replacement Component		Action
Resistors			
R1 680Ω		–	
R2 6.8kΩ		–	
R3		–	
R4 470Ω		–	
R6 15kΩ		–	None
R7 33kΩ		–	
R8 6.8kΩ		–	
R9 390kΩ		–	
R10 270Ω		–	
R11 560Ω		–	
R74 2.7kΩ		–	Remove
Capacitors			
C1 2.2nF		–	None
C2	C2[1]	8.2pF	Remove/replace
C3 2·2pf			Remove
C4 100pF		–	None
C5	C5[1]	2.2pF	Remove/replace
C6	C6[1]	15pF	
C7 15pF		–	None
C8	C8[1]	70pF	Remove/replace
C9 10nF		–	None
C10 10nF		–	
C11	C11[1]	8.2pF	Remove/replace
C12 1nF		–	
C13 70pF		–	None
C14 10nF		–	
C15 100pF		–	
C18	C18[1]	4.5–20pF trimmer; plus 15–20pF fixed, as required	Remove/replace
C19	C19[1]	18pF	
C66	1nf	-	None
—	Cc	47pF	Fit new
Other			
L1	L1[1]		Remove/replace
L2	-		Rewind if necessary
L5	L5[1]		
T1	T[1]		Remove/replace
X1	X1[1]		

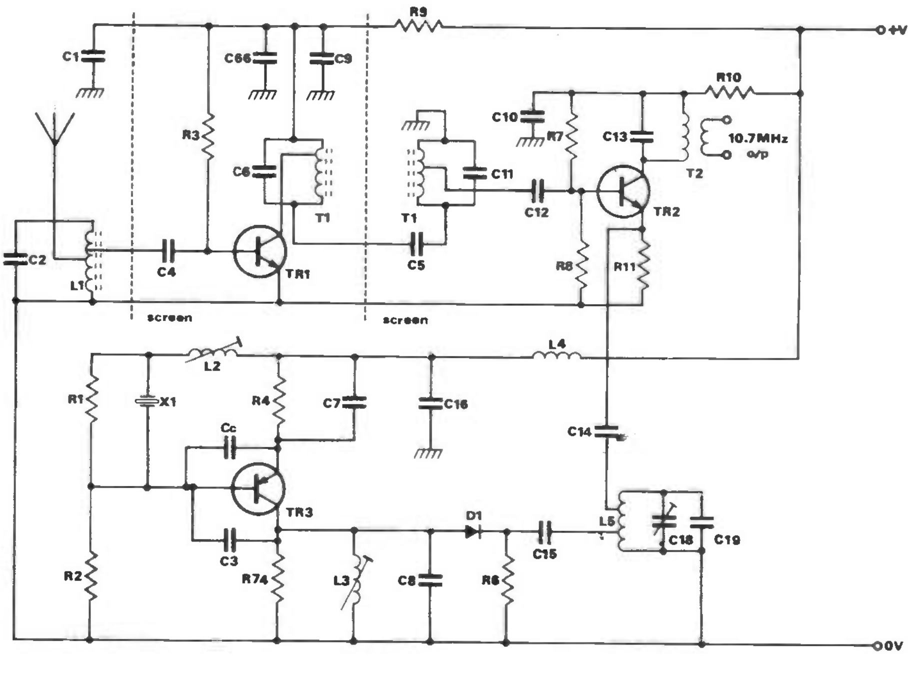


Fig 2 *Circuit detail before modification but showing connections for C_c*

CORRECTIONS AND MODS

Whilst every effort is made to minimise errors in diagrams we will correct these as they come to our knowledge and we also appreciate the co-operation of our readers in notifying these.

We occasionally receive suggested modifications from readers who have constructed projects from ***Radio & Electronics World*** and we will publish those that would interest other readers.

For example, it may be possible to extend the use of a particular item by minor circuit changes or re-arrangement only. If this can be done for minimal cost and the idea has been proved in practice, others may benefit from the information.

Write to Corrections and Mods, ***Radio & Electronics World,*** Sovereign House, Brentwood, Essex, CM14 4SE.

FRG 7700 memory expansion (June, 1983, issue)

Thanks to the article of John Mills in the June 83 issue of *R & EW* I now have an FRG 7700 with 4 x 40 memory-channels

But before starting the modification job I examined the new switch, because I presumed that it would be possible to use the other 2 x 8 contacts for a double display to give the numbers 1-40.

I was right, so here is the description and figures of my modification.

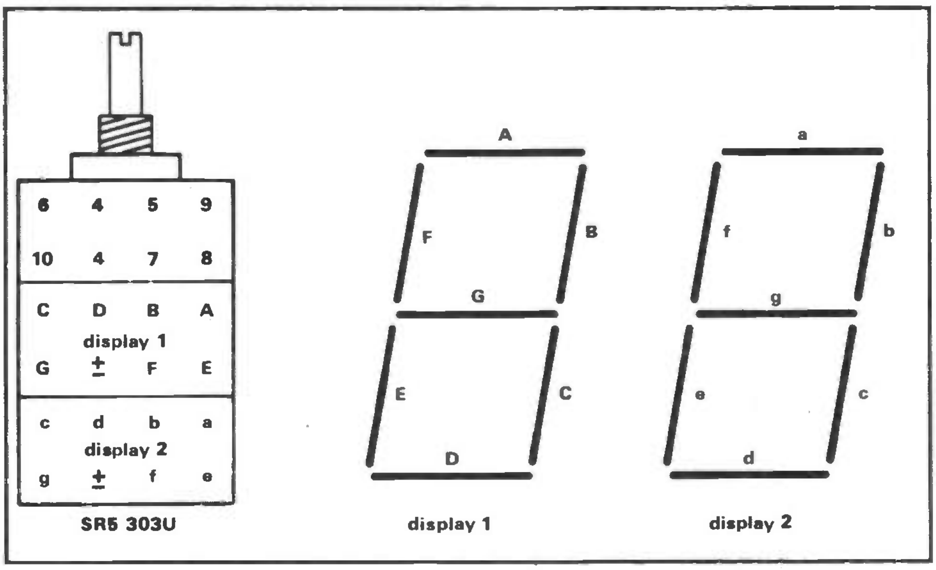
I used two ⅜in displays with common cathode. I took the power from the main rectifier (+18V) via a voltage regulator (7805) giving 5V out, via switch and 14 x 470Ω¼W resistors to the display LEDs

Transferring the AM and PM LEDs to the right side of the frequency-display and shifting the S-meter some millimeters to the left gave a narrow place for my new display, between S-meter and frequency-display

The plumbing-work for this operation made it necessary to dismantle the complete front-sub chassis

J H Wignants (Benelux DX Club), Netherlands

Note: The Airband Memory Unit uses the same type of switch. Some further details of this are in the March 83 issue–Ed

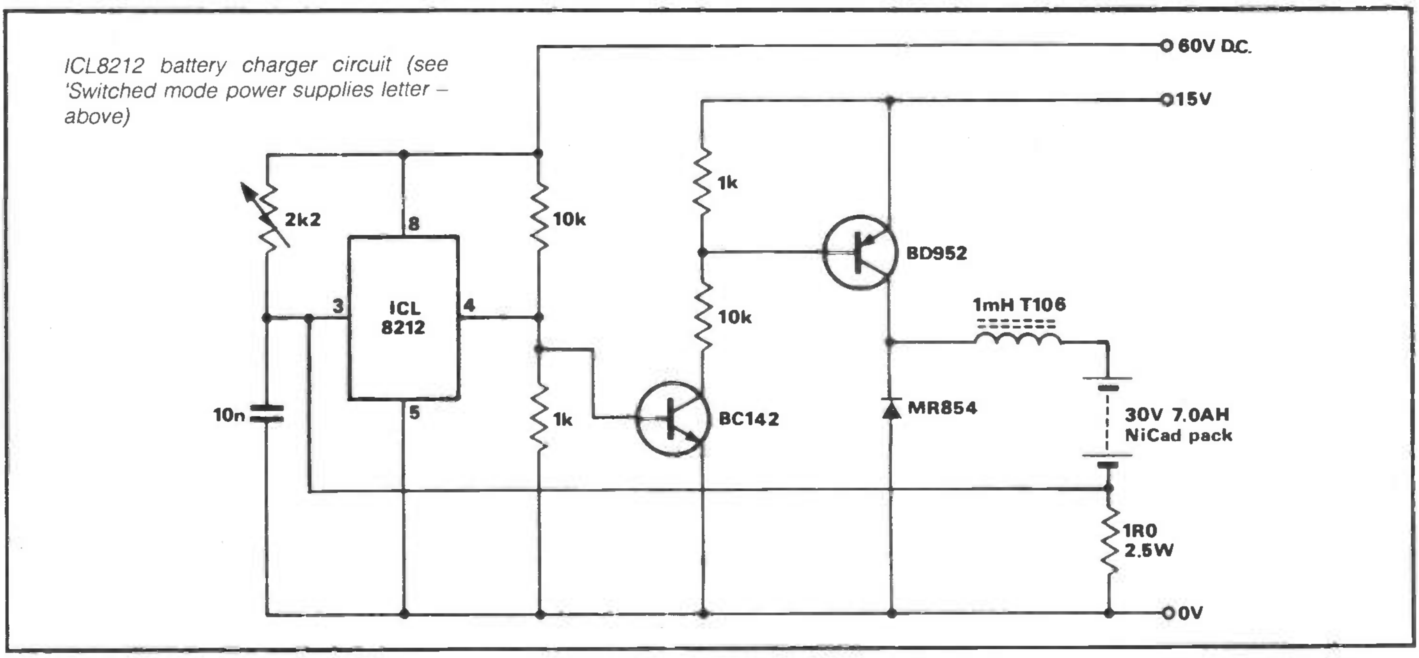


Switched mode power supplies (Feb 84 issue)

I hereby claim the prize for spotting this month's deliberate mistake. Seriously, I believe TR1 & TR2 to be swopped in *Figure 6* and there ought to be a square-root in the formula extracted from *Figure 7*. Otherwise a concise and informative article.

Having worked on SMPSUs for a while may I suggest the following:

(1) The SG3524 has certain advantages in that it is a commercial spec device and therefore cheaper, and it has two undedicated output drivers working in push-pull and therefore also suitable for DC-DC converters, etc.



(2) TIP41A's tend to run a bit warm at 25kHz switching 1A and I have found that the Mullard B949 and BD950 series are far better at about the same price. VN66AJ may also be made to work very well at even higher frequencies and is easier to drive.
(3) You are right in saying that C_4 requires careful choice. The SMPS capacitors can be difficult to obtain cheaply by the home constructor and I have found it possible to use a parallel combination of low value standard axials to work very well in 4 x 100μF in parallel + 47μF tantalum, to look after the real HF spikes.
(4) The Intersil ICL 8211 & 8212 micropower comparators can be made to work quite well as cheaper SMPSU drivers – they have no fancy start-up and shut-down circuitry, but I have used the ICL 8212 to good effect in a high-efficiency constant-current battery charger circuit:

This circuit allows a fast and programmable charge cycle with negligible losses regardless of stability of supply voltage. The charge circuitry can also be made temperature sensitive to detect when cells are fully charged.
D J Hamilton, Pinner, Middlesex

The author replies:-

I agree that two errors do appear to have slipped in betwixt office and printers (well we all make mistakes don't we). The formula shown on Page 30 should read:

$$N = \sqrt{\left[\frac{L \times 10^6}{A_L\,(100\text{-Sat})}\right]}$$

Unfortunately, I cannot agree that the SG3524 Series (1524/2524/3524) is better than the SG3526 Series (1526/2526/3526). It does have wider acceptability, primarily because it has been around for a lot longer and so is well known. The 3526 series is relatively new but has all the same facilities plus some extra ones. Agreed, it is marginally more expensive, but you are getting more for your money.

The TIP41A was used because of ease of access for the amateur. I agree that there are far better devices around which are price comparable. However they are not so readily available. Just look through the copy of *R & EW* that featured the PSU and you will find two advertisers selling the TIP41 but none selling the devices you mention.

I also agree with your point on paralleling several low value capacitors. This was not done on the grounds of cost. However, I do not see why you specify axials because radial types are lower in cost and are technically equal. Special SMPSU radial types are also starting to enter the market place so it will only be a matter of time before they become available to the amateur.

FAX receiver (Jan 84 issue)

The data bus and the address bus are not shown in *Figures 10 & 11.*
U Smith, Darlington

We expect the corrected PCB to be available when this issue is published. If the artwork is required, please send sae to Edwardschild Ltd, 453A Becontree Ave, Dagenham, RM8 3UL

Please note the following corrections:
Figure 1 shows R2 as 268k. This should be 68k as in Parts List.

Figure 3 shows IC11 as 74LS00. This should be 74LS04. Add to Parts List.

Figure 6 shows crystal X1 connected to Pin 2 of IC11. This should be Pin 1 as in the circuit diagram (*Figure 3*).

The Parts List shows IC6 as 74LS04. This should be 74LS00 as in Note on *Figure 2.*

Data file (Feb 84 issue)

The title for *Figure 12* has been omitted and the title for *Figure 11* spans two diagrams in error. Please note that the title for the righthand diagram (*Figure12*) is 'Improved 500Hz–5kHz square-wave oscillator'

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R22, 1R5, 9R1, 10R, 12R, 20R, 33R, 51R, 56R, 62R, 120R, 180R, 270R, 390R, 560R, 620R, 1K2, 2K2, 3K3, 3K9, 10K.
W23 or sim 9 watt .... 6 FOR **£1.00**

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DATA FILE

Ray Marston completes his four-part survey of op-amp principles and applications by looking at instrumentation and test-gear circuits.

Operational amplifiers can be used in a variety of instrumentation and test-gear applications. They can easily be used as precision rectifiers, peak voltage detectors, and ac/dc converters, and as fixed or variable voltage/power sources. They can be used to convert standard dc digital voltmeter (DVM) modules into multi-range instruments capable of reading ac voltage or current, or resistance. When used in conjunction with moving coil meters they can be used to make dc and ac voltmeters, microammeters, and linear-scale ohmmeters, etc. Let's look at some of these applications.

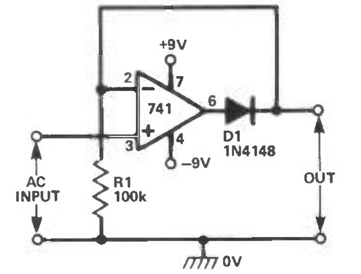


Fig 1 *Simple half-wave rectifier circuit*

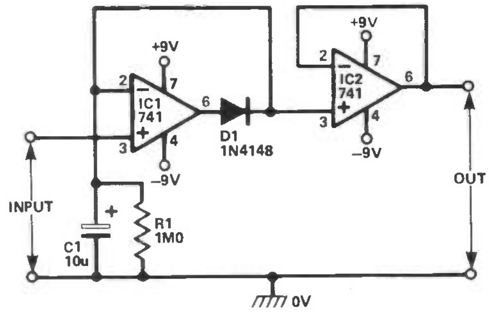


Fig 2 *Peak detector with buffered output*

Electronic rectifiers

Conventional diodes act as imperfect rectifiers of low-level ac signals, because they do not start to conduct until the applied signal voltage exceeds a certain 'knee' value. Silicon diodes have 'knee' values of about 600mV, and thus give negligible rectification to signal voltages below this value.

Op-amps can be combined with silicon diodes in such a way that the effective knee voltage is reduced by a factor equal to the open-loop voltage gain of the op-amp, the combination then acting as an accurate rectifier to signal amplitudes as low as a fraction of a millivolt. *Figure 1* shows a simple half-wave rectifier of this type.

The *Figure 1* circuit is connected as a non-inverting amplifier, with feedback applied via D1, and the output of the circuit is taken from the inverting input terminal of the op-amp. When the input signal is positive, the output of the op-amp swings positive; an input of only a few microvolts is enough to drive the op-amp output to the 600mV 'knee' voltage of D1, at which point the diode becomes forward biased; negative feedback through D1 then forces the inverting input to accurately follow all positive input signals greater than a few microvolts. The circuit thus acts as a voltage follower to positive input signals.

When the input signal is negative, the output of the op-amp swings negative and D1 is reverse biased. Under this condition the reverse leakage resistance of D1 (typically hundreds of megohms) acts as a potential divider with R1 and determines the negative voltage gain of the circuit. Typically, with the component values shown, the negative gain is roughly -60dB. The circuit thus 'follows' positive input signals but rejects negative ones, and hence has the characteristics of a near-perfect rectifier.

Figure 2 shows how the above circuit can be modified to act as a peak voltage detector by wiring C1 in parallel with R1. This capacitor charges rapidly, via D1, to the peak positive value of an input signal, but discharges slowly via R1 when the signal falls below the peak value. IC2 is used as a voltage-follower buffer stage, to ensure that R1 is not shunted by external loading effects.

Note that the *Figure 1 and 2* circuits each have a very high input impedance.

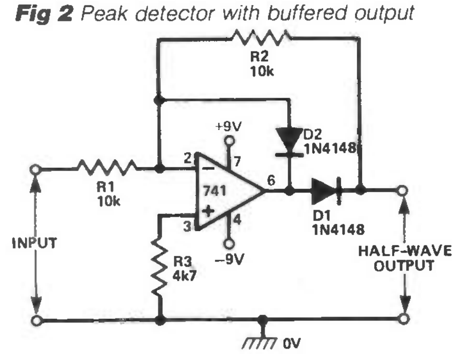


Fig 3 *Precision half-wave rectifier*

Precision rectifiers

The *Figure 1* rectifier circuit has a rather limited frequency response, and may produce a significant negative output signal if D1 has poor reverse resistance characteristics. *Figure 3* shows an alternative type of half-wave rectifier circuit, which has a greatly improved 'rectifier' performance, at the expense of a greatly reduced input impedance.

In *Figure 3*, the op-amp is wired as an inverting amplifier. When the input signal is negative, the op-amp output swings positive, forward biasing D1 and developing an output across R2. Under this condition the voltage gain equals (R2+D1)/R1, where D1 is the active resistance of this diode. Thus, when D1 is operating below the 'knee' value, the D1 resistance is very high and the circuit has a very high gain, but when D1 is operating above the 'knee' value the D1 resistance is negligible, and the circuit gain equals R2/R1. The circuit thus acts as an inverting precision rectifier to negative input signals.

When the input signal goes positive, the op-amp output swings negative, but the negative swing is limited to -600mV via D2. Consequently, the output at the D1-R1 junction does not significantly shift from zero under this condition.

Note that the *Figure 3* circuit produces a positive-going half-wave rectified output: the circuit can be made to produce a negative-going half-wave rectified output by simply reversing the polarities of the two diodes.

Figure 4 shows how a negative-output version of the above circuit can be combined with a second inverting amplifier to make a precision full-wave rectifier. Here, IC2 sums double the half-wave rectified signal of IC1 with the original input signal, to provide the full-wave rectified output. With negative input signals, the output of IC1 is zero, so the output of IC2 equals -Ein. With positive input signals, IC1 produces a negative output, and double this value is summed (via R3-R5) with the true positive input value (via R4-R5) and inverted to produce a final output of Ein. Thus, the output of this circuit is positive and always has a value equal to the absolute value of the input signal.

ac/dc converters

The *Figure 3 and 4* circuits can be made to function as precision ac/dc converters by first providing them with voltage-gain values suitable for form-factor correction, and by then integrating their outputs to give the ac/dc conversion, as shown in *Figures 5 and 6* respectively. Note that these circuits are intended for use with sine-wave input signals only.

In the half-wave ac/dc converter of

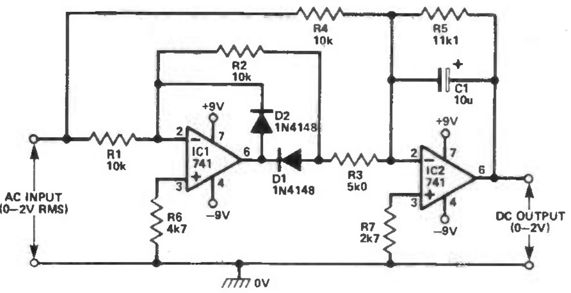


Fig 4 *Precision full-wave rectifier*

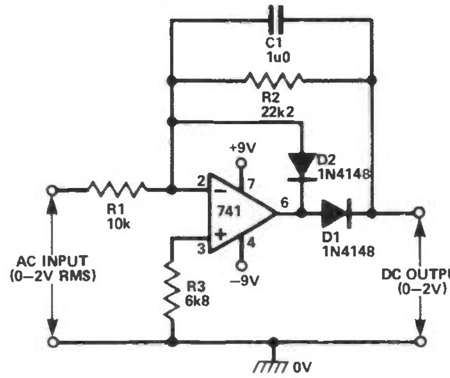


Fig 5 *Precision half-wave ac/dc converter*

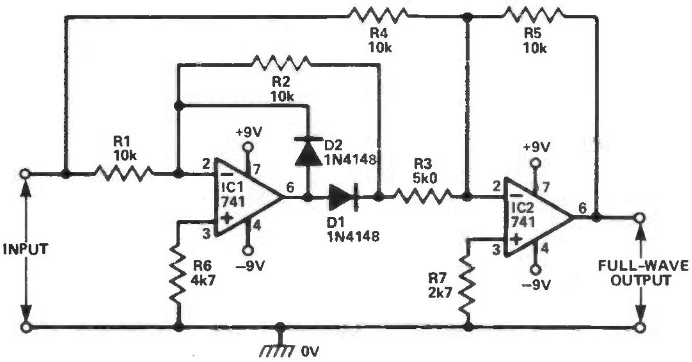


Fig 6 *Precision full-wave ac/dc converter*

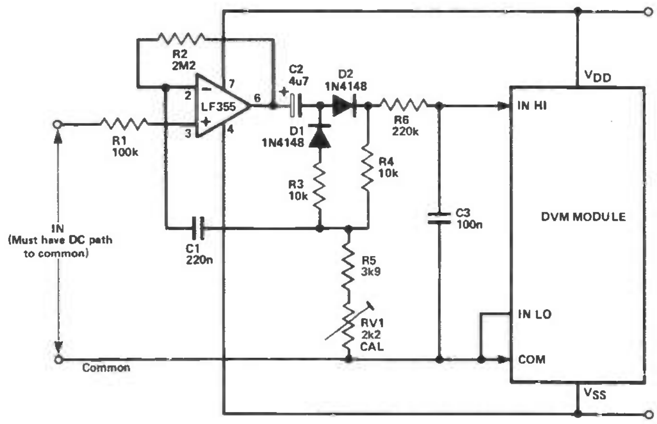


Fig 7 *Ac/dc converter for use with DVM module*

Figure 5, the circuit gives a voltage gain of 2.22 via R2/R1, to give form-factor correction, and integration is accomplished via C1-R2. Note that this circuit has a high output impedance. The output must be buffered if it is to be fed to low-impedance loads.

In the full-wave ac/dc converter of *Figure 6*, the circuit is given a voltage gain of 1.11 to give form-factor correction, and integration is accomplished via C1-R5. This circuit has a low-impedance output.

DVM converter circuits

Precision 3½-digit Digital Voltmeter (DVM) modules are readily available at modest cost, and can easily be used as the basis of individually-built multi-range and/or multi-function meters. These modules are usually powered by a 9 volt battery, and have a basic full-scale measurement range of 200mV dc and a near-infinite input resistance. They can be made to act as multi-range dc voltmeters by simply feeding the test voltage to the module via a suitable 'multiplier' (resistive attenuator) network, or as multi-range dc current meters by feeding the test current to the module via a switched current shunt.

A DVM module can be used to measure ac (rather than dc) voltage by connecting a suitable ac/dc converter to its input terminals, as shown in *Figure 7*. This particular converter has a near-infinite input impedance. The op-amp is used in the non-inverting mode, with dc feedback applied via R2, and ac feedback applied via C1-C2 and the diode-resistor network. The gain of the converter is variable over a limited range (to give form-factor correction) via RV1, and the

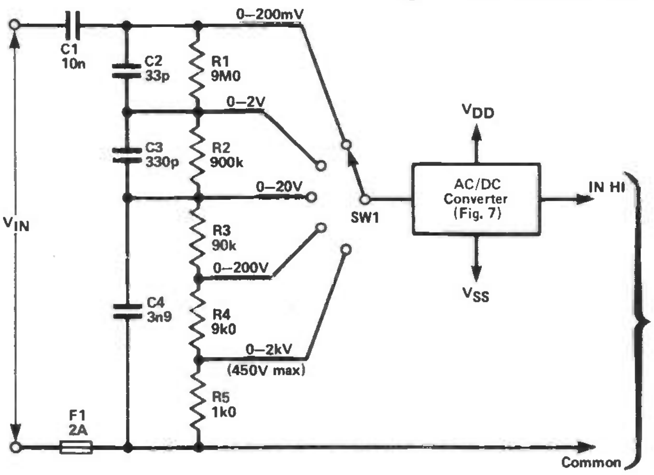


Fig 8 *5-range ac volt-meter converter for use with DVM modules*

rectified output of the circuit is integrated via R6-C3, to give dc conversion. The COMMON terminal of the DVM module is internally biased at about 2.8 volts below the VDD (positive supply terminal) voltage, and the LF355 op-amp uses the VDD, COMMON, and VSS terminals of the module as its supply rail points.

Shown in *Figure 8* is a simple frequency-compensated attenuator network used in conjunction with the above ac/dc converter to convert a standard DVM module into a 5-range ac voltmeter, and *Figure 9* shows how a switched shunt network can be used to convert the module into a 5-range ac current meter.

A circuit that can be used to convert a DVM module into a 5-range ohmeter is shown in *Figure 10*. This circuit actually functions as a multi-range constant-current generator, in which the constant current feeds (from Q1 collector) into Rx, and the resulting Rx volt drop (which is directly proportional to the Rx value) is read by the DVM module.

Here, Q1 and the op-amp are wired as a compound voltage follower, in which Q1 emitter voltage follows the voltage set on RV1 slider. In practice, these voltages are set at precisely 1 volt below VDD. Consequently, the emitter and collector (Rx) currents of Q1 equal 1VO divided by the R3 to R7 range-resistor value, e.g, 1 mA with R3 in circuit, etc. The actual DVM module reads full scale when the Rx voltage equals 200mV, and this reading is obtained when Rx has a value one-fifth of that of the range resistor, e.g, 200R on Range 1, or 2MO on Range 5, etc.

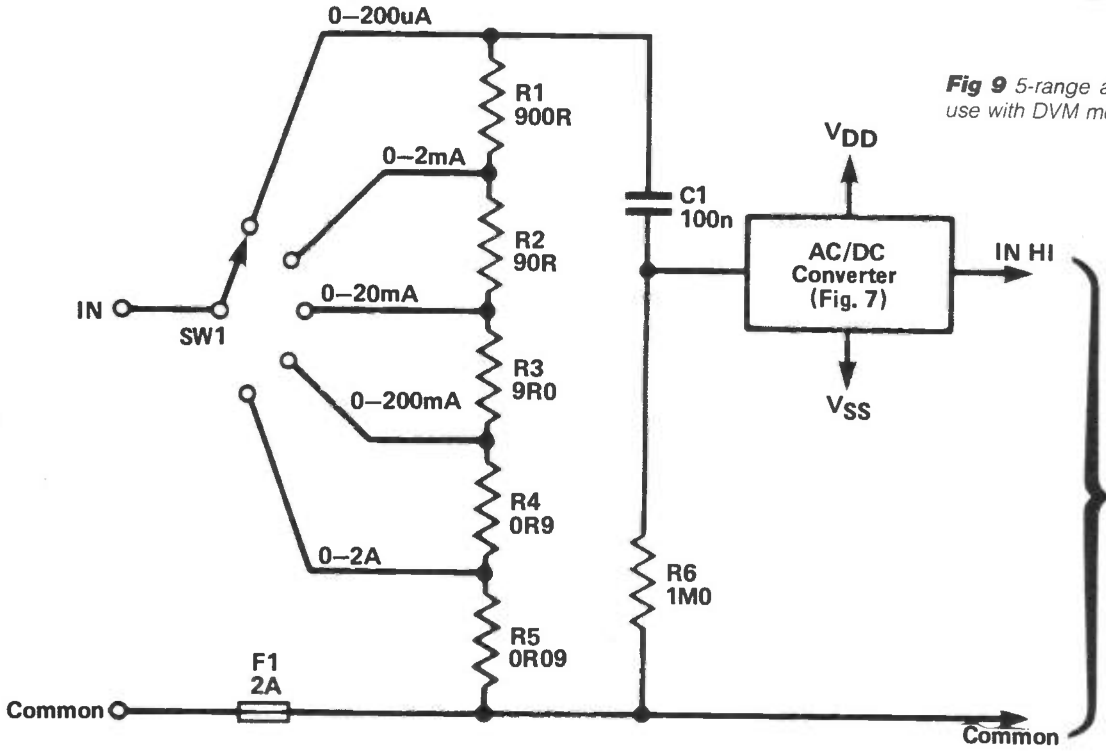
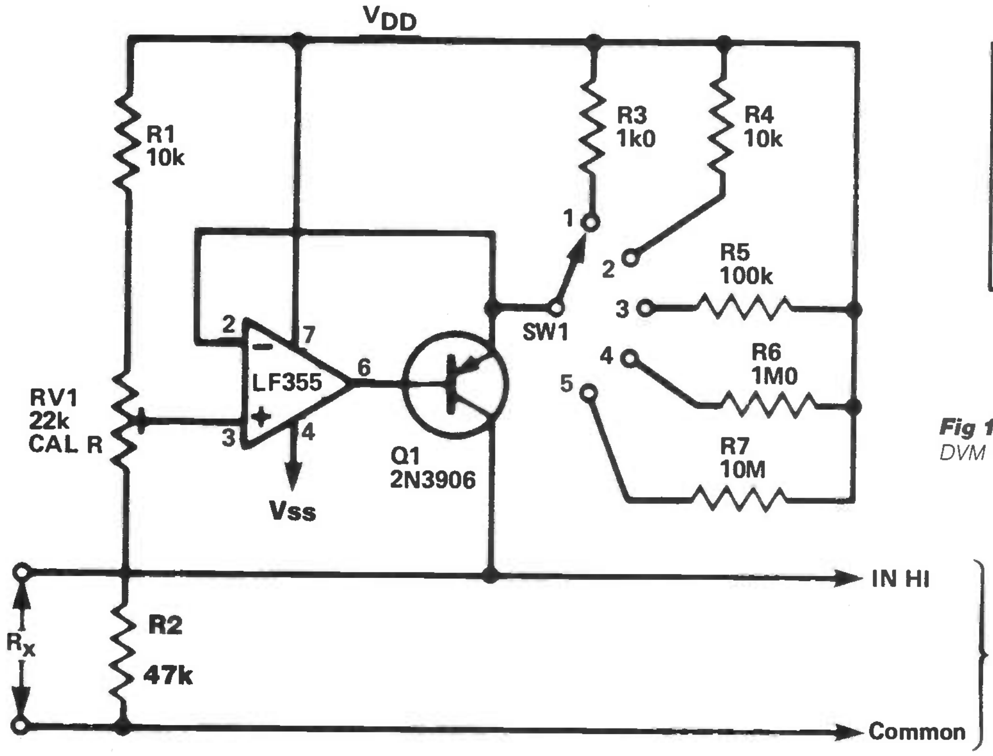


Fig 9 5-range ac current-meter converter for use with DVM modules



SW1 position	Range
1	0 – 200R
2	0 – 2k0
3	0 – 20k
4	0 – 200k
5	0 – 2M0

Fig 10 5-range ohmeter converter for use with DVM modules

Analogue meter circuits

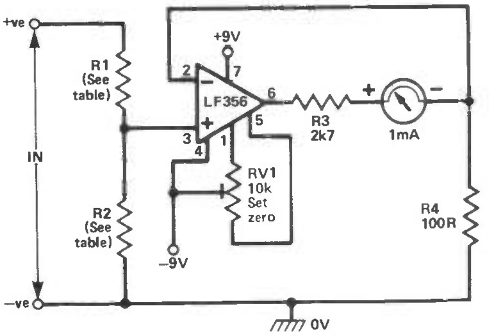
An op-amp can easily be used to convert a standard moving coil meter into a sensitive analogue volt, current, or resistance meter, as shown in the practical circuits of *Figures 11 to 16*. All six circuits are designed around the LF356 JFET op-amp, which has a very high input impedance, good drift characteristics, and operates from dual 9-volt supplies. All circuits are provided with an offset nulling facility, to enable the meter reading to be set to precisely zero with zero input, and are designed to operate with a moving coil meter with a basic sensitivity of 1 mA fsd.

If desired, these circuits can be used in conjunction with the 1 mA dc range of an existing multi-meter, in which case the circuits function as 'range converters'. Note that each circuit has a 2k7 resistor wired in series with the output of its op-amp to limit the available output current to a couple of milliamps and thus provide the meter with automatic overload protection.

A simple way of converting the 1 mA meter into a fixed-range dc millivolt meter with a full-scale sensitivity of 1 mV, 10 mV, 100 mV or 1-volt is shown in *Figure 11*. The circuit has an input sensitivity of 1MO/volt, and the table shows the appropriate R1 value for different fsd sensitivities. To set the circuit up initially, short its input terminals together and adjust RV1 to give zero deflection on the meter. The circuit is then ready for use.

In *Figure 12* a circuit is shown that can be used to convert a 1 mA meter into either a fixed-range dc voltmeter with any full-scale sensitivity in the range 100 mV to 1000 volts, or a fixed-range dc current meter with a full-scale sensitivity in the range 1 uA to 1 amp. The table shows alternative R1 and R2 values for different ranges.

How the above circuit can be modified



VOLTMETER	
fsd	R1
1V	1M0
100mV	100k
10mV	10k
1mV	1k0

Fig 11 A dc millivoltmeter circuit

VOLTMETER		
fsd	R1	R2
1000v	10m	1k0
100v	10m	10k
10v	10m	100k
1v	900k	100k
100mv	–	100k
CURRENT METER		
1A	–	0R1
100mA	–	1R0
10mA	–	10R
1mA	–	100R
100uA	–	1k0
10uA	–	10k
1uA	–	100k

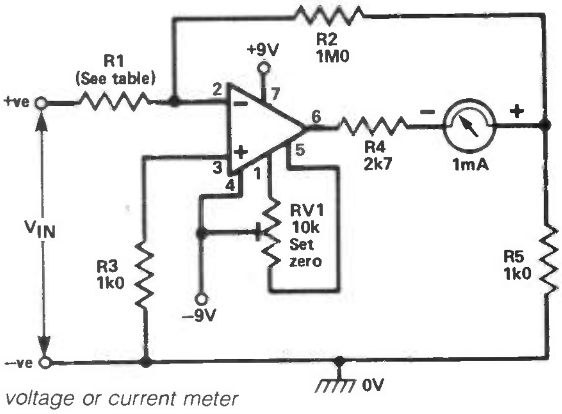


Fig 12 A dc voltage or current meter

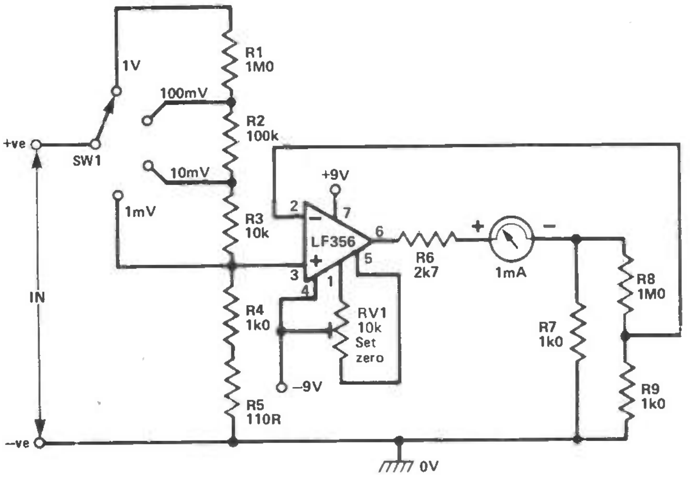


Fig 13 4-range dc millivoltmeter

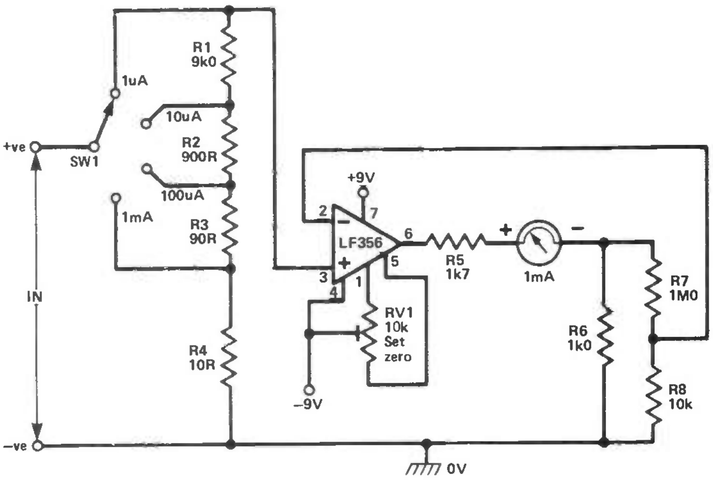
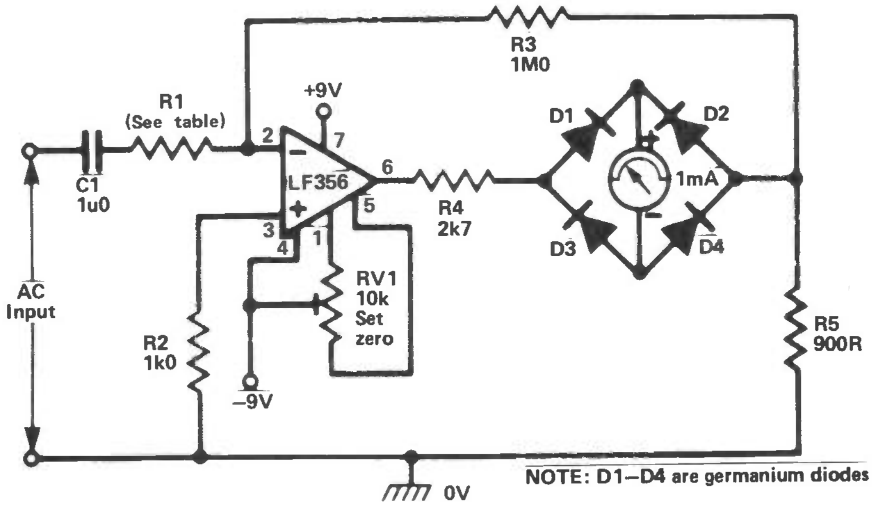


Fig 14 4-range dc microammeter



Vfsd	R1 Value
1V	1M0
100mV	100k
10mV	10k
1mV	1k0

Fig 15 4-range ac millivoltmeter

to make a 4-range dc millivolt meter with fsd ranges of 1 mV, 10 mV, 100 mV and 1VO, is seen in *Figure 13* and *Figure 14* shows how it can be modified to make a 4-range dc microammeter with fsd ranges of 1 uA, 10 uA, 100 uA and 1 mA. The range resistors used in these circuits should have accuracies of 2% or better.

In *Figure 15* is the circuit of a simple but very useful fixed-range ac millivoltmeter. The input impedance of the circuit is equal to R1, and varies from 1kO in the 1 mV fsd mode to 1MO in the 1-volt fsd mode. The circuit gives a useful performance at frequencies up to about 100 kHz when used in the 1 mV to 100 mV fsd modes. In the 1-volt fsd mode the frequency response extends up to a few tens of kHz. This good frequency response is ensured by the LF356 op-amp, which has very good bandwidth characteristics.

Finally, *Figure 16* shows the circuit of a 5-range linear-scale ohmmeter, which has full-scale sensitivities ranging from 1kO to 10M. Range resistors R5 to R9 determine the measurement accuracy. Q1-ZD1 and the associated components simply apply a fixed 1-volt (nominal) to the 'common' side of the range-resistor network, and the gain of the op-amp circuit is determined by the ratios of the selected range-resistor and Rx and equals unity when these components have equal values: the meter reads full-scale under this condition, since it is calibrated to indicate full-scale when 1-volt (nominal) appears across the Rx terminals.

To initially set up the *Figure 16* circuit, set SW1 to the '10k' position and short the 'Rx' terminals together. Then adjust the RV1 'set zero' control to give zero deflection on the meter. Next, remove the short, connect an accurate 10k

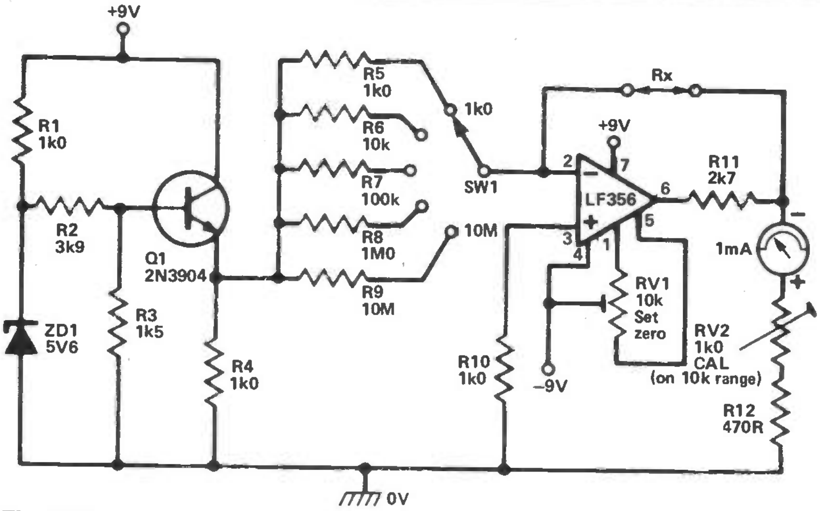


Fig 16 5-range linear-scale ohmeter

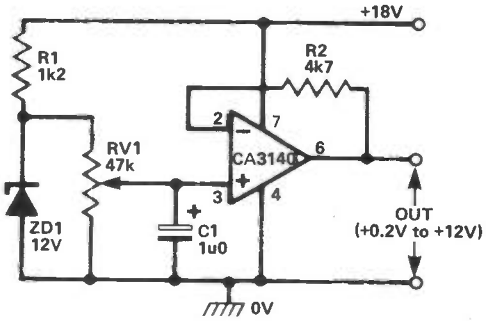


Fig 17 Variable positive voltage reference

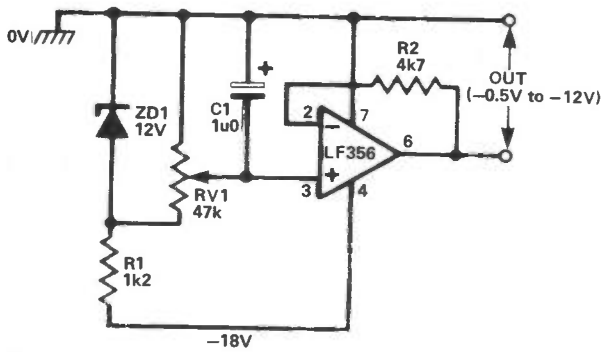


Fig 18 Variable negative voltage reference

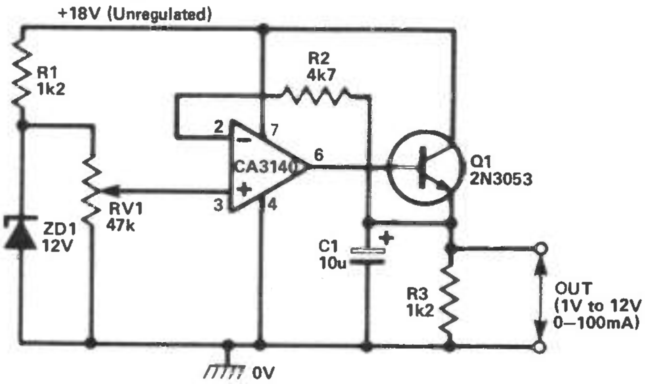


Fig 19 Simple variable-voltage regulated power supply

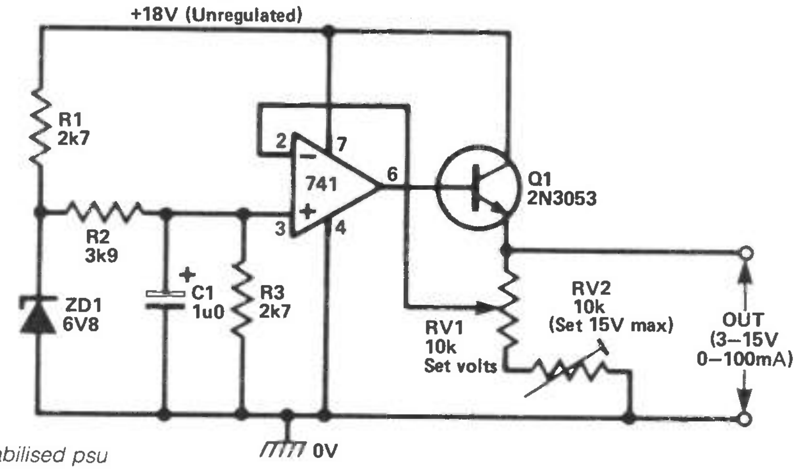


Fig 20 3V to 15V, 0-100 mA stabilised psu

resistor in the 'Rx' position, and adjust RV2 to give precisely full-scale deflection on the meter. The circuit is then ready for use, and should need no further adjustment for several months.

Voltage reference circuits

An op-amp can be made to function as a fixed or variable voltage reference by wiring it as a voltage follower and connecting a suitable (fixed or variable) voltage to its input terminals. The op-amp has a very high input impedance when used in the 'follower' mode and thus draws negligible current from the input reference, but has a very low output impedance and can supply several milliamps of current to an external load. Variations in output loading conditions cause negligible change in the output voltage value.

The practical circuit of a positive voltage reference that gives an output fully variable from +0.2V to +12V via RV1 is shown in *Figure 17*. A regulated 12 volts is generated by Zener diode ZD1 and applied to the non-inverting input of the op-amp via RV1. A CA3140 op-amp is used in this circuit, and the input and output of this device can track signals to within 200 mV of the negative supply rail voltage. The complete circuit is powered from an unregulated single-ended 18V supply. In *Figure 18* is the circuit of a negative voltage reference that gives an output fully variable from -0.5V to -12V via RV1. An LF356 op-amp is used, and the input and output of this device can track signals to within about 0.5V of the 'positive' supply rail value.

Note that the op-amps used in the above two circuits are wide-band devices, and R2 is used to enhance their circuit stability.

Voltage regulator circuits

The basic voltage reference circuits of *Figures 17 and 18* can be made to function as regulated voltage (power) supply circuits by simply incorporating current-booster transistor networks into their output stages.

How the *Figure 17* circuit can be modified to act as a 1 – 12V variable power supply with an output current capability of about 100 mA is shown at *Figure 19*. Note that the base-emitter

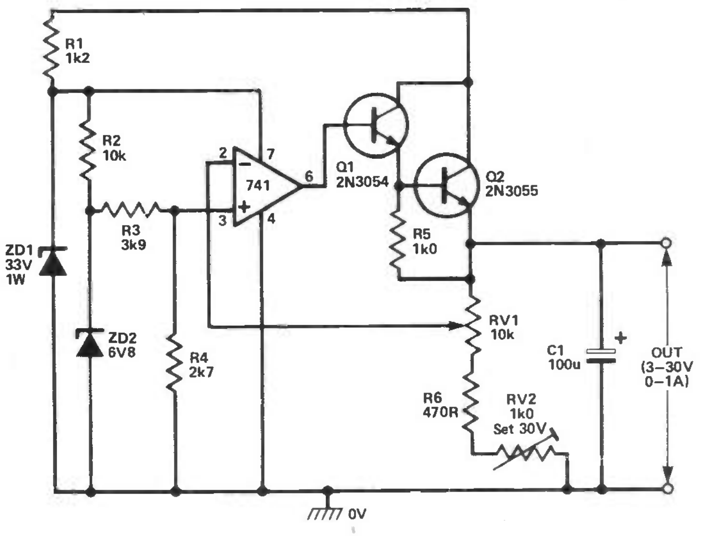


Fig 21 3V to 30V, 0-1 amp stabilised psu

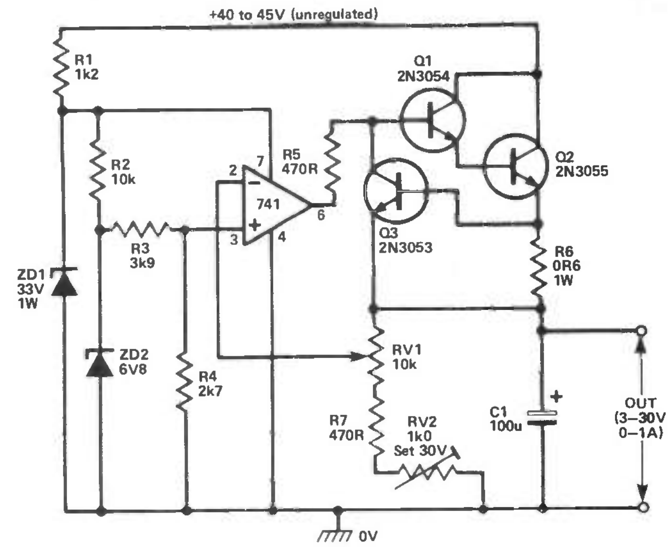


Fig 22 3V to 30V stabilised psu with overload protection

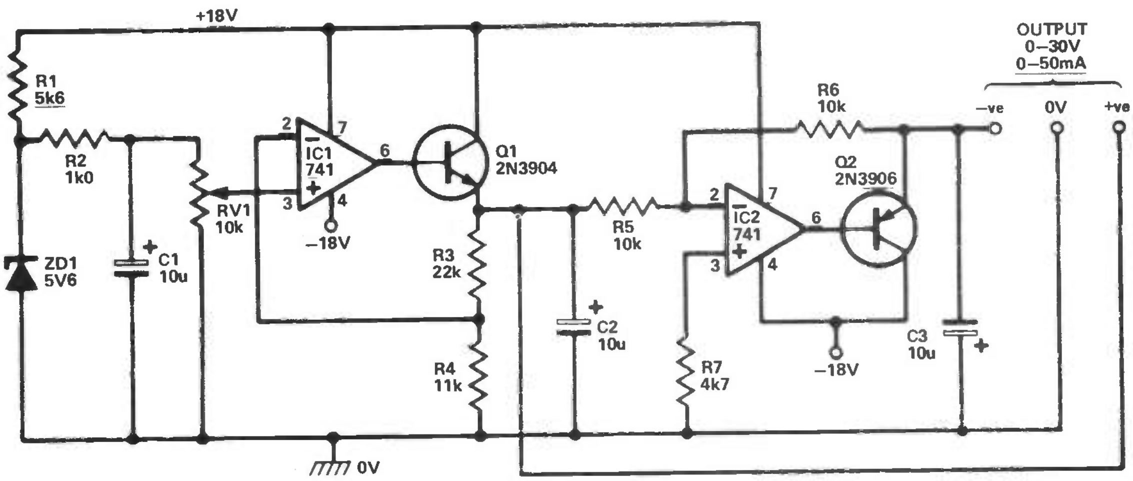


Fig 23 Simple centre-tapped 0-30V psu

junction of the output transistor is included in the negative feedback loop of the circuit, to minimise offset effects. The output current limit of the circuit is determined by the power rating of Q1. The circuit can be made to give an output that is variable all the way down to zero volts by connecting pin-4 of the op-amp to a supply that is at least 2V negative.

At *Figure 20* is an alternative type of power supply circuit, in which the output voltage is variable from 3 to 15V at currents up to 100 mA. In this case, a fixed 3V reference is applied to the non-inverting input terminal of the 741 op-amp via ZD1 and the R2-C1-R3 network, and the op-amp plus Q1 are wired as a non-inverting amplifier with gain variable via RV1. When RV1 slider is turned to the upper position, the circuit gives unity gain and gives an output of 3V. When RV1 slider is turned to the lower position, the circuit gives a gain of x5 and gives an output of 15V. The gain is fully variable between these two values. RV2 enables the maximum output voltage to be preset at precisely 15V.

How the above circuit can be modified to act as a 3V to 30V, 0 – 1 amp stabilised power supply unit (psu) is shown at *Figure 21* . Here, the available output current is boosted by the Darlington-connected Q1-Q2 pair of transistors, the circuit gain is fully variable from unity to x10 via RV1, and the stability of the 3V reference input to the op-amp is enhanced by the ZD1 pre-regulator network.

How the above circuit can be further modified to incorporate automatic overload protection is shown at *Figure 22* . Here, R6 senses the magnitude of the output current and when this exceeds 1 amp the resulting volt drop starts to bias Q3 on, thereby shunting the base-drive current of Q1 and automatically limiting the available output current of the circuit.

Finally, to complete this look at op-amp applications, *Figure 23* shows the circuit of a simple centre-tapped 0 to 30V psu that can provide maximum output currents of about 50 mA. The psu has three output terminals, and can provide either 0 to +15V between the common and +ve terminals and 0 to -15V between the common and -ve terminals, or 0 to 30V between the -ve and +ve terminals. The circuit operates as follows.

ZD1 and R2-RV1 provide a regulated 0 to 5V potential to the input of IC1. IC1 and Q1 are wired as a x3 non-inverting amplifier, and thus generate a fully variable 0 to 15V on the +ve output terminal of the psu. This voltage is also applied to the input of the IC2-Q2 circuit, which is wired as a unity-gain inverting amplifier, and thus generates an output voltage of identical magnitude but opposite polarity on the -ve output terminal of the psu. The output current capability of each terminal is limited to about 50 mA by the power ratings of Q1 and Q2, but can easily be increased by replacing these components with Darlington power transistors of appropriate polarity.

Next month's *Data File* describes CMOS bilateral switches and multiplexer/ demultiplexer ICs. Make sure you don't miss this interesting article by Ray Marston

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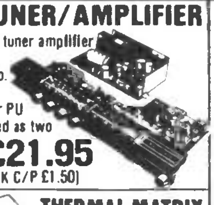

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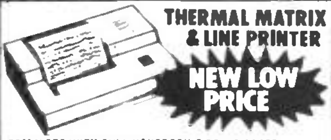

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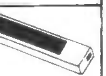

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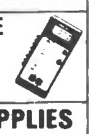

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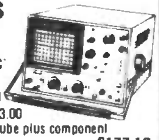

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One Night's Work

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The LM380 can be considered like an op-amp, and if you have been following the series by Ray Marston, you will know that if identical signals are presented to the +ve and -ve inputs, then (in theory) nothing will come out of the speaker. If however the arrow (slider) moves up the variable resistance VR1 *(Figure 1)* then less and less signal reaches pin 6, so the op-amp registers a difference between the input levels and amplifier. This results in sound through the speaker, DC-blocked by C4 (to test the circuit, try touching the 'in' terminal with your finger and see how you can amplify the 50Hz mains hum signal.

Pins 3, 4, 5, 7, 10, 11, 12 are connected to an internal heatsink but this is not usually adequate enough, so a large area of copper has been left on the PCB to help dissipate the heat produced at full volume. Make sure you have a speaker capable of handling 2 watts and, if necessary, clip on an IC heatsink.

C1, 2, decouple the supply, improve the ripple rejection and help to prevent parasitic oscillations. These can also be a problem on the output, if driving a low-impedance inductive speaker load, so R1 and C3, known rather grandly as a Zobel network, are included to inhibit this. As a final note the input may be via an isolating capacitor so that only AC signals reach pins 2 and 6.

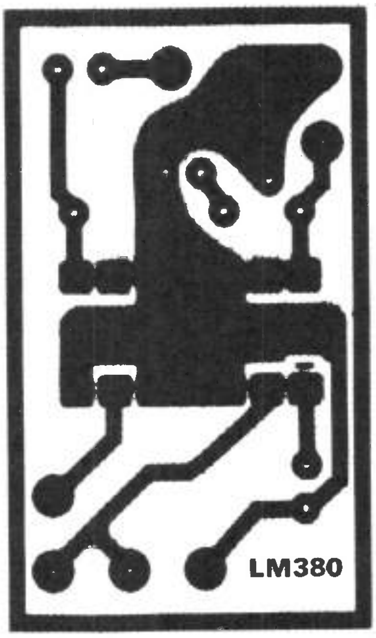

Fig 2 *PCB foil pattern corresponding to Figure 1*

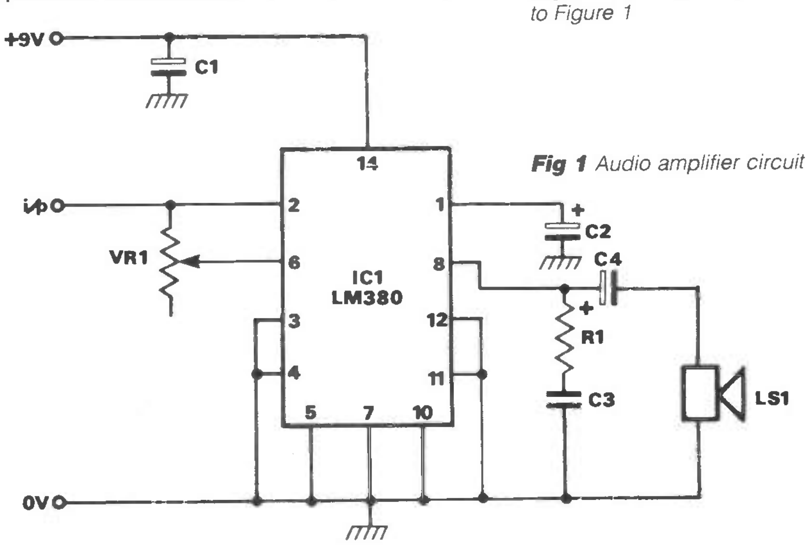

Fig 1 *Audio amplifier circuit*

PARTS LIST

R1	2.7Ω
C1	100μF 16V
C2	10μF 16V
C3	0.1μF ceramic
C4	220μF 16V
IC1	LM380
VR1	2MΩ log
LS1	8Ω loudspeaker

All components are widely available

Enquiries about a PCB for this project should be addressed to Edwardschild Ltd., 453a Becontree Avenue, Dagenham, Essex RM8 3UL (Tel: Brentwood 215488). The price is 99p inclusive.

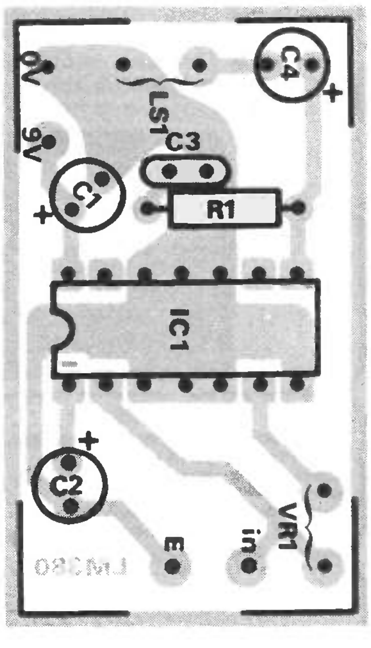

Fig 3 *Component overlay*

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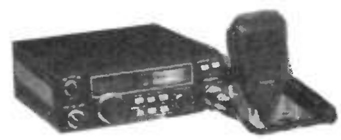

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UOSAT-B

The second satellite from Surrey University

The UOSAT-B satellite, known after launch as UOSAT-2, is the University of Surrey's second experimental spacecraft and has presented a major challenge to the university project team in that the opportunity to launch on March 1st was known with less than five months notice.

All credit must go to the team who designed, built and tested this extremely complex spacecraft in the limited time available and it is recognised that the NASA offer of a launch opportunity at such short notice emphasizes the confidence that NASA has in the team's ability.

The people responsible for UOSAT-B

The university's Department of Electronic & Electrical Engineering provided the project team, led by Dr Martin Sweeting, who was responsible for building the spacecraft itself, all of the communication, attitude control and other 'housekeeping' systems necessary to support and control the experiments and to receive commands from, and send data to, earth. The team also provided two of the educational and scientific experiments namely, a speech synthesiser with a greater vocabulary than that carried by UOSAT-1 and an improved TV camera.

Working with Surrey University in building the experimental hardware were the Rutherford-Appleton Laboratory (SERC), the Universities of Sussex and Kent, and the UK, USA and Canada branches of the International Amateur Satellite Corporation (AMSAT).

SATELLITE DETAILS

The following information has been released by the university:-

Aim

The aim of UOSAT-B is to develop further the success achieved by UOSAT-1 in three areas: space science, education and cost-effective space engineering. These areas do of course overlap. As UOSAT-1 has shown, scientific experiments have great educational value, while one educational experiment – the speech synthesiser – has proved to be an extremely useful operational aid in everyday monitoring by the Command Team.

Experience from UOSAT-1

Launched in October 1981, Surrey University's first spacecraft is still fully operational. It was, we believe, the first spacecraft to be conceived, designed, built and operated by a university anywhere in the world. It was the first to carry a speech sythesiser for transmitting information. It is probably the most widely used scientific satellite ever launched. Its transmissions of scientific and engineering data are being received not only by professional ground-stations but also by upwards of 5,000 radio amateurs, schools and computer enthusiasts; many of them are involved in complex experiments. Apart from the experimental data it has transmitted, it has also provided much valuable operational experience which is being built into UOSAT-B.

Appearance and construction

UOSAT-B closely resembles UOSAT-1 in appearance and construction, but is slightly smaller. About the size of a domestic swing-bin, it weighs about 60 kilograms (132 lb). While its telemetry and other 'housekeeping' systems are very similar to those of UOSAT-1 in concept, its electronic systems have been substantially redesigned to incorporate experience gained with UOSAT-1. Of the 36 printed circuit boards that it contains, 35 are completely new designs.

Orbital information

The planned height of the orbit is 700km (435 miles), compared with UOSAT-1's orbit of 530km (330 miles) and is polar and sun-synchronous, ie, it will be overhead at the same times of day throughout the year (about 0900 and 2100 hours), whereas the times for UOSAT-1 are 1500 and 0300 hours. Taking about 98.8 minutes to complete an orbit, it will be above the horizon for several successive orbits morning and evening (in the UK), for a maximum of 14 minutes. Its planned working life is about three years and the satellite will be controlled from the UOSAT Command Station at Surrey University, with a back-up station in the USA, operated by AMSAT-USA.

Scientific and educational experiments

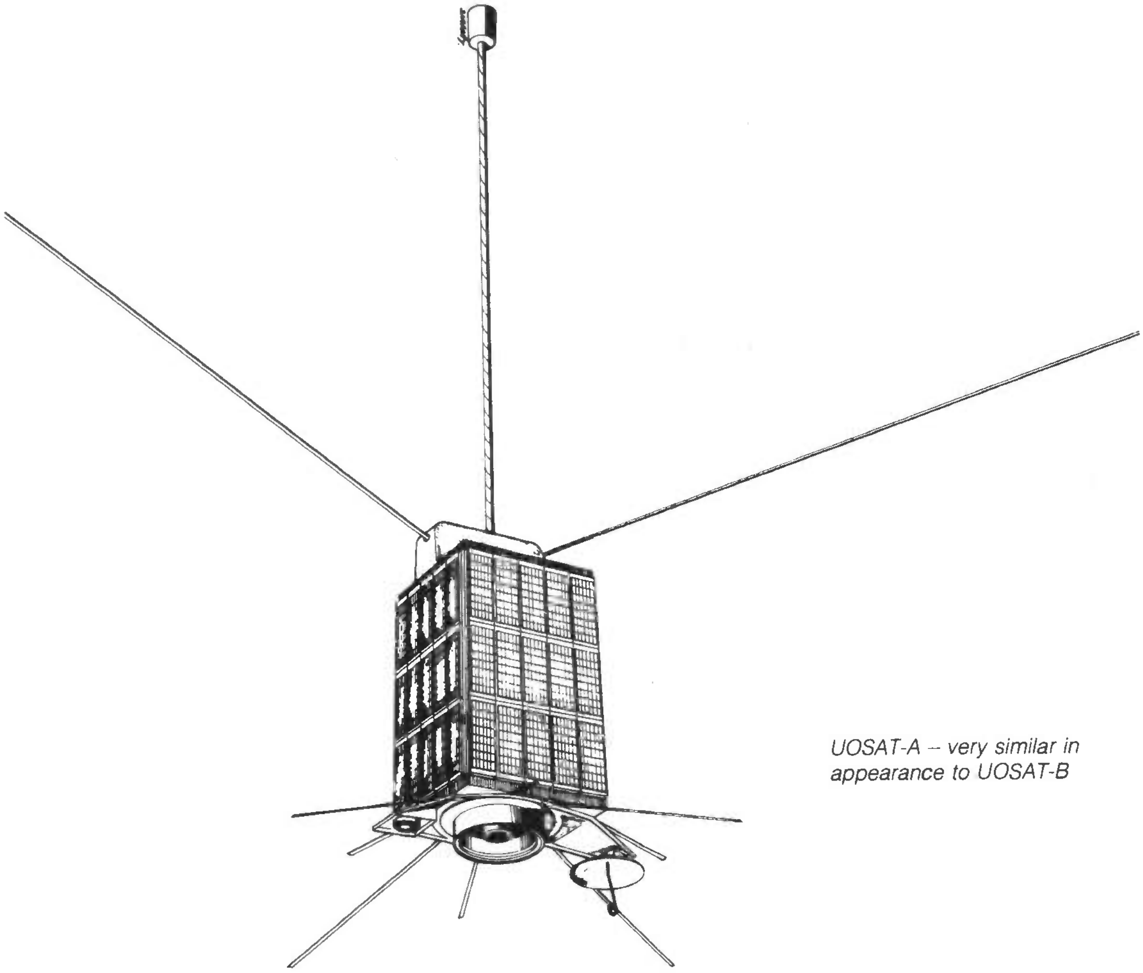
(a) *Particle-wave experiment (Rutherford-Appleton Laboratory, supported by Sussex University).*

Three Geiger counters, similar to those flown on UOSAT-1, and a single electron spectrometer will provide near-earth reference data for magnetospheric studies to be carried out with the USA/UK/Germany AMPTE mission and the Swedish VIKING Mission. Both of these are due for launch later in 1984. The four detectors will monitor electron precipitation in the range 1-100 keV, and will provide important and detailed data on the state of activity in the magnetosphere.

(b) *Earth imaging experiment (University of Surrey)*

The imaging experiment carried by UOSAT-1 used an early charge-coupled device (CCD) to collect images of earth gathered by a conventional lens system. The CCD became degraded after launch, but the electronics of storing the image, and transmitting it to earth in a format suitable for low-cost ground-stations is proving very successful.

An improved CCD, flown in UOSAT-B, makes it possible for pictures of earth to be decoded and stored on simple equipment and displayed on a domestic TV set. In addition to its obvious educational value, the 'camera' system will be used to record auroral displays over the polar regions in conjunction with the particle-wave experiment. The 'camera'will cover an area of about 1600 by 1600km (1000 by 1000 miles), with a resolution of about 2km.



UOSAT-A – very similar in appearance to UOSAT-B

(c) *Synthesised speech experiment (University of Surrey)*

UOSAT-1 was the first spacecraft ever to carry a speech sythesiser. Intended originally to enable school groups and amateurs to receive data with nothing more complex than a £50 walkie-talkie VHF receiver, it has been highly successful, although restricted to a vocabulary of only about 120 words. In addition it has proved to be a valuable operational aid, enabling the UOSAT Project Team staff to check on the performance of the spacecraft while at home, or even while on holiday abroad! UOSAT-B has a more ambitious synthesiser with a larger vocabulary. It is possible to transmit telemetry data and spacecraft news bulletins of the type which advanced users of UOSAT-1 with telemetry equipment are already receiving as a visual or print-out display.

(d) *Digital communications experiment (DCE) (AMSAT-USA, AMSAT-Canada)*

This is essentially a feasibility study which, if successful, could lead to the development of a satellite designed specifically for such purposes. Using a 96k-byte random access memory under computer control, the system enables a radio amateur station to load data or a message into the spacecraft, 'addressed' to a particular station on the other side of the world and held until the intended recipient 'collects' it. The transmission links, suitable for stations with low transmitting and receiving power, have already been demonstrated in principle by UOSAT-1. The main problem in such a system is the reliability of the solid-state memory devices in space conditions. UOSAT-B has various types of static and dynamic memory devices and a CMOS NSC800 microprocessor, so that their long-term performance in space can be assessed. When the spacecraft checkout has been completed following launch, the intention is to make one up-link radio channel available for radio amateurs to transmit and receive messages on an experimental basis; this will also enable the on-board message 'traffic control' system to be evaluated.

(e) *Space dust experiment (University of Kent)*

This experiment utilises a new impact momentum sensor, using technology developed for the Giotto Halley mission, to detect and measure the presence of cosmic dust particles in low earth orbit and also particles of rocket-derived space debris.

Spacecraft systems experiment

(a) *Attitude control and stabilisation experiment (University of Surrey)*

UOSAT-1 used a simple single-axis magnetorquer for adjusting position in space, and the Command Team spent many weeks developing the technique of activating the device to bring about the desired adjustments. In addition the gravity-gradient boom, which should have then kept the spacecraft with its base pointing always to earth, failed to deploy properly. UOSAT-B therefore has three magnetorquers for spin-axis, spin-plane control, also low-cost sun-angle and earth horizon sensors, and an improved navigational magnetometer. The control of the spacecraft is simpler, quicker and more accurate (to within +/- 2 degrees). A gravity gradient boom is also carried.

(b) *Communication systems experiment (University of Surrey)*

The simple transmission formats used for UOSAT-1 are highly effective for reception by low-cost ground-stations but have some limitations at low signal levels and in 'noisy' conditions. Experiments will be carried out with error-resilient coding techniques and other methods suitable for inexpensive ground-station equipment. The 2.4GHz experimental beacon carried on UOSAT-1 has generated much interest and UOSAT-B will carry an operational 2.4GHz beacon to carry telemetry and experimental data as a prime downlink.

CUT IT OUT! A 'Western Which Report' about:-

ROTATORS

Various advertisers will naturally try to persuade you that their product is best (and we are no exception, of course!) but what we will not do is mislead you. So the following are FACTS taken from Manufacturers specifications on their products.

Fact 1: Even small rotators will turn a fairly large antenna, what they will not do is KEEP IT STATIONARY under strong wind conditions. To do this requires good BRAKE TORQUE this is measured in Kg cms.

Fact 2: Low voltage rotators (24v ac) require higher current. This causes a greater voltage loss along the cable than with a higher voltage motor unit. Cable voltage loss will reduce rotational torque.

Fact 3: Some rotators use unbalanced braking. Under strong winds, this places an unbalanced stress on the casing of the motor unit and can cause it to fracture. Balanced braking is thus superior.

Position	Make	Model	Brake Torque kg cms	Cost per kg cm	Price £	Comment
1	Emoto	1102MXX	10,000	2.40p	240.35	75% better braking torque than HAM 4 and costs less
2	Emoto	1103MXX	10,000	2.45	246.10	
3	Emoto	1102MSAX	10,000	3.17	317.40	
4	Emoto	1103MSAX	10,000	3.20	320.85	
5	Western	WE 1145	1,000	4.00	39.99	32% better braking torque than CDE AR-40 and over £50 cheaper.
6	Emoto	105TS	3,000	4.06	121.90	New model 50% better b torque than similarly priced Kenoro KR400RC and Daiwa DR7500R
7	Emoto	502SAX	4,000	4.22	169.05	
8	Daiwa	DR7600R	4,000	4.25	170.00	
9	Kenpro	KR600RC	4,000	4.45	178.00	
10	CDE	HAM 4	5,700	4.54	258.75	Has single brake Emoto 1102-3 have twin balanced braking
11	Daiwa	DR7500R	2,000	6.00	120.00	
12	Western	FU-400	1,500	6.13	92.00	188% better b torque than similarly priced AR40
13	Emoto	103SAX	1,500	6.36	95.45	63% better b torque than CDE CD-45 and £41.40 cheaper
14	Kenpro	KR400RC	2,000	6.37	127.50	
15	Kenpro	KR250	600	7.50	45.00	
16	CDE	Big Talk BT1	920	10.00		
17	CDE	AR22XL	520	13.00		
18	CDE	CD45	920	14.87	136.85	
19	CDE	AR40	520	17.47	90.85	

These figures may have changed. As no current prices were available information taken from last available

From this you will see that the WE-1145 rotator is a very good buy! We even think we are selling it too cheaply! And here's another FACT. When we used to sell another brand of rotator, we had to increase our stock of spares to over £1,200 to ensure that we had adequate spares! We have been able to reduce that stock by 90% by selling Emoto due to their reliability.
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AMATEUR TELEX OVER RADIO

This introductory article about AMTOR is by courtesy of the British Amateur Radio Teleprinter Group (BARTG). Peter Martinez, G3PLX, outlines the history of the TOR System and Ian Wade, G3NRW, refers to a useful baud-rate and AMTOR clock generator.

Five years on from the very first AMTOR contact, it seems appropriate to take a little space to summarise the history of the development of this mode, and at the same time to give new readers a short description of the working of the system.

The letters 'TOR' in the name AMTOR stand for Telex Over Radio, the name given to a system devised in the 1960s by Mr van Duuren of the Dutch PTT, aimed at improving the quality of copy on HF radio-teleprinter circuits to the point where they could be directly connected into the international telex network.

The TOR system

The essential feature of the TOR system was its recognition of the fact that errors do occur on HF radio links, and rather than attempting to minimise these errors by improvements in the transmission system, they are detected by logic after the demodulation process, and correoted by repetition.

Errors are rendered detectable by encoding each of the 32 standard teleprinter characters as a pattern of 4 marks and 3 spaces. Most randomly occurring errors will result in a different number of marks and spaces at the receiving end, and this means that the receiving decoder can reject that character rather than pass it out to the printer as the wrong character.

Auto request system

In the best known version of the TOR system this rejection of bad characters is signalled back to the sending station, which then repeats the bad characters, several times if necessary, until the receiving station gets them correctly. This automatic request (which gives this mode the name ARQ) is done with the two stations working in an accurately synchronised quick break mode, and it is this that gives rise to the now familiar chirruping sound of the TOR ARQ mode, which has been likened to that of a cricket on a summer's evening.

Alternative version

In the other version of the system, each 7-element pattern is transmitted twice, thus allowing the receiver to get the repeat character if the first one was hit by an error. The transmitter sends the repeats regardless, so no 'request' is signalled back by the receiving station. This mode is therefore used where there can be no reverse link, such as when broadcasting to many stations. This mode is known as FEC (Forward Error Correction), and it is not as spectacular in its performance as ARQ, but is nevertheless a considerable improvement over RTTY (Radio Teletype).

Superiority of TOR over RTTY

Another reason for the superiority of TOR over RTTY is its use of synchronous, rather than asynchronous, transmission of serial data. Instead of Start bit at the beginning of each character as in RTTY, the receiving decoder is kept in step by the transmission of a 'start' code at the beginning of a transmission. To make this work, the speeds at each end must be much more accurate than in an asynchronous system, so crystal oscillators are used rather than mechanical governors.

Initial experiments

For several years after the invention of TOR, the cost and complexity of the logic put this system well out of reach of the amateur, but the coming of the microprocessor age meant that in September 1978 AMTOR signals were first heard in the amateur bands. Initially experiments were made in the UK under a clause permitting data transmission on frequencies above 144MHz. However, the following year, with the help of the late Roy Stevens, G2BVN, permission was given by the authorities to use AMTOR on the HF bands. In 1980 the IARU Region 1 conference adopted a resolution urging all member countries to press for similar permission from their respective PTT's.

In the early days the only way to get on AMTOR was to write the program software to run on a microprocessor development system or home-made computer. This proved to be a difficult task, and was no easier when small computers became readily available, as the required programs could not be run in a high level language such as BASIC. It was against this background that, in June 1980, a design was published for a code-converter board which allowed any conventional RTTY station, with the addition of a few level-shifting circuits, to operate on AMTOR. This became available in kit form, and although now obsolete, was replaced by a Mk2 kit. This kit, still available today, represents the easiest way to get on AMTOR for the existing RTTY enthusiast with some home construction facilities.

Commercially available units

The most popular route onto AMTOR at the moment is by using one of the commercially available units, such as the AMT-1. With its built-in demodulator and AFSK keyer, and computer interface, the AMT-1 is attracting a growing number of amateurs not previously active on RTTY.

There are other manufactured units appearing on the scene: HAL, already well known in the RTTY field, have introduced their ARQ1000, which is a code converter unit, and interfaces to their existing terminal unit and video display equipments. Microlog, also well known in the USA for their RTTY terminal, are introducing an add-on facility which should be an attractive proposition for existing owners, and at least one other British and two other Japanese companies are thought to be on the point of launching similar versions or add-ons for their existing RTTY systems. One US company has announced its intention of making software packages available to run on most of the popular home computers. This, if it can be done, represents another low cost approach for existing owners of the Pcomputers concerned.

Baud-rate and AMTOR clock generator

The British Amateur Radio Teleprinter Group have advised *R&EW* of a construction article for a useful baud-rate and AMTOR clock generator which is in course of preparation for publication, hopefully, in the Spring. The generator is designed around the basic CMOS 4702B standard chip and includes extra circuitry for producing the clock for 45.45-baud operation as required by most teletype systems. For further information, apply to Ian Wade, G3NRW, 7 Daubeney Close, Harlington, Dunstable, Bedfordshire LU5 6NF, enclosing SAE for a reply.

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0050	FMUT1	FM unit	42.85
0060	XF8.9KCN	300Hz CW filter	18.40
0070	XF8.9KC	600Hz CW filter	18.40
0080	XF8.9KA	6kHz AM filter	18.40
0090	XF10.7KC	CW filter	16.65
0100	FT980	Gen cov HF t'ceiver	PHONE
0110	SP980	Matching speaker	58.65
0130	FT102	9 band HF transceiver	PHONE
0140	FC102	9 band matching atu	179.00
0150	FV102DM	Remote vfo for above	230.00
0160	SP102	External speaker	52.50
0240	FM AM	Unit for above	46.75
1341	MH1B8	Scanning hand mic	14.95
0390	FT77	8 band 100 watt t'ceiver	PHONE
0450	Marker unit		10.35
0460	FM Unit		27.20
0410	FP700	PSU for FT77	125.00
0420	FC700	ATU for FT77	98.90
1449	FL2100Z	160-10m linear amp	PHONE
0810	FT290R	2m Multimode portable	269.00
0840	FT790R	70cm Multimode Portable	299.00
0860	NC11C	FT290/790 AC charger	9.95
0880	CSC1A	FT290/790 carrying case	4.20
0870	MMB11	FT290/790 Mob mount	46.85
0900	FL2010	290R Linear amplifier	63.25
0700	FT208R	2m FM handheld 2½W	198.00
0710	FT708R	70cm FM handheld 1W	209.00
0750	NC9C	Slow charger	8.80
0720	FWB2	Spare Ni-cad battery pack	21.45
0740	FBA3	Charging sleeve	5.65
0760	NC7C	Base master charger	32.95
0770	NC8C	Base master quick charger	54.05
0780	PA3	Charger 12v DC	15.35
0800	MMB10	Mobile mounting bracket	8.05
1000	FT230R	2m 25W FM mob t'ceiver	PHONE
1010	FT730R	70cms 10W FM mob t'ceiver	259.00
1020	FT726R	3 band all mode base station	PHONE
1030	430T726	70cms module	250.00
1050	50T726	6 metre module	184.00
1051	HFT726R	HF module	200.00
1060	SAT726	Full duplex x/band unit	95.00
1090	FRG7700	0.2-30mHz gen cov rec	PHONE
1100	FRG7700M	7700 with memory unit	PHONE
1110	MEMGR7700	Memory module	69.00
1120	DCRG7700	DC modification kit	1.38
1130	FRT7700	Antenna tuner unit	46.00
1201	FRA7700	Active Antenna	41.80
1140	FF5	Low pass filter	10.75
1150	FRV7700A	118-130, 130-140, 140-150mHz	86.25
1160	FRV7700B	118-130, 140-150, 50-59mHz	90.85
1170	FRV7700C	140-150, 150-160, 160-170mHz	87.40
1180	FRV7700D	118-130, 140-150, 70-80mHz	89.70
1190	FRV7700E	118-130, 140-150, 150-160mHz	89.70
1200	FRV7700F	118-130, 150-160, 170-180mHz	83.95
0490	FT757GX	Multi Mode Gen Cov	PHONE

ICOM

2005	IC751	'NEW' 100W HF	PHONE
2021	IC745	'NEW' 100W HF	PHONE
2008	IC740	100w HF trans 12v DC	29.95
2006	P SU(Int)	230v AC power supply	149.00
2030	FM(EX242)	FM module for above	32.50
2040	KEYER(EX243)	Keyer module for above	39.00
2100	IC730	100w HF trans 12v DC	659.00
2120	FL30	SSB pass band filter	29.00
2190	IC720A	100w HF trans plus gen cov	949.00
2200	PS15	230v psu for HF t'ceivers	119.00
2210	PS20	230v chopper type unit	PHONE
2060	FL45	500Hz filter for 740/730	14.50
2130	FL44	2.4kHz SSB filter	79.00
2220	FL32	CW narrow filter for 720	39.00
2230	FL34	AM filter for 720	34.00
2150	EX202	LDA unit for 730	13.50
2160	EX205	CW audio filter for 730	14.50
2240	B10	TRV unit for 730	14.00
2290	IC2KL + PSU	Memory back up for 720	5.95
2310	AT100	500W solid state linear	1303.33
2320	AT500	100 watt HF Auto ATU	269.00
2340	CF1	500 watt HF Auto ATU	389.00
2970	SP3	Cooling fan	24.00
2360	HP1	Matching ext speaker	45.00
2960	SM5	Communication phones	PHONE
2250	IC-R70	Base microphone	34.50
2260	FM unit	Comms rec 230v AC	549.00
2270	FL63	Plug in module	30.00
2130	FL44	CW narrow filter	39.00
2410	IC290H	Xtal filter	65.00
2430	BU1	Multimode 2m 12v DC	469.00
2440	IC471	Back up supply	24.50
		Multimode 70cm	699.00

ICOM CONT

2450	IC490	Multimode 70cm 12v DC	495
2480	IC2E	2m synth h'held 1.5w	169.00
2490	IC4E	70cm synth h'held 1.5w	218.00
2475		Mobile mounting bracket	229.00
2476		Mobile mounting bracket	TBA
2810	MMB9	Mobile mounting bracket	12.50
2840	MMB12	Mobile mounting bracket	12.50
2870	HM7	8 pin hand mic	14.95
2890	HM9	L/S mic for IC2E/4E	16.50
2900	HM10	Up/down scan mic	29.00
2950	SM2	4 pin desk mic	34.50
2960	SM5	8 pin desk mic	34.50
2970	SP3	External loudspeaker	45.00
2570	LCX3	Cases for IC2E/4E	5.00
2570	BC25	Standard mains charger	6.69
2590	BC30	Base hod type charger	54.35
2610	BP2	Low voltage pack	38.00
2620	BP3	Standard pack	25.00
2630	BP4	Empty battery box (AA cells)	7.95
2640	BP5	High power battery pack	48.00
2650	CP1	Charger lead for 12V supply	4.95
2660	DC1	12v Regulator pack	9.75

TRIO/KENWOOD

1450	TS930S	160-10m t'ceiver with gen cov	1095.00
1460	AT930	Automatic ATU 80-10m	141.75
1470	SP930	External speaker unit	59.00
1490	YK88A-1	6kHz AM filter	33.25
1500	YK88C-1	500Hz CW filter	33.25
1510	YG455C-1	500Hz CW filter	77.50
1520	YG455CN-1	270Hz CW filter	91.75
1530	TS430S	160-10m with gen cov rec	736.00
1540	PS430	Mains PSU for TS430S	112.75
1550	SP430	Speaker for TS430S	29.50
1570	FM430	FM option unit TS430S	34.50
1580	YK88C	500Hz CW filter	31.75
1590	YK88CN	270Hz CW filter	37.25
1600	YK88SN	1.8kHz SSB filter	32.50
1850	TL922	160-10m 2kw linear	724.50
1870	MC60 N4	Desk microphone	51.50
1880	MC60 S6	Desk mic with up/down	53.50
1890	MC60A	Desk mic with pre-amp	55.25
1900	MC35S	Fist mic 50K imp	14.75
1910	MC30S	Fist microphone 500ohm imp	14.75
1920	MC40S	Up/down mic for TR9000/7800	14.75
1930	MC42S	Up/down mic (TS930S)	15.25
1940	LF30A	LF low pass filter	21.25
1950	TS780	2m/70cm all mode t'ceiver	785.00
1980	TR9130	2m multi mode mobile	433.50
1934	TW4000	FM transceiver 2m/70cm	425.00
1680	TR2500	2m FM synth handheld	219.00
1700	ST2	Base stand and charger	51.75
1710	SC4	Soft case and belt hook	13.75
1720	MS1	Mob stand and power unit	31.75
1730	SMC25	Speaker/microphone	16.00
1750	LH2	Deluxe leather case	24.00
1770	DC25	Power supply from 12V	16.00
1780	TR3500	70cm handheld trans.	225.00
1790	TR9500	70cm multimode mob	395.00
1800	R600	Gen cov rec 150kHz-30MHz	239.00
1820	R2000	Gen cov rec	389.00
1821	HC10	World time clock	62.00

DATONG

3880	PC1	Gen cov convertor	137.40
3870	VLF	Very low frequency convertor	29.90
3670	ANF	Freq agile audio filter	67.85
3660	FL2	Multi-mode audio filter	89.70
3650	FL3	Auto filter for receivers	129.00
3700	ASP/B	r.f. speech clipper for Trio	82.80
3700	ASP/A	r.f. speech clipper for Yaesu	82.80
3710	D75	Manual RF speech clipper	56.35
3740	D70	Morse Tutor	56.35
3750	MK	Keyboard morse sender	137.40
3910	RFA	RF switched pre-amp	33.90
3800	AD270	Active dipole indoor	47.15
3820	AD370	Active dipole outdoor	64.40
3810	AD270-MPU	As above with mains p.s.u.	51.75
3830	AD370-MPU	As above with mains p.s.u.	69.00
3980	MPU	Mains power unit	6.90
3730	RFC/M	RF speech clipper module	29.90
3920	PTS1	Tone squelch unit	46.00
3640	SRB2	Auto Woodpecker blanker	86.25

MICROWAVE MODULES RANGE

3130	MML28/100-S	10m 100W lin/preamp	129.95
3140	MML70/50	4m 50 watt lin/preamp	85.00
3150	MML70/100-S	4m 100W lin/preamp	139.95
3160	MML144/30LS	2m 30W linear amp	69.95
3170	MML144/50S	2m 50W lin/preamp	85.00
3180	MML144/100-S	2m 100W lin/preamp	139.95
3190	MML144/100LS	2m 100W (1 or 3W i/p)	159.95
3200	MML432/30L	70cm 30W lin/preamp	99.00
3210	MML432/50	70cm 50W lin/preamp	109.95
3220	MML432/100	70cm 100 watt linear	228.65
3250	MMC435/51	70cm ATV con, VHF out	37.90
3260	MMC435/600	70cm ATV con, UHF out	27.90
3270	MTV435	70cm ATV 20W t'mitter	149.00
3290	MM1000KB	Converter with keyboard	99.95
3300	MM2001	RTTY to TV converter	189.00
3320	MM4001KB	RTTY term with keyboard	299.00
3330	MMS1	The MORSETALKER	115.00
3340	MMS2	Advanced morse trainer	169.00
3350	MMT28/144	10m linear transverter	109.95
3360	MMT70/28	4m linear transverter	119.95
3370	MMT70/144	4m linear transverter	119.95
3380	MMT144/28	2m linear transverter	109.95
3390	MMT432/28-S	70cm linear transverter	159.95
3400	MMT432/144-R	70 cm linear transverter	184.00
3410	MMT1296/144	23cm linear transverter	184.00
3425	MMC27/MW	27MHz to med wave conv	19.95
3430	MMC28/144	10m to 2m up conv	29.90
3440	MMC50/28	6m to 10m down conv	29.90
3450	MMC70/28	4m to 10m down conv	29.90
3460	MMC70/28LD	4m to 10m down conv	32.90
3470	MMC144/28	2m to 10m down conv	29.90
3480	MMC144/28LD	2m to 10m down conv	32.90
3490	MMC432/28-S	70cm to 10m down conv	37.90
3500	MMC432/144-S	70cm to 2m down conv	37.90
3510	MMC1296/28	23cm to 10m down conv	34.90
3520	MMK1296/144	23cm to 2m down conv	69.95
3530	MMK1691/137.5	1691mHz Meteosat conv	129.95
3540	MMA28	10m low noise preamp	16.95
3550	MMA144V	2m RF switched preamp	34.90
3560	MMA1296	23cm low noise preamp	34.90
3570	MMd050/500	500MHz digital freq meter	75.00
3580	MMd600P	600mHz-10 prescaler	29.90
3590	MMDP1	Freq counter amp/probe	14.90
3620	MMS384	384mHz freq source	29.90
3630	MMR15/10	15dB, 10W attenuator	11.90

AZDEN

4060	PCS4000	2mFM transceiver 25W	229.00
4130	MEX55	Mobile boom safety mic	28.50

FDK

5779	M.750XX	2m FM/SSB/CW 10W t'ceiver	315.00
5782	EXP.430	M.750 70cm transverter	249.00
5772	KP100	AC/DC Electronic Keyer	69.00
5780	ATC720	Synth air monitor 110-138MHz	159.00
5781	RX40	Synth FM mon 140-180MHz	149.00

MUTEK LTD

5850	SLNA 50s	50MHz low noise switched preamplifier using BF981	37.10
5860	SLNA 70s	70MHz low noise switched preamplifier using BF981	37.10
5870	SLNA 70u	70MHz low noise unswitched preamplifier using BF981	22.40
5880	SLNA 70ub	Unboxed version of SLNA 70u	13.70
5890	SLNA 144s	144MHz low noise switched preamplifier using BF981 (0.9dB noise figure)	37.10
5900	SLNA 144u	144MHz low noise unswitched preamplifier using BF981	22.40
5910	SLNA 144ub	Unboxed version of SLNA 144u	13.70
5920	SLNA 145sb	Transceiver optimised preamplifier with antenna c/o switching using BF981. Intended for the FT290R, but has many other applications!	27.40
5930	GFBA 144e	Ultra-high performance environmentally housed switched gasfet preamplifier using advanced negative feedback circuitry for superb dynamic performance. Supplied with ATCS 144s controller	129.90
5940	TLNA 432s	Very high performance bipolar transistor switched preamplifier for 430-440MHz using BFQ69 for 1.4dBnf and 0dBm input intercept performance	74.90
5950	TLNA 432u	Unswitched boxed variant of TLNA 432s	29.00
5960	TLNA 432ub	Unboxed TLNA 432u	20.40
5970	GLNA 432u	Series 432 MHz gasfet unswitched preamplifiers	PHONE
5980	BLNA 432ub	Sub-miniature 1.3dBnf BFQ69 preamplifier	13.70

MUTEK LTD CONT

5990	BLNA 1296ub	Noise matched NE64535 1.3GH lna
6000	RPCB 144ub	Complete replacement front-er for the FT221 and FT225
6010	RPCB 251ub	Complete replacement front-er for the IC211 and IC251
6020	HORA 95u-1	1.5dBnf/8.5dB gain high dynar range 88-108MHz preamplifier
6030	HDRA 95u-2	11.5dB gain variant
6040	BBBA 500u	20-500MHz broadband high dynamic range preamplifier
6050	BBBA 860u	250-860MHz broadband low no amplifier
6060	XBPF 700ub	Microstripline bandpass tvi filt
6070	PPSU 012	12V (nominal) mains psu for HDRA95 & BBBA860
6080	CISA 001	'UHF'(f) to BNC(m) coaxial ada
6090	ATCS 144s	Transmit receive changeover sequence and controller

WRAASE ELECTRONICS

SLOW SCAN EQUIPMENT

4720	SC140	SSTV receive board
4730	SC160	SSTV tranceive board
4740	SC442A	SSTV TX/RX + colour
4775	SC-1	SSTV + FAX TX/RX
4750	FG422A	Light pen
4760	KB422A	Keyboard
4780	Prince	12" green display vdu

SCANNING RECEIVERS HF/VI

5573	Sony ICF7600D Digital receiver 'NEW'
5574	Power supply mains, for above
5580	Bearcat BC100 synthesised h/held VHF/UHF
5610	Bearcat BC2020FB AM/FM VHF/UHF
5650	Jil SX200N AM/FM VHF/UHF
5651	Jil SX400 26-510MHz AM/FM
5659	Gemscan Synthesised VHF/UHF scanner 'N
5641	AOR2001 Synth. 26-520 AM/FM
5770	Fairmate AS32320 AM/FM VHF/UHF + milit airband
5760	Corona CD6000 AM airband receiver, digital
5781	FDK RX40 pocket synthesised receiver 140-180MHz
5780	FDK ATC720 pocket synthesised airband receiver

VHF/UHF AMPLIFIERS

TONO PRODUCTS

5340	2M-50W	40W linear for 2 metres
5350	2M-100W	90W linear for 2 metres
5360	MR-150W	140W linear 2 metres
5370	MR-250W	210W linear for 2 metres
5380	MR28	100W linear for 10 metres
5390	4M60	50W linear for 70cms

TOKYO HY-POWER LABS INC

5670	HC-150	3.5MHz to 30MHz ATU. 150V
5680	HC2000	1.8MHz to 30MHz ATU. 2Kw
5690	HL-82V	2M linear amp min 80W O/ includes Mosfet preamp
5700	HL-160V	2M linear amp min 160W O includes J.Fet preamp 3 or I/P
5709	HL-45U	70cm linear amp 10W I/P 40 50W O/P
5711	HL90U	70cm linear amp 10W I/P 10 O/P 'NEW'

ALINCO ELECTRONICS

5720	ELH230E	2M linear min 30W O/P 1/3 P small
5730	ELH710	70cm linear amp 10W O/P-1 3W I/P
5740	ELH730	As above but 30W O/P
5741	ELH230D	As ELH230 but with pre-amp (switched)
5742	ELH250D	2M linear 50W O/P 1/3W I/ pre-amp (switched)

See full range of BNOS and Microwave Module a

DAVETREND LTD

4670	VHF/W	Wavemeter 120-450MHz
4680	4APSU	4 amp 13.8V psu prot.
4690	6APSU	6 amp 13.8V psu prot.
4700	12APSU	12 amp 13.8V psu prot.
4710	24APSU	24 amp 13.8V psu prot.
4711	MT1	Morse tutor with mains psu

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VHF/UHF ABSORPTION WAVEMETER

John Mills provides a comprehensive review of the new AKD WAVEMETER covering the VHF/UHF frequency allocations

One of the first requirements of any newly-licensed radio amateur is a wavemeter. Many designs have been published at various times but most only cover the HF spectrum. The newly announced model WA1 wavemeter from *AKD* aims to fill the gap in the VHF/UHF part of the allocations most commonly in use today. The unit covers two switch-selected ranges, Range 1 covers from 120-200MHz and Range 2 covers from 200-440MHz.

Detection of harmonics

The primary function of the unit is to provide detection of spurious emissions from 2m (144MHz) transmitters. Up to the third harmonic (approx 435MHz) can be detected, and in addition the unit can be used for field strength indications on both the 2m and 70cm bands. Users of 4m (70MHz) should also note the ability of the unit to be able to detect harmonics of up to the sixth order, albeit unable to detect the fundamental.

Sensitivity

Sensitivity can only be described as extremely good, an IC4E on 70cm operating on its own whip antenna managed to make a good attempt at bending the meter needle around the end stop at distances exceeding five feet. Any harmonics present even at much lower levels should be detectable with ease.

Constructional features

Supplied in an attractive grey/white low profile case, the unit has two main controls. A three-way toggle switch selects the two ranges or switches the unit off when in the centre position. A tuning/frequency-setting rotary control is calibrated in two colour-coded ranges to correspond with that of the toggle switch. It should be noted that the unit is tuned by a varicap controlled by the rotary control and not by a mechanical tuning capacitor thus enabling the unit to be very compact.

Range 1 markings are provided in black lettering at 120, 125, 135, 150, 160, 190 and 200MHz, Range 2 provides maroon lettering at 195, 200, 225, 260, 330, 400 and 450MHz. An edgewise meter provides readout of the relative signal strength. A small external rod antenna of length approx. eight inches is supplied with the unit and connects to the rear. The wavemeter, Type WA1, is powered by a single PP3(9v) battery, which is not supplied. It has the usual *AKD* two year guarantee and is available direct from the manufacturer or from most good amateur radio stockists.

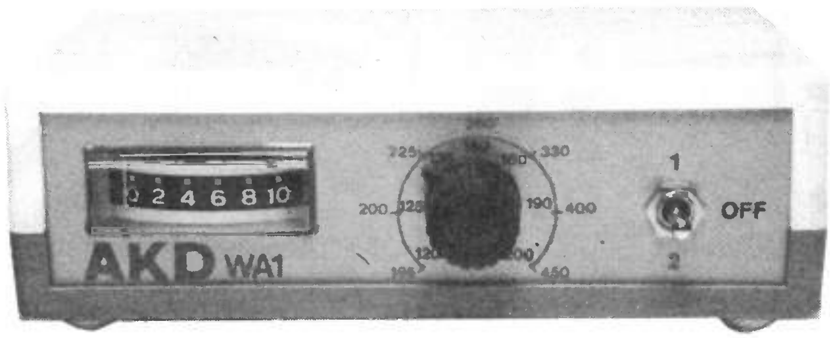


Fig 1 *The AKD Wavemeter, Model WA1*

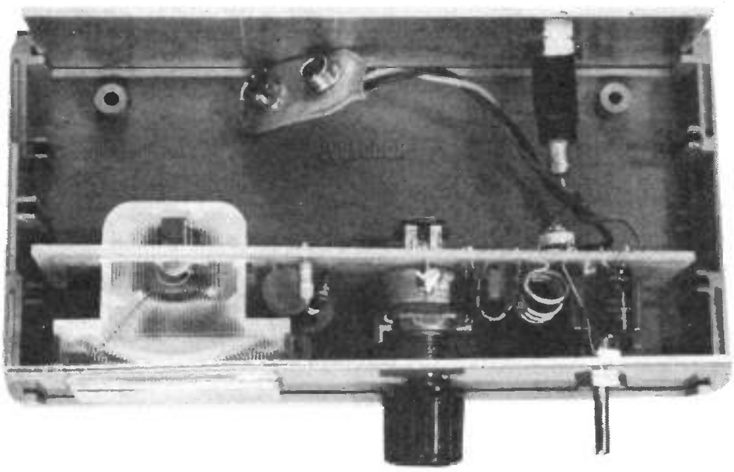


Fig 2 *Interior view from top showing battery connector*

R&EW Data Brief HA1197

Hitachi

HA1197 AM tuner IC (Sanyo — LA1240)

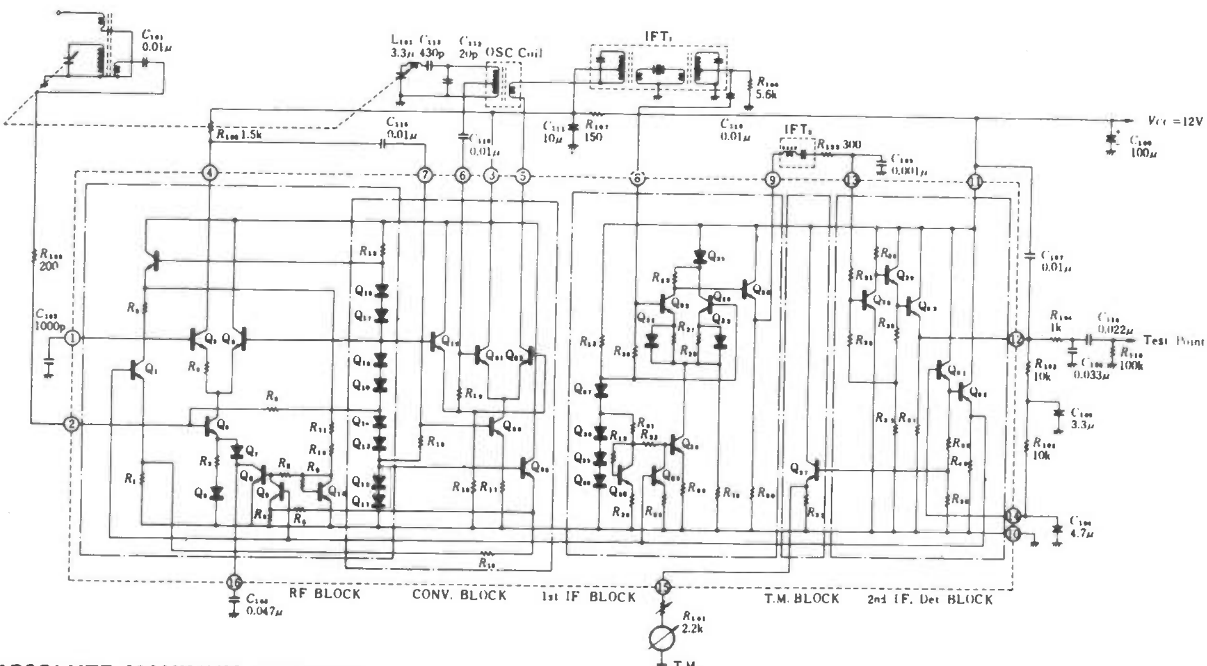
Although around a while, the HA1197 still produces some of the best results for AM radio applications in terms of distortion and signal to noise. The figure of only 0.4% Total Harmonic Distortion (THD) with 30% modulation is unusually low, and together with the S/N of 53dB at a test input of 74dBu, it represents the practical limit of the medium.

The low distortion is achieved by a very linear detector (accessed at pin 13, output at pin 12), which is preceded by a conventional differential IF amplifier stage. The bandpass of the IF filter is a critical factor in determining the distortion: purists seeking AM radio perfection should use something like the NTK SLFD6 for the ultimate MW performance.

However....the oscillator and mixer performance is something of a disappointment. Described on the internal diagram as the 'converter block', the self oscillating mixer is prone to pulling under strong signal conditions which makes the device unsuited to 'communications' applications using its internal oscillator. An external oscillator may be used (fed into pin 6) whereupon the IC regains its composure under difficult circumstances.

The RF stage (RF Block) is essential in the AGC performance of this device, and is specified to work to 30MHz. In most applications the output of the RF stage will be wideband coupled into the mixer, although it is conceivable that the output at pin 4 could be tuned to provide additional image rejection. In most fixed radio applications, preceding the input to the IC with a low pass filter (eg TOKO 237LVS1109) will help keep down spurii from SW broadcast stations.

It's as well to bear in mind that this IC can lend itself very readily to use in 'building block' applications, since the functions provided (wide range AGC, gain, very low distortion AM detection and meter driving) can be used either jointly or separately: nothing obliges the designer to use all the IC, all the time!



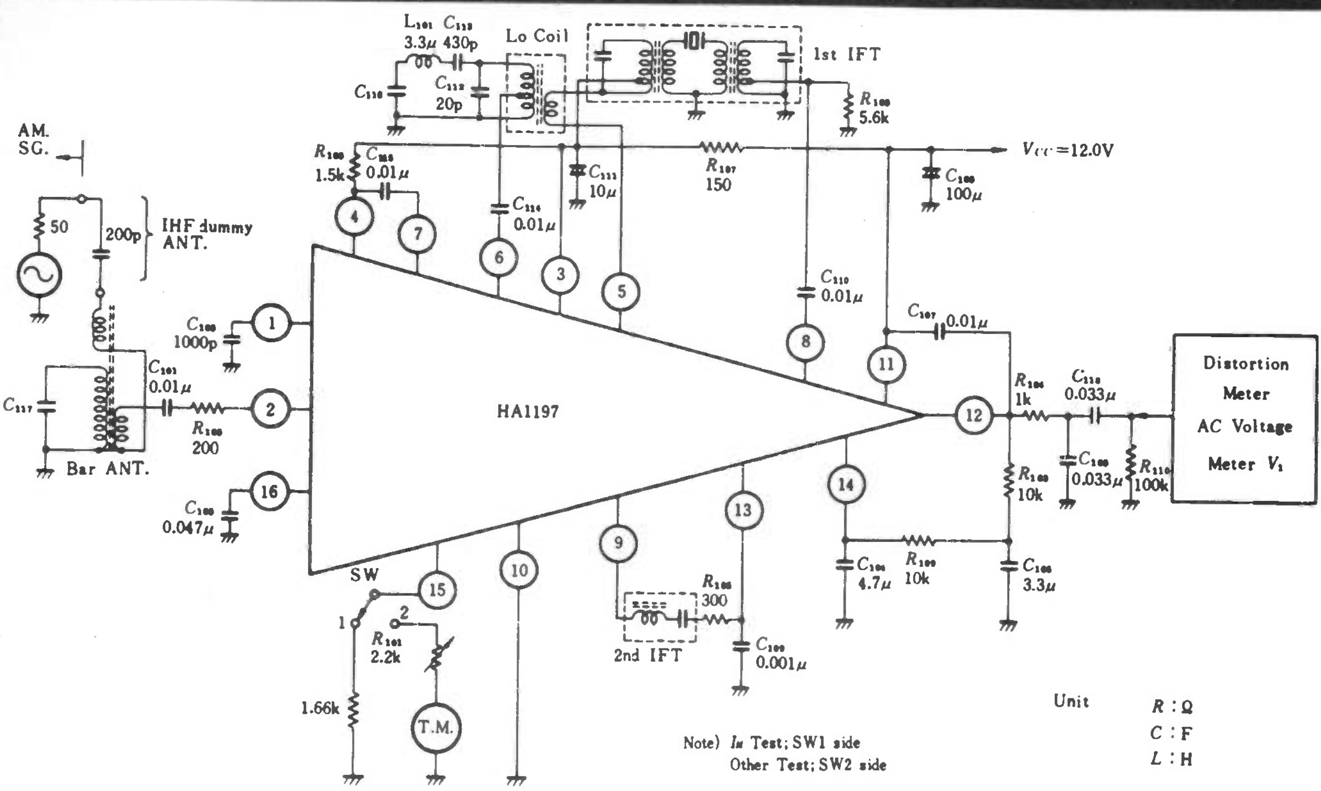
■ ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Unit
Supply Voltage	V_{CC}	15	V
Power Dissipation	P_T	450	mW
Operating Temperature	T_{opr}	−20~+70	°C
Storage Temperature	T_{stg}	−55~+125	°C

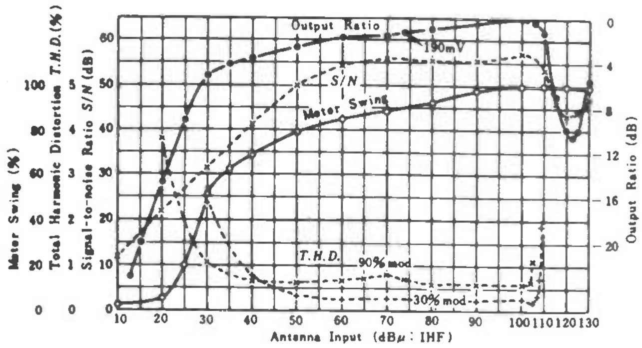
■ ELECTRICAL CHARACTERISTICS (V_{CC} = 12V, f = 1MHz, f_m = 400Hz, Ta = 25°C)

Item	Symbol	Test Circuit	Test Condition	min	typ	max	Unit
Quiescent Current	I_Q	1		—	14.5	25	mA
Signal-to-noise Ratio	S/N	2	Input 74dBμ, Mod. 30%	47	53	—	dB
			Input 34dBμ, Mod. 30%	29	33.5	—	
Total Harmonic Distortion	T.H.D	2	Input 74dBμ, Mod. 90%	—	0.8	—	%
			Input 100dBμ, Mod. 30%	—	0.4	1.0	
AGC FOM		2	−10dB point from output voltage with 100dBμ input	65	75	—	dB
Output Voltage	V_O	2	Input 74dBμ, Mod. 30%	150	212	300	mV
Tuning Meter Current	I_M	2	Input 100dBμ, Mod. 30%	—	240	—	μA

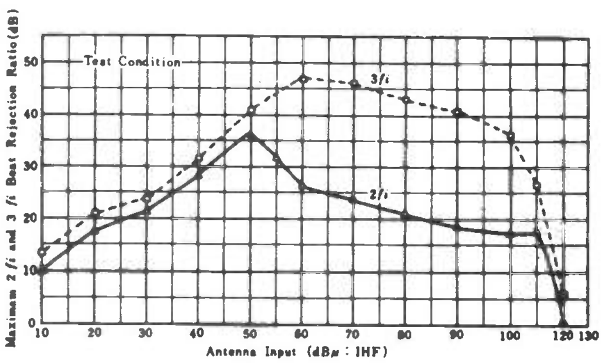
Note: Input level is defined as open-circuit voltage. The IHF (200pF) dummy antenna is used.



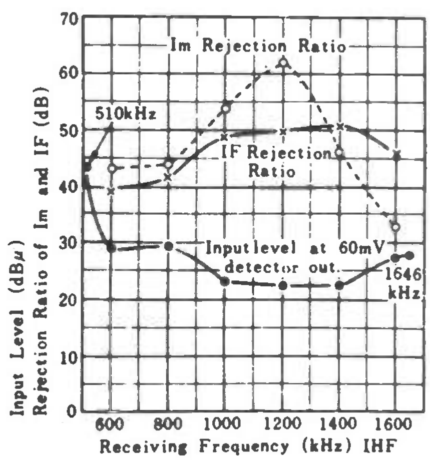
OUTPUT RATIO, SIGNAL-TO-NOISE RATIO, METER SWING AND TOTAL HARMONIC DISTORTION VS. ANTENNA INPUT



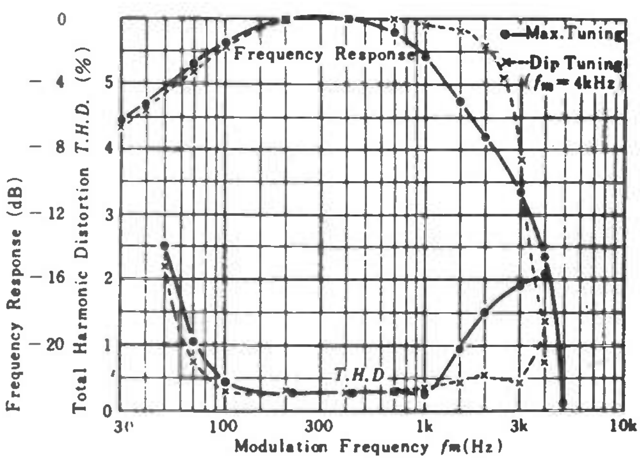
MAXIMUM 2fi AND 3fi BEAT REJECTION RATIO VS. ANTENNA INPUT



REJECTON RATIO AND INPUT LEVEL VS. RECEIVING FREQUENCY



FREQUENCY RESPONSE AND TOTAL HARMONIC DISTORTION VS. MODULATION FREQUENCY



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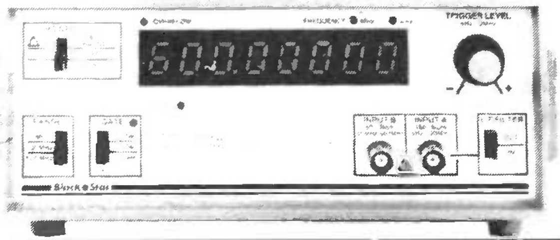

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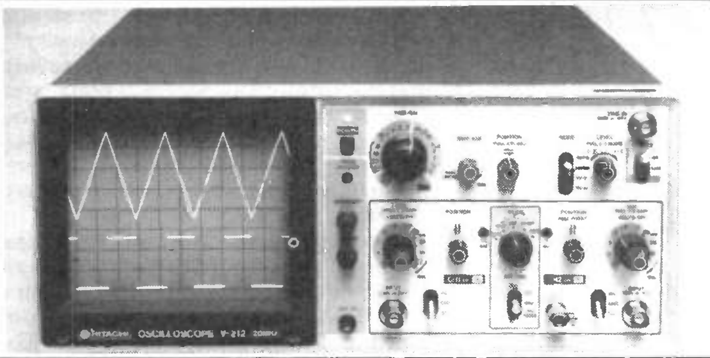

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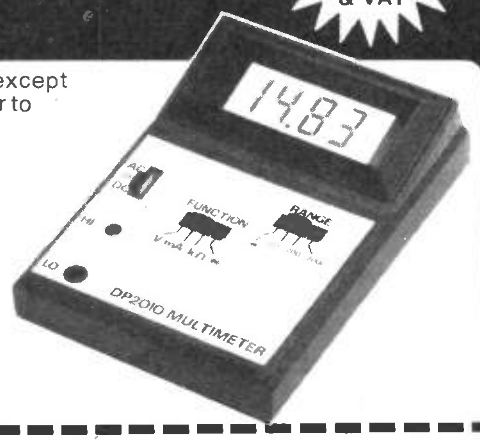

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OSCAR-10
A look at its Orbit

This article by Terry Weatherley, G3WDI, promotes a better understanding of satellite orbital terminology for the radio amateur

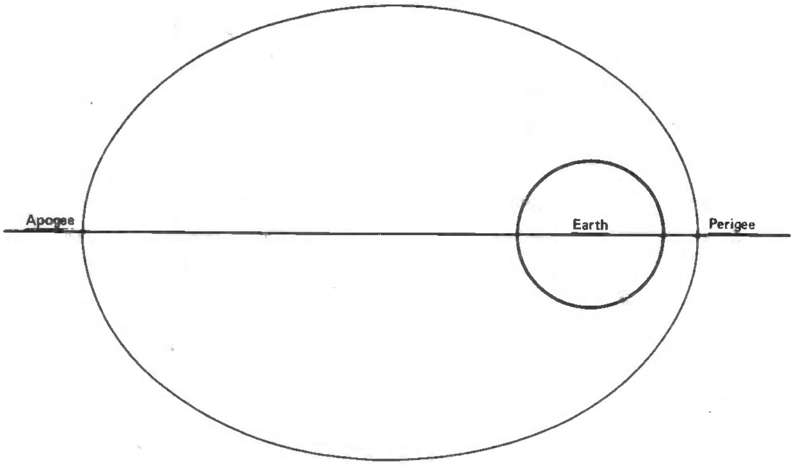


Fig 1 *The orbit of OSCAR-10*

The OSCAR (Orbiting Satellite Carrying Amateur Radio) programme is almost as old as space exploration itself. Indeed the way the OSCAR programme has progressed from a simple orbiting beacon to a sophisticated orbiting communications satellite exactly mirrors the history of commercial communications satellites and demonstrates very clearly the 'self training' purpose behind Amateur Radio which is sometimes overlooked or even forgotten. Amateurs worldwide have become used to communicating through the OSCAR or the Russian equivalents (the RS satellites) with ease.

Until OSCAR-10, amateur satellites have been placed in near-circular orbits with orbital periods of between 90 and 120 minutes. Prediction of the most useful orbits for any location is easily accomplished using pocket calculator or even pencil and paper. The advent of the personal computer made calculation quicker and perhaps more readable but hardly less accurate. The dedicated satellite enthusiast usually relied on one of the OSCARLOCATORS to show the actual satellite track across the surface of the globe and from this was able to track the satellite during its very fast passage from horizon to horizon. The very skilled demonstrated their skill by working the satellite at extreme range and thus working impressive satellite DX.

New era of communication possibilities

With the recent launch of OSCAR-10, amateur satellite activity entered a new era. OSCAR-10 is the first of the *Phase Three* satellites and offers a new world of communication possibilities. Communication through the satellite is not limited to a few frantic minutes of rapid beam swinging but is available for hours at a time on a fairly constant beam heading. It is at last possible to work stations in the southern hemisphere reliably and easily. During a few hours listening one afternoon I heard UK (Australia), ZS (South Africa) and the Solomon Islands.

Elliptical orbit

Communication over such long distances is achieved by OSCAR 10 because it is in a very different orbit to previous satellites. Its orbit is distinctly elliptical and has an orbital period of nearly 12 hours. Because of this, the preparation of orbital predictions is more complex and suddenly the airways are full of talk of 'Mean Anomalies' and 'Argument of Pedigrees' *(sic.)*. No longer do we need simply the orbital period and one reference crossing but what 'Zorba the Greek' memorably called 'the whole catastrophe' – the *KEPLERIAN ELEMENT SET*.

It was the astronomer Kepler who first investigated the motion of the planets and it is upon his laws that orbital theory is based. A satellite in orbit about a parent body follows an elliptical path with the parent body at one of the foci of the ellipse. *Figure 1* shows such a path with the Earth at one focus. The point of the satellite's nearest approach to the earth is called the perigee while that point furthest from the earth is the apogee. With OSCAR-10 the apogee is about 35600 kilometres while the perigee is about 3850 kilometres from earth. The flatness of the ellipse is defined by the eccentricity which has limiting values of 0 for a circular orbit and approaching 1 for a thin flat ellipse. The eccentricity for OSCAR-10 is about 0.6.

With previous OSCARS it has been safe to assume that the satellite's speed in orbit is constant but with a satellite in elliptical orbit this is not so. The satellite moves fastest at perigee and slowest at apogee. It was Kepler who discovered that the satellite sweeps out equal areas in equal periods of time. *Figure 2* shows the orbit of OSCAR-10 with the elapsed time from perigee passage marked on it. This shows the variation of speed quite clearly.

Historically, astronomers have used the word 'anomaly' to denote angles and the position of the satellite is known as the *MEAN ANOMALY*. Particularly note that the CW telemetry from OSCAR-10 gives the MA as a number out of 256 rather than 360. This is shown in *Figure 3*. There are a number of other angles used to define the orbit. The most familiar is the *INCLINATION*. This is the tilt angle between the plane of the satellite and the Earth's equator. On a northbound equator crossing, the angle in the plane of the orbit between the northbound crossing and the perigee is known as the *ARGUMENT OF PERIGEE*.

Interpretation of orbit parameters

The term longitude west of Greenwich is familiar to most people and Greenwich is understood as being the point of the Earth's surface from which longitude is measured. Astronomers use a system of celestial longitude to 'navigate' around the sky. The sky's 'Greenwich' is known as the 'First Point of Aries' *(Figure 4)*. If the point of intersection of the orbit plane and the equator on an ascending crossing is projected onto the Celestial Sphere, the angle at the earth's centre between this point and the First Point of Aries is known as the *RIGHT ASCENSION OF THE ASCENDING NODE. (RAAN)*.

Thus the orbit of OSCAR-10 is defined using the *KEPLERIAN* parameters in the following way:-

Inclination	25.8760
Eccentricity	0.608
Argument of Perigee	225.462
RAAN	227.616
Mean Anomaly	74.7610

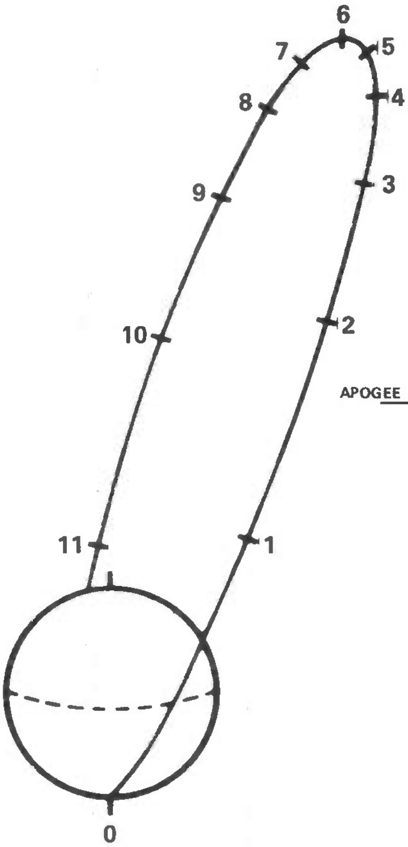


Fig 2 The position of a Satellite with a 12-hour period at hourly intervals showing speed variations

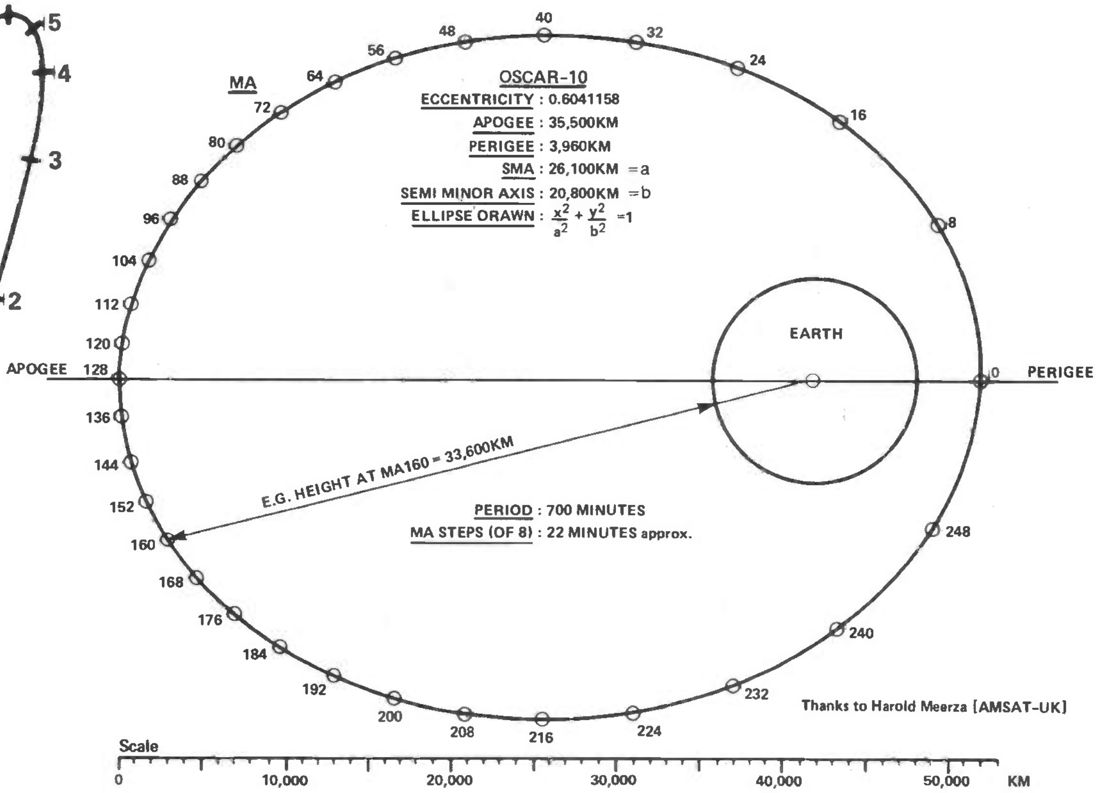
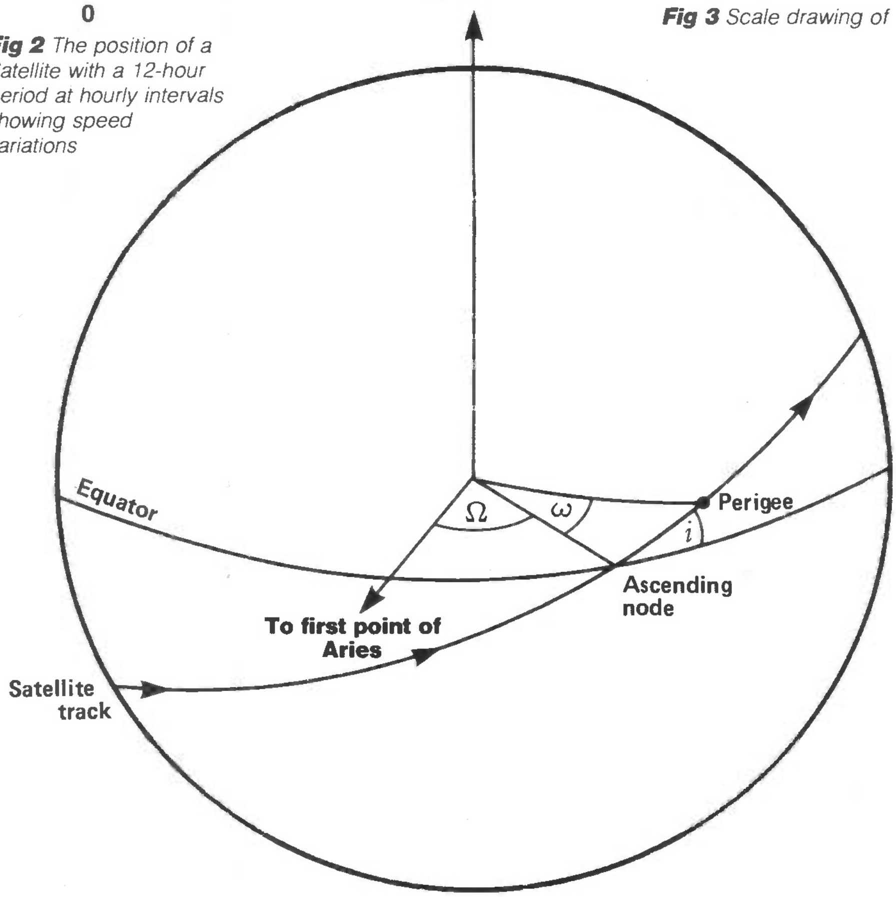


Fig 3 Scale drawing of OSCAR-10 orbit showing MA (out of 256)



Ω = **Right Ascension of Ascending Node (RAAN)**
ω = **Argument of Perigee**
i = **Inclination**

Fig 4 The three elements that fix the orbit relative to Earth

To these five parameters must be added the number of orbits per day (known as the *MEAN MOTION)* and the time the parameters were measured (known as the *EPOCH).* Thus, to complete the set we have:-

Mean Motion 2.05847690
Epoch .... 83:339.5 (Year, Day No)

To turn these parameters into usable Fdata requires a certain amount of 'number crunching'. It is here that a personal computer is invaluable. An excellent program in SINCLAIR Basic by John Branagan GM4IHJ is contained in *The AMSAT-UK Software Handbook* derived from a program by Tom Clark W3IWI, written in North Star Basic and published in *Orbit* in 1981. These programs are fairly easy to translate into other Basics. Using the given element set in such a program gives the print-out shown in *Figure 5* .

AMSAT-UK

For those interested in satellites, membership of AMSAT-UK is a must. Information can be obtained from AMSAT-UK, 94 Herongate Road, Wanstead Park, London, E12 5EQ.

References

Oscar News , October 1983
Orbit , 1981
A Scale Drawing of the OSCAR-10 Orbit – Harold Meerza
Artificial Satellite Observing – Editor, Howard Miles

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BF337	0.29
BF338	0.32
BF355	0.37
BF362	0.38
BF363	0.38
BF371	0.20
BF394	0.19
BF422	0.32

BF457	0.32
BF458	0.36
BF459	0.36
BF595	0.23
BF597	0.25
BFR39	0.23
BFR40	0.23
BFR41	0.28
BFR81	0.25
BFR88	0.30
BFR90	1.50
BFR91	1.75
BFT42	0.28
BFT43	0.28
BFW92	0.85
BFX29	0.30
BFX84	0.26
BFX85	0.32
BFX86	0.30
BFX88	0.25
BFY50	0.21
BFY51	0.21
BFY52	0.25
BFY90	0.77
BLY48	1.75
BR100	0.26
BR101	0.30
BRC4443	0.85
BT106	1.49
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OC71	0.40
OC81	0.50
R2008B	1.70
R2010B	1.70
R2322	0.58
R2323	0.66
R2540	2.48

RCA16334	0.90
RCA16335	0.80
SKE5F	1.45
TIP29	0.40
TIP29C	0.42
TIP30C	0.43
TIP31C	0.42
TIP32C	0.42
TIP33B	0.75
TIP34B	0.75
TIP41A	0.45
TIP41C	0.45
TIP42C	0.47
TIP47	0.65
TIP120	0.60
TIP125	0.65
TIP142	1.75
TIP146	2.75
TIP161	2.95
TIP2955	0.80
TIP3055	0.55
TIS91	0.20
TV106/2	1.50
2N2219	0.28
2N2905	0.40
2N3053	0.40
2N3054	0.59
2N3055	0.52
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3708	0.12
2N3773	1.95
2N3792	1.35
2N4427	1.50
2N4444	1.15
2N5294	0.42
2N5296	0.48
2N5298	0.60
2N5496	0.65
2SA715	0.60
2SC495	0.80
2SC496	0.80
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2SC1173	1.15
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2SC20[illegible]	[illegible]
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BA115	0.13
BA145	0.16
BA148	0.17
BA154	0.06
BA155	0.13
BA156	0.15
BA157	0.30
BAX13	0.04
BAX16	0.06
BB105B	0.30
BT151	0.79
BY126	0.10
BY127	0.11
BY133	0.15
BY164	0.45
BY176	1.20
BY179	0.63
BY182	0.55
BY184	0.35

BY199	0.40
BY206	0.14
BY208-800	0.33
BY210-800	0.33
BY223	0.90
BY298-400	0.22
BY299-800	0.22
BYX10	0.20
BYX36-150R	0.20
BYX38-600R	0.60
BYX55-600	0.30
BYX71-600	1.10
BZY95C30	0.35
OA47	0.09
OA90	0.05
OA91	0.06
OA95	0.06
OA202	0.10
IN914	0.04
IN4001	0.04
IN4002	0.04
IN4003	0.04

IN4004	0.05
IN4005	0.05
IN4006	0.06
IN4007	0.06
IN4148	0.02
IN4448	0.10
IN5401	0.12
IN5402	0.14
IN5403	0.12
IN5404	0.12
IN5405	0.13
IN5406	0.13
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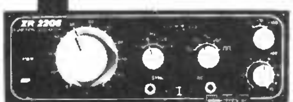

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'NOTES FROM THE PAST'

The fundamental laws governing electronics do not change, although man is constantly discovering new ways of utilising them. Therefore, the following comments on the results of receiving electric shocks are as relevant today as they were when they were written – many years ago. The golden rule for this aspect of electronics is: 'Do not let familiarity breed contempt'. Our second topic very aptly illustrates the truth of our opening comment.

Only too frequently one hears of fatalities resulting from electric shock, even amongst the most experienced of amateurs. Indeed one might always watch the black-bordered panel in the *RSGB Bulletin* headed 'Silent Keys' with a dread that the name of an old acquaintance might appear there. Morbid as it may seem, this was the theme of a discussion at a recent club meeting, only happily this was occasioned by a member who had caught a packet, while adjusting a home-built TV, which didn't prove fatal. It merely threw him across the room, producing bruises which made it uncomfortable for him to sit. Naturally, everybody in turn related their experiences of when they had had an unforgettable tingle run up their sleeves, and there was a great deal of speculation about the prospect of shocks being lethal.

Electric shocks vary in effect

The effect of electric shocks varies considerably, depending on the health of the individual and just what sort of path the current makes through the body. A path from, say, the thumb to a finger of the same hand might only result in a nasty burn, but the same current from hand to hand, forming a path through the heart, would probably prove fatal. Hence the electricians' tip – keep one hand behind your back when touching live circuits.

There are numerous instances of people being killed by shocks from low voltage circuits, and equally as many of the failure of high voltage circuits to prove fatal. At times, too, the electric chair has failed to produce instantaneous death.

In the twenties there was an important case where a firm at Bridgend, Glamorgan, electrified a wire fence to prevent pilferage of coal. One night in drizzling rain, a collier, running, touched one of the strands and fell on to some corrugated zinc. He could not let go, and a friend who tried to pull him off received a lesser shock through his damp clothing. The victim, apparently a healthy young man died and the firm were charged with manslaughter and 'setting a man-trap calculated to destroy human life, etc.,etc.'

It cannot be recalled what the voltage of the circuit was, but the case was successfully defended, it being held that the effect of unexpected shock when already alarmed and running away was out of proportion to the current.

Hot seat

At the other end of the scale we have judicial electrocution which has been in use for over 60 years in the United States. In one well-known case the victim was still not dead after being subjected to a shock of over 1,250 volts for 50-odd seconds! Whatever views we hold about hanging, it is difficult to believe that electrocution is any more humane. The preliminary ordeal of being firmly strapped in the chair and having the electrodes secured to the head and to the calf of one leg is grim enough without the paralysing agony of a shock which fails to kill instantly.

The cases quoted are admittedly extreme ones, but death by low voltages and escapes after accidental contact with high voltages are almost daily occurrences. So much depends upon the individual and the circumstances. Most of us have received sharp shocks at some time, and after a while one is apt to become less cautious until one gets a particularly unpleasant dose, which even if it doesn't really scare leads to damaged gear from violent body movement.

However careful you are about keeping the other hand out of harm's way, there is always a risk of touching some part of the circuit with another part of your body. So as an additional precaution it is policy to make sure that some other person knows just where to switch off and what to do in case of accident. It is, as in the case at Bridgend, useless to try to drag the victim of a shock away until the circuit is broken. To do so simply passes the shock on, and the intending helper may also not be able to let go.

Fortunately, the use of semiconductors in present–day circuits at much lower operating voltages than hitherto has hopefully reduced the fatality rate.

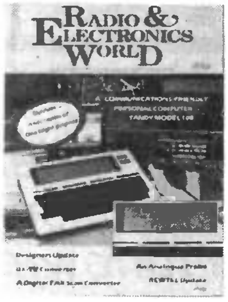
Pure science to application – 100 years

Recent reference was made to scientific knowledge, ideas and inventions – and several correspondents have shown interest. During a recent discussion on transistors, it forcibly became apparent how closely linked they are. As long ago as the early 1830's Michael Faraday noted negative temperature co-efficient of resistance and by 1855 rectification, photo-conductivity and photoelectromotive force had also been observed. It was on these our knowledge of semiconductor materials has been built up, leading (nearly a hundred years later) to the development of the transistor. The transistor made its debut in 1948, by the way, and the junction transistor made its debut in 1951.

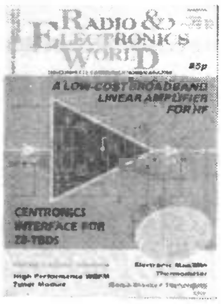
BACK ISSUE SERVICE

All issues from November 1981 onwards are still available, with the exceptions of January 1982 and February 1982. All orders must be pre-paid, the cost of each issue being £1.00 inclusive of postage and packing. A contents index spanning the issues from October 1981 to September 1983 is available on receipt of a stamped addressed envelope. To ensure that you don't miss any future issues, we suggest that you place a regular order with your newsagent or complete the subscription order form found in this issue.

JULY 1983
Projects — Radio Amateur's Test Card; Central Heating Controller; Data Brief 1-DC/DC Converter; Data Brief 2-Up/Down Counter; TX10-RGB (another conversion); Z8 Backplane, Universal Interface; Synthesiser Control System II; Solid State Coupler; SSB Adaptor for the SX200-N; Digital Capacitance Meter; DTMF Signalling System; PF1 Conversion. *Features* — RF TMOS; Zilog Z8000; HF Receiver Performance; Signal Analysis; RF Filters II; Pass Band Tuning Techniques; ATV on the Air, new series for amateurs. *Reviews* — Sony TC-D5M (Live Performance Recorder); Datong ANF (Removes Heterodynes); PMS PROM1 (Plug-in Programming)

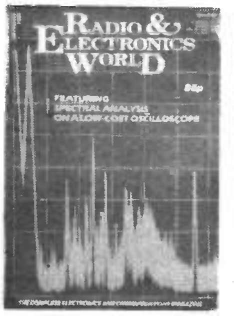


AUGUST 1983
Projects — Analogic Probe; Data Brief 1-Tape Controller; Data Brief 2-RMS-to-DC Converter; Synthesiser Control System III; Crystal Reference: Test Card EPROM Expansion; Continuity Tester; WB RF Amplifiers (Two basic designs); DX Converter. *Features* — Euro-broadcast TV Services (Station information); Zilog Z8000; Polar Orbiting Satellites; Digital FAX Conversion (More on Meteosat); ATV on the Air; HF Rx II. *Reviews* — PDF-11M; TV Aerials; Tandy Model 100 (Communications computer?); 2m Synthesiser

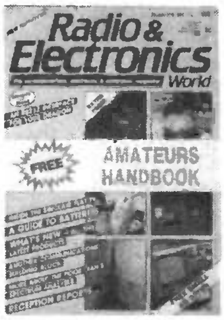


SEPTEMBER 1983
Projects — Max/Min Thermometer; 4 Channel Audio Mixer Morse Key Oscillator; Wideband FM Stereo Tuner Module I; Rotary Encoder Interface (to Control TTL); Centronics Interface for Z8-TBDS (Parallel printer interface); Linear HF Power Amplifier. *Features* — Weather Fascimile Reception; Zilog Z8000; Data Brief 1-ZN419CE Servo IC

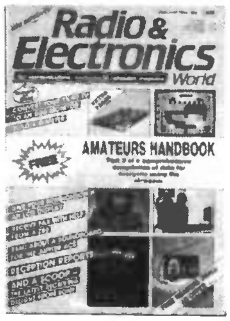
OCTOBER 1983
Designs — Modular Communication Systems Part 1; 4 Channel Audio Mixer Part 2; Tone Bursts; PF70 Conversion. *Features* — Noise Blanking Techniques; The Lambda Diode; A Guide to HF Coils Part 1; The Chromicro (Colour Processing); Timeplex; Data Brief - The NEC PC1037H Double Balanced Modulator; Amateur Radio World. *Reviews* — Tandy VSC-1000 (Variable Speech Control); Yaesu FT-77 (Solid State HF Transceiver)



NOVEMBER 1983
Designs — Communications Building Blocks (Front Ends); Poor Man's Spectrum Analyser; Wideband FM Stereo Tuner Module Part 2; 4 Channel Audio Mixer Part 3; Three Digit Timer. *Features* — Squelch Systems; Expansion Bus (First add-on — A light pen); A Guide to HF Coils Part 2; Data Brief — NE564 PLL Tone Decoder. *Reviews* — Meteor 100, 600, 1000 (All-British Frequency Counters); Personal Pearl (For text and information manipulation)



DECEMBER 1983
Designs — Poor Man's Spectrum Analyser Part 2; Communications Building Blocks Part 2; A 4001/4011 Tester; Continuity Tester. *Features* — Inside the Sinclair Flat TV; An in-depth probe; A Circuit Designers Guide to Batteries; Data File on Op-Amps Part 1; Metal Detectors in Warfare; Data Brief 1-LM1821S Video IF PLL Synchronous Detector; Data Brief 2-SL6270 Gain Controlled Audio Amplifier; An RS232C Interface for Your Dragon 32. *Reviews* — ALDEN Weather Chart Recorder Kit; Digithurst MicroSight 1.



JANUARY 1984
Designs — Communication Building Blocks (Active Antennae); FAX Receiver; RGB Interface for the Ferguson TX-90; A Couple of Voltage Detectors; LCD Capacitance Meter; Cymar Q-meter (An aid to winding coils); Zener Diode Checker; A Drinker's Delight; LCD Display Option for the Rewbichron II. *Features* — A Novel Receiver (Sony); Capacitors for Coupling, De-coupling and Filtering; Data File on Op-Amps Part 2; Farewell to Test Card 'F'; A Soundboard for the Jupiter Ace; Data Brief - MC1377 Colour Signal Encoder.

FEBRUARY 1984
Designs - Switched Mode Power Supplies; Crowbar Protection Circuit; Switched Step Attenuator; Universal NiCad Charger; Communications Building Blocks (IF Amplifiers); Real Time Calendar Clock. *Features* - Data File on Op-Amps; Six Antennas from Three Wires (Double your directions without doubling your cost); Designers Update (Helical Filters); Moving Pictures from Wax - 'Phonovision'; Computers, Communications and Applications; Data Brief - Low cost, wide range varicap diodes.

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The completed 200W PEP transmatch in situ

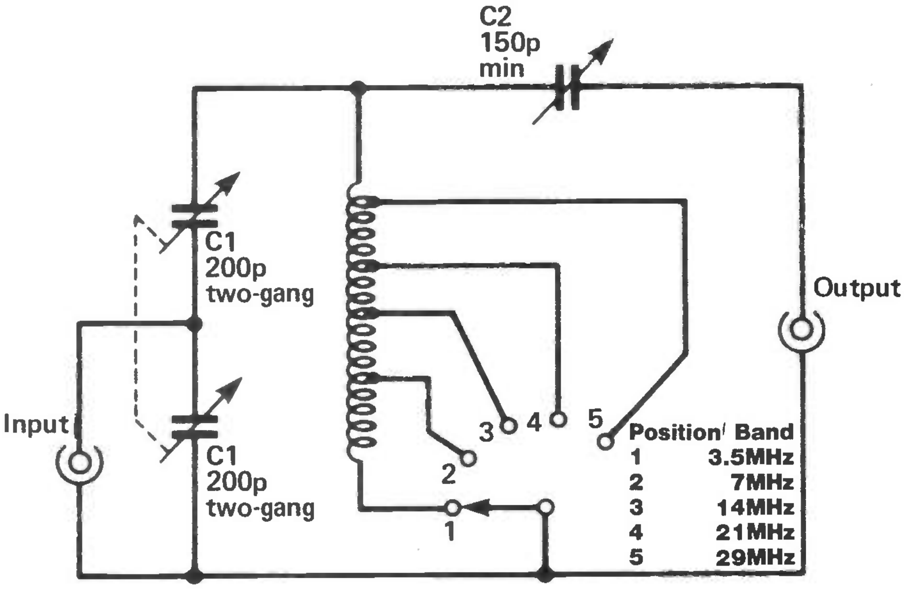

***Fig 1** Circuit diagram of the 200W PEP transmatch*

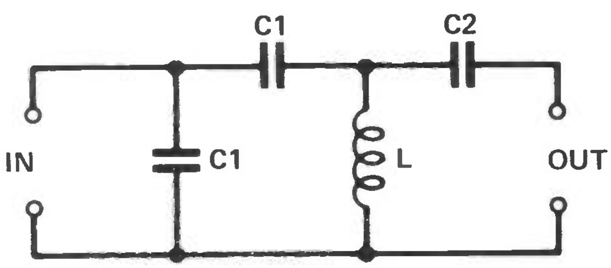

***Fig 2** The circuit redrawn for analysis*

Many operators have been heard to complain about difficulty in matching a solid state rig to their antenna. The main advantage of solid state power amplifiers is the ability to instantly QSY and this can only be done if all the antennae are properly matched to the rig, thus implying that each must have a 50-ohm non-reactive impedance. The operator should be encouraged to achieve this end without resorting to a matching unit. In most cases this means using 50-ohm coax which should be matched to the antenna at the feed point. Many commercial antennae are designed for 50-ohm unbalanced input and so no difficulty should be encountered. Antennae with other impedances can be matched to 50-ohm coax with suitable balun transformers or a gamma match.

Some of the reasons for using a tuning unit include cleaning up the signal by filtering out harmonics and spurious signals and matching antenna systems with other impedances such as a 75-ohm dipole system. In the case of solid state rigs, they are particularly useful for matching antennae with narrow bandwidths (such as mini-beams) and operating away from the design frequency, when the reactive component causes the rig to reduce its transmitted power. These advantages are gained at the expense of the instant QSY capability.

Circuit analysis

The transmatch design is well established and can match virtually any input and output impedances. This particular

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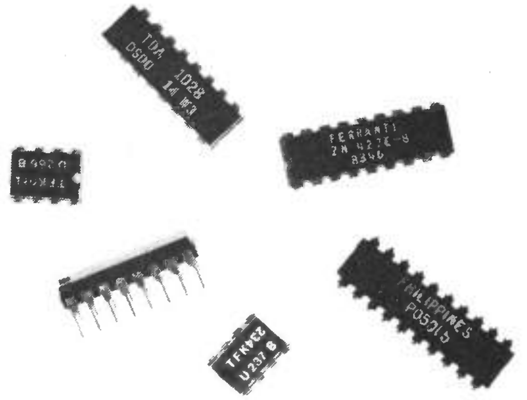

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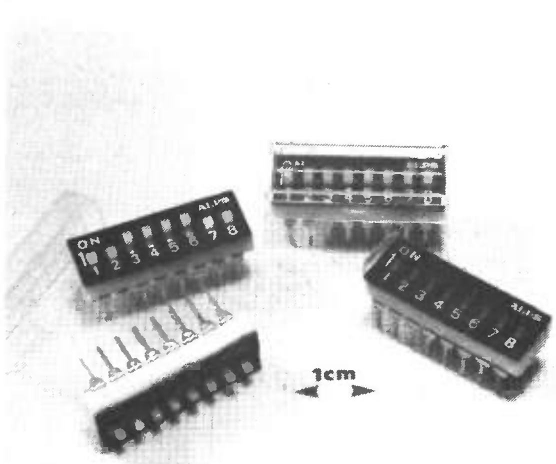

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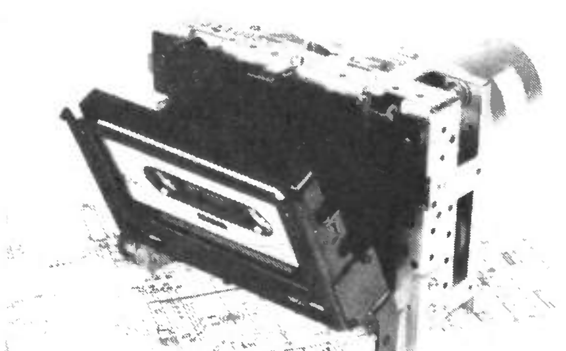

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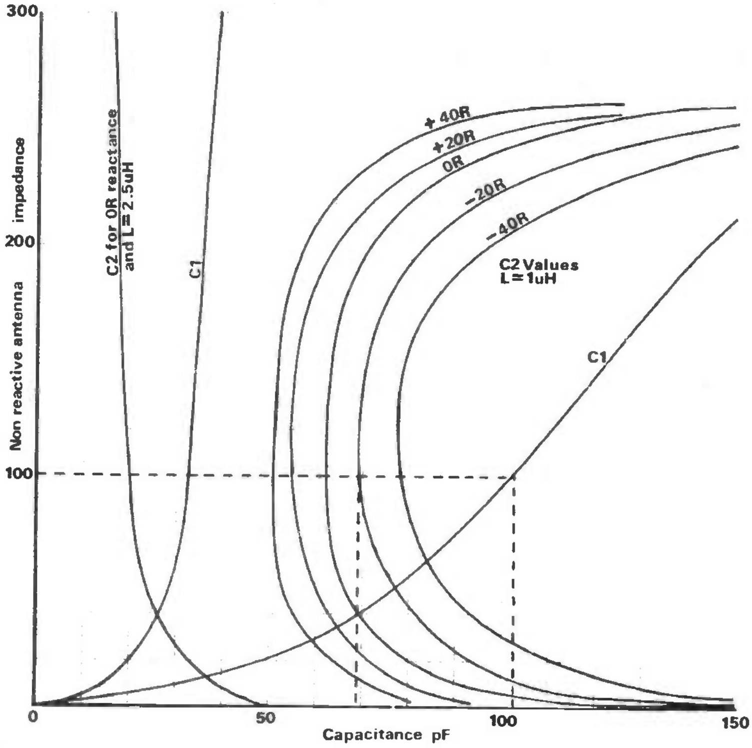
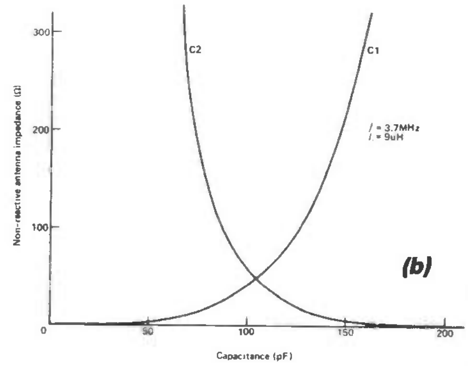
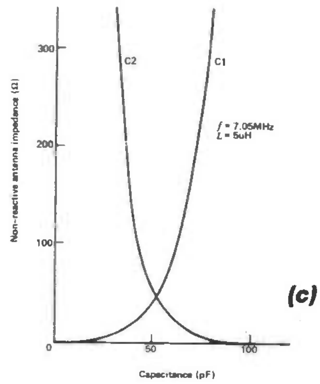
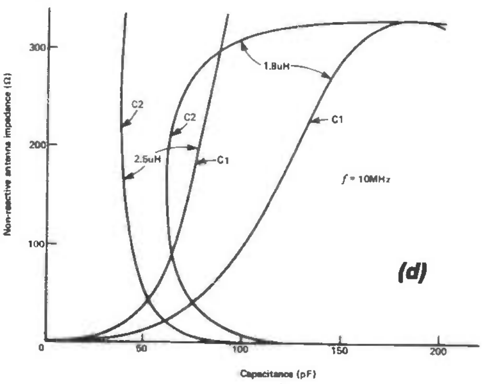
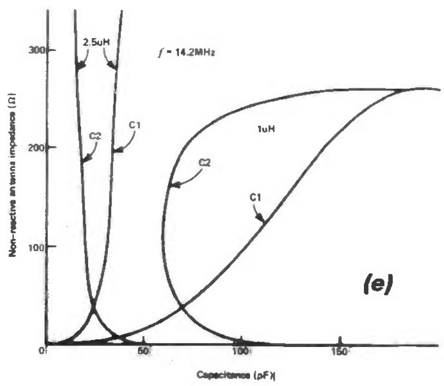


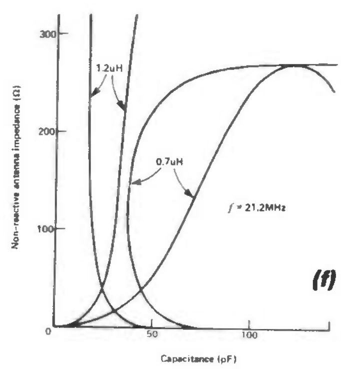
Fig 3 (a) *The effect of degree of antenna reactance on the value of C2*

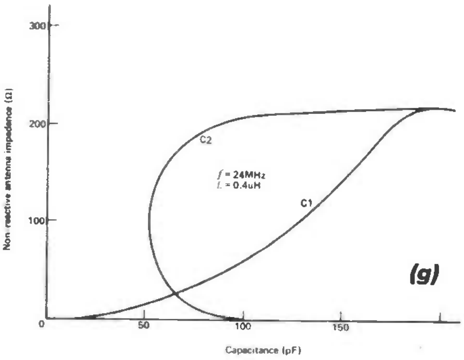












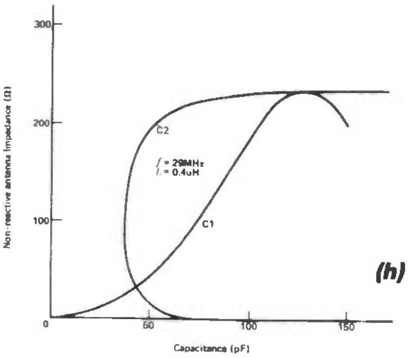


Fig 3 (b) to (h) *Curves at frequencies 3.7MHz to 29MHz*

system was designed for use primarily with a 50-ohm unbalanced output from the rig. The circuit diagram is shown in *Figure 1*.

In order to understand how critical the capacitor and inductor values are, a computer analysis was conducted. The circuit can be interpreted better when redrawn as in *Figure 2*. The computer programs are both in micro-soft basic and can be easily adapted for any home computer.

The first program was developed to calculate the impedance of any Pi or T network. Any component entered (L, C or P) is turned into a complex number and added in series with, or in parallel to, the network already entered. Entering END produces the overall impedance in the form A+jB. For the less mathematically minded, A is the resistive component and B the reactive component in ohms. If B is positive, then the reactive component is inductive. If B is negative, then the reactive component is capacitive. It is possible to enter a reactive antenna impedance by entering the resistive component as R and the reactive component as a suitable value of capacitance or inductance in series with it. Again for those not familiar with it, the formulae are :

$$\text{Capacitive reactance} = 1/(2\pi fC)$$
$$\text{Inductive reactance} = 2\pi fL$$

While this program is useful for checking circuit impedances, it is too laborious for analysing the transmatch circuit so the program was redesigned specifically for this circuit and is listed as program two.

Program two calculates the values of C2 and the resistive antenna impedance for various values of C1 and L. The initial information required is the inductance L, the frequency, the required input impedance (50-ohm non-reactive in this case) and the reactive component of the antenna impedance in ohms. By use of a loop, the values are printed out for values of C1 in 10pF steps.

The inductance values available in the design depend upon the tappings of the coil. The estimated values available for each switch position are as follows.

Using appropriate L values, the program was run for each HF band frequency. This showed that in all cases, the required matching could be achieved with a maximum C1 of 200pF and maximum C2 of 150pF. The results also show how the sensitivity of the capacitor setting is affected by the L value.

Figure 3a shows the result for two L values at 14.2MHz with various values of antenna impedance and illustrates, inter alia, the relatively large changes in antenna impedance that result from small changes of capacitor value (particularly when inductor L = 2.5μH). The dotted lines exemplify the use of the graph and show that an antenna impedance = 100-j20 and L = 1μH gives values of 102pF and 68pF for C1 and C2 respectively. *Figures 3b–3h* are plots for frequencies at intervals from 3.7 to 29MHz showing antenna impedance versus capacitance.

In order to verify the program, a sample of results was cross-checked with program one. The impedance was calculated this way looking into both ends of the circuit. In all cases, this showed that the transceiver always sees 50-ohms non-reactive and the antenna sees a 'mirror image impedance'. For example, if the antenna impedance is 75 – j20 (i.e. 20-ohm capacitive reactance) then the antenna sees 75 + j20 into the box. (i.e. 20-ohm inductive reactance to balance it).

Construction

The twin-gang capacitor C1 was of unknown origin and had an air gap of 0.81mm (.024in). Such capacitors may be found in junk sales or salvaged from old equipment. If a new one is to be purchased then a Jackson Type IR with wide spacing is recommended. The single-gang capacitor is a Jackson Wavemaster Type 95/073 (150pF). For higher levels, the Jackson TX5 range is ideal.

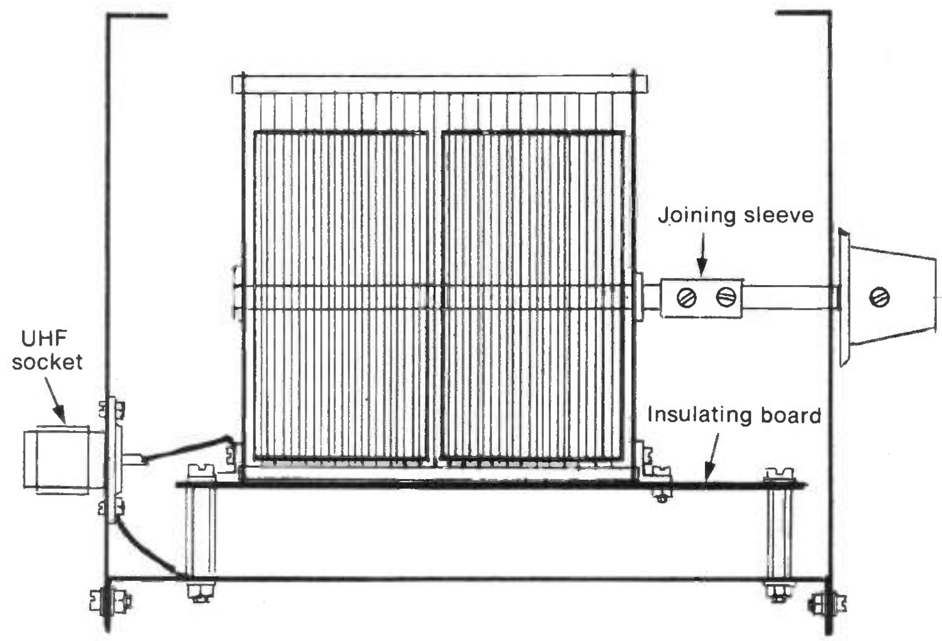


Fig 4 *Mounting of capacitor C1*

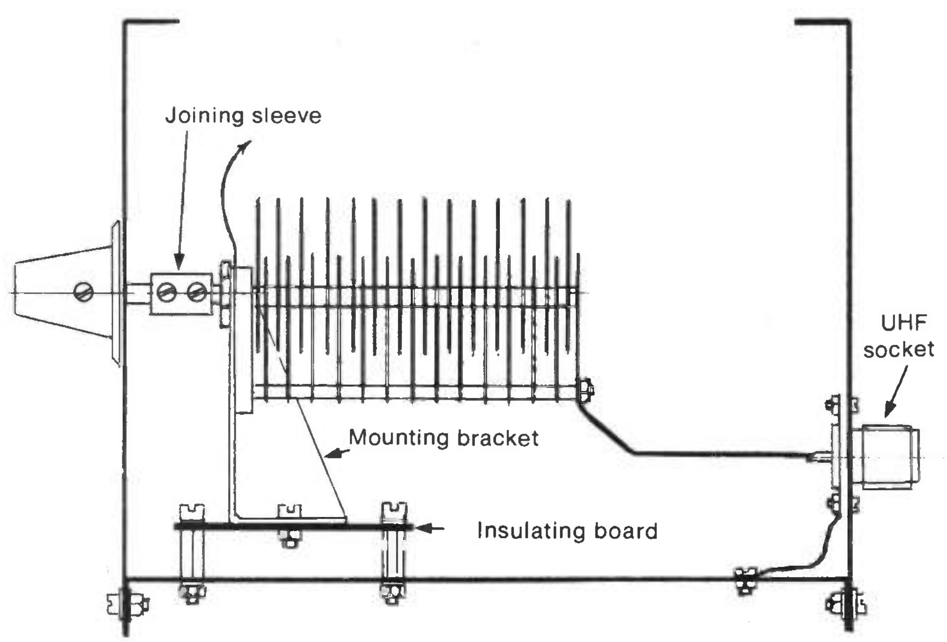


Fig 5 *Mounting of capacitor C2*

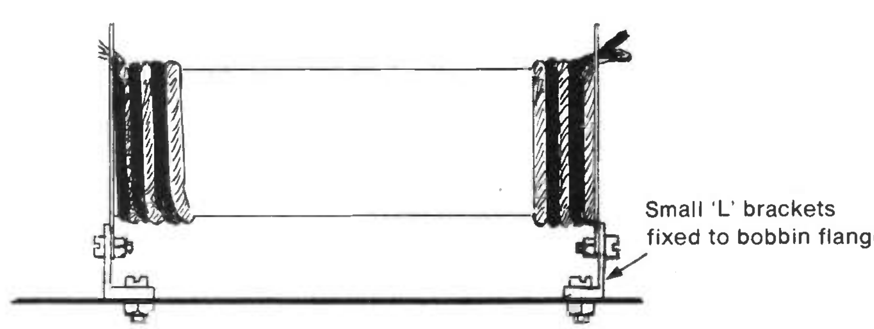
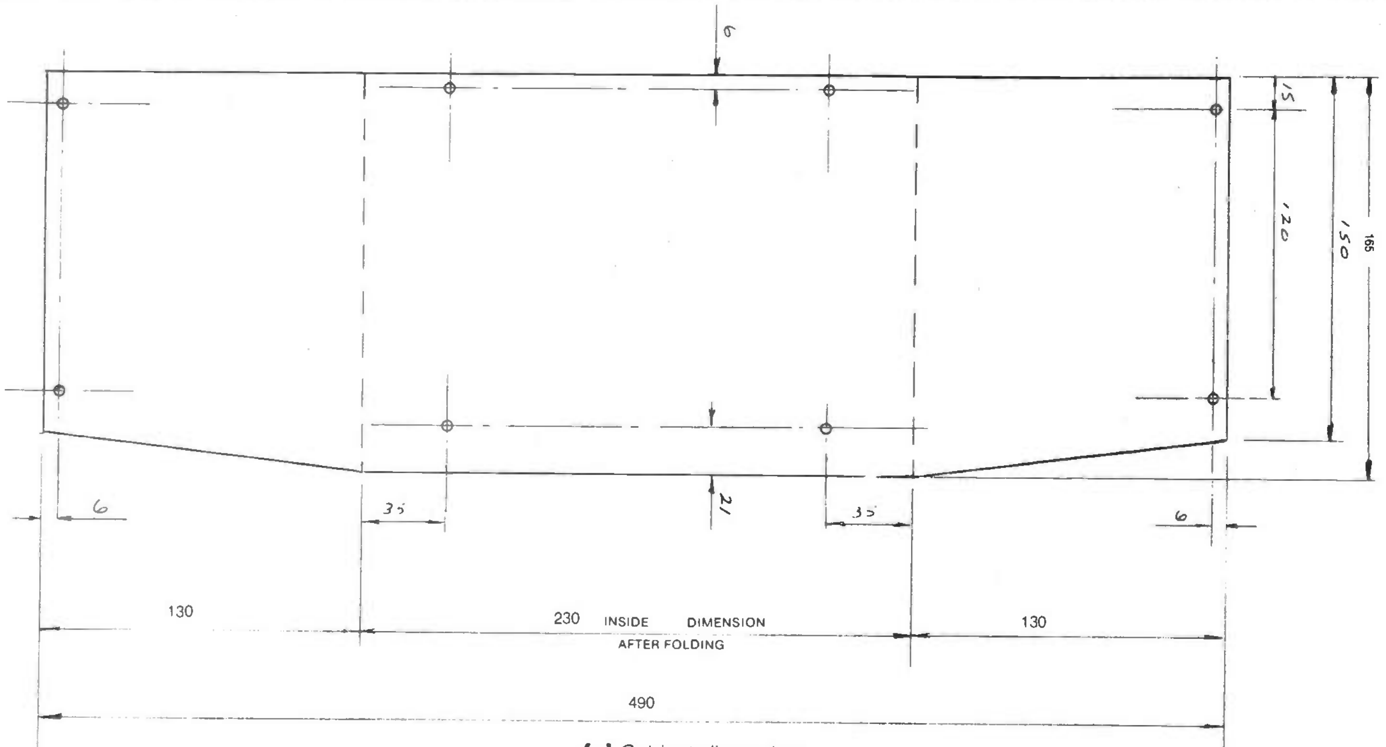


Fig 6 *Construction of coil*



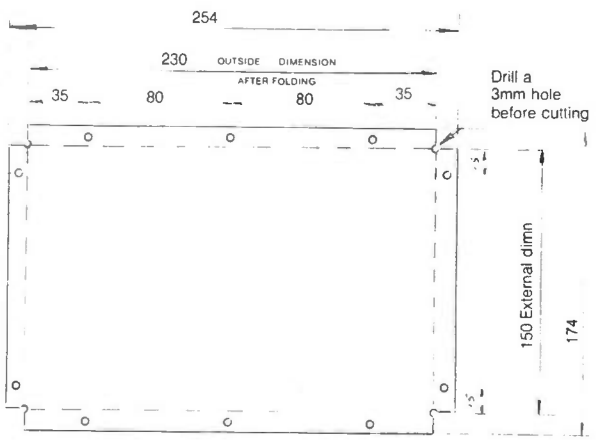
(a) Cabinet dimensions

The coil and switch must be capable of handling the power level. A suitable switch is not easy to come by nowadays but if one is purchased then a ceramic wafer is recommended. George Jessop (G6JP) described a suitable home brew switch in *Technical Topics* August 1983.

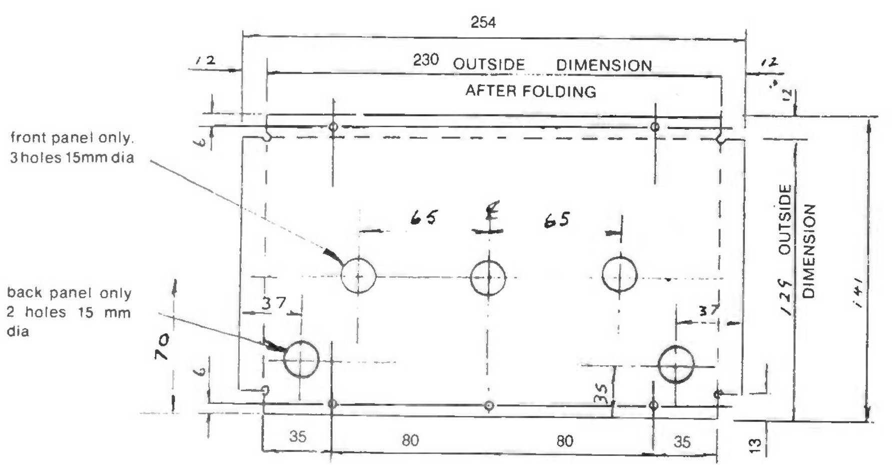
Both capacitors are mounted on insulation board as shown in *Figures 4 and 5*. The boards are mounted on the chassis with pillars. Breadboard, or PCB with the copper removed around the pillar areas would do. The important point is to make sure that there is no contact between the capacitors and the metalwork. Keep at least a 5mm gap between any part of the capacitor and the metalwork to avoid RF arcing. The capacitor spindles are cut short and nylon spindles used to extend them through generous clearance holes in the front panel. If the capacitors have ceramic spindles, then this would not be necessary. The knobs used were ordinary plastic knobs with numbered skirts. The design could be enhanced by using vernier slow motion drives.

The coil was constructed from an old plastic bobbin of the type used to supply connecting wire. The bobbin is 30mm diameter and 100mm long. The method of construction and mounting is shown in *Figure 6*. The 34 turns of 16-gauge tinned wire may be wound as follows.

Thread the wire through a hole in the flange along with a length of nylon string and secure. Wind the coil loosely. Next wind the string in between the coils pulling both tight and compressing the coil along its length. When a full coil has been wound, pass the wire through a hole in the flange and secure. You should now have a tight evenly spaced coil which will not move when the string is removed.



(b) Chassis dimensions



(c) Front and back panel dimensions

Fig 7 *Dimensions of the metalwork*

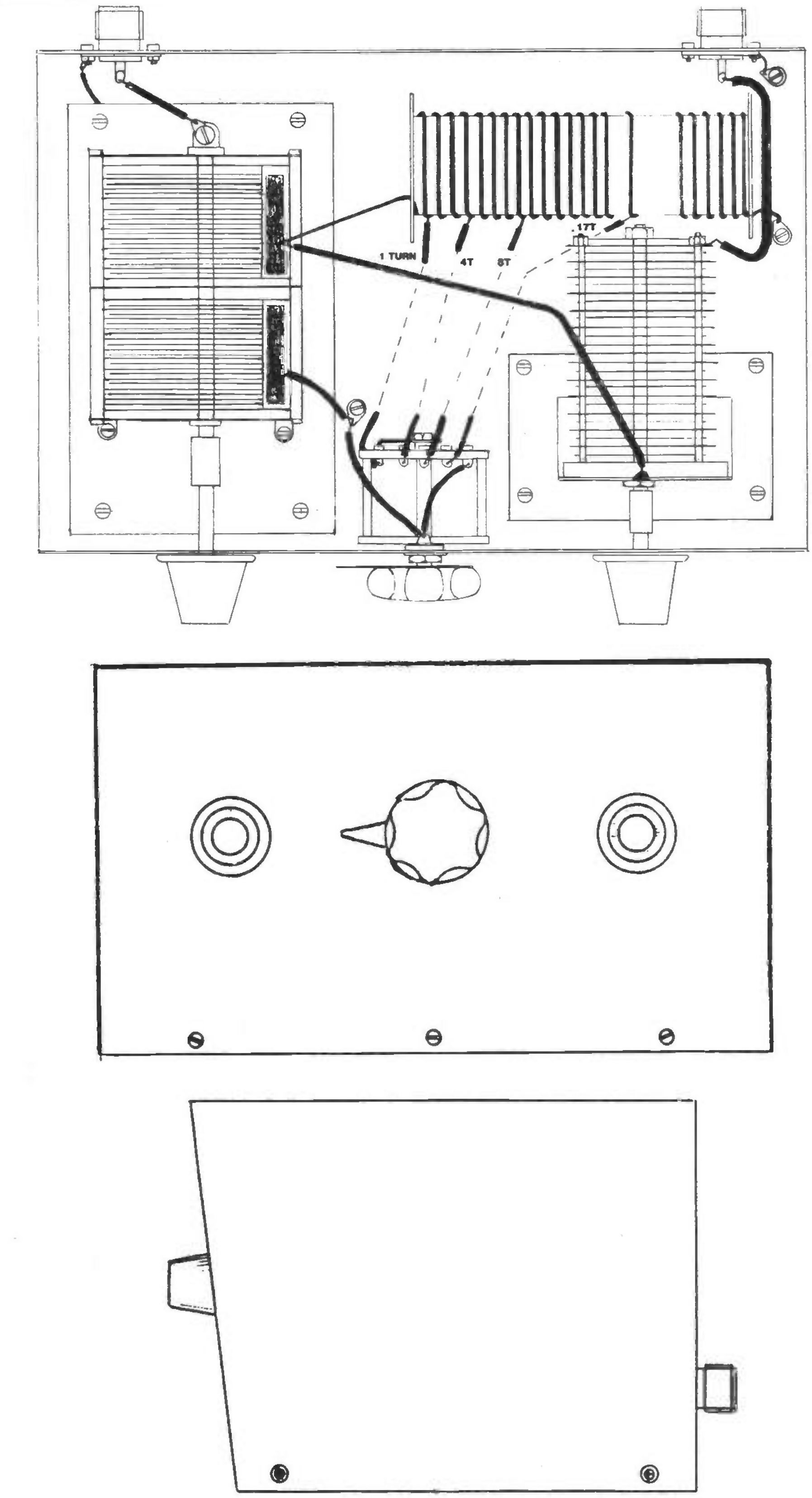


Fig 8 The assembled unit and wiring details

Program 1

```
L.0,500
  10CLS
  20 INPUT"FREQUENCY MHz=";F
  30 IF F<=0 THEN GOTO10
  40 LET W=2*PI*F*10^6
  50 PRINT "R,C or L ?"
  60 A$=GET$
  70 IF A$="R" THEN GOTO 110
  80 IF A$="C" THEN GOTO 160
  90 IF A$="L" THEN GOTO 220
 100 CLS:PRINT"TRY AGAIN":GOTO 50
 110INPUT"R Ohms=";A
 120 IF A=0  THEN PRINT"ARE YOU SURE ?"
 130 IF A=0 THEN GOTO 110
 140 LET B=0
 150 GOTO 280
 160 INPUT"C pF=";C
 170 IF C=0 THEN PRINT"ARE YOU SURE"
 180 IF C=0 THEN GOTO 160
 190 LET A=0
 200 LET B=-(10^12/(W*C))
 210 GOTO 280
 220 INPUT"L microHenries=";L
 230 IF L=0 THEN PRINT"ARE YOU SURE"
 240 IF L=0 THEN GOTO 220
 250 LET A=0
 260 LET B=W*L/10^6
 270 GOTO280
 280 CLS:PRINT"Next Impedance R,C or L ?"
 290 A$=GET$
 300 IF A$="R" THEN GOTO 340
 310 IF A$="C" THEN GOTO 390
 320 IF A$="L" THEN GOTO 450
 330 CLS:PRINT"TRY AGAIN":GOTO280
 340 INPUT"R Ohms=";A1
 350 IF A1=0 THEN PRINT"ARE YOU SURE ?"
 360 IF A1=0 THEN GOTO 340
 370 LET B1=0
 380 GOTO500
 390 INPUT"C pF=";C
 400 IF C=0 THEN PRINT"ARE YOU SURE"
 410 IF C=0 THEN GOTO 390
 420 LET A1=0
 430 LET B1=-(10^12/(W*C))
 440 GOTO500
 450 INPUT"L microHenries=";L
 460 IF L=0 THEN PRINT"ARE YOU SURE ?"
 470 IF L=0 THEN GOTO 450
 480 LET A1=0
 490 LET B1=W*L/10^6
 500 PRINT"Series or Parallel ?"
 510 B$=GET$
 520 IF B$="S" THEN GOTO 550
 530 IF B$="P" THEN GOTO 650
 540 CLS:PRINT "TRY AGAIN":GOTO 500
 550 LETA=A+A1
 560 LETB=B+B1
 570 PRINT"End or Continue"
 580 C$=GET$
 590 IF C$<>"C" AND C$<>"E" THEN GOTO 570
 600 IF C$="C" THEN GOTO 280
 610 D=ABS(B)
 620 IF B>=0 THEN PRINT "Z=";A;"+ J";D
 630 IF B<0 THEN PRINT"Z=";A;"- J";D
 640 END
 650 LET X=(A*B1)+(A1*B)
 660 LET Y=(A*A1)-(B*B1)
 670 LET U=B+B1
 680 LET V=A+A1
 690 LET A=((Y*V)+(U*X))/(U*U+V*V)
 700 LET B=((X*V)-(U*Y))/(U*U+V*V)
 710 GOTO 570
```

The metalwork

Figure 7 gives the dimensions of the metalwork prior to folding. Whilst it is appreciated that most people will not have access to folding machines, the internal and external dimensions indicated should be obtained after folding in order to produce a snug fit. The lines should be carefully marked out. The cutting operation is helped by first drilling 2mm dia. holes at the corners as indicated. The material used was 1mm galvanised plate which is easy to cut with snips.

The holes for the spindles and sockets should be punched but drill the pilot holes before folding. The screw holes should be drilled with a 1mm dia. pilot drill before folding. After folding, line up the front and back panels with the chassis and drill through the pilot holes with a 3.5mm dia. drill for the chassis screws. Temporarily fix the panels and line up the cabinet. This is shaped to give a small hood over the front panel. Ensure that the cabinet fixing holes line up by spotting through with a 2.5mm drill. Remove the cabinet and enlarge the holes in the cabinet only with a 3.5mm drill to clear the self-tapping screws.

```
  5 CLS
 10 INPUT"TX IMPEDANÇE =";Z
 20 INPUT"FREQUENCY MHz =";F
 30 INPUT"INDUCTANCE MICROHENRIES =";L
 40 INPUT "ANTENNA REACTANCE =";B
 50 PRINT"        TRANSMATCH"
 60 PRINT "F =";F;"MHz", "L =";L;"MICROHENRIES"
 65 FOR C=0 TO 200 STEP 10
 70 LET W=2*PI*F*10^6
 80LET N=W*L/10^6
 90 LET O=W*W*L*C/10^18
100 LET E=W*Z*C/10^12
110 LET G=2*N*E
120 LET P=1-O
130 LET K=E*(2-O)
140 LET A=(K*N-P*G)/(K*K+P*P)
150 LETA=INT(A+.5)
155 LET M=(N*P+K*G)/(K*K+P*P)
160 LET M=INT(M+.5)
170 LETC2=(1/(W*(M-B)))*10^12
180 LETC2=INT(C2+.5)
190 IF B>1 THEN PRINT "C1 =";C,"C2 =";C2,"Z =";A;"+j";ABS(B)
200 IF B<1 THEN PRINT"C1 =";C,"C2 =";C2,"Z =";A;"-j";ABS(B)
210 NEXT C

RUN
```

***Program 2** – written on BBC Micro*

Remove the panels and line up the UHF-type sockets in the back panel. Spot the screw holes using the sockets as a template.

The panels and cabinet should be thoroughly cleaned and sharp edges removed before painting. Good results can be obtained by using cans of car paint spray, first an undercoat then an overcoat. Matt black is attractive and goes with most rigs. Apply the spray in thin layers and allow each to dry. Do not rush the job, and avoid runs.

Assembly

Assemble the aerial sockets with 2mm screws and lockwashers. Put a solder tag on one screw on each socket for making a good earth connection to the chassis. Attach the panels to the chassis using 3mm screws and lock washers. Line up the capacitor assemblies with the panel holes and carefully mark the pillar positions.

Drill the pillar mounting holes oversize to allow some degree of alignment. The coil should be similarly positioned and mounted. The switch used was a panel mounting type, some types are mounted on the chassis.

Figure 8 shows the final assembly and wiring. To put a professional touch to the appearance, fit the cabinet with black pan head No.6 self-tapping screws with integral washers. Mark the switch positions on the front panel with white Letraset lettering. The call sign can be put on the panel in this way too.

Tuning up

When using the matching unit, always place the SWR meter between the rig and the tuning unit. Turn the meter to maximum sensitivity. Set C1 and C2 to maximum capacitance. Select the band and put just enough carrier on to deflect the meter. Adjust C2 to find a dip in the reflected power. If none is found, reduce C1 slightly and try again. Repeat this process until a dip is found. Continue to adjust C1 and C2 in turn until no reflected power is present. Gradually reduce the meter sensitivity and increase the carrier power until full power is achieved.

Note the knob calibration to facilitate quick tuning up in future. Ideally, the tuning up procedure should initially be done into a dummy load with a similar impedance to that of the antenna system. To use the unit on 24MHz and 10MHz, the same switch position as for the 21MHz and 14MHz bands should prove satisfactory.

PROGRAMMABLE SOUND GENERATOR

Prompted by a recent EXPANSION BUS review of the Jupiter Ace soundbox Roland Perry presents an in-depth study of the General Instrument AY8910 family of sound generator chips.

It is now very common to use microprocessors as logic replacements in equipment designs. Indeed, as much of the function as possible is incorporated into the processor under software control to increase the flexibility and reduce the hardware costs. In the area of sound generation, however, such economy can severely restrict the range of features available.

Human perception of sounds is usually described in terms of frequency and amplitude, both very much analogue quantities. Computer based sound generation will prefer that notes have a period rather than a frequency and that the amplitude is expressed as a number subsequently presented to a digital-to-analogue converter. A general purpose computing device such as a microprocessor will have to work very hard to create even a simple amplitude waveform at a reasonable frequency.

Fortunately, the demand for sophisticated sound generation to accompany video games and home computers has resulted in the availability of a low cost chip capable of being programmed to give a specific waveform and, once programmed, to continue without further processor intervention. The AY8910 family is designed to connect to a microprocessor bus and gives a direct analogue output. For good measure there are three independent channels and the ability to add white noise to any channel.

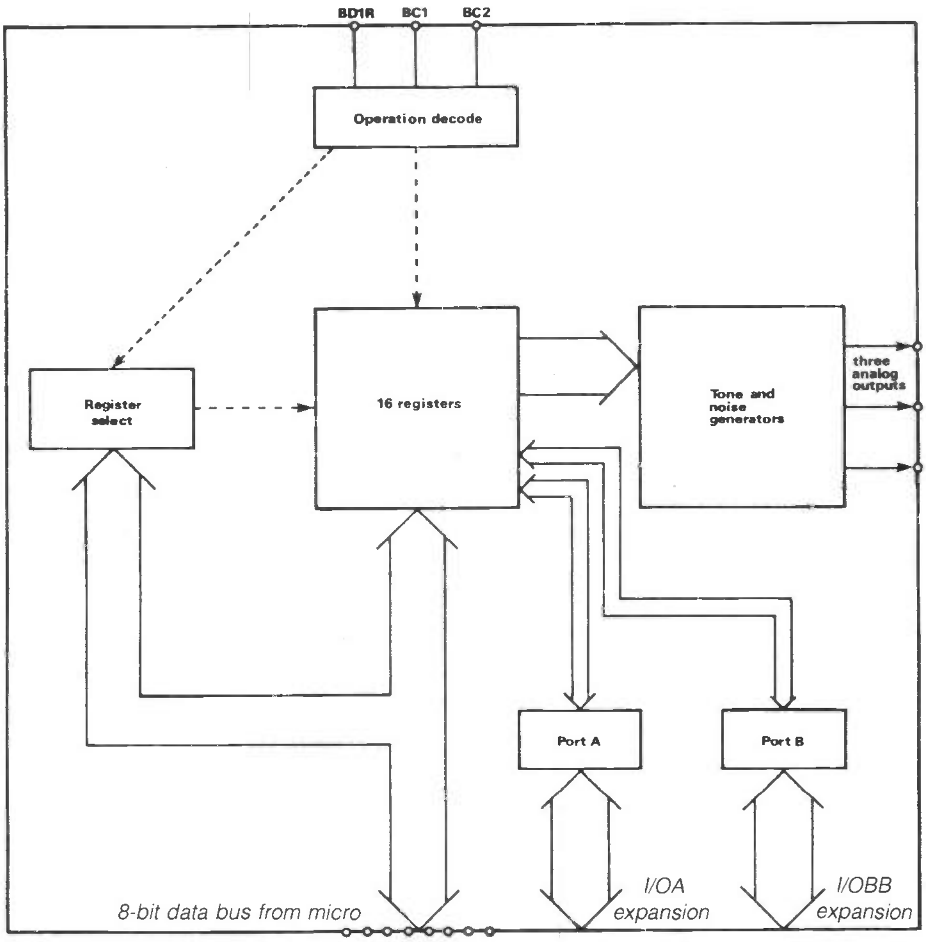


Fig 1 (a) *PSG block diagram*

Operation

Operation of the chip (PSG or programmable sound generator) is controlled by numbers loaded into a set of registers. These registers must be introduced into the address space of the host microprocessor. Three signals are used for address decoding into the PSG providing for a degree of redundancy as there are only four functions to select. If the General Instrument CP1600 micro is used then a one to one connection is made on the lines BDIR (Bus DIRection), Bus Control 1 and Bus Control 2. Otherwise Bus Control 2 can be tied to +5 volts and the arrangement in the table below employed. This assumes that the standard method for small processor systems of partial address decoding is used, ie. no other peripheral devices use the same address bits and all the other (6 or 14) address bits are ignored when invoking the sound generator. If the designer is unable to employ this short-cut then it is common practice to attach the PSG to a general purpose parallel I/O

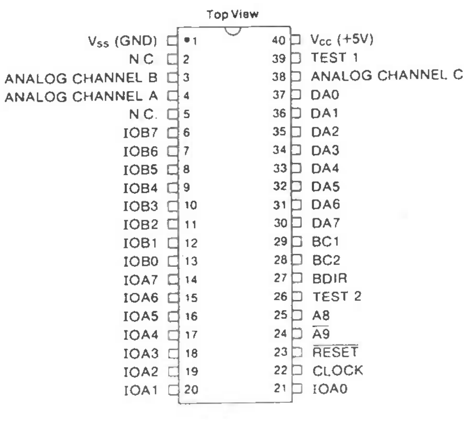


Fig 1 (b) *AY-3-8910 pin assignments*

chip, using 2 lines for address and 8 for data. This is not as wasteful as at first appears because there are parallel I/O ports built into the PSG which more than make up for the loss. (*Figure 1* PSG block diagram.)

There are sixteen registers within the programmable sound generator, but as we can see there are only four addresses decoded by the BDIR/BC1 arrangement. A scheme fairly common among microprocessor peripheral chips is employed. First, the address of the register to be accessed is sent to the PSG. This is accomplished by setting the PSG regis-

TABLE 1

Address bit to BDIR	Address bit to BC1	Operation
0	0	Inactive
0	1	Read data from PSG
1	0	Write data to PSG
1	1	Write address to PSG

ter number onto the data bus and issuing the 'Write address to PSG' operation, Now that the PSG knows which register we want to access, a 'Read data from PSG' operation will present the contents of that register onto the data bus and a 'Write data to PSG' operation will load the register from the data bus.

The analogue output is more of a current source than a voltage source and if presented to a *1kohm* load results in one volt of swing. The three channels can either be simply connected together into one load, mixing the signals, or fed through separate output amplifiers. In order that the PSG output should take account of the response of the human ear, which is roughly logarithmic, the digital to analogue converter has an output as shown in *Figure 3*. An output referred to as 'sawtooth' and represented diagramatically with straight lines will actually follow that logarithmic voltage curve.

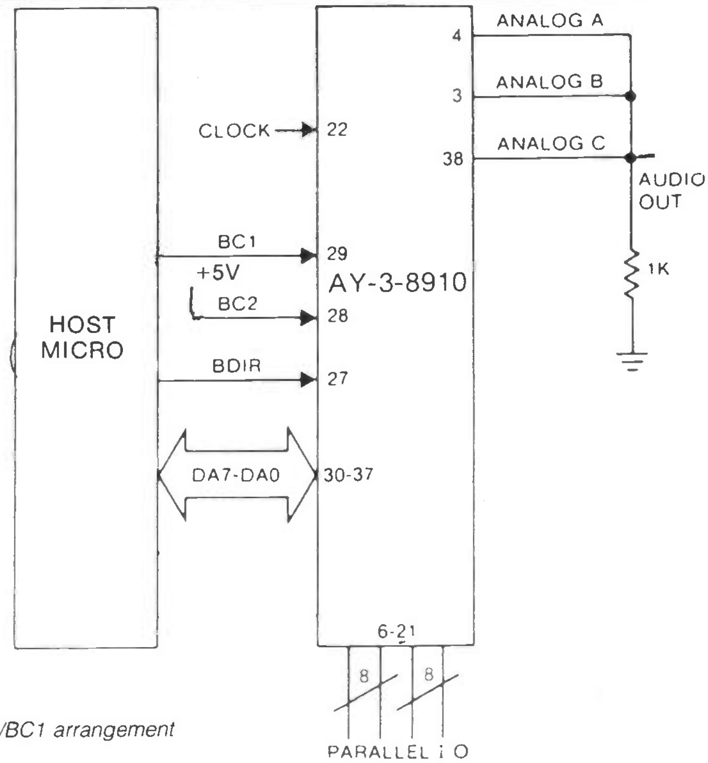


Fig 2 *BDIR/BC1 arrangement*

Automatic waveforms

The range of waveforms that can be generated automatically is shown in *Figure 4* (same as *Figure 2* p75 Jan 84). Each of these waveforms has a fixed amplitude, equal to maximum output swing available. The shape is constructed by interpreting four bits in register 13 of the PSG. Although there are sixteen different combinations of the four bits, only ten different waveforms result. There is only one automatic envelope control, so all channels that use this facility are constrained to the same envelope shape. The alternative to using the automatic envelope control is to set an individual volume. There are three of these volume controls, namely the bottom half of registers 8, 9 and 10. Four bits gives a choice of sixteen steady volume settings, following the built-in logarithmic curve. It is important to realise that this volume control is an alternative to automatic enveloping, and not in addition to it. The choice of enveloping or steady volume control is achieved individually for each channel by bit 5 in the appropriate register 8, 9 or 10.

The automatic envelopes consist largely of sawtooths which therefore have a period as well as an amplitude. The master clock to the PSG (normally 1 to 2 MHz) is divided by 256 and then by the 16 bit value set in registers 13 and 14. The larger the number in register 11/12 the lower is the frequency of the envelope. A typical range of frequencies available is 0.1Hz to 8 kHz. The 16 bit value is divided for convenience (as are all the period constants) into a coarse tune and a fine tune. It is, however, normally more useful to regard these as a single number.

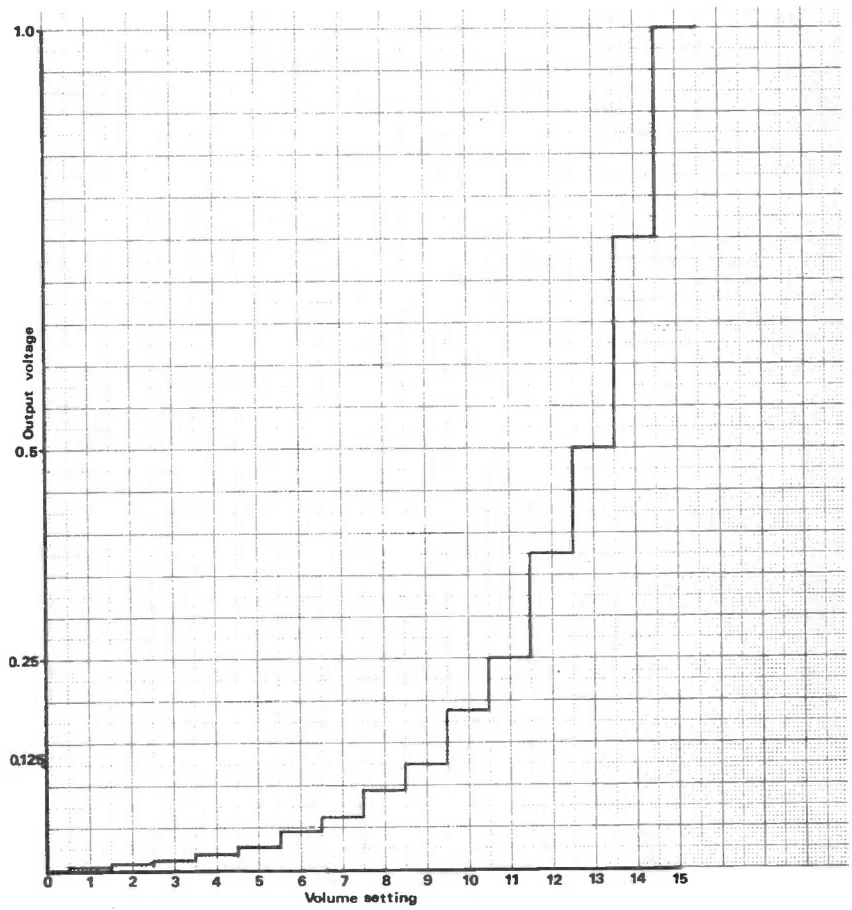


Fig 3 *D/A output*

The periods for the three tone generators are 12 bit values set into register 0/1, 2/3 and 3/4. Whereas the envelope period was derived from the master clock divided by 256, the tone period is derived from the master clock divided by 16. A typical range of frequencies is therefore from 30Hz to 100kHz. Because the value set into the register determines the period, rather than the frequency, a conversion table is required in order to determine the 12-bit register value for a particular tone. In Jan 84 a program was published which calculates these values for the chromatic scale.

Noise, when added to any channel, is derived from the clock frequency divided by 16 and divided by the 5 bit value in R6. Thus noise frequencies in the range of 4kHz to 100kHz are typically available. Experience shows that quite

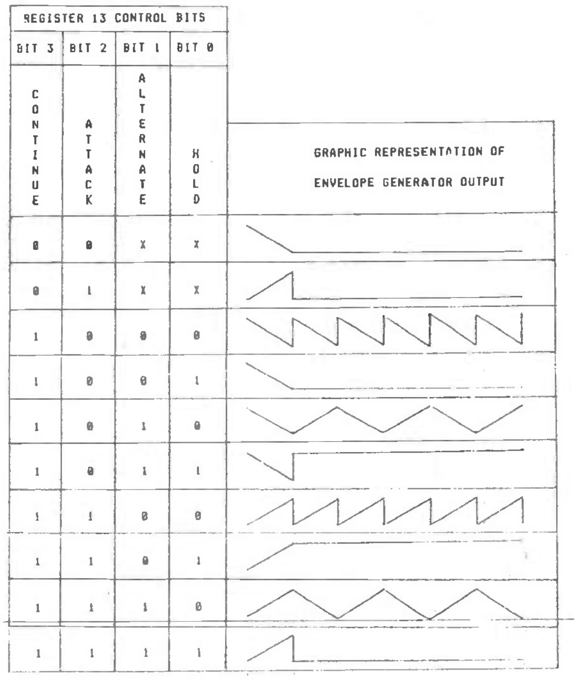


***Fig 4** Envelope profiles*

small values are required for normal effects. As with the envelope control, there is only one noise source, and if selected, the same frequency of noise is fed to each output channel. The volume of the noise is, however, determined by the three individual volume settings or, when selected, shaped by the envelope control.

To summarise

F(envelope) = F(clock)/(256*EP) where EP=16 bit value in R11/12.

F(tone) = F(clock)/(16*TP) where TP=12 bit value in R0/1 or R2/3 or R4/5.

F(noise) = F(clock)/(16*NP) where NP=5 bit value in R6

Although the preferred method of enabling and disabling one of the three channels is by setting the amplitude registers there is also an I/O enable register (R7) which controls the output of tones and noise. This register is bit-significant. B0 to B2 determine if tones are enabled on through to the three output channels. A '0' enables, a '1' disables. B3 to B5 determine if the single noise source is added to each tone output. Bits 6 and 7 select input or output directions on the two built-in I/O ports. A '0' indicates input, a '1' output.

The I/O ports are each set to all inputs or all outputs by setting the relevant bits in register R7. Once the direction has been established the state of the I/O pins can be respectively set or interrogated by writing to or reading from registers 14 and 15. The existance of these I/O ports, as well as using up the spare pins on the package, provides the system designer with further input output capability and compensates for the use of parallel port pins when interfacing the sound chip in the first place.

DX–TV RECEPTION REPORTS

Compiled by Keith Hamer and Garry Smith

Considering the time of year, Sporadic-E activity remained at a consistently high level throughout November, much to the surprise of DX-TV enthusiasts everywhere. The most interesting reception occurred during the first week with frequent openings from southern and south-eastern Europe. Signals were seen throughout the United Kingdom. From the 10th to the 14th tropospheric enhancement produced signals from Central Europe at UHF but Band III was not so lively.

Reception reports

Cyril Willis (Little Downham, Cambridgeshire) noted the following in Band I during November: Rumania R2, Russia (TSS) on R1 and R2, Sweden (SR) E2, Portugal (RTP) E2 and E3, Italy IA, Yugoslavia E3, Czechoslovakia R1 and R2 and Spain on Channels E2, E3 and E4. The latter proved to be a frequent visitor and TVE were noted using a variety of test cards. An opening on the morning of the 13th produced signals from the East and also from Scandinavia on channels R1 and E2 respectively. Programmes were being transmitted thus making identification difficult. The E2 programme included subtitles (white lettering on a black background) and it is thought to have originated from Norway or Sweden. Both countries tend to transmit subtitles in this fashion. Cyril is unfortunately running out of DX-TV receivers. His elderly Bush/Murphy TV125 models have failed and he cannot find anyone willing to repair them.

R W Brooks (Great Sutton, South Wirral) has kindly sent us a selection of off-screen photographs showing recent DX reception. He lives in a bungalow and despite the use of loft aerials his log for the month is impressive. Test cards confirm reception of Spain on channels E2, E3 and E4, Poland R1, Yugoslavia E3, Czechoslovakia R1 and R2, Sweden E2, Switzerland (SRG) E2 and at least two West German networks (Bayerischer Rundfunk and Saarländischer Rundfunk), both on E2. Equipment used is a Plustron 5-inch mono portable type TVR5D and a Philips N1700 video recorder, both of which feature multi-band tuners.

A letter arrived from Hugh Cocks (Robertsbridge, East Sussex) which solved the mystery surrounding the new French transmissions in Bands I and III. Apparently Télédiffusion de France are testing a scrambled version of 'tf 1' (1st network) in Band III from Paris. It features delay-line scrambling techniques where each line is delayed or advanced relative to the next. At a distance, pictures look normal but captions cannot be read since an effect similar to a line sync fault is present. To add to the problem the authorities include a couple of white horizontal lines half-way down the picture which extend about three quarters of the width of the screen from the right-hand side. During recent trops Hugh was lucky enough to receive one of Spain's private services from the Basque region. The PM5544 test card was noted with the identification 'EBT' at the top. Reception was from Bilbao on channel E35. Hugh comments that it is a strange language to read and seems to be totally unlike Spanish. In fact it resembles Yugoslavian.

Switzerland was received from a variety of UHF transmitters on November 12th by Kevin Jackson (Leeds). Towards late evening the outlets at La Dôle and La Chaux-De-Fonds (channel E35) reached snow-free levels until closedown. Signals from La Dôle were noted again on the 13th from the German-language transmitter on E31 (SRG) and also from TSI (Italian) on E34. The Swiss Säntis transmitter was received on the 14th with French-language programmes on E31 together with Italian-language broadcasts on E34. Other countries noted by Kevin during November included France, Belgium, West Germany, East Germany and the Netherlands.

November 2nd was an eventful day according to Clive Athowe (Blofield, Norfolk). The Yugoslavian network from Beograd was received on programmes while the Ljubljana network was showing the PM5544 test card — both on channel E3. At least two Italian transmitters operating on channel IA were noted floating with each other. The programme was also seen on channel IB. An assortment of test cards from Spain proved to be of interest at lunchtime just prior to regional programme commencement at 1300GMT. One of the test cards was the ubiquitous PM5544 (rather than the usual GTE type shown in *R&EW,* September 1983) with the identification 'BARCELONA'. This particular pattern had been seen earlier in the year. Tropospheric ducting was also in evidence producing 1st Network East German signals in Band III (channels E5 and E12 from DDR:F) plus programmes on UHF channels E31 and E33 from DDR:F2.

The following log is typical of reception during the month.

1/11/83: TVE (Spain) on channels E2, E3 and E4 with basketball in colour via SpE.

2/11/83: RAI (Italy) IA with the PM5544 test card at 0843. A lunchtime opening produced TVE on E2, E3 and E4 on test card plus the 'TVE ARAGON' colour-bar pattern on E3. The Italian news programme 'Telegiornale' was noted on channel IA.

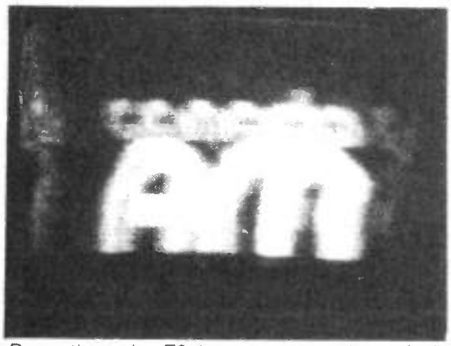
3/11/83: ORF (Austria) on E2a radiating the Telefunken TO5 monoscopic test card; CST (Czechoslovakia) on R1 with the 'RS-KH' EZ0 pattern.

4/11/83: SpE reception on channels R1, R2 and R3 together with OIRT (Eastern European Countries) FM radio stations at the top end of Band I, TVR (Rumania) withtheir new colour electronic test card on R2 and R3 with the identification 'TELEVIZIUNEA ROMÂNÂ' followed by the programme opening sequence.

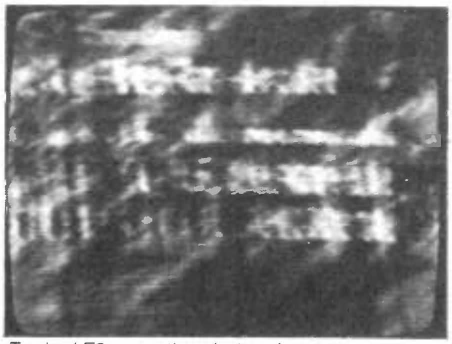
7/11/83: CST R1 with the EZ0 test card.

8/11/83: TVE E2 colour bars, also test card and programmes. An evening SpE opening was noted on E2 and R1.

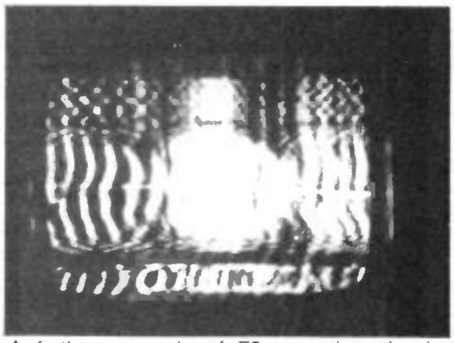
10/11/83: Reception via improved tro-



Reception via F2–layer propagation of the Canadian news programme 'Canada AM' on channel A2



Typical F2 reception during the sunspot peak of 1980 – a caption from China on channel C1



A further example of F2 reception showing characteristic multiple–image distortion – a caption from Nigeria on E3 pospherics from West Germany (ARD and ZDF), France (TDF) and the Netherlands (NOS); CST R1 radiating the EZ0 pattern noted via meteor shower (MS) propagation.

12/11/83: West Germany on E11 with the FuBK test card from Westdeutscher Rundfunk (WDR) via trops.

13/11/83: Reception via SpE noted on channels R1 and R2 during the morning with a further opening at 1947 GMT.

18/11/83: DR (Denmark) on E3 with the PM5544; CST R1; TVP (Poland) on R1 with the 'dt' News programme.

19/11/83: SpE on R1 at 0912 GMT with R2 later in the day.

20/11/83: ORF E2a with the PM5544 at 1304 plus an unidentified station on channel R2. A good SpE opening was noted during the early evening with football on E3 at 1706 and cartoons from Yugoslavia (JRT) at 1724 on E3. The Italian news programme was received on IA at 1739. Rumania were noted using an identification caption on R2 at 1700.

21/11/83: Bayerischer Rundfunk (BR) on E2 radiating the 'GRÜNTEN' FuBK test card at 0805; CST R2 with the 'RS-KH' test card; TVP R2 on PM5544; NRK (Norway) on E2 at 1713 with a programme including subtitles on black bands.

Multi-band VCR

It has come to our notice that the currently available Hitachi VTIIE video recorder is equipped with a multi-band tuner enabling DX in Bands I and III to be recorded directly from the aerial. The machine may be operated in the E-to E mode to act as a frequency converter thus allowing DX reception to be monitored on a standard UHF receiver. An interesting feature is a PAL/SECAM switch but unfortunately this does not convert incoming SECAM chroma information to PAL as one may have hoped for!

Reflections on F2

There were no reports of reception via the F2 layer so we must assume that DX-TV enthusiasts will have to wait until the next sunspot maximum for further experimentation. This of course is presupposing that transmitters will still exist on the lower frequencies in Band I. There is also the possibility that the next solar peak will not be as active as the last since there is a theory which casts doubt on whether extremely high maximum usable frequencies (m.u.f's of above 50MHz) are attained during every sunspot maximum. A recent survey concluded that TV reception over long distances may be affected by the F2 layer every 22 years rather than each 11-year cycle.

The last cycle which peaked in 1980 provided DX enthusiasts with signals from all parts of the globe. Occasionally m.u.f's approached the 70MHz region. Record-breaking signals arrived on numerous occasions from Australia on channel AO (46.25MHz vision) while signals from China and Eastern Russia appeared regularly on channel R1 (49.75MHz), the latter being received in SECAM colour at times! Reception formed a daily pattern. Eastern Russia and China would appear shortly after 0800GMT and the signal strength would increase from practically zero to over loading within a matter of minutes. Transmitters throughout Central Russia (from the Alma Ata region) would often arrive mid-morning on R1 while on channel E2 (48.25MHz) sustained reception from Dubai would be noted until about lunchtime. 525-Line signals from Canada on channel A2 (55.25MHz vision) were received on a regular basis at around 1300GMT and often lasted for several hours. Several UK DXers logged signals on channel A3 (61.25MHz) which indicates just how high the m.u.f. rose. In general, signals arriving from the east and west were stronger and more consistent than those from the African continent.

The sunsport peak during the late sixties barely contributed to DX-TV reception but the late fifties peak did provide a certain amount of trans-Atlantic signals. A comprehensive survey about F2 layer propagation by the Authors was featured in the *E.B.U. Technical Review No. 196* published December 1982, a copy of which can be supplied upon request.

1984 Meteor shower dates

The following list shows the predicted meteor shower peaks for 1984 and should prove useful to DX-TV enthusiasts trying to receive signals via this form of propagation.

Quadrantids	5 Jan to 6 Jan
Lyrids	18 Apr to 25 Apr
Aquarids	1 May to 13 May
Perseids	27 July to 17 Aug peaking 14 Aug
Orionids	15 Oct to 25 Oct
Taurids	26 Oct to 16 Nov
Leonids	15 Nov to 17 Nov
Geminids	9 Dec to 13 Dec

It has been found from experience that the Quadrantids, Perseids and Geminids usually produce the best DX-TV results. The above information was kindly supplied by Pete Sturgess of Derby.

Service information

Spain: Following the introduction of a regional TV service for the Basques in Northern Spain (known as 'Euskal Telebista'), another network has started in the province of Cataluña. The service, known as 'Televisió De Catalunya', began in Barcelona last September on channel E44. At present only test transmissions are radiated using the Grundig test card generator which includes the identification 'TV3-TIBA-DABO-C44'. This particular electronic test card is favoured by many Italian pirate/private TV stations. A similar test card was featured in the April 1983 edition of *R&EW*.

Albania: Radio Televizioni Shqiptar (RTS) are using the PAL colour system and the PM5534 test card with the identification 'RTSH' at the top and 'TV SHQIPTAR' at the bottom.

Bangladesh: The PM5534 test card is radiated by Bangladesh Television but without a digital clock. Identification in Bangladeshi script is incorporated at the bottom.

Algeria: Radiodiffusion Télévision Algeriénne (RTA) are planning a second TV network which is expected to be in service by next June.

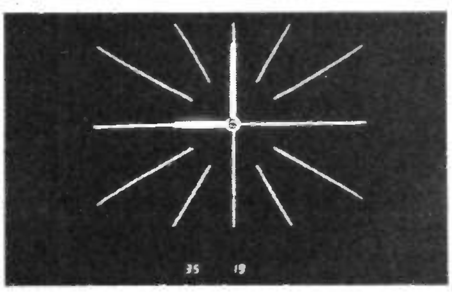
Bulgaria: A third TV network is planned for Bolgharska Televizia with a 250kW outlet on channel R48.

A teletext service is currently under test and it will be known appropriately as 'Bultext'.

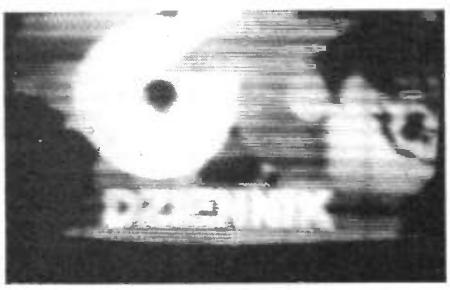
USSR: A new 600kW transmitter has been opened in Viborg on channel R21 broadcasting programmes from the Leningrad studios.

Poland: Following a three-month closedown period, TVP-2 is once again back in service. For the moment programmes are broadcast at weekends only but it is expected that a full service will be resumed in the near future. Despite financial problems a third TV network is planned.

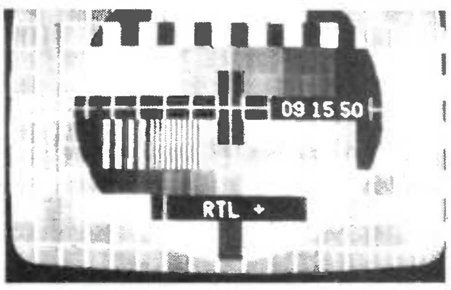
Service information was supplied by Gösta van der Linden (Netherlands) and Alexander Wiese, editor of the West German DX magazine 'Tele-audiovision'.



Clock caption used by Oesterreichischer Rundfunk (ORF), Austria. Photo supplied by Jürgen Klassen, West Germany



Polish News caption heralding 'Dziennik Telewizyjny'. The photo was taken by R W Brooks during a Sporadic–E opening



PM5534 test card radiated by the experimental German–language service in Luxembourg. Photograph courtesy of Alexander Wiese

RANDOM MORSE COMPUTER PROGRAM FOR RADIO AMATEURS

This computer program, submitted by John G Storry, G4OID will provide excellent practice for those who wish to take their class A Licence Test. Younger computer enthusiasts may find that it is a welcome change from their games programs and, perhaps, it will stimulate interest in Morse and amateur radio.

Program facilities

The facilities offered by the program are:-

(1) Moving graphics

(2) Choice of letters only or letters and numbers

(3) Variable pitch and speed of sending

(4) Ability to bias character selection to either end of the alphabet, while retaining an essentially random selection

(5) Readout of elapsed time and total time taken after each 50 characters

(6) Choice of a jingle or a siren to indicate an incorrect response.

The complete program was originally written for a CBM 8032, but it should run with only minor modifications on any 80-column computer if the new screen start address and sound board operating parameters are incorporated. The morse-only part of the program should run on any 40-column computer fitted with a sound board and any minor modifications can easily be accomplished by reference to the Rem statements incorporated into the program.

Operation

Operation consists of the selection of characters by taking numbers from a random string in the range 1 to 26 for letters or 1 to 36 for letters and numbers. Your own favourite method of generation could easily be substituted in lines 112 to 121 if you wish. Fifty characters are accumulated in a string and transmitted one at a time by the use of subroutines. It has been found convenient for consistent operation at higher sending speeds to select the Morse from sequences of five dots/dashes/etc. rather than programing each letter separately and these routines run from line 178 to 201. Letters a-z run from line 141 to line 166 and numbers 0 to 9 from line 167 to line 176. On hearing the Morse, the operator presses the appropriate key on the computer keyboard and, if correct, the next character is transmitted. If incorrect, the jingle plays and the character is re-transmitted until a correct selection is made. On completion of 50 characters, the elapsed time is displayed and a second and subsequent string of random characters is prepared and sent.

Program information

Graphics run........................line 1 to line 99
Main program run.....line 100 to line 206
Jingle run ....line 207 to line 218

If a Siren is required, substitute the jingle with:-
Poke S2,0:Poke S3,16:Poke S2,15:For n = 1 to 10:For nn * 50 to 255 step 5:Poke S1,nn:Next:Next:Poke S3,0:Return

A = Start screen address
F = Length of dot
G = Length of dash
L = Space between letters
P = Pitch of morse
K See Rem on line 115 for changing selection bias
S1, S2, S3 Sound board operating poke numbers
L in sound section = Length of note
PI in sound section = Pitch of note
Control characters shown in reverse field are:-
Q = Cursor down; Square bracket = Cursor right; S = Clear screen;
Heart = Cursor home; R = Reverse field on; Horizontal line = Reverse field off;
Square = Cursor up.

RANDOM MORSE COMPUTER PROGRAM

Program listing for random generation of Morse Code letters and numbers

```
1 A=32779:GOTO28:REM START OF SCREEN ADDRESS
2 FORII=ATOA+66:POKEII,32:NEXT:FORII=A+1921TOA+1969:POKEII,32:NEXT
3 POKEA,124:POKEA+2,226:POKEA+4,226:POKEA+5,124:REM 'R'
4 POKEA+9,124:POKEA+11,226:POKEA+13,124:REM 'N'
5 POKEA+16,124:POKEA+18,226:REM 'A'
6 POKEA+21,226:POKEA+23,124:POKEA+25,226:POKEA+27,124:REM 'C'
7 POKEA+30,226:REM 'T'
8 POKEA+33,124:POKEA+35,124:REM 'I'
9 POKEA+38,124:POKEA+40,124:POKEA+42,124:REM 'S'
10 POKEA+45,124:REM 'E'
11 RETURN
12 FORII=ATOA+66:POKEII,32:NEXT:FORII=A+1917TOA+1979:POKEII,32:NEXT
13 POKEA+11,226:POKE(A+13),226:REM 'M'
14 POKEA+16,124:POKEA+18,226:REM 'A'
15 POKEA+21,226:POKEA+23,124:POKEA+25,226:REM 'K'
16 POKEA+28,124:REM 'E'
17 POKEA+31,124:POKEA+33,124:POKEA+35,124:REM 'S'
18 RETURN
19 FORII=ATOA+66:POKEII,32:NEXT:FORII=A+1921TOA+1969:POKEII,32:NEXT
20 POKEA+3,124:POKEA+5,226:POKEA+7,226:POKEA+9,124:REM 'P'
21 POKEA+12,124:REM 'E'
22 POKEA+15,124:POKEA+17,226:POKEA+19,124:REM 'R'
23 POKEA+22,124:POKEA+24,124:POKEA+26,226:POKEA+28,124:REM 'F'
24 POKEA+31,124:REM 'E'
25 POKEA+34,226:POKEA+36,124:POKEA+38,226:POKEA+40,124:REM 'C'
26 POKEA+44,226:REM 'T'
27 RETURN
28 PRINT"❏":GOTO83
29 POKEA+323,224:POKEA+324,224:POKEA+325,224:POKEA+326,223:POKEA+327,233
30 POKEA+328,224:POKEA+329,224:POKEA+403,224:POKEA+404,224:POKEA+409,224
31 POKEA+406,245:POKEA+407,246
32 POKEA+483,224:POKEA+484,224:POKEA+489,224
33 POKEA+563,226:POKEA+564,226:POKEA+569,226:REM END'M'
34 GOSUB2
35 POKEA+332,224:POKEA+333,224:POKEA+334,224:POKEA+335,224:POKEA+336,224
36 POKEA+412,224:POKEA+413,224:POKEA+416,224
37 POKEA+492,224:POKEA+493,224:POKEA+494,98:POKEA+495,98:POKEA+496,224
38 POKEA+572,226:POKEA+573,226:POKEA+574,226
39 POKEA+575,226:POKEA+576,226:REM END 'O'
40 A=A+1918:GOSUB2:A=A-1918:REM MORSE LINE TO BOTTOM OF SCREEN
41 POKEA+339,224:POKEA+340,224:POKEA+341,226:POKEA+342,224:POKEA+343,223
42 POKEA+419,224:POKEA+420,224:POKEA+421,98:POKEA+422,224:POKEA+423,105
43 POKEA+499,224:POKEA+500,224:POKEA+502,225:POKEA+503,223
44 POKEA+579,226:POKEA+580,226:POKEA+582,124:POKEA+583,226:REM END'R'
45 GOSUB12
46 POKEA+346,224:POKEA+347,224:POKEA+348,224:POKEA+349,224
47 POKEA+426,224:POKEA+427,98:POKEA+428,98:POKEA+429,98
48 POKEA+506,98:POKEA+507,98:POKEA+508,98:POKEA+509,224
49 POKEA+586,226:POKEA+587,226:POKEA+588,226:POKEA+589,226:REM END 'S'
50 A=A+1918:GOSUB12:A=A-1918
51 POKEA+352,224:POKEA+353,224:POKEA+354,224:POKEA+355,224
52 POKEA+432,224:POKEA+433,98:POKEA+434,98:POKEA+512,224:POKEA+513,98
53 POKEA+514,98:POKEA+515,98
54 POKEA+592,226:POKEA+593,226:POKEA+594,226:POKEA+595,226:REM END'E'
55 GOSUB19
56 A=A+1918:GOSUB19:A=A-918:REM ADJ 'A' TO REDUCE ADD-ON
57 POKEA+447,224:POKEA+448,224:POKEA+449,224:POKEA+450,224:POKEA+451,224
58 POKEA+527,224:POKEA+528,224:POKEA+607,224:POKEA+608,224
59 POKEA+687,226:POKEA+688,226
60 POKEA+689,226:POKEA+690,226:POKEA+691,226:REM END 'C'
61 POKEA+454,224:POKEA+455,224:POKEA+456,224:POKEA+457,224:POKEA+458,224
62 POKEA+534,224:POKEA+535,224:POKEA+538,224
63 POKEA+614,224:POKEA+615,224:POKEA+616,98:POKEA+617,98:POKEA+618,224
64 POKEA+694,226:POKEA+695,226:POKEA+696,226
65 POKEA+697,226:POKEA+698,226:REM END 'O'
66 POKEA+461,224:POKEA+462,224:POKEA+463,224:POKEA+464,224:POKEA+465,223
67 POKEA+541,224:POKEA+542,224:POKEA+545,224
68 POKEA+621,224:POKEA+622,224:POKEA+625,224:POKEA+701,226:POKEA+702,226
69 POKEA+703,226:POKEA+704,226:POKEA+705,226:REM END 'D'
70 POKEA+468,224:POKEA+469,224:POKEA+470,224:POKEA+471,224
71 POKEA+548,224:POKEA+549,98:POKEA+550,98:POKEA+628,224:POKEA+629,98
72 POKEA+630,98:POKEA+631,98
73 POKEA+708,226:POKEA+709,226:POKEA+710,226:POKEA+711,226
74 A=A-1000:REM RE-ADJUST 'A' FOR NEXT PASS
75 RETURN
76 FORI=A+323TOA+355:POKEI,32:NEXT:FORI=A+403TOA+435:POKEI,32:NEXT
77 FORI=A+483TOA+515:POKEI,32:NEXT:FORI=A+563TOA+595:POKEI,32:NEXT
78 A=A+1000:REM ADJ 'A' TO REDUCE ADD-ON
79 FORI=A+447TOA+471:POKEI,32:NEXT:FORI=A+527TOA+551:POKEI,32:NEXT
80 FORI=A+607TOA+631:POKEI,32:NEXT:FORI=A+687TOA+711:POKEI,32:NEXT
81 REM ERASE 'MORSE CODE'
82 A=A-1000:RETURN:REM RE-ADJUST 'A' FOR NEXT PASS
83 PRINTCHR$(142)
84 PRINT"                                                                  "
85 FORBD=1TO19
86 PRINT" "TAB(65)" "
87 NEXTBD
88 PRINT"                                                                  "
89 PRINT"QQQQQQQQ":GOSUB29
90 PRINTTAB(2)"THIS PROGRAM TRANSMITS RANDOM LETTERS AND TIMES YOUR RESPONSES"
91 PRINT
92 PRINTTAB(2)"ON A CUMULATIVE ELAPSED TIME BASIS.  ON HEARING THE MORSE, YOU"
93 PRINT
94 PRINTTAB(2)"SHOULD PRESS THE APPROPRIATE LETTER ON THE COMPUTER KEYBOARD."
95 PRINT
96 PRINTTAB(2)"IF YOUR RESPONSE IS INCORRECT, THE MORSE WILL BE REPEATED TILL"
97 PRINT
98 PRINTTAB(2)"THE CORRECT LETTER IS IDENTIFIED.  PRESS ANY KEY TO CONTINUE."
99 GETA$:GOSUB76:GOSUB29:IFA$=""THEN99
100 PRINT"❏QQQQQQQQQQQ]]]]]]]]]SELECT OPTION 1 - LETTERS ONLY"
101 PRINT"]]]]]]]]]]SELECT OPTION 2 - LETTERS AND NUMBERS"
102 GETLA$:IFLA$=""THEN102
103 LA=36:IFLA$="1"THENLA=26:IFLA$="1"THEN105
104 IFLA$<>"2"THENPRINT"QQ]]]]ONLY TWO OPTIONS BENNY, TRY AGAIN":GOTO102
105 PRINT"❏":PRINT"QQQ]]]]]]]]]]]]]]]]]]]]]]]]PREPARING RANDOM SEQUENCE":GOTO110
106 PRINT"❏":PRINT"QQQ]]]]]]]]]]]]]]]]]]]]]]]PREPARING FURTHER RANDOM SEQUENCE"
107 PRINTTAB(15)"ELAPSED TIME ON LAST RUN WAS "
108 PRINT"❏"TAB(45);MID$(TI$,3,2);"MINS";RIGHT$(TI$,2);"SECS"
109 AC$="":PRINT"                    THERE WERE ";CO;" ERRORS":CO=0
110 F=75:G=140:L=60:P=60:CT=1:REM DOT-DASH-SPACE-FREQ-CHAR.COUNT
111 S1=59464:S2=59466:S3=59467:REM SOUND BOARD PARAMETERS
112 K$=STR$(ABS((RND(1)-RND(0))*100))
113 PRINTTAB(24),"❏QQQQQQ***WORKING***"
114 K=VAL(RIGHT$(K$,2)):IFK>36THENK=INT(K-30)
115 REM ALTER VALUE OF INT(K-30) TO BIAS SELECTION OF CHARACTERS
116 IFK>LATHEN120
117 IFK=>27THENK=K-43
118 AC$=AC$+CHR$(K+64)
119 IFLEN(AC$)=>50THEN122
120 PRINTTAB(24),"❏                    ❏❏❏❏❏❏"
121 GOTO112
122 TI$="000000":REM ELAPSED TIME READ OUT OF MEMORY
123 FORB=1TO50
124 C=ASC(MID$(AC$,B,1))-64:GOTO134
125 G$=""
126 GETG$:IFG$=""THEN125
127 IFG$<>MID$(AC$,B,1)THENGOSUB207:GOTO134
128 PRINT"❏QQQQQQQQQQ]]]]]]]"
129 PRINTTAB(4)"CHARACTER NO.";CT;"   ";"IS ";"'";MID$(AC$,B,1);"'"
130 CT=CT+1
131 PRINT"❏",,,"CUMULATIVE TIME ";MID$(TI$,3,2);"MINS ";RIGHT$(TI$,2);"SECS "
132 IFB=50THEN106
133 NEXTB
134 C=ASC(MID$(AC$,B,1))-64
135 IFC=<-7THEN139
136 IFC>13THENC=C-13:GOTO138
137 ONCGOTO141,142,143,144,145,146,147,148,149,150,151,152,153
138 ONCGOTO154,155,156,157,158,159,160,161,162,163,164,165,166
139 C=C+17
140 ONCGOTO167,168,169,170,171,172,173,174,175,176
141 GOSUB200:GOSUB204:GOTO125
142 GOSUB189:GOSUB180:GOSUB204:GOTO125
143 GOSUB192:GOSUB204:GOTO125
144 GOSUB189:GOSUB181:GOSUB204:GOTO125
145 GOSUB182:GOSUB204:GOTO125
146 GOSUB181:GOSUB194:GOSUB204:GOTO125
147 GOSUB188:GOSUB182:GOSUB204:GOTO125
148 GOSUB179:GOSUB204:GOTO125
149 GOSUB181:GOSUB204:GOTO125
150 GOSUB182:GOSUB187:GOSUB204:GOTO125
151 GOSUB199:GOSUB204:GOTO125:REM K
152 GOSUB200:GOSUB181:GOSUB204:GOTO125
153 GOSUB188:GOSUB204:GOTO125
154 GOSUB194:GOSUB204:GOTO125
155 GOSUB187:GOSUB204:GOTO125
156 GOSUB200:GOSUB194:GOSUB204:GOTO125:REM P
157 GOSUB189:GOSUB199:GOSUB204:GOTO125
158 GOSUB193:GOSUB204:GOTO125
159 GOSUB180:GOSUB204:GOTO125
160 GOSUB189:GOSUB204:GOTO125
161 GOSUB182:GOSUB200:GOSUB204:GOTO125
162 GOSUB180:GOSUB189:GOSUB204:GOTO125
163 GOSUB200:GOSUB189:GOSUB204:GOTO125
164 GOSUB194:GOSUB200:GOSUB204:GOTO125
165 GOSUB199:GOSUB189:GOSUB204:GOTO125
166 GOSUB188:GOSUB181:GOSUB204:GOTO125
167 GOSUB185:GOSUB204:GOTO125
168 GOSUB182:GOSUB186:GOSUB204:GOTO125
169 GOSUB181:GOSUB187:GOSUB204:GOTO125
170 GOSUB180:GOSUB188:GOSUB204:GOTO125
171 GOSUB179:GOSUB189:GOSUB204:GOTO125
172 GOSUB178:GOSUB204:GOTO125
173 GOSUB189:GOSUB179:GOSUB204:GOTO125
174 GOSUB188:GOSUB180:GOSUB204:GOTO125
175 GOSUB187:GOSUB181:GOSUB204:GOTO125
176 GOSUB186:GOSUB182:GOSUB204:GOTO125
177 END
178 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
179 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
180 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
181 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
182 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
183 REM:END OF DOT SEQUENCE
184 RETURN
185 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
186 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
187 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
188 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
189 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
190 REM:END OF DASH SEQUENCE
191 RETURN
192 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
193 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
194 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
195 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
196 REM:END OF DASH/DOT SEQUENCE
197 RETURN
198 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
199 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
200 POKES3,16:POKES2,150:POKES1,P:FORD=1TOF:NEXTD:POKES3,0
201 POKES3,16:POKES2,150:POKES1,P:FORD=1TOG:NEXTD:POKES3,0
202 REM:END OF DOT/DASH SEQUENCE
203 RETURN
204 FORI=1TOL:NEXTI
205 REM:SPACE BETWEEN LETTERS
206 RETURN
207 DATA350,150,350,150,40,150,350,150,300,125,40,130,150,130
208 DATA175,150,225,150,75,165,500,150
209 FORJ=1TO11
210 READL,PI
211 POKES1,PI
212 POKES3,16
213 POKES2,15
214 FORN=1TOL:NEXTN
215 POKES3,0
216 NEXTJ
217 CO=CO+1:RESTORE:REM THE JINGLE !
218 RETURN
READY.
```

POINT OF CONTACT

We have had an encouraging response to our POINT OF CONTACT scheme and will publish details in the next issue. If you wish to participate, please complete the form on *Page 86 of this issue*

BBC Microcomputer System

OFFICIAL BBC COMPUTER DEALER

MODEL A AVAILABLE £299 inc. VAT

This is the best microcomputer currently on the market. 32K RAM 32K ROM 8 modes of operation full colour full-size keyboard internal expansions such as disc interface speech synthesizer Econet interface – In short it is a personal computer capable of expanding into a small business system

BBC Microcomputer Model B	£348	+ VAT	£399.00
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BBC Mod B + disk and Econet interfaces	£450	+ VAT	£517.50
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BBC dual 800K disk drive	£699	+ VAT	£803.85
Torch Z80 disk pack including Z80 2nd processor 64K RAM and CPN operating system	£699	+ VAT	£803.85
BBC Teletext receiver (Aug)	£196	+ VAT	£225.40
BBC cassette recorder and lead	£26	+ VAT	£29.90
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Mod A to Mod B upgrade kit	£50	+ VAT	£57.50
Fitting charge for A to B upgrade kit	£20	+ VAT	£23.00
16K memory upgrade kit	£20	+ VAT	£23.00
Games paddles	£11	+ VAT	£12.65
12 Monochrome monitor incl. cable	£89	+ VAT	£102.35
16 Colour monitor incl. cable	£239	+ VAT	£274.85
User guide	£10	+ VAT	£10.00
Econet interface (free fitting)	£60	+ VAT	£69.00
Speech interface (free fitting)	£47	+ VAT	£54.05
BBC disk manual - formating disk	£30	+ VAT	£34.50
Parallel printer cable	£10	+ VAT	£11.50
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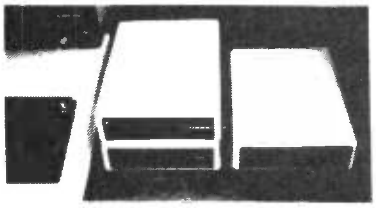
BBC Fourth language cassette	£15	+ VAT	£17.25
BBC Lisp language cassette	£15	+ VAT	£17.25

100% BBC COMPATIBLE MITSUBISHI AND TEAC SLIMLINE DISK DRIVES



These drives are supplied ready cased with all the necessary cables formating program and user disk system guide.

There are some useful utilities included e.g. Epson Screen Dump Program Memory Dump Free Duplicate Merge and Relocate. Power consumption of these drives is very low (0.2A typ. at +12V 0.4V typ. at +5V per drive). Power is taken from the BBC computer

Single drive 100K 40 tracks	£179	+ VAT	£205.85
Dual drive 200K 40 tracks	£329	+ VAT	£378.35
Single drive 400K 80 tracks	£249	+ VAT	£286.35
Single drive 400K 40 80 tracks switchable	£259	+ VAT	£297.85
Dual drive 800K 80 tracks	£449	+ VAT	£516.35
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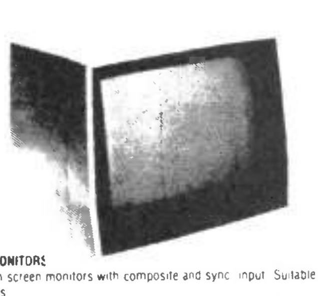
COMPLETE WORD PROCESSOR FOR ONLY £1,099 + VAT

This package consists of BBC Microcomputer View wordprocessor 400K Slimline disc drive High resolution 12 Green monitor Juki 6100 18CPS Daisy Wheel printer and all the necessary cables and documentation. The above package can be supplied with components of your own choice e.g. 800K disc drive or a different printer. Please phone us for a price for your particular requirement.

Special package deal £1,099 + VAT £1,263.85

PROFESSIONAL MONITORS



GREEN MONITORS

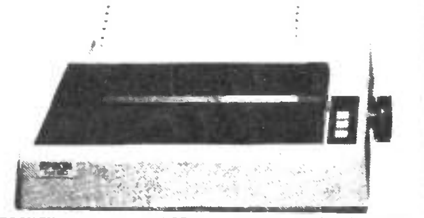
12 Green screen monitors with composite and sync input. Suitable for most computers

★ 18 MHz band width high resolution	£89	+ VAT	£102.35
★ 15 MHz band width normal resolution	£69	+ VAT	£79.35

COLOUR MONITORS

★ MICROVITEC RGB input 14 + monitor supplied with RGB lead for BBC	£237	+ VAT	£274.85
★ SANYO SCM 14 Normal res 14 400 dots RGB input supplied with RGB lead	£219	+ VAT	£251.85
★ SANYO SCM 14M Medium res 14 600 dots RGB input supplied with RGB lead	£299	+ VAT	£343.85
★ SANYO SCM 14H High res 14 800 dots RGB input supplied with RGB lead	£449	+ VAT	£516.35

EPSON FOR RELIABILITY



EPSON FX80 80 column 160 CPS normal italic and elite characters 256 user definable characters superscript subscript 11 x 9 matrix bi-directional logic seeking hi-res bit image printing (960 x 8 dots line) friction and pinfeed 9 international character sets Centronic parallel interface

FX80 PRICE £349 + VAT — **£401.35**

EPSON RX80: 80 column 100 CPS normal italic and elite characters 11 internatonal character sets hi-res bit image printing bi-directional logic seeking 4" to 10" adjustable pin feed Centronic parallel interface

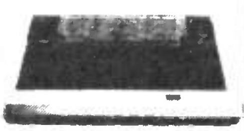
RX80 PRICE £239 + VAT — **£274.85**

136 column 106 CBS fricton and tractor feed up to 15" adjustable carrige hi-res bit image printing true descenders Centronic parallel interface

FX 100 PRICE £479 + VAT — **£550.85**

RS232 Interface for all above printers	£55 + VAT —	**£63.25**
Intelligent IEEE 488 interlace	£65 + VAT —	**£74.75**
Tractor feed for FX80	£79 + VAT —	**£90.85**
Roll holder for FX80	£12 + VAT —	**£13.80**
Ribbon for MX80, FX80, RX80	£8 + VAT —	**£9.20**
Ribbon for MX100	£12 + VAT —	**£13.80**

SEIKOSHA DOT MATRIX PRINTERS WITH HIGH-RES GRAPHICS



GP-100A 80 column 50 CPS dot addressable hi-res graphics 10 wide fully adjustable tractor feed 7 x 5 print matrix Centronic parallel interface

GP-100A 50CPS PRICE £175 + VAT £201.25

GP-250X 80 column 50 CPS 10 wide fully adjustable tractor feed true descenders 64 user definable characters double height and or double width printing 8 x 5 print matrix Centronic parallel and RS232 (serial) interfaces both included

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NEW GP-700A 7 COLOUR PRINTER

This latest addition to Seikosha range gives you print in seven colours 10 wide carriage friction and tractor feed 50 CPS print speed dot addressable high-res graphics 4 hammer printing mechanism 10 CPI or 13.3 CPI special Quite printing mode Centronic parallel interface

GP-700A SPECIAL INTRODUCTORY PRICE £349 + VAT = £401.35

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NEW LOW PRICES ON STAR

The most cost effective quality matrix printers to be launched this year. DP510 and DP515 features include friction and tractor feed and roll holders as standard 100 CPS print speed bi-directional logic seeking 9 x 9 matrix gives true descenders 2.3K buffer as standard hi-res bit image plus block graphics sub and super script italic printing auto underlining vertical and horizontal tabulation left and right margins set skip over perforation back space and self test

STAR DP510 10" carriage 80 columns

SPECIAL PRICE £239 + VAT — **£274.85**

STAR DP515 15" carriage 136 colujns

SPECIAL PRICE £279 + VAT — **£320.85**

RS232 INTERFACE FOR ABOVE £50 + VAT — **£57.50**

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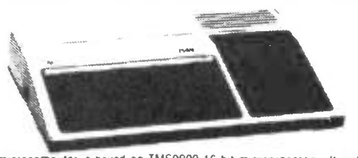
★ CASIO FX-700P Basic language scientific functions 1568 program steps Qwerty keyboard 12 char display	£43.44	+ VAT	£49.95
★ CASIO PB-300 Basic language computer scientific functions 1568 program steps built in mini printer Qwerty keyboard rechargeable batteries and charger 12 char display	£78.22	+ VAT	£89.95
★ CASIO FA-3 Cassette adaptor for PB100 PB300 FX700	£17.35	+ VAT	£19.95
★ CASIO FP-12 Printer for BB100 and FX700	£39.09	+ VAT	£44.95
★ SHARP PC-1211 Basic language computer scientific functions 1424 program steps 24 char display Qwerty keyboard	£60.83	+ VAT	£69.95
★ SHARP PC-1251 Basic language computer 4K RAM 24K system ROM 24 char display Qwerty keyboard user defined key numeric pad	£69.52	+ VAT	£79.95
★ SHARP CE-125 Cassette recorder and mini printer for use with PC-1251 incl batt charger	£86.91	+ VAT	£99.95
★ SPECIAL PRICE PC-1251 + CE-125	£146.95	+ VAT	£169.00

TEXAS INSTRUMENTS TI 99/4A



This microcomputer is based on TMS9900 16-bit microprocessor. It includes 16K RAM 16 colour high resolution graphic (192 x 256). The screen display is 32 characters 24 lines TI-BASIC Full-size keyboard. For Software there are about 1000 programs to choose from. There are a lot of peripherals available e.g. Disk Drives Disk Interface Speech Synthesizer Extra RAM Additional Language (PASCAL TI-LOGO ASSEMBLER)

TI HOME COMPUTER HARDWARE

Title	Description	Price inc VAT
TI99 4A	Complete with UHF modulator and power supply	£89.95
PERIPHERALS		
Speech Synthesizer	When used with selected modules will roduce electronic speech	£41.95
Peripheral Expansion System	This unit takes all card peripherals and on internal disk drive	£79.95
Disk Drive - Internal	92K formatted drive mounts internally in peripheral expansion system	£149.95
Disk Controller Card	Controls up to 3 disk drives complete with disk manager command module	£109.95
Disk Drive Double Sided	92K formatted capacity per side acts as 2 drives DSK1 & DSK2 total capacity 184K bytes	£219.95
Disk Drive External	Complete with own case power supply & connecting cables	£259.95
RS232 Expansion Card	Provides 2 serial RS232 ports and one parallel port for interfacing	£109.95
RAM Expansion Card	Adds 32K bytes extra RAM bringing total capacity to 48K bytes	£124.95
P-Code Card	Includes the UCSD PASCAL P-code interpreter	£189.95
Matrix Printer	80 column matrix printer pinter GP-100A cable	£219.95
Matrix Printer GP250X	80 column matrix printer with RS232 and Centronic parallel interface	£273.95
Epson RX80 Printer	80 column 100 CPS matrix printer	£320.85

Please send S.A.E. for software prices

THE AFFORDABLE DAISYWHEEL PRINTER

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- ★ 18 CPS + Bi-Directional Logic Seeking
- ★ 10 12 15 CPI + Proportional Spacing
- ★ "Drop in" Daisywheel – Triumph Adler Compatible
- ★ Supports all Wordstar features
- ★ Diablo protocols – IBM Selectric ribbon
- ★ 2K Buffer as standard – 100 character Daisywheel

SPECIAL OFFER JUKI 6100 DAISYWHEEL £369 + VAT £424.35

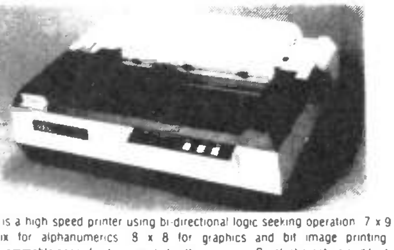
THE CP80 QUALITY PRINTER

ONLY £259 + VAT

- ★ 80 CPS – Bi-Directional Logic Seeking 80 Column
- ★ Friction and Adjustible Tractor Feed
- ★ Patented Square Needles up to 9 x 13 matrix
- ★ Hi-Res Graphics and Block Grphics

SHINWA CP80 PRINTER	£259	+ VAT	£297.85
SPARE RIBBON FOR CP80	£5	+ VAT	£5.75

NEC 8023BE-C PRINTER



This is a high speed printer using bi-directional logic seeking operation 7 x 9 matrix for alphanumerics 8 x 8 for graphics and bit image printing. Programmable paper feed original plus three copies. Greek characters and high resolution graphics. The print quality is exceptional and the price is affordable

Price £299 + VAT £343.85

★ OKI Microline 80 Printer	£199	+ VAT	£228.85
★ OKI Microline 82A Printer	£329	+ VAT	£378.35
★ Dragon 32 Computer	£139	+ VAT	£159.95

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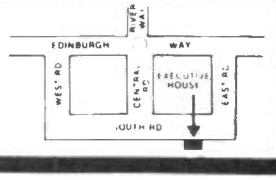
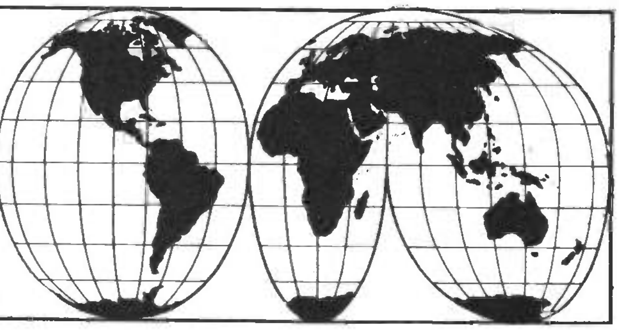


SHORT WAVE NEWS FOR DX LISTENERS

by Frank A Baldwin



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

In this report we continue our review of Indonesian stations that may be logged on the 90-metre band (**3200** to **3400**). A start is made at the low end of the dial, on **3223,** at which point you may, if you are fortunate, manage to hear RRI (Radio Republik Indonesia) Mataram on Lombok-Sumbawa in the Lesser Sundas. Mataram is scheduled from 2130 to 2200 with a power of 1kW and operates at 5kW from 0900 to 1520.

The Indonesian station sometimes reported on **3241** is RRI Ambon in the Moluccas from where it operates from 2000 to 0015 and from 0800 to 1400 with a power of 1kW. The closing time of 1400, however, does not favour reception here in the UK for the reason that much of the short-path signal route via China and the USSR is in daylight at this time. For the same reason, signals from RRI Jakarta on **3277** would be difficult to hear as it lists the closing time at 1300. But there is always a chance of success around the 2300 mark – QRM allowing. RRI Jakarta is timed from 2155 to 0100 (Sunday until 0200) and from 0800 to 1300 at 1kW.

RRI Pontianak on Borneo in the Greater Sundas is timed from 2200 to 0100, from 0400 (Sunday from 2300) to 0700 and from 0900 to 1520 with a power of 5kW. The channel is **3345** and this one is reported fairly often in the SWL press.

RRI Sumenep on **3355** is rarely reported in the UK but if you fancy your chances – you'll need more than one chance – then try around 2300 or just prior to the final closing time of 1600. The full schedule of this one is from 2200 to 0100 (Sunday until 0700), from 0500 to 0700 and from 1000 to 1600 with a power of 1kW. I have yet to succeed!

Despite that RRI Medan operates irregularly on **3375,** it is quite often to be seen in lists published in the SWL press of the world. With a power of 7.5kW, it is scheduled from 2300 to 0100, from 0200 to 0500 and from 1000 to 1700. This latter period will almost certainly provide the best chance of reception if conditions are good for Indonesian reception. However, there is a snag – isn't there always? In this case the snag is represented by the AIR transmitter at Gauhati. Operating mostly in Assamese, it is scheduled from 1230 to 1740 and features an English newscast at 1530. With a 10kW signal this Indian station can, and often does, dominate the channel.

Not often logged here in Europe is the RRI transmitter at Malang in Java. It has a power of 1kW and operates from 2200 to 0045 (Sunday to 0730) and from 0900 to 1600 on **3381.**

Sometimes logged – but not by me unfortunately – is RRI Singaraja on Bali from where it is scheduled on the air from 2200 to 2400 (Sunday until 0700) and from 0900 to 1600 with a power of 1kW.

For those who really fancy their chances with the Indonesians on the 90-metre band, why not have a try for RRI Madiun on **3286?** Seldom reported, it operates from 2200 to 0115 (Sunday until 0800), from 0455 to 0800 and from 1000 to 1600. The power is just 0.3kW – now you know why it is seldom reported!

If you are baffled by the commercial QRM that abounds on the 90-metre band, why not try the somewhat easier 75-metre allocation (**3900** to **4000**)? A comparatively easy Indonesian to log here is the RRI Banda Aceh transmitter on **3905,** timed on the air from 1100 to 1600 with a power of 50kW. Also note the often reported RRI Kendari in the Celebes operating on **4000** from 2130 to 2345 and from 0900 to 1520 at 5kW.

In between these two channels are RRI Semarang on **3935** from 2200 to 0100 and from 1000 to 1600 with a power varying from 5 to 10kW; RRI Ternate on **3946** with a 1kW signal operating from 2030 to 0030 (Sunday until 0600), 0300 to 0615 and from 0800 to 1415 and seldom heard in Europe; RRI Tanjungkarang on **3956** from 2200 to 0200, 0450 to 0750 and from 0850 to 1600 at 2.5kW, not often reported; RRI Palu on **3960** from 2130 to 2230 and from 0900 to 1520 at 10kW and often heard; RRI Surabaya on **3975** from 2130 to 0200 and from 1000 to 1700 at 10kW and often logged; and RRI Pontianak on **3995** from 2200 to 2400, from 0400 (Sunday from 2300) to 0700 and from 0900 to 1520 at 10kW.

If you care to go over the top end of the 75-metre band you may be able to log RRI Padang in Sumatra on **4002** where it is scheduled from 2230 to 0100 and from 1000 to 1600 (Saturday until 1700). With a power of 10kW, this station is often heard here in the UK.

In the next issue I will draw your attention to some of the other transmitters operating in the Far East and in South East Asia that may, with some luck and not a little persistence, be heard in the UK and Europe on the LF bands.

AROUND THE DIAL

In which are presented the frequencies, the times and some of the programme content of stations that may interest readers – both SWLs and DXers alike.

AFRICA

Cameroon

Yaounde on **4850** at 0447: OM's with songs, OM with announcements all in French. This is the National Service which operates in French from 0430 to 0700 and from 1630 to 2300 but with news bulletins in English at 0530, 1830 and at 2100. The power is 100kW.

Egypt

Cairo on **11665** at 1552: OM with a talk in Arabic in the Domestic Service which is scheduled from 0400 to 0715 and from 0800 to 1735.

Cairo on **21465** at 1350: OM with quotations from the *Holy Quran* (sometimes incorrectly westernised as the *Koran*) being featured in the Malaysian programme which is timed on this channel from 1345 to 1430.

Lesotho

Maseru, the capital which is on the Caledon river near the South African border, on **4800** at 2040: OM preaching a sermon then hymns during a religious service in English. This one has a power of 100kW and is on the air from 0400 to 2030 (Wednesday and Sunday until 2105).

Libya

Tripoli on **17930** at 1143: OM with announcements, OM with songs complete with local-style orchestral backing in the Arabic External Service programme *'Radio of the Voice of the Arab Homeland'* which may be heard on this frequency from 1745 to 0400.

Madagascar

Radio Netherlands Relay on **15220** at 2107: OM with a programme for SWLs, all about the growing use of micro-computers by DXers as an aid to their hobby – in the English transmission for Central and West Africa and timed from 2030 to 2120.

Radio Netherlands Relay on **21480** at 1445: OM presenting news of African affairs during an English programme for the Far East and South Asia, timed from 1430 to 1520.

South Africa

RSA (Radio South Africa) Johannesburg on **25790** at 1127: OM with news and comment on African affairs during an English transmission directed to Central, East and West Africa, scheduled from 1100 to 1200.

THE AMERICAS

Antigua

Cologne Relay on **15105** at 2128: interval signal, OM

repeated station identifications in Portuguese, identification in English then into the Portuguese programme for Latin American consumption, timed from 2130 to 2300.
Cologne Relay on **17715** at 1200: OM with station identification in English then into the German programme for Europe and the Far East, scheduled from 1200 to 1400.

Argentina
Radio Nacional Argentina, Rio de Janeiro, on **15345** at 0117: OM with a talk in English about Argentinian affairs in an English programme for Latin America, scheduled from 0100 to 0130.

Brazil
Radio Nacional, Cruzeiro do Sul, **4765** at 0353: Young Lady (YL) announcer, with a programme of local pops on records, the signal riding over that of the Havana Relay of Radio Moscow. Radio Nacional on this channel is scheduled from 1000 to 0500 with a power of 10kW.
Radio Anhanguera, Goiania, on **4915** at 0337: OM with a talk in Portuguese and mention of several local place-names. This one operates from 0900 (Sunday from 1000) to 0400 with a power of 10kW.
Radio Nacional da Amazonia, Brasilia, on **15445** at 1916: OM and YL with announcements in Portuguese and news of local events. ZYE365 Radio Nacional da Amazonia is on the air from 0500 to 1200 and from 1500 to 2400. The power is 250kW.

Colombia
Radio Bucaramanga on **4845** at 0307: OM with announcements in Spanish and promos with many Bucaramangan addresses. The schedule is from 1000 to 0400 with a power of 1kW.

Ecuador
CRE, Guayaquil on a measured **4656** at 0232: OM with a sports commentary in Spanish. This one is on the air from 0900 (Sunday from 1100) to 0430 and the power is 10kW.
Radio Luz y Vida, Loja, on a measured **4851** at 0434: local pops on records, OM announcer in Spanish. Listed times are from 1045 to 0400 but sometimes 24 hours continuous with a power of 5kW.
Radio Centinela del Sur, Loja, on **4890** at 0345: OM with an excited commentary on a sports meeting, this programme also being heard on Radio Quito **4920** in parallel. Loja is scheduled from 1000 to 0400 (Sunday from 1300 to 0300) and the power is 2kW.

EUROPE

Albania
Tirana on **6200** at 0357: YL with some propaganda in an English transmission to North America, timed from 0330 to 0400.

Bulgaria
Sofia on **6070** at 2130: OM with station identification, frequencies and then a news bulletin in the English programme for Europe, timed from 2130 to 2200.

Czechoslavakia
Prague on **6055** at 2140: OM with a newscast during the English transmission for Europe, scheduled from 2130 to 2200.

Finland
Helsinki on **15275** at 1200: YL with station identification, OM with *'Northern Report'* which is a regular programme dealing with Finnish internal affairs. This English transmission may be heard from 1200 to 1225 *(not Sundays)* and the target areas are North America, the North Atlantic, the Middle East and South East Asia.

Greece
Athens on **11645** at 1547: YL with a news review of recent Greek affairs in an English programme timed from 1540 to 1550. Just ten minutes, but there is another newscast of the same time period, in English for Europe, from 1920 to 1930 on this same channel.

Switzerland
Berne on **6165** at 1059: Swiss music in typical style, YL with station identification at 1100 then OM with a newscast in the English programme for Africa, timed from 1100 to 1130. Also logged on **21520** and on **25780** in parallel.

Turkey
Ankara on **15435** at 0519: OM announcer with local-style music records in a Turkish transmission for Turks abroad and directed to Western Europe, the Middle East and North Africa.
Broadcast from 0355 to 0805 on this frequency.

ASIA

China
Gansu PBS, Lanzhou, on **4865** at 1525: OM and YL alternately with announcements in Chinese. This is the Home Service which opens at 2115 and finally closes (there are other Pperiods of operation) at 1600.
Radio Beijing (Peking) on a measured **6493** at 2203: OM and YL in Chinese in a Domestic Service 1 programme, scheduled here from 2000 to 2300.
Radio Beijing on **6665** at 2104: OM with a talk in the Domestic Service 1 programme scheduled on this frequency from 2000 to 2300, from 0100 to 0300 and from 1100 to 1730.

North Korea
Radio Pyongyang on **6400** at 2214: OM with a talk in the Korean programme for South Korea, on this channel from 2000 to 2130, from 2200 to 1030 and from 1100 to 1930.

India
AIR (All India Radio) Gauhati on **3235** at 1533: OM with a newscast in English. This 10kW transmitter is scheduled on the air from 1230 to 1700 (Saturday until 1740). Newscasts in English are featured at 1530 and at 1730.
AIR Hyderabad on **4800** at 1553: YL with announcements in English in the South Regional Service. Hyderabad is on the air from 0025 to 0215 and from 1200 (March to April from 1130) to 1740 with a power of 10kW.

Pakistan
Karachi on **15565** at 1350: YL with songs, local-style music, YL with station identification in the Urdu programme for the Persian Gulf and the Middle East, timed from 1330 to 1600.

Indonesia
RRI (Radio Republik Indonesia) Bukittinggi, Sumatra on **4910** at 1525: YL with a slow, sad song in Indonesian. This one opens at 2300 and finally closes at 1600. Power 1kW.
RRI Pekanbaru, Sumatra, on **5886** at 1527: OM with a song in Indonesian, OM's with the chorus. Pekanbaru opens at 2230 and finally closes at 1600, the power being 10kW.

Qatar
Doha on **11740** at 1834, OM with songs, Arabic-type music in the Domestic Service which is scheduled on this channel from 1730 to 2130 but sometimes covered by co-channel Radio Nederlands Relay in Madagascar with an English programme to Europe and Africa from 1830 to 1920.

United Arab Emirates
Dubai on **21655** at 1137, YL announcer in a programme of Arabic music and songs in a Ptransmission for Europe and North Africa, scheduled from 1130 to 1615.

PDR Yemen
Aden on **6005** at 0354, YL with songs complete with orchestral backing in a Domestic Service programme scheduled on this channel from 0300 to 0630 (Friday from 0630 to 1100) and from 1100 to 2200.

CLANDESTINE
'Radio Free Surinam' on **6850** at 0102: OM with a marching song interspersed with exhortations by an OM and YL alternately. This transmission in a local vernacular ended abruptly at 0110.

NOW LOG THIS
Melbourne, Australia, on **7205** at 1500: OM with station identification and a newscast in English presumably directed to the Pacific and Papua New Guinea. This channel is not mentioned in the latest schedule to hand. Heard only after TWR Monaco signs off at 1459.
Melbourne on **6035** at 1550, OM with announcements in a programme entitled Country Music Australian Style. OM with a programme review and station identification at 1600. Melbourne is on this channel from 1400 through to 2200.
Melbourne on **7135** at 1345, YL with station identification and OM with announcements in the Cantonese programme for South and South East Asia and the Far East, timed from 1230 to 1430.

NOW HEAR THESE
●Radio Pyongyang on **4770** at 1517: OM with a talk in Korean. This one has a power of 120kW but operates irregularly, the session being timed from 1500 to 1555.
●Radio Cobija, Bolivia, on a measured **4856** at 0118: OM with promos in Spanish, YL with announcements, then OM with station identification as 'Radio Cobija' at 0120.

POINT OF CONTACT

In order to facilitate ready contact between radio amateurs, ***Radio & Electronics World*** will publish a monthly updated list of licensed readers, including some of the bands they favour, approximate times and days of the week when they operate and a few other details.

MOST IMPORTANT – Include a **telephone number** – if you have a particularly interesting contact we might want details for publication.

If you wish to be included in this scheme, would you please complete and return the form below and send to: ***Radio & Electronics World***, Sovereign House, Brentwood, Essex CM14 4SE.

We thank readers who have responded to this new scheme. The response coincides with our time of going to press with this issue but we will publish details of the response in the next issue – please keep them coming.

Name.. Address ....

.... Postcode..................

Telephone No .... Call Sign .... Date licensed................................

Type of Licence A..................☐ B..................☐

Bands usually preferred ....

Operating days M T W T F S S Times ....

Equipment ....

Phone/CW...

Special interests eg DX,AMSAT etc...

....

Most interesting contact made to date ....

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—CLUB NEWS—

Buxton Amateur Radio Rally Group

The organisers have advised that due to overwhelming response from traders it has been found to be necessary to acquire a larger venue for the 1984 Rally on 8th April. It will now be held at the Pavilion Gardens, Buxton which is only some 200yds from the original site, with similar facilities on a larger scale plus a licensed bar. Open 11am. 10.30am for R A I B C. Admission 50p (under 14yrs free if accompanied by an adult). Talk-in on 2m & 70cm. Ample Car Parking. Snack Bar and Cafeteria. Numerous Trade Stands.
D Cooper G6MIF, 7 St James Terrace, Buxton, Derbyshire, SK17 6HS. Tel: (0298) 6174.

Chelmsford Amateur Radio Society

The society meets on the first Tuesday of each month at the Marconi College, Arbour Lane, Springfield at 7.30pm. Usually a talk is arranged about some aspect of amateur radio, sometimes by a visiting speaker and sometimes by members of the Society. Members take part in competitions such as DF hunts, NFD and hold a constructors' competition every year. Membership is open to anyone in the area with a genuine interest in amateur radio and costs just £2.50 per year. Further information can be obtained from:–
A C Mead, Secretary, 9 Abraham Drive, Silver End, Witham, Essex, CM8 3SP. Telephone: Witham 512316 (day), Silver End 83094 (any other time).

Glenrothes & District Amateur Radio Club

Open Night. On Wednesday 30 November the Club held its 11th Open Night in the Laural Bank Hotel, Markinch. A total of 84 people attended the evening with many new as well as old faces among the visitors to its now well known annual event. The talk and slide presentation on the manufacture of capacitors was most interesting and stimulated questions from the floor.

Overseas Visitor. The Club welcomed recently Manu Manohar, VU2MNU, from Mysore in southern India. Manu is staying in Kirkcaldy for a short while during a visitto Scotland on a work project.

Space Shuttle. GM3OLK, GM3ZSP, GM4TNP and GM4TVB attempted to contact W5LFL during the recent Space Shuttle flight. Operating from East Lomond Hill, they were successful in copying transmissions from Dr Garriot during two passes of the Space Shuttle. However, they will have to await confirmation if their signals were heard in space.

Interference Filters. The club has purchased a set of filters which can be borrowed by members experiencing interference problems. If it is found that any of the filters are of use, members can purchase them through the club at reduced rates. A copy of the data sheet on the filters is available.
GM4GRC, *Provosts Land, Leslie, Fife, Scotland.*

Lincoln Short Wave Club

The following programme has been provided by Pam Rose, Secretary *(Tel. Gainsborough (0427) 788356).*
May 9: DX-pedition to St Pierre et Miquelon by W1PFA/FP8BH slides/tape.
May 23: Annual General Meeting
June 6: CW
June 13: Activity night/Night on the air
June 20: CW
June 27: Junk Sale
Sept 23: Hamfest.

The Midlands VHF Convention

Here are some details provided by J P H Burden, G3UBX, the Secretary to the Organising Committee. The Midlands VHF Convention was held on Saturday, October 15, at the British Telecom Training College, Stone. Throughout the day the measurements area was busy measuring the special characteristics of numerous transceivers right up to 10GHz.

A considerable quantity of test equipment had been made available by the British Telecom Training College. This included an Ailtech 12.4GHz spectrum analyser, a Systron Donner 26GHz frequency counter, a Hewlett Packard 18GHz power meter, a Racal Dana 512MHz AM/FM synthesised signal generator, a Sinadder, a Marconi Instruments 512MHz modulation meter, a Bird 43 power meter with a good set of inserts and appropriate power supplies.


Bring & Buy stall (photo — courtesy of G8DJC)

By far the most popular measurement was sensitivity of 2m and 70cm handheld FM equipment. Measurements were made using the signal generator and Sinadder to determine the input signal level required to achieve 12dB SINAD. An FT290 modified with a Mutek front end was the most sensitive measured.

A Microwave Modules 2m transverter was evaluated for sensitivity. This was achieved by feeding its 28MHz output into the spectrum analyser and observing s/noise with various signal generator input levels. Two microwave enthusiasts (G8SWZ and G8MWR) tested out their 10GHz narrowband systems and observed (probably for the first time) their output spectrum. Several wideband 10GHz systems were also tested and a problem of stability was observed on that of G3NAQ's. One intrepid builder brought along a 133MHz VFO for use with a homebrew 2m rig. This was aligned and measured on the test equipment.

As well as a few select trade stands there was a well-stocked bookstall and a busy bring-and-buy stall. The large and comfortable social area included an exhibition of maps, charts, and other matters of radio interest. After the afternoon lecture session, the evening was rounded off with a buffet and evening bar accompanied by musical entertainment from the South Manchester Radio Club.

Mobile Radio Users' Association

The Mobile Radio Users' Association was founded 30 years ago to represent the user of mobile radio with the Government Department regulating its use. In 1953 this was the Post Office and is now the Department of Trade and Industry.

At the present time great changes are taking place in equipment and operating techniques. The Merriman report 'Independent Review of the Radio Spectrum' (30–960MHz), presented to Parliament in July 1983, forecasts radical changes in the regulation and licensing of mobile radio systems. For a long time mobile radio has suffered from a shortage of radio frequencies and users and Industry looked to this report for an indication that more frequencies would be made available – in the event nothing was offered for the private mobile radio user.

For the reasons outlined above the Mobile Radio

CLUB NEWS

Users' Association has arranged to hold a conference setting out these changes and to consider the future of mobile radio in the light of new equipment and methods of operation which are now available.

Conference on Mobile Radio

The Conference, 'Mobile Radio – World of Change', will be held on 20-30 March 1984 at New College, Oxford. Speakers have been invited from: University of Surrey, British Broadcasting Corporation, Aston University, British Telecom, London Transport, Department of Trade & Industry, Post Office Engineering Union, and West Midlands PTE. Further details of the Conference and registration forms are available from:- *MRUA Secretariat, c/o IEE Conference Services, Savoy Place, London WC2R 0BL. (Tel: 01-240 1871 Ext. 222, Telex: 261176 IEE LDN G.).*

Further information on the MRUA may be obtained from:– *Secretary, Mr E F Goodwin, (Tel. 01-660 3747).*

White Rose Amateur Radio Society

The annual rally is to be held on 1st April 1984 at the University of Leeds. This will be the 17th White Rose Radio Society Rally and the 3rd year at the University of Leeds site which has been judged as eminently suitable in terms of access and space. The Rally is a one-day event and opens at 11.00am. About 50 stands will be taken by dealers offering new and used amateur radio equipment, components, computing equipment, surplus equipment etc. Repeater groups, BYLARA, talk-in station on 2m and 70cm, book stalls and a bring-and-buy stall will also be present. A demonstration station GB2WRR will be in operation and permitting unlicensed radio amateurs and other visitors to transmit greetings messages. Parking is free but an entrance fee of 50p will be charged (children and OAP's free). A very comprehensive rally with something for everyone.

Alan N. Bramley G4NDU, (Rally Manager), 7 Belvedere Avenue, Leeds LS17 8BN. Tel: 0532 689880.

Q T I Talking Newspaper Association

Q T I Talking Newspaper for blind and partially sighted radio amateurs has been granted full charity status by the Charity Commission (No. 325464). Donations and offers of financial support may be directed to:– *Mr J Feeley (G4MRB) Chairman QTITNA. 79 Narrow Lane, North Anston, Sheffield S31 7BJ. Or, contact Dawn (Tel: 0909 566301)* between 10.00am to 4.00pm, Monday to Thursday.

Sheffield Amateur Radio Club

The Sheffield Amateur Radio Club meets on the first and second Monday of every month at the Firth Park Pavilion, Firth Park, Sheffield, 7.30 till 9.30pm. New members are welcome.

The club activities include RAE classes, lectures on most Amateur Radio subjects and social events. On the third Monday of every month the club meets at the Sheaf Hotel, Framhall Lane, Sheffield for a pint and a chat night.

All enquiries to:– *The Secretary Mr G W Hancox, G8PVM, 242 Ecclesall Road, Sheffield, S11 8JD. Tel: 682963 (evngs.)*

British Amateur Radio Teleprinter Group

Ian Wade, G3NRW, is the new editor of 'Newsletter', the journal of the British Amateur Radio Teleprinter Group (BARTG).

BARTG exists to encourage and promote interest in amateur radio teleprinting and associated activities and the Group is affiliated to the Radio Society of Great Britain (RSGB). We consider that many of our readers would be interested in the activities of this Group (the 1984 subscription is £5, plus £3 airmail surcharge for intending overseas members). If you wish to obtain an application form, please write to: *Mr John Beedie, G6MOK, Membership Secretary, 161 Tudor Road, Hayes, Middlesex, UB3 2QG.*

DATES FOR YOUR DIARY

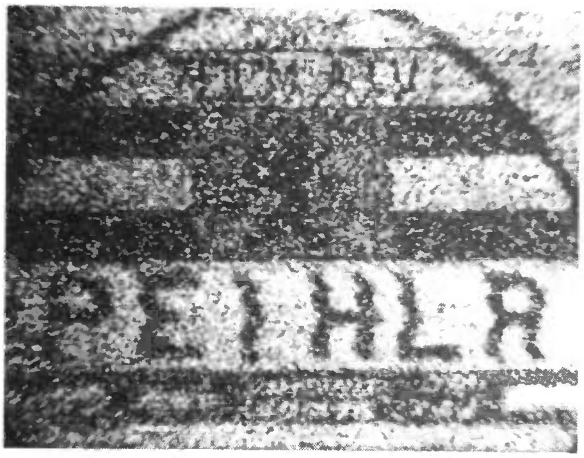
Dates for your diary is updated every month.
Club secretaries and organisers are requested to send information of forthcoming events as early as possible to *Radio & Electronics World,* Dates for your Diary, Sovereign House, Brentwood, Essex CM14 4SE

Date	*Function*	*Location*	*Contact*
14th March	Club project/construction night	S Bristol A. R. Club	L Baker G4RZY
	Lecture – Amateur Radio on a Shoestring	Lincoln Short Wave Club	Pam Rose G4STO
16th March	BCS/Computing Award Winner	Lancaster Polytechnic	BCS, Coventry Branch
18th March	4th Annual Components Fair	Carleton Community Centre, Pontefract	A Mason G4TGU N Whittingham G4ISC
21st March	SWL night	S Bristol A. R Club	G8XIH/G4OPQ
28th March	Annual General Meeting	Lincoln Short Wave Club	Pam Rose G4STO
	Computer night	S Bristol A. R. Club	Terry G6SVR
1st April	White Rose ARS Rally	University of Leeds	A Bramley G4NDU
3rd April	Microcomputers as applied to amateur Radio – talk by A Butcher G3KPJ	Chelmsford A. R. Society Marconi College	J Martyr G3PMX AC Mead G4KGB
4th April	Lecture – Data Comms. RS232–X-25	S Bristol A. R. Club	Steve G4MCQ
7-8th April	Amateur Radio Exhib. on computing and electronics	Northern A. R. Society Assocn	P. Denton G6CGF
11th April	Lecture – UHF then and now with a look at RSGB Metre-Wave Awards System	Lincoln Short Wave Club	Pam Rose G4STO
	HF night	S Bristol A. R. Club	Alan G4TSS
15th April	Two-metre FM contest	Stevenage & Dist A. R. Society	B Dean G6NZC
17th April	Display by D Howes, G4KQH C M Howes Communications	Biggin Hill A. R. Club	I Mitchell G4NSD
18th April	VHF NFD preparation night	S Bristol A. R. Club	Mark G4KUQ
25th April	Activity night/Night on the air	Lincoln Short Wave Club	Pam Rose G4STO
	10-metre FM night	S Bristol A. R. Club	Colin G4SQQ
28-29th April	RSGB National Amateur Radio Exhib	NEC, Birmingham	RSGB Potters Bar 59015
1st May	RF Power Transmitters – talk by Dick Brocks G3WHR	Chelmsford A. R. Society Marconi College	J Martyr G3PMX AC Mead G4KGB
2nd May	Lecture – 23cms operation	S Bristol A. R. Club	Steve G4MCQ
4-7th May	Midland Computer Fair	NEC, Birmingham	Fiona Howell 01-643 8040
16th May	Fox hunt briefing	S Bristol A. R. Club	G8XIH/G4OPQ
17th June	Royal Naval ARS Mobile Rally	HMS Mercury, nr Petersfield	A Walker G4DIU

ATV on the Air

Presented by Andy Emmerson, G8PTH

John (G8MNY) of S Croydon sent the picture on the left. This and the picture below were taken by Andy (G6LTZ), Old Stratford, Bucks



From PE1HLA in Amersfoort near Hilversum, a little more sync would prevent line tearing on this picture

In last month's columns I made brief mention of the difficulties some ATV operators were getting into with solid-state linears.

It's terrible how one tends to talk in shorthand; I have 70cm fast-scan in mind, of course.

Most ATV operators like to be 'big signals', it's only natural, and after a while of operating at the 3- or 10-watt level, thoughts turn to a power amplifier to boost those signals.

To make a significant improvement in received pictures at the other end this means going up to at least 50 watts, ideally 100 or more.

As we are dealing with amplitude modulation our PA stage has to be linear, which immediately rules out some Class C designs. OK you say, let's go out and make (or buy) a linear PA, but what is a linear PA? Certainly *not* some of the amplifiers sold as linears!

Criteria for linear amplifiers

An ideal linear amplifier (one that is ideal for TV) will produce an exact replica of the input signal, though boosted five- or ten-fold. It will have a totally flat response over a 10MHz bandwidth so that we can radiate our naughty double-sideband colour pictures with colour subcarriers at 4.43MHz either side of the vision carrier and it will not cramp the sync pulses to any degree. And do you think this amplifier exists? You must be joking!!!

There is no commercial product on the amateur market which fulfils this specification – not even a broadcast amplifier, since the broadcasters do not radiate double sideband. The nearest thing to our ideal amplifier is, or was, the SOTA/EDL machine which was a valve machine (remember valves?). Unfortunately this useful device is no longer in production, though you can pick up examples at rallies or make your Chinese copy. Using a 2C39AB tube it boosted a 5W to 10W input to at least 50 genuine watts out with remarkable linearity, and it certainly had sufficient bandwidth to pass colour subcarrier properly and without appreciable sync compression. About the only negative points with this design were an underrated power supply and poor heat extraction, which can both be remedied by the user.

For some ATVers, though, 50W is inadequate and the choice is then between solid state devices (up to 100W or 125W output, or so) or a more powerful valve job. In the latter instance it is possible to modify the K2RIW kilowatt design to handle a full bandwidth TV signal. Many operators prefer to avoid lethal voltages in the shack altogether and so the selection is among solid state linears. Now this is where the problems begin – and where we came in.

Sync pulse problems

So what is the difference between a solid-state and a thermionic amplifier then? Surely watts are watts? Why am I hinting that there is something inferior about transistors? Of course, there is nothing 'wrong' with transistors, but they are rather different from valves. UHF power transistors tend to exhibit poorer linearity than valves, which are linear up to the abrupt point of limiting in Class C. Good video transmission means linear grey-scale reproduction and deep, clean syncs, so linearity *is* important.

With transistors, input-to-output gain varies greatly depending on the power output level. Generally the last 3dB of output increase takes more than 6dB of input power. This is fine for SSB, where it gives a soft limiting effect and voice recognition suffers little from peak distortion. With video, however, the stability of the picture depends on clean, undistorted sync pulses, and since the sync is transmitted at peak envelope power, compression here can be deadly. A transistor amplifier can easily cramp the sync amplitude to half or less, giving a jittery, torn or rolling picture at the far end.

A rule of thumb for using power transistors in the linear mode is to set the peak envelope power at half the manufacturer's rating. Thus a Motorola MRF648 is rated at 60W but should be run at 30W for ATV. You can compensate a little by artificially stretching the syncs of the driver signal on the input; in other words you deliberately feed a non-linear amplifier with a signal that is non-linear in the opposite sense.

Power supplies

One of the first things you find out when you buy a solid state PA is that your power supply has to be beyond reproach. Before you mutter volts are volts, just ponder on this... An average PSU is considered good if it provides 13.8V at the terminals with low source impedance, good mains and output regulation, and reasonable 50Hz ripple suppression. But we are using it for TV and the load is varying at the modulation rate. Our transmitter is drawing some 15 to 20 amps at 13.8V during sync pulses and at maximum signal levels, but perhaps only an amp at peak white. It would not be so bad if we sent just the vertical blanking pulses 50 times a second because then the big storage capacitors, regulator devices and time constants could handle this without difficulty. But in fact the current changes at video rate, in other words up to 5MHz! The larger the filter capacitance, the higher the impedance at frequencies above the audio range, thanks to internal inductance and what is called 'equivalent series resistance'. Add to this the small but finite resistance and inductance in the leads between the PSU and the transmitter and you now see where that ripple on the picture, mentioned by your QSO partner, arises.

The ripple is another cause of sync compression, with the normal gain curve of UHF power transistors. If the 13.8V supply drops a couple of volts during line syncs (you probably won't be able to measure this), the gain of those power transistors is going to be that much less. Therefore, it pays to keep the supply leads short and thick, also to provide the most suitable stabilising capacitors in the amplifier itself. These should be 100μF and 470μF electrolytics, rated at 25V.

Commercial amplifiers

Most ATVers who follow the solid-state course go for one of the *Microwave Modules* amplifiers and if you heed the advice of not driving it to maximum output you can achieve very good results. I understand that *MM* have a modification for ATV use which involves changing some components and they do not charge for this (at least they did not hitherto). There are, for instance, some chokes which tend to resonate at colour subcarrier frequency and must be changed and there are some further 'mods'.

The output signal

Having done my bit for the Transistor Education Council I had better touch on another source of confusion which affects all TV operators, regardless of transmitter type. That is the fact that we employ negative modulation. Having stated the obvious I now make my point: if you are transmitting negative modulation you cannot tune your PA with a power meter! If you *do* tune for 'maximum smoke' you will end up with a signal which is all carrier and no modulation. By all means tune up the PA for maximum with carrier and no modulation, but once you advance the video gain on your driver the power meter will no longer help you.

From now on you need to monitor the transmitted signal. Unfortunately, a TV in the shack cannot do this since it will overload in the strong RF field and give a totally misleading impression. The solution is a simple diode detector sampling a tiny bit of the RF output which is then monitored on a scope. In this way you can watch the carrier level go up and down as you adjust the bias control and see the way the linearity of the transmitted syncs varies as video gain and bias interact. Designs for RF detectors can be found in the RSGB handbook and the BATC's *ATV Handbook*, or you can buy a ready-made one from *Fortop* at a modest price.

Power meters are pretty useless for TV use anyway, since they are normally designed to measure the average value of a symmetrical signal. A television signal, however, is not symmetrical; instead it consists of short bursts of concentrated power (the syncs) and longer periods of reduced power level (the vision content). Sync pulses add up to less than 10 per cent of the total signal; so even if you can get an accurate average signal reading, this is about 60 per cent of the peak sync power. Confusing? I hope not!

I guess I can get down off my soapbox now, and I apologise if this article seems a bit heavy. The intention was to radiate a little information that appears to be in short supply, not to point the finger at anyone or to be patronising. Of course, all this will be commonplace to the old hands, but we all have to start some time, don't we?

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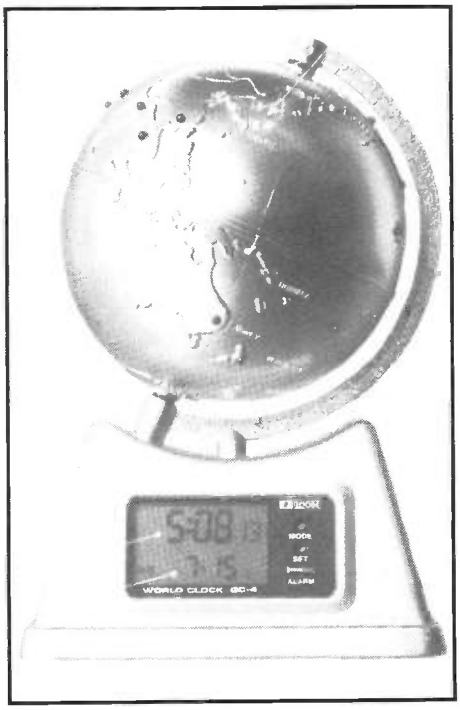
THE ICOM DIGITAL QUARTZ WORLD CLOCK GC–4

If you are looking for a really useful clock for the radio shack – or indeed if you want a decorative, eye-catching clock for the home – then take a look at ICOM's new *World Clock*. It combines a digital quartz clock showing hours, minutes and seconds and the date in days and months, with a globe of the world which, when rotated, shows the corresponding time at twenty-four cities spaced around the world and located in different time zones. When the globe is revolved, a red LED indicates one of the major cities of the world – the LED blinking for 20sec at each stop – and the local time of that city is displayed on the clock in place of the date. It also features an alarm and an hourly time signal.

The mini-globe clock stands 195mm (i.e. about 7½ inches) high and the clock base is approximately 130mm (5 inches) wide at the bottom and about 85mm (3¼ inches) deep. The clock display area is 40mm x 25mm (1½ inches x 1 inch). The globe itself is approximately 110mm (4 inches) in diameter. The whole unit has a metallic finish in a gold colour, which



makes for a very attractive, smart unit which will grace any shack table, office desk or living room. It has also proved to be an excellent 'talking-point'!

To me, it seems an invaluable accessory for the SWL interested in worldwide shortwave reception and for the amateur radio DX enthusiast, as well as for those with friends or relations living overseas. If you are in the habit of making long distance telephone calls worldwide, this clock will show you when you can phone people abroad without calling them in the middle of their night!

It is supplied set up as a 24-hour clock but it can be reset to operate in 12-hour mode by the purchaser. Another benefit is that it is so programmed that it re-adjusts itself for automatic end of month correction (though, unfortunately, it does not automatically correct for leap years). The error is quoted as ± 15sec/month. Battery driven, it uses four SUM-3 type dry batteries or similar (AA, R-6, etc) which should run the clock for a year. Altogether, a very intriguing accessory for the radio enthusiast.

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FOR SALE

● Realistic DX-160 communications receiver with separate frequency counter. Despite age of both items, 77/78, they have not had a lot of use. Almost as new, both for £150. Tel: Collingbourne 398 between 5 – 7pm only. Not weekends.

● Binatone long range, 40ch, hand-held transceiver. 4 Watt output, with carrying case, rubber-duck rechargeable batteries, and charger. Very good condition £50 – or exchange for 2m accessory of similar value or what have you? Tel: Seaford 898515.

● ICOM IC740 SSB Xceiver, plus FM Board EX242 and SP3 speaker. As new. Little used. £525.00. No offers. Belcom LS20XE 2 mtr mini hand-held plus NiCads and Vox headset £100. Standard C58. 2 mtr multi-mode, with NiCads and slide-in mobile mount £150.00. Steve G4MJW QTHR 0376 84144.

● Marconi TF99SA/S AM FM signal generator 1.5 to 220 MHz £150 ono. Microwave modules, 70 CMS, 50 Watt, Linear with preamp £65. Belcom Liner 430, 70 CMS, SSB CW RIG. £120 ono. Farnell 13.5 volt 5 amp PSU. £15. John Moxham (G8KBQ), 22, Whiting Road, Glastonbury, Somerset BA6 8HP. Tel: 0458 33145 (Work).

● G2VF Do-it-yourself loop antennas for long, medium and short wave bands. Only twenty one inches square. Easy to make. No special skill required. Parts required in most ham shacks. SAE for details to F.G. Rylands, 39 Parkside Avenue, Millbrook, Southampton SO1 9AF.

● Collins S-Line RX 75S3 No 14334. TX 32S3 No10970 PSU. All in good cond comp with instructions book £675 or HF linear trio TL922 YAESU FL2100Z taken in part ex. G4RGJ Tel: Worcester (0905) 421908.

● S.R.9 VHF FM 2M RX. 11CH. XTALS and VFO and 3 spare XTALS instructions, mobile brackets. DC12V or can be used with 13.8V power pack. Orig packing. £40 postage extra. M.B. Marsden, 205 Moss Lane, Burscough, Nr. Ormskirk, Lancs L40 4AS. Tel: Burscough 892088.

● Approx 1000 electronic mags 1960-1983 for sale. Tel: Chichester 782486 evenings or weekends.

● SX200W scanning receiver. Two months old with PSU and telescopic aerial. Perfect condition. £250 Tel: 08893 3495 evenings.

● Stereo System. 30-30 Watt amplifier. 1pr (2) '15'L.S. Units. Matching cabinets. HMV only 1 15 Watt L.S. Unit cabinet to match. Rest of units, one Garrard 3.000 auto-clanger complete in cabinet. One HMV four wave-band radio – 'Tuner', matching cabinet. All for £100. For details. Tel: Llanbedrog 740477. Purchaser call collect.

● Eddystone 730 comms receiver. Sale or swop. Good oscilloscope. Is worth £120. Tel: BACUP 874928 after 7pm. Can be delivered in Lancs or Cheshire area.

● Microwave modules 2001 RTTY to TV converter £100. Heathkit RF oscillator .31kHz to 220MHz. £20. Heathkit Mohican receiver £10. Carriage extra. Tel: Williams 0376 23604 after 6pm.

● Bearcat 220FB scanner 66-88MHz Band, 220 Volt. As new. Price Irish punts £180. Can send to England. Write Paul McGovern, 35 Barton Road, East Dundrum, Dublin 14, Ireland, or W.H.Y. for exchange.

● AR88 excellent working condition with fitted 'S' meter. Covers bands 30.8 to 300 am SSB FM. Sell or exchange 2M transceiver. Buyer collects. Tel: Ivybridge 4030 evenings or weekends.

● FT101 MkII with G3LLL clipper, fan, mic. spare P.A. valves. Mint cond £280. Deliver reasonable distance or carriage extra. G3GRX16 Monnington Way, Penrith, Cumbria. Tel: 0768-64890.

● YAESU FRG7700M, plus FRT7700 ATU, little used, good condition with box. £330 o.n.o. Tel: Paul 0734 667901 after 7pm.

● Roneo Vickers duplicator complete with stand, three colour drums, mains and hand powered. Excellent condition £60. Buyer collects. Complete A.T.U. Kit instrument case. All components complete inductance feet fascia knobs £15. Crystal set uses no power at all. Including 100ft aerial 40ft earth wires. Complete £10 will pay £20 complete ZX81 with instructions. G.A. Partridge, 17 Ethel Rd, Broadstairs, Kent CT10 2BE. Tel: 0843 62839.

● MM2001 RTTY to TV convertor, up to 1200 ASC11-Great for UOSAT-9, telemetry and news bulletins. £150. MMS1 morse talker £85. Heathkit 16-37 FM Stereo generator. Lots of useful functions £50. Adrian G4ROA (EX66ADC). Tel: Coventry (0203) 412201 evenings.

● Disposing of ham station on behalf of widow of late G3Mi. Send S.A.E. for list which includes Eddystone EC10, Drake 2B plus Q-Mult. Eddystone 750X, Hammarlund HQ129X, Home brew transmitting equipment, crystals galore, etc. Eric H. Rickett, 29 North Road, Berkhamsted. Herts HP4 3DU. Tel: 04427 3622

● Video Genie 1 computer £180. If collected £150 cash or will swap for modern, general coverage, all modes receiver. W.E. Gates, 16 High Mill Drive, Scarborough, North Yorkshire YO12 6RN. Tel: (0723) 365093

● YAESU FT107, 1-8-30MHz solid state HFRIG Inc ExtPSU/SPK FP107E ExtVFO FX107 £580. Trio 2200G Auto IB Nicads mic charger fitted 7 rept 5 simp crystals £70. Linear 3-30MHz solid state 400W SSB 200W FM as new £65. Linear 29MHz 30W FM £17. Low pass filter new YAESU FF501 £21. Prefer buyer collects or carriage extra Tel: Jeff. Redditch (0527) 41985.

● FT 101ZD as new. Used twice. £300. Trio 7600 FM mobile £75. Trans-match 1Kw £25. All items o.n.o. demonstrations welcome.Tel: Stonehouse 4531 after 6.00pm. Ask for Ken G4MOH.

● Wireless constructors encyclopedia dated 2/12/33 in mint condition. Sensible offers invited for this collectors item. Cash or exchange. J.A. Share, 3 Upland Crescent, Llandough, Cardiff CF6 1PR Tel: 0222 702455

● Swop Racal RA17 receiver (good cond) with manual for Fender Stratocaster guitar (poss cash adj) Tel: 0642 318237 (Middlesbrough).

● Trio R1000 Comm' receiver boxed 150kHz to 30MHz digital readout etc offers about £195. Tel: 0787 75931 (Sudbury Suffolk) anytime.

● FT29OR with Nicads and 12V charger. One year old. No mods. £210. VIC20 micro computer C/W tape unit, super expander cartridge, demo tape, extra books and carts incl morse tuition prog. As new with cover. £125. Phone G4AFF. Stewart, at 03057 75456 Weymouth (not QTHR).

● Summerkamp TS 788DX AM.FM,SSB,CW. 26-29999MZ 100W pep absolutely as new, boxed, unused, still under guarantee, cost £300, £235 o.n.o. SX200 scanner 26-29999Mz police, air, mobile, telephone etc 32.000 frequencies search, scan, modes. 16 channel memory for favourite frequencies. £195 o.n.o. Excellent condition genuine reason for reluctant sales. Moving house Tel: 0203 – 316103 after 6pm.

● CBM 64: who wants to exchange software (on disk or cassette). Lots of games, tools and scientific programs. Special interests: Adventures, maths and machine code routines. Stefaan Janssens, Antwerpse Straat 63, B-2670 NIEL, Belgium. Tel: 03 888 21 73.

● Maplin 5600s synthesiser. Superb stereo patchboard sythesiser. Almost completed. All parts to finsh construction included. Your time is all that is required plus £450.00 o.n.o. – a saving of at least £250. Money required for new projects. Tel: Staverton 434 day or night.

● ICOM IC25 5E just overhauled. C/W ACPU ⅝ mag mount antenna £200 o.n.o. or would part-exchange for small HF Rig in good condition such as TS120S or similar G3ABB QTHR. Tel: Bexhill 214876.

● Heathkit short wave receiver SW 717 factory aligned. Cost new £120 will accept £60. B40 HF RX A.M. SSB CW FSK. Very sensitive. Listen to the world and space. Recently aligned and re-valved by ex-admiralty communication engineer. For quick sale £75 o.n.o. buyer collects. H.B. Askwith, 311, Lidgett Lane, Leeds LS17 6PD. Tel: Leeds 682682.

● IBM Golfball typewriter in good condition with computer interface, ideal for word processing. Suitable for enthusiasts with interfacing knowledge or anyone who needs a good typewriter £70 o.n.o. Also Powertran Lindsey-Hood 75W amplifier in teak sleeve, needs attention £20. Stuart Holden, 1 Bacons Yard, Ashwell, Herts SG7 5NH. Tel: 046274 2000.

● Must go! 10 memory phone, mute and auto redial, wall bracket. Sealed box, unwanted gift, hence give away price, only £17. Mr. Antony, 20 Kenmare Gardens, London N13 5DN. Tel: 01 807 4585.

● Mobile 80AM/FM Andrew J President C.B. boxed mint condition £60. Home base president Dight 80/AM built in clock S.W.R. meter A.W.1. with external speaker £80. Mobile president grant 120 CH AM/FM VSB/LSB 10Watts AM/FM 21 Watts P.E.P.side band boxed £100. For further info please enclose SAE to Mr. C.W. Woodward, 4 Fallows Road, Sparkbrook, Birmingham B11 1PQ.

● TS430S HF transceiver. C/W AM Filter, as new £630. Kenwood AT23 Antenna Tuner (new) £100. B/W video camera (Vidicon Tube) new £68. 8mm 'C' lens £30. R.L.Dixon, 51 Addington Rd, West Wickham, Kent BM4 9BN. Tel: 01 462 2222.

● KW2000a AC + DC PSU £180: TRIO 7730 25W 2M FM £180: TRIO 8300 70cm 10w FM most repeaters £100: Belcom Liner II 2m SSB £60: 2m 9 element X YAGi £10: Citizen stereo amp 8 wpc £20: Celestion Hedleigh Speakers 8Ω20W £20: Tel: 01 363 6075.

● Mizuho SB2M 2M CW/SSB rig. 144.200 to 144.400. NiCads and shoulder strap but no changer £70 ono. Liner 2. 2m. 55B, 10W 144.1 – 144.33. Manual £60 ovno. Heath 2m R16 offered as RX (TX needs rebuild)) manual etc worth £40 for case +PSU. 1Kx4 SRAM 2114 at 50p each. Some other comps. Tel: Yateley (0252) 871077.

● Modem 2200 Racal Milgo 1200 or 2400 B.P.S. many options, B.T. approved, good working order. £30 each or £50 for pair. Keyboard, enclosed alloy case, 76 good quality reed keys ideal for use with ZX81 or for other computer/RTTY uses £6. Phone Ralph G4PEY Horsham (0403) 69835.

● 40W stereo booster, 2 channel or 4 channel base, treble volume controls audioline 317 brand new unwanted. Present £30 new will accept £19.50. J Summerfield, 31 West Street, Earl Shilton, Leicestershire. Tel: Hinckley 612423 daytime only.

● Morse Code trainer prog for Oric 1, 16k or 48k, on cassette £4. W Adam, 14 Glastonbury Close, Kettering, Northants, NN15 5ES.

● Brand new, boxed and unused Lynx 96 home computer. Genuine reason for sale. Under guarantee £270 ovno. Bimal K.Jain, 6 Dagmar Road, Southall, Middlesex.

● R.A.F indicator type 75 ohms, 100 watts., dummy load and power. 2A meter £12. Aldis lamp with mini morse key and cables, box and strap £7. T1154M transmitter, grey crackle finish, all valves and cables. Data included. No PSU £30. Garrard record deck and mono amplifier £8. K W 'Viceroy' CW/SSB transmitter, integral mains PSU, fault, thus £35. Heathkit 'RA-1 Amateur Bands Receiver £35.Tuning caps, variometer coils, many valves, etc., offers.A W Mc Neill, 40 Turnpike Rd, Newbury, Berks, RG13 3AS. Telephone Newbury 40750

● For BBC Micro, model A or B. Radiocall will calculate feeder impedance, attenuators, coil inductance, resonant frequencies etc £2.50 including postage and packing. Martin Smith, 45 Stanhope Gardens, Ilford, IG1 3LQ.

● Muirhead Fax receiver (see recent articles). VDU and instrument cases. AOR280 handheld transceiver, headsets, printers, small video camera and monitor. Bob Sayers, 40 Royal Oak Drive, Leegomery, Telford, Shropshire, TF1 4SS

● Valves, brand new and boxed X63, PY31, DF33, L63, MH4, FC4, QP21, UCH21, UCF80, HBC91, 20D2, 43, QP21, U301, EK2, HL41, U101, Z21, TP23, U84, KT101, U33, 75, 5Z3, KT66, 6V6, 6D2, £15 ono the lot. N F Gee, 4 Byron Avenue, Lichfield, Staffs, WS14 9BX. Tel: Lichfield 51828.

● Solartron CD1014/K DB CRO wkg. Circuit data £40. Anita 1000 comptometer, 10 gas discharge readout tubes, mains operated £30. Harvard two XTAL channel CB Hand held, new £10. Marine radio receiver, sailor 40T, short, medium, long and marine bands. Exc. cond. £40. Tel: Hythe (Kent) 68854

● FT101E. 160-10m. vgc. Serviced by SMC 12V DC. and mains leads, service manual, handbook, mic, original packing and box £350. Reason for sale: Want to buy 2m all mode tx/rx. M Rogers, 662 Maidstone Road, Wigmore, Gillingham, Kent, ME8 0LH. Tel. Medway: 30822.

● Keith Monks record cleaning machine. Perfect condition little used, includes plastic cover, 100

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record inner sleeves, and two gallons cleaning fluid £500. Tel: Burgess Hill 3796.

● Vernier slow motion drive type 'D' brand new. 2 ECL86 Valves. 1 neon power indicator. 1 variable condenser double bank measures 3in sq. 1 toggle switch. Complete set of Radio Communication 1982. Old DX foreign list callbook and various lengths of GVY wires £15 lot. Will split. Tel: 0564 822280 (YL) G3XWV.

● Trio 2200 2m FM portable. Nicads, mains lead, case. R5. S11. 13. 18. 20. 22. £55. G6AFF QTHR. Tel: Crowthorne (0344) 776632.

● ZX 81 16k DK Tronics keyboard Q save prog. ass save inv. vid. £70. Books and software offers. swops. WHY? Martyn Bolt. 112 Leeds Road, Mirfield. W Yorks WF14 OJE.

● Shack sale, need room. Advance power packs PP3 Venner TSA6636/2M digital counter £25: Racal universal counter SA550 complete with SA544 active probe unit £40: Tektronix plug-in units No1A1 £40 and No CA £25: Tektronix 190A constant amplitude sig. gen. £45: AVO valve tester with manual No3 £20: several WWII American and British pieces of radio equipment – ie BC733-D, BC 433-G. Receivers type 78 & 76. Transmitter type 51: SCR625-F mine detector in own box. WWII vintage £50. Please write or call anytime. I need the room. Too many other electronic items to name here. Mr R J Shaw, 86a High Street, Poole, Dorset BH15 1DB.

● FDK Multi 2700 2m Multi Mode. USB LSB FM 5/10= AM CW. VFO 144 to 148 and synthesiser 143 to 148. Vox, speech compression and 70cm converter. All inbuilt. £275 ono. Tel: Burnham (06286) 64436. G6DRP NOT QTHR.

● Printer Okidata CP110. Commercial grade Matrix printer (ex BBC) centronics and RS232 interfaces. Wired for Dragon 32 but works most micros £90. CD-6000AR scanning aircraft band receiver. LED frequency display 110-139MHz. £75. G6HQK. Tel: Wolverhampton (0902) 69285.

● FT225RD mint cond. £460. FRG7 latest model + Dig freq display, dust cover £140. Datong Morse tutor, 4CX250B valve with base, chimney, brand new, offers. 9-ele Xtonna, new cond, with 50mtr of UR67 £40. 8mtr Mast with rigging £25. Can deliver to Lincs/Surrey/Hants. Tel: 0526 42710 at weekends only.

● Components, equipment, valves, transformers, coils, receivers, motors etc. Heaps of items, many of antique vintage, collected over the years. Must now have a good clear out! Please send a large SAE 8½in x 6in minimum for my long list of obsolete electronic items. R Francis, 93 Scrubs Lane, London NW10.

● Trio DM 801 GDO. Mint condition. £40 only. D Patrick (G8 NKU), 3 Castleacre Close, South Wootton, King's Lynn, Norfolk PE30 3TD. Tel: King's Lynn 674015.

● FT227R 2-metre mobile FM transceiver. 142-149MHz memory scanner. 10W remote control facility. Good condition. Works perfect. 14 element Parabeam 2m aerial. Good condition and excellent signal reports. Offers. Ross Adams, 'Kirojuke', Pett Road, Pett, Hastings, East Sussex TN35 4ME. Tel: Pett 2012.

● Bush radio about 1937. Good condition, working order. Offers to: H K Brown, 105 Mildmay Road, Chelmsford, Essex CM2 0DS. Tel: 351108 (evenings).

● Radio – realistic DX160 communications receiver, with speaker. Perfect condition. Bargain £60. Tel: 01-346 5889 (evenings or weekends).

● YAESU FT707-S. 8 band HF solid-state TX/RX. Work DXCC without TV1 with this super 20W rig, in mint cond. and orig. packing. Plus, H/B extl VFO for split freq. operation, very stable. £340 pair. Tel: 01-578 4484 (evenings).

● ZX81 with 16k RAM, full size k/board, progs, books £50. Yashica TL Elecro SLR camera with many extras 4 lenses £100. Colour darkroom outfit complete £125. Will consider exchange of any of the above for any decent radio gear. Dave GW6UGD. Tel: 0222 (Cardiff) 733885.

● Yaesu FT 22r/R memoriser 2 metres FM. 10Watts. Mint condition. Very little used £110. Yaesu FT 101 350Hz, CW filter. 160 to 30 metres. Looks and works like new £250. G4ENW QTHR. Tel: Southend 525569.

● Trio 2200G 2m FM 11 channels. New nicads. preamp, helical. Wood Douglas 10W linear, BP filter. 12V, nicad charger, neat case, all leads match 2200G. £80 the pair. G8EPF QTHR. Tel: Toddington (Beds) 2995.

● Icom IC730 HF transceiver with FM 100Watt output. 80-10mtr Warc. £430. Will accept part exchange handheld 2mtr transceiver or FT290R. LAR antenna switch, new £12. LAR HF ATU 160-10mtr Warc. new £50. LAR 160-10mtr antenna traps, new £14. Grundig satellite with SSB unit, 150kHz – 30MHz and VHF FM as new £120. Tel: (0772) 635560. Mike.

● FDK Multi 11, 2metre FM transceiver, 10W O/P, auto scan £100. Car radio MW/LW £5. AM CB £15. 1Kw paraffin heater £5. 40Amp earth leakage circuit breaker £10. Brand new 4CX250B valves £25. BSR record deck, electronic belt drive £5. Tel: Milton Keynes 316052. Mick.

● Pye Europa LBHP £40; HB £35; VHF £40; W15AM + cbox £20; L470 on70m £40; Converters at £15; 432-144 144-28 116-16 1296-144, Triplers at £15; 144-432 432-1296, MMA144X2 at £15; Lowe Rx ASV1515 at £20; 2200GX at £60; VFO-30 at £30; spectrum analyser S560 at £50; Marconi Sig gen THO64B/5 at £100; Telford TC9TX at £25; Hudson FM208 at £5; All as seen ono. G8HVV QTHR. Tel: Cambridge 0223-812188.

● Belcom LS102L 26-30 Multi- mode transceiver. Mobile bracket, power lead, all instructions £175. Offers considered. T D Purcell, 18 Marston Avenue, Chessington, Surrey. Tel: Chessington 391 0514.

● AR22 rotator and 8-ele Yagi. 2M ant. £45. G3SHQ QTHR. Tel: Twyford (0962) 713003.

● Pye pocket phone receivers. UHF. Less nicads £3 each. Discone antenna VHF, UHF for scanners £10. Bencher paddle silver tipped, as new £25 cost over £48. Marconi TF1064A signal generator, in perfect working order, price £65. Tel: Bart on Burnley, 0282 59320, anytime.

● ZX81 16K with 12 cassettes. All as new. Boxed £35. Tel: Maidenhead 20806.

● Radio and television servicing manuals. 17 Volume 1957/58 to 1975/76. Radio Constructor from January 1963 to July 1971. Practical Electronics from November 1964, first copy, to November 1972. Practical Wireless from August 1966 to December 1973. Television from October 1969 to June 1975. Some copies missing 1970/71. Any offer. P S Tehara, 21 Coombe Close, Langley Green, Crawley, Sussex RH11 7TP. Tel: 0293 31072.

● 'Her Indoors' Orders: multi FDK M2000 £125; FDK2700 £200; FT227RA + scan £150; Standard C78 + mntg £175; AR240 + access £95; linears MML432 1100TV £175; MML432/20 £45; MML144/100LS £125; HB 2m 2 x 4CX250B 650W £300; transverters MMT1296/144 LN £175; MMT432/144R £125; 5 x 200N £200; all as seen. ono. G8HVV QTHR. Tel: Cambridge 0223 812188.

● Teletype model 32, 5 unit code, 50 and 75 Baud gears, punch and reader in silence case on stand. Some paper tape and ribbons £55. J B Abbishaw, 22 Spell Close, Yarm, Cleveland TS15 9SD. Tel: Eaglescliffe 784454.

● ATV program for the 48K Spectrum as reviewed in Nov 83 R & EW now with 36 features, including testcards, maps, large printing. QRA calculator and much, much more. The price which includes a 16K version and full instructions, is only £5.50 inc P+P. For list of other programs send SAE: Robin Stephens, Toftwood, Mill Lane, High Salvington, Worthing, Sussex. Tel: Worthing 67228.

● Racal diversity unit £20. 'Persuader' CB speech processor £15. 2HD 12V batteries, new 125A £25 each. War medals exchange for TX/RX equip. Tel: 0908 314095.

● Realistic DX100L, 140kHz-30MHz receiver plus Binatone 12-channel hand-held CB transceiver. Both as new cond. Will exchange both for small dual trace oscilloscope. Tel: Chester 313857.

● Centronics ASCII dot-matrix printer. Vgc. C/W. A second printer for spares and workshop manual £100. Bill Coombes (G4ERV), 33 Clarence Park Road, Boscombe, Bournemouth. Tel: 0202 424092.

● Going QRT must sell. Trio TR2500 2 metre handheld, including leather case and spare nicad. Immac cond. £185. Two seven element 2 metre YAGi, plus combiner and coax for stacking. As new £45. Low loss coax heavy duty 20mm diameter 50Ω 100mm long £75. Phone G8TQO Hastings 437513 evenings.

● Morse Tutor program for BBC Micro only £3.50. Morse RX/TX program for BBC only £4.00. Also a few games programs for BBC, all on cassette. Cheap. Includes 747 Flight program only £4. Also circuit diagrams for many projects both valve and transistor, includes constructional details. Also Radofin TV game with cartridges (four). Only £23. SAE for full list. C J Duffy, 105 Cranbrook St, Oldham, Lancs, OL4 1QH.

● Aerial Rotator. Suit single 2M, 70cm or UHF TV beam. Fits tower or up to 2-inch mast. Complete with clamps and control unit £20. Tel: Pete. Brighton (0273) 563595.

● Taylor 171A, Electronic test meter, with handbook £30. RA 218, SSB, Unit, £20. FT 208R with YM24A speaker Mic, NC-9C charger, and soft case, £150. Sansui SC-3330 Stereo cassette deck, black £60. Sansui R50 Stereo receiver 50 wpc silver £50. R Jolly, 17 Mylen Road, Andover, Hants, SP10 3HD. Tel: 0264 53843.

● New Crompton Parkinson 240V, ¼ H.P. single phase 2,800 R.P.M. motor. Also same 1¼ H.P. 2800 R.P.M will sell or exchange for good A.T.U. S.W.R. power meter. Aerial Rotator. Two meter antenna. Dummy load. Desk Mic. or two meter convertor or W.H.Y. W. Hirst, 5, St Dominic Road, St John's Estate, Colchester, Essex. Tel: 0206 841538.

● Uniden 2030 2m FM transceiver. 12 channels £100. Audioline 412 car radio LW, MW & FM. Five push buttons £15. Portable reel tape recorder £10. Mains adaptor £3. R. Idiens, Chard, Bovingdon Green. Tel: Marlow 3186.

● Hitech high resolution computer (S100 BUS) colour graphics board and software £100. Quality Eprom U.V erasing lamp £20. North star software CP/M £25. C/Basic £25. Plus lots of others. Sony 2000P colour video camera £270 (brand new). HVA 200 P.S.U £40 (brand new). HVC caption/mix generator £80 (brand new). Might P/X for scope Gould trio or similar. Mr Chamberlain, 9 Goffs Close, Crawley, Sussex, RH11 8QB. Tel: Crawley (0293) 515201.

● Swop 2m SSB/CW MIZUHO h/held Nicad, s/mike etc. Also Suzuki F250, 2700 miles only 1980, MOT, extras, careful lady driver immaculate. Also Marconi CR100 receiver, with copy manual, spare valves. Also Sharp R-Reel stereo complete. Also Tandberg 2000, R-Reel complete. Tel: 0634 53874.

● National NC121 general coverage communications receiver. 550 kHz to 30 MHz. 240V or 110V operation. Mint condition. Comprehensive manual. £80. K W Clark (G3WIF), 16 Goldney Road, Clifton, Bristol. BS8 4RB. Tel: 0272 293738.

● UK 101 Wemon, Cegmon, toolkit 16K extras etc £100 or offers. 8086 development chip set £50. (includes monitor roms, interface chips etc, plus full documentation. Hugh Bridge, 363 Kennington Lane, Vauxhall, London, SE11 5QY. Tel: 01-735 1862.

● Drake MN4.C ATU SWR power meter rated 250W output, range 160m-10m. As new in box with instructions book £90. P J Bennett, (G3VDU-QTH), 56 Winchester Avenue, Weddington, Nuneaton, CV10 0DW. Tel: Nuneaton 349461.

● Sony HMK-9000 stereo music system. Many high quality features. Full function IR remote control. Crystal controlled turntable with auto disc size/speed selection, linear motor driven tonearm, Shure M75EDII cartridge. Any type of tape. Sendust head, brushless motors and automatic cassette track selection. 50+50W rms cont. 2 switched outputs. Digital clock and timer. Auto synchronised disc-cassette transfer. Mint condition with original packing etc. Cost £580. Offers over £290. Large SAE for photocopy of manual. Goodmans Mezzo SL speakers (60W) £75. Alex Gray, 49 Olney Road, Emberton, Olney, Bucks, MK46 5BU. Tel: 0234 713757.

● Yaesu FRG7 HF communications receiver with Marconi ATU. Excellent condition £120.00. Reason for sale moved house so not QTHR. G6SDP. Tel: Eastbourne 0323-30888

● Two 6½in speakers 8 OHM £1 each. Also baby alarm £3. All plus carriage. Tel: Halifax 0422 53979

● Yaesu FT200 100 watt HF transceiver. Perfect condition with desk mike £220 ono. Realistic DX300 digital communications receiver £120 ono. Trio 2300 portable two metre FM transceiver with Ni-

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cads, charger and power supply £125 ono. Martyn Moss (G4WBK) Tel: Sheffield 488564 (evenings or weekends)

● HRO 5T receiver with mains PSU and complete set of nine general coverage coils 50KL – 30ML. Clean working condition with handbook £25 plus carriage. Tel: 0745 570538

● FDK Multi 11, VHF, 2M, FM transceiver. Autoscan, tone burst, 10w o/p,£100. Car radio MW/LW £5. Roller blinds £3 and £5. Bamboo blind 5ft by 5ft £5. New 4CX250B valve £25. Earth leakage circuit breaker £10. Ring Mick, Milton Keynes 316052

● Yaesu FT708, 70cm FM hand-held transceiver with YM24A speaker/microphone. Very good condition with handbook £170. Postage extra. Peter Howard, 52 Fairview Way, Stafford, Staffs ST17 OAX Tel: Stafford (0785) 52693

● Datong Doppler radio direction finding equipment, mobile version. 27MHz magnetic arials also available. £110 or exchange HF receiver or microwave modules 432/144R transverter. Mike Fincher, 17 Albert Street, Tring, Herts. Tel: Tring 6752 (weekday evenings)

● Grundig Satellit 3400 digital receiver. Brand new. Unused. Still in box £275. Tel: 01 485 4251

● BARTG ST5/MCD and Creed 444, 45/50 baud rates, in perfect working order. Must sell as wife not very understanding hence £135. Also Atari 400. 48K, with recorder. Works perfectly. Only £150. Phone any time. Tel: 01 743 8352

● Yaesu FT7 HF SSB/CW 10watt TX/RX, used as base only. No mods, fitted 28MHz 'A' and 'B' Xtals. Excellent condition £220. Would consider part exchange for FT101E or similar. Cooper (G4PIY QTHR), Tel: Brookwood (Surrey) 2251 (evenings or weekends)

● Sommerkamp FL200B TX and matching FRI00B RX. Good working order. Manuals and diagrams. Ring Vic 02602-4197

● 2200G VHF portable: 10 channels fitted: c/w microphone, Helical, charger and Nicads £50 ono. G8RBT. Tel: Canterbury 66822 Ext 257 (office hours only)

● Creed 6/56 £4. Keyers, Iambic £11. Electronic £6. AVO universal bridge £15. 30A PSU, fully protected £40. 2A PSU £6.50. 60m reel, 300Ω ribbon, £3. 80m RX/TX direct conversion £16 (TX needs atten). 2KV DC PSU suit 813 linear £20. Trans 240V I/P. 16V, 30A output, £16. SEM HF Pre amp £8. G Martorano, 81 Sapcote Drive, Melton Mowbray, Leics LE13 1HG. Tel: 0664 500228

● Yaesu HF base or mobile rig. FT707 with matching power supply and antenna tuner, FP707 and FC707 never used, mobile. All boxed with instruction manuals. Cost £700 new. Accept £450. Carriage extra at cost, G14PCQ Tel: Belfast (0232) 612533

● General Electric 40ch FM base station CB. ⅓ of cost, £60 + post or swap valve £100 WHY. Two radio control Sherman tanks run from one control box, b/new £35. Ultra sonic alarm system uses coded keyboard, ⅓ cost. £50. FRG770D, as new, with ATU and 144/2 MM converter. The lot for £250 + post. SY200N scanner as new. Very good sensitivity on this unit £220 + post. Micronite 22-201B Multitester, 18 ranges, b/new £10+p. TR30 multiband radio, 54MHz to 176MHz, + CB, b/new Benkson £15+p. M/W English ball heads micrometer £12+p. Mitutoyo Metric STD. Micrometer £15+p. 13.8±V, 20amp min, PSU. Fan cooled. Total semiconductor £35. Must collect (heavy). Tel: (0473) 85526 anyday 9am to 12pm. John.

● Medium wave broadcast transmitter, 50W output, crystal controlled, excellent modulation quality. Unit employs valves but is compact and portable Can operate on HF bands. Full instructions included £130. Also 15W unit £70. Mr Cole, 39 Tooting Bec Gardens, London SW16 1RE. or Tel: 01-672 8764 evenings 7.30 to 8.30.

● CR100 £25. Homebrew 4m convertor £7. Jap bug key £5. Buyers collect. G4AWB Tel: 01-864 8656 after 6pm.

● Mega ultra violet exposure unit, type 2002, for printed circuit board work etc, with spare UV tube £30. Buyer collects. Mr G Walker, 77 Deerleap, Bretton, Peterborough. PE3 6YB Tel:269342

● Unused integrated circuits. TIL311 displays £3.50. TMS40L44, 4Kx1 memories £1.50. 7S11S £1.30. FCH111, FJL101, FCY101 30p each. Please include 40p for postage. B A Jones, 13 Albert St, Cheltenham, Glos

● Three Solatron scopes, type CD523S2, complete with manuals, trolley, four spare Z759 valves, new £55 collected. Dick (0533) 552809 evenings

● Epson MX80 F/T dot matrix printer, friction and form feed, word processor, quality output £210 ono Tel: Cambridge (0223) 64380

● Yaesu FT301. 100W output. Solid State transceiver. 13.8VDC input. Fitted AM/SSB/CW filters £350 ono. Trio R1000, MFRX, 1.5-30MHz £190. Home brew MF linear, parts include PSU comps £100. G2DAF design uses 4CX250 (plus spares). Several decades WW/RSGB bulletins free to collectors. Tel: 0908 313379

● ORIC programs RTTY (requires TU). Features split screen, memories, auto CR/LF £7.50. Morse tutor £4.50. QTH locator gives distance, bearing, points, £4.50. MML 144/100 two metre linear £70. 13V 18 amp PSU £75. T Tugwell, 11 The Dell, Stevenage, Herts, SG1 1PH. Tel: 0438 354689

● Trio TR9000 2M multimode rig, 10 watts, FM/SSB/CW. Also 13.5V, 7amp PSU both for only £240. 100 watt microwave modules linear (144/1005) 10 watts in £100. 13.5V @ 7-10 amp power supply (ex-computer) £30. Offers? WHY? Rig and linear together £320 ono. Tel: Sittingbourne (0795) 75093 evenings, weekends. Ask for Tim

● Distortion meter BKF5. £25. Two ACR13 tubes unused £6 each. CRM123 tube unused £6. Various TTL, CMOS, transistors and small components. All cheap. Please enquire Tel: 04446 2974

● FT707 boxed. Used RX only £325. FT102 as new, boxed £550. Western electronics 70TV 28-432 transverter £50. FR101 FM board with filter £10. R Whitehead, 14 Southgate Crescent, Rodborough, Stroud, Glos GL5-3TS Tel: Stroud 2429

● MZ80K Sharp, 48K computer, complete with basic tape and morse tuition. Could be used for RTTY £230 ono. Good working order. Also Tono 550 RTTY and morse unit as new. Excellent piece of equipment and works well £230. Can demonstrate if required. Buyers collect or pay transport. Tel: Gosport 585638

● MML 144/100-S. Reconditioned by makers Nov 1983. £65 ono. Tel: 026-582-3287. Ask for Jim

● Texas 14 pin sockets, 10 for £1.20: 8 pin sockets, 10 for £1 +SAE. Also some electrolytic capacitors from 6.3V to 60V and 2.2UF to 640UF. SAE for list. Also some new valves. D Martin, 29 St Johns Close, Leatherhead, Surrey.

● Icom IC-457E 70cm multimode base station in VGC original packing, leads etc. Sell for £400 or exchange for Icom R70 or Tr10 R-2000 receiver. Tel: Ian Shepshed (Leics) 0509 502989

● Duplicator with cabinet. Will accept £230. Space required. Tel: 01-459 8274

● Cheap computer printers. Centronics 306 dot matrix printer, 120CPS with manual £120 ono; KSR35 heavy duty teletype friction feed £30 ono; RO35 teletype mech. with sprocket feed, no electronics £10: IBM electric typewriter wih box of decoding relays £10. Also 19in rack cabinet with fan. Offers. D S Francis, 22 Clifton Wood, Holbrook, Ipswich IP9 2PY Tel: (0473) 328013

● FM TX 88 to 105 MHz. 80 watts RF output. Stable and clean with instructions £120. Tel: 01-672 8764 ask for Julian.

● Radio valves new, boxed ECL82 70p. EZ80 60p. UCH81 75p. UABC80 65p. UCC85 70p. UL84 £1. UY85 60p. plus SAE. 8 pin IC sockets (Texas) 5p each, 14 pin 6p each, +SAE. Electrolytic capacitors (100uF 25v 11p), (160uF 25v 15p), (640uF 40v 25p), (250uF 64v 25p) each +SAE. D Martin, 29 St Johns Close, Leatherhead, Surrey

● Sharp MZ80K personal computer, one year old, exc condition. Software includes Pascal, assembler dis-assembler, plus many games including space invaders. Three books about the MZ80K. All worth over £450. Will accept £250 ono. S Ibrahim Tel: 0992 466240 (only after 6pm)

● Frequency meter. Also DMM with capacitor. R Phillips, 4 Riversley Road, Gloucester GL2 0QT

● Several lots of electronic bits. Write Martin Black, 11 Moorland Avenue, Crumpsall, Manchester. M8 6WT Tel: 061 795 5025

● MM4000 RTTY £200. World wide frequency list 10 to 160kHz £6. Crispino Messina, Via Di Porto, 10, 50058, Signa Fi, Italy

● Racal diversity unit £20. Large collection 1/96in scale die-cast military vehicle models £250. Military campaign medals. Collectors RX Howard 450 circa 1937, very rare, £100 ono. Working and good condx for age. Tel: Milton Keynes – 0908 314095

WANTED

● Any info plus MW and SW loops Detector set RF interference CT-6625-99-924-1533, MMT 1296/144 transverter. Watkins & Johnson travelling wave tubes, bits at 10 and 24 GHz. Crispino Messina, Via di Porto, 10, 50058. Signa FI, Italy.

● Collins Kokusai Toko or similar 455KHz mechanical 55B filter. Spares for Collins 325-1 or 755-1. Scrap set considered. T Simpson (G3NSF), 58 Cemetery Road, Houghton Regis, Dunstable, Beds. LU5 5DA. Tel: Dunstable (0582) 62621.

● McMichael Radios, TVs, advertising literature, etc. Also MH components. Free servicing data for McMichael Radios: just send model and serial numbers. D F Cochrane, 55 Hazell Way, Stoke Poges, Bucks. SL2 4DD. Tel: 02814-2396.

● YAESU FTOX 401, any info on mods, extra bands, rit. Has anyone fitted FM? Any info on general operation and care. Full photocopy and camera copy available. All documents returned in A1 condition. Ian Smith, G6MVM, 24 Seaview Road, Herne Bay, Kent, CT6 6JA.

● 2 MTR Rig with CW, modern: or WHY have to P/X 12in cut frontier (F.35) chain saw little used: typewriter Imperial in case (portable): FDK 16 XTAL VHF/FM Receiver Mains/12 volt 2 mtr/marine. Can sort a swop local if poss. Ring Syd, Bursledon 4333 (Hants) any time till midnight.

● Lloydtron Pathfinder 12 bands receiver or anything similar. Delroy Rowe, 178 Ferrars Road, Sheffield, S9 1SA.

● German WW2 Radio and Radar equipment and parts/accessories. Offering British WW2 Radios in return or cash. Also interested in technical descriptions, documentation of German military electronics from the war. Will collect or pay transport. R Otterstad, Vejdammen 5, DK-2840 Holte, Denmark. Tel: (452) 801875 (pm).

● Information on Sony ICF-2001. External aerials, possible ATV's, attenuators. Also circuit diagram, changes for improving selectivity, and any information related to this receiver. Write to E Napchan, Imperial College, Dept. Metallurgy, London, SW7. Tel: 01-589 5111 ext.1777.

● Transistors BFQ85. K Craft, 'Ness Bank', Invermoriston, Inverness. IV3 6YE. Tel: 0320-51218.

● Help needed by school to interface BBC Micro to Creed 7B Teletype. Ends in nine pin plug. All letters answered. J Mercer, 5 Bushey Road, Sutton, Surrey. SM1 1QR.

● Akai VC115 Mono-chrome camera for spare parts. Tel: Bath (0225) 29309.

● Telescopic mast at least 40ft. Must be easy up and down to experiment with 934MHz aerials. N Childs, 30 Chobham Rd, Knaphill, Woking, Surrey. GU21 2TA. Tel: Brookwood 2011

● Old books about amateur radio. Details to M. Twigg, 30 Valley Drive, Yarm, Cleveland, TS15 9JQ.

● Datong D70 Morse Tutor. I'm desperate for that 'A' licence. Telephone or write. M Jackman, (G6TGZ), 96 Porter Road, Brighton Hill, Basingstoke, Hants. RG22 4SR. Tel: Hackwood 4260 (Home) or Hackwood 4011 ext. 59 (Work).

● 4CX250B Valves and VHF or UHF bases. 2C39A or 7289 ceramic valves prefer EIMAC if possible. Also require Linear Amplifier components, HF to UHF. Cash waiting. John Moxham (G8KBQ), 22 Whiting Road, Glastonbury, Somerset. BA6 8HP. Tel: 0458 33145 (Work).

● Back issues of QST 1950-1979. Eddystone Panoramic Display Unit EP15. Eddystone 850/4 LF Receiver. Tel: Wokingham 782236.

● YAESU FRG 7700. R R Phillips, 4 Riversley Road, Gloucester. GL2 0QT.

● Two air-spaced variable condensers, one 500pf straight line capacity and one straight line frequency 350pf. Cyldon types liked if available. Tel: 01-555 5900 (evenings).

● Radio/TV servicing books from 1968 to 1983 and circuit diagrams. Tel: Bradford (0274) 308853

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evenings and weekends.

● Hewlett Packard 410C electronic voltmeter, 8405A vector voltmeter, 432A power meter. Any condition considered since I can repair. Interested in other HP gear. S J Branson, 111 Park Road, Peterborough. Tel: (0733) 67604 weekend.P

● Photocopy or original handbook/circuit for Philips GM2891/05, 405 line pattern generator. Tel: 0993-882238 (weekends or evenings).

● Swop Phillips G7000 Home Video Computer with seven game cartridges including golf, samurai, baseball, etc., for SX 200-N scanner in mint condition. Mrs J Chapple, 14 Orchard Bank, Drayton, Norwich, Norfolk. NR8 6RN. Tel: 0603-867005.

● Old wireless books, magazines, catalogues, QSL-cards, wiring diagrams, Gamages catalogue, morse keys, valves, components, Baird neon tube, Baird vision record. Details to Douglas Byrne, G3KPO, 34 Pellhurst Road, Ryde, IOW. Tel: 0983 62513.

● Circuit diagrams service sheets or any inform data following TV receivers. Sony Transistor Portable Model TV 110UK; old GEC 24in B/W, has separate tuners 405 and 625 line. Has no model number. C Barrett, 22 Hollyfield Avenue, London. N11 3BY. Tel: 01-361 8961.

● Buy or borrow manual and circuit diagram for SA-28-SII Super Delux 10mtrs Mobile Unit with variable power atten and scan mode. Tel: 061 748 9804.

● 2 metre TX/RX for new station. Must be cheap as I am not in work. G6 RBF Martin Black, 11 Moorland Avenue, Crumpsall, Manchester 8. Tel: 061 795 5025.

● Tektronix 454 oscilloscope, working or not. Tel: Ingatestone (0277) 352105.

● Hard up student requires HF receiver-/transceiver. Any condition but must work. Contact Brian Barwick. Tel: Bradford 0274 727734.

● Oscilloscope, Hitachi or other make if in good condition. Phone Mr Lee G4TWL. Maldon 0621 76577.

● Wireless World back issues 1970 to 1979 complete. £5. Tel: Burgess Hill 3796.

● ETM2(B) Keyer about £10. G4RGB. Tel: Medway (Kent) 0634 30822. Ring anytime, day or night. (Ansafone).

● Trio AT230 and VFO230. Tel: Gosport 585638.

● Modern CTV alignment test gear and solartron 1400 CRO probes. Tel: Hythe (Kent) 68854.

● Plustron TVR5D or similar for DXTV reception. Tel: Lichfield (Staffs) 51828.

● Standard CV110 VFO, Yaesu FRT 7700 ATU. Any copies of US Magazine 'Byte' prior to May 1982. Software or accessories for Tandy Model 100. Bob Sayers, 40 Royal Oak Drive, Leegomery, Telford, Shropshire TF1 4SS.

● Amateur Radio magazine for November to complete collection. Will pay £2 or copy of above program. Martin Smith, 45 Stanhope Gardens, Ilford. IG1 3LQ. Tel: 01-554 2767.

● Low cost commercial makes QRP gear; details: McNeill, Tel: Newbury 40750.

● Non working but complete home computers. Contact Bimal K Jain, 6 Dagmar Road, Southall, Middlesex.

● Non working but repairable EX-WD type RX/TX, BC348, HRO, AR88, GELOSO, Hallicrafters, Hammerlund, etc. Will collect. Fair prices paid. Tel: Milton Keynes (0908) 314095.

● Philips N1700 video, working order. Will pay carriage. Please send details of price required. Or Sanyo Betamax video working or not. Joseph Milne, 52 Baillie Drive, Bothwell, Glasgow.

● To purchase or copy manual and circuit diagram for Grundig transistor radio satellite 6001. Also SSB connector for the above model. W Rigby, 34 Clarence St, Morecambe, Lancs LA4 5EX

● Ex-RAF type D morse key, and aircraft key. Also official manuals and any photographs of following: ex-RAF TX/RX R1082/T1083; ex-RAF Hallicrafters RX; ex-RAF signals vans as used in Western Desert. Frank Glynn, 41 Crossways Avenue, East Grinstead, Sussex. RH19 1JD. Tel: (0342) 22967

● KW 160m. ATV. KW 80-10m. (E-ZEE) match ATU. Good wkg cond. Cash waiting. A Newton, 35 Poplar Road, Rayleigh, Essex. SS6 8SN. Tel: Rayleigh 774195 (Evgs)

● Service manual for Philips N1700/15, also Decca Legato cassette recorder. Non-worker considered. L W Elliott, Brethergate, Westwood St, Doncaster. DN9 2AD Tel: 0427 752528

● Heathkit barograph, type ID2090E, kit, part built or completed. Microscope slides, accessories. Marconi signal generator. 812 valve. Thruline elements particularly 250H. Bencher keying lever. Yaesu Y0901P, FV901DM. Details of paper tear-off adaptor for Commodore printer. A.F. signal generator. ATV to TV converter. Modem. FAX receiver. 117MHz crystal. Rohde Schwarz diagraph. McCann, Tel: 0772 37815

● Ex W.D. RX, H.R.O. BC348, SX27, Redifon, 1155, CR100 etc. working or not. Can collect. Reasonable price paid. Tel: Milton Keynes-0908-314095

● Two brand new 4CX-250B valves and two U.H.F. bases. Will exch for two brand new TY4-400C Mullard valves. Value about £160 a pair. Contact Geoff (G8ONG). Tel: Norwich 715423 (after 6pm)

● Circuit/handbook/data Eddystone 730/4 receiver. Purchase or loan. Tel: 07476 2024

● Want to contact somebody to buy and send to me technical publications and small components, all expenses covered. Please write to Prof. A Fanzeres, PO Box 2483, Rio de Janeiro, 20.001, BRAZIL

● Urgently require Yaesu FRG7 receiver/operating handbook. Beg, buy or borrow! All postage costs refunded. Also circuit diagram required and service handbook for same. Ian Dent, 7 Argyle Terrace, Newbiggin by Sea, Northumberland-NE64 6PR. Tel: 0670 816078 (evenings and weekends)

● Icom ICB 1050 handbook or cirt diagram and PC layout – photocopy or loan p.paid. For conversion and repair. Also any Ferrite cores for this model or where can be purchased? G2DHV QTHR.G V Haylock, 28 Longlands Road, Sidcup, Kent. DA15 7LT Tel: 01-300 1649

● To purchase or photocopy manual or circuit diagram of telequipment DM53A double beam scope. Also required, two plug in Y amps for same. Possibly amp type A and X T/base switch. A diagram for telequipment D43 also required less urgently. P Owen, 127 Stepney Rd, Scarborough, N Yorks YO12 5NJ Tel: 0723 373303

● Yaesu YO-901 multiscope and FT-101ZD MkIII. P Sullivan, 39 Merivale Rd, Lawford, Manningtree, Essex. Tel: Colchester 4336

● Circuit diagram for Jennings 'Univox' J6.Mod. (musical keyboard). Price to H Haden. 28 Welch Hill Street, Leigh, Lancs.

● ET021 Varicap tuner, VHF- UHF. Phone Rob, (01) 341 2642, mornings

● Valves for Racal RA-17 Mk2, E180F, 6F33, 6A56 and circuit diagram for Racal RA-17 MkII, North American version. Offers to: J H Kroon, Ziewegje T/O No 14, 2033AD, Haarlem, Holland

● Exchange SP600 APR4 and Lloytron 12 band portable for 7700 or APR9 or SX200N. D Everall, 36 Eleanor Road, Waltham Cross, Herts EN8 7DL

● Vacation employment wanted. 1st year physics student at Imperial College London wants any interesting job during July to October. Anything considered. Enjoyment more important than high pay. Licenced radio amateur, driving licence, very keen electronics design and construction. G8WKS. Andrew Larkins, 55 Evelyn Gardens, London SW7 3BH Tel: 01-373-0429

● Manual or circuit diagram for Sony Tektronix 335 oscilloscope. Buy or borrow. William McMillan, 149 Easterhill St, Glasgow. Tel: 041-778 5040

● Mirage two metre linear RF amplifier type 3016. Tel: 0420 82739. Ask for John (G8BIH)

● N1700 Philips video part. Audio-sync head required, plus other bits. What have you? Or exchange G6 CTV spares, Philips TX portable chassis, Pye. Thorn CTV parts etc. Tel: 0742-311191 after 4.30pm

● ZX81. Anything considered old colour LOPT. Non-working acceptable but Ferrite must be unbroken. Tel: 04446-2974

● CB sets. Must be working. For breaking. Must be cheap. D Martin, 29 St John's Close, Leatherhead, Surrey

● Drake desk mic, type 7075, heavy duty. Price and details QTH. P J Bennett (G3VDU), 56 Winchester Ave, Weddington, Nuneaton CV10-ODW Tel: 349461

● Disk drives for Nascom or UKLO1. Also printer, serial terminal (R8232) or WHY. Hugh Bridge, 363 Kennington Lane, Vauxhall, London SE11 5QY Tel: 01-735 1862

● Bright emitter valves, amplion dragonfly horn speaker, pre-1930 wireless mags and pre-1926 wireless set. Also Yaesu FT75 transceiver. K W Clark (G3WIF), 16 Goldney Road, Clifton, Bristol BS8 4RB Tel: 0272 293738

● 2m multi-mode, HF antenna rotator scope or WHY. Tel: Medway 0634 53874

● A CB radio or any electronic components. C Anand. Tel: Basildon 726288

● Back copies of BBC and IBA pocket books (transmitter listings) and also IBA technical reviews 1 to 10. Tel: Dursley 0453 842238 (evenings/weekends)

● Post war Hallicrafters and/or Lafayette amateur bands receiver. Would consider general coverage model. Please advise condition and price wanted. Geoff Mersereav, Crucible Theatre, 55 Norfolk St, Sheffield. S1 10A Tel: 0742 760621

● EHT generator for Solartron oscilloscope type CD1740. G61HF Qthr. Tel: Ashford (Middx) 44745

● 3 pin Xtal ZA13327, 100/1000 KC/S, working, ex-class D wavemeter, etc. Circuit/handbook for crystal calibrator type BW270 GEC – Salford electrical instruments. Microwave modules, receive converter, MMC 144/28 LO. AG Edwards (G3MBL), 244 Ballards Lane, London N12 OEP Tel: 01-445 4321

● Yaesu FT901 accessories. FV 901 VFO. FTV 901R transverter plus 2m module and others. Mint cond. With connecting cables if possible. Details, price to Alan Littlewood (G3FPJ), Marrolomeda, Holne, Newton Abbot, Devon TQ137SJ

● CCT diagrams and data on the following. Airmec wave analyser 248A and 853. B.TH Rotabalance type 83 and Marconi signal generator T.F.144H/S. Also C.V to commercial valve charts. Reasonable prices paid. LRK Gregory, The Well House, The Downs, Herne Bay, Kent CT6-6JP Tel: 02273 4774

● Eimac or AEI Loctal valve socket for 4CX250B Tel: 0903 66329

● Heathkit SB-401 transmitter with manual. Fair price paid. Please state condition and price to K Depledge (G3 PAN), 24 Cooks Drove, Earith, Huntingdon, Cambs. Tel· 0487 842224 (after 6)

● Transmitting ATU high voltage variable capacitors etc. Mr Winwood, 132 Shakespeare Crescent, Hallowes, Dronfield, Derbyshire. S18 6ND. Tel: 0246 410057

● FT290R wanted. T Leitholm, Tunstead Road, Hoveton, Norwich. Tel: Wroxham 2109

● American data book digital ICs. Also linear ICs and Tektronix IAI plug-in. Spares for Collins 75-S1 and 32S-1. G3NSF. Tel: 0582 62621

● Any information on Savage amplifier K.M.2N and I.R.D. Corp. mech analysis model 330 – 24. Reasonable price paid. Can photocopy. Also 'S' meter for AR 88. LRK Gregory, The Well House, The Downs, Herne Bay. CT6-6JP. Tel: 02273 4774

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Simply complete the order form overleaf, although we will accept ads not on our order form. Feel free to use an extra sheet of paper if there is not enough space on the order form. Send to: ***Radio & Electronics World*** Small Ads, Sovereign House, Brentwood, Essex CM14 4SE.

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