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The communications and electronics magazine

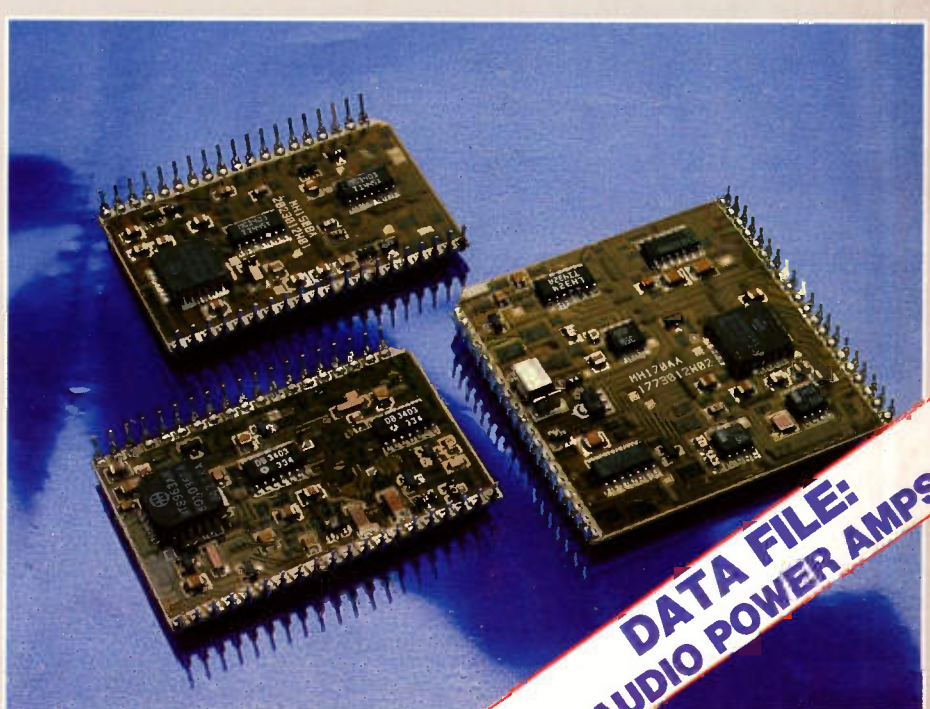
KP-202 MODS:
BARGAIN BASEMENT 2M HAND-HELD

Rx REVIEW:
NEW BROADCAST RECEIVERS

TRIODE VALVE:
THE TRIODE AS AN AMPLIFIER

NETWORK 934:
THE ONLY REGULAR 934MHz COLUMN?

TV DISH:
A TVRO DISH GOING CHEAP



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RWC AUTUMN SALE

This is our first ever Shop Sale in over Five years trading in the Amateur Radio Field (about time too!) All stock offered is new and has full warranty. Some units are Ex-Demonstration and may have slightly marked Boxes. We need to clear some stock to make way for our new range of scanning receivers and other products. Pssss, Keep in touch for latest news.

Important Note Due to current exchange rates the price of all imported equipment is subject to change, and rarely do prices come down (you noticed!) we anticipate a price increase on ICOM, YAESU and KENWOOD/TRIO of between 5-20% imminently. This added to copy dates of between 1 and 3 months before the magazines appear on sale means that you normally have up to a three month old price list! we hold our prices on existing stocks and usually get **NO WARNING** from our suppliers when prices go up. Consequently we often have to make a sale at the OLD PRICE or loose a good customer. Well, if you want a Bargain here are some offers you cannot refuse, **DONT SAY WE DIDN'T WARN YOU, we will never again be able to make you the following offers!**

Sorry Bernie and Brenda, Harvey and Peter, we are having a SALE!
(prior to opening our Fast food Take-away maybe!)

All goods are offered on a first-come first-served bases. Please check stock levels before ordering.
Please add post and packing of £5.00 minimum on transceivers and £2.50 on accessories. Datapost/Next day delivery extra. Please telephone for more details. PART EXCHANGE WELCOME, FULL CREDIT FACILITIES ARRANGED AND INTEREST FREE FINANCE ON SELECTED ITEMS. (SUBJECT TO STATUS)

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Safety in the shack

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

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

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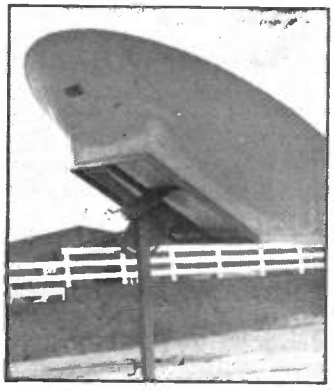
Cover date November 1986 on sale Thursday, 9 October

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

Big and expensive...



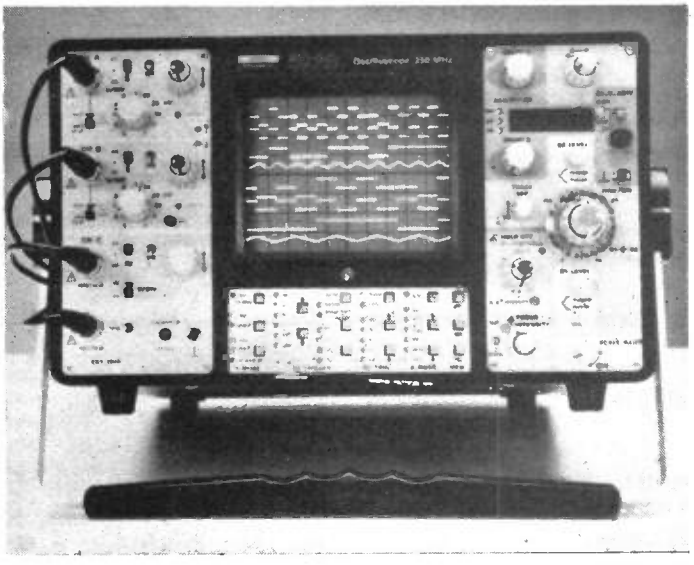
...or cheap and cheerful

Hello Ken!

Hello ugly!

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



250MHz OSCILLOSCOPE

A 250MHz oscilloscope designed to give the maximum degree of measurement flexibility but which remains simple to use has been introduced by Solartron Instruments. The 5228 Compact Oscilloscope makes use of clear function keys to simplify operator procedures while providing storage for two complete oscilloscope configurations, which can be recalled at any time even after the instrument has been switched off.

The 5228 has a bandwidth of 250MHz together with a wide choice of independent, clearly identified trigger modes for each timebase.

The oscilloscope's input impedance is 50 ohms or 1 megohm for channels A and B, which can be selected from the front panel controls, and 10M or 100M according to the probe used. The vertical axis provides for simultaneous display of channels A and B, the algebraic sum of A±B, and channel C.

A high luminosity spot CRT gives easy, simultaneous display of any type of signal. All sweep combinations are possible, including the 'mixed' and 'alternative' modes.

A built-in multimeter with automatic range selection and LED display is incorporated in the 5228, for measurement of time interval, offset amplitude and input voltage values. A selectable filter enables the vertical amplifier bandwidth to be reduced to 20MHz.

A third input (channel C) has two sensitivity positions: one is 100mV/div and the other is 1V/div.

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

LOGIC ANALYSER

Fieldtech Heathrow has introduced the Meguro MLA-3300 16-channel logic analyser, a compact, lightweight instrument with a 100ns maximum resolution (at 10MHz). The liquid crystal display gives the analyser very low power dissipation in logic circuits, allowing battery-powered operation. The analyser is designed to measure timing, state and signature and can be used in many applications from hardware to software.

The instrument may be powered from mains voltage, a 5-8V dc line in or by its internal nicad battery. In addition to the 16-channel data input there is an external clock input, external trigger input and a clock qualifier input.

The MLA-3300 provides a 256-bit/channel acquisition memory and a 256-bit/channel reference memory, allowing comparative acquisition. Both memories have a storage back-up facility allowing detailed analysis at a later time if required.

Power trigger functions including words, glitch detection and clock delay send all assigned data into memory: glitch detection speed is at least 15ns.

Fieldtech Heathrow Ltd,
Huntavia House,
420 Bath Road,
Longford,
Middlesex UB7 0LL.
Tel: (01) 897 6446.

LOGIC ANALYSIS

New from Thurlby Electronics is the LA160-PC interface package which provides the facilities of a sophisticated logic analyser using a standard IBM PC or compatible computer.

The package allows a Thurlby LA160 16 or 32-channel logic analyser to be linked to the computer via its RS232 interface. The software takes data from the LA160 and loads it into the computer memory. A user friendly control program makes maximum use of the computer's graphics functions, disc storage, printing capability and computational powers to provide the user with sophisticated facilities.

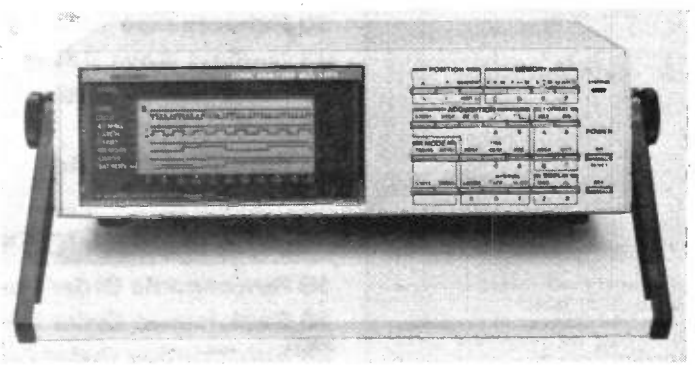
In the timing display mode the screen shows 16 channels vertically with either 64, 256 or 1024 samples horizontally. Each channel can be given a user defined name and can be placed in any desired position. A moveable cursor and a moveable pointer are provided. The screen also shows a read-out of the cursor position, the pointer position, the time difference between the two, and the data word value at the pointer position.

Instantaneous pan and zoom facilities are provided, enabling specific areas of interest to be located and examined in detail very quickly. Careful use is made of colour in order to aid legibility and clarity, although the system can also be used with a monochrome monitor.

In the state display mode a page of 30 words can be displayed from anywhere in the memory. The data format can be binary, octal, decimal, hex or ASCII, and formats can be mixed.

The Thurlby LA160-PC operates with the IBM PC/XT or AT, and with most close compatibles including Olivetti, Compaq and Sperry. The cost of the LA160-PC interface package is £99+VAT. The cost of the Thurlby LA160A logic analyser is £395+VAT.

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



DMM

The model 4500 digital multimeter, available from PPM, requires no test probe for measurement of voltages up to 15kV dc or peak ac. Only for voltages in excess of 15kV, and up to 40kV, is the optionally available high voltage divider probe required.

This 4½-digit instrument provides 0.005% resolution, permitting measurements down to 10μV. The unit offers six ranges each of ac volts, dc volts, and high and low ohms. On the two lowest voltage ranges input impedance is 1000 megohms, which improves measurement integrity by a factor of 100 compared with conventional DMMs.

The constant current digital ohmmeter section has three dedicated diode check ranges which supply adequate potential to forward bias most semiconductor junctions so that actual junction voltage drop can be displayed. The remaining three ohm ranges will not turn on a diode junction.

For ac measurements the unit features a wideband, low noise average responding ac converter, offering ±0.25% accuracy with bandwidth specified to 50kHz. True rms is optionally available for applications where highly distorted waveforms are frequently encountered.

The model 4500 is powered by an internal rechargeable battery pack and charging circuitry running on 230V mains supply.

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

HIGH SPEC SCOPE

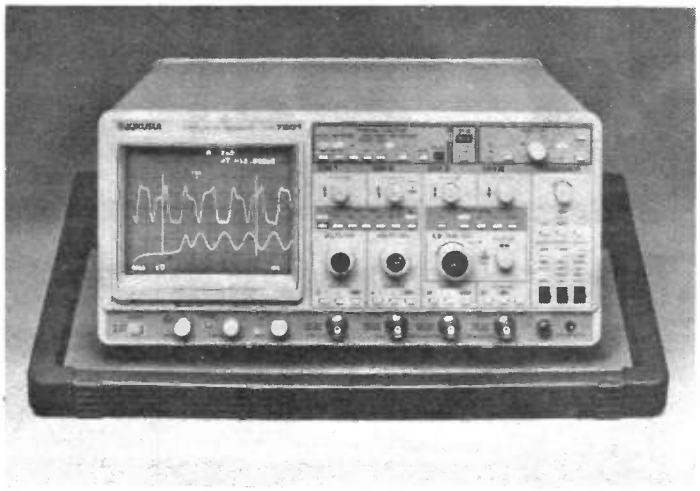
Telonic Instruments Ltd, the UK distributor for Kikusui, have announced the availability of a new high specification CRT read-out oscilloscope range.

The COM 7000 series consists of 6 models with real-time bandwidths of up to 200MHz, all with CRT read-out, built-in DVM and frequency counter. Three of the six new instruments also incorporate digital storage.

The top of the range is the COM 7201, a 200MHz real-time bandwidth instrument with 50MHz clock rate digital storage capability and GPIB compatibility.

In real-time mode the COM 7201 has 4 inputs, all with a 200MHz bandwidth. Channels 1 and 2 have selectable input impedances of 1 megohm or 50 ohms and have a sensitivity range from 1mV/div to 5V/div. Channels 3 and 4 have sensitivities of 0.1V/div or 0.5V/div.

Timebase speeds cover 1 nanosec/div to 0.5 sec/div on both A and B timebases. The timebases can be operated in A only, alternate, B only or B triggered modes. The variable delay time range is 100 nanosecs to 5 seconds. Two separate trigger circuits provide for internal or external trigger capability.



In its digital storage mode the COM 7201 has 50MHz clock rate 8-bit A to D converters. Single-shot sinusoidal events up to 20MHz can be stored by using the sinusoidal interpolation facility. Repetitive signals up to 100MHz can be stored by using the repeat function (equivalent to sampling). A magnification function allows the stored waveform to be magnified by up to 100 times centred on the trigger point.

Telonic will be displaying the COM 7000 range at the International Test and Measurement Exhibition, Olympia, London, from 23rd-25th September. Also on show will be Kikusui's new FFT analyser, synthesizer function generator and various logic analysers and conventional scopes.

Telonic Instruments Ltd,
Boyn Valley Road,
Maidenhead,
Berks SL6 4EG.
Tel: (0628) 73933.

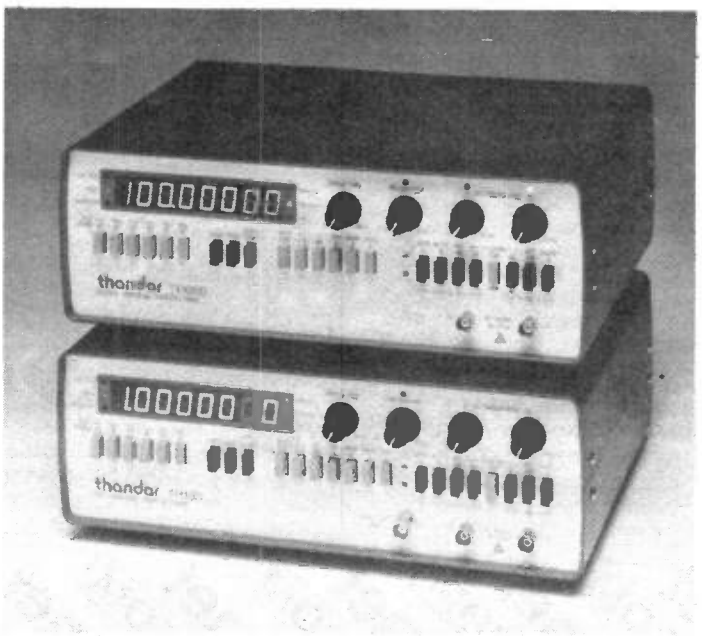
COUNTER TIMERS

Thandar have introduced two new counter timers. Designated the TF1000 and TF1100 respectively, they offer the following specifications.

The TF1000 is a 100MHz universal counter timer with frequency, period, period average, time interval, time interval average, frequency ratio and totalise measurement modes.

Both inputs (A and B) have dc to 100MHz bandwidth, ac or dc coupling, slope selection and a ×1/×10 attenuator. Channel A also has an HF filter. Both channels have trigger level controls with 3-state trigger indicators.

A trigger hold-off control is provided for time interval measurements and a display timer control allows display times between 100ms and infinity (hold). There is an 8-digit 0.56 inch red LED display with six additional annunciators for external standard, gate, overflow, MHz/μs, kHz/ms and seconds.



Mounted on the rear panel are an internal/external clock switch and socket, low frequency monitors for channels A and B for probe calibration, and dc trigger level outputs for A and B. There is also a monitor output for indication of start and stop points when in time interval mode; the output has 3 states when trigger hold-off is selected.

The TF1100 has an extra input (C) to allow frequency measurements to 1GHz. Both models have a high stability timebase option based upon a fast warm-up ovened crystal.

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

ICOM

Total coverage.. 100kHz to 2GHz!

IC-R7000.

The R71E now has a team-mate – the IC-R7000. With these matching receivers it is now possible to tune from 100KHz-2GHz.*

The IC-R7000 covers Aircraft, Marine, FM Broadcast, Amateur Radio, Television and weather satellite bands. The IC-R7000 incorporates FM wide/FM narrow, AM, USB and LSB modes of operation with six tuning speeds - 0.1, 1.0, 5, 10, 12.5, and 25KHz. *Frequency coverage 25-1000MHz and 1025-2000MHz (25-1000MHz and 1260-1300MHz guaranteed specification). With the IC-R7000 you have normal tuning capability with the front panel tuning knob or for quick tuning of a desired frequency by using the front panel key-pad. A total of 99 memory channels are available for storage of received frequencies and operating mode. Memory channels can be called up by pressing the memory switch then rotating the memory channel knob or by direct keyboard entry.

These receivers are available seperately but together would make a superb listening station for the shortwave listener or licensed amateur.

A sophisticated scanning system provides instant access to specific frequency ranges. By depressing the Auto M switch, the IC-R7000 automatically memorises frequencies that are in use whilst in the scan mode and can be recalled later. The scanning speed is adjustable and the scanning system includes memory selected frequency ranges or priority channels. All functions including memory channel readout are clearly shown on a dual-colour fluorescent display with dimmer switch. Other features include dial-lock, noise blanker, S-meter and attenuator.

Options include: RC12 infra red controller, EX310 voice synthesizer, SP3 and SP7 external loudspeakers, HP1 headphones and the ICOM AH-7000 super wideband discone antenna.

The IC-R71E is a general coverage receiver 100KHz-30MHz featuring direct keyboard frequency entry and infra-red remote controller (optional). SSB, AM, CW, RTTY and FM (optional) modes of operation. With 32 programmable memory channels, twin VFO's scanning systems, selectable AGC, noise blanker, pass band tuning and a deep notch filter. Keyboard frequencies can be selected by pushing the digit keys in sequence of frequency. The frequency is altered without changing the main tuning control. Options include: EX257 FM unit, RC11 infra-red controller, CK70 D.C. adaptor for 12 volt operation, CW filter options and a high stability crystal filter, SP3 and SP7 external loudspeakers, EX310 voice synthesizer, HP1 headphones.

IC-R71E.

Computer Control These receivers can be connected to a computer terminal via a suitable interface.
JT602 Serial Interface for IC-R7000
JT603 Parallel Interface for IC-R71E (IC-R7000)
The ICOM IC-R71E requires the IC-EX309 interface connector

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IC-3200E Dual-band

If you are a newly licensed or just undecided about which band to first operate, then the ICOM IC-3200E is just the answer. This is a dual-band (144-146/430-440MHz) F.M. transceiver ideally suited for the mobile operator. The IC-3200E has a built in duplexer and can operate on one antenna for both VHF and UHF, and with 25 watts of output power on both bands (the low power can be adjusted from 1 to 10 watts) you can never be far from a contact whether simplex or 2m/70cm repeater.
The IC-3200E employs a function key for low priority operations to simplify the front panel and a new LCD display which is easy to read in bright sunlight, 10 memory channels will show operating frequencies simplex or duplex, and four scanning systems memory, band, program and priority scan.

IC-271 & 471 Multimode Base stations

ICOM can introduce you to a whole new world via the world-communication satellite OSCAR. Did you know that you can Tx to OSCAR on the 430-440 MHz IC-471 and Rx on the 2m IC-271.
By making simple modifications, you can track the VFO's of the Rx and Tx either normally or reverse. This is unique to these ICOM rigs and therefore very useful for OSCAR 10 communications. Digital A.F.C. can also be provided for UOSAT etc. This will give automatic tracking of the receiver with digital readout of the doppler shift. The easy modifications needed to give you this unique communications opportunity are published in the December '84 issue of OSCAR NEWS. Back issues of OSCAR NEWS can be obtained from AMSAT (UK), LONDON E12 5EQ.
This range includes the IC-271E-10W, IC-271E-25W, 271H-100W and the 70cm versions IC-471E-25W and 471H-75W r.f. output. The 271E has an optional switchable front-end pre-amp. The 271H can use the pre-amp AG-25, with the 471E and 471H using the AG35 mast-head pre-amp. Other options include internal switch-mode PSU's: the 271E and 471E use the PS25 and the 271H and 471H use the PS35.

Telephone us free-of-charge on:

HELPLINE 0800-521145.

Mon-Fri 09.00-13.00 and 1400-17.30

This is strictly a helpline for obtaining information about or ordering ICOM equipment. We regret this service cannot be used by dealers or for repair enquiries and parts orders. Thank you.

You can get what you want just by picking up the telephone. Our mail order department offers you free same day despatch whenever possible, instant credit, interest free H.P., Barclaycard and Access facility, 24 hour answerphone service.

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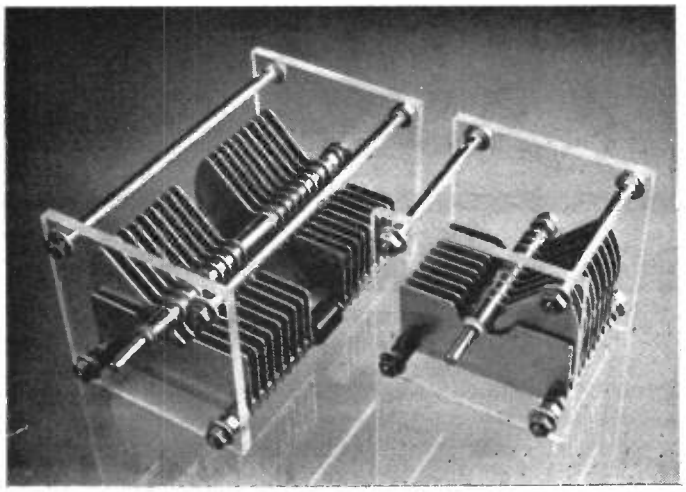
Thanet Electronics
Sea Street, Herne Bay, Kent CT6 8LD
Tel: (0227) 363859.
Dept. REW

PRODUCT NEWS



TELECOMMS NEWS

Recent additions to the Nevada Communications range include some high power variable capacitors intended for both professional and amateur use.

The TC-250 is variable from 13-250pF and features a breakdown voltage of 7.8kV. It measures 101 × 105 × 88mm with a weight of 0.62kg. The price is £15.61 + VAT.

The TC-500 is a twin version of the TC-250, with similar specifications. It costs £19.50.

Both units feature a 2mm air gap between the plates and have end plates of 6mm thick acrylic perspex. For commercial broadcast equipment there is a version available with ceramic end plates.

The TC-250 and TC-500 are available in kit form for amateurs building ATUs.

Telecomms have also announced the release for cellular use of the TC12LW wideband beam antenna. This features a gain of over 18dBi and a frequency coverage of 855-955MHz, and has been developed "to enable users to gain access to the UK cellular system from outside the cells, eg areas such as Wales or in the English Channel".

Samples have been purchased by BT for evaluation. The cost of the beam is £65 + VAT.

And finally... Telecomms are now importing a range of 50 ohm ultra low loss cable from Japan. This double-screened cable is claimed to offer much greater flexibility than the popular H100, as well as lower losses. It is available in three diameters, 8.1, 11.6 and 13.7mm, the cost being £0.72, £1.68 and £2.52 per metre respectively.

Telecomms,
189 London Road,
Portsmouth PO2 9AE.
Tel: (0705) 698113.

ANTEL ANTENNAS

The Swedish company Antel has launched three series of antennas intended for mobile telephone systems.

The antennas are manufactured without internal cables and this, according to the manufacturers, results in low losses and improved reliability.

The three series of products have differing properties. The BCD range consists of omnidirectional antennas, while the BCR and LPD ranges are directional.

The antennas are intended for use in the 800-960MHz band. The BCD and BCR types are split into two frequency bands, 800-900MHz and 870-970MHz. Bandwidth is 100MHz. The LPD antennas have a bandwidth of 170MHz.

The absence of internal cables offers several advantages. Cable losses and the risks resulting from humidity and contact problems disappear, thus further improving reliability.

The use of various forms of reflector, in conjunction with an omnidirectional antenna, type BCD, allows wider opportunities for design of the radiation pattern to suit specific requirements.

In the case of the LPD series, radiation patterns giving 120°, 90° and 60° sectors are available. Gain is between 5dBd and 15dBd, depending on design. The BCD type gives a gain of 7 or 10dBd while the BCR is available for 14 or 17dBd gain. The antennas give 5% null fill-up in the vertical plane and a lobe tilt of 1.25%.

Antel AB,
Bagargatan,
S-384 00 Blomstermåla,
Sweden.
Tel: 46 499 22710.

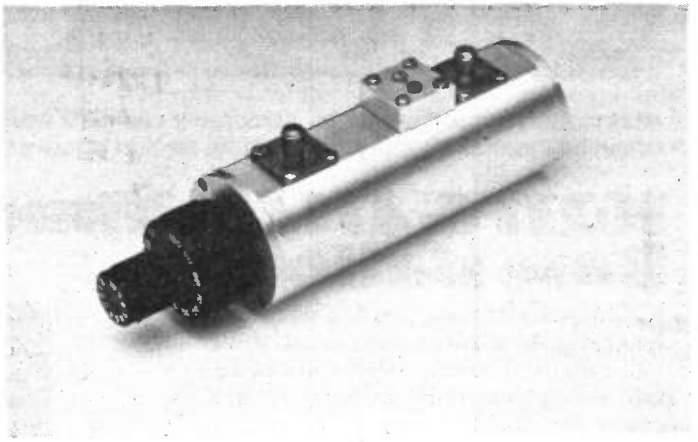
MORSE AID

Invotron Limited has commenced production of a digital morse processor (DMP1), which interfaces between a morse key and a transmitter so that with a conventional up/down key it becomes possible to send perfect morse. The processor decodes the input and buffers it in an 8K static RAM store, before outputting it as a continuous morse stream with all mark and space durations precisely correct. The DMP1 integral store enables a call to be stored and repeated at will by simply pressing the RUN button.

In the correcting mode, the output speed is set by the user to be very slightly lower than the average input speed. In the repeat mode the output speed can be changed to higher or lower speeds irrespective of the initial input speed.

The digital morse processor is a powerful trainer, enabling high speeds to be generated from low input speeds for receiving practice. When sending, the indicators will guide the beginner towards improved dot and dash durations and inter-letter spacings.

Invotron Ltd,
Brookfield Avenue,
Blackrock,
Co Dublin,
Ireland.
Tel: Dublin 884993/831938.



VARIABLE ATTENUATORS

The comprehensive range of variable attenuators made by JFW Industries Inc for use in RF, microwave, programmable and automatic test equipment and systems is now available in the UK from Tony Chapman Electronics.

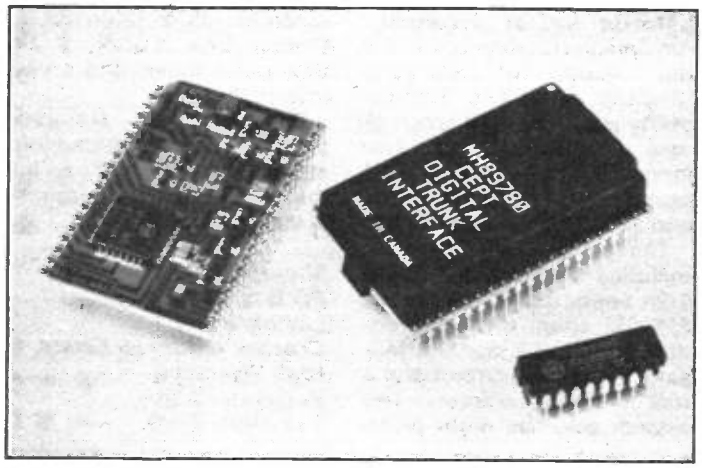
It embraces the R and DR rotary series which provides attenuation values up to 110dB in 1dB steps for dual concentric types, 70dB/10dB and 10dB/1dB steps for single shaft designs.

The frequency range covers dc to 2000MHz and impedance values can be 50 or 75 ohms. A choice of SMA, BNC and TNC connector configurations is available.

Bench mounted attenuators for laboratory applications can comprise two attenuators giving switchable values down to 0.1dB.

The range of JFW attenuators available from Tony Chapman Electronics covers fixed, rotary and programmable models.

Tony Chapman
Electronics Ltd,
Electron House,
Hemnall Street,
Epping,
Essex CM16 4LS.
Tel: (0378) 78231.



REMOTE CONTROL

IQD has developed a single-function version of its Phonecontrol telephone remote control system, Mini-Phonecontrol, which incorporates a synthesized 'voice'. It has received BT approval and will retail at £420.

Mini-Phonecontrol can be used to monitor or control any electrical function. As well as industrial and commercial applications, such as remote switching, it can check and reset security devices or switch on and off domestic central heating or hot water by means of a simple telephone call from anywhere in the world.

The unit plugs into an ordinary telephone socket and an authorised caller simply dials a dedicated number followed by the function code. A synthesized voice immediately replies, giving both the identity and current status of whatever function is to be controlled or monitored. This can then be changed as necessary.

IQD Ltd,
North Street,
Crewkerne,
Somerset TA18 7AR.
Tel: (0460) 74433.

IT'S A GAS

Now available from Steinel is the GL1000 butane gas powered multi-purpose thermal tool.

The GL1000 is small and compact, not much bigger than a magic marker, yet it offers the user the ability to weld at temperatures of approximately 1300°C at the hottest point of the welding flame.

For soldering and hot air shrinking applications a catalyser controls the heat, giving typical temperatures of between 200-400°C for soldering and 100-600°C for heat shrinking. The GL1000 will be of use to the professional serviceman, DIY enthusiast and hobbyist alike.

The unit is supplied boxed, complete with adaptors for each application. It uses ordinary butane gas and gives up to three hours use from each filling.

Steinel (UK) Ltd,
37 Manasty Road,
Orton Southgate,
Peterborough PE2 0UP.
Tel: (0733) 238265.

FIBRE OPTIC COUPLERS

Amphenol have introduced the Interfuse 945 series couplers for uniform distribution of light signals between single-mode fibres, with very low insertion loss.

The star coupler is available with 4×4 or 3×3 port options, implementing 25% or 33% split ratios. Excess loss is less than 0.5dB and output uniformity less than 0.5dB.

The tree coupler is available with 1×4 or 1×8 port options, 25% or 12.5% split ratios. Excess loss is <0.5dB for 4-port couplers, <1dB for 8-port. Output uniformity is <0.6dB. The units are suitable for wavelengths of 820, 1300 and 1520nm.

Amphenol Ltd,
Thanet Way,
Whitstable,
Kent CT5 3JF.
Tel: (0227) 264411.

ISDN COMPONENTS

Online Distribution can now supply the new Mitel ST-Bus family of ISDN digital communications components. The Serial Telecom Bus (ST-Bus) is a synchronous intercomponent bus operating at 2.084Mbit/sec for communicating data, voice and control messages.

The range includes the MT8972 digital network interface, the MT8978 and MH89780 CEPT digital trunk interface chips, and the MT8950 data codec.

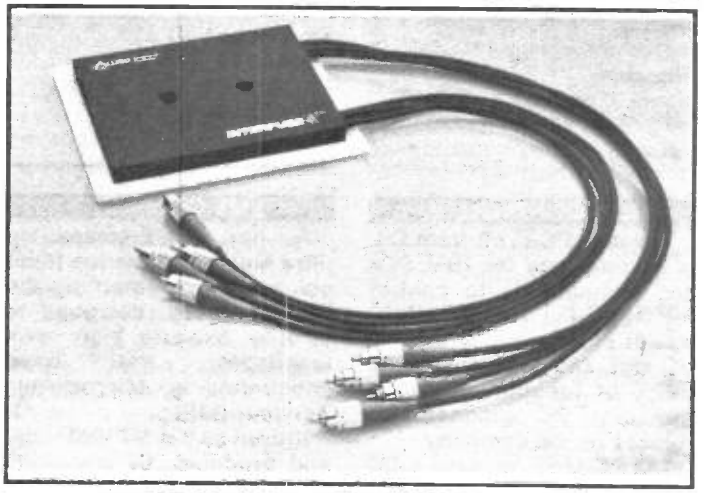
The MT8972, programmed at 80/160kbit/sec, gives full duplex transmission over two-wire telephone cable with echo cancellation. It can also be used as a high speed modem and is available with an evaluation board set.

The MT8978 is a single chip Tx/Rx interface to CCITT/CEPT digital trunk format at 2.048Mbit/sec. Applications include trunk equipment, PBX/Central Office and computer/high speed data interfacing.

The MH89780, an enhanced version of the MT8978, is available with an evaluation kit.

The MT8950 uses ISO-CMOS technology to convert low speed data into 64kbit/sec channel formats. Applications include RS232/UART data terminal to ST-Bus interfacing and encoding/decoding synchronous/asynchronous data into a voice codec equivalent format.

Online Distribution Ltd,
Melbourne House,
Kingsway,
Bedford.
Tel: (0234) 217981.



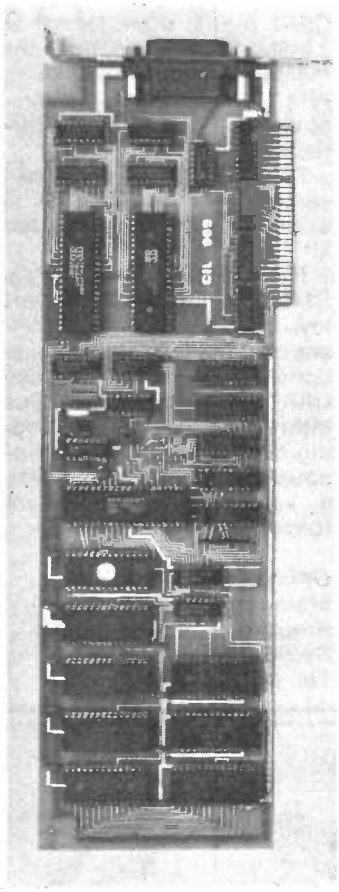
INTERFACE HYBRIDS

Mitel Semiconductor have now developed a family of analogue-to-A-Law PCM interfaces. Using Mitel's advanced ISO²CMOS and hybrid technology, these devices offer advanced levels of modularity, space saving and cost effectiveness.

Current line card designs using discreet ICs, large transformers and complex assembly, test and repair procedures "can now be rendered obsolete". The MH89615/25/35 family of analogue line interfaces (ALIs) minimise critical line card costs and PCB real estate for the existing and emerging digital communications equipment such as PBXs, cellular radio, voice messaging, CO trunks and line concentrators.

Each interface circuit contains and/or controls, all of the BORSCHT functions (using an advanced transformerless 2W/4W conversion design) and A/D and D/A processing. The ALI devices are available in three options to allow flexibility of application between short and long subscriber lines, CO trunks and Mitel's ST-Bus, serial PCM interface.

Mitel Telecom Ltd,
Severnbridge Estate,
Portskewett,
Newport,
Gwent NP6 4YR.
Tel: (0291) 423355.



IEEE CONTROLLER

The new PC-IEEE from CIL is an interface for IBM PCs and compatibles to control the IEEE-488 (GPIB, HPIB) bus. It plugs directly into an I/O slot, and is the first of a range of function cards for the IBM PC planned for release by the company.

The PC-IEEE features a Z80 microprocessor and up to 56K of on-board memory. The combination of high and low level commands held in ROM provide simplicity of operation without sacrificing power and flexibility.

CIL Microsystems Ltd,
Decoy Road,
Worthing,
Sussex BN14 8ND.
Tel: (0903) 210474.

FAILURE ANALYSIS

A new system for semiconductor component failure and defect analysis using liquid crystals is now available from Test Reliability Limited. The surface of a device is coated with a liquid crystal which at a clearly defined temperature, within a few tenths of a degree Celcius, changes to a normal liquid. Below the transition temperature the device appears bright, but above this temperature light is extinguished. Thus any dissipation associated with the operation or malfunction of a device is clearly seen as a dark spot or area.

The success of the technique relies substantially on the degree of temperature control and to a significant extent on the selection of liquid crystals.

Temptronic Corporation's TP0314 Alpha Controller, Thermochuck, Thermosocket, Microjogger and Liquid Crystal Application Kit provide all the essential elements for success using this technique. Now it is possible to observe defects with a dissipation of only a few microwatts and geometries as small as just one micron.

Test Reliability Ltd,
PO Box 20,
Petersfield,
Hampshire.
Tel: (0730) 65412.

VME COMPUTER

A new VME-compatible ultra high performance 16-bit computer, implementing the first processor designed to directly execute high level languages, has been announced by Microsystem Services (MSS).

Known as the MF1600 VME, and produced by Metaforth Computer Systems Limited, this self-contained development system employs an MF1600 CPU – Metaforth's new 20MHz 16-bit data, 24-bit address processor which is capable of executing at 6.6 MIPs.

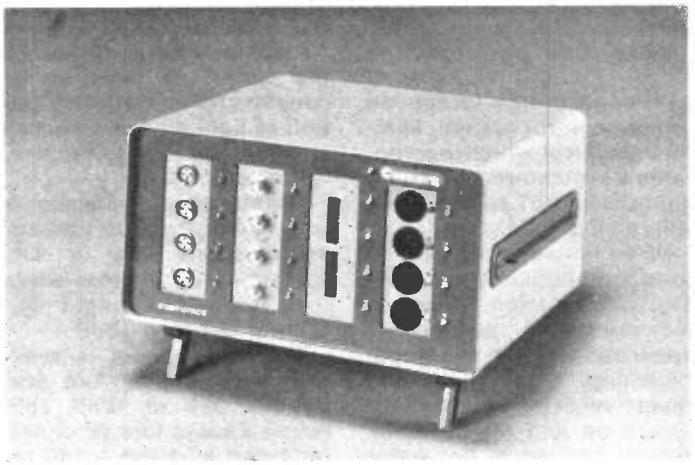
The system allows highly interactive application development entirely in a high level language, without either assembler programming or performance loss. The kernel operating system is a high level language that complies with the Forth 83 Standard, and most high level instructions are executed in less than 200ns.

Unlike conventional processors, the MF1600's soft architecture permits the addition of the user's special microcoded primitive instructions to further accelerate run time performance without the need for software rewrites. A built-in Profiler utility allows identification of new instruction requirements, and new microcoded primitives can be designed and simply installed in ROM.

The MF1600 VME system includes a 128K static RAM, 512K bootstrap ROM, two 64K EPROM sites, two independent RS232 I/O ports, a fail-safe 'watchdog' circuit and a real-time clock/timer. The system also has eight prioritised levels of interrupt, an Option One arbiter, a bus time-out counter and a VME interface.

Reset and test/abort switches, an alphanumeric status display and a bus master LED are built into the system's front panel.

Microsystem Services,
PO Box 37,
Lincoln Road,
Cressex Industrial Estate,
High Wycombe,
Bucks HP12 3XJ.
Tel: (0494) 41661.



COMPUTER INTERFACE

The new Comark Compuface is a bench-top Z80 based interface accommodating up to 16 independent analogue input/outputs which are configured for interfacing to a host computer. This interface permits a variety of measurement and control facilities to be performed by use of the computer input and output commands. Powerful 16-bit A/D and D/A conversion is incorporated to provide high resolution (one digit in 65536).

The sixteen I/O channels are arranged in 4 modules, each having 4 channels which can be selected from: analogue voltage input, differential with 4 selectable gain ranges; thermocouple input with automatic cold junction compensation and linearisation (types J, K, T and N); platinum resistance thermometer input; frequency input for applications such as flow rate metering; analogue voltage output; relay output; and 32 channel digital I/O option and 1 channel counter in addition to 16 inputs/outputs.

The modules can be selected in any required combination to cater for a wide variety of applications and the voltage outputs can be used to supply control signals or feed chart recorders. Relay output modules can be used to operate solenoid valves, process alarms and other devices.

A fast scan rate, in excess of 1,000 readings per second, permits 'dynamic scanning' in data acquisition mode. Up to 16,000 readings can be stored for subsequent transfer and processing using the optional 32K RAM board.

The Compuface can be specified with either an RS232C or IEEE-488 interface. Whilst the IEEE-488 inherently provides for 'daisy-chaining' of up to 15 units, a special feature of the Compuface's RS232C also allows for daisy-chaining.

Comark Electronics Ltd,
Rustington,
Sussex.
Tel: (0903) 771911.

REAL-TIME CLOCK

A real-time clock module now available from IQD is specifically designed for use in microprocessors. The RTC 58321 features a built-in 32.768kHz standard clock quartz oscillator which eliminates the need for regulation and aids rationalisations. It also incorporates battery back-up, time counter (hour, minute, second), date counter (year, month, date and day), a 12 hour/24 hour clock switch-over function and automatic leap year setting, and counter start, stop and reset functions.

The clock module has an integrated circuit with an output of 1Hz, and standard signal output can be set at 1024Hz, one second, one minute, one hour. A 4-bit bi-directional bus line is employed for data, which is written to and read from memory.

IQD Ltd,
North Street,
Crewkerne,
Somerset TA18 7AR.
Tel: (0460) 74433.

SPEECH CHIP

A low cost scrambler integrated circuit to ensure privacy with cordless and cellular telephones, mobile radios and security systems is now available.

The DVS100 chip was designed by Advanced Electronic Products (Merseyside) Limited, and will be manufactured by Marconi Electronic Devices Limited.

Manufactured in bulk CMOS, the new device is a digital speech processor which implements time division multiplex (TDM) encryption techniques to provide effective security along with good voice quality at low cost. The DVS100, with the addition of a 64K DRAM, incorporates all the necessary circuit elements to encrypt and decrypt two analogue speech channels, which may be combined to form a full duplex system.

The TDM scrambling technique used in the DVS100 'slices' the speech waveform in the time domain, and the slices are re-ordered before being transmitted. This breaks up the phonetic content of the waveform and makes the signal unintelligible to the human ear.

Marconi Electronic Devices,
Doddington Road,
Lincoln LN1 3LF.
Tel: (0522) 688121.

RADIO ALARMS

Osiris Controls Ltd are now manufacturing the first units in a range of radio alarm equipment at their new factory in South Wales. These include a push-button operated portable transmitter which sends a coded signal over a distance of up to 200m, and single, 16 and 31-channel double superhet receivers which produce pulsed outputs on receipt of the coded signals. There is an optional preamplifier to increase the range in adverse conditions.

Codes are selected by 16-position DIL switches, providing more than 2000 alternatives to ensure security.

It will also be possible to connect a transmitter to proximity switches and pressure pads to protect doors and windows.

The equipment has been approved to DTI specification MPT1309 and operates at 173MHz. Prices are claimed to be unbeatable.

Osiris Controls Ltd,
22 Pwll-Y-Min Crescent,
Peterston-Super-Ely,
Cardiff CF5 6LR.
Tel: (0443) 740627.

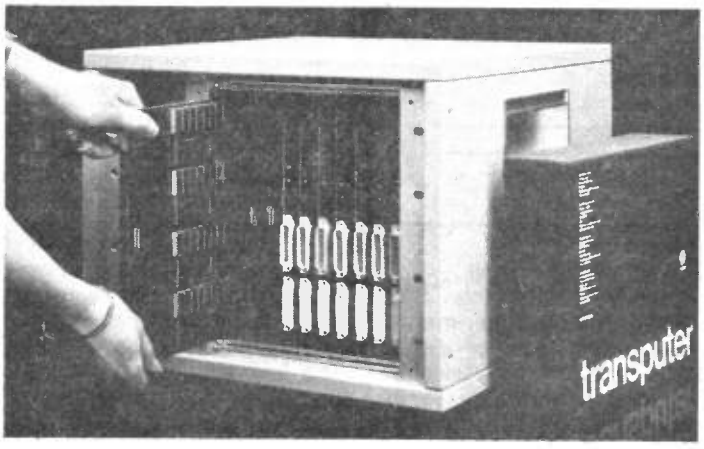
MULTIPURPOSE SOLDER

Multicore Solders Limited have developed a unique, fast acting flux-cored solder which is suitable for all electrical and electronic work, as well as for most types of metal. The flux in the solder wire is entirely non corrosive.

Recently this has been sold for specialised industrial use, but it is now available in a consumer pack, and is a 60/40 alloy, 1.2mm diameter 5-core solder wire.

The new MX100 solder is available from most electrical and hardware stores at a retail price of £1.99 inc VAT.

Bib Solder Division,
Bib Audio/Video
Products Ltd,
Kelsey House,
Wood Lane End,
Hemel Hempstead,
Herts HP2 4RQ.
Tel: (0442) 61291.



16-BIT TRANSPUTER

The new IMS T212 16-bit Transputer with on-chip memory and communications is now available ex-stock from Rapid Silicon.

Manufactured using a single 1.5 micron CMOS chip and housed in a 68-pin package, the IMS T212 includes 2K bytes of 50ns static RAM, an interface for up to 64K bytes of direct address memory, and four Inmos standard 10Mbits/sec full duplex serial links for concurrent message passing to other transputer devices. In addition, the device has a maximum data rate of 40M bytes/sec and multi-port access for the processor and serial links.

The IMS T212 is compatible at both program and interface level with all Transputer products, including the B006-1 Transputer expansion board. This board contains one T212 Transputer and space for another eight.

A fully populated B006-1 provides a processing capability of 90MIPs.

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

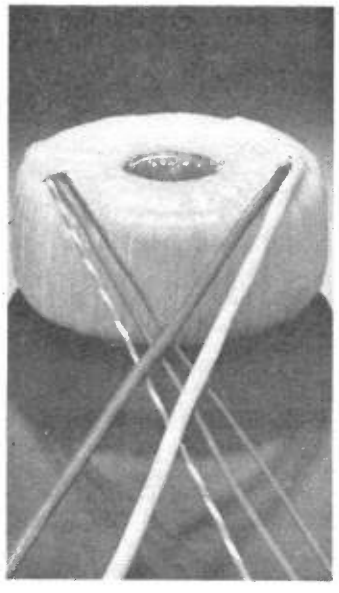
POWER TRANSFORMERS

Toroid Technology Ltd are introducing a new range of UK designed and manufactured toroidal power transformers with applications in electronic and electrical equipment.

This high quality professional range consists of five power ratings from 15VA to 130VA, 48-60Hz: maximum ambient operating temperature is 55°C. These products are designed for applications requiring low magnetic field and low temperature rise. They incorporate a copper foil screen between primary and secondary.

Terminations are heat resistant PVC stranded wires and mounting arrangement is by single screw fixing into the base of the transformer. Physical size is between 63 × 31 and 114 × 41mm.

Toroid Technology,
175a Brigstock Road,
Thornton Heath,
Surrey CR4 7JP.
Tel: (01) 689 8002.



NEWS DESK

Digital stereo sound

On 18th July the BBC started limited experimental engineering tests of digital stereo sound with television. The first programme to be transmitted in these tests was 'The First Night of the Proms', which was broadcast live from the Albert Hall. The tests, from the BBC 2 television transmitter at Crystal Palace and its dependent relays, will enable staff to gain operational experience and allow manufacturers the opportunity to build and test prototype stereo decoders.

The stereo channel on the transmitter carries either programme related material when this is available or high quality music at other times. The experimental signal will be liable to interruptions, although the normal sound channel is not affected by these tests.

The stereo sound signal is transmitted by quadrature phase-shift keying (QPSK) modulation of a carrier placed 6.552MHz above the vision carrier. The system, developed by the BBC, underwent trials in 1983/84, and is the subject of a joint BBC/IBA specification that is under consideration by the DTI as a potential UK standard.

New sound distribution equipment has been developed to carry the stereo signal to the transmitters. The BBC currently uses a digital transmission system known as sound-in-syncs to distribute the sound signal. However, the present system cannot accommodate a stereo sound signal, and therefore a dual-channel system has been developed by the BBC Engineering Design and Equipment Department together with Pye TVT Ltd, who are manufacturing the dual-channel sound-in-sync equipment.

There are currently no domestic receivers capable of decoding the stereo signals, and stereo televisions intended for use with video cassette recorders will not work in stereo with this system. It is expected that the BBC 1 transmitter at Crystal Palace will join the experiment later this year, although there are no plans as yet to extend the experiment to other parts of the UK.

A pose for the picture!

A young Welsh engineer became a human link with a satellite 22,000 miles up in space to provide pictures of the royal wedding to millions of people around the world. The Manpack, a BT invention, is a mobile, battery-operated microwave radio transmitter which converts video pictures to microwave frequency

Defence spectrum review

Following its inaugural meeting, the Defence Spectrum Review Committee has asked for evidence from broadcasters, manufacturers, public utilities and lobby groups.

It will examine the current and foreseen use of those parts of the radio frequency spectrum which are allocated for national defence.

The review is to take account of the operational needs of the services for which the Ministry of Defence has responsibility, defence procurement policies and procedures, the obligations imposed by international treaties and agreements, the impact of technological developments, the availability of economic and other resources to implement changes and the overall demands on the spectrum by all users, civil and military.

The review will be conducted in stages. The first stage will concentrate on the frequency range 470-3400MHz and is to be completed by 31st December 1987.

The first stage of the review will run concurrently with a more general survey of the allocations within the same frequency range. This survey is being undertaken by the Radio Regulatory Division of the DTI. A report covering the work of both bodies will be published.

Individuals or organisations wishing to submit written evidence should send their submissions before 3rd October 1986 to: Ken Hutchinson, Secretary, Defence Spectrum Review, DTI, Room 508, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

Good idea, silly name

Motorola has announced the availability of *Dr BUB*, an electronic bulletin board dedicated to digital signal processing (DSP). The bulletin board offers the DSP community a wide range of information on Motorola's new line of digital signal processors.

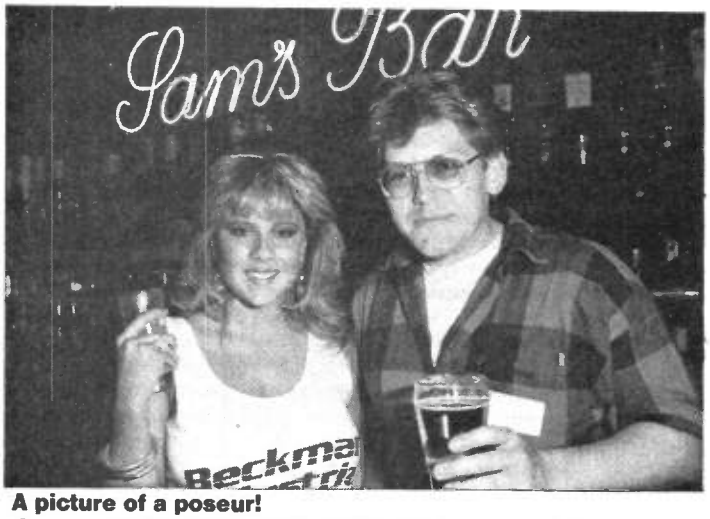
Dr BUB provides the user with documentation on new products and improvements on existing products, application notes, DSP contest information, a confidential mail service, and a question and answer forum. A user can access the bulletin board from anywhere in the world providing they have a 1200 baud modem (Bell 212A or V.22) and a terminal or personal computer.

For more information on *Dr BUB* and Motorola DSP call *Dr BUB* at (512)440-DSP1 (440-3771) or contact the Motorola Literature Distribution Center, PO Box 20924, Phoenix, Arizona 85036 and request BR297.

Burmese short wave

Under a £700,000 contract placed by Gesellschaft Für Technische Zusammenarbeit (GTZ) and funded by German Aid, Incomtel are to provide and install a new short wave radio transmission network in Rangoon for the Burma Broadcasting Corporation.

The two latest design short wave PDM transmitters with PIE equipment will, with the two 100kW combined medium wave transmitters and antennas supplied by AEG Telefunken, provide clear border to border transmis-



A picture of a poseur!
Our very own Mr Duncan Leslie mixing with the 'Pop (out) Set' at a press launch held by Beckman Industrial in Sam's very own bra(?)

sion throughout Burma for the first time.

The network, to be commissioned by engineers from Incomtel's British and German offices next year, will replace the present outdated short and medium wave system and will be housed in a new transmission building now being built by the Burma Broadcasting Corporation.

Satellite TV centre

Whoever said that there was a lot more money residing in the south-east of England than elsewhere in the country certainly wasn't talking out of the wrong orifice. In testimony of this fact, a new shop dealing only in satellite TV equipment was due to open in sunny Brighton during August. There must be a good deal of disposable cash down that way for such a shop to be considered commercially viable, considering the embryonic nature of this market.

The Home + Business Satellite TV Centre is situated in Churchill Square, Brighton, and will deal in equipment from NEC, Ferguson, Grundig, Luxor, Philips, STS and "many other leading European, Japanese and American manufacturers".

Weather satellite decoder

If you're keen on weather satellites it's well worth taking a butcher's at the latest edition of *Electronics – The Maplin Magazine*, which features a weather satellite decoder to complement their receiver project published earlier this year. This issue also contains an 8-bit parallel input port for the Amstrad CPC computers, which Maplin suggest could be used to interface the weather satellite decoder.

Incidentally, *Electronics – The Maplin Magazine* is apparently the UK's best selling electronics publication. Must be great to work on: produce one issue every three months and then watch it sell more than anyone else. I'm obviously doing something wrong here!

Satcom system for BNSC

A civil satellite communications Earth terminal, custom-designed and manufactured by Ferranti for the British National Space Centre (BNSC), has been installed and commissioned at RSRE Defford in Worcestershire.

The BNSC, formed last year to improve and co-ordinate the development of British space technology, will use the terminal initially to support an experimental programme with Ku-band satellites and Olympus – 1.

The terminal is a 'turn-key' system based on a 5.6 metre Intelsat E2 dish aerial. Initial operation will be in the 12/14GHz bands, and the system is adaptable to allow field substitution of an 11/13GHz horn and OMT (ortho-mode-transducer). The antenna pointing system is compatible with the tracking requirements of the Intelsat standard E Earth station and the Eutelsat ESC multi-service system specifications.

The satellite communications Earth terminal is made by Ferranti Microwave at Poynton using mainly British equipment. The stringent noise specifications for the up/down converters are met using Ferranti low noise phase-locked oscillators, and a Ferranti low noise FET amplifier is used in the receive chain.

Laser antenna alignment

Tony Chapman Electronics claims a new boresight laser provides test engineers with an exciting new totally portable system for the quick, accurate and inexpensive alignment of antennas. It enables perfect alignment between transmit and receiver antennas and means the elimination of the need for traditional surveying instrumentation, which is both time consuming and difficult to use.

Before antennas can be tested in an anechoic chamber, the source antenna and the antenna under test must be aligned, or boresighted, perfectly. The new centre-head boresight laser made by Hulbert Engineering, and introduced to the UK by Tony Chapman Electronics of Epping in Essex, is designed to greatly ease this task without sacrificing accuracy by using a coherent light source to adjust the antennas.

The laser is first used to align the antenna under test by replacing the source antenna and directing a 1mW visible light beam down-range to the test antenna. Azimuth adjustments are then made to this antenna's polarization positioner until the laser beam intersects the geographical centre of the antenna to leave the positioners aligned in one plane. The laser is then mounted on the test antenna's positioner and the process is repeated until both antennas' positioners are boresighted in two planes.

The whole process requires about 30 minutes. The laser tube has a typical lifetime of greater than 15,000 hours, and has been built to operate from 10° to 60°C at humidity levels as high as 95%. Since the laser's current requirements are low, 4.5± 0.1mA, it can be battery powered for field use. Each unit is supplied with its own rechargeable battery.

ESPRIT Conference

Following its success in 1984 and 1985, the ESPRIT Conference will once again be held at the Palais des Congrès in Brussels from 29th September to 1st October 1986. As in previous years, some 700 participants will attend technical working sessions on the first two days and 1000 guests will hear major industrial and political speakers on the third day – 'The IT Forum'.

The Forum day speakers include Karl-Heinz Narjes, Vice President of the Commission of the European Communities; Geoffrey Pattie, UK Minister of State for IT and Telecommunications and Chairman of the Research Council at that time; and Carlo de Benedetti, Chairman of Olivetti. Michel Poniatowski, Chairman of the European Parliament's Commission on Energy Research and Technology, has also been invited. These speakers will address major themes in high technology, and review the strategic importance of information technology and industrial co-operation in Europe; the title of the sessions is 'European IT – Turning the Tide'.

Further details are available from the Organisation Bureau ECCO, 17a rue Vilain XIIII, 1050 Brussels. Tel: (02) 647 8780.

EMI

The IEEIE is to hold a one day symposium on 'Electromagnetic Interference: Practical Design and Construction Techniques' in London on Monday 17th November 1986.

This event, co-sponsored by The Institution of Electrical Engineers, Institution of Electronic and Radio Engineers, Institute of Measurement and Control, and Society of Electronic and Radio Technicians, is a sequel to the IEEIE symposium in April 1985 which provided a practical introduction for engineers to the subject of electromagnetic interference, and which attracted a capacity attendance.

The basic aim of this latest IEEIE symposium is to discuss practical design and construction techniques to minimise electromagnetic interference effects in electronic and similar equipments. Consideration will also be given to installation, test and maintenance aspects. The emphasis will be on practical engineering (rather than academic or theoretical) considerations. The symposium is intended primarily for engineers and managers in the electronics, communications, computer and related industrial sectors.

A special discount will be allowed to delegates who book and pay before 1st October.

Programme details and application forms are obtainable from: The Conference Secretary, IEEIE, Savoy Hill House, Savoy Hill, London WC2R 0BS. Tel: (01) 836 3357.

Sound Comm 86

Following last year's successful event at Preston, the Association of Sound and Communication Engineers will hold their second Sound Show at a larger venue, the New Century Hall, Manchester, on Wednesday 1st and Thursday 2nd October 1986. A late night on Wednesday will give everyone the opportunity of seeing this exhibition. Opening times are 10.00am until 9.00pm and 10.00am to 5.00pm respectively.

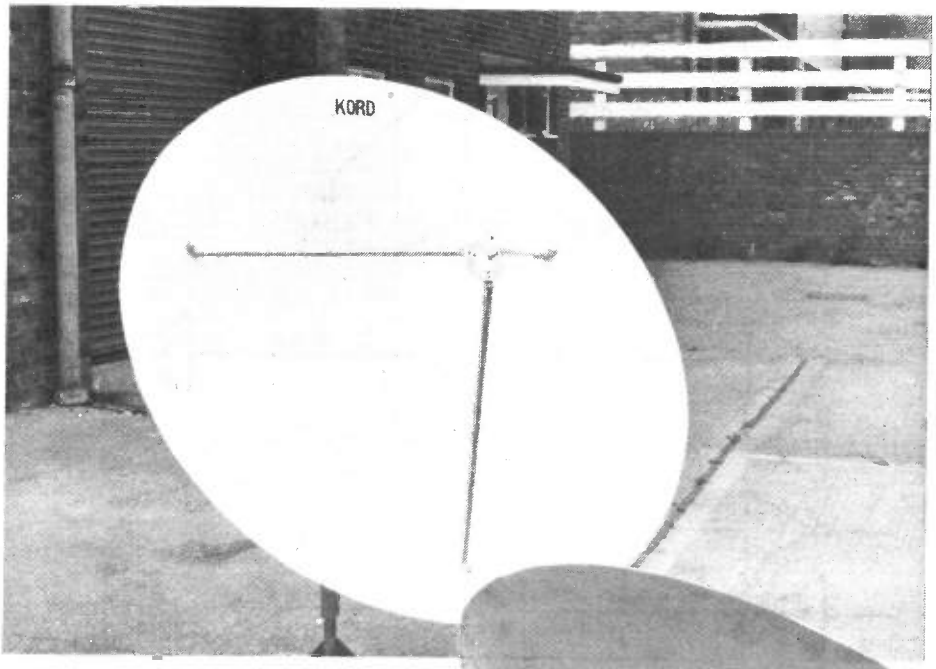
Sound Comm 86 will cater for all who use equipment for the reproduction of sound. This show is described as a must for the PA system designer, club proprietor, purchasing manager, architect and 'end user' alike.

Special rail and hotel concessions are available. For details contact the ASCE on (06286) 67633.

SATELLITE TV ON A BUDGET

When the satellite TV tuner project appeared in *Radio & Electronics World* back in the August issue, a comment subsequently heard more than once concerned availability (or lack thereof) of cheap dishes and LNBs.

"OK," said Mr Enthusiast, "so I can save a few bob by building my own tuner. But I'm still going to have to pay full whack for the other bits. The overall saving on a full system will hardly be worth the effort..."



Great minds?

Well, great minds think alike it seems (and *R&EW* readers all have great minds, don't they?). A phone call from Mike Fox of Kord Audio Products, until now known for their hi-fi speakers and amps, produced details of a cheap dish antenna that his company's been working on.

The Kord product has been designed with the DIY enthusiast very much in mind. The various elements are available separately to allow the purchaser to do as much himself as he feels capable of, and thus benefit from the resultant cost savings.

The dish itself is of glass reinforced plastic (GRP), with a layer of conductive material encapsulated beneath the surface. In early models this material was nickel based, but now a substance of greatly improved conductivity is being employed.

The diameter is 1.5m (5ft) and the gain is quoted as 42.5dB (this being for the nickel based conductive layer, incidentally). This compares favourably with dishes from other manufacturers, who generally quote between 42 and 44dB, and should prove entirely adequate.

Mike describes his product as being stronger than a comparable metal dish, and other GRP dishes on the market seem to bear out his contention that such dishes are capable of performing as well as metal. And the price? Well, you can have a Kord dish (minus mount) for £77 + VAT.

Who's keen on DIY?

For the keen DIY enthusiast, Kord provide full details of dimensions and construction of the tripod for mounting the LNB on the dish. Likewise there are notes and dimensions describing how to build a simple dish mount out of Dexion or similar, although it is pointed out that such a simple mount is really only suitable for pointing the dish at one satellite (unless you really *insist* on manhandling it around and fiddling about with alignment every time you want to change between ECS1 and Intelsat V).

If the idea of such metal bashing doesn't appeal (it's worth bearing in mind that the dimensions of the LNB mount have to be followed closely at these frequencies), the LNB tripod is available separately for £14.50 + VAT, while a proper polar mount for the dish costs £95 + VAT.

According to Mike, Kord are producing far fewer polar mounts than they are dishes, since they anticipate that many people will devise their own mounts. If demand is sufficient, however, the price might well fall considerably.

If you're wondering how these prices compare with the competition, you could expect to pay at least £280 for a dish and mount if purchased from an 'established' dealer.

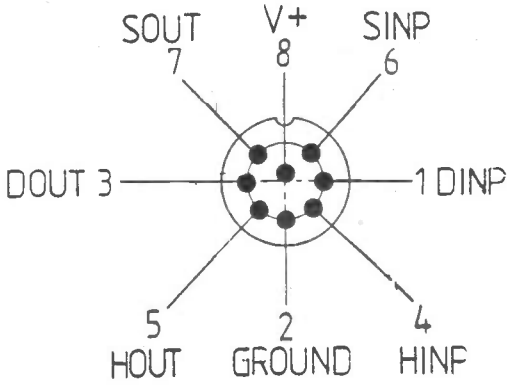
The DIY notes are available from Kord for £2 + a large SAE, the £2 being refundable on the purchase of a dish. These notes also include some details of alignment with the satellites. The company will also send a data sheet (free of charge) in response to enquiries, although this won't tell you any more than you've learnt here.

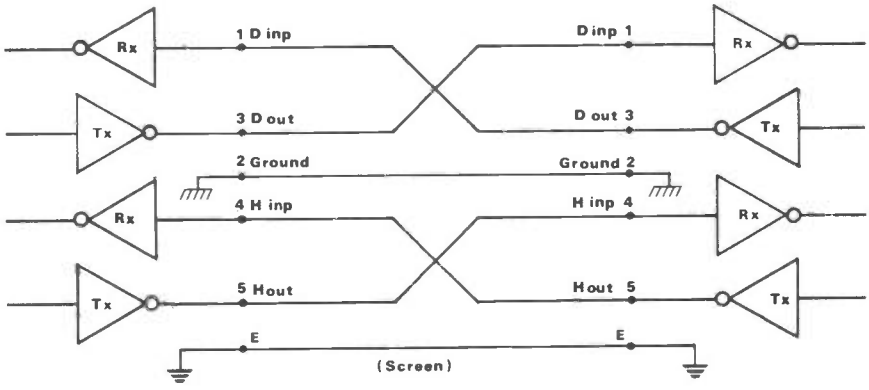
Cheep, cheep!

So, now you can get a cheap dish as well as a cheap tuner. All we need now is a source of cheap LNBs, or a simple means of otherwise converting down the signals. Any ideas? REW

Kord Audio Products Ltd
7 The Green
Nettleham
Nr. Lincoln
Tel: (0522) 750702

USING THE S5/8





Bob Redding G3VMR

The supply of cables and interface devices is the fastest growing and most lucrative part of the home computer and the electronic office industry. The reason for it is a lack of standardisation, so that each manufacturer's line has special features which inhibit interconnection with units made by anyone else. Although a skilled amateur might defeat this, and 'Fixit-Widget Merchants' enjoy a bonanza, this is still a debilitating process in no-one's long term interest.

However, there is hope on the horizon in the form of the S5/8 (serial 5V, 8-pin) interface, which is now before BSI and which I outlined in *R&EW*, May 1985.

There is now a definitive description of this in *Wireless World* of July and August 1986 by Andrew Hardie, who has been very active in the birth of the proposals now in the hands of the British Standards Institution.

I have been involved in its use on a line-powered modem, which is a special case where not all matters associated with connections are clear. This gave experience in connecting such an S5/8 unit to a variety of computers with RS232 in various forms, BBC and Kyocera micros, for example.

To solve a problem we need to know how and why it arose, as well as the obvious symptoms, so let us look at the standardisation process.

Problems of standardisation

When I first became involved with engineering standards, I thought they were 'an agreement of common ground among experts, in order to co-operate and develop further in accord'. They were certainly not a cookbook of how the uninitiated could do it, and many of the documents said so in no uncertain terms. Unfortunately the term 'Industry Standard' has since tended to become a global answer to all questions that are difficult to answer and, of course, is completely meaningless, for it means whatever you want it to!

The reason for the problem is the fact that so many people do not really know what they are doing, a problem compounded by the cult that a manager (or a salesman) is the same, whether it is in the field of computers or fish and chips. He can always ask his experts, but he should remember the joke about the army message 'send 3 & 4d. We are going to a dance'.*

The 'magic keyword' syndrome can be even worse. The marketing manager of a company who makes V21 and V23 modems phoned me because an important customer wanted something else – a V24 one. I had to explain that 'V24' is essentially a list of the names of the pins on an 'RS232 connector', and that is the grandaddy of this problem area.

If you do not know about gender-benders, null modems, DCEs and DTEs as well as other items of the RS232 language, you are lucky and you will find a large range of fix-it devices in many mail-order catalogues. Many people think that a 'D-25 connector' is a sure sign of an RS232 interface, whereas none of the specifications define what connectors shall be used, and in fact almost any number of pins between 3 and 37 is in use at present.

The reason of course is that RS232 has just growed like Topsy since the early days of the 48 volt mechanical teleprinter, and we have added new things when we needed them, without throwing away the old ones.

A fresh start

Obviously we need to start again, and the impetus came with the advent of the hand-held computer because a much smaller connector was essential, and a single-sided supply of 5 volts is clearly adequate for all reasonable purposes. The Public Services Working Party, originally formed to define a standard for micro floppies, turned its attention to interfaces and the S5/8 is a result. The organisation has been hosted by one of the bodies – the Central Computer and Telecommunications Agency – but it is hoped it will be gradually taken over by the British Standards Institute which has to attain industry's endorsement of it.

A personal impression

The proof of the pudding is in the eating, and the following is the personal experience of utilising the S5/8, with particular reference to the special but difficult case of modems.

Below is an outline diagram which indicates the basic features for this discussion, but I suggest that anyone really interested should obtain the full documents from the BSI or CCTA at Riverwalk House, Millbank, London SW1P 4RT. They describe fully the buffering and the evolving of new items so that S5/8 replaces not only serial connections but also parallel connections, eg 'Centronics', and it's meant to operate at up to 9,600 baud!

The basis is that all units are equal and have signals called 'D In' and 'D Out', and what goes out of one socket goes into another. There are also handshake 'H' signals which also go 'In' and 'Out'. For some uses you might want further control signals in and out, and so we call these 'S' for special. We need a common or earth, ground pin 2, and there is a central pin 8 marked '+' which carries a

*send reinforcements. We are going to advance

5 volt supply so that we can power one unit from another, instead of having interminable supply and lead problems.

This means that there is only one cable which has a plug on each end, and the cross-connection between input and output for the data and handshakes is done within the cable, so – "You can't go wrong". Because of the universality of the DIN series, you can put 3, 5, or 7-pin as well as 8-pin connectors into the S5/8 sockets and there is no reason why we shouldn't use them. However, it would appear contrary and stupid to choose a socket for a unit for less than the full S5/8 complement of 8 ways, even if only 3 or 5 are used. Finally, the system is designed around a 5 volt single-sided supply, and few hobbyists or professionals worth their salt would quarrel with that.

Applications of S5/8

The best known application of the S5/8 is the Liberator, a hand-held PC specially developed for Government departments by Thorn-EMI. Various people have provided ancillary equipment, eg printers, modems etc, and there are now a considerable number of devices using the system.

The real proof of its efficacy shows when it has to be interconnected with existing equipment using the old conventions. If we can do this in a clean and simple way, then the advantages will become obvious.

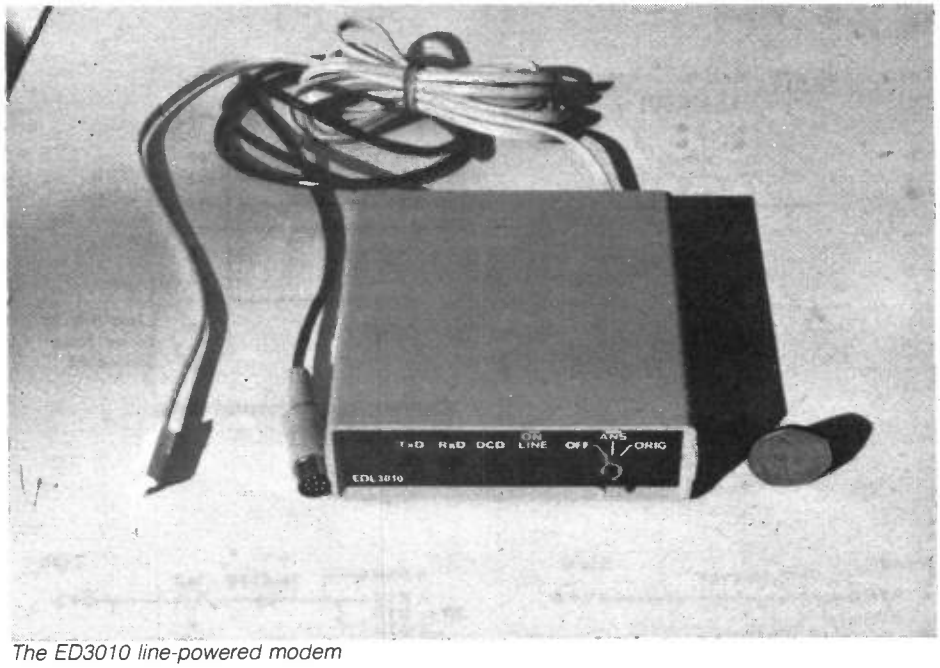
A line-powered modem was adapted to suit the Liberator and similar hand-held terminals, because the use of the line-holding current of the telephone simplifies cabling and means there is no drain on the internal batteries.

To standardise on the S5/8 connection for the modem, we needed adaptors to work with other plugs and sockets, and with the various complications of the RS232.

Recent experience

My recent experience is described below. The modem will be detailed in a separate article, and for the moment we need only concern ourselves with the logical 'data input' and 'data output' connections. These are signals that any modem must provide, as distinct from such auxiliary ones as carrier detection, line ringing and dialling facilities which we have come to expect in the more exotic models. What really matters is 'D in' and 'D out' for the data, for the rest are really isolated connections to suitable extra circuitry in the computer or in the modem itself.

A modem cannot provide hardware handshakes, and so H1 and H2 cannot be employed, although their use might be simulated. The S5/8 specification makes this point clear by insisting that the control of data should be software control, ie 'X on', 'X off'. The exact way in which the H and F2 are used to bring in the other connections and to provide dialling will be described in a later article.



The ED3010 line-powered modem

Connection to a telephone line

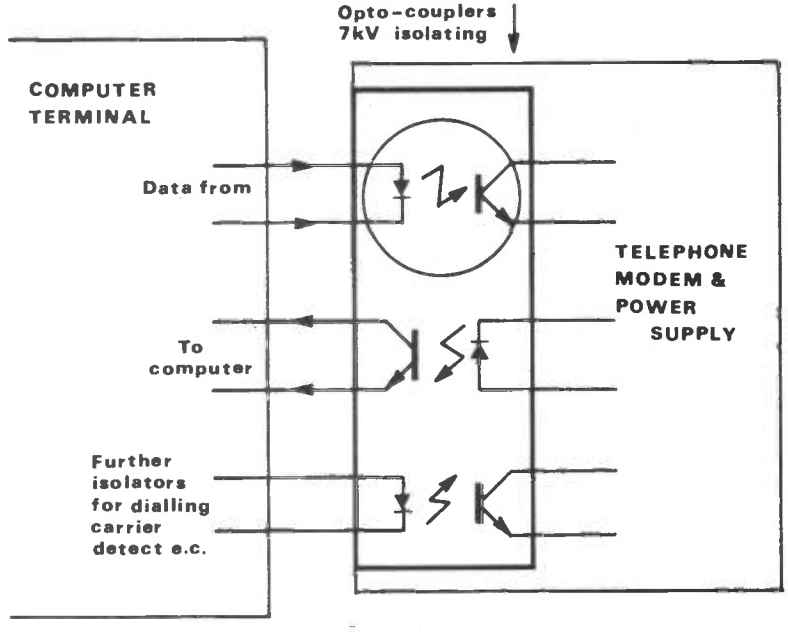
The standard way of connecting any terminal to a BT line is by means of an opto-isolator of suitable rating, and consequently data of a modem invariably uses something like the interface shown 'Data out' invariably has sufficient energy to operate the LED (which requires a milliamp or less at about two volts), but the data inwards is received at an open transistor junction which requires a local voltage on the computer side to turn this into data, and hence pin 8 and its 5 volts does the necessary via a 10k resistor.

This also applies to any other machine if a suitable voltage can be found. There is a good case for using a battery to avoid having to find a suitable pin in whatever connector is used.

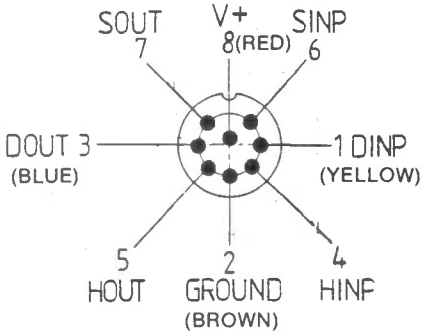
Connection to other interfaces

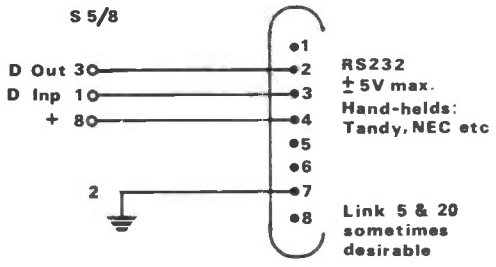
Connection of the modem to previous standards such as RS232 and RS422 or 423 is quite easy, subject to precautions that the voltage and current available is not excessive, and that one picks up voltage for the received data of 5 volts from a convenient spot. This is probably best described by considering individual

Isolating a computer from the BT phone line using opto-isolators

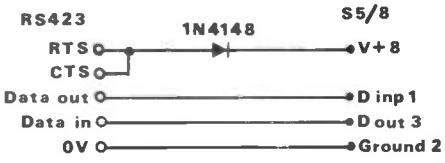


S5/8 INTERFACE

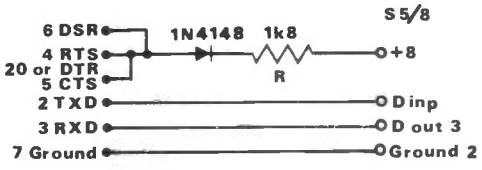




Connection to hand-helds
Tandy, NEC, Olivetti etc



BBC computer to modem
If RS423 is inactive RTS goes negative: the diode prevents confusion



Typical RS232 'DTE'
Use resistor R to limit current to 4mA if ±12V is present

computers, since unfortunately the plug and the designation terminology and convention vary widely between manufacturers.

Listed below is the way a number of popular types have been used, which will give a clue to the operation of further ones. A general diagram is given along with the precise arrangement for the BBC and Kyocera, and hand-helds by Tandy, NEC and Olivetti.

Replacing plugs

The ED3010 has a captive lead ending in an S5/8 plug so that the cable cannot be lost or mislaid. If you will use it only with a non-S5/8 computer, then it is probably best to cut off the plug and make connection to a D type or other appropriate plug to suit your computer. The colouring of the leads is as follows: pin 8 is red, pin 3 (D OUT) is blue, pin 1 (D INP) is yellow, and pin 2 (ground) is brown.

One can then make any internal handshakes or 'kick one's own behind' connections in the plug that goes to the computer. Alternatively, a socket for the 8-pin DIN plug may be connected by a further lead which has the handshake necessary for the terminal or computer concerned. REW

AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

From *Solar News* we gather that the first sunspot group of the new solar cycle made its appearance on 3rd July. This makes June the minimum of the old cycle so we can now look forward to a gradual increase in solar activity. The accompanying graph produced by Roger Heard and reproduced from *Solar News* shows clearly how solar activity has decreased over the last few years.

Those readers who are interested in solar matters and their relationship to radio propagation will find *Solar News* a most interesting and informative publication. It is available from Bert Chapman, 'Brindles', Mill Lane, Hooe, Battle, East Sussex TN33 9HT.

'Hands Across America'

In our July contribution we mentioned the part amateur radio was to play in the 'Hands Across America' project. From *Westlink Report* we learn that this project was eminently successful. From California to New York more than five and a half million Americans, co-ordinated by more than three and a half thousand radio amateurs, held hands for fifteen minutes on Sunday, 25th May. The idea was to further an awareness of the plight of the homeless and hungry and to raise money to aid them. W6RO, aboard the old Queen Mary ocean liner, served as the West Coast Net Command, while the Eastern Command originated from a 'walkie-talkie' in Battery Park, New York.

Each actual mile of the route had a radio amateur assigned to it and information was fed to state HQs. VHF and UHF were mostly used, although there were several areas where 80 or 40 metre SSB proved a better alternative.

The amateur radio network saved the project a lot of expenses which would otherwise have been incurred. This being the case, the dollar value of amateur radio time contribution may well be one of the biggest in bringing aid to those Americans most in need of it.

Oscar 10 back in limited service

Recovery efforts aimed at restoring Oscar 10 to service proved partially successful when, on 15th July, the Mode B transponder was brought back into limited service, thus successfully concluding a process of diagnostic testing, rewriting the Integrated Housekeeping Unit (IHU) software and cautious evaluation of results at each stage of testing.

Oscar 10's IHU memory had been showing evidence of accumulated radiation damage for several months. While there is a software error correcting system aboard the satellite, this was ultimately unable to correct all the software errors which had accumulated through repeated radiation damage to the IHU memory and it finally became overwhelmed. The operating system 'crashed' and Oscar 10 went off the air.

At the time the situation looked bleak and the satellite controllers were only able to reset the IHU with the master reset command. Karl Meinzer DJ4ZC, the principal architect of the IPS operating system, designed a memory diagnostic package which produced a 'memory map' of the failed memory cells. Based on this he was able to rewrite the IPS operating system so as to avoid the affected zones.

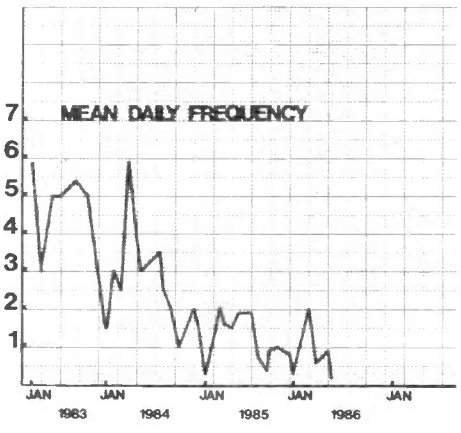
Ian Ashley ZL1AOX, the New Zealand Satellite Controller, soon reported that this new IPS software package seemed to be working. By about 12th July the decision was taken to turn on the Mode B transponder. This was done with a reduced operating schedule.

Reorientation procedure

The overall situation is now stable and it has been possible to carry out a reorientation procedure to adjust the satellite's attitude to accommodate seasonal changes in sun angles. Had this reorientation not been possible, by late summer Oscar 10 would have been in dire straits due to reduced sun angle and a consequent reduction in electrical power.

Following this reorientation process an improved operating schedule may be possible. At present, however, due to the reduced memory capacity it is not possible to transmit CW and RTTY telemetry. Bulletins are therefore currently being sent by PSK 'M' blocks only.

Showing how solar activity has decreased over the last few years



JAS-1

At the time of writing, satellite enthusiasts are awaiting launch of the first of the Japanese amateur radio satellites, JAS-1. The first date given for launch, *viz* 31st July, has passed and the second date, 3rd August, has also passed. The proposed date is now 12th August, with launch time being between 2030 and 2230 hrs UTC (*we have lift-off! Launch was, in fact, successful* – **Ed**).

It is interesting to see that Japanese launch dates are just as subject to delays as those originating in the West! These delays are also due to similar causes apparently, as the launch vehicle H-1 failed a rehearsal test on 15th July, but did pass the countdown rehearsal on 19th July. The problem was due to a faulty fuel tank valve failing to close on telemetry command. The launch takes place from the Japanese island of Tanegashima.

Sporadic-E propagation

Sporadic-E propagation of radio waves occurs when patchy regions in the E layer of the ionosphere become sufficiently ionised to reflect or refract signals in the VHF band of frequencies. Usually it's the 28 and 50MHz bands which show this phenomenon, propagation taking place over a range of 400 to 1,200 miles or so, although multi-hop effects may extend the range to some two thousand miles or more. It can occur at any time, but is more likely to be encountered in the early evening or mid-morning. It is most common around midsummer.

Particular interest is being shown in these multi-hop propagation conditions, for until recently sporadic-E was thought to be confined to single hop short skip paths only.

The recent general release of 50MHz to British radio amateurs has greatly

increased interest in sporadic-E propagation, because this band is particularly prone to such propagation. The much greater use of 50MHz resulting from the new licensing regulations has led to much more knowledge of sporadic-E characteristics being accumulated, and during the past summer period dozens of reports of QSOs with many unexpected countries have taken place. Sporadic-E contacts have been made almost daily between this country and Malta, Cyprus, Portugal, the USSR, Norway, Sweden and Finland. Not all European countries have been licensed for 50MHz as yet, so cross-band contacts between 50MHz and 28MHz or 144MHz have been worked.

More common

Evidence is growing that multi-hop sporadic-E propagation is much more common than was previously thought to be the case. So much so, in fact, that transatlantic QSOs might be possible via this mode on 50MHz. Considerable interest is being shown amongst the '50MHz DX experimenters' in trying to make such contacts. Reports of QSOs with Iceland and Greenland from America and Europe are especially important.

The *VHF/UHF Newsletter* for last June, number 6/86, provides some useful hints for monitoring sporadic-E openings using TV and FM stations on the Continent as 'beacons'. It gives the various channels and their frequencies from 48.25MHz to 93.25MHz, so that as they appear one can see just how conditions are changing toward producing sporadic-E. There is also a circuit diagram for a sporadic-E monitor which will give an early warning of sporadic-E via a klaxon! The *VHF/UHF Newsletter* is published by the RSGB and is full of information, particularly on current events, for the VHF enthusiast.

Datacom

Datacom is the official journal of the British Amateur Radio Teletype Group (BARTG). It is sent free to all BARTG members, and is published at the end of March, June, September and December. It must be one of the best amateur radio specialist group journals produced, and covers the whole field of amateur radio data communication techniques, from packet radio, computers and software for RTTY and other similar applications, to error correcting techniques such as AMTOR, FAX and many more similar topics as well. The latest edition contains a hundred pages of very readable information. Even the advertisements are informative, such as the one on 'Fax for the 48K Spectrum' from G4IDE Micro Systems. Anyone who is interested in this aspect of amateur radio is strongly advised to join BARTG, if only to get their journal. Membership details from: Pat and John Beedie, GW6MOJ/MOK, Flynnonias, Salem, Llandello, Wales SA19 7NP. Tel: (0558) 822286.

UoSAT spacecraft data booklet

A new, revised and enlarged edition of the UoSAT data sheets has been produced by the UoSAT team. It is a 40-page booklet containing UoSAT 1 and 2 mission summaries, technical data summaries, UoSAT orbits and tracking, spacecraft data formats, whole orbit data (WOD), telemetry calibration equations, and details of the UoSAT 2 digital communications experiment, UoSAT CCD camera and DSR experiments, and UoSAT ground station equipment. It's a very useful collection of much of the information that has been disseminated over the past months in 'bits and pieces', brought together between two covers and updated where necessary. It is available from AMSAT-UK, 94 Herongate Road, Wanstead Park, London E12 5EQ for £2.25 plus 18p p&p. REW

GRUNDIG RECEIVER REVIEW

by Brian Kendal G3GDU

When I first received the review samples of the Grundig Satellit 400 and 650 receivers, I must admit that I immediately broke a rule of a lifetime – and read the instruction books first! This proved a wise move, for to take full advantage of all the facilities which either receiver offers requires some study, although the various procedures are quickly learned and easily remembered.

When reviewing any equipment, consideration must be given to its intended purpose. If it has been designed for professional or amateur communications, it must be judged with other equipment in its class: a broadcast receiver must be viewed in terms of its ability to receive commercial broadcast stations, and the fact that the listener is unlikely to be a skilled operator should be taken into consideration.

The Satellit receivers fall somewhere between these extremes, so the domestic broadcast was regarded separately from the HF wavebands.

With both sets on the bench certain similarities were immediately evident, as both cover the LF, MF and FM broadcast bands and 1.6 to 30MHz on the HF waveband, with synthesised frequency control. Furthermore, each contains a digital clock which also controls auto switch-on and switch-off facilities. These include switching for an external cassette recorder, although the switch-off in the case of the 400 is preset at 60 minutes after switch-on. It is definable on the 650.

In addition, either receiver may be operated from mains, 12V dc or internal batteries.

Satellit International 650

The Satellit International 650

The Satellit 650 is a relatively large receiver (504 × 242 × 202mm) with a weight of 8.5kg excluding batteries. A large proportion of the front panel is taken up by the speaker fret. To the right of this are the controls, above which is a long scale. This, however, is not the tuning scale but indicates the setting of the preselector, the tuned frequency being shown by a large LCD display. The latter indicates the frequency, date or time as required, in figures an inch high – a boon to those whose eyesight has lost the perfection of youth!

A meter is situated to the right of the LCD. Again this is of adequate size, and either indicates battery voltage or acts as a tuning meter. For the latter function it is arbitrarily scaled 0-10.

Beneath the LCD and meter is the keypad which controls the frequency, memory and timing functions, and to the right of this lie the manual frequency and preselector tuning controls. Tuning the receiver may be accomplished by selecting a frequency from memory, keying the required frequency into the pad, or manual tuning.

Across the bottom of the receiver is a line of rotary controls which includes AF gain, RF gain, bandwidth, sideband selector, clarifier, and bass and treble tone controls. There are also switches for on/off, battery check/dial illumination, loudspeaker selector and noise limiter.

The FM broadcast band

The Satellit 650 is undoubtedly the most sensitive FM broadcast receiver I have ever handled. This was recently demonstrated when in one half-hour session during a slight 'lift' I identified no less than 43 British and Continental FM broadcast stations, using only the whip aerial attached to the set.

On this waveband tuning is in 10kHz increments, but if the tuning knob is rotated more quickly an audio muting circuit comes into circuit while the increments are increased to 110kHz.

The quality of reproduction is good but not exceptional. On this band full advantage can be taken of the dual loudspeaker system by switching in the tweeter to improve the audio high frequency response.

Sixteen frequencies may be stored on the VHF FM band.

The LF and MF bands

On these bands the Satellit proved excellent for broadcast reception with, in general, the medium bandwidth position proving most satisfactory. Due to the restricted frequency response of the transmissions, however, use of the tweeter speaker tended to degrade rather than enhance the quality of reception.

As the set is equipped for attachment to a direction-finding aerial on the LF band, it was also obviously intended to receive the LF navigational beacons. Accordingly, with the help of a beacon list and switching in the BFO with the receiver in its most selective state, I managed to identify a number of these transmissions up to a range of a hundred miles or so. Bearing in mind that many of these, especially those installed for airport identification, are only intended for ranges of 10 or 25 miles, I considered this highly satisfactory.

On the MF broadcast band the sensitivity was excellent, and the selectivity was such that crosstalk from adjacent stations was rarely a problem.

The preselector tuning may be operated in two modes, automatic and manual. In automatic mode this is achieved with the help of a small motor, but it is recommended that when operating remote from the mains supply, manual control is selected to save unnecessary drain on the batteries. The necessary changeover is by depression of a button in the centre of the concentric tuning/preselector control.

On all bands, LF, MF and HF, the automatic preselector tuning was found to track with such accuracy that no improvement was possible with the manual adjustment.

On the LF band the tuning is in 1 or 3kHz increments and on MF either 1 or 5kHz increments, depending on the speed of rotation of the tuning control.

Four frequencies from the LF band and eight from the MF band may be stored in memory.

The HF bands

The frequency coverage of the Satellit 650 is from 1.6 to 30MHz. Within this spectrum are four types of transmission which may be of interest to readers: broadcast AM, commercial SSB, amateur SSB and CW.

For listening to a particular broadcast AM station this receiver is excellent, for it is merely a matter of either keying in the required frequency or recalling it from store. The accuracy of the frequency control makes further tuning adjustment unnecessary. When searching across a band, however, it doesn't pay to be impetuous, for on rapid rotation of the tuning control the incremental rate soon jumps to 11 or 111kHz, and if the operator is not careful he (or she) can easily increment 500kHz when 50 was intended. When this occurs the receiver mutes until the synthesiser again locks, causing a brief but annoying silence. I consider that the high tuning rate could well have been omitted, for when large frequency excursions are necessary it is as quick to use the keypad. Apart from this, the equipment proved excellent for HF broadcast reception.

The reception of commercial HF SSB demonstrated the excellent frequency accuracy of this receiver. Almost all transmissions are on an exact number of kilohertz (ie 4750.0, 13306.0 etc), and it was possible to switch from one to the next without adjustment of the clarifier. In such service the receiver was a pleasure to use, with transmissions from coastal and meteorological stations and transatlantic aircraft being received at good strength.

The reception of amateur SSB signals is, however, less convenient or effective, for amateurs rarely transmit on an exact number of kilohertz, and due to the 1kHz tuning increments almost every station has to be individually clarified. This makes tuning across the amateur bands both slow and laborious. Furthermore, as only the BFO is adjusted during clarification it is often necessary to use medium bandwidth rather than narrow, with consequent further problems from adjacent stations.

When using the receiver for SSB reception it will often be found desirable to use manual rather than automatic gain control. At such times care must be taken to keep the gain to an absolute minimum, for there are many extremely strong signals on HF which are capable of giving serious cross modulation problems.

Although it might be thought that similar problems would be present for CW listening they were not much in evidence, although even on narrow position the filters are not really sharp enough for this purpose. The ear is tolerent to the pitch of the received CW signal and if it is desired to adjust this on a particular signal, this can be done at leisure.

Through most of the HF band the sensitivity seemed adequate, but above 20MHz it seemed a little deaf and would not stand comparison with the station equipment. Furthermore, although it was possible to slope-detect strong CB FM signals on 27MHz, it would not even detect the presence of signals which were quite readable on standard CB equipment.

32 frequencies on the HF band may be stored in memory.

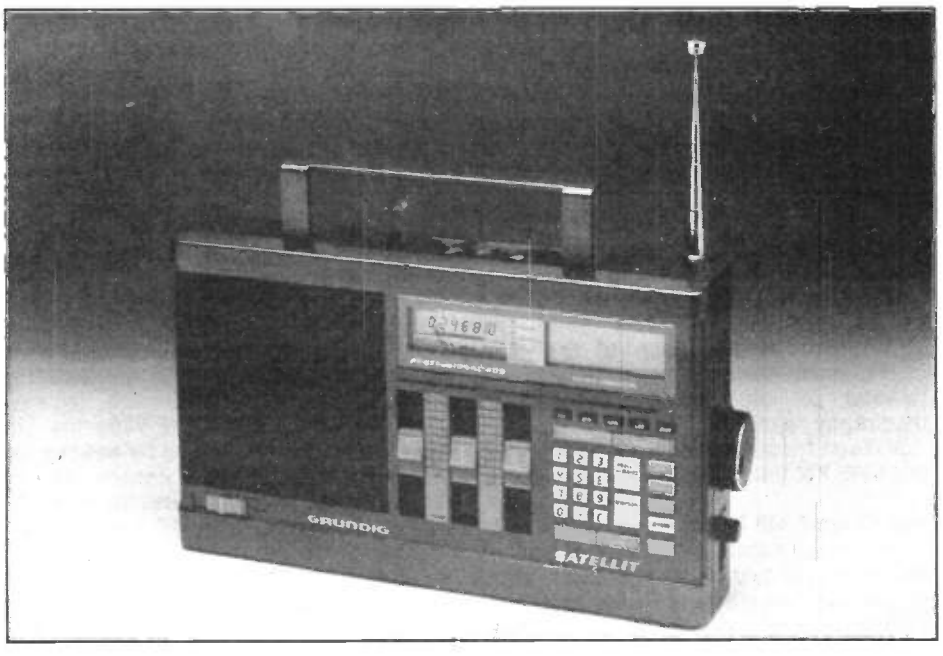
General impressions

On first seeing the Grundig Satellit 650 it gives the impression that it is a well engineered piece of equipment typical of that manufacturer. Over weeks of testing that impression remained.

For most purposes it is an excellent piece of equipment, performing well for broadcast and commercial SSB reception. On the amateur bands, however, the 1kHz incremental tuning rate is really too high to be convenient. I was also disappointed that the sensitivity seemed inadequate above 20MHz, for I would have thought that it ought to have at least matched my rather old station equipment.

Overall, I believe that this equipment will prove to be of considerable interest to the listener who requires a good quality broadcast set with the additional facility of HF broadcast (but not amateur) listening.

Satellit International 400



The Grundig Satellit 400

The Satellit 400 is far smaller (304 × 180 × 70mm), lighter (2.15kg) and of simpler design than the 650.

As with the larger receiver a considerable proportion of the front panel is occupied by the loudspeaker fret, with the controls to the right of this. Three slider potentiometers dominate the front panel, slightly to the right of centre, these controlling audio gain and HF and LF audio response. To the right of this is the keypad controlling frequency, waveband and memory functions, etc. These are surmounted by a signal strength/battery condition meter and LCD frequency display.

The manual tuning knob is located to the side of the cabinet and operates in 1kHz increments on AM and 10kHz on VHF FM, with no 'fast tune' facility. Up to 24 frequencies across all wavebands at random may be committed to memory.

As with the Satellit 650, I shall consider the performance on each band separately.

The FM broadcast band

The Satellit 400 performs creditably well on this band, providing good sensitivity and good audio quality.

Tuning can be accomplished in three ways: by selecting a station from store, by using the search facility, or by manual tuning.

When using the search facility, either the up or down button is pressed. The receiver is muted and the display indicates the frequencies as they are examined. When a carrier is detected there is a brief pause while the signal

strength is examined, and if sufficient to give entertainment quality the audio mute is released.

This is a very convenient means of operation, but the brief wait before the muting lifts can be a little annoying if the user is just scanning up and down the band looking for a programme of casual interest.

The LF and MF broadcast bands

On the LF and MF bands the Satellit 400 proved an excellent broadcast receiver, although the restricted frequency coverage on LF, compared with the 650, inhibited use for monitoring navigational beacons.

The search facility can also be used on these bands, and the comments made previously apply equally.

The HF bands

The HF frequency coverage of the Satellit 400 is exactly the same as the 650, but the fact that it is a less expensive receiver is evident. The highly accurate synthesiser is a delight, but unfortunately the RF selectivity is inadequate and except on the strongest stations there is a continuous background of cross modulation and/or second channel interference present.

This may be reduced by switching the 'DX/Local' switch to the local position, but this considerably reduces the overall receiver sensitivity. I found that during the evenings it was impossible to operate the receiver in the DX mode.

If it is intended to use this receiver for serious short wave listening, an external aerial with a good aerial tuning unit to provide additional RF selectivity will be essential.

On the HF band the search control operates in a different and novel way. On depressing either button the receiver retunes to the next broadcast or amateur waveband, up or down, as appropriate. On amateur wavebands the lowest frequency is selected, but on broadcast the receiver is tuned to the middle of the selected band.

This facility is also extended to the tuning, for if two digits corresponding to the wavelength of the desired band (eg 15 for 21MHz) are keyed, the receiver will immediately tune to that waveband.

On amateur bands, due to the 1kHz tuning increment the clarifier has to be continually adjusted, but the accuracy of the synthesiser makes this unnecessary when listening to commercial SSB transmissions.

The sensitivity at the higher end of the HF band was somewhat disappointing, for stations which registered S7 or S8 on the station equipment were often inaudible on the 400.

General impressions

The appearance of the Satellit 400 gives the impression of a well made piece of equipment of the standard we have come to expect from Grundig.

The performance on the LF, MF and VHF FM broadcast bands is excellent, but unfortunately on the HF band where conditions are so much more critical poor RF selectivity gave rise to severe cross modulation and second channel problems. With additional RF selectivity I believe this could be minimised and HF broadcast reception considerably improved.

I was also disappointed with the poor sensitivity above 20MHz considering that, with modern semiconductors, adequate gain is available and that a great deal of modern communications equipment uses no RF amplification before a diode first mixer.

I believe that this receiver will appeal most to the listener who requires a good quality portable broadcast receiver with the availability of the HF band for occasional listening. REW

ACTIVE AUDIO FILTER DESIGN USING THE ZX SPECTRUM

by F Houghton G3VZM

Audio filters can be used to significantly improve many receivers, and are an essential part of other items of equipment. Passive filters may be built from capacitors and resistors or capacitors and inductors, but these suffer from relative bulk, signal loss and poor skirt performance.

Cascading sections can improve the shape factor, but only at the expense of further loss and size. Active filters provide a sound solution to these inherent problems.

Although active filters may be built from discrete transistors, the simplicity, low cost and small size of integrated circuit op-amps (operational amplifiers) makes them the usual choice. This is the approach taken for this program.

The design of these filters uses only simple equations which can be easily solved with a pocket calculator. So why use a computer?

The starting point of each set of calculations is an arbitrary choice of a capacitor value. Like most arbitrary choices, the first is unlikely to be the best. The initial value may result in resistor values which are inconvenient or not easily produced with combinations of preferred values. When this happens the results must be used to help select another starting value and the calculations repeated.

This can become tedious if a number of runs are needed. Computers are very much at home with tedium, so why not let the machine do the work?

Each of the three common configurations is represented, low-pass, high-pass and band-pass. The circuits are shown in the accompanying diagrams.

The program

The program was written using only a simple approach, with no clever tricks or expanded Basic commands. It should run on any ZX Spectrum.

Each step in using this program has been made self explanatory, but I shall nevertheless offer a quick guide.

After the initial title screen a menu is offered, giving a choice between filter types. Selection is by a single key for each.

Following selection you will be prompted to enter the starting information. First, cut-off frequency, or for the band-pass case, centre frequency. This must be in Hz. Next you will be asked to specify the gain of the circuit. This should be the numerical gain (ie V_{out}/V_{in}), not the value converted to dB. Values less than 1 represent loss. For good results don't try to get too much from the circuit. In the case of the band-pass filter it is also necessary to enter the bandwidth required.

The last input required is the arbitrary starting value of a capacitor. This must be entered in microfarads. Keep in mind the range of frequencies being used when making this decision, and remember that a little practice will give you some idea of the capacitances to be used.

Before making the calculation the computer will need confirmation that you have entered the correct values. Pressing 'N' will return the program to the input routine and 'Y' will allow it to continue. This particular feature may seem extravagant in a simple program, but it can save a lot of time if mistakes are made when complex calculations are involved. Its use has simply become a habit.

Making the printing of hard copy a choice is simply to avoid wasting paper if the result is unsuitable. Using the copy command when no printer is connected has no effect, the computer just ignores it. After accepting or refusing a copy the program resets to the menu. Remember to take any notes first if you want to record the results without a printer.

Now you can simply select the filter type again if you want to try and improve on the values calculated.

Validation

Typing errors are easily made when transferring a program to the computer, so after making a copy on tape try the examples shown to check the results.

Low-Pass Filter:					
Cut-off	1000Hz				
Gain	2				
C1	0.001				
C2	0.006				
R1	56269	R2	112539	R3	37513
High-Pass Filter:					
Cut-off	1500Hz				
Gain	1				
C1	0.002				
C2	0.002				
R1	159154	R2	17683		
Band-Pass Filter:					
Centre frequency		1200Hz			
Bandwidth		400Hz			
Gain		5			
C1		0.001			
C2		0.001			
R1	79577	R2	30606	R3	795774

If you get these results then all is well. You will also see what makes a computer so useful when trying to get convenient resistor values.

Fig 1 *Low pass filter*

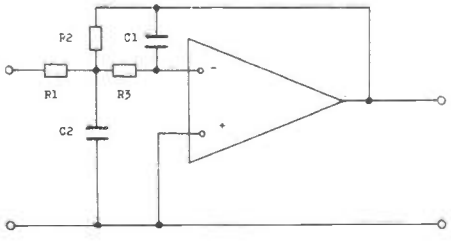


Fig 2 *High pass filter*

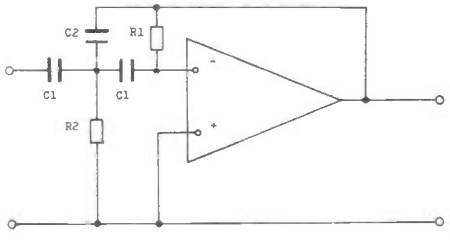
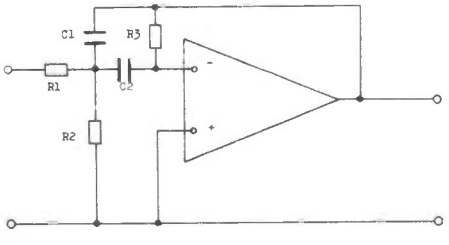


Fig 3 *Band pass filter*



Active audio filter design program

```
 10 BORDER 1: PAPER 1: INK 5
 20 PRINT AT 5,5;"ACTIVE FILTER
DESIGN"
 30 PRINT OVER 1;AT 5,6;"_______
_______"
 40 PRINT AT 7,6;"FOR AUDIO FRE
QUENCIES"
 50 PRINT OVER 1;AT 7,6;"_______
_______"
 60 PRINT AT 12,5;"( © F. Hough
ton 1985 )"
 70 PRINT AT 20,5;"Press any ke
y to start"
 80 PAUSE 0
 90 CLS
100 PRINT AT 5,9;"WHICH FILTER?
"
110 PRINT AT 8,9;"""L"": Low-Pa
ss"
120 PRINT AT 10,9;"""H"": High-
Pass"
130 PRINT AT 12,9;"""B"": Band-
Pass"
140 PRINT AT 20,10;"Enter Lette
r"
150 PAUSE 0
160 IF CODE INKEY$=76 OR CODE I
NKEY$=108 THEN GO TO 190
170 IF CODE INKEY$=72 OR CODE I
NKEY$=104 THEN GO TO 530
180 IF CODE INKEY$=66 OR CODE I
NKEY$=98 THEN GO TO 850
190 CLS
200 PRINT AT 5,8;"LOW PASS FILT
ER"
210 PRINT OVER 1;AT 5,8;"_______
_______"
220 INPUT "Cut off frequency? (
Hz)";f
230 PRINT AT 10,3;"Cut Off Freq
uency (Hz)";TAB 24;f;" Hz"
240 INPUT "Gain?";g
250 PRINT AT 12,3;"Gain:";TAB 2
4;g
260 INPUT "Value of C1? (microf
arads)";c1
270 PRINT AT 14,3;"C1  (microfa
rads)";TAB 24;c1
280 PRINT AT 20,8;"Correct Valu
es? (Y/N)"
290 PAUSE 0
300 IF CODE INKEY$=76 OR CODE I
NKEY$=110 THEN GO TO 190
310 LET w=2*PI*f
320 LET a=50R 2
330 LET c1=c1*.000001
340 LET r1=a/(2*g*w*c1)
350 LET r2=g*r1
360 LET r3=r2/(g+1)
370 LET c2=(2*(g+1))*c1
380 LET c2=c2/.000001
390 CLS
400 PRINT AT 5,8;"LOW PASS FILT
ER"
410 PRINT OVER 1;AT 5,8;"_______
_______"
420 PRINT '''TAB 3;"Cut-Off (Hz
);";TAB 22;f
430 PRINT 'TAB 3;"Gain:";TAB 22
;g
440 PRINT 'TAB 3;"C1  (microfar
ads)";TAB 22;c1/.000001
450 PRINT TAB 3;"C2  (microfara
ds)";TAB 22;c2
460 PRINT TAB 3;"R1  (Ohms):";T
AB 22;INT r1
470 PRINT TAB 3;"R2  (Ohms):";T
AB 22;INT r2
480 PRINT TAB 3;"R3  (Ohms):";T
AB 22;INT r3
490 PRINT AT 20,5;"Hard Copy? (
Y/N)"
500 PAUSE 0
510 IF CODE INKEY$=89 OR CODE I
NKEY$=121 THEN PRINT AT 20,5;"
                    COPY
520 CLS : GO TO 100
530 CLS
540 PRINT AT 5,8;"HIGH PASS FIL
TER"
550 PRINT OVER 1;AT 5,8;"_______
_______"
560 INPUT "Cut off frequency? (
Hz)";f
570 PRINT AT 10,3;"Cut off freq
uency";TAB 24;f;" Hz"
580 INPUT "Gain?";g
590 PRINT AT 12,3;"Gain:";TAB 2
4;g
600 INPUT "Value of C1? (microf
arads)";c1
610 PRINT AT 14,3;"C1  (microfa
rads)";TAB 24;c1
620 PRINT AT 20,5;"Correct Valu
es? (Y/N)"
630 PAUSE 0
640 IF CODE INKEY$=76 OR CODE I
NKEY$=110 THEN GO TO 530
650 LET c1=c1*.000001
660 LET w=2*PI*f
670 LET r1=((2*g)+1)/(w*c1)
680 LET r2=1/(w*c1*(2+(1/g)))
690 LET c2=c1/g
700 LET c2=c2/.000001
710 LET c1=c1/.000001
720 CLS
730 PRINT AT 5,8;"HIGH PASS FIL
TER"
740 PRINT OVER 1;AT 5,8;"_______
_______"
750 PRINT '''TAB 3;"Cut off (Hz
);";TAB 22;f
760 PRINT 'TAB 3;"Gain:";TAB 22
;g
770 PRINT 'TAB 3;"C1 (microfara
ds)";TAB 22;c1
780 PRINT TAB 3;"C2 (microfarad
s)";TAB 22;c2
790 PRINT TAB 3;"R1 (Ohms):";TA
B 22;INT r1
800 PRINT TAB 3;"R2 (Ohms):";TA
B 22;INT r2
810 PRINT AT 20,5;"Hard Copy? (
Y/N)"
820 PAUSE 0
830 IF CODE INKEY$=89 OR CODE I
NKEY$=121 THEN PRINT AT 20,5;"
                    COPY
840 CLS : GO TO 100
850 CLS
860 PRINT AT 5,8;"BAND PASS FIL
TER"
870 PRINT OVER 1;AT 5,8;"_______
_______"
880 INPUT "Centre Frequency? (H
z)";f
890 PRINT AT 10,2;"Centre Frequ
ency (Hz):";TAB 25;f
900 INPUT "Bandwidth (Hz)";b
910 PRINT AT 12,2;"Bandwidth (H
z):";TAB 25;b
920 INPUT "Gain?";g
930 PRINT AT 14,2;"Gain:";TAB 2
5;g
940 INPUT "Value of C1? (microf
arads)";c1
950 PRINT AT 16,2;"C1 (microfar
ads):";TAB 25;c1
960 INPUT "Value of C2? (microf
arads)";c2
970 PRINT AT 18,2;"C2 (microfar
ads)";TAB 25;c2
980 PRINT AT 21,5;"Correct Valu
es? (Y/N)"
990 PAUSE 0
1000 IF CODE INKEY$=76 OR CODE I
NKEY$=110 THEN GO TO 860
1010 LET q=f/b
1020 LET w=2*PI*f
1030 LET c1=c1*.000001
1040 LET c2=c2*.000001
1050 LET r1=q/(q*w*c1)
1060 LET r2=1/((q*(c1+c2)*w)-(1/
r1))
1070 LET r3=(q/w)*((1/c1)+(1/c2)
)
1080 CLS
1090 PRINT AT 5,8;"BAND PASS FIL
TER"
1100 PRINT OVER 1;AT 5,8;"_______
_______"
1110 PRINT '''TAB 1;"Centre Freq
uency (Hz):";TAB 24;f
1120 PRINT 'TAB 1;"Bandwidth (Hz
):";TAB 24;b
1130 PRINT 'TAB 1;"Gain:";TAB 24
;g
1140 PRINT 'TAB 1;"C1 (microfara
ds):";TAB 24;c1/.000001
1150 PRINT TAB 1;"C2 (microfarad
s):";TAB 24;c2/.000001
1160 PRINT TAB 1;"R1 (Ohms):";TA
B 24;INT r1
1170 PRINT TAB 1;"R2 (Ohms):";TA
B 24;INT r2
1180 PRINT TAB 1;"R3 (Ohms):";TA
B 24;INT r3
1190 PRINT AT 21,5;"Hard Copy? (
Y/N)"
1200 PAUSE 0
1210 IF CODE INKEY$=89 OR CODE I
NKEY$=121 THEN PRINT AT 21,5;"
                    COPY
1220 CLS : GO TO 100
```

£1 BAKERS DOZEN PARCELS

Price per parcel is £1.00, but if you order 12 you get one extra free.
All the parcels listed below are brand new components. Unless marked s.h.

1 – 5 13 amp ring main junction boxes
2 – 5 13 amp ring main spur boxes
4 – 5 surface mounting switches suitable insulated for mains voltage
5 – 3 flush electrical switches intermediate type, will also replace 1 or 2 way switches
7 – 4 in flex line switches with neons
8 – 2 80 watt brass cased elements
9 – 2 mains transformers with 6v 1a secondaries
10 – 2 mains transformers with 12v ½a secondaries
11 – 1 extension speaker cabinet for 6½" speaker
12 – 5 octal bases for relays or valves
13 – 12 glass reed switches
14 – 4 OCP 70 photo transistors
15 – 25 assorted germanium transistors OC45 etc
16 – 4 tape heads, 2 record, 2 erase
17 – 2 ultra sonic transmitters and 2 ditto receivers
18 – 2 15000 mfd computer grade electrollics
19 – 2 light dependent resistors similar ORP12
20 – 5 different micro switches
21 – 2 mains interference suppressors
22 – 2 25 watt crossover units
23 – 1 40 watt 3 way crossover unit
28 – 1 6 digit counter mains voltage
29 – 1 BOAC in flight stereo unit (second hand)
30 – 2 Nicad battery chargers
31 – 1 key switch with key
32 – 2 humidity switches
33 – 2 aerosol cans of ICI Dry Lubricant
34 – 96 × 1 metre lengths colour-coded connecting wires
35 – 4 battery operated model motors
36 – 2 air spaced 2 gang tuning condensors
37 – 2 solid dielectric 2 gang tuning condensors
38 – 10 compression trimmers
39 – Long and Medium wave tuner kit
40 – 4 × 465 KC IF transformers
41 – 8 Rocker Switches 10 amp Mains SPST
43 – 5 Rocker Switches 10 amp SPDT Centre Off
44 – 4 Rocker Switches 10 amp DPDT
45 – 1 24 hour time switch mains operated (s.h.)
46 – 1 6 hour clock timeswitch
47 – 2 lever switches 4 pole changeover up and ditto down
48 – 2 6v operated reed switch relays
49 – 10 neon valves – make good night lights
50 – 2 × 12v DC or 24V AC 4CO relays
51 – 1 × 12 v 2C 0-very sensitive relay
52 – 1 × 12v 4C relay
53 – 2 mains operated relays 3 × 8 amp changeovers
54 – 10 rows of 32 gold plated IC sockets (total 320 sockets)
55 – 1 locking mechanism with 2 keys
56 – Miniature Uniselector with circuit for electric jigsaw puzzle
57 – 5 Dolls' House switches
58 – 2 telephone hand sets incorporating ear piece and mike (s.h.)
59 – 2 flat solenoids – ideal to make current transformer etc.
60 – 5 ferrite rods 4" × 5/16" diameter aerials
61 – 4 ferrite slab aerials with L&M wave coils
62 – 4 200 ohm earpieces
63 – 1 Mullard Thyristor trigger module
64 – 10 assorted knobs ¼ spindles
65 – 5 different thermostats, mainly bi metal
66 – Magnetic brake – stops rotation instantly
67 – Low pressure 3 level switch
69 – 2 25 watt pots 8 ohm
70 – 2 25 watt pots 1000 ohm
71 – 4 wire wound pots – 18, 33, 50 and 100 ohm
72 – 1 1250 watt dimmer Ultra ref SE20
73 – 4 3 watt wire wound pots 50 ohm
74 – 50 ⅓ watt carbon film resistors food spread 10 valves
75 – 20 2 watt carbon resistors 10 values
76 – 30 1 watt carbon resistors 15 dif values
77 – 1 time reminder adjustable 1 60 mins
78 – 5 5 amp stud rectifiers 400v
81 – 2 30a panel mounting slydlok fuses
82 – 4 porcelain fuse holders and fuses
83 – 1 fluorescent choke – your choice – 15, 20, 30, 40 or 65 watt
84 – 10 1 uf mains voltage suppressor condensors
85 – 1 mains shaded ple motor ⅜" stack – ¼ shaft
86 – 2 5" ali fan blades fit ¼" shaft
87 – 2 3" plastic fan blades fit ¼" shaft
88 – Mains motor suitable for above blades
89 – 1 mains motor with gear box 1 rev per 24 hours
91 – 2 mains motor with gear box 16 rpm
92 – 4 fluorescent starters suit 4-80w tubes
93 – 4 11 pin moulded bases for relays
94 – 5 B7G valve bases
95 – 4 skirted B9A valve bases
96 – 1 thermostat for fridge
98 – 1 motorised stud switch (s.h.)
99 – 5 assorted ferrite shapes
101 – 1 2½ hours delay switch
103 – 1 6v mains power supply unit
104 – 1 4½v mains power supply unit
105 – 1 5 pin flex plug and panel socket
106 – 2 12v vibrating reed bleepers
107 – 5" speaker size radio cabinet with handle
109 – 10¼" spindle type volume controls
110 – 10 slider type volume controls
111 – 2 musical boxes (less keys)
112 – 1 heating pad 200 watts
113 – 1 1m front end with tuning condensor and data
114 – 1 1w amplifier Mullard 1172
115 – Wall mounting thermostat 24v
117 – 4 pairs large (car size) crocodile clips
118 – Teak effect extension 5" speaker cabinet
119 – 1 log & 1 coal fibreglass fire fronts
120 – p.c.b. with 2 amp full wave and 7 other recs.
122 – 10 mtrs twin screened flex white p.v.c. outer
123 – 100 plastic with hardened pin flex clips
124 – 10 assorted slide switches
132 – 2 plastic boxes with windows, ideal for interrupted beam switch etc.
155 – 3 varicap push button tuners with knobs
188 – 1 plastic box, sloping metal front, size16 × 95mm, average depth 45mm
241 – 1 car door speaker (very flat) 6½" 15 ohm made for Radiomobile
243 – 2 speakers 6" × 4" 15 ohm 5 watt made for Radio mobile
266 – 2 mains transformers 9V ½A secondary split primary so OK also for 115V
267 – 1 mains transformer 15V 1A secondary PCB mounting
BD318 – 1 Metal box with paxpo in lid, size 6" long × 3½" wide × 2" deep
BD324 – 20m fig 8 flex .75mm for loudspeaker extensions
BD326 – 1 4 min. clock work time switch
BD327 – 10 double compression trimmers 500pf & 100pf
BD329 – 1 clock display 13mm figures LCD
BD330 – 2 6v 0 6v mains transformer .3A p.c.b. mounting
BD337 – 1 24v 5 amp mains transformer toroidal
BD339 – 10 control knobs long shaft push on type 1" approx metallic embellished
BD340 – 4 V3 micro switch SPCO 10A mains, with ¼ tags for push on connection
BD348 – 1 20kv ceramic capacitor 001 mfd
BD349 – 2 10kv ceramic capacitor 002 mfd
BD350 – 40 double pole leaf switches
BD351 – 2 1 watt record player amps
BD360 – 100 sub minif transformers all the same type as in pocket radios
BD365 – 1 7uf 660v 50hz metal cased condenser

MULLARD UNILEX AMPLIFIERS

We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the four Mullard modules – i.e. Mains power unit (EP9002), Pre amp module (EP9001) and two amplifier module (EP9000) all for **£6.00** plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

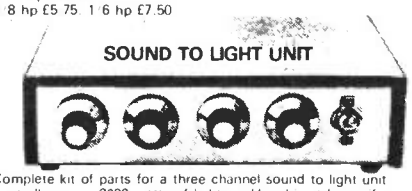
VENNER TIME SWITCH

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

Ex-Electricity Board.
Guaranteed 12 months.

12 volt MOTOR BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3½" long by 3" dia. They have a good length of ¼" spindle.
1/10 hp £3.45
1/8 hp £5.75. 1/6 hp £7.50



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.

GOODS ARE ON APPROVAL

These notes are often hastily written and technical information sheets are seldom available about the items we have to describe, also advertisements sometimes go to press without our having a chance to correct any mistakes. However, everything we sell is supplied on the understanding that if it is not suitable for your project you may return it within 7 days for credit. If there was a definite error of description in our copy then we will pay postage. If not, then you pay the postage. Note – this offer applies to kits, but only if construction is not started.

TELEPHONE BITS

SOCKETS ETC for BT phones.

Master socket (has surge arrestor, ringing condenser etc) and takes B.T.plug	£3.95
Extension socket	£2.95
Dual adaptors (2 from one socket)	£3.95
Cord terminating with B.T. plug 3 metres	£2.95

Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets. **£11.50**

25A ELECTRICAL PROGRAMMER

Learn in your sleep. Have radio playing and kettle boiling as you wake. switch on lights to ward off intruders. have a warm house to come home to. You can do all these and more. By a famous maker with 25 amp on/off switch. Independent 60 minute memory jogger.
A beautiful unit at **£2.50**

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 cary about and which will give you superb reception.
Other uses are a "get you to sleep radio", you could even take it with you to use in the lounge when the rest of the family wants 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 – 170KHz, medium wave band 525 – 1650KHz, FM band 87 – 108 MHz, mono, stereo & AFC switchable, 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 **£4.95**

IONISER KIT

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

J & N BULL ELECTRICAL

DEPT. EL, 128 PORTLAND ROAD HOVE, BRIGHTON, SUSSEX BN3 5QL

MAIL ORDER TERMS: CASH, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & B/card orders accepted. Phone Brighton (0273) 203500

MINI MONO AMP

on p.c.b. size 4" × 2" (approx.). 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**

TWO POUNDERS

Following the popularity of our BAKERS DOZEN £1 PARCELS, we are now introducing some BAKERS DOZEN £2 PARCELS. We feel that you will agree that most are exceptional bargains but you can still get a bit extra, as with the £1 parcel, if you buy 12 you get another free!

2P1 – 24 hour time switch with 2 on/offs, an ideal heating programmer
2P2 – Wall mounting thermostat, high precision with mercury switch and thermostat
2P3 – Variable and reversible 8 12v power supply, ideal for model control
2P4 – 24 volts psu with separate channels for stereo made for Mullard UNILEX Amplifiers
2P5 – 12 volt psu 750 ma output – pastic cased
2P6 – 100 watt mains to 115 volts auto transformer with voltage tappings
2P7 – Mini key, 16 button membrane keyboard, list price over £12, as used on PRESTEL
2P8 – Mains motor with gear box and variable speed selector. Series wound so suitable for further speed control
2P9 – Time and set switch. Boxed, glass fronted and with knobs. Controls up to 15 amps. Ideal to program electric heaters, battery chargers etc
2P10 – 12 volt 5 amp mains transformer – low volt winding on separate bobbin and easy to remove to convert to lower voltages for higher currents
2P11 – Power amp module Mullard Unilex EP9000 (note stereo pre amp module Unilex 9001 is BD216)
2P12 – Disk or Tape precision motor – has balanced rotor and is reversible 230v mains operated 1500 rpm
2P14 – Mug Stop kit – when thrown emit piercing squawk
2P15 – Interrupted Beam kit for burglar alarms, counters etc
2P17 – 2 rev per minute mains driven motor with gear box, ideal to operate mirror ball
2P18 – Liquid gas shut off valve mains solenoid operated
2P19 – Disco switch motor drives 6 or more 10 amp change over micro switches supplied ready for mains operation
2P20 – 20 metres extension lead, 2 core – ideal most Black and Decker garden tools
2P21 – 10 watt amplifier, Mullard module reference 1173
2P22 – Motor driven switch 20 secs on or off after push
2P24 – Clockwork operated 12 hour switch 15A 250V with clutch
2P25 – 1000 watt flasher mains motor driven
2P26 – Counter resettable mains operated 3 digit
2P27 – Goodmans Speaker 6 inch round 8ohm 12 watt
2P28 – Drill Pump – always useful couples to any drill
2P29 – 24 position Yaxley switch contacts rated 5A – ¼ spindle
2P31 – 4 metres 98 way interconnecting wire easy to strip to use the cores separately
2P32 – Hot Wire amp meter – 4½ round surface mounting – old but working and definitely a bit of history
2P34 – Solenoid Air Valve mains operated
2P35 – Battery charger kit comprising mains transformer, full wave rectifier and meter, suitable for charging 6v or 12v
2P36 – 20 Amp meter, with shunt unused but ex equipment
2P38 – 200 R.P.M. Geared Mains Motor 1" stack quite powerful, definitely large enough to drive a rotating aerial or a tumbler for polishing stones etc.
2P43 – Small type blower or extractor fan, motor inset so very compact, unused.
2P36 – 0-20 amp panel mounting meter with fitted shunt ex equipment but guaranteed
2P46 – Our famous drill control kit complete and with case
2P48 – Telephone ringing unit reduces mains to 50 volts and changes frequency from 50 Hz to 25 Hz to give right ringing tone
2P49 – Fire Alarm break glass switch in heavy cast case
2P51 – Stereo headphone amplifier, with pre amp and normal controls
2P54 – 2½kw blow heater section of coal or log effect fire, this is a sheet metal assembly which holds the elements the motor with fan and the lamp holders and bits which give the fickering flame effect. Please collect or add £3 to cover packing and Postage.
2P56 – Mains motor extra powerful has 1½" stack and good length of spindle both ends.
2P61 – 1 control panel kit for Unilox
2P62 – 1 pair of Goodmans 150hm speakers for Unilox
2P63 – 1 5kv 20 ma mains transformer
2P64 – 1 five bladed fan 6½" with mains motor
2P65 – 2 resettable trips 4 5A mains
2P67 – 1 12v 0 12v 2 amp mains transformer
2P68 – 1 15v 0 12v 2 amp mains transformer
2P69 – 1 250v 0 250v 60 mA & 6.3 V 5A mains transformer
2P70 – 1 E.M.I. tape motor two speed and reversible
2P72 – 1 15v Muffin fan 4" × 4" approx
2P75 – 1 6 hour timer plugs into 13A socket
2P76 – 1 Audax tweeter partner to 5P26 speaker
2P77 – 1 instrument box with key size 12" × 4½" wide 6" deep
2P78 – Metal clad switches with 4 5amp 250v switches GEC
2P81 – ORACLE VB100 instrument panel this is a MODEM with extra it is the heart of many viewdata systems including the prestal unit we recently stocked its uses 25 IC's 11 Crystals U.H.F. modifier Aztec UM1233 etc. etc. You receive this new unused and complete except for 7 of the plug in IC's.

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FM Receiver Kit – for surveillance or normal FM	£3.50

THE TRIODE VALVE

PART TWO by Roger Alban GW3SPA

So far we have examined the various parameters of the triode valve, but have yet to find a practical use for it.

We know that when a small voltage is applied to the grid, it will affect the anode current and anode voltage. Therefore it must be possible to use the triode as an amplifier.

If an alternating voltage is applied across the grid and cathode as shown in *Figure 8*, it will in turn control the anode current.

If a load resistor R_a is placed in series with the anode of the valve, the anode current will cause a fluctuating voltage to be dropped across R_a which will be greater in magnitude than the peak to peak value applied to the grid.

The effect upon the anode current of applying a sine wave signal to the grid circuit may be examined in conjunction with the mutual characteristic of the valve, *Figure 9*. The signal applied to the control grid will cause the grid voltage to swing either side of its normal zero voltage in equal positive and negative peak values.

If the effect of the sinosoidal grid voltage is projected onto the mutual characteristic graph, the instantaneous values of anode current resulting can be plotted.

It at once becomes apparent that if the grid is allowed to operate over a range which includes any non-linear portion of the graph, the changes in anode current will not bear a constant relationship to the changes in grid voltage. When the grid voltage becomes positive, the resulting change in anode current will be smaller owing to the onset of saturation. Therefore the resulting anode current waveform will not be a faithful reproduction of the signal applied to the grid.

To reduce the distortion on the output signal it is necessary to move the operating point P such that the input signal applied to the grid remains within the straight portion of the characteristic curve. It is therefore necessary to add a steady negative dc component to the input signal to bias back the grid voltage so that the operating point P lies half-way along the straight portion of the characteristic curve. This condition is shown in *Figure 10*.

If the input signal is applied about this biased operating point, then the input sinosoidal signal will vary above and below the negative bias value. For example, if the steady bias supplied to the grid is −5V and the applied signal has a peak value of 2V, the grid voltage will swing between the values of −3V to −7V.

If this range of grid voltage is within the linear portion of the characteristic curve, the changes in anode current will bear a constant relationship to the change in grid voltage. This condition is, however, subject to the fact that grid current does not flow.

Grid bias

In the early days of valves the grid bias was supplied by a separate battery known as the grid bias battery. With the vast majority of modern valves, being of the indirectly heated variety, the grid bias can be obtained from the voltage dropped across a resistor connected in series with the cathode.

In *Figure 11*, the resistor R carries the anode current I_a. The arrow indicates the direction of conventional current flow which makes the grid negative with respect to the cathode. The bias voltage is simply calculated from the formula $V = I_a \times R$.

The voltage on the grid comprises an alternating voltage and the bias voltage which is produced by a fluctuating anode current. It is convenient to regard the anode current as the combination of a steady direct current with an alternating current component having a similar waveform to that of the input signal. The ac component of the anode current may be separated from the dc component by providing a shunt capacitor circuit to bypass the cathode resistor. The capacitor is in parallel with the cathode resistor and provides a low impedance path for the ac component of the anode current.

Load Lines

Except under static conditions when the grid is kept at a constant voltage and there is no load resistor R_a in the anode circuit, the actual voltage on the anode will not be equal to that supplied at the terminals of the high tension battery. A voltage drop of $I_a \times R_a$ volts will always exist across the load resistor R_a. The anode of the triode valve will actually be at the voltage of the high tension supply minus the voltage dropped across the load resistor R_a, *Figure 12*.

To examine the dynamic working characteristics of the triode, a study of the static characteristics is insufficient. It is necessary to draw the load line which represents the actual operating points of the valve when the grid voltage is varied and the anode circuit includes a known load impedance.

The load line is most usefully constructed across a series of graphs of V_a plotted against I_a for different values of V_g, *Figure 13*. The load line for a pure resistive load may be plotted on this graph in the following way. If the grid is heavily biased negatively so that I_a is

Fig 8 *Triode valve used as an amplifier*

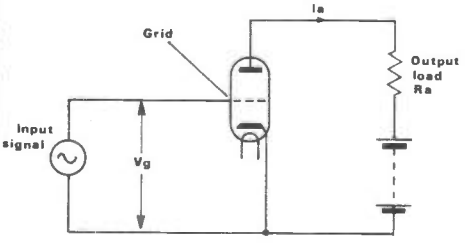


Fig 9 *Valve amplifier without grid bias applied*

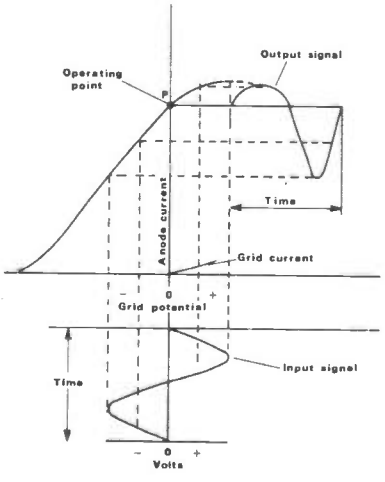


Fig 10 *Valve amplifier with grid bias applied*

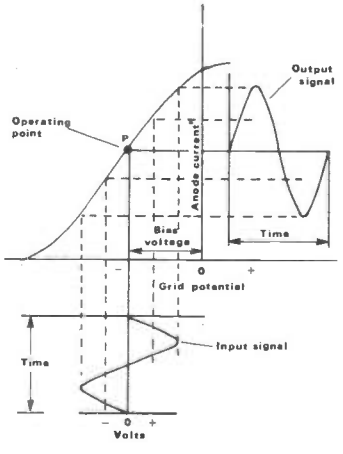


Fig 11 *Grid bias produced by cathode resistor*

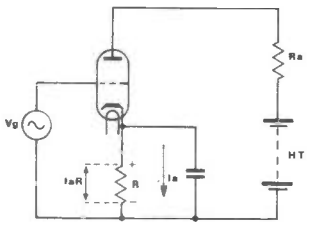


Fig 12 *Valve operating under dynamic conditions*

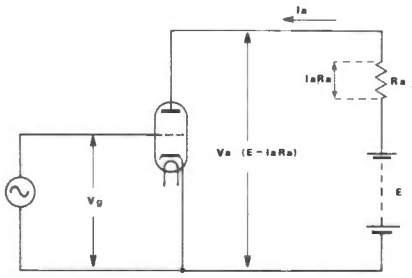
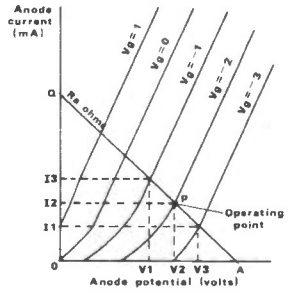


Fig 13 *Load lines applied to anode characteristic graphs*



zero, the voltage on the anode will be the high tension battery voltage because no voltage is dropped across the load resistance R_a. The point where I_a is zero and V_a is equal to E is plotted at point A.

A second point Q can be plotted for the condition when V_a becomes zero. That is when all the high tension voltage is developed across the load resistor R_a. The value of I_a will be determined by E divided by R_a.

A straight line AQ, the load line, can be drawn and has a slope which will represent the value of the load resistance. The line passes through the points whose co-ordinates are zero anode current and the full anode voltage supply. Therefore if the value of the load resistance is altered the gradient of the slope will be changed, but the straight line will still pass through point A.

In the example shown the value will most probably be biased to achieve the operating point with a grid voltage of −2V. The application of a sine wave signal to the grid will cause the operating point to swing an equal distance on either side of P along the load line. The range within which the load line is cut at equal distances on both sides of the normal bias point P by equal changes in grid voltage will be the range of undistorted output.

If the anode load should be reactive rather than resistive the load line becomes an ellipse, the dimensions of which will be a function of the frequency of the input signal and its peak value.

Amplifier efficiency

The anode characteristic graph with the attached load line can be used to calculate the power efficiency of the valve amplifier.

The total power supplied to the valve can be calculated from knowing the operating point P. The total power supplied will be $I_2 \times V_2$ watts. The power developed in the anode load resistance can be calculated from a close examination of the load line. If the signal applied to the grid causes the grid voltage to vary between −1V and −3V, then the resulting swing in V_a will be between V_3 and V_1 and the anode current will vary between I_1 and I_3 milliamps.

The values of anode voltage and current are given in peak to peak values and need to be converted to rms values.

The resulting rms power developed in the load resistance will be:

$$P = V_a \times I_a$$

$$P = \frac{(V_3 - V_1)}{2\sqrt{2}} \times \frac{(I_3 - I_1)}{2\sqrt{2}}$$

$$= \frac{(V_3 - V_1) \times (I_3 - I_1)}{2\sqrt{2}}$$

The difference between the total power supplied and the power supplied to the load will be power dissipated within the valve anode. Consequently care must be exercised when choosing a valve to ensure that the quoted anode dissipation is adequate for the design in which the valve is to be used.

If the manufacturer's quoted anode dissipation is exceeded, the anode temperature will rise higher than the anode temperatures experienced during manufacture.

This will result in the release of gasses which will eventually poison the cathode and reduce the electron emission. The high anode temperatures can also cause anode primary emission or even melt the anode.

It should also be noted that when the grid voltage is increased, this produces a rise in I_a and consequently in the voltage dropped across the load resistor R_a. Therefore V_a will decrease, producing a phase change of 180° between the input and output signals of the valve amplifier.

The valve amplifier can be represented by an equivalent circuit shown in *Figure 14*, comprising a voltage generator in series with its own internal impedance, connected across the load R_a. A change in voltage on the grid will produce a voltage change at the anode of μ times the change in grid voltage. This is the voltage produced by the voltage generator in the equivalent circuit. The internal impedance is the valve resistance r_a. The output voltage developed across the load resistor R_a can be expressed as follows:

$$\text{Output voltage} = \mu \times V_g \times \frac{R_a}{R_a + r_a}$$

$$\text{Voltage gain} = \frac{\text{Output voltage}}{\text{Input voltage } (V_g)}$$

$$\text{Therefore voltage gain} = \mu \times \frac{R_a}{R_a + r_a}$$

To obtain a high value of voltage amplification it is necessary to ensure that μ is high and that r_a is larger than R_a. The input resistance R_{in} is high in value and will normally be in the order of megohms.

Miller effect

The triode valve has been used successfully as a voltage amplifier at audio frequencies. However, circuit designers experienced difficulties in obtaining the theoretical voltage gain when the operating frequency was increased.

This unusual phenomenon baffled the experts for some time until it was discovered that the triode contained natural capacitance which had an effect on the voltage gain at high frequencies. The cathode, anode, and grid behave as the plates of a capacitor producing C_{gk} between grid and cathode, C_{ag} between anode and grid, and C_{ak} between anode and cathode.

Figure 15 shows a typical triode amplifier complete with its associated internal capacitance. At high frequencies the high tension supply for ac purposes can be considered to be a short circuit with the load impedance Z being in parallel with the valve.

The input impedance can be calculated by dividing V_1 by I_1. But:

$$I = \frac{\text{voltage drop across } C_{ag}}{XC_{ag}}$$

$$= \frac{V_1 + A \times V_1}{1/\omega C_{ag}}$$

$$= \omega C_{ag} (A + 1) V_1$$

where A is the voltage gain of the amplifier. Therefore:

$$Z_{in} = \frac{V_1}{\omega C_{ag} \times (A + 1) \times V_1}$$

$$= \frac{1}{2\pi FC_{ag} \times (A + 1)}$$

It can be seen that the capacitance C_{ag} appears as a capacitor of value $C_{ag} \times (A + 1)$, which is across the input terminals of the valve amplifier.

At radio frequencies the reactance of the small inter-electrode capacitance drops to a very small value. A resistance coupled amplifier gives very little amplification at RF, for example, because the reactance of the inter-electrode capacitance C_{ag} is so low that it practically short circuits the input and output circuits. Thus the valve is unable to amplify.

Unstable amp

In addition, at RF frequencies the capacitance C_{ag} provides a relatively low path over which the amplified signals can be fed back to the input of the amplifier in the correct phase so as to cause the amplifier to become unstable and start to self-oscillate.

Fig 14 *Equivalent circuit of the triode valve*

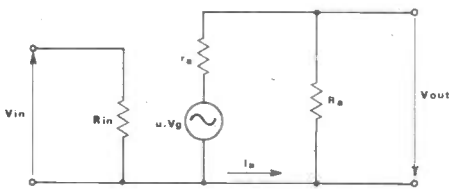
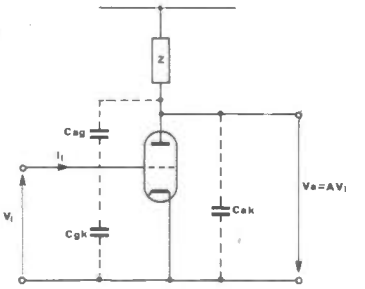


Fig 15 *Miller effect in a triode valve*



Hope and aspiration

The hopes and aspirations of the valve manufacturers and the circuit designers were dampened for a time while a solution was sought. Like all problems, given time and effort, a solution was eventually in sight to reduce the inter-electrode capacitance between anode and grid. This particular era was a milestone in the development of the modern valve which provides the home entertainment comforts taken for granted today. The further development of the valve is, however, yet another story. REW

Sorry!

As you might have noticed, a couple of deltas did a bunk from last month's equations! The errant blighters have repented, so here they are:

$$r_a = \frac{\delta V_a}{\delta I_a} \qquad \mu = \frac{\delta V_a}{\delta I_a} \times \frac{\delta I_a}{\delta V_g}$$

$$g_m = \frac{\delta I_a}{\delta V_a} = \frac{15 - 5}{7 - 4} = \frac{10}{3}$$

$$\mu = \frac{\delta V_a}{\delta V_g} = \frac{120 - 80}{6 - 4} = \frac{40}{2}$$

DATA FILE . . .

Ray Marston concludes his 'transistor mini-series' by looking at a miscellany of useful circuits

The last few editions of *Data File* have formed a mini-series of articles looking at the operating principles and applications of the discrete bipolar transistor. Last month we concentrated on the subject of audio power amplifier principles. In this edition of 'The File' we conclude the mini-series by looking at three practical power amplifier circuits, plus a wide variety of useful (and not so useful) gadgets and miscellaneous transistor circuits.

Power amplifiers

The easiest way to build a low to medium power audio amplifier is to simply use one of the many dedicated ICs that are now available for this task. In some cases, however, particularly when making 'one off' projects, it may be cheaper or more convenient to use a discrete transistor design, such as one of those shown in *Figures 1* to *3*.

The *Figure 1* design is that of a general purpose low power high gain amplifier with a class A output suitable for driving a medium impedance (greater than 65 ohms) speaker or headset. The circuit draws a typical quiescent current of about 20mA (this can be reduced by increasing the R3 value), and operates as follows.

Tr1 and Tr2 are both wired as common-emitter amplifiers, with the output of Tr1 direct-coupled to the input of Tr2, and the circuit thus gives a typical overall voltage gain of about 80dB. Note that Tr2 emitter load (R3) is decoupled via C3, and Tr2 emitter thus 'follows' the mean collector voltage of Tr1, and that the Tr1 base bias is derived from Tr2 emitter via R2; the bias is thus stabilised by dc negative feedback. Input pot RV1 acts as the circuit's volume control.

Figure 2 shows a simple 3-transistor class AB complementary amplifier which can typically drive about 1 watt into a 3 ohm speaker. Here Tr1 is wired as a common-emitter amplifier driving collector load LS1-R1-RV2, and has its output voltage 'followed' and power-boosted by the Tr2-Tr3 complementary emitter follower stage. The output of the amplifier is fed (via C2) to the LS1-R1 junction, thus providing a low impedance drive to the speaker and simultaneously bootstrapping the value of R1 so that the circuit gives a high value of voltage gain. The output is also fed back to Tr1 base via R4, thus providing base bias via a negative feedback loop.

In use, RV2 should be carefully adjusted to provide minimal audible signal crossover distortion consistent with minimal measured quiescent current consumption; a good compromise is to set the quiescent current at about 10 to 15mA.

Figure 3 shows a rather more complex audio power amplifier that can deliver roughly 10 watts into an 8R load when powered from a 30 volt supply. This

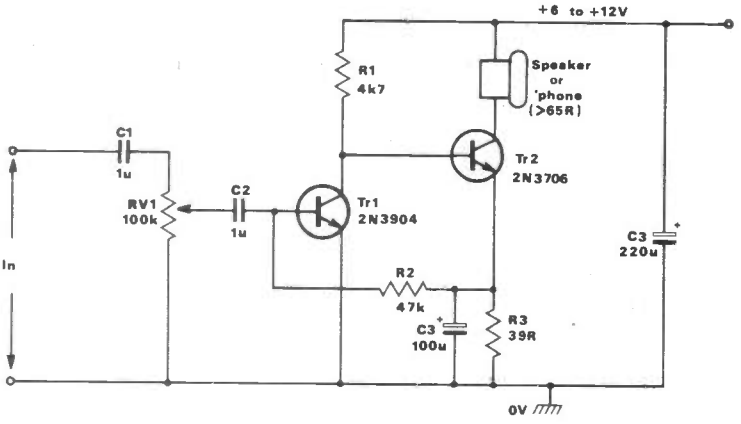


Fig 1 *General purpose high gain low power audio amplifier*

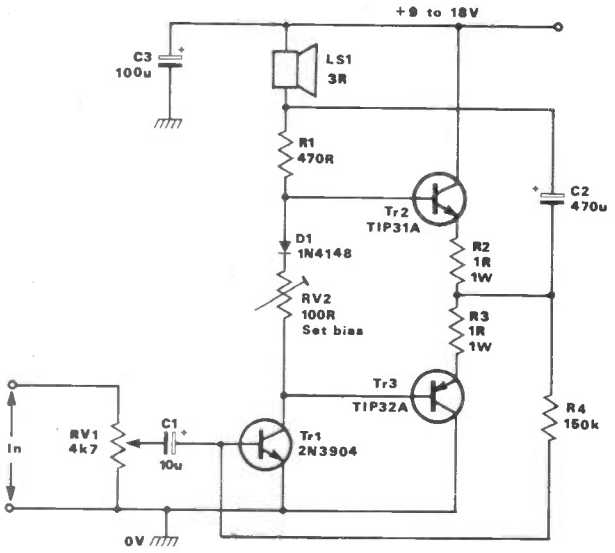


Fig 2 *Simple 1 watt amplifier*

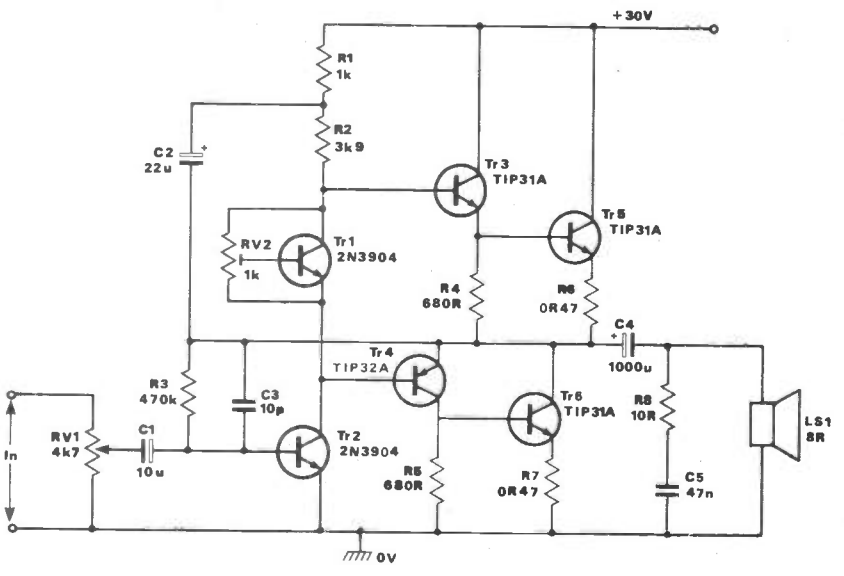


Fig 3 *10 watt audio amplifier*

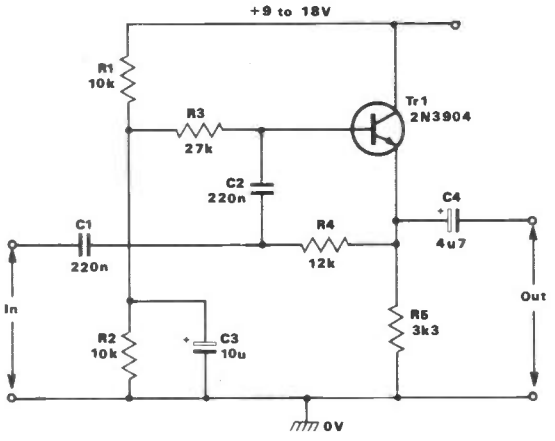


Fig 4 *50Hz 'rumble' or high-pass filter*

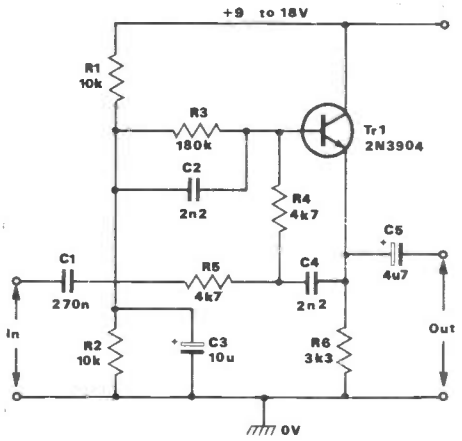


Fig 5 *10kHz 'scratch' or low-pass filter*

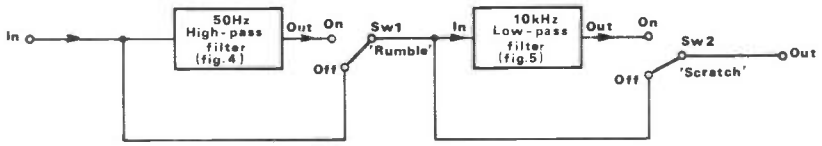


Fig 6 *Complete scratch/rumble filter with switching*

circuit uses high gain quasi-complementary output stages (Tr3 to Tr6) and uses an adjustable 'amplified diode' (Tr1) as an output biasing device.

The Tr2 common-emitter amplifier stage has its main load resistor (R2) bootstrapped via C2, and is dc biased via R3, which should set the quiescent output voltage at about half-supply value (if not, alter the R3 value). The upper frequency response of the amplifier is restricted via C3, to enhance circuit stability, and C5-R8 are wired as a 'Zobel' network across the output of the amplifier to further enhance the stability. In use, the amplifier should be initially set up in the way already described for the *Figure 2* circuit.

Scratch/rumble filters

A common annoyance when playing old record discs through a decent 'hi-fi' system is that of 'scratch' and/or 'rumble' noises. The scratch noises are mainly high frequency sounds (usually greater than 10kHz) picked up from the disc surface, and the rumble noises are low frequency sounds (usually less than 50Hz) that are mostly caused by slow variations in motor-drive speed. Each of these noises can be effectively eliminated (or greatly reduced) by passing the record player audio signals through a frequency filter that rejects the troublesome part of the audio spectrum. *Figures 4* and *5* show suitable circuits.

The rumble filter circuit of *Figure 4* acts as a high-pass filter that gives unity voltage gain to all signal frequencies greater than 50Hz, but 12dB per octave rejection to all frequencies below this value, ie 40dB of attenuation at 5Hz, etc.

Here, Tr1 is wired as an emitter follower and is biased at roughly half-supply value from the low impedance point formed by R1-R2-C3, but has negative feedback applied via the R3-C2-C1-R4 filter network, which causes the 'active' filter response mentioned above. The frequency turnover point of the circuit can be altered, if desired, by changing the C1-C2 values (which must be equal). Thus if the C1-C2 values are halved (to 110n) the turnover frequency will double (to 100Hz), etc.

Scratch filter circuit

The scratch filter circuit of *Figure 5* acts as a low-pass filter that gives unity voltage gain to all signal frequencies below 10kHz, but gives 12dB per octave rejection to all frequencies above this value. This circuit is similar to that of *Figure 4*, except that the positions of the resistors and capacitors are transposed in the C2-R4-C4-R5 filter network. The turnover frequency of the circuit can be altered, if desired, by changing the C2-C4 values; eg values of 3n3 will give a turnover frequency of 7.5kHz.

The circuits of *Figures 4* and *5* can be combined to make a composite scratch and rumble filter by simply connecting the output of the high-pass filter to the input of the low-pass filter. The individual filter sections can be provided with bypass switches, enabling the filters to be easily switched in and out of circuit, by using the connections shown in *Figure 6*. Note that if the *Figure 4* and *5* designs are to be built as a single unit, a few components can be saved by making the R1-R2-C3 biasing network common to both circuits.

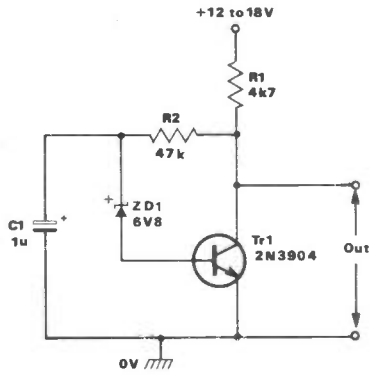


Fig 7a *Transistor-Zener white noise generator*

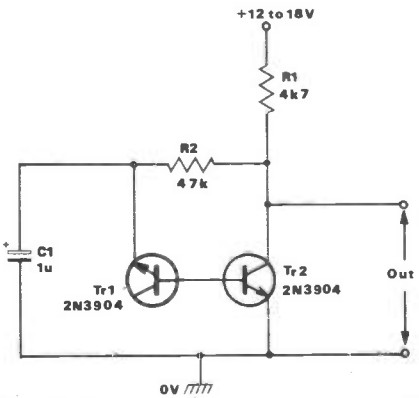


Fig 7b *Two-transistor white noise generator*

'Noise' circuits

The waveform known as 'white noise' can be described as a signal containing the full spectrum of randomly generated frequencies, each having equal mean power when averaged over a unit of time. White noise is of value in testing AF and RF amplifiers, and is widely used in special effects sound generator systems etc.

Figure 7a shows the practical circuit of a simple but useful white noise generator which relies on the fact that any reverse-biased Zener diode inherently generates a substantial amount of white

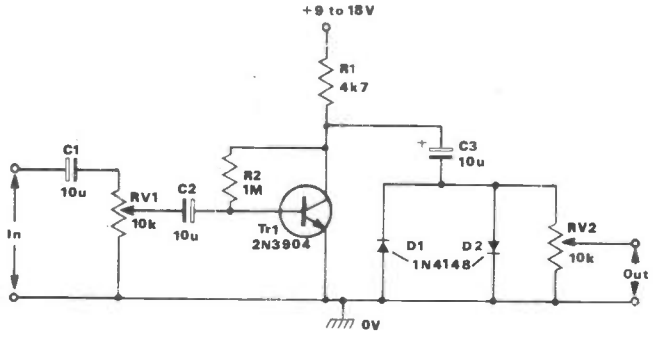


Fig 8 *Noise limiter*

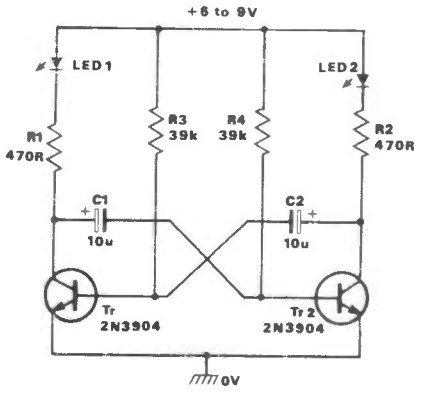


Fig 9 *Two-LED 'flasher' circuit*

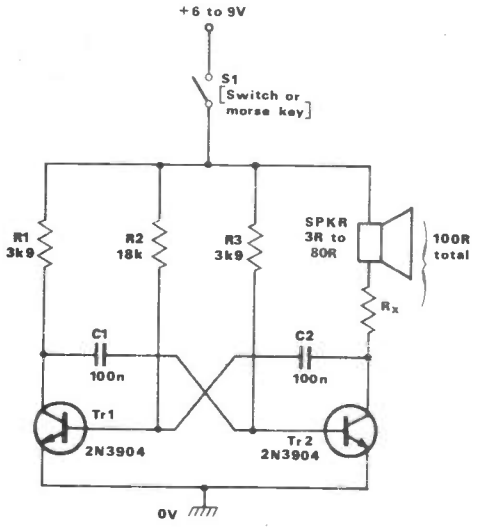


Fig 10 *Morse code practice oscillator*

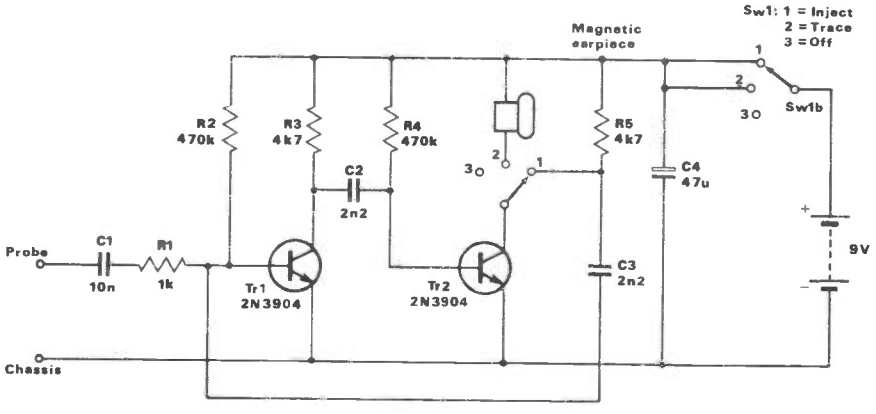


Fig 11 *Signal injector/tracer*

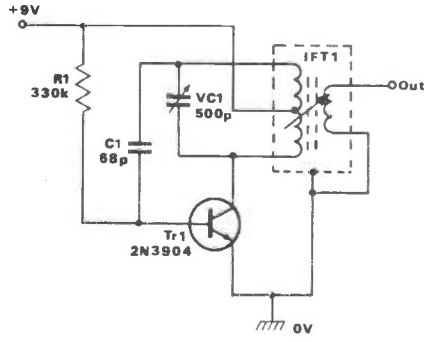


Fig 12 *MW signal generator/BFO*

noise. In this circuit, R2 and ZD1 are wired in a negative feedback loop between the collector and base of the common-emitter amplifier Tr1, thus stabilising the dc working levels of the circuit; the loop is ac decoupled via C1. Consequently, the Zener diode acts as a white noise source that is wired in series with the base of the transistor, which then amplifies the noise to a useful level of about 1V p-p.

In practice, the base-emitter junction of any silicon transistor can be made to function as a noise generating Zener diode by simple reverse-biasing the junction to its breakdown point. In the 2N3904 small-signal transistor this breakdown typically occurs at about 6 volts, and a 2-transistor white noise generator can thus be made by using the circuit shown in *Figure 7b*, in which Tr1 acts as a Zener diode.

Noise can at times be a great nuisance. When listening to very weak broadcast signals, for example, it is often found that the peaks of unwanted background noise completely swamp the broadcast signal, making it unintelligible.

This problem can sometimes be overcome by using the 'noise limiter' circuit of *Figure 8*. Here, the signal plus noise waveform is fed to amplifier Tr1 via RV1. Tr1 amplifies both waveforms equally, but diodes D1 and D2 automatically limit the peak to peak output swing of Tr1 to about 1.2 volts. Thus if RV1 is adjusted so that the signal output is amplified to this peak level, the noise peaks will not be able to greatly exceed the signal output, and intelligibility is greatly improved.

Astable multivibrators

The astable multivibrator or 'square wave generator' circuit has many uses. *Figure 9*, for example, shows how it can be used as a 2-LED 'flasher' that operates at about 1 flash per second. The rate is controlled by the time-constant values of C1-R4 and C2-R3.

In the *Figure 9* circuit the LEDs are wired in series with the transistor collectors and flash on and off in opposition to one another symmetrically. The flash rate can be changed by altering the values of either C1/C2 or R3/R4. If desired, one of the LEDs can be replaced with a short circuit to make a 1-LED flasher.

A simple variation of the astable circuit is shown in *Figure 10*. Here, a non-symmetrical waveform of about 800Hz is generated and fed to a speaker and limiting resistor in the collector of Tr2, thus producing a monotone audio signal when S1 is closed. The circuit can thus be used as either a simple sound generator (by using an ordinary switch in the S1 position) or as a morse code practice oscillator (by using a morse key as S1). The circuit's tone frequency can be changed by altering the C1 and/or C2 values.

Figure 11 shows how an astable multivibrator can be used as the basis of a signal injector/tracer piece of test gear. Here, when SW1 is in 'inject' position 1, Tr1 and Tr2 are configured as a 1kHz astable multi and feed a good square wave signal into the 'probe' terminal via R1-C1. This waveform is very rich in harmonics, so if it is injected into any AF or RF stage of an AM radio it will produce an audible output via the radio's loudspeaker, unless one of the radio's stages is faulty. By choosing a suitable

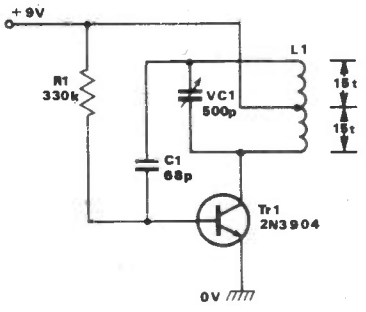


Fig 13 *Metal/pipe locator*

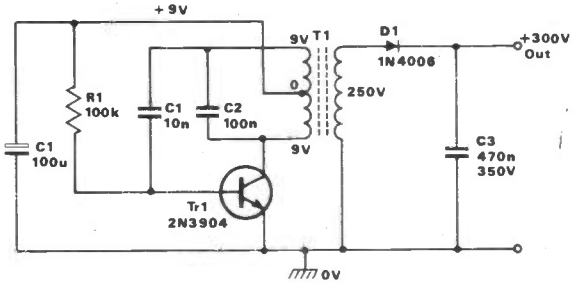


Fig 14 *9V-300V dc to dc converter*

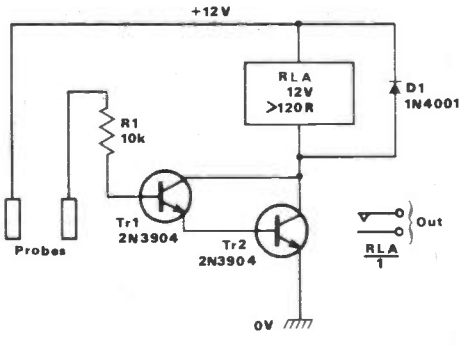


Fig 15 *Water or steam operated relay switch*

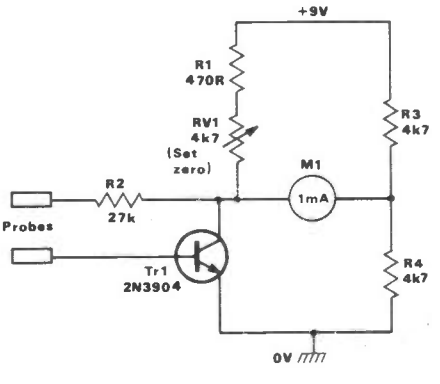


Fig 16 *Simple 'lie detector'*

injection point the 'injector' can thus be used to trouble-shoot a defective radio.

When SW1 is switched to 'trace' position 2, the *Figure 11* circuit is configured as a cascaded pair of common-emitter amplifiers, with the probe input feeding to Tr1 base, and Tr2 output feeding into a magnetic earpiece or headset. Thus any weak audio signal fed to the probe will be directly amplified and heard in the earpiece. Similarly, any amplitude-modulated RF signals that are fed to the probe will be demodulated by the non-linear action of Tr1 and the resulting audio signals will then be amplified and heard in the earpiece. By connecting the probe to suitable points in a radio, the 'tracer' can thus be used to trouble-shoot a faulty radio, etc.

L-C oscillators

L-C oscillators have lots of applications in test gear and gadgets of various sorts. *Figures 12* to *14* show some simple examples.

The *Figure 12* circuit is that of a medium wave (MW) signal generator or beat frequency oscillator (BFO). Here, Tr1 is wired as a straightforward Hartley oscillator, but uses a modified 465kHz IF transformer as its collector load. The internal tuning capacitor of the IFT should be removed; variable oscillator tuning is then available via CV1, which enables the output frequency (on either fundamentals or harmonics) to be varied from well below 465kHz to well above 1.7MHz. Any MW radio will detect the oscillation frequency if simply placed near the circuit; if the unit is tuned to the IF frequency of a radio a beat note will be heard, enabling CW and SSB transmissions to be clearly detected.

Figure 13 shows how the above oscillator can be modified so that when used in conjunction with a MW radio it functions as a simple 'metal/pipe locator'. In this case oscillator coil L1 is hand-wound and comprises 30 centre-tapped turns of wire, firmly wound over about 25mm length of a 75 to 100mm diameter non-metallic former or 'search head' and connected to the main circuit via 3-core cable. The search head can be fixed to the end of a long non-metallic handle if the circuit is to be used in the classic 'metal detector' mode, or can be hand-held if it is to locate metal pipes or wiring hidden behind brickwork or plaster, etc.

Operation of the *Figure 13* circuit relies on the fact that the electromagnetic field of L1 is disturbed by the presence of metal, causing the inductance of L1 and the frequency of the oscillator to alter. This frequency shift (and thus the presence of metal) can be detected on a portable MW radio placed close to the search head by tuning the radio to a local station and then adjusting CV1 so that a low frequency 'beat' or 'whistle' note is heard from the radio's loudspeaker. This beat note will change significantly if the head is placed near metal, and the circuit thus functions as a simple metal detector.

Figure 14 shows another application of the Hartley oscillator. In this case the circuit functions as a dc-to-dc converter, which converts a 9 volt battery supply into a 300 volt dc output. T1 is a 9V-0-9V to 250V mains transformer, with its primary forming the 'L' part of the oscillator. The supply voltage is stepped up to about 350V peak at T1 secondary, and is half-wave rectified by D1 and used to charge C3. With no permanent load on C3, the capacitor can deliver a powerful but non-lethal 'belt'. With a permanent load on the output, the output falls to about 300V at a load current of a few mA.

Water/steam switch

One gadget that is always useful about the home is a water or steam activated relay switch which activates when water or steam simultaneously comes into contact with a pair of metal probes. *Figure 15* shows such a circuit. Here, Tr1 and Tr2 are wired as a super-alpha pair of transistors wired in the common-emitter mode, with the relay coil (RLA) as their collector load.

The circuit action is such that the relay is normally off, but turns on when a resistance less than a couple of megohms is placed across the probes. Normal (non-distilled) water, steam and human skin all have resistances below this value, so this simple little circuit can be used as a water, steam, or touch-operated relay switch. External devices such as motors or alarms can be operated via relay contacts RLA/1.

Lie detector

Our final circuit (the lie detector of *Figure 16*) is most emphatically an "experimenters'" circuit. Here, the 'victim' is connected, via a pair of substantial metal probes, into a Wheatstone bridge circuit formed by R1-RV1-Tr1 and R3-R4. The meter, which should be a 1mA centre-zero type, is used as a bridge-balance detector. In use the victim makes firm contact with the probes and once he or she has attained a relaxed state (in which the skin resistance reaches a stable value) RV1 is adjusted to obtain a null on the meter. The victim is then cross-questioned . . .

The theory of operation is that the victim's skin resistance will change and the bridge will go out of balance if he or she lies or shows any signs of emotional upset (embarrassment etc) when being questioned. Some people claim wonderful results from this circuit. Others don't!

In next month's edition of 'The File' we'll look at a variety of useful relay and relay-driving circuits. REW

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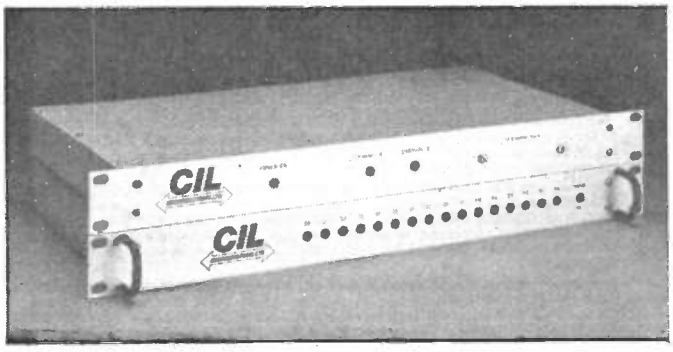

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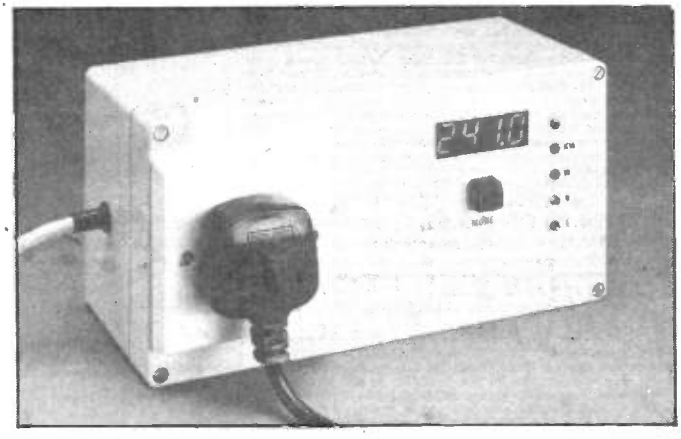

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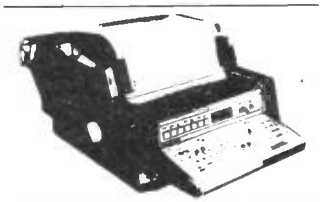

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DIGITAL FILTERS

PART TWO

Bringing the computer closer to the analogue world

by Mary Dick

So far, we have considered how the computer acquires an analogue signal and how, by representing the signal on a diagram, a suitable mask can be designed to remove or amplify signals at different frequencies. Now we need to be able to take the mask and implement it as a digital filter. First, however, let us look at two examples to gain a small insight into how a signal can be modified once it has been digitised.

Figure 12 shows a very simple 'filter' in two forms: the first is a software instruction while the second is a possible hardware solution. An explanation of both now follows. If the input samples are stored in the computer's memory as an array called X such that X(1) is the first sample taken, X(2) the second (and so on), and the output values after some filtering has been performed are placed in an array called Y, we can see that the equation allows any Y value to be obtained providing we know the current and previous X values.

The second form of the filter replaces the software with a diagram more closely associated with a hardware implementation. The adder output is equivalent to Y, and its two inputs are the current (digitised) sample value and the previous sample – the box with a 't' in it represents a delay of one sample period. To test this very simple filter, a variety of signals can be applied and the corresponding output measured. If this was done, the frequency response would be identical to that of *Figure 9.*

Now we have made a link between a simple, arbitrary design of filter and a mask – what is required next is to be able to implement a filter design using the mask (which represents the desired frequency response) as the start-point. This is best done by introducing a minimal amount of complex mathematics.

The circle and mask that we have been using are in the z-plane, a cartesian co-ordinate system with a 'real' x-axis and an 'imaginary' y-axis. If the variable which describes position on this plane is z, where $z = x + iy$ (i being the square root of -1), the mask may be equated to a function of z. Hence, if our mask contains a zero point at (x=1, y=0), the mask function H may be written as:

$$H(z) = 1 - z$$

so that when $z=1, H(z)=0$.

Now, the mask function was described earlier as what is multiplied with the input signal to obtain the output signal. Returning to our description of *Figure 12* where the input signal was X and the output signal Y (not to be confused with the small x and y which form the components of z), the equation for this mask function may be expanded to:

$$H = \frac{Y}{X} = 1 - Z$$

Hence $Y = X - XZ$.

Examining *Figure 12*, this new equation which relates the input and output signals is rather similar to the $y(t) = x(t) - x(t-1)$ used for the software calculation. Indeed, this equation in y(t) is made realisable by inserting a pole at x=y=0, which only adds a unit delay. Hence, the more complex relation of:

$$H(z) = \frac{Z^2}{Z^2 - z + 1} = \frac{Y(2)}{X(2)}$$

may be changed to $XZ^2 = YZ^2 - YZ + Y$, which gives (dividing through by Z^2):

$$x(t) = -y(t-1) + y(t-2) + y(t)$$

This is implemented in *Figure 13* and represents a filter with a double zero at the origin and two poles 1/6th and 5/6th of the sampling frequency. So once an analytic expression for H(z) has been obtained by calculating the required mask, the time-related equation in y(t) may be solved and the filter implemented.

'Recursive'

Note how the filter output, y(t), is fed back with different delays to the calculation stage of the filter. This feedback gives the filter the name 'recursive' which might be more familiar to computer buffs. An alternative name is that of an Infinite Impulse Response filter – or IIR for short. This name is derived from the result of applying a sharp impulse to the filter input: the output of the filter, at least theoretically, never returns to zero. Hence the response of the filter to an impulse has an infinite duration in time. Later we shall see why this may not be the case in practical filters. The simple filter in *Figure 14* is used to demonstrate the effect; the impulse at the input results in a decaying exponential output.

The other type of digital filter is also known by the names Finite Impulse Response (FIR) or non-recursive. Here there is no feedback from the output of the filter to any earlier stage. The

Software: Y (T) = X (T) – X (T-1)

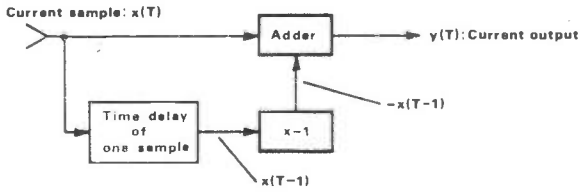


Fig 12 *Software and hardware description of a simple filter*

Software: Y (T) = X (T) + Y (T-1) – Y (T-2)

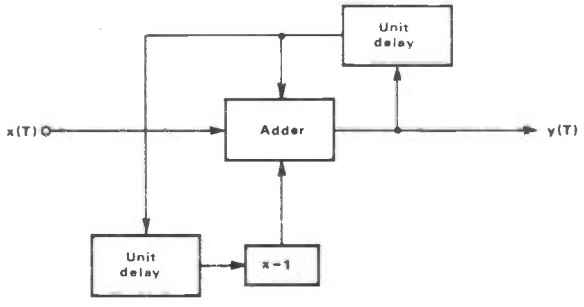


Fig 13 *Software and hardware example of a simple bandpass filter*

response to an impulse is therefore of limited (finite) duration. *Figure 15* represents a simple FIR filter and its response to an impluse – note how the impulse dies out after only two samples.

While the design of some FIR filters may use the pole-zero model of the z-plane as a starting point, it is much more common for other more elaborate techniques, based on the Fourier Transform, to be used. However, these are beyond the scope of this article; readers interested in pursuing their study will find ample description in most digital filter books.

One common type of FIR filter is the so-called comb filter. *Figure 16* shows a filter and its frequency response; the periodic zero-points in the frequency response resemble the teeth of a comb and so name the filter. A typical use for such a response is to place the first zero on the fundamental of an interfering signal (perhaps 50Hz for mains rejection) and the remaining zeros then fall on the harmonics of the interference. Since the harmonics often contain significant power, the comb filter provides a simple solution to the filtering problem.

Figure 17 shows another filter based on the original comb design. The comb, with n delays, has n zeros around the circumference of the z-plane's unit radius circle which was used for the earlier description of signals and the mask. If such a filter is followed by a design of IIR filter which has two poles coincident with two of the comb's zeros (and then two zeros at the origin), the poles on the circle which would normally cause an unstable filter are cancelled and the z-plane diagram appears as in *Figure 18. Figure 18b* shows the frequency response – note the band-pass nature of the filters. Most practical filters of this sort would involve many more delays and would have a much smaller bandwidth.

If several centre frequencies are required, the latter part of the filter may be duplicated (with appropriate values of coefficients) while keeping a common comb section. This is a simple method of producing a spectrum analyser with 'arithmetically' spaced centre frequencies for the channels.

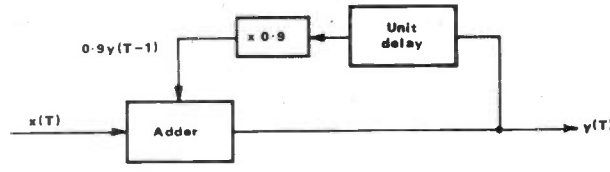


Fig 14 *Example of IIR filter and its response to an impulse*

Table of Filter Input/output

X(T)	Y(T)	Y(T-1)
0	0	0
1	1	0
0	0.9	1
0	0.81	0.9
0	0.73	0.81
0	0.66	0.73
0	0.59	0.66

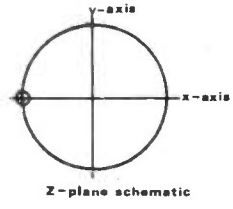
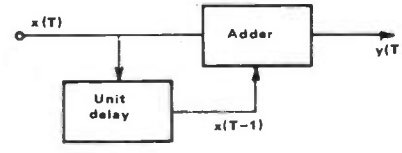


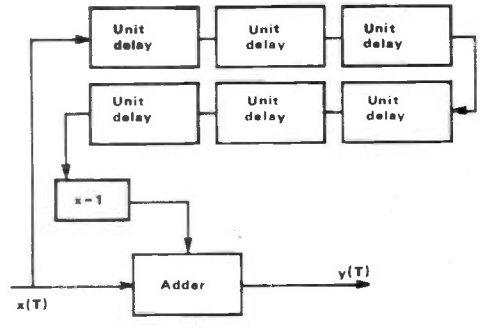
Table of Filter Input/Output

T	X(T)	X(T-1)	V(T)
1	0	0	0
2	1	0	1
3	0	1	1
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0



Software: Y(T)=X(T)+X(T-1)

Fig 15 *Example of FIR filter and its response to an impulse*



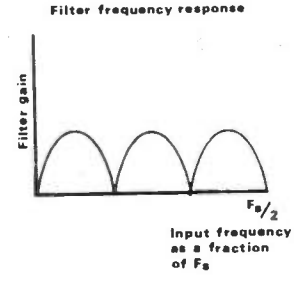


Fig 16 *Comb filter and frequency response*

Implementing a filter

Up until now little consideration has been given to the implementation of a filter, and this area can often be the main constraint on the complexity that is achievable for a given application. Perhaps the simplest way of introducing some of the problems is to design a simple filter for AFSK. Wide-shift AFSK uses two tones spaced by 850Hz: 1275 and 2125Hz. Let us design a dual band-pass filter with a passband centred on each of the AFSK tones.

First, we draw the z-plane (*Figure 19*) diagram and mark the positions of the two tones on the circle. The sampling frequency is chosen to be 6375 so that the tones lie at ⅓ and at ⅕ respectively of the sampling frequency. Next, four zeros are placed on the circle to null frequencies while four poles are placed near the required signals (and their symmetric points about the x-axis) at a radius of 0.95: if they were placed on the circle, the filter would be unstable. The mask function, H(z), mav now be written as :

$$H(z) = \frac{1 - Z^{-4}}{(Z^2 - 2rz\cos\omega_1 t + r^2)(Z^2 - 2rz\cos\omega_2 t + r^2)}$$

where $r = 0.95$, $r^2 = 0.90$, $\cos\omega_1 t = 0.31$, and $\cos\omega_2 t = -0.5$. If we substitute in the appropriate values we obtain (remembering that H(z) = Y/X):

$$XZ^{-4} - XZ^{-8} = Y + 0.31YZ^{-1} + 1.27YZ^{-2} + 0.28YZ^{-3} + 0.81YZ^{-4}$$

Translating the Z^{-1} terms into time delays and the X, Ys to x(t), y(t) gives:

$$y(t) = x(t-4) - x(t-8) - 0.31y(t-1) - 1.27y(t-2) - 0.28y(t-3) - 0.81y(t-4)$$

This is the equation we would use if we were writing a software filter. However, the average home computer would take quite a few seconds to execute a 200-sample block of data. How fast do we need to calculate the above equation if we are to keep up with the incoming data? For a sampling frequency of 6375Hz, a new value is obtained every 157 microseconds. With four multiplications

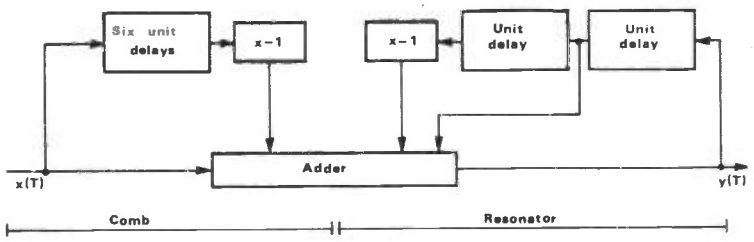


Fig 17 *Comb and resonator filter – hardware*

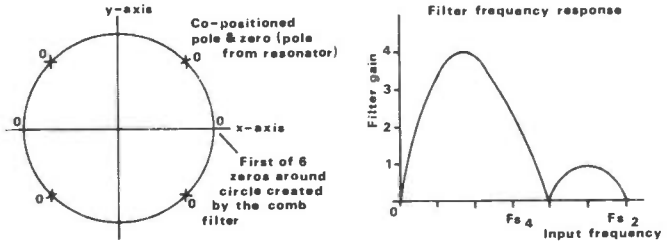


Fig 18 *Z-plane and frequency response for Figure 17*

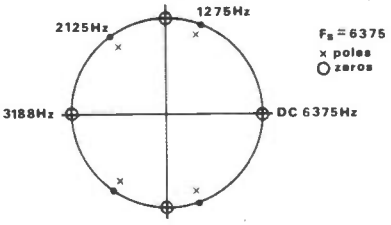
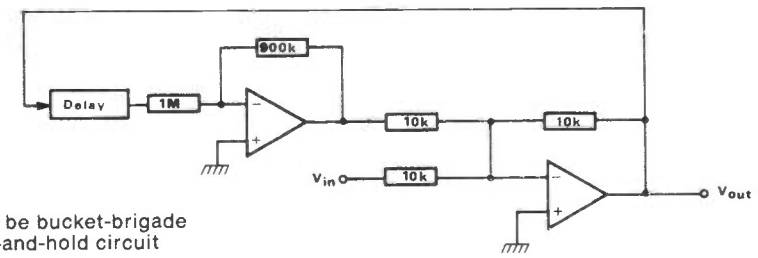


Fig 19 *A FSK filter – Z-plane*



Delay may be bucket-brigade or sample-and-hold circuit

Fig 20 *Analogue implementation*

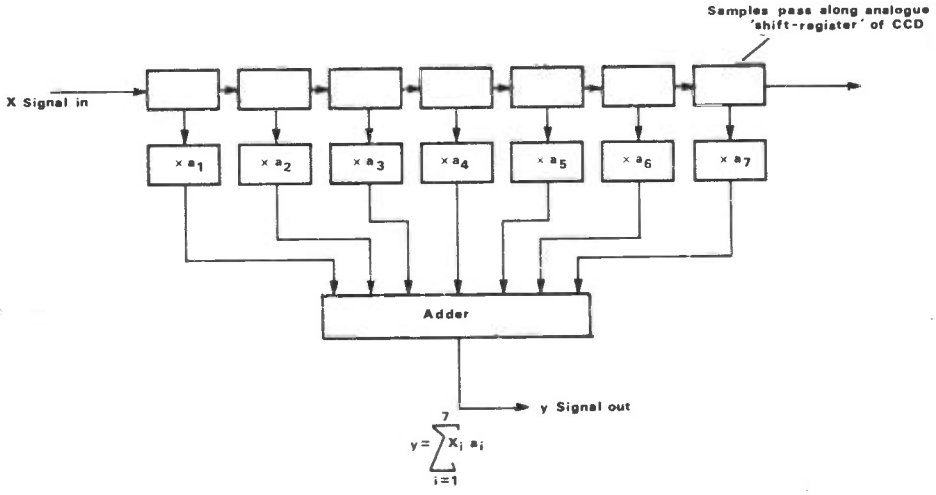


Fig 21 *Charge coupled device FIR filter*

and six additions to perform as a minimum workload, our computer has to be fairly quick. Even a numeric co-processor may take 17 microseconds per multiplication!

Digital filters are one of the specialist areas where powerful array-processors are used. These computers manage ten million floating-point operations per second – so the simple filter above could be easily handled in real time.

Another solution is to dispense with floating point and use integers. This speeds up the filter calculation because many simple microprocessors (such as the 6809 family) have an 8 × 8 MUL instruction. This will limit the dynamic range of the analogue input to 8 bits. An assembler program would perform the filter calculation much quicker since a 6809 only takes 11 clock cycles for the MUL instruction and 10 for a 16-bit add (depending on addressing mode).

Apart from the problem of squeezing your filter calculations into the time available, numerical accuracy is also of concern. Although not too critical in many applications, disaster can easily occur. Very particular filter shapes, like a sharp notch filter, require poles near the circle, and should a pole with radius of 0.98 stray onto 1.00 (only a 2% error!) the filter may ring for prolonged periods. This is an obvious problem where an integer implementation is used.

Implementation problems are being eased, however, as new devices appear on the market. Advanced microprocessors, like the 68020 and National Semiconductor's 32032, have 64-bit integer maths op-codes and may have floating-point operations, or at least facilities for maths co-processor support. Texas Instruments have their TMS320 digital signal processor, which is a microprocessor with an internal architecture designed specially for signal processing and digital filtering. This sort of processor complements the fast multiplier chips that have been around for a few years, such as those made by TRW and AMI, which have multiply times of a few tens of nanoseconds.

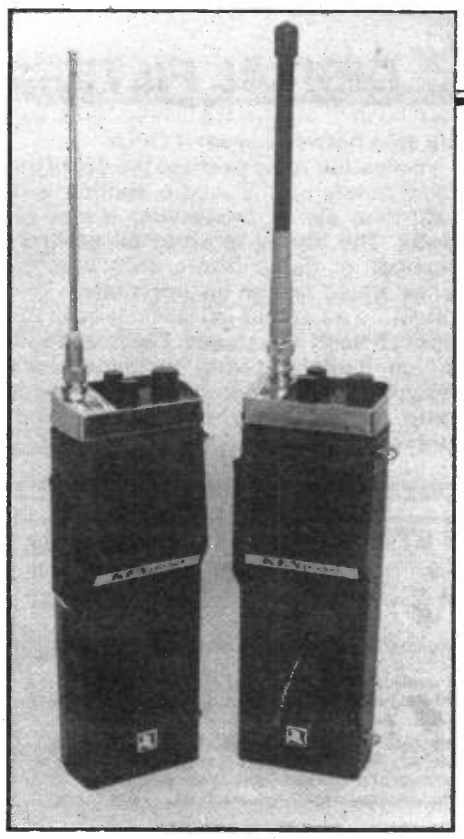
Although we have assumed up until now that a 'digital filter' is implemented using digital hardware this is not always true. The adjective 'digital' can sometimes refer to the fact that the filtering operation is done on a sampled data-stream. The samples need not be digitised – they may be held as an analogue voltage on the capacitor of a sample-and-hold circuit or as packages of charge in the semiconductor of a charge-coupled device (CCD). The CCD and its relations have been well introduced by the use of bucket-brigade delay chips in audio reverberation systems. *Figure 20* shows a conceptual view of a simple filter using a delay unit and an op-amp which is the same as *Figure 14's* filter.

Such a system is very complicated and prone to drifting with age and temperature. However, the CCD is commonly used to implement FIR filters. By 'tapping' into the buckets of charge and multiplying (in analogue) the voltage by a coefficient, a complex filter can be made. *Figure 21* shows the resultant model. Because the data sample can be clocked through the CCD at very high rates and no analogue-to-digital conversion has to be done, filtering may be formed at video rates. Remember, however, that because sampling is used aliasing will still be present. The determination of the coefficient values is fairly complex and involves the inverse Fourier Transform of the desired frequency response of the filter.

Future look

So what of the future? New devices are providing faster times for maths functions, and with processors becoming one of the cheapest parts of any computer the work of handling a complex filter can be split between several CPUs.

In amateur radio perhaps the day of the 'completely digital' audio section with real-time signal processing is not far away. The ability to steer an arbitrary number of notch filters onto interference would not go unappreciated. This might be an added extra when even the speech itself is digitised. The speed with which digital filtering techniques are adopted into amateur radio depends only on the radio enthusiasts' ever-present ingenuity.



MODIFYING THE KEN KP-202

Peter Rouse GU1DKD irons out some quirks on this bargain price two metre hand-held

The Ken KP-202 was amongst the early generation of hand-held 2 metre FM portables and in its day was so popular that several enterprising but naughty UK firms even sold retuned but non-approved versions for marine and PMR use. It was discontinued about seven years ago, but it seems that since then quite a large stock of these 6-channel crystal controlled sets has been lurking in a corner of the Tama Denki factory in Japan. That's where they were spotted by a keen-eyed UK equipment importer who bought up the lot and put them on sale here for little more than £40 a set, plus VAT. At that price they were soon all snapped up like hot cakes.

As with many cut-price bargains there has to be a snag or two. On this particular set these are, in order of annoyance, non-standard receive crystals, non-standard (F type) aerial socket, and a difficulty in recharging nicads without removing them from the set. Obviously no accessories are available.

The good news is that these problems can be quite easily overcome and the necessary modifications call for little in the way of tools, skill or time.

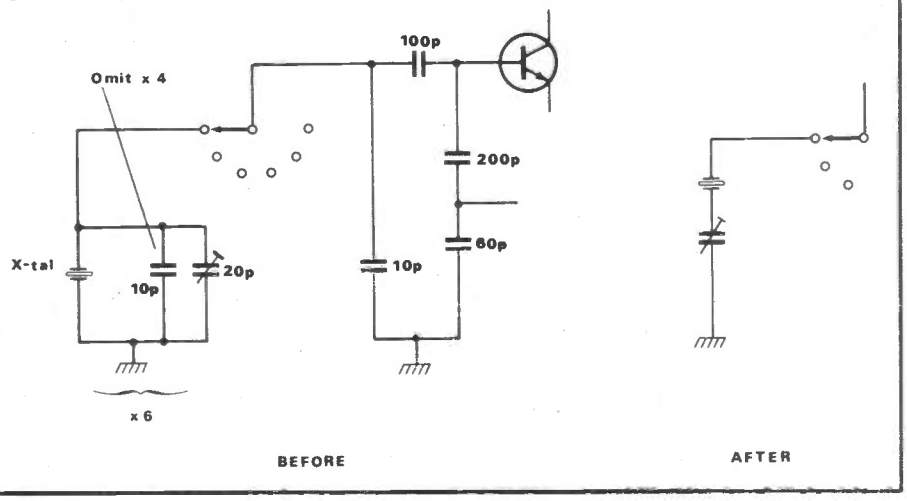
Big and beefy

Before discussing modifications let's have a quick look at what we have as standard. The set is bigger than, say, an IC-2E, but it has a good robust feel to it and is quite well made both inside and out. It has six switched channels, 2 watts of output power, and operates from 8 AA (penlight) dry cells or 10 nicad equivalents which are housed in a slide-in carrier that pulls out from the base of the set once you've broken your fingernail . . .

On top of the set is an F type aerial socket, a rotary channel changer (crystals for S20 and S22 already fitted), volume, squelch and combined S meter/battery state meter with the latter function operating in transmit mode.

The current batch are supplied with a small carry strap, easy-to-break telescopic aerial, difficult-to-fit F type aerial plug (it relies on the centre conductor wire of the co-ax being the contact pin), two dummy batteries for use when dry cells are installed, and the obligatory Japanese crunchy bag of silica gel (they either have an extremely damp climate or more of this stuff than they know what to do with).

Fig 1 *showing the before and after sequence*



Receiver and crystal mods

The receiver is a fairly conventional double superhet with IFs at 10.7MHz and 455kHz, but a problem arises in the first local oscillator because the circuit requires crystals which are loaded with a parallel capacitor. These crystals are not as readily available as the standard off-the-shelf 44MHz series type. If series type crystals are inserted in the existing circuit they will not tune correctly onto channel no matter how far the trim capacitor is swung.

This is a shame, because firms like Quartslab* sell standard HC25u series crystals for 2 metre channels at around £2 each when two or more are purchased, whereas parallel types cost far more and may have to be specially cut even for standard channels.

Fortunately there is a simple remedy. The circuit is easily modified so that the remaining four crystal positions accept standard series types (there is no problem with the transmit crystals).

Before and after

Figure 1 shows the before and after sequence, with a swap in connections to put the trim capacitor in series with the crystal and the removal of 4 fixed capacitors. Before anyone squeals that other circuit values are not optimised for the new crystal configuration, I promise that you cannot hear, feel or smell the difference without instruments.

Note that a standard BNC chassis socket is a direct fit into the hole used for the existing aerial socket, and if you want to change it do so while the set is opened up for the crystal modification. The advantage of using a BNC is that a

standard rubber duck helical can be fitted in place of the telescopic, and connection to an external aerial can be made with a conventional connector.

Work proceeds as follows:

(1) Remove the battery slider, the two screws that are revealed with the slider out, and the two screws on the back of the set's casing. The two halves of the case will now separate. Next remove the five screws that secure the PCB (the one you can't find is hidden under the grey co-ax that runs down the middle of the set). If you are going to change the aerial socket also remove the two screws that hold the meter in place.

(2) Locate the four 10pF capacitors shown in *Figure 1* for crystals C,D,E,F (the trimmer locator chart on the back of the set will help) and remove them. Don't try and desolder them as it's not worth it – just snip them out.

(3) Use a sharp knife or mini-drill pulled across the PCB at an angle to make cuts in the tracks to separate the connections between crystal and ground tracks and the crystal/trimmer connection. Now cross-connect with the six insulated jumper wires (these must be as short as possible) between the non-earth end of the trimmer and the now isolated end of the crystal. Note that in the photograph this has been done for all six crystals, but in fact it's only necessary for channels C,D,E and F.

(4) Check the receiver is working and trim the crystals onto channel either with a signal generator, second set, off-air signals etc.

(5) Desolder the aerial socket and remove it, then replace the socket with a BNC, which will have to be tightened from behind. It is a bit fiddly but with long-nose pliers and patience it can be done.

Dry cell versus nicads

The set draws a fairly hefty current for dry cells: 15mA stand-by, 150mA receive and 400mA on transmit. With AA size nicads available for around £1 each (search the small ads) it seems sensible to fit them.

The sets sold recently were not fitted with nicads, although there are two studs on the base of the set for recharging. In its heyday the set was supplied with a charger stand which it plugged into. Building a suitable charger along these lines is beyond the engineering skills of most amateurs, and a simpler solution is to fit a miniature jack socket.

The only place where such a socket can be fitted is on the right-hand side of the case as viewed from the front (*Figure 2*). Disconnect the red positive lead from the battery contact rail and connect it to the socket so that the set is disabled during recharge. The socket sleeve connects to the negative battery rail. A simple charging circuit is shown in *Figure 3*.

Fig 2 *Showing position where socket can be fitted*

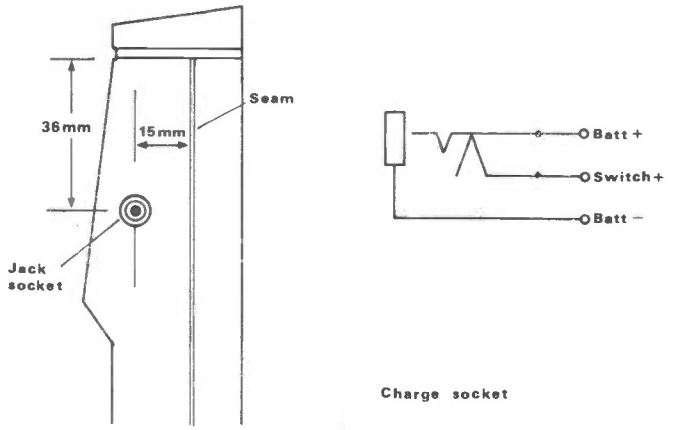
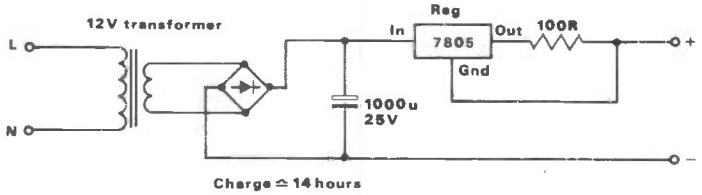


Fig 3 *Simple charging circuit*



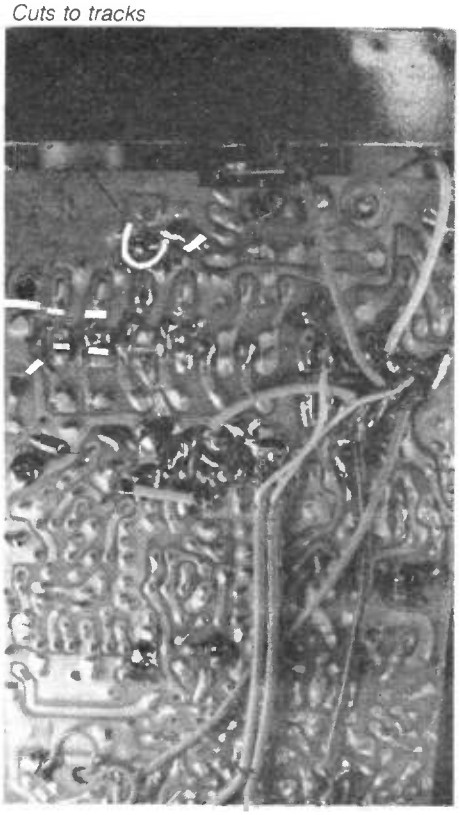
What else?

Not a lot Ken! If you've been scared of modifying equipment before, give this one a whirl – after all, you can hardly devalue it. Don't bother trying to fit tone-burst, there isn't room: just learn to whistle at 1750 hertz if you want to fire up repeaters. Need a leatherette case? Take the set to one of those firms who do upholstery, boat covers, shop canopies, car seats etc.

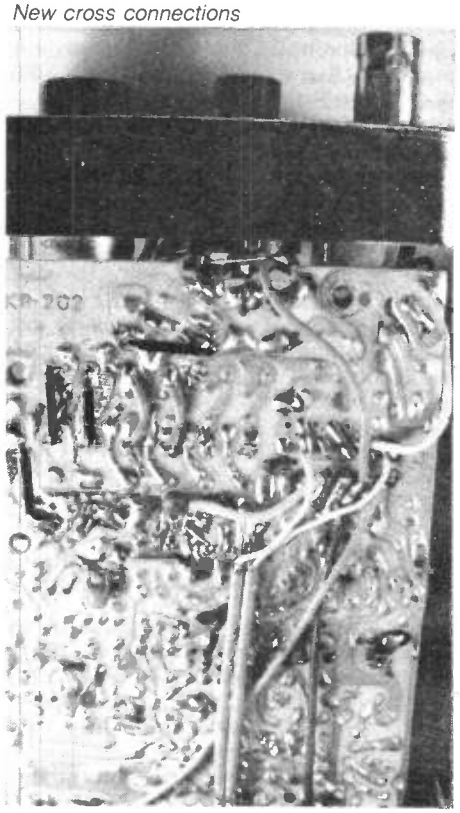
One firm stitched one up for me for a fiver. "Always makin' 'em for the cops, guv. The ones they get wiv their sets fall apart after six munfs". REW

**Quartslab Marketing Ltd, PO Box 19, Erith, Kent. Tel: (01) 318 4419.*

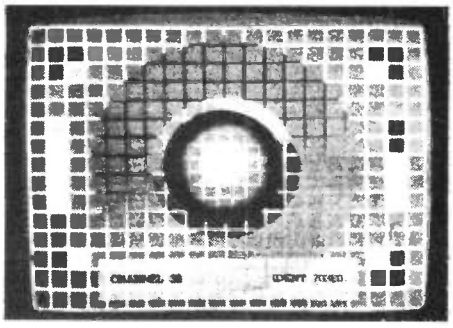
Cuts to tracks



New cross connections



DX-TV RECEPTION REPORTS



Compiled by Keith Hamer and Garry Smith

The month of June proved to be a real corker for DX-TV activity. The almost daily sporadic-E openings in Band I were supplemented by tropospheric propagation in Band III and at UHF throughout the second half of the month. This provided quite a choice of DX viewing and a headache for those with only one receiver!

Revised schedules and longer programme hours resulted in problems with identification, although fortunately many TV services now superimpose their logo in the corner of the picture to help prevent programme piracy.

Arabic transmissions arrived in the UK on several days including the 1st, 5th, 7th, 8th and 19th, giving many DX-TV enthusiasts their first taste of an exotic. It's also come to light that a new Band I transmitter is operational in North Africa. This is, of course, most welcome, especially since some other countries are considering shutting up shop on this band!

There were also a few mysteries during June. A hectic sporadic-E opening from the south-east on the 7th produced a programme carrying English subtitles on channel E2. Feature films with Arabic subtitles were also noted on channel E2 on the 26th and 29th.

DX-TV activity via enhanced trop conditions was plentiful from the 12th onwards with quite a few interesting catches, notably Switzerland at UHF and several low power relay stations in Belgium and West Germany.

DX-TV log for June

This month we are featuring Chris Howles' log, which reflects the excellent sporadic-E conditions noted by many enthusiasts during the month.

1/6/86: Sporadic-E opening for most of the day. Signals included SVT (Sweden) E2; TVE (Spain) E2, 3 and 4; RAI (Italy) on channels IA and IB; ORF (Austria); TSS (Russia) on R1.

2/6/86: TVE1 on E2 and E3 with breakfast TV at 0730. Spanish signals also later in the evening; unidentified R1 programme at 0730; TSS R2 with good SECAM colour during the evening.

3/6/86: Sporadic-E DX between 1800-2000 including TSS R1 with ВРЕМЯ (current affairs/news); RAI IA and IB with programmes; MTV1 (Hungary) R2 on clock caption; CST (Czechoslovakia) R1 and R2 with REKLAME caption; JRT (Yugoslavia) E3 with weather map at 1850.

4/6/86: Sporadic-E DX between 0730 and 0830 including TVE E3 breakfast TV; RAI IA showing teletext pages followed by the 'RAI-1' PM5544 test pattern; unidentified PM5544 on R1 thought to be MTV1 – also co-channel film at times.

5/6/86: Sporadic-E between 1745 and 1915 including TVE2 E2 on 'tve tve' GTE colour test card; TVE1 E3 and E4 showing M*A*S*H with good colour and sound; TSS R1 news programme; RUV (Iceland) E4 radiating the 'RUV ISLAND' PM5544 test pattern; RTT (Tunisia) E4 showing a discussion programme.

6/6/86: A strong and intense sporadic-E opening noted at switch-on at 1800 including TVE1 on channel E2; JRT E3; ORF E2a; RAI IA; ARD (West German 1st network) E2. Further reception at 2355 consisted of TVE E3 and 4 with the news in colour; RAI IA showing football.

7/6/86: JRT E3 noted at various times throughout the day with test card and programmes. The identification 'JRT BGRD' was present on the PM5544. JRT E4 (different region to E3) seen transmitting the FuBK test pattern bearing 'JRT ZGRB1' identification; TVE E2, 3 and 4 in colour with sound; RTP (Portugal) E3 showing the FuBK test pattern with 'RTP LISB1' identification followed by the clock and opening sequence at 1130; the same signal was present on E2 at times; MTV1 R1 with clock at 1135; TVE2 E2 on 'tve tve' GTE test card; TVR (Rumania) R2 showing the 'TVR BUCURESTI' FuBK test pattern in PAL colour and sound at times; RAI IA at 1730; RTS (Albania) IC with a concert; unidentified E2 programme at 1937 with English subtitles.

8/6/86: RAI IA and IB at 0750 with the 'RAI-1' PM5544; JRT E3 showing 'JRT RTV LJANA' PM5544; another JRT station was logged consisting of colour bars on E3 changing to the PM5544 with 'JRT BGRD' identification; ORF E2a showing the 'ORF FS1' PM5544.

9/6/86: JRT E3 with 'JRT BGRD' PM5544; RAI IA and IB with teletext pages and programmes; TVE E2, 3 and 4 on programmes; RTU (Radio-Tele-Uno) IA using the FuBK style test pattern with 'RADIO-TELE-UNO' inscription; ORF E2a, 3 and 4 on programme schedule followed by the PM5544; CST R2 radiating the 'RS-KH' EZO test pattern; DDR:F1 (East Germany) E4 on test pattern; TVP (Poland) R1 and 2 with clock and dark background PM5544; TSS R1 showing 'HOBOCTN'; SVT (Sweden) E2 on 'TV1 SVERIGE' PM5534; MTV1 R1 and 2 programmes at 1945.

10/6/86: NRK (Norway) E3 with 'NORGE TELEVERKET' PM5534; RUV E4 on PM5544; SVT E2 PM5534; YLE (Finland) E4 radiating the 'TV1 YLE' FuBK test pattern.

11/6/86: RAI IA in good colour at times.

12/6/86: RAI IA with 'TG1' news; JRT E4 showing 'JRT SKOPJE' PM5544; JRT E3 showing 'JRT BGRD' PM5544.

13/6/86: RAI IA in colour and sound.

14/6/86: TVE E2, 3 and 4 programmes in colour; CST R1 with REKLAME caption at 1037; TVE2 E2 on GTE test card; RTP E3 'RTP LISB1' FuBK test pattern; RAI IA programmes at 1240.

15/6/86: RAI IA and IB programmes from 1220.

19/6/86: TSS R1 on electronic colour test pattern at 0820; TSS R1 programmes noted during the evening.

24/6/86: An intense sporadic-E opening was noted at switch-on at 1755. Signals identified included RUV E3 and E4 with the 'RUV ISLAND' PM5544; TVE E3 basketball in colour with sound; ARD E2 with news and weather at 1910; MTV1 R1 and 2 adverts; JRT E3 and E4 news and clock caption; RAI IA programmes; TVR R2 news followed by an announcer.

25/6/86: TVE E2, 3 and 4 with colour and sound; RAI IA and IB also in colour with sound.

26/6/86: TSS R1 clock at 1800; RAI IA programmes; RUV E3 and E4 on PM5544; TVP R1 and R2 news at 1830; MTV1 R1 adverts at 1845; unidentified E2 programme at 2120 with possible Arabic subtitles.

29/6/86: Sporadic-E DX between 1000 and 1210 including RAI IA and IB in colour; MTV1 R1 with 'VIDEO REKLAM' caption; SVT E2, 3 and 4 with the PM5534 prior to station opening; ARD E2 news; JRT E3 and E4 programmes.

New Band I country

The exciting news this month is confirmation that a new channel E4 transmitter is operational in Tunisia. The station is at Ramada in the south of the country and it would appear to be fairly high power judging by the results obtained by a number of DX-TV enthusiasts in the UK.

This particular outlet was mentioned in Nigel Cawthorne's *Spectrum Watch* a few issues ago and is part of Tunisia's transmitter expansion programme. Channel E4 was chosen to avoid problems with interference from the many high power Band III outlets operating in neighbouring Libya.

The first definite sighting of the new station occurred on June 25th during a sporadic-E opening from the south. Tony Privett of Basingstoke was amazed to see an FuBK test card bearing the identification 'RTT' and a line of Arabic script across the centre. The picture quality was as good as his local between 1634 and 1700 with colour and sound present.

Other suspected sightings of RTT occurred earlier in the month. On the 1st,

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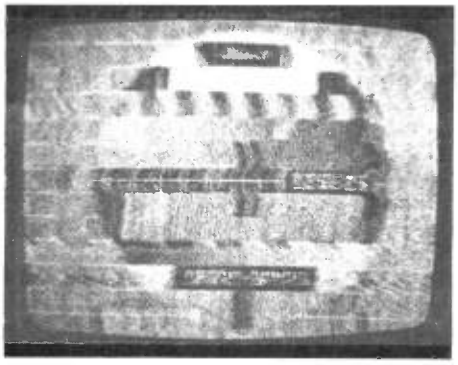
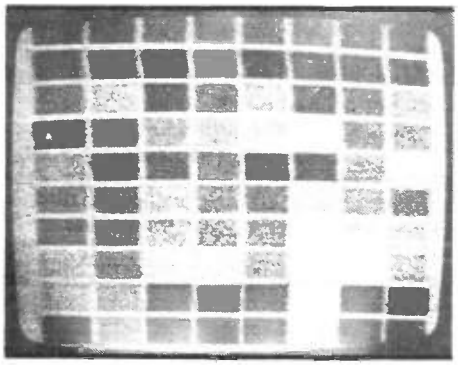
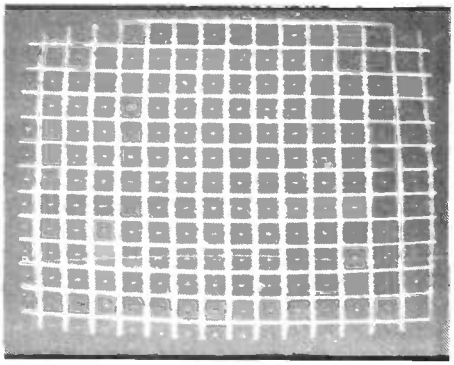


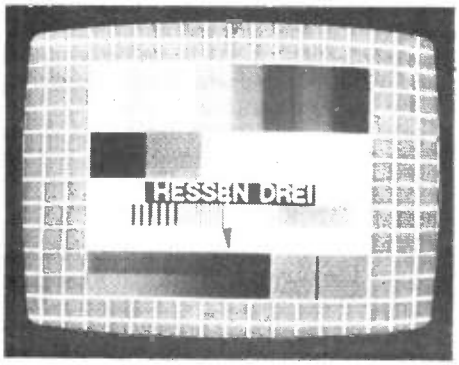
PM5534 test card radiated by the Syrian TV service, SBT



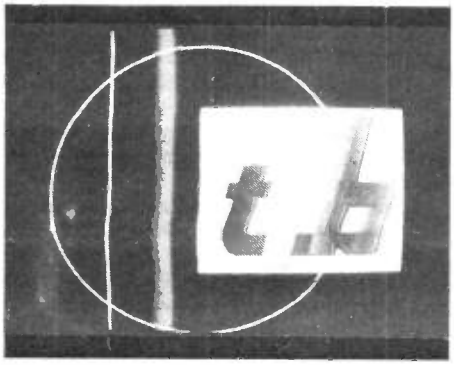
An alternative test pattern used by SBT and received in Hungary on E3



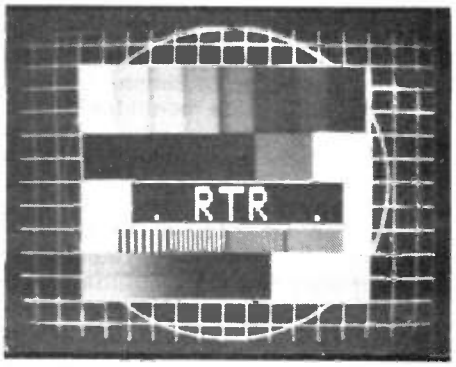
Cross-hatch test pattern used by JTV in Jordan



FuBK test card used by the 3rd network of Hessicher Rundfunk, West Germany



Test pattern used by the French tfl relay service in West Berlin



An FuBK test card broadcast by one of the pirate TV stations in Italy

Tony saw an Arabic film followed by credits and an announcer at approximately 1700. On the 8th, reception consisted of Arabic script, a picture of a prayer tower at sunset followed by a female singer. Reception on both occasions was in colour together with sound.

Another possible sighting of RTT took place on June 5th, although the signal was originally logged as emanating from Morocco. It consisted of a discussion programme on channel E4 from a southerly direction. Arabic script was also noted. This was seen by a number of enthusiasts including Roger Pates (Nottingham), Chris Howles (Lichfield), Tony Mancini (Belper, Derbyshire) and Andy Webster (Billinge, near Wigan). The tail-end of this reception was seen at Derby but it became increasingly obscured by Spanish signals from TVE on the same channel.

Reception reports

Simon Hamer of Powys pulled in no fewer than forty stations from eight different countries during the latter part of June via improved trop conditions in Bands I and III and at UHF. The highlight for Simon was definitely on the 26th. While searching the UHF band for Scottish signals he spotted a political discussion programme on channel E34. The sound channel was monitored and found to be in Italian. As the signal became stronger the Swiss-Italian logo from RTSI was noticed superimposed in the corner of the picture. The transmitter is situated at La Dôle, close to the border with France. Reception was due to tropospheric ducting, since there were very few other UHF signals present at the time from that direction.

Despite suggestions that the new Italian private station Radio-Tele-Uno may have replaced Nord Center Television on channel IA, Simon can confirm that NCT is indeed alive and well! He identified them during an opening on the 4th when a feature film was being shown with the letters 'NCT' in the corner of the picture.

Other successes during June include the French service 'Canal Plus' in Band I on channels L3 and L4, Albanian channel IC programmes on the 3rd, 7th and 18th, and RUV-Iceland on E4 at well after 0100 BST on the 30th. This was a 'real nightcap' according to Simon.

The highlight of the month for William Maries was the sighting of the Jordanian PM5534 test card on channel E3 with the identification 'JTV SUWEILEH' from 1105 BST. A co-channel FuBK test card appeared at times carrying the identification '–JRT SA-1'. The inscription confirms reception from the low power Yugoslavian relay at Pisvir.

The late appearance of the Greek PM5544 test pattern from the low power E3 outlet quashed rumours that the station had been taken out of service. Kevin Jackson of Leeds noted it on the 9th at 0710 and again on the 12th at 1231. The JRT relay on E3 at Pisvir was also noted during both openings with the '–JRT SA-1' FuBK test card. Another rare catch was the PM5534 from the Skopje channel E4 outlet seen displaying the inscription 'JRT SKPJ RTV SKOPJE' at 0721 on the 8th.

Kevin has commented that the Radio-Tele-Uno test card on channel IA has descended regularly in the Leeds area. On one occasion it was so clear that it may have locked colour, but unfortunately a colour set wasn't available to check this possibility.

An identification on the Russian UEIT test card posed something of a mystery during an early morning opening on the 19th. Translated into the Roman alphabet it read 'CHGD'. Another identification noted during the same opening read 'Leningrad' when translated from the Cyrillic. Another mystery noted by Kevin was a colour-bar pattern on channels E2, E3 and E4. The reception on E2 was as late as 1803 BST. Has anyone else noted this pattern at such a relatively late time?

Quite a few low power trop signals were logged by Kevin towards the end of the month. Not content with the Belgian RTBF-2 500W relay at Brussels on channel E45, he also received the SSVC relay on E59 from Mönchengladbach. Its ERP is only 100W!

Mark Dent of Leeds has reported a very good month with a mixture of sporadic-E and tropospheric reception. A number of rare stations have made an appearance, such as the 25W channel E4 Pisvir relay of JRT which radiates programmes from studios in Sarajevo. The FuBK test card was seen on the 9th bearing the '–JRT SA-1' identification during the morning. This was also noted in Derby but with rather poor and unstable frame lock compared with other DX signals around at the time.

Mark also logged two other low power relays on the 9th. They were radiating the Austrian 1st network on channel E3. Both signals were floating and reference to the EBU list of TV stations indicated that the outlets were Birkfeld (100W) and Tauplitz (25W). On the 19th he saw Jordan on the PM5534 test card. Although reception was weak and occasionally suffered from multiple images, the identification 'JTV SUWEILEH' could be deciphered. On the same day a French Band I 'Canal Plus' signal was resolved comprising a pulse and bar test pattern on channel L3.

Thanks to improved trop conditions Mark received the PM5544 test card from SSVC at 0030 GMT on the 28th. The identification was 'SSVC GERMANY' and the signal was logged on channels E51 and E52. The network is now operated by 'Services Sound and Vision Corporation' but it is more widely known by its old title of 'BFBS' (British Forces Broadcasting Service). SSVC was present the following evening on channels E27, E41, E48, E49 (two stations), E57 and E59.

The Belgian RTBF-2 'TELE 2' PM5544 was noted in colour from the 500W relay at Brussels on the 29th along with the TV5 800W relay on channel E56, also located at Brussels. The good trop conditions allowed Mark to watch the West German 2nd network (ZDF) with the FuBK test card being radiated right through the night on several occasions. The transmissions probably originated from the Schleswig Holstein region.

At 0549 on the 15th a mystery colour-bar pattern appeared (in monochrome) on channel IJ/R12. There are two possibilities. It was either RTE-2 (Eire) testing on full power from the Kippure transmitter or an OIRT signal, probably of Polish or Czechoslovakian origin. Mark would like to hear from anyone who managed to identify this signal.

Finally, Tony Mancini of Belper (Derbyshire) has been puzzled by two captions noted via sporadic-E activity. One appeared during a news programme and consisted of the letters 'HOY' with a clock inside the letter 'O'. The other caption read '3 Antenna'. Did anyone else see these captions in Band I? If so, please send any information via *R&EW*.

Service information

Portugal: RTP-Portugal have occasionally been noted using an alternative form of identification on the FuBK test card. The inscription reads 'RTP LISB 1' although sometimes the '1' is absent. The older 'RTP--PORTO' identification is also used.

Sweden: A transmitter operated by the Finnish TV service YLE is operational in Stockholm on channel E39. The exact ERP is not known but it is thought to be between 600kW and 1000kW. The PM5544 is radiated with the identification 'KANAL 39' and 'STOCKHOLM' at the top. Text is superimposed and reads, 'I Södertälje sker provsändingen pa kanalerna 47 och 49'. This indicates that there are also YLE test transmissions in the town of Södertälje on channels E47 and E49.

Netherlands: The very familiar EBU Bar test pattern is no longer used by the Dutch PTT. The identification was 'PTT-NL AVVC-HVS'. It has been replaced by the FuBK test card which incorporates a circle and the identification 'AVVC-HVS'. This is an abbreviation for 'Audio Video Verdeel Centrum – Hilversum' (Vision and Sound Distribution Centre – Hilversum). The FuBK has been used since May 16th.

West Germany: The main HR-3 (Hessischer Rundfunk) transmitter at Kassel on channel E42 (200kW) was taken out of service on May 31st. This month's service information was kindly supplied by Gösta van der Linden and the Benelux DX Club (Netherlands). REW

ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

A feast for slow-scanners this time; hope you don't get indigestion. I guess this proves that there are some SSTVers out there, but when you write next time don't forget to include some pictures as well!

Regional reports

Starting in the Potteries, we have a detailed letter from Steve G4DVN setting out the active stations in his part of the world.

Chris G4UDG, Paul G4UDH and G4DVN will shortly have completed their home-brew Robot 400 clones: Steve intends to operate on 20 metres and 2 metres FM, while the other two will be on 20 and 10 metres. Both Paul and Chris have built the G3WCY scan converter, and although this design works very well the pictures look better when displayed on a Robot.

Incidentally, building a Robot clone is not expensive, as all the chips are still readily available. The only trick, says Steven, is getting hold of the PCB for it: Robot UK say this is now a discontinued line.

From Atherton (Manchester) Dennis G6YBC writes that eleven stations are active SSTVers there, using WCY/ENA set-ups or Robot 400s. They have fairly regular skeds with G3CCH and G1OZH and have even managed to work G2BAR (when the local FMers honour the bandplan SSTV frequency of 144.500).

Colin Pennell G3EFP in Northwood Hills (Middlesex) is on SSTV every day on 20 and 2 metres; on the former band he has had SSTV contacts as far as VK-land. Four different set-ups are available: a Robot 450C, a Wraase SC-1, a Scarab terminal unit for the BBC micro and the BATC G3WCY/G4ENA boards.

Designer plastic for video cameras: the Panasonic WV-C10E raincoat

Fenland chronicle

Our regular SSTV stalwart G3WW has not failed us. This time Richard mentions the Sunday morning 3730kHz net, which has been joined by G3IAI "after dusting off his Robot 400". Interesting DX worked by Richard since we last heard from him includes SM5DAJ, I0EMU, OE3JKA and HA5SX.

On Mondays at 1930 we have the Fenland net on 144.5MHz, and this has been joined by newcomers G0BNR (Ramsey St Mary), G4WJB (Stanground, near Peterborough) and G6SCD (Chatteris). All are welcome to join in, says Richard. It's not only Cambridgeshire, Norfolk and Suffolk stations that take part, but also some well-sited ones in Avon and Salop. The Wednesday evening Essex net has gone quiet – hopefully this is only temporary.

New hardware

John Feely G4MRB is making contacts with the aid of an Oric 1 computer, which he says can be picked up very cheaply now. He uses a French program which he has modified somewhat. In Milton Keynes Tom Mitchell G3LMX has got his G3WCY board going and is very pleased with the results from this converter. G4WJB has acquired a Venus SS2 4.5 inch SSTV monitor for use with his TR4C. G4PJT now has an SC-1 with single frame colour capabilities; he uses a TR5. EA5FIN also now has an SC-1 and immediately added a facility for sending and receiving double 48 second single frame colour SSTV (if anyone wants a 96 second frame!).

To newcomers to SSTV Richard says don't be put off if stations announce that they are about to transmit in colour and you only have a monochrome monitor. If they say they will send two frames of red and then two of green and blue, you will receive them all in varying shades of black and white. Those who send sequential frame colour will produce elongated b/w pictures with a venetian blind effect. Richard suggests that folk equipped with colour remember the people who just want an 8 second b/w frame!

For a demonstration of all the latest colour modes tune in between 3730 and 3735kHz around 10.00 on Sunday mornings. G3CDK and G3OQD will be pleased to demonstrate...

Nets north and south

In the past I have mentioned the Essex SSTV net, and now I have been given details of a similar set-up in Middlesex. On Wednesdays you are likely to pick up at least six people – Philip G1MOG in Ruislip, Roddy G3CDK in Wallington (in Surrey), Jim G3WGM in North Harrow, Vince G4WDF in Staines and Barry G4SJH in Hillingdon. They can of course be found on the air at other times as well.

Equipment in use includes Robots, Wraase SC-1s, the Drae transceiver and software packages involving the Commodore 64 computer (RX4 program by GW3RRI) and the BBC micro (using G3LIV's program and interface). There are lots of colour pix flying around, mainly aerospace orientated! Some of these people also use the SC-1 for FAX type reception including weather pictures on VHF.

Yet another net, this time on South Humberside. John G3CCH reports activity on most nights involving G0CUI, G4NJI, G4SZX, G4KZQ, G6YBC, G1OZH, G4MWU and himself. The Wraase SC-1 seems to be the most popular converter, though Sinclair Spectrums are also in use. John's own SSTV equipment is all home-made to the designs of G4EQD (G8IYI). The mark 2 version of this, for which John can supply a data sheet, is a most versatile and economical unit, receiving Robot 1200 colour pictures as well as FAX and weather satellites.

Sending and receiving SSTV by packet radio is also being considered. Drop him or G4EQD a line at his callbook address for further details. In the mean time listen around 3730kHz for slow-scan signals; apparently lunchtimes and Sunday mornings see the most activity.

Media star

Dave Probert G4JBU had an unexpected contact when he took his slow-scan gear on holiday. His first CQ call from the caravan was answered by Jouko Kytosaho OH5ZJ in Finland, who just happened to have some newspaper people in his shack researching a story on amateur radio. Dave sent me a photocopy of the resulting piece from the Finnish newspaper; a lengthy article complete with an on-screen photograph of Dave as received in Finland. Well done, we can always do with more publicity for our hobby. The transmitter was a TS520S, incidentally, sending 80 watts to a long wire strung between two trees. Frequency was 14.230MHz.

Well that's it again. Please send your news and photos care of the editor. Until next time, have fun! REW

NETWORK 934

Andy Emmerson G9BUP

Last month we concluded by discussing hardware news, and I will begin this month's column with the same subject. The number of suppliers offering antennas for 934MHz now is quite remarkable: you won't find all of them in the shops, but if you attend the amateur radio mobile rallies which take place every weekend throughout the summer months you may have seen some of these new aerials.

Heatherlite Products of 75 St Catherine's Drive, Leconfield, North Humberside (tel: (0401) 50921) have a vertical collinear intended for home-base use. It offers a gain of 6.8dB over a dipole and costs £26.50. For the slightly lower price of £24 they offer an 11-element yagi of no quoted gain. The yagi looks rather like a TV aerial and the collinear was poorly finished, so I would not go out of my way to buy these. On the other hand I shall be happy to publish any user reports.

A longer established outfit, also selling largely through the rally outlets, is Sandpiper Communications, who reside at Pentwyn House, Penyard, Llwydcoed, Aberdare, Glamorgan CF44 0TU (tel: (0865) 870425). They have a very wide range of products for just about every band under the sun. For 934 they offer:

- 5dBd gain collinears for fixed (£39.95) and mobile (£25) use;
- a 7dBd home-base collinear (£49.95);
- two compact helical beams, with 12 turns (15dBi gain, £30) and 20 turns (17dBi, £38);
- a 16dB gain double quad for £30;
- a delta-fed parabolic dish (18dB gain, £45);
- a double delta-fed dish (23.5dB, £95).

If some of these designs sound a bit exotic a look at the RSGB's *VHF/UHF Handbook* or *The UHF Compendium* might help. Alternatively, visit their stand at one of the rallies! I have had insufficient feedback about these aerials to make any recommendation.

Viceroy packs power

One aerial which a lot of people do have a good word for is the Viceroy from Marksman Products of Milton Keynes. As I mentioned last time it is a delta-fed yagi, superficially similar to the Halbar production. It differs in several details, however, and comes in 4 and 12-element sizes. I promised to bring you a user test last time, so here is the report. Both sizes of beam were tried out over a 22 mile obstructed path and were compared with a standard Japanese collinear and the 23-element Tonna long yagi.

Before going further I must say it is dangerous to attach too much importance to a single set of tests, and a glance at the S-meter showed that conditions were changing by one S-point or more over any given 5 minute period. Without a proper test range one can only draw limited conclusions, but the unit did put up a very creditable show.

The 12-element gave consistent results one S-point up on the collinear and just one S-point down on the Tonna. I would estimate its gain at 15dB or so, and this is achieved in a length of just 104cm. For its compact size it is a powerful antenna, and it has already attracted quite a following. The price is around £30 (not exactly cheap) and it is distributed by Telecomms of Portsmouth.

If you want something smaller (and more legal) the 4-element job is for you; again the gain is not quoted (probably around 5dBi), and this one has a much broader beam width. Roll on the day when longer beams are authorised!

Tropo DX without a lift

If you have ever driven a car at night you will know that you can tell if a vehicle is coming in the opposite direction, even if he is round the bend or below the summit of a hill. A small portion of the headlight's beam is visible: not much but just enough of the beam is scattered for other vehicles to see.

The same technique can be exploited in UHF radio, and it is also the way telephone calls are beamed out to offshore oil rigs, for instance. Using a directional antenna as much power as possible is beamed at (or just above) the horizon and a small fraction of the energy is scattered beyond the horizon. Using good beams and sensitive preamps this so-called tropospheric scatter technique can be used at 934MHz, and there are some stations which can manage distances of 150 miles and more, regardless of conditions.

A lot of patience and experimentation is called for, of course, but the results can be very rewarding. It is always worth calling CQ DX; if you constantly monitor channel 20 but wait for someone else to do the calling, you probably won't make those contacts! The other day we heard a station well over 100 miles away, and several locals hooked up with Les CDX101 in Castleford. The contact was scratchy and didn't last long, but conditions were as flat as a pancake. This was probably due to aircraft reflection; a plane along the route can act as a passive repeater and reflect back to earth signals which would normally escape into space.

Getting out

Once you have been operating for a while you will get to know your best directions and where your signals are obstructed. Plotting paths on a large-scale Ordnance Survey map can be very instructive if you enjoy this kind of thing. At 934MHz trees, chimneys and nearby hills suck up signals like a sponge, and you will do well to get your antenna as far clear of obstructions as possible. Sometimes another five feet of height may make all the difference!

Height above sea level is important, but take-off is significant, too. The first mile or two is really important for your transmitted signal; any major obstructions here are deadly. Hills which are higher than your location need not be a problem if they are *distant*, say five or ten miles off; by then your signal has had a chance to 'get airborne'. If the ground falls away rapidly from your location, all the better, but the important thing is keeping the radio horizon as far away as possible. If you're stuck in a radio black hole this will be cold comfort... I think I have made the point now, so I'll drop the subject.

Illegal operators?

One hears some pretty uninformed comment on the band from time to time; I suppose people have a right to talk rubbish! A little knowledge is dangerous, though, and I do get fed up hearing people misquoting the licence regulations to suit their own notions. Condition 12 states: *The apparatus shall not be used for the purpose of advertising goods or services of any kind.*

In other words you cannot use your wireless to advertise any goods or services. It does *not* say the radio shall not be used in connection with any commercial service, and in fact CB radio can be used for any kind of business purpose, so long as no advertisements are broadcast.

Some 934 operators are apparently having arguments with taxi firms on the air and telling them that taxi drivers have no right to use 934. Of course they do, and it was partly in order to make two-way radio more affordable for small firms that the Government promoted 934MHz.

We have a taxi firm on channel 5 in our neck of the woods and we co-exist very well. They leave the other 19 channels to us, and even change channel temporarily if a QSO lands on 'their' channel by accident. What's more, in the absence of a proper channel 9 monitoring service they are the only people who can be relied on to give a radio check at any time, and I am sure they would ring up the police and pass messages if called up in an emergency.

73

Once again I've used up all my space, so I'll have to sign off. The new power meter and SWR bridge has arrived from Telecomms and you'll have a user report of this next time. I'm still waiting for your reports and QSL cards, so take time out to drop me a line c/o the editor. REW

SPECIAL EFFECTS USING TAPE LOOPS

by Ivor Nathan

Many people now own tape recorders, be they reel-to-reel or cassette machines. For the experimenter wishing to expand activities beyond simply collecting favourite recordings on tape, ie the creative sound recordist who wishes to compile sound tracks or sound effects for amateur dramatics, films or videos, or hospital radio programmes, this article describes how tape loops can be used effectively. Similarly, people owning a musical instrument, particularly an electric guitar or electronic keyboard, can build up an 'orchestra' of themselves playing quite elaborate musical arrangements (with a 'choir' of their own voice as well, if desired) by using tape loops which can finally be copied onto a second, conventional tape when completed.

It is appreciated that special effects, including 'chorus' sounds, can be produced by purely electronic circuits, but electro-mechanical methods were used because all the parts were readily to hand and quickly convertible; all parts were found in the junk box.

Initial attempts

Initial experiments were made with a spare cassette recorder, but because a continuous loop of ⅛ inch cassette tape moving at 1⅞ips inside a standard cassette case completes one revolution extremely quickly, insufficient information is recorded on the first revolution; also, head spacing (if the erase head were to be replaced with a second record/replay head) is too close to achieve suitable delay for a convincing echo effect. Therefore a spare reel-to-reel recorder using ¼ inch tape at 3¾ips was modified and used with spectacular results.

As shown in *Figure 1*, the original erase head was removed and replaced by a second record/replay head (A) to which was soldered a length of audio coaxial cable terminated with a phono plug. The erase power output lead of the recording amplifier was then terminated in a resistor equivalent in value to the impedance of the missing erase head; a resistance value of approximately 500 to 1000 ohms should be suitable.

Note that failure to add this resistive load could result in the oscillator circuit burning itself out; in any event, the oscillator would probably not operate if left open-circuited and therefore RF bias for recording would not be available, thus distorting any subsequent recordings.

Record/replay head

The existing record/replay head (B) should also be disconnected from the recording amplifier and terminated with the same amount of audio coaxial cable fitted with a phono plug, as with head A. The original connecting cable from the record/replay amplifier should then be extended with a length of audio coaxial cable and terminated with a chassis-mounted phono socket. Connect another chassis-mounted phono socket across this first phono socket and mount them side by side in a convenient position on the tape recorder cabinet. This then means that either one of the two heads (A or B) can be connected to the record/relay amplifier, or both A and B can be connected in parallel.

In order to make the ¼ inch tape loop as large as possible and thereby record sufficient information on the tape as it completes one revolution at 3¾ips, a supporting arm carrying two extra tape guide posts was constructed, as shown in *Figure 1*, and fixed to the tape deck using an existing screw fitting. This configuration enabled a 26inch length of unused ¼inch tape to be cut from a reel of tape, and very carefully spliced to form the loop. Several attempts may be necessary to cut and splice the correct length of tape needed to form a fairly taut but free-running loop; if the tape is too long it will 'bunch' when revolving and will probably become entangled in the pinch-wheel assembly. If it is too tight it will not run freely and will eventually become stretched and damaged.

It should be emphasised that a good, clean splice must be made so that the tape loop can revolve smoothly and not cause 'drop-outs' or unwanted noises as the join passes both heads. Two empty spools should be left on the deck to act as tape-loop guides; whether they both revolve or not during use should be immaterial.

Easy method

It will be easier to fit the completed loop by first removing one spool, placing the loop into its correct path around the deck and added support arm (preferably with just a little slack in the loop), and then refitting the spool. *Figure 2* shows the modifications made to the wiring of the reel-to-reel tape deck and its amplifier.

Using only the modified reel-to-reel tape recorder, *Figure 3* shows how, with heads A and B connected in parallel, the tape loop can be used for multi-track overlay on the continuous loop. By watching for the tape splice as the loop revolves, the correct timing can be achieved so that enough can be recorded during one revolution, using a

Fig 1 *Modifying the reel to reel tape deck*

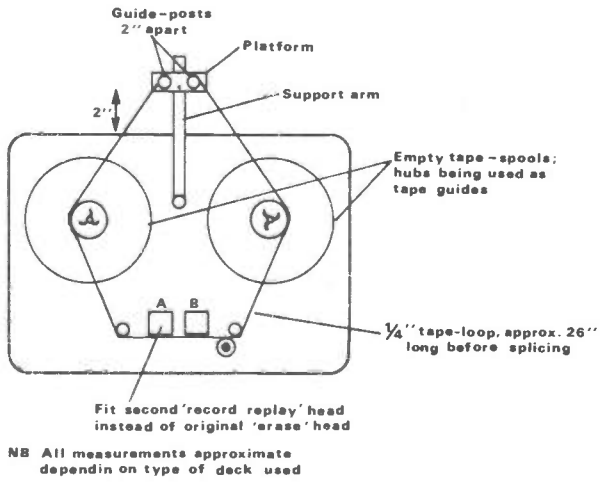
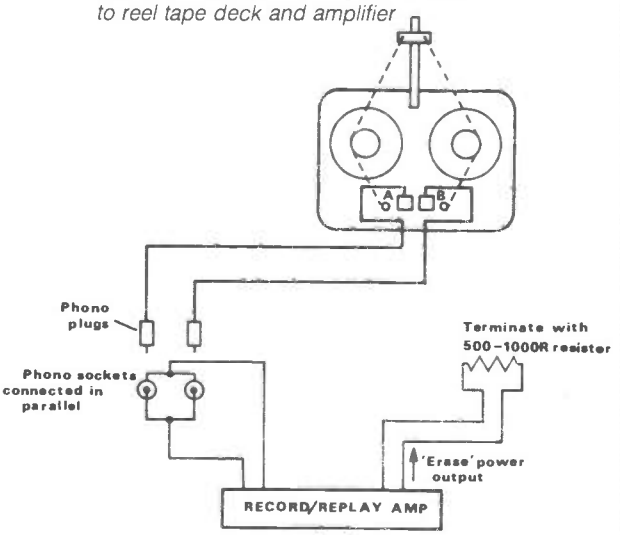


Fig 2 *Modifying the wiring of the reel to reel tape deck and amplifier*



microphone for example, before overlaying a second track via the microphone. After a little practice a complete revolution can easily be observed, and an instinctive 'feel' for the correct timing is soon developed. Because no erase head is being used the signal is recorded twice, with a delay that is dependent on the distance between the two heads.

Practice helps

Recording on the second revolution of the tape will slightly erase the signal that was recorded on the first revolution, but sufficient information should be retained to enable about three overlays to be made. Again, practice will enable appropriate levels to be set to minimise this effect, and to allow all the overlays to be heard at optimum volume.

Upon removing the microphone from the amplifier input and switching to replay, the signals on the loop can be listened to and, if complete, copied onto a standard tape by using either a separate reel-to-reel recorder or a cassette recorder. If necessary, adjust the azimuth of head A so that both head gaps scan the recorded track accurately, before commencing serious recording sessions.

For more ambitious work *Figure 4* shows how the loop can be used to record a signal with head A, pick off the signal with head B and introduce variable echo and other acoustic effects via a monitor power amplifier with its associated loudspeaker system while simultaneously re-recording the final, composite signal with a separate cassette recorder. Head A remains connected to its record/replay amplifier via its phono plug; head B is connected to the input of a separate cassette recorder whose 'monitor output' is connected to the input of a separate monitor power amplifier with its associated loudspeaker system.

Start the loop moving (at present, blank tape), switch (a) to record with gain at maximum, and switch the separate cassette recorder (b) to record, with the monitor power amplifier (c) gain at zero and its treble control about half-way and bass control at maximum. Speak into the microphone and record onto the loop. Advance the gain of the separate cassette recorder (b), start its tape moving and check that head B is picking off the signal recorded by head A.

Disconcerting!

Slightly advance the gain control of the monitor power amplifier until you hear your voice coming from the loudspeaker system slightly delayed behind what you are currently saying – this can be quite disconcerting until you become accustomed to it! The loop can now be left to revolve indefinitely, acting as an electromechanical delay while you continue to speak into the microphone. If the monitor power amplifier (c) gain control is carefully advanced further, slight acoustic feedback will occur between the loudspeaker system and the microphone so that dramatic echo and ringing 'space' effects can be achieved, all being combined on the separate cassette recorder (b) to produce the final result.

With practice, and with the monitor power amplifier controls set to optimum positions (note that the treble control should be set only about half-way), a controlled, pleasing effect can be produced and uncontrolled acoustic feedback is avoided. If the entire system is left running on record and no more is said into the microphone, a very slow fade is achieved as the echo diminishes and as the signal stored on the tape loop is slowly erased by the RF bias power.

After testing the system, constructors may wish to dispense with the interchangeable phono plugs/sockets arrangement by using a suitable system of switches. Similarly, the system can be expanded by using stereo heads throughout or can be modified to add/subtract portions of sub-tracks by using different combinations of half and quarter-track heads on the modified tape deck. REW

Fig 3 *Connections for multi-track overlay on loop*

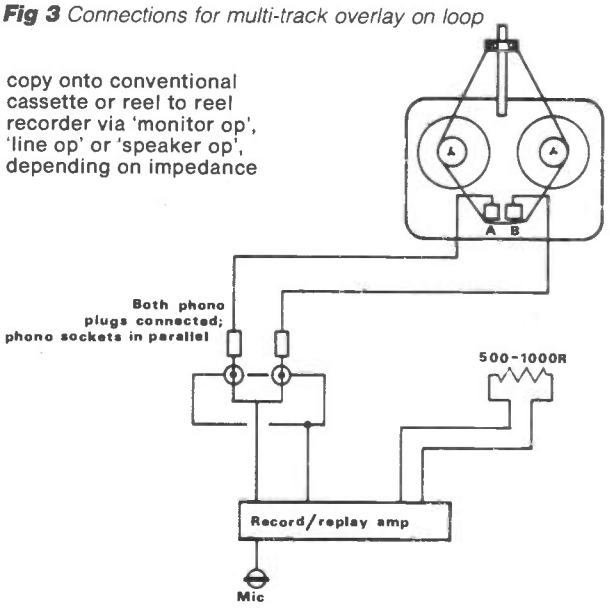
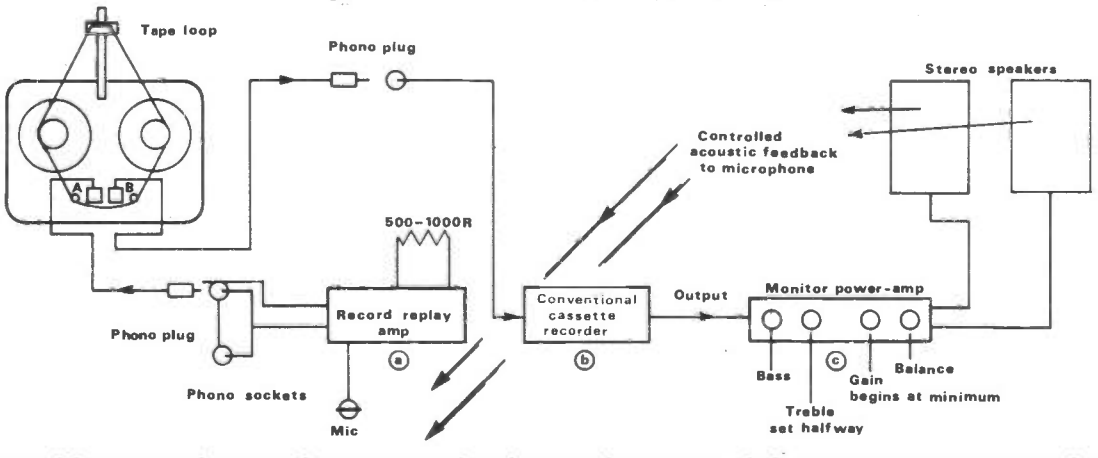


Fig 4 *Connections for 'echo' and 'space' effects*



MEDIUM WAVE DXING

by Steve Whitt

Welcome back to the wonderful world of MW radio. This month I've decided to take a special look at some aspects of broadcasting in the UK, highlighting the latest news as well as featuring an item of historical interest.

Station news

Although MW stations make far fewer adjustments to their broadcasting schedules than their short wave counterparts, there are many dozen changes reported every month from Europe alone. Usually these changes affect low power local or relay stations, and it is fairly rare for changes to be made on the main high power networks. This month I have a couple of items which should be worth watching out for.

Firstly R Finland (YLE) is currently building a new 600kW transmitter that will operate on 963kHz from early 1987. YLE already operates its international service on this frequency, but it is planning much greater coverage of Europe, quite possibly at the expense of R Caroline/Monique.

The next item concerns Ocean Sound, which is the new ILR franchisee for the Southampton area. R Victory became the first ILR station to lose its franchise when it closed down on 28th June, and the IBA selected Ocean Sound to take over an expanded operating area. The station is due to come on air on 14th October using 1170kHz for Portsmouth and 1557kHz for Southampton.

Another new set-up that will be affected by the activities of R Caroline is BBC Essex, which is due on air some time this November, provisionally with a 500W transmitter on 558kHz. BBC Essex is setting up its HQ in Chelmsford but is planning nine satellite studios throughout the county. It seems likely that 558kHz will be abandoned in favour of another frequency (which had not been announced at the time of writing) together with a local 100W relay for Southend on 1530kHz.

Station profile

This month, instead of focusing on one particular station, we'll take a stroll down memory lane to examine the origins of BBC local radio.

Although many people think of BBC local radio in its present form, it could be said that the story of BBC local radio goes back to 1922, to the start of radio in fact, when the BBC had stations in Birmingham, Manchester and Newcastle.

By 1924 there were 20 of these regional stations, but twenty stations needed twenty frequencies, and by 1925 radio was becoming so widespread that an international conference was arranged to share out the available channels. Britain's allocation was just 13, and as a result the local stations were closed down to make way for a national radio network operating fewer but more powerful transmitters.

Nearly forty years passed before the idea of local radio was revived. In 1960-61, 18 closed-circuit experimental stations were set up in places such as Bournemouth, Hull, the Isle of Wight, London, Norwich, Poole and Reading.

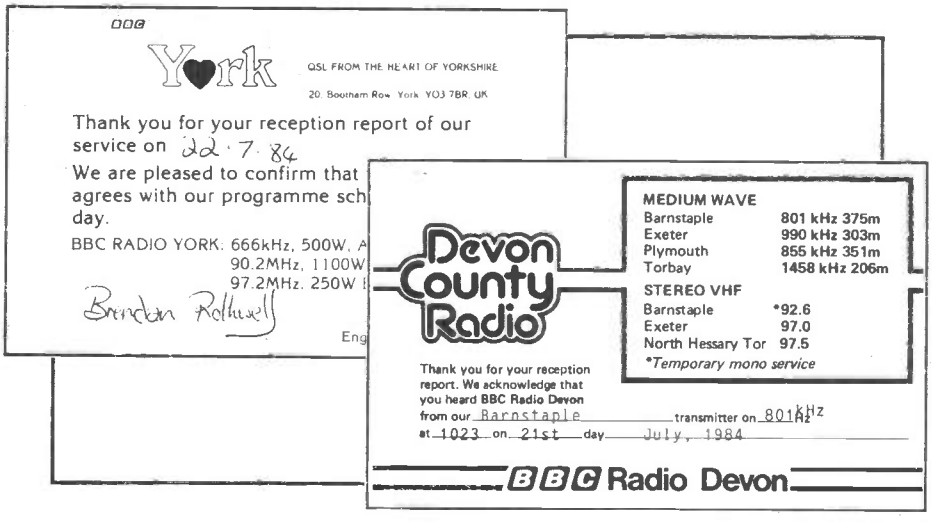
Soon afterwards the Pilkington Committee recommended that the BBC should be allowed to open some experimental stations. Five years of delay later, in December 1966, the Wilson Government gave the go-ahead for nine experimental local stations which were intended to be at least partly financed from local council funds. Of the nine, only eight eventually became operational since the Conservative council of Manchester refused to finance their local station. The first station on the air was BBC Leicester, which opened on 8th November 1967.

It should be noted that the early stations (ie the first eight at Leicester, Sheffield, Nottingham, Stoke, Leeds, Brighton, Durham and Merseyside) were confined to VHF FM frequencies, which were not that popular with listeners. Nevertheless in 1969 the experiment was

BBC LOCAL RADIO ON MW

R Aberdeen*	990kHz
R Bedfordshire	630 & 1161kHz
R Bristol	1323 & 1548kHz
R Cambridgeshire	1026 & 1449kHz
R Cleveland	1548kHz
R Clwyd*	657kHz
R Cornwall	630 & 657kHz
R Cumbria	756 & 1458kHz
R Derby	1116kHz
R Devon	801, 855, 990 & 1458kHz
BBC Essex	1530kHz
R Foyle*	792kHz
R Furness	837kHz
R Guernsey	1116kHz
R Humberside	1485kHz
R Jersey	1026kHz
R Kent	774, 1035 & 1602kHz
R Lancashire	855 & 1557kHz
R Leeds	774kHz
R Leicester	837kHz
R Lincolnshire	1368kHz
R London	1458kHz
R Manchester	1458kHz
R Merseyside	1485kHz
R Newcastle	1458kHz
R Norfolk	855 & 873kHz
R Northampton	1107kHz
R Nottingham	1521 & 1584kHz
R Oxford	1485kHz
R Sheffield	1035kHz
R Shropshire	756kHz
R Solent	999 & 1359kHz
R Solway*	585kHz
R Stoke-on-Trent	1503kHz
R Sussex	1161, 1368 & 1485kHz
R West Midlands	828 & 1458kHz
R York	666 & 1260kHz

* These stations are local opt-outs from the BBC regional networks in Scotland, Wales and Ulster



declared a success and another twelve stations were authorised, bringing the total to 20.

The BBC had planned a second phase in its local radio development programme which would have resulted in another 20 stations coming on air, but in 1971 the Heath Government pledged itself to the introduction of commercial radio. As a consequence, between 1971 and 1975 19 commercial stations opened but the BBC's development plans were frozen. During this period the only change in BBC local radio occurred when the Durham station closed down (August 1972) and was replaced by R Carlisle in November 1973.

Slow developments

Despite by and large taking a political back seat, BBC local radio continued to develop, and 1973 presented a major opportunity to expand the size of station audiences when medium wave frequencies first became available. Oddly enough, although BBC local stations had been confined to the VHF band for their first six years they had failed to exploit the benefits of this band, as they remained in mono even after commercial stations started appearing with stereo broadcasts.

Until 1978 the BBC local network remained static, but in July of that year a Government White Paper gave the BBC authority to expand its local radio coverage.

The BBC opened new stations at Norwich and Lincoln in 1980 and subsequently a further eleven stations have become operational in places as far apart as the Channel Isles and York.

Currently the BBC is still adding to its network, but recently the most significant changes have affected programming and station identity. BBC local stations have been seeking an image with which listeners could identify, and this has resulted in a distinct 'county station' image that is reflected in a number of fairly recent station name changes (the table shows the present position of BBC local radio).

Next month I'll be taking a look at the start of commercial radio, but in the mean time can you name the very first commercial station to take to the air from Great Britain? REW

DX FILE

Having spent most of this month's column looking at radio in the UK, it's about time to have a peek at what is being heard from far away. MW conditions over the summer have (relatively speaking) been very good, with extended periods of low solar and ionospheric activity. My log book reveals reception of:

WINS New York, 1010kHz, continuous news

WHN New York, 1050kHz, baseball commentary

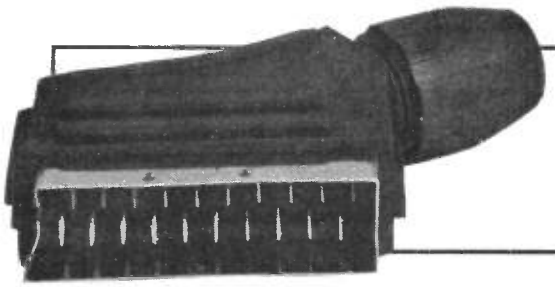
ZDK Antigua, 1100kHz, reggae music and sports phone-in

R Globo Rio de Janeiro, Brazil, 1220kHz, Portuguese sports

Caribbean Beacon Anguilla, 1610kHz, religious programmes

All these stations could be heard between midnight and 0100 GMT in July. It is interesting to note that reception around 0300 (just before UK sunrise) of stations in the Chicago area of the USA has been reported by other MW DXers – even in winter these stations are not that regularly heard.

That's all we have room for this time round, so I'd better be going. Remember that your letters, logs, tips and comments are always most welcome.



PLUG INTO PERITEL

by Andy Emmerson G8PTH

If you have looked at a new TV receiver or video recorder lately (or read reviews of them) you may have spotted a strangely shaped socket on the back. Known variously as a Peritel or SCART connector, or more widely as a Euroconnector, this new plug and socket system promises at last to take the hassle out of connecting up video recorders, TVs, home computers and TV games. The concept is a universal multi-pin connector catering for all options and bypassing the modulator and tuner compromises to give you a better picture.

Anyone who has seen a home computer or VCR connected both to a TV and a monitor will know that a monitor gives a sharper, less smeary and washed-out picture. Many new TVs can also be used as monitors, and in order to simplify the connections a committee in France devised a system to meet all requirements. The sockets have been obligatory on all French TV sets for some years, and TV manufacturers in other countries have now seen the light and are fitting the socket on their TVs and VCRs too.

DIY possibilities

Now known as the Euroconnector, this plug and socket combination is also referred to as SCART (after the committee which designed it) and Peritel (because it connects *peri*pheral equipment to the *tele*vision). Euroconnectors are cheap, and you can buy ready-made leads, but if you want to make up your own cables this article should help.

When you look at the plug you will note that it is shaped so that it cannot be inserted the wrong way round. There are 20 pins, each with its own purpose: to carry vision signals, mono or stereo audio and command signals in and out of a TV. There is even provision for a 'domestic data bus', which is not something you keep in the garage!

The idea is that the whole house can be wired for sound and vision, with a slave entertainment centre (comprising a TV screen and hi-fi sound system) plugged into the cable in any room. You would also plug in a remote control command unit to call up your choice of broadcast or cable TV, radio, or perhaps something from your video recorder or hi-fi deck. This is clearly something for the future, but firms like Philips and Bang & Olafsen are already working on it.

Compatibility

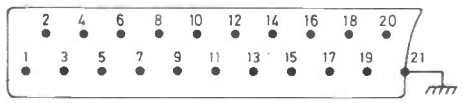
For complete compatibility between equipment of different makes the whole system relies on firms 'sticking to the rules' and using the pins of the connector for their proper purpose. With the DIN audio plugs and the J-type video plugs this has not been the case, but we can hope that it will be different with the Euroconnector. The Japanese manufacturers are fitting it to some of their products for Europe, so perhaps even the rest of the world will adopt it!

The actual allocation of each pin is shown in *Table 1*. There are twenty pins in a staggered arrangement, and the 21st contact is made by the metal surround.

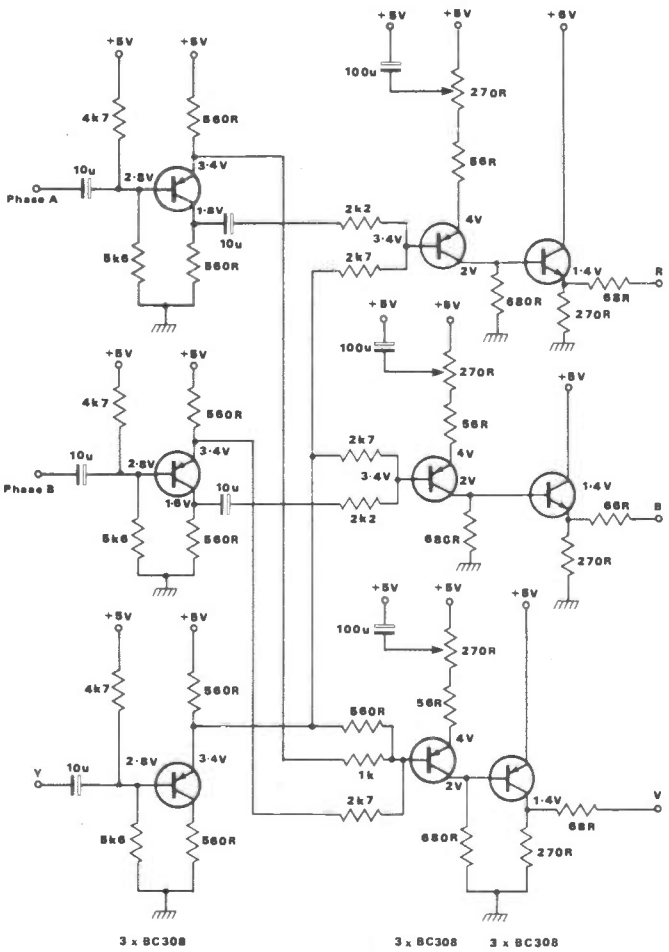
The plugs are available from several sources, but one of the cheapest is *Maplin Electronics, PO Box 3, Raleigh, Essex SS6 8LR, tel: (0702) 552911* (you have probably seen their catalogue in W H Smith). The part number is FJ41U and the price is 75p (postage 50p). They also supply all other types of video, audio and computer plugs which you may need for the other end of your home-made lead, as well as the cable.

To make up a connecting lead you will need to use good quality, *screened* cable. For short lengths of up to three feet you can use the same type of cable for both audio and video signals. This cable is available in both single and multi-core versions, so you can either use a separate cable for each function or a two-, four- or six-way cable. If you use

The Peritel pin assignment



Circuit for linking the Atom (separate luminance and chrominance outputs)



EUROCONNECTOR CONTACTS
1. Audio out (right-hand channel)
2. Audio in (right-hand channel)
3. Audio out (left-hand channel)
4. Ground for audio channels
5. Blue video channel ground
6. Audio in (mono or left-hand channel)
7. Blue video channel input
8. Source switching, ie TV/monitor status (see *Table 2*)
9. Green channel ground
10. Remote control (inverted) *or* clock
11. Green channel input
12. Remote control
13. Red channel ground
14. Ground for remote control channel
15. Red channel input
16. TV/non-TV status (see *Table 2*)
17. Ground for composite video
18. Ground for TV/non-TV status
19. Composite video output
20. Composite video input *or* sync for RGB signals.
21. Socket earth (plug shield)
Because the contacts are staggered and grouped in even and odd columns the allocation order shown above looks illogical – it isn't!

Table 1

this multi-core cable *make sure that each core inside has its own individual screen or braid*: we don't want the signals to leak across or interfere with each other.

The Euroconnector is supplied in parts and is a little different from other plugs. First of all take the round ferrule and thread it down your cable – you don't get a second chance! Each pin is loose: you offer up the bared end of the wire to it, then squeeze the 'wings' tight with pliers to hold the wire. Then solder your wire to it in the normal way and press fully home into the central body of the plug.

When you have inserted all the pins into the body, clip the metal shield around the body and press the plastic shell around the centre. The plug should protrude almost ¼ inch outside the shell. Finally run the ferrule down the cable and screw it onto the shell.

Wiring examples

(a) *Linking a microcomputer, VCR or camera with composite video output.* Video signal to pin 20, 12V to pin 8 and 3V to pin 16. Any audio to pin 6.

(b) *Linking a microcomputer with RGB output.* Red to pin 15, ground to pin 13, green to pin 11, ground to pin 9, blue to pin 7, ground to pin 5, 12V to pin 8 and 3V to pin 16.

(c) *Linking a microcomputer with separate luminance and chrominance outputs.* This applies to some older micros using the MC6847 video circuit, eg the Acorn Atom. The three signals for luminance (Y) and chrominance (phase A and phase B) must be used to create R, G and B as follows:

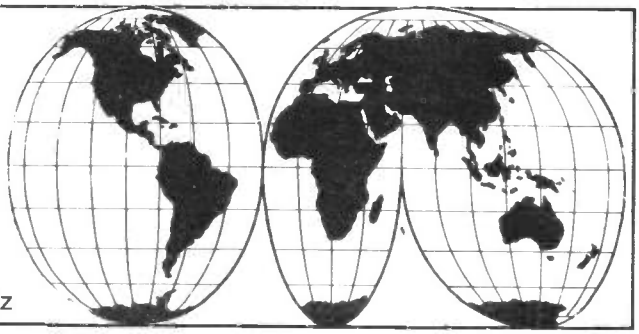
$$R = \text{phase A} - Y;$$
$$B = \text{phase B} - Y;$$
$$G = (-Y) - 0.51 \times \text{phase A} - 0.19 \times \text{phase B}.$$

The circuit devised by M Greff (see diagram) shows how to do this for the Atom. The preset variable resistors adjust the contrast levels and the voltages shown are quiescent. REW

SIGNAL LEVELS (NOMINAL)	
Composite video:	1V peak to peak into 75Ω
RGB video:	0.7V into 75Ω
Audio in:	500mV into 10KΩ
Audio out:	500mV into 1KΩ
TV/monitor status:	inactive (during TV reception) 0-2V, active (TV used as monitor) 10-12V (into 12KΩ)
External fast blanking input:	inactive (during TV reception) 0-0.4V, active (TV used for anything else) 1-3V

Table 2

SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

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

This month is the time of year to direct the attention of broadcast band hobbyists to that least popular of all low frequency ranges – the 120 metre band (**2300** to **2498**) and, in the next issue, to the out-of-band limits **2600** to **3015**. Abounding in utility (UTE) interference (QRM), these ranges are in fact not only avoided completely by the majority of SWLs – at least according to the scarcity of published reception reports – but are also not all that often frequented by DXers. One reason for this state of affairs is the fact that not all enthusiasts can erect an outside aerial of sufficient length to achieve a reasonable chance of success. Furthermore, operating a receiver exhibiting a very high degree of selectivity is an undoubted advantage.

None the less, readers are urged to have a go. Some of the Chinese transmitters listed below are capable of putting into the UK a signal audible to many listeners – it is just a question of visiting the respective channels on a consistent basis throughout the season and awaiting the right conditions for such results. Start now and continue through until the end of February, mid-term usually being the prime time.

China

Cathay (the medieval European term for China) has several outlets within the frequency limits specified above, the lowest in frequency order being Yunnan PBS.

Yunnan PBS (People's Broadcasting Station) in Kunming carries Yunnan 2B minority language programmes in Dehong Tai and Jingpo from 2230 to 0030 and from 1225 to 1430 on **2310**. Identifying as 'Yunnan Renmin Guang-bo Dian-tai', it is not often heard in Europe. Kunming is the capital of Yunnan Province in southern China, bordering Burma on the west, with both Laos and Vietnam in the south. The province is mainly a plateau, drained by several rivers including the Mekong, Salween and the Yangtze.

On **2340**, Fujian PBS, Fuzhou (formerly Foochow) identifies in Chinese as 'Fujian Ren-min Guang-bo Dian-tai, dui Tai-wan Guang-bo' and carries the Home Service 1 in Chinese from 2050 to 2400 and from 1020 to 1700 with a power of 10kW, being logged by the writer during January last at 1518. English language lessons are featured by many Chinese stations, that of Fujian being timed from 1330 to 1400. Fujian (Fukien) is located in south-east China on the Formosa Strait opposite Taiwan.

Voice of the Strait ('Hai-xia-zhi-sheng Guang-bo Dian-tai') at Fuzhou is a PLA (People's Liberation Army) Fujian Front station broadcasting the Haixia 2 programme in Chinese and Amoy from 1200 to 1755, the Amoy slots being from 1400 to 1415, 1445 to 1500, 1600 to 1615 and from 1645 to 1700 with a power of 10kW. The frequency is **2430**, this one being logged during January and February at around 1518.

Explanation 1

Voice of the Strait, meaning the Formosa Strait, has all PLA transmitters, which radiate either the First or Second Programme, these being differentiated in DXers language as Haixia 1 and Haixia 2. These transmissions are intended for offshore islands and Taiwan.

Yunnan again

Yunnan appears again on **2460**, at which point on the dial it radiates the Home Service 1 in Chinese from 2150 to 0100, from 0250 to 0600 and from 1020 to 1600 with English language lessons from 2200 to 2230, 0500 to 0530 and from 1400 to 1430. The power is 15/50, being logged in December 1985 at 2308.

Zhejiang PBS, Hangzhou on **2475** also features programmes in the Home Service 1, the schedule being from 2050 to 0530 and from 0850 to 1505 with the almost inevitable English language lessons from 2140 to 2210 and from 1330 to 1400. The power is 10kW. Hangzhou (Hangchow) was entered into the log during January and February at 2235 and 2136 respectively. Hangzhou is the capital of Zhejiang Province in south-east China on the East China Sea, the fertile Yangtze delta being a part of this province.

Voice of the Strait, Fuzhou carrying Haixia 1 in Chinese can be heard on **2490** broadcasting from 0955 to 2355 at 10kW.

Explanation 2

It is convenient for DXers to report the programme language as Chinese, usually shown abbreviated as C or CC. In fact the language is Putonghua (Standard Chinese). It is used as the national programme language throughout China and is based on the Beijing (Peking) dialect. Dialects such as Amoy, Cantonese, Hakka, etc are used in the relevant regional services, as are Tibetan, Vigher etc in the minority language service.

Beijing translates as 'Northern Capital', having been named by the Nationalists in 1928, when they had their capital at Nanking, as Peiping ('Northern Peace') and altered to Beijing by the present regime in 1949.

More on Cathay

Cathay was popularised by Marco Polo, the Venetian traveller in China who became a favourite and an agent of Kublai Khan. On returning to Venice in 1298 he became the main source of information on the Far East.

This review will be continued in the next issue – make sure of your copy if a return to fabled Cathay appeals.

AROUND THE DIAL

As usual, Africa is the springboard – dive in and strike out for some DX.

AFRICA

Algeria

Algiers on **7245** at 1000, OM with the station identification, YL with announcements in the Kabyle programme for Africa, scheduled from 0700 to 2300.

Ascension Island

BBC Relay on **7160** at 0513, OM with a newscast in English in a programme for Africa, timed from 0300 to 0545 daily. Ascension Island lies in mid-Atlantic and is part of the British colony of St Helena, 1,216km to the south-east. It is customary to group the island with African countries in SWL publications.

Botswana

Gaborone on **4820** at 1950, YL with a local pop song, OM with announcements in SeTswana.

Radio Botswana operates the Home Service in SeTswana on this channel from 0330 to 2100 with English newscasts timed at 0510 and 1910 daily, 1110 and 1610 Monday to Friday and at 1125 on Saturday and Sunday. The power is 50kW.

Cameroon

Douala on **4795** at 0430, OM with the station identification and frequencies in French and English repeated several times, the National Anthem, then a short news bulletin in French. This 100kW transmitter carries the Home Service in vernaculars, French and English from 0425 to 0800 and from 1630 to 2300 (Saturday and Sunday until 2230). The programmes in English are timed from 1745 to 1845 week-

days, from 0705 to 0800 and 1730 to 1845 on Saturday and from 0600 to 0645 on Sunday. Relays of the Yaounde English newscasts are made at 0530, 1800 and at 2100 daily.

Chad

Njamena on a measured **4920.2** at 1952, OM with a talk in French.

This is a move from the former **4905** channel now stridently occupied by the 250kW VAE Abu Dhabi transmitter which tested on that frequency a few months ago.

Guinea

Conakry on **4900** at 2028, OM with a talk in a vernacular, YLs with a song then OM with an announcement in French. The Home Service in French and vernaculars is radiated from 0600 to 0800 and from 1230 to 2400 Monday to Saturday, and from 0800 through to 2400 on Sunday. There is an English programme from 1830 to 1930 daily. The power is 18kW.

Libya

Tripoli on **7245** at 0050, OMs with songs in Arabic, local-style music in an Arabic presentation to Africa, scheduled from 1645 to 0330.

Tripoli on **9600** at 1427, YLs with songs complete with local-style music in an Arabic schedule for Africa, 0400 to 2255 daily.

Nigeria

Lagos on **4990** at 0527, OM with some announcements in English then OM with a local pop song.

The Home Service 1 in English and vernaculars is on this frequency from 0430 to 2310 with a power of 50kW.

Senegal

Dakar on **4890** at 2158, YL with a song in vernacular with stringed instrumental backing then OM with announcements and the station identification in French at 2200. Dakar is on the air with the National Service in vernaculars and French from 0600 (Sunday from 0700) to 0800 and from 1800 to 2400, but the closing time can vary up to 0100 on occasions. There is an English programme timed from 1845 to 1905. The power is 100kW.

Tanzania

Dar-es-Salaam on **5050** at 2003, OM with the news in Swahili, many place names mentioned such as Morocco, New York, etc. Choral rendition of the National Anthem at 2016 and off at 2018. Radio Tanzania operates the National Service in Swahili from 0300 to 0700 and the Commercial Service from 1300 to 2015. The power is 10kW.

SOUTH AMERICA

Brazil

Radio Nacional de Manaus, Manaus on **4845** at 0230, OM with the full station identification and promotions (promos) in Portuguese.

This 250kW Radiobras transmitter is on the air from 0900 to 1600 and from 1800 to closing around 0300 (Sunday at 0100).

Radio Nacional, Boa Vista on **4875** at 0317, OM with promos and the station identification in Portuguese. This one is scheduled from 0900 to a variable closing time around 0400 with a power of 10kW.

Colombia

Caracol, Neiva on **4945** at 0609, OM with a newscast in Spanish. Caracol operates around the clock with a power of 20kW.

Ecuador

Radio Quito, Quito on **4920** at 0240, OM with a talk in Spanish followed by a YL with a song extolling the virtues of Quito. At 5kW, Radio Quito is scheduled from 1000 (Sunday from 1200) to 0500 (Sunday until 0300) and identifies as 'Radio Quito, La Voz de la Capital', which makes identification an easy matter. In the Andes, at an elevation of 2,852 metres and situated 24 kilometres south of the equator, Quito is the capital of Ecuador, being the educational, cultural and political centre of the country.

A Quito Indian settlement, it was captured by the Incas just prior to conquest by Benalcazar in 1534.

PACIFIC

Australia

Melbourne on **6035** at 1809, OM with a news bulletin of both local and world events in an English programme for Asia and Europe, timed from 1530 to 2100.

Melbourne on **15240** at 0354, OM with a pop song, OM with announcements in an English transmission to the Pacific, scheduled from 2100 to 0730.

NEAR AND MIDDLE EAST

India

AIR Delhi on **7412** at 1538, OM with news of local affairs and events in English. The North Regional Home Service operates on this channel from 1430 to 1630 and from 1730 to 1740 with newscasts in English timed from 1530 to 1545 and from 1730 to 1735.

Israel

Jerusalem on **17565** at 1010, OM with a talk about international affairs of concern to Israel during an English programme for Europe, scheduled from 1000 to 1030.

Pakistan

Islamabad on **17660** at 1104, OM with the station identification then YL with local news in English read at slow speed. The Urdu transmission for Europe is timed from 0715 to 1115, the English newscast being scheduled from 1100 to 1115.

Turkey

Ankara on **7215** at 1918, OM with a song in Turkish with local-style musical backing during the German programme for Europe, scheduled from 1900 to 2000.

United Arab Emirates

Dubai on **21700** at 1050, OM and YL with a talk in English about some of the local sites of antiquity. This English transmission for Europe is scheduled from 1030 to 1100.

North Yemen

San'a on **9780** at 1058, YL with songs and music in the local style then OM with the station identification in the Arabic programme timed from 0300 to 0700 and from 1000 to 2100.

EUROPE

Greece

Athens on **9935** at 1340, OMs with a folk song together with some local-style music during the Greek presentation to the Middle East, scheduled from 0900 to 2115.

Athens on **11645** at 1523, OM and YL with songs and music in typical Greek style during a Greek programme to North America, timed from 1500 to 1540, and then a YL with an English news bulletin scheduled from 1540 to 1550.

Poland

Warsaw on **7270** at 0059, interval signal then OM with the station identification, frequencies and times of Polish programmes for the North Atlantic area. This particular Polish transmission for the area is timed from 0000 to 0200.

Romania

Bucharest on **7195** at 1923, OM with the DX programme in a German transmission for Europe, scheduled from 1900 to 1925. Then suddenly off without the National Anthem at 1925.

Spain

Madrid on **7280** at 0505, OM and YL with the news during the Spanish programme for Europe, timed from 0500 to 0600.

CLANDESTINE

Seda-ye Jebhe-ye Nejat-e Iran (Voice of the Liberation of Iran) on **7080** at 1815, OM with the station identification followed by a talk in Farsi (Persian). Also logged on **9027** in parallel, which makes identification an easy matter. The use of **7080** makes this transmitter another amateur band intruder and is a shift from the **15555** channel. This particular transmission is scheduled from 1630 to 1825. Voice of the Liberation of Iran has, however, been logged on **15555** and in parallel on **9027** at 0352, radiating from 0330 to 0525.

NOW HEAR THIS

Niamey, Niger on **3260** at 2021, OM with a talk in vernacular followed by the sound of African drums. ORTN Niamey is on the air from 0530 to 0700 (Sunday until 1130) and from 1700 (Saturday and Sunday from 1630) to 2300 carrying the Home Service 1 programmes. The power is 4kW and the channel is beset by utility interference. NEW

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HOWES QRP TRANSMITTERS. We have three QRP CW transmitters in our range at the moment. The **CTX** transmitters are available for 40 or 80M bands, and the **MTX20** is for 20M. All three feature adjustable output power, up to about 5W on 80, 3W on 40 and 10W on 20M. The heatsinking for the output stage is onboard, and one crystal is included. There is space for two more crystals on the PCB, and provision is made for connecting a VFO. The CVF VFOs are available for 40 and 80M at the moment, the 20M version is under development. The VFOs have dual buffered outputs, so that not only will they drive the transmitter, they can also drive the DcRx receiver as well, for full transceive operation. Voltage regulation, and IRT (clarifier) facilities are included.

CTX80 80M Transmitter Kit £12.95 — **Assembled PCB Module £18.95**
CTX40 40M Transmitter Kit £12.95 — **Assembled PCB Module £18.95**
MTX20 20M Transmitter Kit £19.90 — **Assembled PCB Module £26.95**
CVF40 or CVF80 VFOs: Kit £ 9.30 — **Assembled PCB Module £14.90**

HOWES 2M to HF TRANSVERTERS

If you have a 2M SSB/CW transceiver (an FT290 for example) you can get on to 20 or 80M without having to spend a fortune on an HF transceiver. These transverters also make HF Mobile operation much more practical, as a small 2M rig is all that has to be mounted within reach of the operator. These units deliver about 10W output from mismatch proof transistors, and do not require any fancy test equipment to set them up. A high proportion of fixed value filter components keeps alignment simple, and the output spectrum clean.

HC220 20M Kit £48.90 — **Assembled PCB Module £79.90**
HC280 80M Kit £48.90 — **Assembled PCB Module £79.90**

HOWES CTU30 ANTENNA MATCHING UNIT

The CTU30 is a "T" match type ATU for use with receivers and transmitters of up to 30W output on all bands from 1.8 to 30MHz. It uses two air-spaced capacitors, and 12 switched inductance settings. An unusual feature in a small ATU is the provision of a balun for feeding balanced antennas in addition to the more common unbalanced types. All the parts are PCB mounted in this novel design. Simply add a case and connectors to fit in with your station, even the knobs are included in this kit!

HOWES CTU30 Kit £24.90 — **Assembled PCB Module £29.90**

HOWES TRF3 SHORTWAVE BROADCAST RECEIVER

The TRF principle was developed 80 years ago. Here it is brought up to date with modern silicon devices. The receiver tunes from about 5.7 to 12.8MHz in three bands, if you wind the coil as suggested in the instructions, although you can easily experiment with the coverage if you wish. The TRF3 has switchable input impedance and attenuator, so it can be used with large or small antennas. This is an excellent educational project for the "junior op", as well as providing a bit of fun for the old timer as well! You should be able to read all about building it in the September issue of Ham Radio Today.

A suitable tuning capacitor is available at £1.50

HOWES TRF3 Kit £13.90 — **Assembled PCB Module £18.90**

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73 from Dave G4KQH

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100	13.43	2.59
200	19.03	3.10
250	23.01	3.24
350	28.46	3.40
500	35.45	3.66
1000	64.28	4.62
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2000	99.76	6.36
3000	139.39	O/A
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VA	Price	P&P
60	11.51	2.31
100	13.43	2.59
200	19.03	3.10
250	23.01	3.24
350	28.46	3.40
500	35.45	3.66
1000	64.28	4.02
2000	99.76	6.36
3000	139.39	O/A
6000	298.89	O/A

12/24V or 12-0-12V
2x12V Secs Pri 240V

12V	24V	Price	P&P
0.3	15	2.92	1.10
1	.05	3.70	1.60
2	1	5.15	1.70
4	2	5.94	1.90
6	A 3	9.31	2.05
8	M 4	10.89	2.10
10	P 5	11.91	2.10
12	S 6	13.20	2.25
16	8	15.73	2.60
20	10	21.17	3.04
30	15	26.31	3.10
40	20	37.56	4.25
60	30	53.92	4.90
83	41	62.09	5.65

48/96V Pri 2x120V
Secs 2x36/48V

72/96	36/48	Price	P&P
0.5	1	6.51	1.50
2	4	17.81	2.54
3	6	21.57	2.75
5	10	39.08	3.70
6	12	48.94	3.99
8	16	53.39	4.20

25/50V or 25-0-25V
2x25V Tap Secs. Volts available
5,7,8,10,13,15,17,20,25, 30,33,40,20-0-20 or 25-0-25V

25V	50V	Price	P&P
1	0.5	5.01	1.76
2	1	6.09	1.90
4	2	10.84	2.20
6 A	3	12.54	2.25
8 M	4	17.16	2.58
12 P	6	21.84	2.79
16 S	8	30.89	3.15
20	10	36.66	3.60
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2	1	8.67	1.91
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6 P	4	18.38	2.55
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15-20x2	1Ax2	6.46	1.99
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2	1	5.24	1.70
4	2	8.47	1.92
6	3	9.82	2.10
8 A	4	11.72	2.20
10 M	5	14.49	2.31
12 P	6	16.40	2.55
16 S	8	21.95	2.60
20	10	25.32	2.84
24	12	28.07	2.95
30	15	31.66	3.51
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250	10.34	1.98
350	12.43	2.31
500	16.12	2.68
1000	28.79	3.25
1500	34.17	3.68
2000	51.09	4.62
3000	86.88	5.72
4000	112.78	O/A
5000	131.33	O/A
7500	202.71	O/A
10000	239.53	O/A

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VA	Price	P&P
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150	14.67	2.20
250	17.87	3.02
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QSO

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

UoSAT success

The pioneering store-and-forward digital communications experiment (DCE), currently in orbit on the UoSAT 2 satellite has proved an unqualified success. In eight months of experimental operation, the digital communications experiment has been used to relay up to 15 pages of text (100Kbytes) per day between inexpensive groundstations in the UK and the USA.

Following this success groundstations in Australia, New Zealand and Alaska are now going to join the network. Communications experiments with low power, highly portable ground terminals for use in remote or less developed areas will begin soon.

UoSAT 2, built at the University of Surrey and now in a polar orbit at 700km altitude, provides an ideal test bed for the store-and-forward communications concept. Using this technique, a message from one ground terminal is stored in memory on the satellite and delivered as the satellite passes over the destination ground terminal. The two ground terminals do not have to 'see' the satellite at the same time, and a single satellite can provide global communications coverage.

This is unlike geostationary communications systems, which require three satellites to provide world-wide coverage, and still cannot provide communications in the polar regions or in areas without access to large ground stations. As a store-and-forward satellite is in a relatively low orbit, ground terminals need use only low power transmitters and small antennas.

There is growing government and commercial interest in this form of communication. Of particular interest is the Swedish Space Corporation which is now planning a dedicated store-and-forward satellite named Mailstar. Data gained from the UoSAT 2 DCE will be invaluable to designers of large-scale store-and-forward systems. The University of Surrey ground control station, in an on-going study funded by ESA, is collecting data from the DCE on both the long and short-term effects of the low-earth orbit environment on high-density CMOS memories and other LSI devices necessary for a store-and-forward transponder.

Engineers with the University of Surrey and VITA (the USA-based Volunteers In Technical Assistance) have been using the DCE to evaluate access protocols and error detection and correction techniques that will perform efficiently on links to store-and-forward satellites in low-earth orbit.

The experiment is one of a number of space technology and space science experiments in orbit on the UoSAT satellite. The DCE was built by volunteers in the United States and Canada, co-ordinated by the Amateur Radio Satellite Corporation (AMSAT) and funded by VITA. VITA's interest in store-and-forward communications stems from a need for timely and accurate communications between volunteers in remote, less-developed areas of the world (generally not served by geostationary communications networks) and technical advisors in the USA.

The UoSAT unit has, for the past ten years, been a pioneering force in cost-effective spacecraft engineering, and has carried out many experiments in low cost spacecraft and ground station technology through its two successful spacecraft missions – UoSAT 1 and UoSAT 2, launched in 1981 and 1984 respectively as piggyback payloads on NASA Delta rockets. Both are still fully operational in orbit, providing valuable engineering and scientific data.

Members of the Ballymena Amateur Radio Club, GI3FFF, operating the special event station, GB2MRI, on Rathlin Island on 6-10 August, using the 2m, 70cm and 23cm bands

Tyneside ARS event

BBC Radio Newcastle will be inviting the public to view their new studios during an open day on Sunday, 12th October. The purpose-built broadcasting centre at Fenham, near the city centre, has been on the air since 25th May, and next year BBC Television will move in when the TV studios are completed.

As an added attraction the Tyneside ARS will operate a special event station from the newsroom, with the callsign GB2FBC.

This will be the second time Tyneside ARS has run a special event station for Radio Newcastle. In 1982 when the BBC was celebrating 60 years of public broadcasting in Newcastle (originally from 5NO), Tyneside ARS operated GB5NO at the site of the first broadcast for one week. During this time they had a QSO on two metres with G4MHW, a staff presenter for the BBC, which was broadcasted over the air.

Repeater news

The South-West Hertfordshire UHF Group's 433MHz FM repeater, GB3HR (RB14), is now 10 years old.

Although no longer operational from the original site at Bushey Heath, near Watford, the present site near Stanmore gives a much improved coverage in most directions, and the installation of a better aerial system in February 1986 further improved the service.

Reliability over the last 10 years has been very satisfactory with only one component failure and a feeder cable fault at the Stanmore site. The Bushey Heath site suffered from several electricity mains failures, but so far the supply at Stanmore has been excellent, except for the day that the EEB removed the fuses and meter by mistake!

Plans for the future of HR include a complete standby repeater station, a new duplexer for single aerial working and a protected mains electricity supply.

The group also operates a 10GHz beacon station, GB3SWH, on 10.3680GHz. Facilities are provided for both narrow and wideband reception. This station, located at Bushey Heath, is horizontally polarized and gives an almost omnidirectional coverage. Several long distance reception reports have been received by the beacon keeper, Trevor Groves G4KUJ, but many more would be gratefully received to build up a better picture of the paths that exist from the site. The present transmitter was built by Les Sharrock G3BNL.

GB3BH, a 23cm FM beacon/repeater, Tx 1297.0MHz, Rx 1291.0MHz, is due to be operational from Bushey Heath during 1986.

Welsh rally

This year's Welsh Amateur Radio Convention will be held at The Oakdale Community College, Blackwood, Gwent on Sunday 5 October. Doors will open at 10.00am and the official opening will be at 11.00am by Mr W McClintock G3VPK, President of the RSGB.

The programme will include the ARRL video presentation of the shuttle mission 51F (W0ORE/Challenger), a tape/-slide presentation of the 1985 Clipperton Island DXpedition, a lecture on amateur fast scan TV by E Edwards, GW8LJJ and a VHF feature. Morse test facilities will be available, although applicants must apply previously to the RSGB. There will be £300 in cash prizes, plus other prizes, the usual trade stands, bring and buy and RSGB stand. Admission is £1.50 at the door. Talk-in will be on S22.

Further details can be obtained from R B Davies GW3KYA, 16 Vancouver Drive, Penmain, Blackwood, Gwent NP2 0UQ.

Wakefield Mobile Rally

The Wakefield Mobile Rally, organised by the North Wakefield Amateur Radio Club, will offer various attractions, including radio, electronics and computer stalls, a handicraft stall and entertainment for the kids.

It will be held on Sunday 5th October at the Outwood Grange School, Potovens Lane, Wakefield. Doors open at 11am and talk-in will be on S22 and GB3WU. Admission is free.

Refreshments, including a licensed bar, will be available as well as good car parking facilities.

Further details can be obtained from Steve G4RCH on Leeds 536633.

Bristol Radio Rally

The South Bristol Amateur Radio Club has organised the second Bristol Radio Rally for Sunday 19th October. The venue will be the Hartcliffe Youth and Community Centres, Hareclive Road, Hartcliffe, Bristol and the doors will open at 10am.

The floor area has been increased by 40%, enabling a substantial growth in the number of traders. There will be a bar on site and other refreshments will also be available.

A special event station, GB2BRR, will be operating on the HF bands and talk-in will be provided on S22. Admission will be 50p.

Further information may be obtained from Mark Goodfellow G4KUQ on (0272) 716093 or Colin Hollister G4SQQ on (0272) 508451, both QTHR.

Testing, testing

Members of the Chelmsford Amateur Radio Society will have a chance to test their rigs on 7th October, under the watchful eyes of fellow hams. The society's AGM is also scheduled for that evening, and a high turn-out is expected.

Regular meetings occur on the first Tuesday of each month. For details of time and venue contact Roy G3PMX and Ela G6HKM on (0245) 360545 (home) or (0245) 353221 ext 3815 (office).

A club net is held on the Tuesdays between meetings at 8.00pm on 145.275MHz or 145.225MHz if this frequency is already occupied.

OK yah!

On Tuesday, 11th November at 6.00pm, Professor William Melody, Director of the programme on information and communication technologies at the Economic and Social Research Council, will be speaking at the Royal Society of Arts on 'The contribution of the Canadian Broadcasting Corporation to Canadian culture'.

Those of you not confused by the title may be interested in attending, tickets for which can be obtained free of charge from Carole Singleton, The Royal Society of Arts, John Adam Street, Adelphi, London WC2N 6EZ.

RIP 10-UK

Due to various business and personal changes of circumstance, the organisers of 10-UK have been forced to give up any involvement in the now defunct organisation. On investigation it has been found that an amount of £230.17 remains as a balance of the 10-UK funds.

Provided that no objections are received by 1st January 1987, it is proposed that the above sum, less any expenses involved (postage, etc), will be donated to the RAIBC. If there are any objections kindly advise G3LWM at 21 Waltham Way, Frinton on Sea, Essex CO13 9JE as soon as possible.

EMC info

On 8th October the Farnborough and District Radio Society will host an evening concerning EMC (electromagnetic compatibility), which will be presented by the RSGB. This will be followed on 22nd October by a surplus equipment sale.

More details of the society are available from G4SBU QTHR.

Morsum Magnificat

A new morse journal, *Morsum Magnificat*, will shortly be available.

A Dutch version has been published since 1983 by PA0BFN and PA3ALM, and contributions have been received from both amateur enthusiasts and professional morse telegraphers from around the world.

Now Tony Smith G4FAI has joined the editorial team as English language editor, in order to produce an English version of the journal.

It's aim is to publish material about morse which is not normally found in popular magazines, including history, anecdotes, technique and illustrations.

UK subscription for one year will cost £6.00 (four issues) including postage. Apply to G4FAI, Tash Place, London N11 1PA, and cheques should be made payable to *Morsum Magnificat*. Phone 01-368 4588 for further details.

QRP demo

The Borehamwood and Elstree Amateur Radio Society meets on the second Monday of each month at the Organ Hall Community Centre, Bairstowe Close, Borehamwood, Herts.

The October meeting will consist of a QRP demonstration and lecture by G3JPJ. A tour of the BBC Brookmans Park Station is also being arranged. Enquiries about this should go to Tony King G0DDJ on 01-207 3809 (after 7.00pm) and general information is available from Ivor Rosenberg, 11 Parkside Drive, Edgware, Middlesex.

Olympic city?

In *Probe*, the journal of the Midland Amateur Radio Society (MARS), it is reported that a special event station, GB6OC, is being organised in support of the City of Birmingham's campaign to host the 1992 Olympic Games.

The city is a finalist in the selection procedures to choose an appropriate venue for the games. MARS hopes to publicise the idea that Birmingham is a worthwhile choice.

There are several sporting events arranged in Birmingham this year, and MARS plans to operate the station at each of them. The first event was the Royal International Horse Show at the NEC, when 151 stations were contacted in 38 countries. Other events will include the Birmingham Superprix on 24 and 25 August and the Brum Olympic Fun Run on 27 and 28 September.

For further information contact Stuart Grainger G4NSG.

Intruder Watch

In the latest edition of the Irish Radio Transmitters Society's Yearbook a form was published to encourage members to submit reports of intrusion heard on amateur bands.

Now the IRTS plans to recruit volunteers to monitor the bands. These monitors will be provided with a pad of forms and a booklet giving guidelines on the types and modes of transmission to look for. Any SWL or licensed amateur will be welcome to take part.

All reports will be collated by the IRTS and submitted to the Region 1 Intruder Watch, who will report to the IARU. The IARU will in turn put pressure on the ITU to have the intruders removed. The IRTS believes that this action will help preserve amateur allocations on the HF bands.

More information on the scheme is available from PO Box 462, Dublin 9.

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■ Tandy hand-held CB, 4 watts, 40 channels, £65 with extension microphone. Two metre base receiver, crystalled R2, R6, R7, S-10, S-12, £30. Tandy DX100 analogue comms recvr, 0.553-30MHz, £40. Sony 7600D portable comms rcvr, £95. Metal detector C-Scope, £15. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: (01) 674 0513, Thursdays 6-9pm

■ Electronic noise circuit, complete and working with 6 buttons, speaker, main IC makes train, fire engine, laser gun sounds etc plus more. Still as new, cost about £12, £5. Also second sound circuit with 14 LEDs, 6 buttons, plus sounds IC making crowd noises, set-up as football game but can be used for more noises, still new, cost £14, £5. Plans for building low-cost electric welder using car dynamo, £5.50. All by post. Mr D L Martin, 7 Griffin Crescent, Littlehampton, W Sussex

■ FT75 ac and dc PSUs, £130 ono. Hitachi 6 inch colour TV/radio and cassette set. Excellent condxn, £150 ono. Carriage extra. David, c/o Davis, 1 Milovaig Avenue, Glasgow G23 5HY

■ RTTY ST5 TU, £57. KW Ezee match, £30. Yaesu FP4, 13.8V, 4 amp PSU, £30. Yaesu FRV7700 converter, 118-130, 140-150 and 70-80, £30. 20ft 2in alloy mast, £5. 15ft 2in aluminium mast, £5. Altron Swingpost, unused, to make easily adjustable mast, £35. Last three items to be collected. R Middleton, 49 Wolseley Road, Stafford ST16 3XW

■ New N-type plugs, not ex equip, £2 each. 1kW isolation transformer, 240V, £20. 70cm helical filters, two stage 50 ohm i/p o/p, suit preamp, £3.50. 50MHz to 28MHz trvtr, 0.5W o/p, 12V, not boxed, £40. PCB to make 6 mtr, 4mtr, 2mtr trvtr. Double sided, drilled, plus CCT, £3.50. 4ft wing R/C plane kit, new, no radio, £27. All collect or postage extra. Ben. Tel: (021) 525 9772

■ No 19 MK3 radio with mains power pack. Any offers? Also two reel to reel tape recorders. Tel: Grantham (0476) 860421

■ AR-2001, original box and accessories, mint, £245. Revcone discone aerial, £20. Lab ground plane aerial, £10. Both as new, includes cable. Collect or plus. carriage. A J Meakins, 55 Huntingtower Road, Grantham, Lincs NG31 7AZ. Tel: (0476) 72304

■ Radio text books: Scott-Taggart, Terman, Reyner, Witts, Rapson, etc. Ring Reading (0734) 883799 for details

■ 13 top programs for 16K TRS-80 colour computer, worth £110. Yours for only £35. Thomas Ashurst, 4 Oak Street, Patricroft, Eccles, Manchester M30 0GE

■ Roneo 750 stencil duplicator, motorised, with two spare colour change drums, steel cabinet, stand, also steel spare stencil store cabinet. Lots of paper and inks, perfect for club newsletters, or your own business! Cost £400, sell, or swap for anything 'radio'. Lawrence, 13 St Aubyn Estate, Praze an Beeble, Cornwall TR14 0LE

■ Canon AE1 SLR with motor drive and fine carry case, lots of accessories, cost over £300, sell or swap for WHY radio or electronic. Lawrence, 13 St Aubyn Estate, Praze an Beeble, Cornwall TR14 0LE

■ Free transformers and some hardware and components. They're a bit heavy, so please send £1 to cover post. D Martin, 6 Downland Garden, Epsom, Surrey KT18 5SJ. Post only

■ N-type plugs, £2 each. 70cm helical 2 stage filters, £3. PW Meon 50MHz trvtr, 28MHz IF, not boxed, £40 ono. 1kW isolation transformer, 240V, £20. Model plane kit, 3ft span, suitable for r/c, new, £27. PCB for 50MHz Meon, £2.50. PCB for VLF converter, any IF, £1.50 with CCT. 10 mtr SSB Tx/Rx, £20. All collect or postage extra. Ben. Tel: (021) 525 9772

■ Hallicrafters S108 comm receiver, 8 tubes, £55. Halli S72 mains/battery, 8 tubes, portable rec, also Echophone commercial gen cov receiver, £55 each. Trio JR599 comm Rx. Excellent, boxed, £140. National HRO, 14-30MHz coil, £40. 1934 Murphy A30C console, £12. Murphy 1950 VHF baffle, £25. McMichael 135 1934, £30. Ekco 313 mains, 1930, £75. Ferranti UNA, 3 valve, 1935, original carton, £35. Exchanges: early crystal sets and Philips Superinductance sets wanted. Jim Taylor G4ERU, QTHR, 5 Luther Road, Winton, Bournemouth. Tel: (0202) 510400

■ Have stack RS232 interface for C64 or Vic 20, ZX Spectrum computer (48K), Micro-Professor MPF computer (needs RAM), or VIC 20 computer. Would exchange for communication receiver or KW200A. Tel: (039) 67 23811

■ Yaesu FT301 transceiver, solid-state, digital, 160-10m, AM, SSB, CW, FSK, speech processor, noise blanker, notch. All filters, marker, frequency standard RIT on Rx/Tx, VOX, MOX, variable AGC, £350 ono. Spectrum Plus computer, unused, unwanted gift, £70. Varkalis, 116 Waverley Road, St Albans, Herts AL3 5TH. Tel: St Albans 39333

■ Bird element for Thruline Type 43 wattmeter, 25W 100-250MHz, No 25C, £15. Will swap for 50H, 25E, 25A or 25B element. Tel: (0407) 741879

■ Receiver gen, covr 0.5 to 30MHz plus VHF, FM, broadcast bands. Barlow Wadley XCR30 (portable) Rx, very good cond, AM plus SSB, £95 ono. Tel: Alan, Basildon (0268) 45573, after 6pm

■ Bargain. Yaesu FT One general coverage transceiver, all extras fitted, all filters, FM, non-volatile memory, manuals, scan mike, original packing, excellent condition, buyer to inspect and collect. Phone for price and details or for other arrangements. Tel: (0792) 475629

■ Datong active antenna, outdoor model, little used, with MPU AD370, 200kHz to over 30MHz, £40. Contact Mr N Porter, 23 Calder Court, Britannia Road, Surbiton, Surrey KT5 8TS. Tel: (01) 390 2650

■ Microwave Modules MM4000 RTTY terminal, with full ASCII keyboard, £130. Pet 2001 computer/IEEE controller, integral VDU and KB, £100. Tektronix 849 storage scope with IA2 VHF dual amp, £180. 2102-2 RAM chips 20p each, 74LS262 character generator ROM chips, £2 each. Microwave Modules MTV435 ATV transmitter, £110. G-whip coils, £3 each. GEC Prestel/Videotext edit terminal with full keyboard, £20. R Whitbread. Tel: Lutterworth (04555) 57790 (Leics)

■ Class D wavemeter, £5. Valves, meters, lamps, including projector. For list send SAE. 8ft fluorescent fitting, £5. Portable typewriter in case (recently serviced), £15. Ultravox Dictaphone with foot switch, mic and instructions (Swiss), £20 with extra spare machine. Shure Unidyne B mic, £16. Contact Mr Williams, 25 Glenmore Road, Oxton, Birkenhead, Cheshire L43

■ Olympus OM2 with F1.8 50mm lens, £110. Olympus T32 flash (TTL and OTF metering), £40. Olympus winder – 1 (single frame), £30. Olympus fit Vivitar auto tubes (focus to 2in), £20. Tamron 35-70mm zoom lens (close focus), £75. Tamron 90mm F2.5 macro lens, £125. Tamron 2X converter (doubles lens power), £28. Pen-EE auto/half frame compact camera, £25. Pen-EES auto/half frame (both give up to 72 shots), £30. Fujica ST801 (SLR) first with LEDs only (M42), £50. Pentax 35mm F2.3 lens, semi-auto (mount loose), £15. Dric MCP40, 4 colour printer/plotter (centronics), £45.Shinwa CP-80 printer (fully Epson compatible), £125. Advance Gould Alpha 4 digital multimeter (bench mod), £70. Taylor 132 analogue multimeter, £15. Will swap, WHY? Best offers only. 7 Drumcliff Road, Thurnby Lodge, Leicester LE5 2LH

■ Advance type T2 Q meter, £25. Heathkit transistor tester model IT21, £15. GEC mini scope, 1 inch tube, £25. Roband 13.8V 5 amp pwr supply, £12. Advance OS2000 oscilloscope, £80. Icom IC21 transceiver, £80. Clarke G8CZH, QTHR. Tel: (01) 859 1852

■ 2m FM Blazetone transceiver, 1W plus 15W, £70 ono. Tel: (0844) 237131, Bucks/Oxon

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■ Newnes colour TV servicing manual, Vol two, by Gordon King, practically mint condition, £8. Post paid. Jenkins, 12 Upper Market Street, Haverford West, South Wales SA61 1QA

■ Racal RA17L and manual, £150 or swap 2m transceiver. Creed 75 teleprinter and isolation transformer, £15. Redifon terminal unit to suit, £10. Extel dot matrix 40 column 5 level baudot code printer, 80 volt or RS232 input, £50. Hewlett Packard oscilloscope, model 150A, older valve type, dual trace, believed to be 50MHz bandwidth. Fault in X-timebase giving reduced scan, hence £25. Buyers collect above items. Mr Levers, 'Waverley', Independent Hill, Alfreton, Derbyshire DE5 7DG

■ Final clearance. I still have about a car boot full of stuff left from my August advert. This would be ideal starter pack for a new enthusiast as it contains all types of components, equipment, spares, etc. Value about £300, but I will accept £49 provided it goes as one job lot. Delivery anywhere in UK arranged for. Bargain of a lifetime. K Bailey, 40 Seymour Close, Selly Park, Birmingham B29 7JD. Tel: (021) 472 3688

■ Yaesu FRG965 (Japanese home market FRG9600) communication Rx, 60 to 905MHz, AM/FM/SSB, CW PSU, £300 ono. G Dawson G8PYC. Tel: (0844) 215857

■ Large quantity boxed communication valves, transmitting and receiving, some rare, ie DA100, CV187, CV2224, RCA931A, QC43, S11E12, QQV03-20A etc. SAE with your requirements, all half list price. Tel: (0202) 680500 or (0202) 622051

■ Trio 9130 2m multimode, ex cond, original packing, less than 10 hours Tx, never used mobile, £460 ono. James G1OOB. Tel: Street (0458) 42200, evenings after 6pm

■ Computer bits, Colecovision games computer, 23 cartridges, Pole Position module, Atari module, boxed, mint condition, £150 ono. Vectrex games computer, 3 cartridges, boxed, mint condition, £250 ono. Tandy TRS80 Model 1, plus VDU, 16K RAM, level 1/2, offers. ZX81 16K plus Memotech assembler, hi-res graphics, RS232 interface, some games, £50 ono. Will swap any of above for mint Jumbo 2/3 untampered, BRL500 or WHY? Tel: Mike (working days) (01) 831 0648

■ BBC micro parts. Serial ULA unused, £8. Prism, Micronet, Prestel, etc modem and lots of software etc, £25. Computer Concepts speech ROM system, £15. Inter-chart, £16. Solidisc Linemaster comms

ROM, £6. Disc drive, Shugart DS 40TRK with leads, £50. View printer driver for Epson and Uchida, £5. Tandon TM100/2 drive PCB, £5. CDC drive PCB, £2.50. T2D ROM system, £7. D J Graham, 10 Leadhall Road, Harrogate, N Yorks. Tel: (0423) 872045

■ Telephone, works OK, £6. Dual disc drive cabinet for full heights, black, £10. Nascom FDP1 disc power supply with transformer, £8. Adman byte drive, 5 and 12 volt pwr supply, but no transformer, £3.50. 2K and 4K Eproms, £1. D J Graham, 10 Leadhall Road, Harrogate, North Yorks. Tel: (0423) 872045

■ Have 2 sets of infra-red photo cell links. Separate emitter and receiver heads. Control module with various time delays. Make good intruder alarm. Brand new, cost £200, sell £60, post paid. Would swap for Tandy PRO22 hand scanner. Tel: (0207) 544342, eves, w/ends

■ TS520 HF 100W transceiver, internal 120/240V and 12 volt dc power supply. This truly universal rig is in excellent condition, boxed, manual, leads, £345 ono, or part exchange for recent solid-state HF rig and power supply (cash adjustment). Roy G0BZT. Tel: Sedgley (09073) 78792

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WANTED

■ New disabled callsign has ICE68OR Super Tester analogue meter, boxed, as new. Also Advance signal generator, 150kHz – 220MHz, SG62B with manual. Exchange for any 2m equipment in good working order. Mr N Porter, 23 Calder Court, Britannia Road, Surbiton, Surrey KT5 8TS. Tel: (01) 390 2650

■ Antenna rotator for 2m beam, about £30.00. Also Heathkit RA1, VHF SWR meter, and 70cm Slim Jim. Steve Kelly, 137 Brookhurst Avenue, Bromborough. Tel: (051) 334 4301

■ VHF, UHF xtal scanner, eg Realistic PRO53 or similar, for about £25. Also pair 49MHz walkie-talkies. Also marine VHF, possible PMR converted. 8 St Martins Crescent, South Heighton, Newhaven, Sussex BN9 0PH. Tel: Newhaven (0273) 516801

■ Software or EPROM for MPS803 CBM printer, to give true descenders for Ys, Fs, Gs, etc. Write to WE Scott, 33 Winchester Drive, High Farm, Washingborough, Lincoln LN4 1DJ with details

■ Macdonald 81-82 *Radio and Television Servicing*, will pay £40. Tel: Ray (0272) 568764

■ TS120, TS130, TS180, FT101ZD or TS520 for operator going o/seas. Also PSU for TS120/180. Write stating price and condition. David c/o Davis, 1 Milovaig Avenue, Glasgow G23 5HY

■ 13.8V heavy duty 30 amp (approx) PSU, regulated or WHY and solid-state HF rig, recent model with digital frequency readout. Can collect. Contact Roy G0BZT. Tel: Sedgley (09073) 78792

■ Top Audioline car stereo, electronic, a/reverse, metal, Dolby, seek, 18 station memory, 20+20 wpc, scan, clock etc, with remote control, unused. Cost £237, would exchange for 2m multimode or part exchange with cash for multimode TR9130 etc, WHY? Tom. Tel: Truro 572547

■ FT101, FT101ZD Tx/Rx, BE model. New valves: 572B, 6146B, 6J56C. Richard. Tel: (0787) 280259

■ Service information, circuit, manual, any help with the following: AVO valve tester CT160 and Tektronix oscilloscope, type 545A. Will buy, or borrow to copy, and return promptly. Please help, expenses reimbursed. Lawrence, 13 St Aubyn Estate, Praze An Beeble, Cornwall TR14 0LE

■ Band 1 VHF transistor mechanical tuner, not varicap, for TV DX. Four tuned sections if possible, combined VHF/UHF, push button acceptable, but VHF only preferred. Mr H Clark, 6 Pentney Road, Balham, London SW12 0NX. Tel: (01) 675 1708

■ I need two multipole sockets as used to connect FDK multi 750XX to 430 expander. Non running model FDK750 or 725 or expander units. Would consider buying. Also need a PRO22 Tandy 6ch scanner. All letters answered. John GJ8RRP, No 2 Thornley, Bagatelle Road, St Saviour, Jersey, CI

■ Stolle 2010 (control unit), automatic, five core cable model. Had two red direction lights at top centre. Would consider complete rotator set-up as long as it is feed-through and not offset type. No personal transport but would pay for postage etc or delivery. Tel: (01) 505 6303 or write Mike Evans, 120 Loughton Way, Buckhurst Hill, Essex IG9 6AR

■ Exchange ST5MC RTTY terminal unit and Pye PF2UB with charger batteries, mike, 3 crystals and Sinclair 48K Spectrum with leads for SX200N scanner or Revco RS2000E scanner. Clive Powis, 28 Kington Gardens, Chelmsley Wood, Birmingham B37 5HS. Tel: (021) 788 8447

■ 2m Rx/Tx, anything considered. Must be fairly cheap. Please write with details to S Mohan, 75 Pennine Road, Glossop, Derbyshire SK13 9UL

■ Pye Pocketphones type PF1 Rx, I will pay £4.00 each. Also a BC5 charger for PF1 Pocketphones. Please write to M Stevens, 6 Cavendish Rd, Henleaze, Bristol, Avon BS9 4DZ with an SAE

■ Motorola Thyristor M752 or substitute for ignition timer strobe light. Amtest model TL0IA Kalamazoo, Michigan. A Haddy, 33 Bolton Lane, Bradford BD2 1DR

■ Datong DF1 direction finding system. Please send details and price to T Ashworth, 2 St Peters Hill, Stamford, Lincs PE9 2PE

■ Lynx data, software, disc interface and other bits considered, but must be cheap! Atari 520 wanted, also details of how to connect a disc drive to Atari 520, partic an 80 TRK 3½ or 5¼. Used on a BBC up to now. Anybody used a Lynx as a BBC 2nd processor? DJ Graham, 10 Leadhall Road, Harrogate, N Yorks. Tel: Harrogate (0423) 872045

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The communications and electronics magazine

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

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Radio & Electronics World

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263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

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Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
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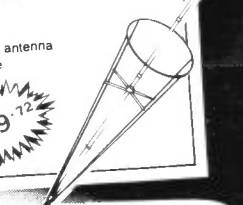

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BY134 ..... 10p
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BY179 ..... 40p
BY184 ..... 25p
BY187 ..... 10p
BY190 ..... 40p
BY196 ..... 30p
BY198 ..... 10p
BY204/4 ..... 8p
BY206 ..... 8p
BY208/800 ..... 8p
BY210/400 ..... 5p
BY210/800 ..... 10p
BY223 ..... 60p
BY224/600 4 8A/ 600v bridge £1.00
BY226 ..... 15p
BY227 ..... 15p
BY228 ..... 20p
BY229/400 ..... 30p
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BY255 ..... 30p
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BY299 ..... 10p
BY406 ..... 8p
BY527 ..... 20p
BY407a 10p
G11 470M/250V SP £1.00ea
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R2257 ..... 60p
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R2305 ..... 50p
R2306 ..... 50p
R2322/2323 ..... pair 80p
R2323 ..... 15p
R2396 ..... 50p
R2461 ..... 80p
R2030 ..... 50p
R2443=BD124 ..... 40p
R2737 ..... 40p
R2738=TIP41 ..... 30p
R2775=TIP41c 40p
R3129=TIP47 ..... 40p
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BU 126 ..... 80p
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BU 204 ..... 70p
BU 205 ..... £1.00
BU 206 ..... £1.00
BU 207 ..... £1.00
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BU 208 on heat sink 70p
BU 208A £1.10
BU 208D 90p
BU 222 ..... £1.00
BU 326 ..... £1.00
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BU 409 ..... 60p
BU 426V 60p
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BU 508A £1.20
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BUW 84 ..... 30p
BUY 71 ..... £1.00
TIC 106A 30p
TIC 116m 40p
TIC 116n/Y 1003 ..... 35p
TIC 126N 40p
TIC 206m 30p
TIC 225S 40p
TIC 226E 40p
TIC 226m 30p
TIC 236m 30p
TICV 106D (T092 case 2A/400V) 10p
TIP 29 ..... 20p
TIP 30 ..... 35p
TIP 30A 35p
TIP 30B 40p
TIP 30C 45p
TIP 31 ..... 30p
TIP 32 ..... 25p
TIP 33B 50p
TIP 33C 70p
TIP 34A 50p
TIP 34B 60p
TIP 34C 70p
TIP 35B 50p
TIP 35C 70p
TIP 35D 80p
TIP 36 ..... 50p
TIP 36C 70p
TIP 41B 40p
TIP 41D 70p
TIP 42/BRC 6109 ..... 30p
TIP 48 ..... 40p
TIP 49 ..... 30p
TIP 57 ..... 30p
TIP 100 ..... 30p
TIP 102 ..... 30p
TIP 112 ..... 30p
TIP 115 ..... 50p
TIP 117 ..... 50p
TIP 120 ..... 35p
TIP 125 ..... 35p
TIP 130 ..... 30p
TIP 131 ..... 25p
TIP 136 ..... 30p
TIP 140 ..... 50p
TIP 640 ..... 50p
TIP 2955 ..... 35p
T 6032 ..... 30p
T 6036 ..... 40p
T 6040 ..... 40p
T 6047 ..... 40p
T 6049 ..... 40p
T 6051 ..... 40p
T 6052 ..... 40p
T 9004 ..... 40p
T 9005 ..... 40p
ZTX 102c 10p
ZTX 107 ..... 10p
ZTX 108c 10p
ZTX 109k 5p
ZYX 213 ..... 5p
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ZTX 342 ..... 10p
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ZTX 451 ..... 10p
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BD 534 ..... 30p
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BD 595 ..... 30p
BD 610 ..... 30p
BD 646 ..... 30p
BD 676 ..... 30p
BD 678 ..... 30p
BD 681 ..... 30p

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-5V/LM79MO5CP 25p
-8V/79M08c 30p
+6V/78M06c 30p
+10v/78LA10 ..... 20p
LM 337 ..... 30p
LM 342/18 ..... 30p
LM 340T 5.0 ..... 50p
+12V/LM 340T12 ..... 50p
+15V/78M15 ..... 15p
+18V/MC78M18 ..... 20p
+24V/78M24 ..... 30p
MC 7724cp 40p
MC 7824 ..... 40p
TIS 90 ..... 10p
TIS 91 ..... 20p
TIS 92 ..... 20p
TIS 93 ..... 20p
U 19885 ..... 40p
U 3832 ..... 15p
U 3845 ..... 15p
MR 508 ..... 10p
MR 501 ..... 10p
MR 502 ..... 10p
BCW 71R 30p
BYF 1202 ..... 10p
BYF 1204 ..... 10p
BYF 3126 ..... 40p
BYF 3214 ..... 40p
BYX 10 ..... 6p
BYX 36/600 ..... 35p
BYX 38/300 ..... 25p
BYX 49/600R 75p
BYX 55/350 ..... 10p
BYX 55/6000 (Bead) 10p
BYX 71/350 ..... 20p
BYX 71/600 ..... 50p
BYX 72/300 ..... 20p
BYX 33/600 ..... 50p
BYV 95B 10p
BVY 95C 12p
BYZ 106 ..... 10p
BPW 41 ..... 15p
BYW 562/A1000v G11 ..... 8p
BZU 15/24 ..... 54p
BZY 93c75 ..... 50p
BZV 15/18 ..... 30p
BZV 15/30 ..... 30p
BZW 70c6v2 ..... 10p
BZX 79.3v 10p
BC414 ..... 10p
BC416 ..... 10p
BC440 ..... 30p
BC454 ..... 10p
BC455 ..... 10p
BC456 ..... 10p
BC460 ..... 25p
BC462 ..... 10p
BC463 ..... 10p
BC478 ..... 10p
BC527 ..... 10p
BC532 ..... 10p
BC546 ..... 10p
BC547 ..... 10p
BC548 ..... 10p
BC556 ..... 10p
BC557 ..... 10p
BC558 ..... 10p
BC559 ..... 10p
BC635 ..... 10p
BCX31 ..... 25p
BCX32/36 pair 75p
BCX32 ..... 25p
BD116 ..... 25p
BD124 ..... 50p
BD124 (metal) 60p
BD130Y 25p
BD131 ..... 30p
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BD138 ..... 30p
BD176 ..... 25p
BD182 ..... £1.00
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BD202 ..... 60p
BD204 ..... 60p
BD221 ..... 20p
BD222 ..... 30p
BD228 ..... 30p
BD226 ..... 20p
BD233 ..... 30p
BD235 ..... 30p
BD239 ..... 15p
BD243c 30p
BD244 ..... 50p
BD250a 40p
BD252 ..... 20p
BD253B 50p
BD331 ..... 20p
BD332 ..... 20p
BD373b 20p
BD416 ..... 25p
BD433 ..... 25p
BD437 ..... 25p
BD439 ..... 50p
BD501 ..... 30p
BF761 ..... 30p
BF858 ..... 30p
BF871 ..... 30p
BFR39 ..... 15p
BFR52 ..... 7p
BFR79 ..... 15p
BFR81 ..... 15p
BFR87 ..... 10p
BFS60 ..... 10p
BFT42 ..... 20p
BF694 ..... 10p
BF758 ..... 30p
BF760 ..... 30p
BFT34 ..... 15p
BFT43 ..... 10p
BFT84 ..... 8p
BFW11 ..... 20p
BFX29 ..... 30p
BFX84 ..... 25p
BFY50 ..... 15p
BFY52 ..... 20p
BFY90 ..... 25p
BLY49 ..... 25p
BPW41 ..... 25p
BRC116 ..... 25p
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8C107 ..... 10p
8C108 ..... 10p
8C109 ..... 5p
8C113 ..... 10p
8C114 ..... 10p
8C115 ..... 10p
8C116 ..... 10p
8C117 ..... 20p
8C119 ..... 20p
8C125 ..... 10p
8C126 ..... 10p
8C139 ..... 10p
8C140 ..... 30p
8C141 ..... 25p
8C143 ..... 25p
8C147 ..... 10p
8C148 ..... 10p
8C149 ..... 10p
8C153 ..... 10p
8C154 ..... 10p
8C157a 10p
8C158 ..... 10p
8C159 ..... 10p
8C160/16 ..... 25p
8C171 ..... 10p
8C172 ..... 10p
8C173 ..... 10p
8C174 ..... 10p
8C183 ..... 10p
8C184 ..... 10p
8C204 ..... 10p
8C207 ..... 10p
8C212 ..... 10p
8C213 ..... 10p
8C214 ..... 10p
8C237 ..... 10p
8C238 ..... 8p
8C239 ..... 10p
8C250 ..... 8p
8C251 ..... 10p
8C252 ..... 10p
8C262 ..... 10p
8C263b 20p
8C294 ..... 30p
8C298 ..... 10p
8C300 ..... 30p
8C301 ..... 30p
8C303 ..... 30p
8C307 ..... 7p
8C308 ..... 7p
8C309 ..... 10p
8C327 ..... 10p
8C328 ..... 10p
8C328/338 pair 15p
8C337 ..... 10p
8C338 ..... 10p
8C347 ..... 10p
8C349b 10p
8C350 ..... 20p
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AC153K 15p
AC142K 15p
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BD610 ..... 40p
BD646 ..... 50p
BD676A 30p
BD678 ..... 50p
BD681 ..... 25p
BD807 ..... 20p
BD826 ..... 50p
BD948 ..... 30p
BDX75 ..... 20p
BDX32 ..... £1.25
BF115 ..... 20p
BF121 ..... 20p
BF127 ..... 20p
BF137 ..... 20p
BF157 ..... 20p
BF160 ..... 20p
BF161 ..... 20p
BF164 ..... 60p
BF179 ..... 30p
dF180 ..... 20p
BF181 ..... 20p
BF182 ..... 20p
BF184 ..... 20p
BF194 ..... 10p
BF195 ..... 10p
BF196 ..... 10p
BF197 ..... 12p
BF198 ..... 10p
BF199 ..... 10p
BF200 ..... 20p
BF222 ..... 10p
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