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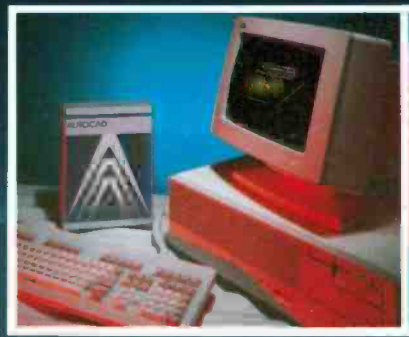

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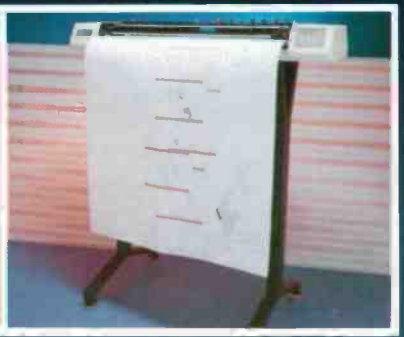

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COVER: Photograph by Peter Beattie.
Kitchen oven courtesy of Omega Appliances, Redfern, Sydney.

THE AGONY & THE ECSTACY

DASH™ **The Schematic Design and Documentation System that saves valuable time for busy engineers**
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The Engineer's Dilemma

Too many engineers remain slaves to time. They still labour countless hours to produce schematic designs the old fashioned way, using pencil, rubber, ruler and template. Many more hours are spent developing Net Lists, Lists of Materials, Design Check Reports and other essential documents. In short, they're overworked and slaves to time. And its not getting any better with circuits becoming larger and more complex. There must be a better way.

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At first, the large Computer Aided Design (CAD) system appeared the answer. But these, althougn powerful, are very expensive, complicated and difficult to learn. The $50,000 standalone CAE workstation isn't the answer either – by the time the engineer gets access he's probably forgotten the complex commands.

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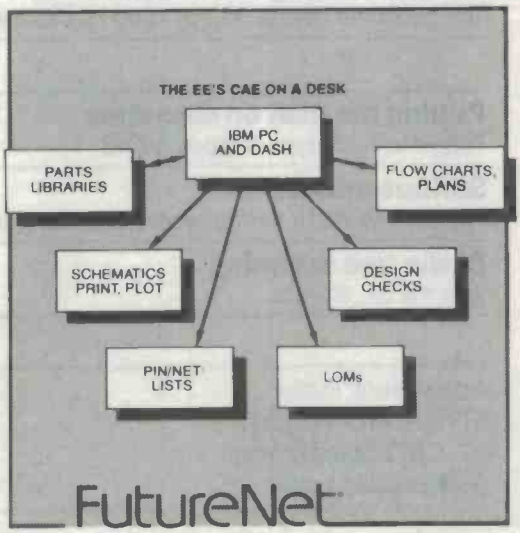

in a fraction of the time it used to take. And that's not all. Since DASH automatically captures design data, key documents such as Net Lists, Lists of Materials, and Design Check Reports can be printed at will using DASH post-processors.

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GTs sound hot on the highway too, with high-note clarity that overcomes sound-deadened car interiors. And clever concave "A" and convex "B" side markings and different left/right feel allow quick side selection by touch – without taking your eyes off the road.

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As communications systems evolve at an amazing rate, STC maintains its status at the leading edge. Today, the many STC products and services, all designed within the last two years, continue to speed and simplify the ways in which people and businesses communicate. STC. The first Australian company into space.

The only Australian company into space. Proudly part of the AUSSAT Programme.

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After all I've spent a small fortune on my car sound system, and the people I'm listening to have spent a small fortune in a recording studio. So the least I can do is listen to their stuff on tape with the kind of quality I reckon will do them justice.

I mean anything that makes me sound good has to be terrific.

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SON0001

Test your component IQ

For some companies and their products, today's market is very "testing" indeed. Firstly because more and more products are incorporating electronics for improved performance and reliability, so they fit a market hole precisely.

Secondly, the scope and range of functions they perform are leap-frogging each year with the introduction of intelligent features, via micro-processor based components.

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Philips Elcoma (Electronic Components and Materials) encompasses some 200,000 different products to help you extend your products' IQ and improve sales. From micro-processors that can be built into computer assisted appliances – to a switch for a typewriter keyboard. From tiny resistors to integrated circuits of high complexity, or giant megawatt klystrons.

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Seeing in the dark

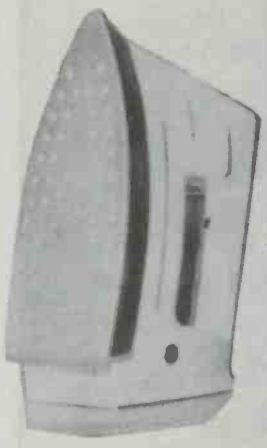
Scientists at the University of NSW (UNSW) have developed a microelectronic sensor chip which can create television images in total darkness by imaging objects in their own heat radiation.

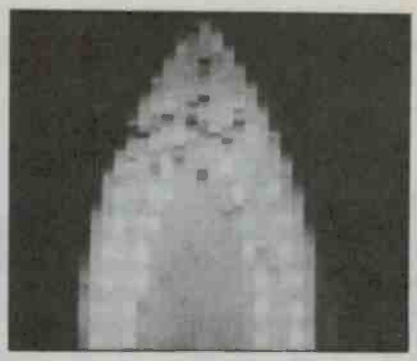
The ultimate aim of the project is to produce an inexpensive, portable, infrared TV camera. "Such a device has enormous implications for industry, mining, astronomy and medicine. However, it is in astronomy, remote sensing and defence that the most immediate and revolutionary applications are to be found," according to one of the team leaders, Dr John Storey, of the University's School of Physics.

Known as an Infrared Schottky Charge Coupled Device, the sensor chip contains more than 2000 separate pixels, or picture elements. Each pixel incorporates an ultra-thin layer of palladium, which converts the infrared radiation into an electronic charge.

The sensor chips are fabricated in the extensive facilities of the Joint Microelectronics Research Centre (JMRC) on the UNSW campus. After testing and packaging, the devices are taken to the School of Physics where they are cooled to −200°C to prevent the weak infrared signal being swamped by thermal noise in the detector itself. An image of the particular object of interest is then formed, using a special calcium fluoride and sapphire optical system which can focus the infrared rays. The image is then processed by a small computer before being presented on the TV screen.

Not only can images be taken in total darkness, but by examination of the 'thermal signature' or temperature profile of a scene, information is revealed which is completely hidden at normal visible wavelengths. Dr Storey says that in medicine, for example, thermal images of a human body can reveal abnormalities in the heat distribution and blood circulation, thus pointing the way towards diagnosis of an underlying malady. In industry too, the ability to assess instantly the heat loss of an entire machine or facility is invaluable.





Thermal image of a steam iron. The image shows the distribution of infrared radiation at a wavelength of 1.6 microns, roughly three times the wavelength of ordinary visible light. Although the steam holes are not hotter than the surrounding aluminium baseplate, they appear brighter because they are 'blacker' than the shiny baseplate.

The development is the latest product of a four-year research program conducted jointly in the School of Physics and JMRC, by a team consisting of Associate Professor M. A. Green, Mr J. M. Kurianski, Mr E. Ollier, Dr J. W. V. Storey, Dr S. T. Shanahan, Dr U. Theden and Mr M. R. Willison. Funding for the project has come from the Australian Research Grants Scheme and a wide variety of potential users of the sensor, in particular the Anglo-Australian Observatory, CSIRO Division of Mineral Physics, and the Defence Research Centre, Salisbury.

SERVICES

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CONTRIBUTIONS: Submissions must be accompanied by a stamped, self-addressed envelope. The publisher accepts no responsibility for unsolicited material.

Funds for NASA

The US Space Foundation has outlined plans for fund raising activities related to construction of a replacement orbiter for the Challenger.

The foundation is a private, non-profit, educational organisation established to stimulate international dialogue on the beneficial uses of space and to integrate space education materials into the curriculum of schools at all levels.

The foundation has established the Challenger 7 Fund which already has received significant contributions and has marshalled the support of a number of individuals and organisations. The foundation ultimately plans to donate the contributions to NASA for its use in financing a replacement orbiter should the US Congress authorise a replacement.

OVER THE COUNTER

All Electronic Components is a maze of fascinating electronic parts ranging from the latest state of the art and printed circuit boards, to old radio valves, 20 year old projects and copies of *Radio, TV and Hobbies* from the 50s.

The company is run by father and son team, Neville and Andrew Frolley, both keen fishermen and kit-set constructors.

According to Neville, they carry an extremely wide range of kit sets and components, many of which are not available from 'cash 'n' carry' type stores. Neville says proudly that the store in Lonsdale St, Melbourne has "Australia's largest range of kit-sets and components, and is one of Melbourne's oldest and most respected electronics companies.

The Frolleys pride themselves on both their counter service and their stock. All their staff are trained people who understand customer needs. "All our parts are top quality, recognised brands and are covered by manufacturers' warranties. We do not stock cheap imitation or hobby grade components as they have high failure rates," Neville explains.

"Our customers are mainly electronic connoisseurs, industrial people or experienced hobbyists and they appreciate the quality and range of our components and our kit-sets."

The company accepts mail orders from all parts of Australia and often from overseas. Policy is to keep a wide range of stock under the one roof instead of spreading out into the fast food, serve yourself type chain stores. If we don't stock an item, we can usually quote. We believe in old-fashioned, help-the-customer service. AEC is genuinely prepared to help the confused customer," says Neville.

Before entering the wholesale/retail side of the electronics industry with All Electronic Components, Neville had 32 years experience in the electronics industry with servicing, designing, quality control, inspection and service-managing in radio, TV, industrial electronics and instrumentation.

Andrew Frolley, tongue firmly in cheek, likes to describe himself as the "typical boss' son — long lunches, late starts, appearances only on pay day, four-wheel-drive addict and fishing fanatic," — but he built his first kit when he was seven years old.

Andrew says he is continually trying to convince the staff they should have a fishing-tackle section, but when he takes you on a tour behind the counter, you know that he is an expert in all the components that are hidden away.

An ex-Melbourne and Queensland University student and rugby player, Andrew is a keen kit-man (almost as keen on kits as he is on Murray cod) and he is as proud of the company as his father.

"While kits are just a side line for other companies who discount them and allow the parts and the quality to deteriorate, they are of prime importance to us," Andrew says with confidence.

POSTSCRIPT:

Tantamount to their component knowledge, All Electronic Components has recently been appointed sole Victorian distributors for Jemal Products, and National Panasonic components. Andrew is currently 'on the road' representing the company in this field.

A company to push Australian ideas

A new company to develop and market Australian products has been set up by McPherson's Ltd, (best known for its engineering and steel distribution activities) and the Australian Industry Development Corporation.

The new company, Engineering Innovations Ltd, will concentrate initially on industrial products, although it will also assess prospects for selling technical products into consumer markets.

The company plans to work with CSIRO, university and government research laboratories as well as with private inventors.

Presently, Engineering Innovation Limited is examining products from a wide range of industries and markets although some, like the electronics business, are by nature more receptive to ideas and change. "But this also presents problems," says Robert Zahara, Managing Director. "New products in the electronic field are very difficult to patent and can be superseded before manufacture has commenced.

"One of our main aims is to become involved in products not facing up front competitive market positions."

Engineering Innovation Limited expects that products which will be of most interest will come from sole inventors or small private companies that have been born from an actual need rather than from generalised scientific research.

"We have a strong preference for being involved with the products at a very early state — at prototype or even earlier — and beginning funding at that stage. And that means being fully involved both with product development and marketing development."

The company hopes to take on products on a licence agreement with the inventor whereby the inventor gets a royalty based on percentage of sales "while we fund development of manufacturing, marketing and selling of the actual article".

Mr Zahara is under no illusions when it comes to marketing Australian inventions overseas, but says "With any new product our aim would be to attempt first to achieve success in the USA."

For further information contact **Robert Zahara, Engineering Innovation Limited on (03)699-3588.**

BRIEFS

Electronic component quality scheme

Electronic component distributors in Australia are to be offered a financial incentive to become part of an international quality assessment scheme run by the International Electrotechnical Commission. (The Commission's assessment scheme is the only world-wide certification scheme of its type.) Funding will be provided by the Commonwealth government, Telecom, and the Australian Electronics Industries Association.

Intel micro drives Nissan cars

Intel recently unveiled a 16-bit microcontroller, the MCS-96 featuring 12.5µs average instruction times. The chip will be used in conjunction with an 8-bit Nissan microprocessor to control functions such as fuel injection, ignition timing, a twin variable nozzle turbo charger, valve timing and four speed automatic transmission in Nissan vehicles from the 1990s.

NOTES & ERRATA

Project 4102, Digital sampler, May '86: Resistors mentioned in the Parts List as 5% should be 2% and those marked as 2% should be 5%. The standby power supply VA mentioned at the end of the How It Works should be in house style reading V_{GG} as in the circuit diagram. On the wiring diagram, the trigger switch is labelled incorrectly: terminal lettering F should read J and vice versa.

Courtesy STC.

COMPUTER AIDED DESIGN

Jon Fairall

Computer aided design is one of the most talked about facets of modern computing. The beauty of its images has a fascination that goes beyond the merely utilitarian. Meanwhile its potential to change the manufacturing process has made it the centre piece of technical change.

CAD HAS ALSO been notoriously slow to take off in Australia. While other uses of computers have expanded by leaps and bounds, CAD makers are still trying to shift product out of the factory door.

Drafting

Firstly, what is CAD? Because of the way in which the market has developed, it's possible to make a fundamental distinction between drafting machines and design machines, both of which go by the name of CAD. A drafting machine is essentially something that uses a computer to replace the pen and ruler of the conventional draftsman.

Drafting machines are all pretty much of a muchness, offering a rather circumscribed list of features. Their importance in the market-place is due almost entirely to powerful small computers like the IBM-PC, which have made it possible to generate reasonably sophisticated graphics at a price just about anyone can afford.

So packages for drawing circuit diagrams abound in which the various components of a circuit can be called up from a library of symbols and displayed on the screen. Then some simple graphics functions allow the operator to join the symbols together with straight lines.

Another part of the package allows the operator to lay out the pc board. Usually

PROTEL PCB

Protel-PCB is typical of many of the low end CAD systems now appearing on the market. Designed by Hobart based HST Industries, it allows the user to draw the artwork for a pcb on the screen, essentially replacing the draftsman and his tools. Its power lies in the various labour saving devices stored in software.

For instance, to lay down a DIP package, it is necessary to position only pin 1, and specify the direction in which the package is to lie. It's possible to repeat tracks so that you can lay down many parallel tracks very quickly. Even more advanced, the user can define a block on the board which can be repeated at will in other portions of the board. It also features rubberbanding, in which it's possible to move a component after all the tracks have been laid down to it.

From the pcb master, Protel can generate other drawings. For instance it can give you a solder mask, a pad master and a component overlay.

It supports both a plotter and a mouse, and sells for under $1000.

AUSTCAD

Austcad's new Basicad program has been sold to both the Cessna Aircraft Corporation and the huge US defence contractor General Dynamics, and is the first in a series of complementary software programs being developed by the company.

Basicad is currently under evaluation by several other international groups including Motorola, Goodyear, the Hong Kong Housing Authority, UK construction group Condor Technology, German civil engineers UHDE GMβ-H, and NZ whitegoods company Fischer & Paykell.

Established only five years ago, Austcad now operates what it claims is the largest CAD bureau in the world, specialising in servicing the Cadam system. Cadam was developed by the Lockheed Corporation now Cadam Inc. Austcad's Basicad has been designed as an end-user interface for Cadam.

Since the system's debut sale to Cessna, Cadam Inc. has signed a sole distribution agreement with Austcad for international distribution throughout manufacturing, architecture, engineering, mechanical and electrical concerns, and government and public utilities among other sectors.

Based on the early acceptance of the system, Austcad is predicting that Basicad will generate revenue of over $5 million within the next five years, at a unit cost of $12,000.

HP EGS

Hewlett-Packard is one of the larger companies to make a considerable investment in CAD tools. It manufactures an impressive range of 2D and 3D systems ranging in price from $45,000 through to $390,000. They are combined hardware-software packages for the most part based around the Motorola 16/32-bit processor running at 12.5MHz with vast amounts of memory (minimum 2M) on the side.

Its 2D package called EGS features three 'personalities' for electrical, mechanical and general drawing. Its electronic drawing package features the full range of CAD options, from data capture of the schematic through to layout of the board. It has a library which contains 50 commonly used circuit components plus provision for the user's own additions.

It has no auto routing ability, but it does do rat's nests, which allow for manual routing and optimum chip placement.

It has a full documentation package with it, so parts lists, drawing references and so on can be generated easily and quickly. It even has the ability to interface with Techwriter, the HP word processing package.

To a greater degree than most, HP has encouraged third party contractors to supply interfacing programs for its CAD systems. One such is called Esprit, distributed by JB Davies Computer Systems, which is claimed to be able to generate proper numerical control code to control the manufacture of a party by any machine tool.

There is also a program by DP Technology called Microcad II that will turn Esprit into a fully blown CAD system. It also has the ability to use Esprit to do test runs on the NC information in order to check the CAD output for errors.

a library of features such as pads, tracks and dip patterns is included. These are called up and placed on the screen in the desired position. Subsequently, artwork can be generated from a plotter ready to be used to generate artwork for making the board. A typical package is the Protel PCB package (see box) which sells for under $1000.

Design

On the other hand, a design system uses the power of the computer to transpose non-visual inputs into visual terms (given the appropriate models) and also to generate non-visual outputs from a screen presentation. It allows the designer to play 'what if' games with the machine, to expand this line, change that resistor.

Design systems form a far more diverse group than drafting machines. Since they are purpose built for the job in hand, the software is far less limited by the hardware, and there tends to be a linear relationship between the features offered and the price demanded.

Important points to look for in modern design machines are the extent to which the machine can be integrated into the entire manufacturing process, the presence or absence of three dimensional and solids modelling abilities, and the ability to perform extensive mathematical modelling before or after the screen display.

A good design system dedicated to electronics will probably have a software library of components, transistors, resistors, IC packages and so on. The correct symbols and pin numbers will be generated automatically on the screen, and the machine may even have sufficient power to detect certain types of simple errors, like two inputs connected together, or illegal fan out. The extent of this 'design rule' checking is very much a measure of the sophistication of the hardware.

Simulation

On sophisticated machines, it's possible to simulate the performance of the circuit. You specify inputs, the machine will demonstrate the outputs (see Figure 1). The simplest simulators will calculate simple logic level changes. More complex machines will actually take account of propagation delays, known component tolerances and so on.

This facility is obviously fantastically useful, effectively doing away with much of the necessity for prototyping, especially in digital boards.

However, there are large problems with simulation. It is clearly a tremendously expensive procedure in terms of computer time. The mathematics necessary to generate a simple counter as we have done in Figure 1 is phenomenal, and grows with the complexity of both the circuit and the individual chips under test.

But there are some tricks that allow simulation of otherwise overwhelmingly complex circuits in a reasonable space of time. Small chunks of the circuit can be modelled separately, then stored as separate circuit elements complete with a pattern of inputs and outputs. This can save a considerable amount of computer time when running a simulation of the complete board.

Another clever idea is to use a real chip. This is a valuable procedure when the circuit contains an integrated circuit too complex for easy modelling, like a central processing unit. In this procedure, the chip is actually driven by the software. Its output is then fed back into the software where it is ▶

COMPUTER GRAPHICS FOR MANUFACTURERS

Ausgraph 86, the fourth Australasian conference and exhibition on computer graphics, is holding a special industry stream for those involved in the design and manufacture of a wide range of products.

The 'design and manufacture' program is aimed at engineers and designers in mechanical, electrical or electronic disciplines, and covers all aspects of computer-aided engineering.

The conference, which is being held in Sydney at the Hilton Hotel July 7 to 11, is organised by the Australasian Computer Graphics Association, an organisation of both users and vendors of all types of computer graphics equipment.

A trade exhibition at the Sydney Town Hall is being held in conjunction with the conference, and will feature equipment and services from all the major vendors of computer graphics equipment.

Chairman for the design and manufacture program is Frank Mullen, Managing Director of the Centre for Industrial Technology (CIT) at the New South Wales Institute of Technology. CIT was set up with the support of government and industry to assist in the transfer of advanced manufacturing technology into Australian industry.

Keynote speaker for the design and manufacture stream will be Joel Orr, one of the world's leading authorities in the field of CAD/CAM, who specialises in industrial automation.

Other speakers include Hulas King, from McDonnell Douglas Corp, USA, and Daniel Raker from Design and Systems Research, USA.

Companies exhibiting include IBM, Tektronix, Intergraph, Easinet, McDonnel Douglas Automation and Auto-trol Technology.

The exhibition will take up both the upper and lower floors of the Sydney Town Hall, and represents the largest specialist exhibition of computer graphics equipment ever staged in Australia.

For further information about Ausgraph 86, contact Robyn Hughes on (02)929-5855.

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ETI READER SERVICE 5

"With my HP CAD sail a boat that

Ask Ben Lexcen what his most valuable design tool is and he'll tell you it's his Hewlett-Packard Computer Aided Design system. Here he talks about his experience with the HP system and offers some salient advice to the new generation of designers who will follow in his wake.

Have you always felt at ease working with computers?

"No way! Really I was a latecomer to computers because I didn't have any formal training and I was frightened of them. In fact, I used to dream up some wonderful excuses to avoid getting involved with them.

"But, of course, I realise now that if you're going to be a leader in any field, not just design, you've got to utilise the leading technology. And really this HP stuff is so easy to use, I'm not sure what I was frightened of."

Which parts of a boat do you design with the help of the computer?

"Virtually the whole lot, with the exception of tiny mechanical things. But we use it to design the shape and structure of the boat, and the sails.

"We use it to do all the hydro-dynamic considerations such as the total drag of the hull unit. Plus we use the computer to test different hull shapes."

What aspect of your involvement with Hewlett-Packard strikes you as being particularly beneficial?

"Well, once you become involved with HP, you'll soon realise that apart from their technical excellence and innovation, one of their major strengths is that they have the people to help you get the best results from CAD.

"Because HP supply the hardware and the software, you've got a terrific advantage over the guy who tries to work with a lot of different suppliers. I mean it counts for a lot when the person who writes the software understands the workings of the processor.

"If you've got questions or problems, you can get answers and solutions from the one place. And believe me, that can save a lot of time and worry."

How has the HP equipment assisted in the day-to-day running of your office?

"Well, it's staggering how much faster we can get things done since we plugged into HP. This is mainly due to the fact that the computer does so much of the calculation which we used to labour over manually.

LBV 7775 HEPL

system I can virtually doesn't exist."

"For instance, now I can create the basic shape of a boat in a matter of hours whereas it used to take about a month. It might take me about ten minutes to do a keel whereas before it might have taken a week."

Does saving so much time mean that you have to compromise on quality or accuracy?

"Absolutely not. The equipment is dead accurate and I can do a more thorough job for far fewer man-hours.

"In fact, we are so confident in the HP equipment that when we've settled on the design of the boat to defend the America's Cup, we won't tank test it in Holland, we'll test it here in the computer. And when you're talking about a million dollar boat, you've got to be damn sure you've got the right equipment to do it."

What of CAD in the future?

"Look – I'm sure that if Australian designers don't grab CAD with both hands and run with it, the rest of the world will pass us by. And once we all realise its potential, you're going to see a lot of very happy and satisfied people in all sorts of design offices."

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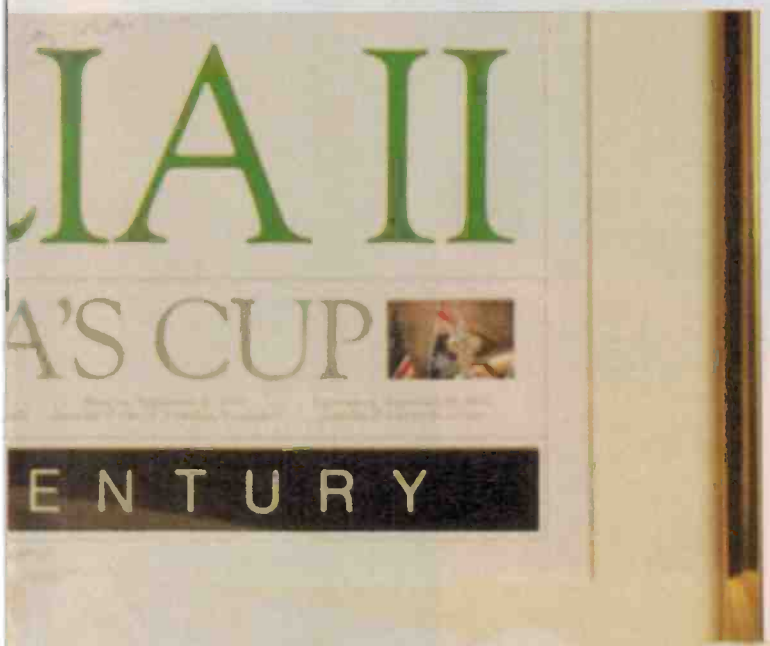

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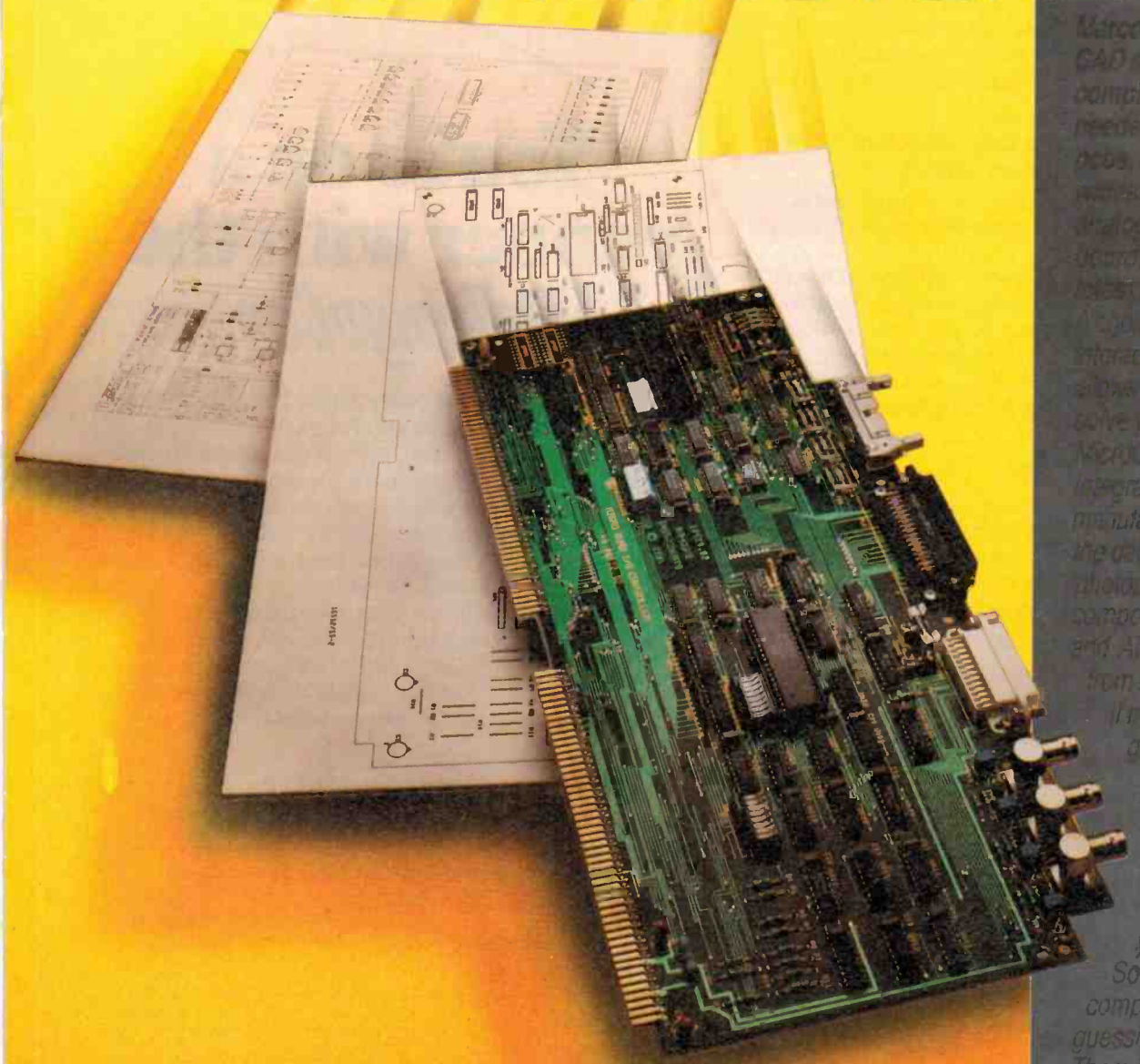

The Marconi microQUAD CAD system creates the complete data base needed to manufacture pcbs. It caters for the widest range of discrete and analog digital boards. It handles the latest SMD technology. A choice of automatic or interactive layout tools allows you to engineer out problems. MicroQUAD totally integrates design and manufacture by capturing the data once. Output for photoplotting, CNC drills, component insertion and ATE are all derived from a common data base.

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treated as required by the rest of the simulation.

The result is a hybrid hardware-software simulation that can sometimes be very effective. It's an idea that can't be taken too far, however, since it can defeat the whole purpose of simulation.

When the circuit is complete it is possible to generate the artwork for the circuit board. This involves using a 'netlist' to identify which pins on which components need to be connected together. There are a number of levels at which this may be done. Some systems generate a 'rat's nest' in which straight line connection is made between pins. This allows for auto placement routines, the idea being to shuffle the various components around on the board to minimise the track length required.

A far greater level of sophistication is auto routing, in which practical tracks are generated, and, in fact, can be used to generate artwork for the finished board.

Routines such as this require many of the attributes of artificial intelligence. It's computing of very high order and is frequently not done particularly well. Some of the most highly regarded machines will regularly position 80% of the tracks, and leave 20% for manual placement.

CIM

Most modern CAD packages will now permit a number of interfaces into the rest of the manufacturing process. For instance there will be automatic generation of parts lists, perhaps interfacing to stock and inventory programmes. All the documentation associated with individual drawings themselves will be controlled. There will be interfacing to numerically controlled drilling machines, which actually drill the holes in the circuit board.

Computer integrated manufacture (CIM) is the name given to a philosophy more than a product. The essential idea is that there are many products in the world that can be made by computer once a human being specifies exactly what is required. At the heart of CIM, naturally, is CAD. Using the CAD system, the designer can specify every significant element in the product. Output from the CAD can then be used to drive the machines necessary to make the product, and also perhaps to establish the routines necessary to test it.

CAD will affect the way in which the components are stuffed into the board. In fully automated factories, output from the CAD will control the insertion machines. It can provide visual displays to machine operaters in some systems, even showing a manual inserter where to place a component, and its polarity.

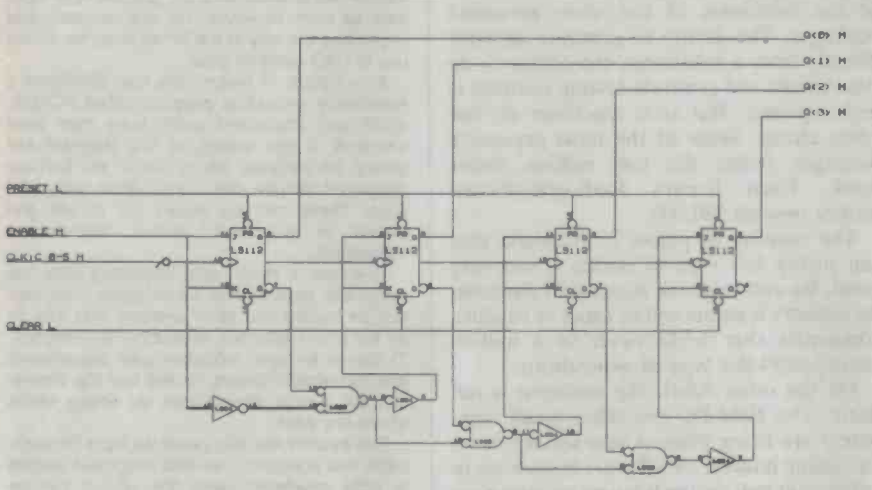
In very sophisticated packages it is possible to take the results of simulations and use these to generate inputs for automatic test equipment, so that boards can be tested after they have had their components mounted.

3D

Three dimensional modelling is not much in demand in electronic CAD packages, however, it is one of the more interesting criteria by which mechanical engineering systems are judged.

Modern 3D solids graphics packages have a number of abilities that can be taken for granted. They will all be able to take a plan view and project a 'z axis' onto it. On instruction, the component can be rotated such that all sides of the model can be viewed.

Some of the standard routines will include hidden line removal and filling. Hidden line removal involves recognising that certain lines are in front of other lines, and not printing them. Filling involves recognising that a certain area of the screen is in fact a plane, and should all be filled in an appro- ▶



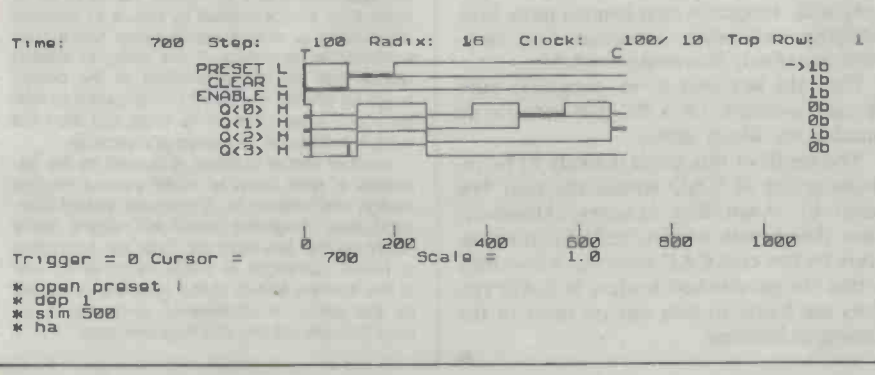


Figure 1. CAD drawn schematic. Below is simulation of the same circuit. (Courtesy DEC.)

REDLOG/REDBOARD

Racal's Redlog and Redboard are typical of middle of the range CAD systems costing about $25,000. They are contained on seven floppies that need to be loaded into the hard disk of an IBM-XT or similar.

Redlog is the package designed for circuit 'capture', that is, laying out the schematic. Parts are called from a library and appear with the correct labelling, pin numbers and logic symbols where appropriate. New symbols can be created and added to the library as required.

The pins are connected by the designer. However, Redlog will only allow connections that conform to its design rules. It's not possible to draw a connection to nowhere for instance, or to connect in defiance of the rule laid down for the inputs and outputs of the components.

At the conclusion Redlog will generate a complete netlist for use with board layout systems like Redboard.

Redboard features complete auto placement of chips on the board, and complete auto routing. How well these systems work depends on the complexity of the board. As the board gets larger and the interconnections more complex it takes progressively longer for the computer to solve the problem. There is provision for manual override when the automatic routines get bogged down.

Automatic checking routines check the design at every stage to make sure that design rules are obeyed. These concern things like spacings between tracks, pads, components and bare copper areas.

Output from the system is via photoplotter, pen plots or disk into other CAD or CAM systems.

A Marconi CAD workstation. At right, the system monitor provides menus and status information. At left, is a computer module with 768K of memory and drives. A tape unit sits under the desk.

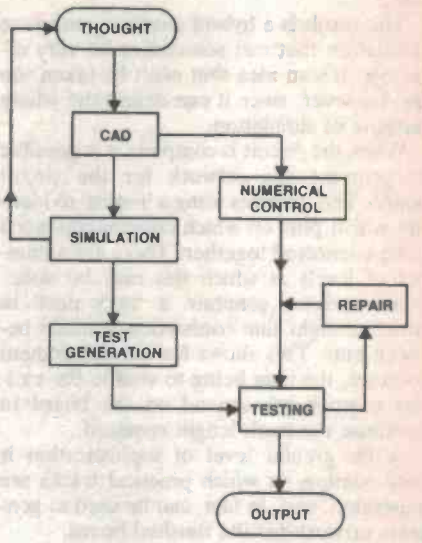


Figure 2. CIM — computer integrated manufacture.

priate colour. More sophisticated versions of this will recognise that parts of an object are in shade and alter the colour and texture accordingly.

These may seem somewhat overblown features in an engineering design tool. However, manufacturers and users argue strongly in their favour. One of the main design strengths of CAD is its ability to demonstrate what something will look like before it's built, and to try out various designs for their aesthetic appeal.

Markets

Strangely enough, given its evident advantages, CAD is a technology that has largely been ignored in Australia. Tim O'Sullivan of Hewlett-Packard describes the Australian scene as 'eons' behind that in the US in terms of CAD usage. At Racal, Jeane Palmer echoes his sentiments.

Theories to account for this state of affairs abound: industry is too conservative, managers too ignorant, there are no designers here, industry's in a mess, and so on. There may be a smidgin of truth in all of them.

One argument stands out: the machines are still too expensive for the increase in productivity they generate. The drafting type packages are, without doubt, accessible to almost anyone in business. The increase in productivity they claim is more problematic.

Doug Rees of Bishop Graphics, which, uniquely in Australia, sells both CAD and artwork for manually taping up boards, argues that drafting-type CAD systems are no faster than a skilled draftsman with tape. It is probably true, however, that a CAD system is easier to operate well than tape, so that a CAD system might be worthwhile when there is insufficient work to retain a full time draftsman.

On the other hand, there can be no doubt of the usefulness of the more advanced packages. The ability to generate artwork directly from a schematic, the ability to do simulations and generate testing routines is highly prized. But such machines do not come cheap. Some of the most expensive packages nudge the half million dollar mark. Even Racal's Redlog/Redboard pushes beyond $20,000.

The number of places in Australia that can justify this type of outlay is not very great. By and large the Australian electronics industry is composed of small or smallish companies that could never in a million years justify this type of expenditure.

On the other hand, the situation is not static. The IBM-PC and other small computers are being pressed into service as an increasing number of software houses try to implement real design features on minimum hardware. Auto routing is increasingly available, even if it doesn't work particularly well. Programs that control parts lists, labelling and other documentation functions are slowly becoming available.

Over the last year or so, programs have become available on a PC that actually do simulations, albeit slowly.

The result of this trend is likely to be increasing use of CAD within the next few years by Australian industry. However, since this growth will be fuelled almost entirely by low cost CAD systems, a corollary is that the established leaders in CAD systems are likely to lose out on most of the growth in business. ●

TEXAS INSTRUMENTS

Texas Instruments does not produce any CAD gear as such. However, it is one company that is pointing the way to the future in so far as the use of CAD systems goes.

In a typical TI system the user confronts a reasonably innocuous program called PCADS, which can implement some fairly high level functions. It has access to TI's standard cell library, for instance, which has all the 54/74xx integrated circuits plus some other odds and sods. These can be pulled out at will and placed in a circuit, (either discrete or integrated).

However, it really gets interesting after the schematic capture has taken place. The disk can be loaded into other systems that can do an extremely accurate simulation, for instance. TI claims to have modelled gate capacitance and propagation delays so well that the simulation will almost always pick up timing errors where any exist.

The system will also generate input for automatic test equipment, so that integrated circuits or pcbs developed using the system can be checked automatically.

Although it sounds simple, it is this phase of the operation that often gives the most problems. One sort is caused by failure to simulate some input or output configuration which later turns out to be critical. If the designer doesn't realise that he has a problem at the design stage he will fail to instruct the simulator to look for it and it will pass all its tests and then not work in the circuit, to everyone's surprise.

Another sort of problem is caused by the extremes of time taken to model even a modest design mathematically. A relatively simple thousand-gate, integrated circuit will require many hours on the simulator for instance. According to David Cartwright of Texas Instruments, one of the exciting trends of the next few years will be the arrival of accelerated computing functions that will cut into this time overload.

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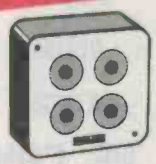

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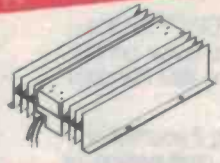

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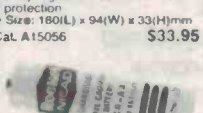

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C	1.2	A.H.	$7.95	$6.50
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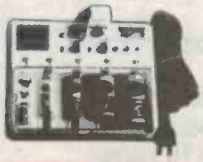


UNIVERSAL BATTERY CHARGER AND TESTER

Save money on expensive batteries with this universal battery charger. Features include meter tester, and provisions for D, C, AA, AAA, N, button and cell batteries, 9V and 6V (square types). Comes complete with detailed instructions.
Cat. M23533 **$27.95**

STANDARD DESOLDING PUMP

Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 195mm.
Cat. T11241 $16.95, Now **$14.95**

MINI DESOLDERING PUMP

Light weight, powerful suction, teflon tip. Replacement tips teflon and ceramic. Length 165mm.
Cat. T11251 $15.95, Now **$13.95**

DELUXE DESOLDERING PUMP

Light weight, non conductive, powerful suction, ceramic long life tip. One of the best in the business. Length 210mm, replacement tip HT3C ceramic.
Cat. T11261 $22.95, Now **$19.95**

10 TURN WIRE WOUND POTENTIOMETER

Spectrol Model 534
¼" shaft.
Equiv (Bourns 3540S, Beckman 7256)
Dials to suit 16-1-11, 18-1-11, 21-1-11.

R14050	50R	R14100	5K
R14055	100R	R14110	10K
R14060	200R	R14120	20K
R14070	500R	R14130	50K
R14080	1K	R14140	100K
R14090	2K		
1-9		10+	
$13.50		$12.50	

DPM-200 PANEL METER

- Ultra Low Power
- Separately Addressable Annunciator
- 15mm Digits
- Bandgap Reference

A low profile LCD DPM with a range of useful symbols as shown. The DPM 200 features 15mm 3½ digit display, and ultra low current consumption and a bandgap reference for high stability. It also features Auto-zero, Auto-polarity, 200mV fsd. It may be used in single-ended, differential or ratiometric modes. The fsd can be easily changed by the user to indicate any other units. The decimal points and symbols can all be driven from an internal source. Wide supply and symbols can all be driven from an internal source. Wide supply rail (5-15V DC) with a variable threshold low battery warning indicator. Supplied with mounting clips and comprehensive data sheet.

SPECIFICATIONS:
Accuracy: 0.1% + – 1 digit
Linearity: + – 1 digit
Samples/sec: 3
Temp. Stability: 50 ppm typical
Temp. Range: 0 - 50-C
Supply Voltage: 5 - 15V DC
Supply Current: 50uA typical
Max DC Input Volts: + – 20V

Cat. Q15510 **$99.95**

TELECOMMUNICATIONS AUSTRALIAN STYLE ADAPTOR CABLE

- Australian socket to plug/socket
- Length 10 metres

Cat. Y16015 Normally $15.95
$12.75

TELEPHONE ADAPTOR

- Australian plug to U.S. socket
- Length 10cm
- Cream colour cable

Cat. Y16026 Normally $6.95
SPECIAL, ONLY $5.55

TELEPHONE CURL CORD

- U.S. plug to U.S. plug
- Replacement hand set cord
- Length 4.5 metres
- Colours: cream, dark brown.

Cat. Y16022 Normally $7.95
SPECIAL, ONLY $6.35

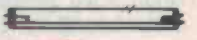
TELECOMMUNICATION PLUG TO 2 SOCKETS.

Ideal for modem connections.
Cat. Y16014 Normally $12.95
SPECIAL, ONLY $10.35

RS232 MINI PATCH BOX

- Interface RS232 devices
- With male to female 25 pin inputs
- 25 leads with tinned end supplied
- Complete with instructions

Cat. X15654 Normally $25.95
SPECIAL, ONLY $20.75



U.V. TUBES

Fits into standard 15W flouro holder. Suitable for Scotchcal, Eprom erasing etc. As used in ETI Eprom Erasing Kit.
WARNING: Do not look directly into UV Tubes.
Cat. H28600 **$24.95**
*If ordering by mail please include an extra $2 for "special" packing.

METEX MULTIMETERS

These instruments are compact, rugged, battery operated, hand held 3 1/2 digit multimeters. Dual-slope A-D converters use C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided.

METEX 3800 MULTIMETER

Features...
- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- 1/2" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001".
- High Surge Voltage protection 1.5 KV-3 KV.
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS

Maximum Display: 1999 counts 3 1/2 digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

Cat. Q91530 Normally $99.95
SPECIAL $89.95

METEX 3530 MULTIMETER

Features...
- Push-button ON/OFF power switch.
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection.
- 1/2" high contrast LCD.
- Automatic over-range indication with the "1" displayed.
- Automatic polarity indication on DC ranges.
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001"
- High Surge Voltage protection 1.5 KV-3 KV.
- Capacitance measurements to 1pF
- Diode testing with 1 mA fixed current.
- Audible Continuity Test.
- Transistor hFE Test.

SPECIFICATIONS

Maximum Display: 1999 counts 3 1/2 digit type with automatic polarity indication.
Indication Method: LCD display.
Measuring Method: Dual-slope in A-D converter system.
Over-range Indication: "1" Figure only in the display.
Temperature Ranges: Operating 0-C to +40-C
Power Supply: one 9 volt battery (006P or FC-1 type of equivalent)

Cat. Q91540 Normally $129
SPECIAL $109

HIGH EFFICIENCY RADIAL FIN HEATSINK

Black anodised with a thick base plate, this radial fin heatsink can dissipate large amounts of heat for maximum efficiency. Designed by Rod Irving.

105x30mm Cat. H10520	$ 3.50
105x75mm Cat. H10525	$ 3.50
105x100mm Cat. H10529	$ 4.90
105x140mm Cat. H10534	$ 6.50
105x150mm Cat. H10535	$ 6.75
105x170mm Cat. H10538	$ 7.95
105x195mm Cat. H10542	$ 9.90
105x200mm Cat. H10543	$ 9.90
105x225mm Cat. H10546	$10.50
105x300mm Cat. H10549	$12.00
105x600mm Cat. H10560	$24.95

UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips). High UV intensity at chip surface ensures EPROMS are thoroughly erased. (Dimensions 217 x 80 x 68mm)

Without timer Cat. X14950
only $99.95
With built in timer Cat. X14955
only $129

SPECTROL MULTIDIALS

Model 16-1-11 (.9")
Cat.S14300 ..... **$16.95**
Model 18-1-11 (1" x 1.75" Rect.)
Cat S14305 ..... **$28.50**
Model 21-1-11 (1.82")
Cat.S14310 ..... **$27.50**

VALUE!

MITSUBISHI DISK DRIVES

MF353 (3½" DRIVE)
Double sided, double density, 1 M/Byte unformatted, 80 track per side.
Cat. C11953 **$280**

M2896-63
Slimline 8" Disk Drive, Double sided Density No AC power required, 3ms track to track, 1.6 Mbytes unformatted, 77 track side 10s/su10 bit soft error rate.
Cat. C11916 **$895**
Case & Power Supply to suit
Cat. X11022 **$159**

M4854
Slimline 5 1/4" disk drive, Double sided, double density, 96 track/inch, 9621 bit/inch, 1.6Mbyte unformatted 3ms track to track access, 77 track/side.
Cat. C11904 **$375**
Case & Power Supply to suit
Cat. X11011 **$109**

M4853
Slimline 5 1/4" disk drive, Double sided, double density, 1 Mbyte unformatted, 3ms track to track, 80 track/side, 5922 bits/inch.
Cat. C11903 **$295**

M4851
Slimline 5 1/4" disk drive Double sided, double density 500K unformatted, 40 track/side. Steel band drive system.
Cat. C11901 **$249**
Case & Power Supply to suit
Cat. X11011 **$109**

M4855
Slimline 5 1/4" disk drive, double sided, double density, 96 track/inch, 2.0 Mbytes unformatted.
Cat. C11905 **$385**

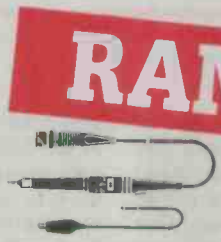
APPLE* COMPATIBLE SLIMLINE DISK DRIVES

Japanese Chinon mechanism.
Cat. X19901 Normally $225
NOW $195
(*Apple is a registered trade mark.)

AEROSOLVE SPRAYPACKS

PCB Coating '201'
Cat. N11040 ..... **$6.95**
Freezing Spray '202'
Cat. N11042 ..... **$6.95**
Insulating Varnish '203'
Cat. N11043 ..... **$7.95**
Electric Motor Cleaner '204'
Cat. N11044 ..... **$6.95**
Electronic Super Clean (Freon) '205'
Cat. N11047 ..... **$7.50**
Flux Remover '206'
Cat. N11049 ..... **$6.95**
Elec Contact Cleaner & Lube '207'
Cat. N11051 ..... **$5.95**
Silver Cote '208'
Cat. N11054 ..... **$6.95**
Formula "65" '535'
Cat. N11057 ..... **$5.95**
Clear Coat Plastic Spray '540'
Cat. N11059 ..... **$6.95**

RANGE!



BESWICK 88100 PROBE SET

CONTAINS: Compensated probe lead with:
- Detachable 6 inch earth lead
- Retractable hook
- IC test tip
- Tip insulator
- BNC adaptor
- Trimming tool

SPECIFICATIONS:
Bandwidth: 10:1 position 250MHz at −3dB into 20 pF
Rise Time: 10:1 position less than 1.4ns nominal
Switch Function:
(a) 10:1 attenuation +/− 5%, with oscilloscope of 1 Mohm input resistance.
(b) 1:1 attenuation with bandwidth of 10 MHz approx.
(c) Reference position, tip grounded via 9 Mohm, oscilloscope input grounded.
Input Capacitance: 16pF typical depending upon oscilloscope input capacitance.
Compensation Range: oscilloscopes of 15 to 60 pF input capacitance.
Working Voltage: 600V DC or peak AC

$34.95

ARLEC SUPER TORCH

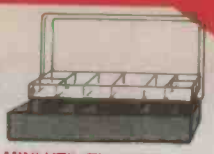
A sophisticated rechargeable torch ideal for use in and around the home, the car, the boat, etc.
FEATURES:
- Powerful built-in Nicad batteries
- Reflector head swivel through 90 degrees
- 3 position switch gives on/off/ and dim.
- Indicator lamp when recharging.
- Charges from mains, electricity or from a car battery.
- Supplied complete with
  (A) SEC approved battery charger
  (B) Plug and cord for car lighter socket.
  (C) Handy charging bracket with fixing screws.
- 12 months guarantee.

Cat. A15055 Normally only $44.95
SPECIAL, ONLY $39.95

PROFESSIONAL SERIES RACK MOUNTING CABINETS

These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance.
- All aluminium construction.
- Removeable top and bottom panels.
- All dimensioning conforms to the International Standard.
- Natural or black finish.
- Ventilated lid.
- Deluxe brushed finish anodised front panel.

	WAS	NOW
H10401 Natural	$49.50	$43.50
H10402 Natural	$59.50	$56.00
H10403 Natural	$69.50	$63.50
H10411 Black	$59.95	$57.50
H10412 Black	$69.95	$65.00
H10413 Black	$79.95	$75.00



MINI UTILITY CASE

Features a clear plastic lid for instant inspection of contents. Up to five, adjustable lower compartments, plus a self elevating upper tray for smaller items.
Dimensions: 110 x 210 x 43mm.
Cat. H10087 **$7.95.**

CENTRONICS GENDER CHANGER

- Female to Female.
- Saves modifying or replacing non-mating Centronics cables.
- All 36 pins wired straight through.

Cat. X15662 **$33.95**

"SNAP TOGETHER" PLASTIC CABINET

Top and bottom simply snap together (no screws required), removable front and back panels.
Dimensions: 186(W) x 125(D) x 50(H)mm
Cat. H10116 **$6.95**

SPEECH SYNTHESISER CHIPS!

SPO256A-AL2: Speech synthesiser chip, needs programming to work. **$13.95**

CTS256-AL2: Contains the code recognition circuit to enable the project to plug directly on the printer port, or into an IBM PC. **$27.95**

A SET OF EACH . $39.50

NEW!

MICRODOT 5¼" DISKS

100% certified and error free guaranteed! Where else can you get 100% guaranteed disks at these prices?!

	1-9	10+
S/S Cat.C12440	$17.95	$16.95
D/S Cat.C12445	$19.95	$17.95

Bulk and Dealer inquiries welcome please phone (03) 543 2166

ARGUS 726 ADJUSTABLE MAGNIFIER WITH LAMP

Absolutely perfect for close up work! Intricate PCB's, projects, etc., will be a breeze under this superb, adjustable magnifying lamp.
- Magnifies 1.75 times
- 40 watt incandescent lamp
- 2 spring-balanced arms, extendable to 95cm
- Adjustable head for optimum viewing angle.
- Fantastic Value!!

Cat. **only $89**

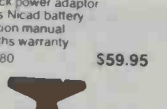
CORDLESS RECHARGEABLE SOLDERING IRON

- Built in solder point illumination
- Easy replacement of solder tip
- Protective stand which also functions as charging unit
- Sponge pad attach to stand
- Plug pack power adaptor
- Includes Nicad battery
- Instruction manual
- 12 months warranty

Cat. T12480 **$59.95**

UNIVERSAL SOLDERING IRON STAND

Cat. T1302
Normally $5.95 slashed to $3.95



MAGNETIC BULK ERASER

The best and by far the quickest way to erase tapes, cassettes and computer disks! Reduces noise levels below recorders own erase head level. On/Off switch located in handle 240V AC operation.

Cat. C14950 Normally $34.95
SPECIAL, ONLY $29.95

SPECTROL 43P

Equiv (Bourns 3006)
Essential for precision work.

R14200 10R	R14290 10K
R14210 20R	R14300 20K
R14220 50R	R14310 50K
R14230 100R	R14320 100K
R14240 200R	R14330 200K
R14250 500R	R14340 500K
R14260 1K	R14350 1M
R14270 2K	R14360 2M
R14280 5K	

1-9	10+
$1.95	$1.75

IC SPECIALS

	1-9	10+	100+
4116	$3.95	$3.75	$3.50
4164	$2.95	$2.75	$2.50
2716	$5.90	$5.50	$5.50
2732	$6.25	$5.95	$5.50
2764	$6.25	$5.95	$5.00
27128	$6.95	$6.50	$6.25
6116	$2.95	$2.75	$2.50
41256	$6.95	$6.50	$6.00
6264	$6.50	$5.50	$5.25
27256	$11.50	$10.50	$10.00

WORLD MODEM CHIP

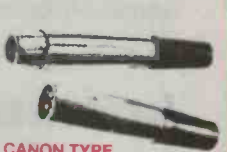
Cat. U21614 Normally $49.50
Save $20, SPECIAL $29.50

TEXTOOL SOCKETS

P17016 16 pin	**$14.50**
P17024 24 pin	**$14.50**
P17028 28 pin	**$19.50**
P17040 40 pin	**$22.50**

IC STORAGE CASE

Electro static charge proof plastic IC case with conductive sponge.
Dimensions: 75 x 130 x 19mm.
Cat. H10095 NORMALLY $8.95
SPECIAL, ONLY $7.95



CANON TYPE CONNECTORS

Cat. No.	Description	Price
P10960	3 pin line male. Was $3.90	**NOW $2.70**
P10962	3 pin chasis male Was $3.00	**NOW $2.10**
P10964	3 pin line f.male Was $4.20	**NOW $2.95**
P10966	3 pin chas. f.male Was $4.50	**NOW $3.15**

ROD IRVING ELECTRONICS

425 High Street, NORTHCOTE, 3070
VICTORIA, AUSTRALIA
Phone (03) 489 8866

48 A'Beckett St, MELBOURNE, 3000
VICTORIA, AUSTRALIA
Ph. (03) 663 6151

Mail Order and correspondance:
P.O. Box 620, CLAYTON 3168
TELEX: AA 151938

MAIL ORDER HOTLINE (03) 543 7877 (2 lines)

POSTAGE RATES

$1-$9.99	$2.00
$10-$24.99	$3.00
$25-$49.99	$4.00
$50-$99.99	$5.00
$100-199	$7.50
$200-$499	$10.00
$500 plus	$12.50

This is for basic postage only. Comet Road freight, bulky and fragile items will be charged at different rates.
Certified Post for orders over $100 included "free"!
Registered Post for orders over $200 included "free"!
All sales tax exempt orders and wholesale inquiries to RITRONICS WHOLESALE, 56 Renver Rd., Clayton Phone (03) 543 2166

MasterCard VISA

Errors and Omissions Excepted.

Apple and IBM are registered trade names

Multi play CD player

The new Pioneer PD-M6 has a six disc multi play magazine giving versatility in the selection of compact disc tracks.

A pre-program facility allows choice of up to 32 selections from the discs in the magazine. Alternatively, the PD-M6 will play the discs in sequence or, to add even more variety, the CD's micro computer will select the tracks at random.

The multi play magazine also doubles as a storage and additional holders will be available as accessories.

The PD-M6's other features include a disc stabiliser to minimise vibrations and mistracking and a linear servo system with its three laser beam pick-up which detects damage on the disc and reduces dropouts.

Other components and features include a single disc magazine, allowing the PD-M6 to play as if it were an ordinary single play CD, four repeat modes (for repeating all discs, a single disc program or single track), three speed manual search of the desired track, full remote control operation, subcode output for future disc technological development and headphone output with volume control.

The PD-M6 retails from Pioneer dealers at a suggested retail price of $899.

International video festival

Plans are now under way to establish a premier video competition and exhibition to bring together the most innovative video-based images produced in Australia and overseas.

The format of the event planned for August will include competitions in a variety of categories: video art and graphics, documentary and information, music video, drama/narrative student works, and home video. Exhibitions of the best entries will be shown with a selection from various countries. An historical section is proposed for several Sydney venues such as the Art Gallery of NSW, Chauvel and Academy Twin Cinemas, Metro TV Studios, Roslyn Oxley Gallery, Artspace and the Performance Space. There will also be forums and discussion sessions of topical interest such as copyright issues, the effects of new technology like Aussat, digital television and distribution possibilities.

For more information contact the Secretary, **Australian Video Festival Committee, PO Box 316, Paddington, NSW 2021. (02)339-9555.**

NAD 30 Series

NAD has introduced three new models as successors to its 20 Series: the 1130 preamplifier, the 3130 integrated amplifier and the 4130 tuner. NAD's claim is that this 30 Series offers more power, better FM reception and more features than its predecessors.

The newly designed, discrete transistor phono preamp section of the 1130 preamp includes a quiet moving coil input, as well as a moving magnet input and very wide dynamic range. NAD claims the CD input is a true overload proof compact disc input, not merely a renamed AUX input. As with other NAD products, it incorporates the very useful BASS EQ and INFRA DEFEAT features.

The 3130 integrated amplifier includes NAD's high current design and +3dB of IHF dynamic headroom. This means that the 3130 can develop more than 60 watts of power per channel into speaker impedances of almost any value. The speaker impedance selector matches the power supply to the speakers. Instead of the usual spring clips, heavy duty speaker binding posts are used to ensure low resistance connections for high current delivery with any type of speaker cable.

The 4130 tuner includes a new FM noise reduction circuit to provide optimum compromise between quieting and stereo separation at every signal level improving stereo S/N by up to 10dB in weak signals. NAD also boasts exceptional immunity to rf overload and over-modulation. The tuner features five AM and five FM presets.

BRIEFS

Carin car map

Prototype systems of Philips' Carin CD-based car information and navigation system are being developed for further testing. The system operates such that when a Carin disc is loaded into the system, all the driver has to do is enter his departure and destination points and any special route requirements such as the shortest, the most economical or the most scenic. The best route meeting these requirements is then planned and stored in memory. During the journey, Carin monitors progress and provides all the navigation information that the driver needs to follow the correct route.

Cassette deck from Onkyo

The new TA-2090 from Onkyo is a three-head, three-motor cassette deck. Its fully automatic "Accubias" system, developed by Onkyo research fine tunes the recording bias to provide optimum results regardless of tape and eliminates the need for a tape equalisation control. Other features include fully automatic tape selection; automatic music control system; three repeat modes — single song, whole side and block; multiple mode display for six deck operating modes; and remote control capability with optional accessories.

The TA-2090 is available for around $1500.

A quick DRAM makes TV better

A new family of dynamic random access memory chips designed by NEC should give better TV and video pictures. The chips are used for separating luminance and chrominance signals, eliminating cross colour interference, reducing jitter in VCRs and interpolating non-interlaced scan displays. They also implement the one-line delay required in European and PAL standards.

dbx CD player

dbx is stressing the three parameters of compression, DAIR and ambience control in its DX3 CD player. The compression function makes the quiet passages on the recorded disc more audible at low listening levels, and loud peaks less fierce; the digital audio impact recovery is intended to restore lost peaks from compression or clipping in analog master tapes; and the ambience function is an effort to reproduce the fuller, more "spacious" sound of phono.

Jaycar's CD buyer's club demise

The mail order compact disc buyer's club established by Jaycar recently has collapsed due to a lack of supplies from the record companies. Although response to the club was good, Jaycar found that it could not offer reduced prices for large orders because the record companies could not supply the discs ordered.

Twin mechanism design: a new innovation

Sharp's new 'twin mechanism' design for the cassette player, uses a single compartment instead of the conventional two to house both cassettes. Two cassettes placed in the mechanism, stacked one behind the other, are activated by a single capstan whose axis assures uniform operational precision and optimum performance. Performance accuracy and operational ease are said to be improved without the characteristic performance differential found in ordinary two-compartment systems. This is of advantage in, for example, editing, where even the slightest mechanism difference between compartments may adversely affect the editing quality.

Short-play tapes for commercial application

Abbreviated-play audio cassette tapes, suitable in such applications as advertising and music recording are being introduced by Klarion. The special tapes are made to three configurations, with a casing of sturdy polystyrene or polycarbonate. Corrugated slipsheets ensure a flat pancake within the cassette, an important feature when the tape is used for high speed duplicating or subjected to frequent fast forward/rewind operation. A pressure pad is secured to the spring by four clasps as well as being glued so the pad cannot be subject to any lateral movement on the backing spring if the cassette is frequently driven at high speed (such as when used in language laboratories).

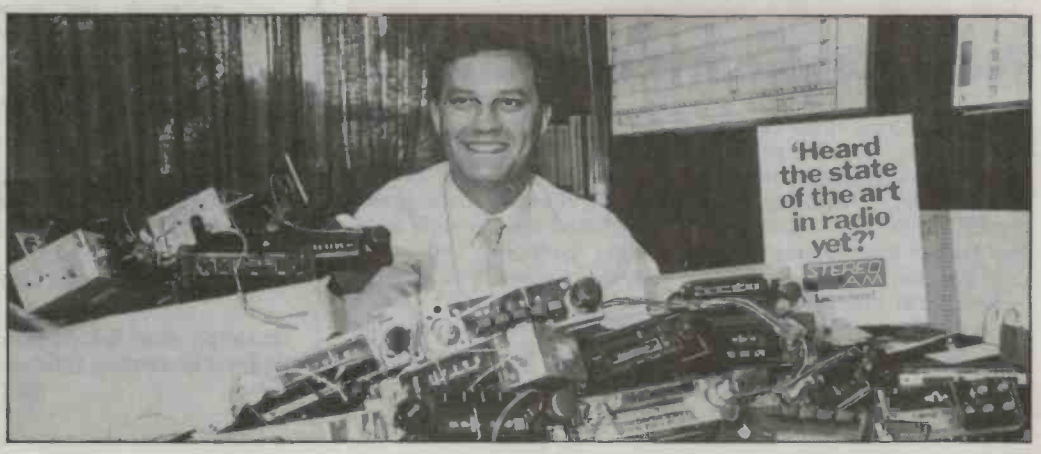
AM stereo campaign

One of the largest promotional campaigns in Australian radio has caused Pioneer some unusual storage problems.

Using former pop star Glenn Shorrock as the new Pioneer presenter, the message was to 'get out and equip yourself with a new AM car stereo radio/cassette'. To do this Pioneer offered a $100 trade-in for any mono car radios to those making the changeover.

But the success of the promotion has Pioneer's Product Manager for Car Sound, Neil Whitehead, inundated with car radios of various brands, types and antiquity.

The project's success is being attributed to its 'synenergy' created by involving Pioneer, the AM radio stations and the car sound retailers. Pioneer said that the promotional campaign was valued at $1 million and covered every AM stereo station in Australia — a radio advertising schedule unmatched in frequency and reach.



JVC's lightest CD player

The new JVC XL-R10 boasts a minimal weight of only 440g (without carrying case and battery pack).

The XL-R10 has 15-channel random access with a full digital display of track, time and programme. Other features include repeat play, remaining time and skip/search functions.

Apparently JVC's intention is to integrate this player with the PC-W320XA mini hi-fi system. This would consist of the XL-R10; double cassette deck with normal or double speed dubbing; 5-band graphic equaliser; Dolby B noise reduction; digital synthesiser tuner programmable for six AM/FM channels; and two-way speakers.

Midi size hi-fi sales assault

According to the Consumer Electronics Suppliers Association, sales of midi size hi-fi systems now account for about 20 per cent of Australian hi-fi sales.

All the major manufacturers of hi-fi have released midi systems in the last few years and in many cases, CESA claims, the specifications, performance and features of these models are better than comparably priced big rack style systems. Manufacturers and suppliers are apparently supporting the sale of midi systems at the expense of their other units.

The obvious selling points companies are stressing are, of course, the space saving benefit of the midi size systems (particularly relevant to the millions of people residing in small units or terrace houses), and their facility for combining with TV and video in the 'integrated entertainment centre'. But more interesting is the claim that midi size systems are very likely to incorporate the latest Japanese technological developments. The reasoning behind this goes that because midi systems are the most popular in Japan, the high demand means that problems are ironed out and improvements implemented before shipments reach our shores.

With the recommendation of at the very least no loss of quality and their attractive small size midi systems should yet have a maxi future in Australia.

New Keyboard System

The introduction of the JVC NS (New Series) commences with the two new models NS50 and NS70 System Component Keyboards. Both can be purchased and built in modular stages, like hi-fi systems.

Keyboards Manager for JVC in Australia, Geoffrey Hyde, says he believes the modular keyboard concept will become the industry leader and will lead to a return to popularity of the dual keyboard home organ product. "We do not think of our new keyboards as organs. The JVC NS has a sound generation based on the new technology synthesis and most sounds are possible to create." He added that the main 'mother module' is only a start and that JVC intends to continue introducing new add-on modules for the New Systems.

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PUTTING THE HEAT ON CASSETTES

The heat is on: twelve type II chrome cassettes undergoing some of the harshest treatment and testing Louis Challis can dish up. Which type burnt out? Which expired? Well actually, it was a pretty cool group that emerged.

Louis Challis

ALTHOUGH THE pre-recorded cassette market is large and appears still to be growing, the market for blank tapes for domestic and semi-professional recording is substantially larger and, in the eyes of most of the manufacturers, far more important. While most of the recording companies (or their subsidiaries) which produce pre-recorded cassettes use type I tapes, a small (but increasing) number lay claim to superior products because they use chrome (type II) tapes. Almost anybody taking the trouble to read this review takes recording seriously and many, if not most of you, will also purchase chrome (type II) tapes for a large proportion of your recording activites.

There are four primary classifications of blank cassette tapes currently being manufactured. These have been designated by the International Electro-technical Commission (IEC) as type I (gamma ferric-oxide), type II (chrome or chrome equivalent), type III (ferro-chrome — a two layer composite of types I and II tapes) and type IV (metal), which is most expensive and, like type III, sold in somewhat smaller quantities.

Gamma ferric-oxide coated tapes (type I) were the original tape formulation. Over the last 25 years they have been subjected to multiple refinements and improvements. These developments have included the low noise (LN tape) formulations, the cobalt-doped formulations, and last but not least the controlled particle sized tapes (as typified by the TDK ADX tapes) which, as a group, achieve performances you may never have even contemplated for your serious recording activities.

A word of warning, however, although not the subject of this review, our prior testing revealed dramatic differences in the range of performances and qualities provided by the commonly available type I tapes in Australia. As a consequence, I cannot off-handedly recommend type I tapes for serious recording without appropriate pre-qualification and where possible proper testing.

The first of the type II tapes were released in the early 70s as 'straight chromium dioxide' tapes, generically described as 'chrome tapes' by Du Pont (which developed the first formulation), as well as by BASF (which soon became the market leader).

The new chromium dioxide magnetic material had a far higher coercivity than the gamma ferric-oxide tapes. Whilst the cassette recorders developed to accommodate the full potential of the chrome tape incorporated new equalisation and bias characteristics, obviously the old machines did not. If you tried to play the new chrome tapes on an older machine, the frequency response was boosted unnaturally at the high frequency end of the spectrum. The different magnetic properties of the chromium dioxide required a vastly different equalisation characteristic and that is why the industry, with the cooperation of the IEC, specified the 70 microsecond equalisation curve, which is now standardised for types II and IV tapes.

The most obvious advantage of the

(Continued page 32) ▶

	Hitachi UD 90	BASF CR-SII90	Denon HD890	Fuji GTII90	Konica GMII90	Maxell XLII-S60	Philips MC-II90	Realistic Chrome 90	Scotch XSII90	Sony UCXS90	Technics Angrom90	TDK SA-X90	Thats EM-X90
Measured Record to Replay Frequency Response @ -20 VU	15 Hz - 20 kHz +0 -2dB	13 Hz - 20+kHz +1 -3dB	13 Hz - 20+kHz +0 - 3dB	13 Hz - 17 kHz +0 -3dB	13 Hz - 13 kHz +0 -3dB	13 Hz - 20+kHz +1 -3dB	13 Hz - 13 kHz +1 -3dB	13 Hz - 6 kHz +2 -3dB	13 Hz - 16 kHz +1 -3dB	13 Hz - 20+kHz +0 -3db	13 Hz - 18 kHz +1 -3db	13 Hz - 20+kHz +1 -3db	13 Hz - 20+kHz +0 -3dB
Noise Figure dB re 0 VU													
Mid-Band	-68	-69	-71.5	-67.5	-68	-71	-68.5	-71.5	-69	-68	-67	-71	-67
A-weighted	-53.5	-54	-56	-52.5	-53	-55.5	-53.5	-56	-53.5	-52.5	-50.5	-56.5	-53
3% 3rd Harmonic Distortion Level	7.5	7	6	7.5	7.5	6	6.5	6.5	6.5	7	6.5	6.5	6
Compression Level @ 10 dB	8.8	8.7	8.3	8.8	8.6	8.5	8.2	8.1	8.4	8.6	8.6	8	8.6
333 Hz Non-Uniformity	••	••••	**(*)	••••	••••	•••	•••	*	•••••	•••••	•••••	•••	••••
High Frequency Non-Uniformity	•••	•••	•••	••••	••	•••	•••	*	••••	•••	•••••	•••	•••
Flutter Performance Rating	•••	•••	•••	•••	•••	•••	••	••	••••	••••	••••	•••	•••
Thermal Performance	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••	•••••
Cost (RRP/cassette)	$6.99	$5.99	$9.49	$7.76	$6.29	$8.30	$8.49	$6.99	$6.99	$8.15	$8.59	$8.50	$7.99

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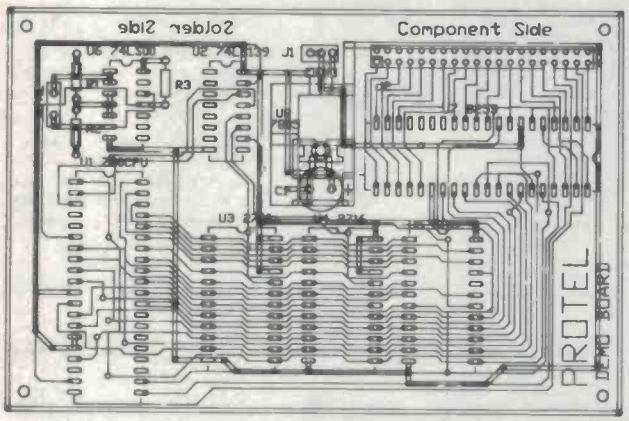

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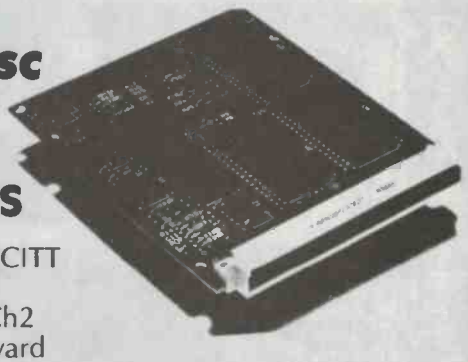

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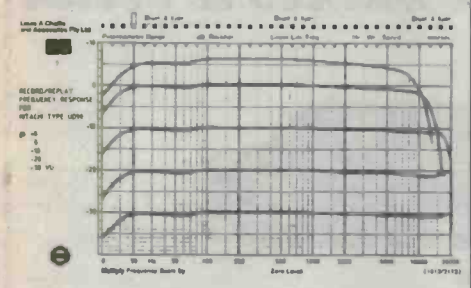
Record-to-replay

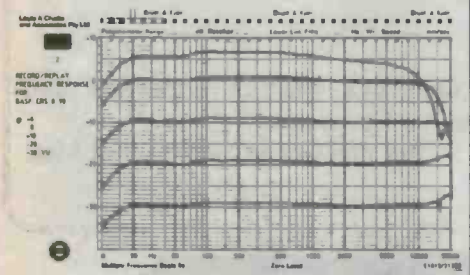
The record-to-replay evaluation was conducted on a machine, theoretically optimised for a Nakamichi tape, and which prior testing has shown to have a higher coercivity and retentivity than the standards laid down by IEC. This means that, if a tape has been correctly formulated to conform to the IEC standards, it should exhibit a slight drooping response at high frequencies rather than being dead flat or providing a slight rising response.

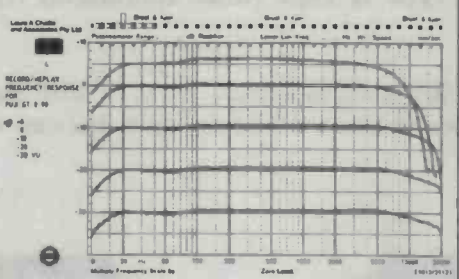
Very few of the tapes provided a dead flat response although a number of them did perform closely enough to be regarded as just less than perfect. The typical boost or drop is less than 3dB at 15kHz with the exception of the Realistic Chrome 90 which obviously does not conform to the basic requirements of the IEC specification and has other characteristics, which disturbed me.

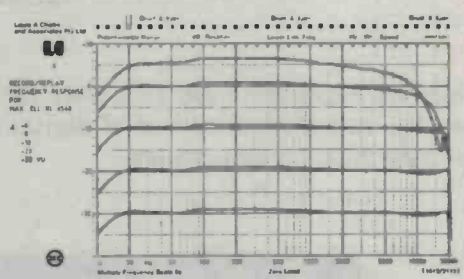
With the exception of the Realistic, all of the tapes provided record-to-replay frequency responses which I would classify as outstanding and with which the intending user should be happy. The one factor any buyer would need to be sure of is that the bias level on his/her machine has been correctly set for type II tapes and *that the heads are clean.*

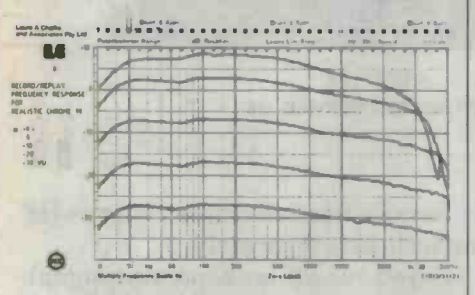
By comparison, the Hitachi UD90 tape provided a frequency response that was *just as flat* because the head, gap and geometry of this particular recorder allows it to achieve excellent results with a type I tape.

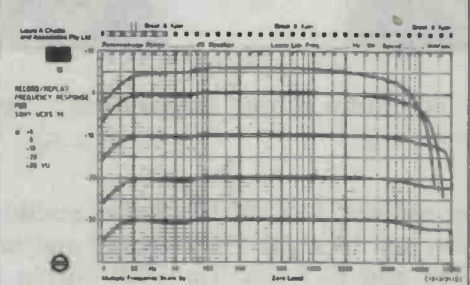


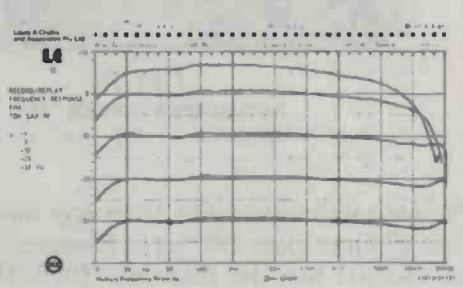


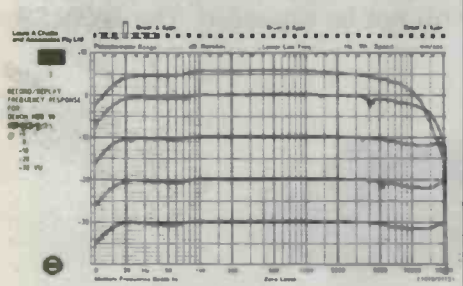


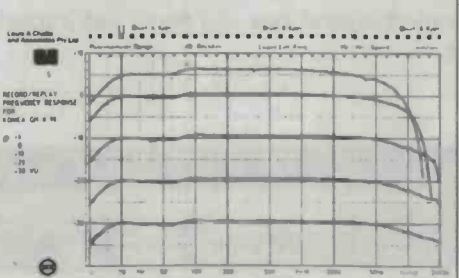


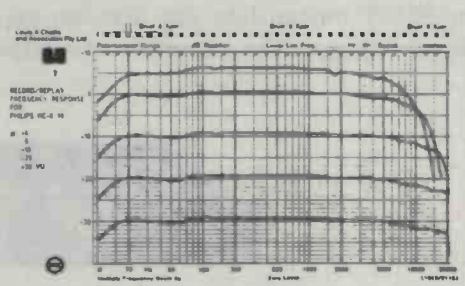


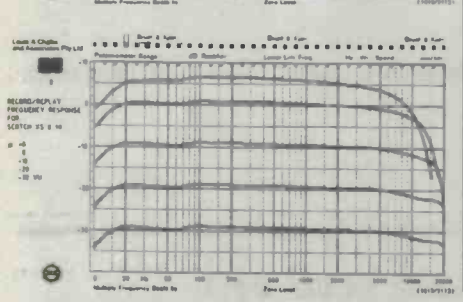


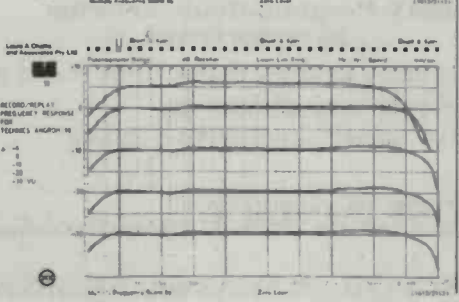


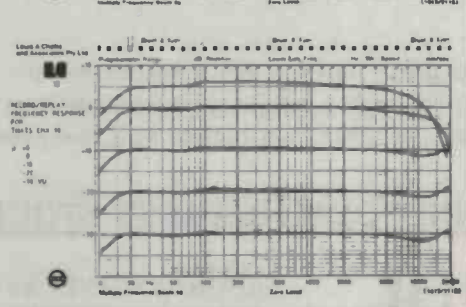












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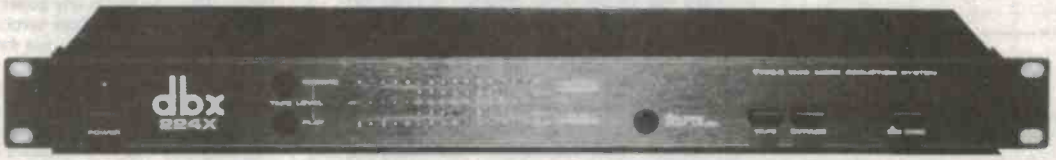

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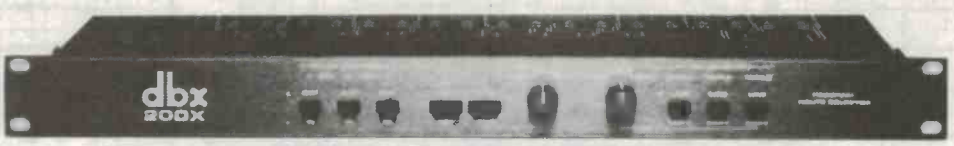

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audio/3

Third octave background

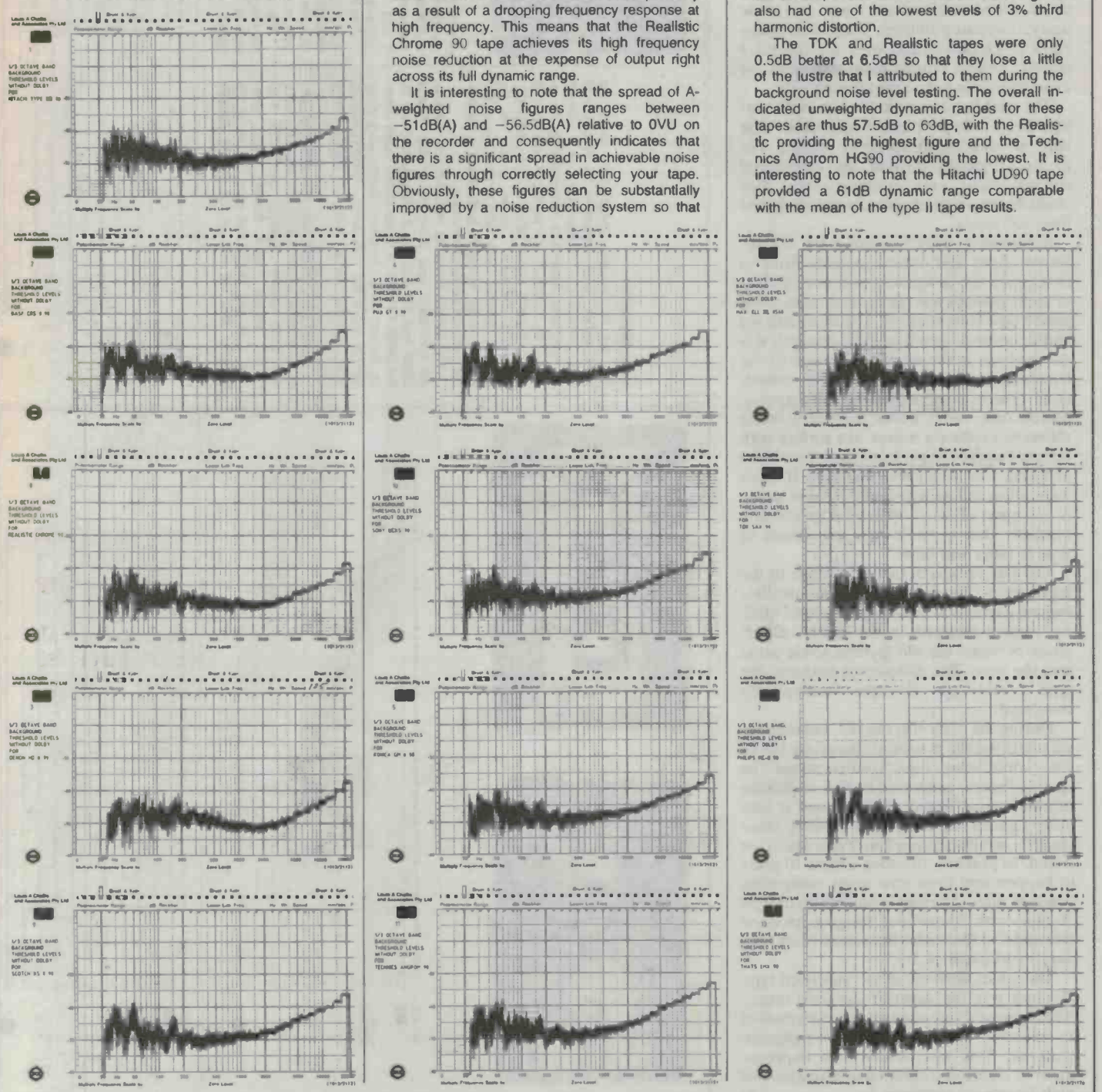
The shape of the noise threshold of each of these tapes varies significantly from tape to tape, as do the A-weighted and unweighted noise figures.

The lowest noise figures were provided by the Maxell XLII-S 60 tape and the Realistic Chrome 90 tape, whilst the TDK SA-X 90 tape was only 0.5dB higher. The result from the Maxell is very commendable, but the result from the Realistic is not really in the same class because it has been achieved primarily as a result of a drooping frequency response at high frequency. This means that the Realistic Chrome 90 tape achieves its high frequency noise reduction at the expense of output right across its full dynamic range.

It is interesting to note that the spread of A-weighted noise figures ranges between −51dB(A) and −56.5dB(A) relative to 0VU on the recorder and consequently indicates that there is a significant spread in achievable noise figures through correctly selecting your tape. Obviously, these figures can be substantially improved by a noise reduction system so that absolute differences between one tape and another will be far less significant when Dolby B or Dolby C is used, making the less obvious differences of tape uniformity and upper saturation level assume a greater importance.

The evaluation of third harmonic distortion revealed a very narrow spread in the recording levels to produce 3% third harmonic distortion (relative to a 333Hz signal). The levels fell between +6VU and +7.5VU and for reference the Maxell, which had the lowest noise figure, also had one of the lowest levels of 3% third harmonic distortion.

The TDK and Realistic tapes were only 0.5dB better at 6.5dB so that they lose a little of the lustre that I attributed to them during the background noise level testing. The overall indicated unweighted dynamic ranges for these tapes are thus 57.5dB to 63dB, with the Realistic providing the highest figure and the Technics Angrom HG90 providing the lowest. It is interesting to note that the Hitachi UD90 tape provided a 61dB dynamic range comparable with the mean of the type II tape results.



chrome and chrome equivalent tapes was their ability to record peak signals at levels as much as 3dB higher than the early generation of gamma ferric-oxide tapes. In many cases this was also achieved with a lower noise figure which was appreciated by amateur and semi-professional recordists alike.

Soon after the release of the type II tapes users found themselves beset by some nasty, insidious problems. There were many cases of excessive head wear on expensive cassette players causing many people to shy away from using the new chrome tape.

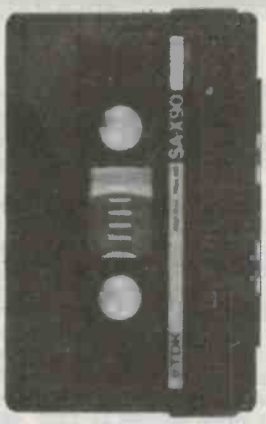
The problem lay with poor manufacturing, specifically poor calendering of the tape with unusual sharp epitaxial chrome elements projecting beyond the calendered surface. These were so abrasive that they could destroy a set of recording heads in less than 100 hours.

Sufficient market resistance led BASF, Scotch, Sony and other reputable firms to investigate the complaints and one product of their research was the development of superior tape formulations. The most striking and important benefit of their research was the increase in the number of stages of calendering of the tape surfaces. The calendering process involves passing the magnetic coated base webb under counter rotating rollers to produce a mirror-like surface with minimal surface imperfections and no loose material. The result was that type II tapes were produced with polished finishes so far in advance of what had been previously available that a whole new generation of type II tapes was born.

The same research flowed through to the type I tapes. The improvements in calendering, magnetic material, adhesives and quality control resulted in substantial differences between the old gamma ferric-oxide and the new. The differences between the type I and type II tapes consequently narrowed.

During the early 70s, the IEC committees standardised the magnetic characteristics of the 'conforming tape configurations' so that, in theory, you would be able to pick up any individual brand of tape, load it into your cassette recorder and achieve comparable results irrespective of the source or brand. In practice, this took almost 10 years to happen and even now many companies produce three different formulations of type II tape with coercivities ranging between 500 and 750 Oersteds; the retentivities may vary by as much as 2:1.

The major attribute of the improved type II tapes was the superior dynamic range. The improved calendering process resulted in superior consistency of the magnetic material. This was observed as improvement in record-to-replay characteristics and high frequency responses. ▶



Compression

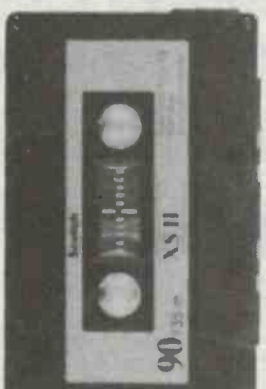
For the non-linearity compression tests, the input signals were applied in 10 precise 1dB steps from 0VU. Simultaneously we monitored the saturation level and non-uniformity of replay. The results of this particular test were in some respects encouraging and in others discouraging. Because I chose to use an expanded dynamic range with a 10dB pot in the level recorder, miniscule fluctuations in the output level are easily observable.

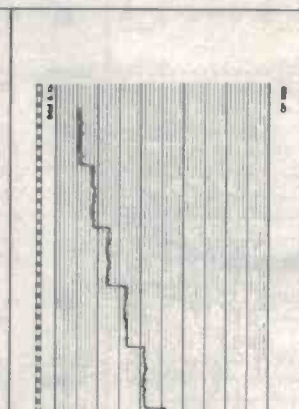
The spread of results indicates that the lowest saturation was provided by the Hitachi UD90 and the Fuji GT II, closely followed by the BASF CR-S II. A group of five tapes (Konica, Scotch, Sony, Technics, That's) were close behind, whilst the TDK SA-X, although starting well, saturated fairly rapidly at levels above 7VU.

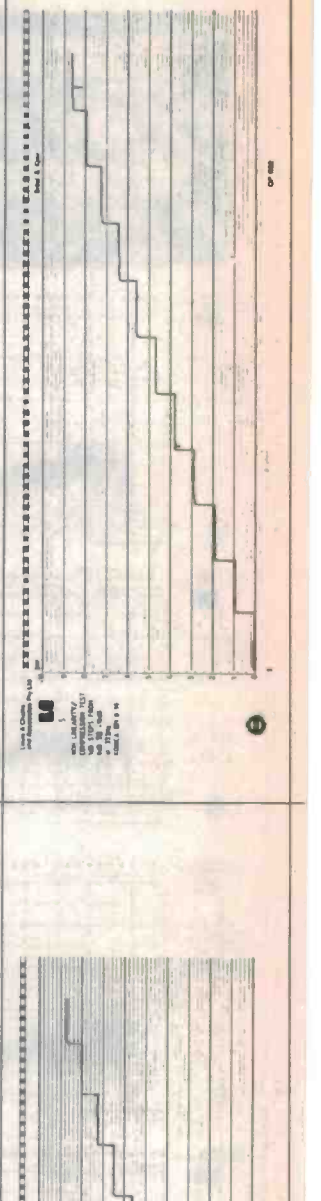
I found the indicated tape non-uniformity just as interesting as the saturation characteristics with good results displayed by BASF, Fuji, Konica, Maxell, Philips, Scotch, Sony, Technics, TDK and That's and poor results by the Realistic and the first of the Denon sample (subsequently labelled 'A'). The second Denon sample was completely different. I suspect from a different production batch, as the 'A' sample produced terrible results in every test in which it was included. The 'B' sample, by contrast, displayed no such problems.

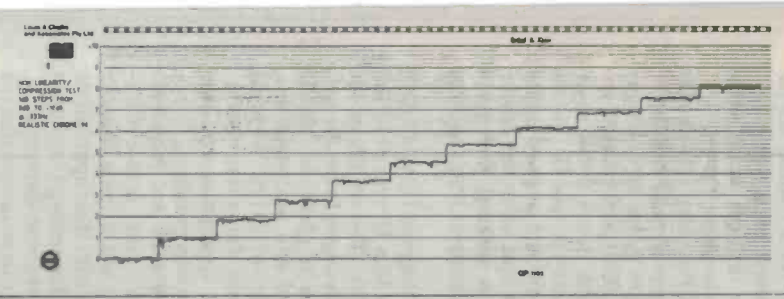
The Realistic sample, as I subsequently discovered to my sorrow, fouled the heads of the recorder and necessitated careful cleaning and re-running of a number of tests in order to provide valid test results.

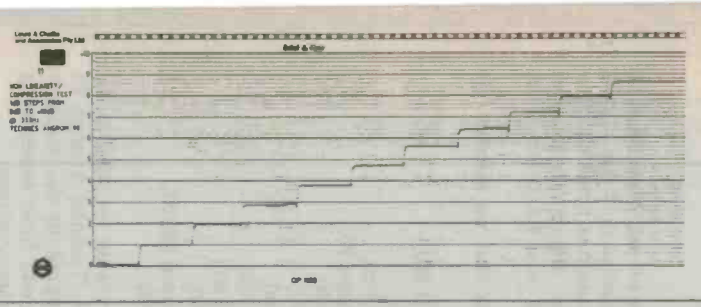
The Hitachi UD90, although providing outstanding tape compression results, did not display a linearity comparable with the type II tapes.

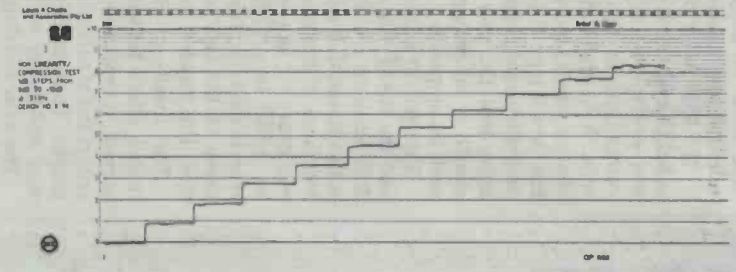


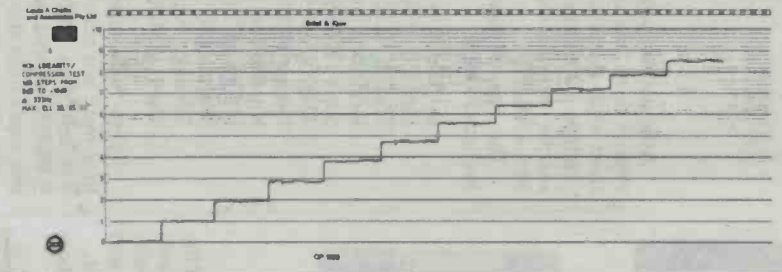


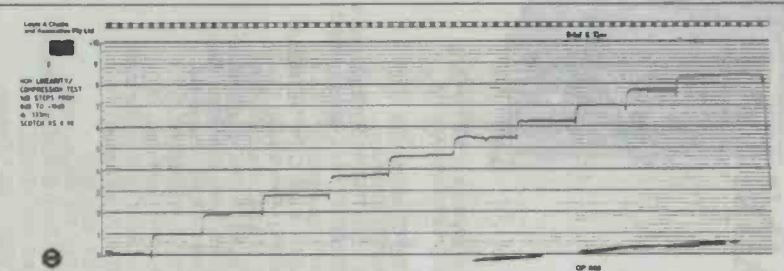


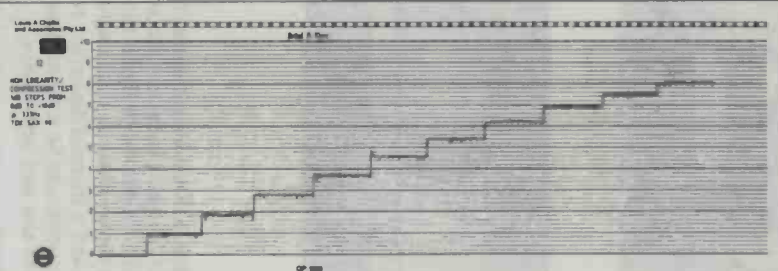


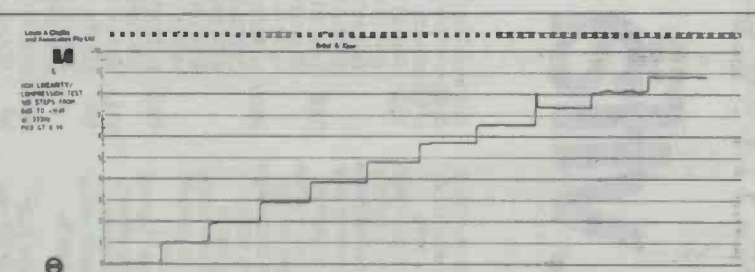


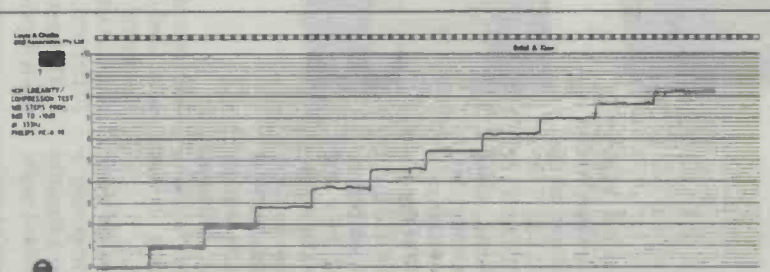


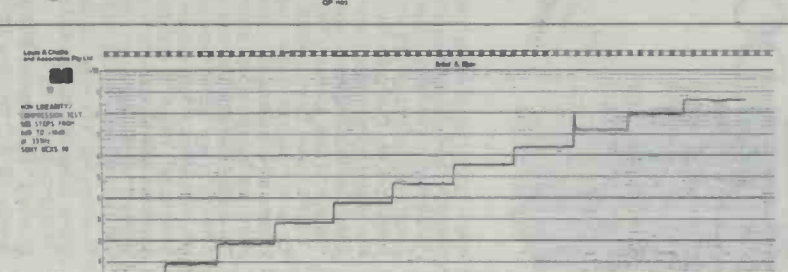


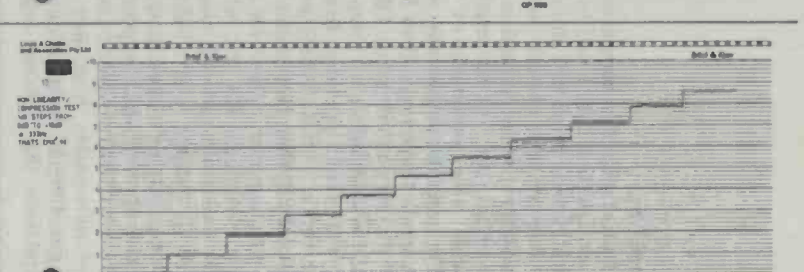












Testing

In designing this comparison the most critical question that I had to resolve was which cassette recorder I should use, given the many possible choices that I had. I decided not to use the Nakamichi 'Dragon', or one of the other similar machines, which provide either automatic or manual bias and/or azimuth optimisation, as this feature is generally found in less than 3% of the cassette players on the market. I decided that I should ideally utilise a current generation recorder which provides fixed bias and equalisation. If the machine provided variable controls, then they would not be used. The machine that I chose for this purpose was a Nakamichi BX 300, which was already a year old and well used. Although nominally cleaned (and I believe adjusted to manufacturer's specifications) it was otherwise normal in all respects.

The tests that I resolved to conduct were: a record-to-replay frequency response; a background noise determination; a linearity compression test utilising expanded scale level recording, a direct measurement of the peak level of 3% third harmonic distortion; the correct determination of signal-to-noise ratio; a tape replay linearity test; a wow and flutter test; and a thermal distortion test.

The next question to be resolved was how many tapes to test and which ones.

Although we were offered in excess of 20 type II tapes, we selected only one sample from each manufacturer as some of them produce up to three different types. The sample we selected was, we believe, the best available.

The type II tapes that we selected for evaluation were

BASF CR-S II 90,
Fuji GT II 90,
Maxell XLII-S 60,
Realistic Chrome 90,
Sony UCX-S 90,
TDK SA-X 90,
Denon HD8 90,
Konica GM-II 90,
Philips MC-II 90,
Scotch XSII 90,
Technics Angrom HG90,
That's EM-X90.

As no Agfa tapes were supplied to us, they were not tested. Technics Angrom 90 was tested in preference to the National RT90EX as that would have represented two tapes from the same company.

One of the firms (Hitachi), approached by the magazine, stated that it does not market a type II tape in Australia (although it does in America). As a control, we decided to include a sample of its type UD 90 tape as a yardstick through which other relevant conclusions might be drawn.

The Hitachi UD90 type I tape that we decided to evaluate is representative of the latest generation of low noise type I tapes conforming to the IEC performance criteria. You might think that it unfair to include a type I tape with the type IIs, but we felt that if type II tapes are as good as the manufacturers claim and offer the advantages that the user is seeking, then there should be no embarrassment resulting from such an approach.

I started off evaluating the Hitachi UD90 and the BASF CR-S in a 16 year-old PRO 2000 cassette recorder. The results of the tests showed that with a type I tape the performance of the cassette player at −20VU was every bit as good as it was when new, ie, ±3dB from 25Hz to 12kHz. With the type II tape, the results were disastrous because of the lack of appropriate equalisation. But down to serious testing.

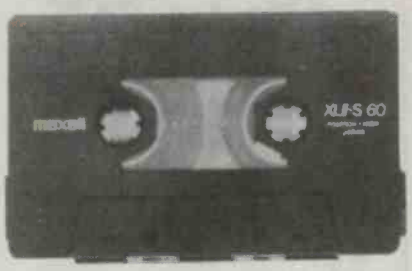
The results of the tests for record-to-replay characteristics, third octave background, compression, and dropout linearity are set out separately with their appropriate graphs. To complete the testing I evaluated wow and flutter and thermal distortion.

The wow and flutter tests were conducted on each of the type II tapes at five points ▶

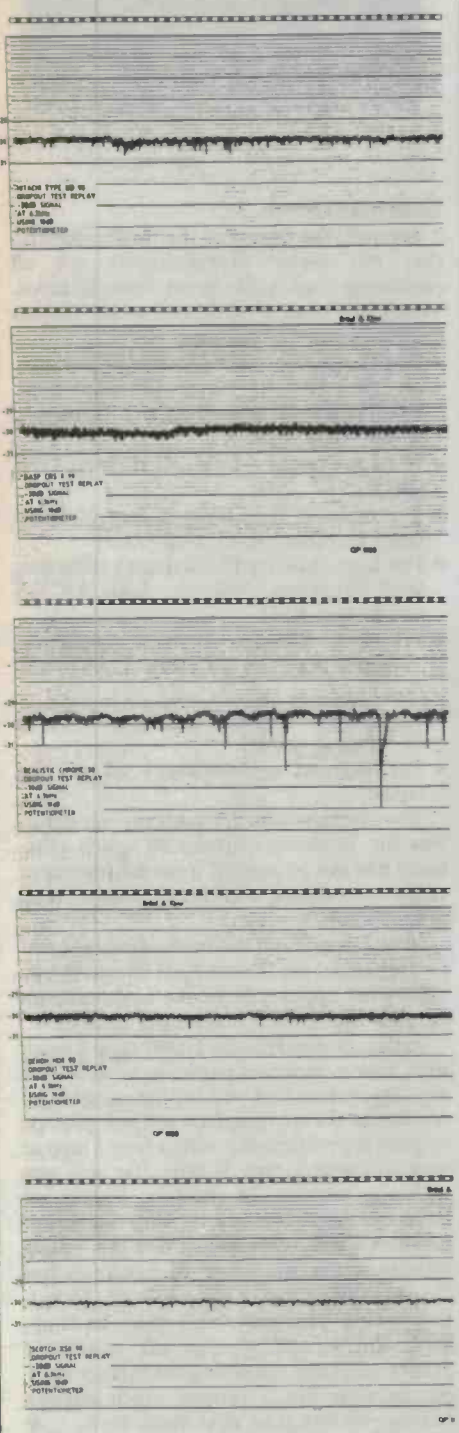
Dropout linearity

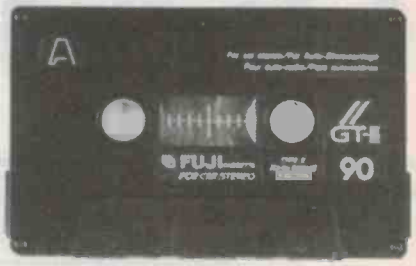
This test clearly displays significant differences in the tape formulation between one tape and the next so that you are able to assess other important characteristics of the tape coating. The thinner and straighter that the line is the better the quality control of the magnetic coating and the cleaner the response at high frequencies.

The most outstanding results in this respect were provided by the Technics Angrom 90 (which utilises a different manufacturing procedure from the rest of the tapes) closely followed by the Scotch SXII and the Fuji GT II, which were head and shoulders above the rest of the tapes. All of the other tapes were good, with the exception of the Konica GM-II; this tape displayed a number of significant dropouts that were quite noticeable. The Realistic displayed poor linearity and some rather disturbing dropouts which would have both been audible.



It is pleasing to note how uniform the output is at high frequencies compared with the last series of tests that I conducted and even the Hitachi UD90, which fared better than the Konica and Realistic tapes, is on a par with most of the other type II tapes in this regard.





through the length of the tape. All of the tapes displayed the same wow figure, indicating no signficant difference in this respect. By contrast, the flutter figures and the weighted flutter varied significantly throughout the length of the tape with the highest figures one-third through the tape and generally lower figures towards the end. The tapes providing the lowest flutter figures were the Scotch, Sony and Technics samples, whilst the highest figures were produced by the Realistic and Philips samples.

The thermal distortion tests were performed in our thermostatically controlled oven, which incorporates two heater elements and a circulating fan in a convection configuration with separating barrier. I was very pleased to note that none of the samples displayed any trace of distortion at temperatures up to 76°C and that only when exposed to the direct radiant heat of the heaters could we induce any thermal distortion in the samples.

This was important because automotive cassette players in Australia are subjected to conditions amongst the most gruelling in the world. The temperatures under our dashboards regularly exceed 65°C, sometimes exceeding 70°C and I have heard of cases reporting up to 80°C. The temperatures on top of dashboards (which are normally black), where the cassettes are exposed to the direct sunlight, may be even higher.

Investigations I did back in 1971 revealed that most of the thermo-plastics utilised by European manufacturers had low softening points which resulted in innumerable 'meltdowns' inside the cassette players of many cars. The top American brands, like Scotch, which catered for a more diversified market (including the 'deep south') selected their plastic formulations much more carefully to meet extremes of temperature. By contrast, BASF was so red faced following my review that the local importers immediately put a temporary hold on all further imports of cassettes while the moulding formulation was replaced with a new higher temperature withstanding material.

Summation

Overall, the results of the testing confirm that the major manufacturers are all producing reasonably good cassette tapes. Those that caught my attention for various attributes were as follows:

- For frequency record-to-replay linearity on the cassette player actually used: BASF CR-S II, Maxell XLII-S, TDK SA-X and That's EM-X.
- For noise figure: Maxell XLII-S and TDK SA-X.
- For minimal tape compression of maximum recording level: Fuji GT II.
- For tape linearity at maximum recording level: Technics Angrom, Sony UCX-S and Scotch XSII.
- For tape linearity at high frequency: Technics Angrom 90, Scotch XSII and Fuji GT II.
- For flutter: Scotch XSII, Sony UCX-S, Technics Angrom.
- For thermal performance: all of the tapes.

The one tape which did not get any prizes was the Realistic Chrome 90 which obviously had not benefitted from the Memorex company merging with the Realistic group of companies.

In conclusion, on the basis of price versus performance, the Scotch XSII 90 and BASF offer what appears to be the best performance on the basis of dollars per decibel.

Although the Hitachi UD90 type I yardstick tape performed particularly well, it is my observation that 90% of the cassette recorders in the marketplace will not provide as good a performance with a type I tape as they will with a type II tape. To help you with the problem of choosing brands we have tabulated the results with numerical results (where relevant), a five star rating scheme where the range of figures is less clearly defined and RRP prices at the bottom which may vary from shop to shop. With this tabulation, and the associated graphs and level recordings to further complicate your life, I foresee much anguish before you buy your next blank tape. ●

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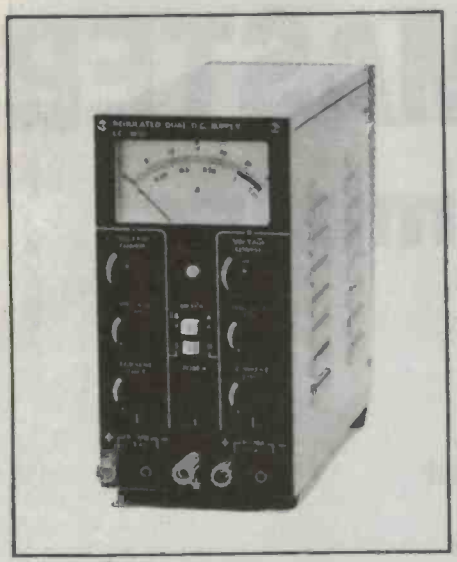

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ETI READER SERVICE 20

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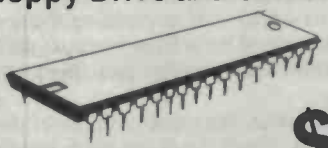

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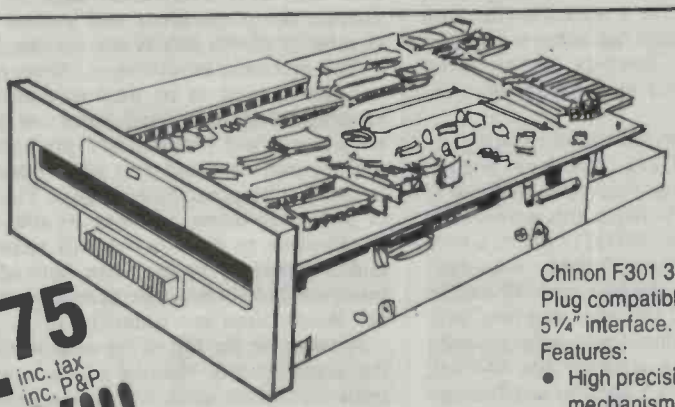

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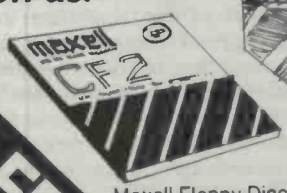

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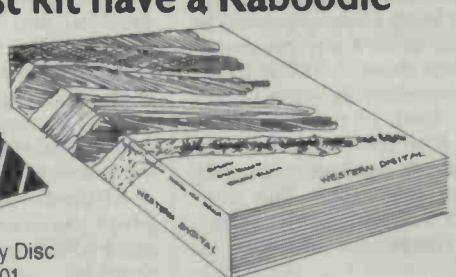

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ETI READER SERVICE 21

SERIOUS MIXMASTER — Akai MG1212 mixing recorder

If your intentions are a bit more serious than cooking up a catchy little tune, the Akai MG1212 is something you should view. This 12-channel mixing recorder offers dbx on each channel, accurate timing memories, easy access to inputs/outputs and comprehensive mixing facilities, just to name a few features.

THE CONCEPT OF a combined mixing desk and multitrack recorder has been around for a fair while. It has usually taken the form of a portable 4-track recorder with mixing facilities. Akai has taken a quantum leap with this unit, however, and created a 12-track, 12-channel mixing recorder: the MG1212.

As with most of the smaller mixing recorders, the MG1212 combines mixing, recording and noise reduction facilities in the one package. However, this is where the similarity stops. The MG1212 offers a very comprehensive mixing facility, automatic control facilities on the tape deck, dbx noise reduction on all 12 channels and two dedicated tracks for control and synchronisation signals. The mixing recorder has 14-track capability as you don't need to sacrifice any tracks for synchronisation and control.

Design and operation

Mixing

The console is layed out with the 12-track recorder located on the right and the 12 mixing channels in 12 columns on the left.

At the top of these columns are the input and output sockets for each individual channel. Located on the top panel of the console, they are more easily accessed when connecting the mixer with instruments, effects, microphones, etc. On most mixing desks these connectors are situated on the rear panel, which can be inconvenient, especially if you don't have a patch-bay.

Each channel has one microphone input, a line input, an accessory input and an accessory output. As the microphone jack is a balanced input, a pin Cannon jack is used to connect microphones to a channel. To connect line level instruments such as keyboards, drum machines and guitars to a channel, a phono jack is also provided.

The accessory input/output allows external effects units to be used on individual channels. The associated jacks are internally connected between the preamplifier and the equaliser and thus allow effects to be driven by a preamplified signal. This pair of jacks also allows the user to add extra equalisation to each channel (if required) and is especially useful when both effects buses are being used. The accessory output can also be used as a channel output.

A switch at the top of the column allows the input to any channel to be selected from microphone jack, line jack or from the 12-track recorder. Below it is the PAD control which attenuates signals from the microphone inputs by 0, 20, or 40dB, then the TRIM knob, used to adjust the signal level from the microphone and line inputs over a 20dB range.

Equalisation

When using the mixing facilities of the MG1212 the first thing I was impressed by was the incorporation of 3-way parametric equalisation of each channel. This is implemented by the three controls located under the TRIM knob. Each of these is coaxial with the lower half controlling the frequency range and the top half controlling cut and boost for that range. The three ranges covered are 1.5kHz to 15kHz (high), 350Hz to 5kHz (midrange) and 40Hz to 800Hz (low). Since parametric equalisation allows one to cut or boost the centre frequency anywhere within a particular band, it gives the user more control over the sound than graphic equalisation. The amount of cut or boost allowed is 15dB; for situations where you do not require any equalisation there is a BY-PASS switch.

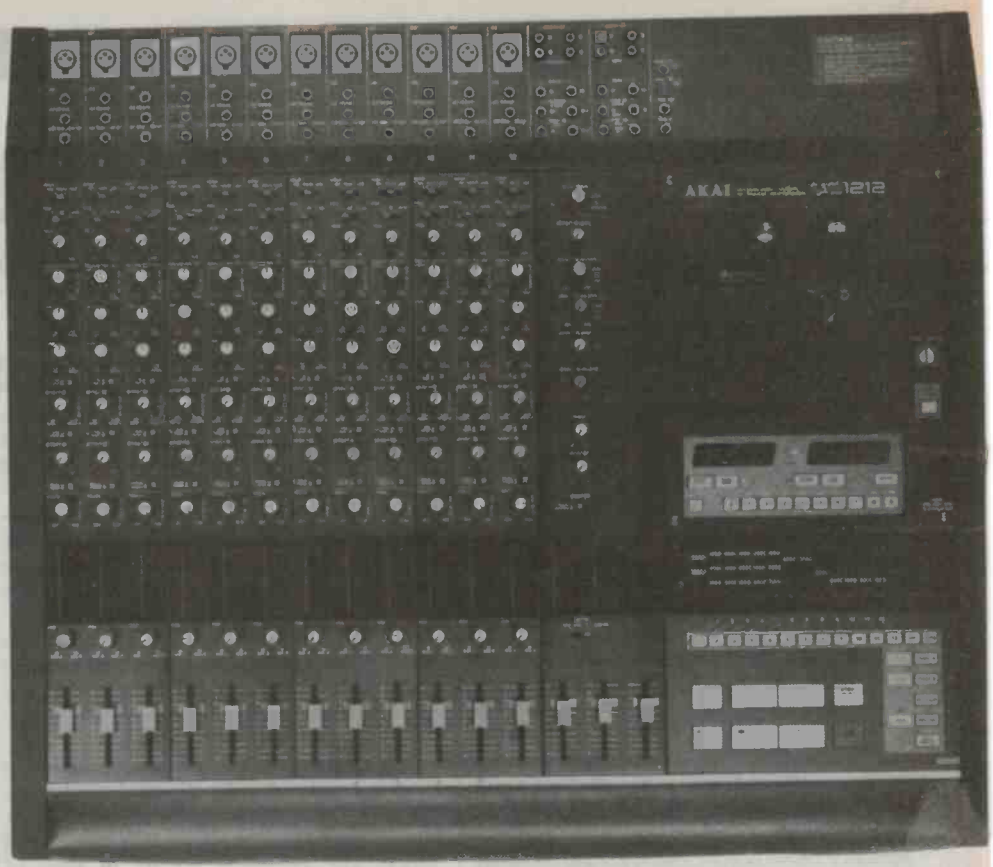
The MG1212 mixing recorder has two EFFECTS SENDS located directly under the parametric equaliser controls.

Next, the TRACK control is used during recording and playback. The knob is coaxial with its upper half controlling the level of signals played back from the tape deck and the lower half used to pan them left and right.

Below this, the peak level meter displays the peak signal level on each channel in playback and recording using an LED bar graph. The displays act like the VU meters on a multitrack recorder, but are more convenient because they are located close to the fader controls. Therefore, when you are recording you can see what is happening on each track of the tape deck without looking away from the console. Nice one Akai!

Next to the peak level meters are the overload and recording indicators which light up when the signal is 3dB below the saturation level of the amplifiers in the channel, giving prior warning of signal clipping. The recording indicators illuminate when the corresponding input channels are in recording standby or in recording mode.

At the bottom of the column of knobs, where you would expect them, are the PAN and FADER controls. These set the overall signal level in the channel and the amount



Neale Hancock

of signal sent to the left and right outputs.

The master module controls the overall level of monitoring, the EFFECT SENDs, the sync track level, and the overall output level. The inputs and outputs linked with this module are located at the top of the master column.

There are outputs provided for monitoring, mastering, sending to effects in stereo and mono, a track output and a direct output for buses A and B as well. There is also an input and an output to allow synchronisation with external devices such as drum machines and sequencers via a sync track. Corresponding inputs are provided for receiving effects; a direct bus input and an auxiliary input is provided for cascading mixing desks.

The tape deck monitor and the level mixing desk monitor controls are located under the EFFECT SENDs and RECEIVEs. The monitor output can be used on the track output or the master output.

Two LED bar graphs are used to show the overall peak signal level switchable to display the signal level at the master output, buses A and B and effect bus A.

Three faders control the amount of signal going to bus A and bus B (the left and right signal channels of the mixing desk) and the output level at the mastering output.

Recording

Recording is done on a half inch cassette tape (Akai MK20 RRP $29 each packaged in boxes of 10), which is about the same size as a video cassette, but uses a different recording at 19cm/s (7.5ips) and 20 minutes of recording at 9.5cm/s (3.75ips). This is less time than you would have on a reel-to-reel tape deck, however it is offset by a short changeover time. A pitch control located here can be used to adjust the speed by ±12%.

Controls and indicators for the tape deck are on the right of the console (just under the cassette lid) and are clustered into three groups. The bottom group contains the controls for the tape transport along with the channel and track selectors. The middle group contains the display showing which channel is allocated to which track and whether the track is in RECORD or PLAYBACK. The top group consists of the counter and memory controls with their respective indicators.

The tape transport is controlled by the standard cassette-type controls namely, PLAY, REWIND, FAST FORWARD, STOP, PAUSE and EJECT along with a CUE button for finding the start of a track. There is also a MEMORY SEARCH control which can automatically rewind or fast forward the tape to a preset memory location.

The 12 channels of the mixing desk can be assigned to any of the 12 tracks dedicated to audio recording by using the bank of pushbutton switches located above the cassette transport controls. These buttons set any track into PLAYBACK or RECORD allowing recorded tracks to be played back whilst others are recording. One set of buttons selects the mixing desk channels to be sent to the bus and another selects the track the bus output is sent to. This method of configuring PLAYBACK or RECORD takes a bit of getting used to, but beats the hell out of rearranging a patch-bay each time you want to change your recording set-up. What would be ideal in this instance would be a memory for each set-up, but I suppose you can't ask for everything.

By using this set of buttons in conjunction with the display you can quickly set up the MG1212 for ping-pong recording, overdubbing, mixdown or playback. Once again the advantages of having the mixing desk and recorder combined are evident. Because of plenty of access to inputs and outputs, no flexibility is lost either.

In the bottom group of controls a SOLO button allows monitoring of a single channel. An AUTO/MANUAL tape monitor button monitors the tape during playback and rewind, and the source during record, record standby, eject and stop. To protect against accidental recording, an ANTI-RECORD button is also provided.

The counter and memory section of the 12-track recorder has two displays, one showing the running time of the tape and the other indicating the time stored in memory.

The running time of the tape is displayed in minutes, seconds and tenths of seconds. This method is far superior to the standard tape counter, not only because it counts in real time, but also because the time signal is recorded on a dedicated track — at the same time as music is recorded on the audio tracks. Therefore, the display on the time counter will always be accurate (to within a tenth of a second) with respect to the recorded music. ▶

The time counter can also be reset to zero at any point, thus indicating positive time from that point on and negative time back from that point.

The memory section enables the user to set times to within a second and use them to automatically control some functions of the tape deck. When using the memory search facility the tape can be automatically rewound or fast forwarded to any of the times stored in memory. This search can be performed in two ways. Firstly, it can be performed by presetting memories 1 to 8 during recording or playback to points of interest. Then the tape can be automatically fast forwarded or rewound to any of these points at a later time. The second way is by using the buttons labelled 0 to 9 to manually key in the desired time, then fast forward or rewind the tape to this time.

Automatic recording and playback of the tape deck can also be implemented using these memory times. The automatic PUNCH IN/PUNCH OUT enables the tape deck to automatically record between two specific memory times on any channel, so if your hot shot guitarist plays a dud note half way through his solo you can set the memory times before and after his moment of embarrassment then play the tape through again. Your guitarist can get his timing right as the tape plays, so when the first memory time occurs and starts the recording he can correct his mistake. The second memory time will stop the recording, thus preserving any musical gems located later in the track.

The PLAYBACK MUTE uses the memory times in the same way as PUNCH IN/PUNCH OUT does. The only difference is that the PLAYBACK MUTE automatically turns off a particular channel (or channels) at the first memory time and turns the channel on again at the next memory time. This feature is ideal for quickly editing a track in the mixdown situation.

For situations where you want to listen critically to a part of the song you have recorded, there is also a REPEAT PLAYBACK facility. This feature plays the tape between two memory times, then rewinds it to the first time, and plays it again.

Summation

After extensively using the MG1212, I was quite impressed with its capabilities and performance. The features of the mixing section which I appreciated, were that it was modular, it used parametric equalisation and had the level meters located right near the faders giving me direct visual feedback of the signal level in each channel.

I was also impressed with the stereo effects capability of the effect bus A; there is the potential for some interesting stereo sound effects. The amount of access given to the user by the abundance of inputs and outputs also pleased me. The location of these jacks on the top panel of the console is a definite plus for home studio owners.

The features of the recording section which I was immediately taken with were the use of dbx on all twelve channels, additional dedicated channels for synchronisation and timing signals, the use of a real time counter with memories and the overall feel of the controls. However, it would have been nice to have a memory for different configurations of mixing desk channels and tape deck tracks.

I would have liked to have seen the inclusion of SMPTE time code compatibility with this system, to permit it to work more closely with digitally controlled studio equipment.

My only reservation about the tape system, is that there is no other source apart from Akai. Users should beware that despite the tape's resemblance to VCR cassettes it uses a different format.

Recording with the MG1212 in my home studio, I used a variety of sound sources including microphones, synthesisers, guitars, drum machines, effects and prerecorded tapes. The recording quality of each of these sound sources on the tape was excellent, largely due to the dbx noise reduction. The parametric equalisation also assisted in achieving a good sound on each channel.

One test I put the MG1212 to was recording a soundtrack for a live performance in the recording hall of the Sydney Opera House. Some passages of music required the full 20 minutes of tape to record them as well as a number of cues for the performers to work from which had to be accurately timed. The memories and the time counter were extremely useful for this.

The master tape for the performance was recorded using dbx noise reduction on the mastering deck as well. The master tape was played back from the mastering deck through a PM2000 mixing desk, driving four speakers and two sub woofers. Every one I consulted about the sound (including Opera House technical staff) was impressed with the overall quality of the tape, as was I.

The combination of a 12-channel mixer with a 14-track recorder equipped with dbx and digital control would undoubtedly exceed the price of the MG1212. The MG1212's low $12,000 (at present) is largely due to everything being integrated in one console. It is a price ideal for people who are recording demos, soundtracks, jingles and for home recording enthusiasts.

For live situations there may not be enough mixing desk channels, but since the mixing desk has inputs directly into the bus as well as two auxiliary inputs it would be possible to cascade another mixing desk anyway.

●

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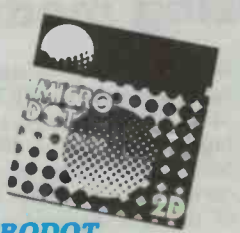

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Y11026	4.9152MHz	HC18	1.40	.90	.75	.60
Y11042	6.144MHz	HC18	1.40	.90	.75	.60
Y11050	8.00MHz	HC18	1.40	.90	.75	.60
Y11055	8.867238MHz	HC18	1.40	.90	.75	.60
Y11070	12.00MHz	HC18	1.40	.90	.75	.60
Y11072	14.318MHz	HC18	1.40	.90	.75	.60
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W12625	25 Way	2.50	32.50	29.00	28.50	25.00
W12626	26 Way	2.60	34.00	32.00	29.00	26.00
W12634	34 Way	2.80	44.00	42.00	39.00	34.00
W12636	36 Way	3.00	49.00	47.00	42.50	36.00
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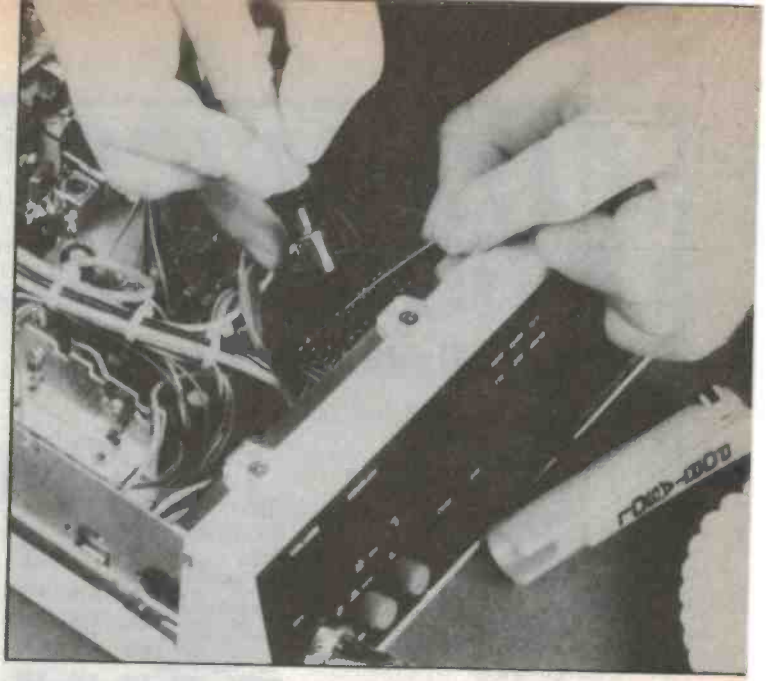


The invention of the Portasol soldering iron by Irish firm Oglesby and Butler has been a remarkable success. The small company was founded by three former Braun engineers just over a year ago. Distributors DRM Industries is selling the pen-sized tool to people in the electrical, mechanical and engineering business, and soon to the home handyman and hobbyist.

The Portasol is a butane gas soldering iron, ignited by a flint ignition in the cap. It has a 10 to 60 watt temperature control and is filled with gas lighter fuel giving 60 minutes of continuous use. The Portasol also comes with three tip sizes each giving 30 hours of use.

The design features also include important safety advantages. When the cap is replaced the gas is automatically switched off, and when the user is finished with the Portasol there is no need to wait for it to cool or find a suitable place to rest it, as the cap is able to withstand up to 250 degrees. There is little waste or leakage since the user can switch on and off at will. The Portasol takes just 20 seconds to reheat. And because it's static free, the Portasol is ideal for use with CMOS and other static-sensitive components.

To find out more call **DRM Industries on (02)997-5522.**

Low cost 20MHz oscilloscope

Parameters has released a low cost Kenwood CS1021 20MHz dual channel oscilloscope. The CS1021 is designed as a general purpose maintenance tool for the factory test laboratory. Optional 10:1 switchable Greenpar oscilloscope probes are available at extra cost.

Full service and 12 month warranty are available from **Parameters Sydney and Melbourne, Centrecourt, 25-27 Paul Street Nth, North Ryde, NSW, (02)888-8777, and 1064 Centre Rd, Oakleigh South, Vic, (03)575-0222.**

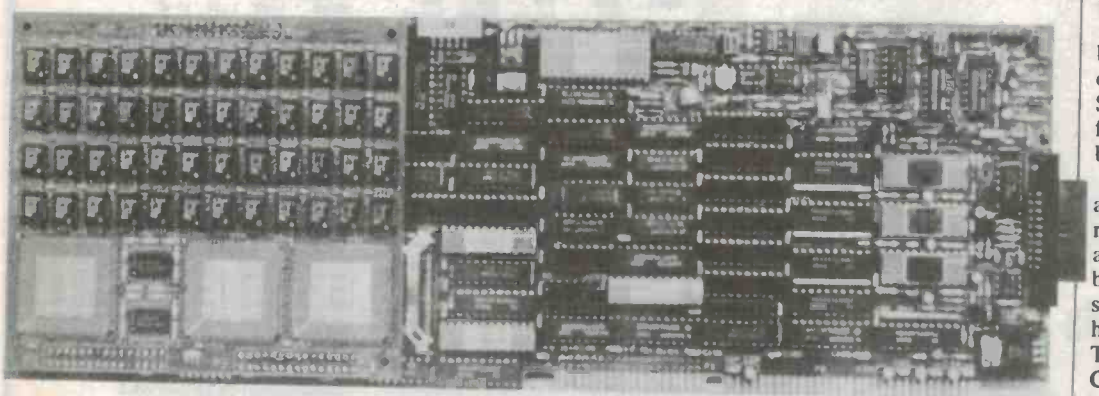
Image processing module

Imaging Technology Inc has announced two new software packages for its Series 100 product line: the ITEX 100 subroutine library, and IMAGE-PRO 100 interactive image processing program.

ITEX 100 is a library of subroutines specifically designed to ease the development of sophisticated image processing applications programs. ITEX 100 exploits the architectural advantages of the Series 100 single-board real time image processor, relieving Series 100 users of the time-consuming task of writing their own driver-level software.

Written in C programming language, ITEX 100 routines provide image processing graphics, and hardware control functionality.

For more information contact **The Dindima Group, PO Box 106, Vermont, Vic 3133. (03)873-4455.**



In-circuit fault locator

The Polar T1000 and T1200 fault locators from Emona are designed to isolate faults on unpowered boards down to individual components. Faulty components can be found on boards containing such devices as transistors, diodes, analog ICs, digital ICs and regulators.

Troubleshooting can usually be done without a full knowledge of the circuit's function. Simple transistor curve tracing features mean that devices can be checked for gain.

The T1000 and T1200 provide a trace of the impedance (current against voltage) between any two points on a circuit board. Both models provide the same features except the T1200 has its own CRT. The lower cost T1000 must be used with a CRO.

For more information contact **Emona Instruments, 720 George St, Sydney 2000.**

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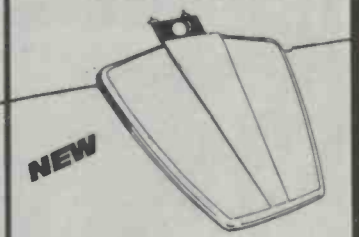

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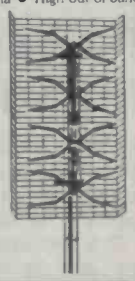

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BRAND NEW 100 page 1986/7 ENGINEERING CATALOGUE OUT NOW SEND LARGE S.A.E.

Intel emulator for 8096 microcontroller

Intel Corp has introduced an enhanced in-circuit emulator for the 8096 (MCS-96) family of microcontrollers.

The new VLSiCE-96P emulator is a comprehensive debugging and test tool used for hardware and software development of prototype systems. The emulator operates on Intel's Intellec Series III and IV development systems as well as on the IBM Personal Computer AT and PC XT.

The VLSiCE-96P emulator uses Intel's bondout technology, a proprietary emulation processor that allows higher functionality, particularly in viewing activity on the internal data bus and gaining access to the special function registers of the microcontroller.

A distinctive feature of the VLSiCE-96P emulator is its ability to read many 8096 write-only registers and write many read-only registers. This allows the user to examine write-only registers, which can be written to in the component only, and to preset (before emulation) read-only registers, which can be read in the component only.

The VLSiCE-96P emulator features precise, real-time (up to 10 MHz), transparent emulation of 8096 components, allowing users to debug time-critical input/output hardware. Software code debugging can take place in the emulator's 64 kilobytes of memory in high-level or assembly language before prototype hardware is available. Integration of hardware and software can begin as soon as modules of code are completed and the microcontroller socket is connected to the prototype.

The VLSiCE-96P emulator provides an assortment of complex break and trace capabilities. With break, the user can stop the emulation process when a given set of conditions occurs. Trace captures the program execution and data flow, including that from internal registers (in memory) for later examination. The emulator allows break and trace qualifiers to be set on execution addresses, data addresses, external and internal RAM values, opcodes and selected program status-word flags.

For further information contact **Intel Corp, Level 6, 200 Pacific Hwy, Crows Nest, NSW 2065. (02)957-2744.**

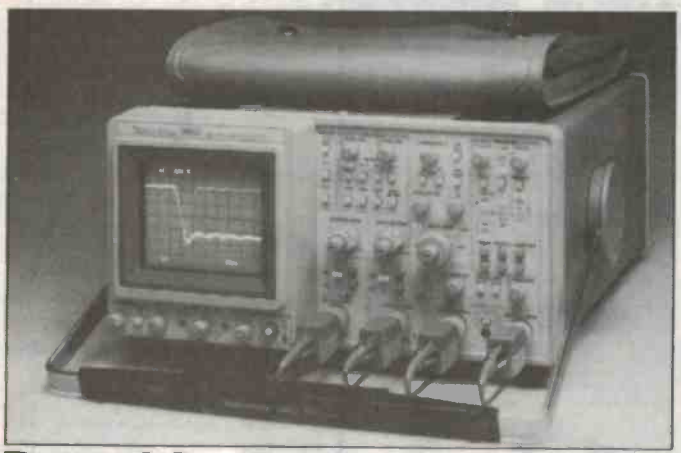
Versatile Eurocard rack

Unirac is the latest release from Betacom NS through Temple Smith Australia. It is a subrack module and card housing package to DIN 41494 standards, accepting all sizes covering the Eurocard standard.

Available in the standard 3U and 6U frame kits, the system will also include divider kits, blank panels, front panel and card kits, four rail modules, frame covers, card handles and module covers.

Betacom promises a very competitive and extensive customising service with reduced lead times.

For information contact **Temple Smith, 252 Graham St, Port Melbourne, Vic 3207.**



Portable scope highlights transients

A new portable oscilloscope from Tektronix, the 2467, has been designed to solve a major problem for digital designers.

The 350MHz scope amplifies the intensity of infrequent transient events, while the intensity of highly repetitive events is limited. This is achieved by incorporating a micro channel plate (MCP) CRT.

According to Tektronix, "infrequent variations in high repetition rate signals cause the most difficult problems in digital system design applications".

With the transient-intensifying capability of the MCP, the 2467 displays rare events superimposed on otherwise much brighter repetitive signals.

System faults caused by infrequent metastability, asynchronous noise, crosstalk, or erratic timing-margin violations are the target of the 2467's transient-intensifying capability.

The new 350MHz 2467 portable oscilloscope with adaptive intensity can display fast, single-shot events at 500ps per division — even in normal room light.

BRIEFS

Liquid crystal display modules

The Oki dot matrix LCD modules from Amtex are compact, lightweight and have low power consumptions. The displays range in size from 16 characters by two lines to 80 characters by 25 lines and come in reflective and back-lit types. For information ask Amtex, 36 Lisbon Street, Fairfield NSW 2165.

Training for all-digital communications

Feedback Instruments' new digital communications system DCS297 is a fundamental trainer illustrating the principles underlying behaviour in most common digital communications circuits. The system is designed on a modular basis and covers such things as digital signalling, noise, clock regeneration, frame synchronisation, and amplitude, frequency and phase shift keying. For more information contact Electrical Equipment Ltd, Unit C, 8 Lyon Park Rd, North Ryde, NSW 2113.

Ten-way lighting switching panel

UK firm NJD Electronics has released a switching unit capable of switching 1500 watts of resistive load or 1000 watts inductive load on each of the 10 channels. Primarily designed to switch lights or lighting control units, the Logic 10 provides either momentary or latching control. For more information contact Musitronics, 19 Ashford Rd, Keswick, SA 5035. (08)297-8932.

Power cable fault locator

The new Telefault P240 low voltage cable fault locator is a battery operated portable device which uses the pulse echo method of locating a fault. It is microprocessor based and can be used normally when connected to energised low voltage power cables. The P240 covers cable lengths up to 3.2km in five ranges. For more information contact Macey's Electrical Accessories, 37 Ryedale Rd, West Ryde, NSW 2114.

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MICROBRIAN TOLD ME

The prospect of non-specialists being able, by personal computer, to process information transmitted from polar-orbiting satellites is a reality. The Melbourne-based company, Microprocessor Applications Pty Ltd, is marketing, nationally and overseas, a fast and accurate system for processing satellite images.

THE FEDERAL MINISTER for Science, Mr Barry Jones, unveiled the new system, called MicroBRIAN, in Melbourne on 27 February. It was developed by the CSIRO Divisions of Water and Land Resources and Wildlife and Rangelands Research from its forerunner, the Barrier Reef Image ANalysis (BRIAN) system.

MicroBRIAN is a flexible and powerful image-analysis package designed for processing data from Landsat (or the National Oceanographic & Atmospheric Administration environmental satellite, NOAA, and the Systeme Probatoire d'Observation de la Terre commercial resources satellite, SPOT).

Its main elements are the IBM personal computer a Vectrix graphics board set and software, and sells for $33,000. More complicated systems that could be assembled to do similar tasks might cost upwards of $200,000 and still require specialists to operate them.

In developing MicroBRIAN, the Division of Water and Land Resources set out to bring satellite-image processing into the office of the end user rather than to the corporation with a large, centralised computer system, aiming to design an intelligent stand-alone work station.

The MicroBRIAN package

Purchasers of the system receive a package comprising the MicroBRIAN software (written in Microsoft Fortran 77) and manuals, serial communications software, and one of three optional hardware configurations.

The hardware offered by MPA Pty Ltd allows the user access to the range of general purpose software available for the IBM personal computer (XT and AT models).

In addition, users can choose from a wide range of modern commercial graphics software which they can implement on the system's Vectrix board. This graphics board set has the capability of producing 512 different colours on the screen at any one time from a palette of 16.8 million.

The hardware options are:

- Vectrix VX/PC board set, colour monitor, inkjet plotter for use with an existing IBM-PC AT;
- IBM-PC XT fitted with the Wavemate 286 board, inkjet plotter and colour monitor;
- an MPA-manufactured computer, based on the Wavemate 286 board, Vectrix VX/PC board, 20 Mbyte hard disk, inkjet plotter and colour monitor.

MicroBRIAN can be expanded to incorporate options such as a range of high quality printers, extra hard disks, cartridge and standard 1600 BPI tape drives a special array processor, optical disk, joystick and full communications interface.

The manuals included in the package detail the steps for carrying out the following applications: basic image processing, shallow water mapping, land cover mapping and monitoring, image rectification and data integration, crop and forest condition mapping, and land erosion mapping.

Data is transferred to the system by means of floppy diskettes or, directly, through serial data lines.

Considerable quantities of data already exist on floppy diskette. The Australian Landsat Station, for example, is to release Landsat data on a floppy disk.

Communications software in the package enables subsets to be transferred between a mainframe (or other PCs) and the MicroBRIAN PC by serial line.

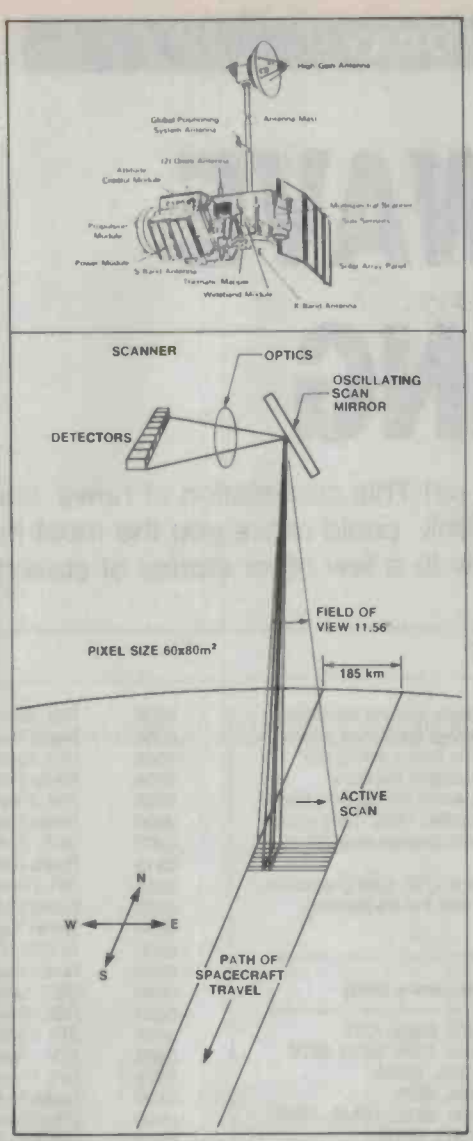
The joint CSIRO/MPA team is working towards the development of a complete workstation environment for the MicroBRIAN system and the capability of communicating faster and more directly with selected mainframes such as VAX and HP.

Use

MicroBRIAN mathematically transforms the digitally recorded measurements of light in the four 'spectral windows' transmitted by Landsat (as it passes over Australia every 16 days) to reflect desired physical properties, eg, water depth and vegetation. It then re-codes them in colour to form graphic maps.

It is a handy tool for monitoring land use such as the development of rice crops. In this respect, it would be a most useful and relatively inexpensive acquisition for agricultural co-operatives in countries like China (which receive Landsat images). In fact, a number of Chinese institutions have

Hazardous volcanic ash from the 1982 eruption of Mt Galunggung, West Java monitored by the NOAA satellite. NOAA satellite images can now be processed by MicroBRIAN (Photograph by courtesy COSSA).



Landsat 5 and its scanning path. The satellite digitises the collected data before transmitting it to Earth for processing by systems such as MicroBRIAN

expressed interest in using the system for agriculture, land cover and erosion mapping.

The earlier BRIAN system was the outcome of a collaborative project between CSIRO, the Great Barrier Reef Marine Park Authority and the Australian Survey Office (ASO) for application in shallow water mapping and reef survey in many parts of the world.

The Authority's chairman, Mr Graeme Kelleher, believes BRIAN has saved about $21 million and 10 years effort on pre-existing techniques for mapping the reef. The Authority realised that BRIAN could be used for mapping the entire region at international cartographic standards of accuracy (1:250,000 scale). Subsequently, maps covering the entire Great Barrier Reef (348,000 km^2) were completed by the ASO at a cost of around $250,000.

The system has also attracted interest from government authorities in Indonesia, the Philippines, Malaysia, Thailand, the Republic of the Maldives, Fiji and the Solomon Islands.

Representatives of a number of Asian and Pacific countries who attended international training courses on remote sensing at the Australian Institute of Marine Science in Townsville last August, and at the University of the South Pacific in Fiji last month, had the opportunity to use MicroBRIAN and were impressed by its versatility and speed.

The Division is continuing with further work on MicroBRIAN and customers can expect to benefit from any new software developments.

For more information contact **Dr David Jupp, CSIRO Division of Water and Land Resources, GPO Box 1666, Canberra, ACT 2601. Phone (062)46-4911. Or Mr Hal Shuster, Microprocessor Applications Pty Ltd, 48 Rutland Road, Box Hill, Vic 3128. Phone (03)890-0277.** ●

ADVERTISERS' INDEX

The transmitting site at Sackville, New Brunswick, which houses the Radio Canada transmitters and was first built in 1945.

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Arthur Cushen

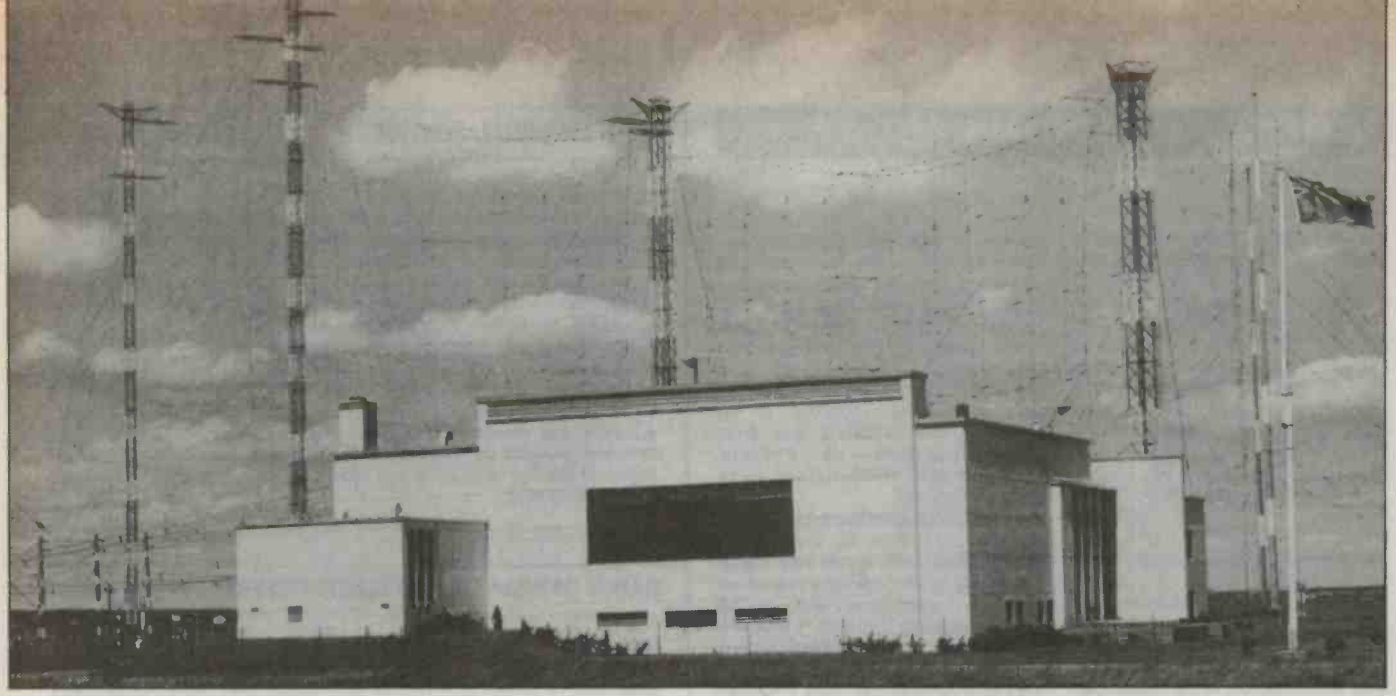
Have we got news for you! Yes sir! This compilation of news services available to the shortwave listener around the clock could make you the most informed person on the block. And for the really alert, we throw in a few other stories of stations and changes.

YOUR INTERNATIONAL NEWS SERVICE

In the April issue of this year we featured English News Around the Clock from many countries which carry broadcasts on the high frequency bands. This review of schedules mainly highlights the signals heard during the daylight and early evening hours when listening in eastern Australia (2000-1200 UTC). The frequencies listed are those which should give best reception in Australia and New Zealand up to November, 1986. They should remain relatively stable, although in September a time change may affect some broadcasts from European countries.

Times quoted in this selection of World News are in UTC (GMT) which is 10 hours behind Eastern Australian Standard Time and the frequencies listed are in kilohertz.

Time (UTC)	Source	Frequency (kHz)
2000	Radio Australia, Melbourne	6060, 6080, 7215
2000	BBC, London	7145, 7325, 9410, 9570
2000	RCI, Canada	11945, 15325
2000	Radio Damascus, Syria	7455, 9670
2000	IBA, Israel	9009, 9815, 11605, 12080
2000	RNZ, New Zealand	11780, 15150
2000	VOA, Washington	6040, 9760, 11760
2030	Radio Nederland, Holland	9715, 9895, 11740
2050	Radio Havana, Cuba	11720, 11790, 15300
2100	Radio Australia, Melbourne	9580, 15160, 15240
2100	DW, West Germany	7130, 9765
2100	Radio Moscow, USSR	15130, 15155, 15385
2115	Radio Cairo, Egypt	9805
2200	BBC, London	6195, 9410, 9570
2200	RCI, Canada	9755
2200	AIR, India	9595, 9910
2200	VOFC, Taiwan	11855, 15370
2200	VOT, Turkey	9560, 9730
2200	VOA, Washington	11760, 15185, 17740
2300	Radio Australia, Melbourne	15160, 15240
2300	Radio Moscow, USSR	15130, 15455, 17700
0000	BBC, London	9410, 9915
0000	AFRTS, Los Angeles	11790, 17765
0000	VOA, Washington	11760, 15185, 17740
0000	RNZ, New Zealand	11780, 15150
0100	RAE, Argentina	9690, 11710
0100	Radio Prague, Czechoslovakia	9630, 9740, 11990
0100	DW, West Germany	9545, 11785
0100	Radio Moscow, USSR	12050, 13635, 15140
0130	Radio Nederland, Holland	9895
0200	AFRTS, Los Angeles	11790, 17765
0200	Radio Australia, Melbourne	15240, 17795
0200	BBC, London	9410, 9915
0200	RCI, Canada	5960, 9755
0200	Radio Korea, Seoul	11810, 15575
0200	SRI, Switzerland	9725, 9885, 12035
0215	Radio Cairo, Egypt	9475, 9675
0230	RSI, Sweden	9695
0300	Radio Baghdad, Iraq	9565, 11750
0300	RCI, Canada	5960, 9755
0300	Radio Prague, Czechoslovakia	9630, 9740, 11990
0300	DW, West Germany	9545, 9640
0300	Radio Budapest, Hungary	9835, 12000
0300	VOT, Turkey	9560, 9730
0315	Radio Cairo, Egypt	9475, 9675
0315	RFI, France	9535, 9790, 9800
0330	Radio Dubai, UAE	11730, 11940
0350	Italian Radio, Rome	9710, 11905, 15330
0400	AFRTS, Los Angeles	11790, 17765
0400	Radio Australia, Melbourne	15240, 17795
0400	BBC, London	5975, 9410
0400	RSI, Sweden	9665, 9695
0400	SRI, Switzerland	9725, 9885, 12035
0400	VOA, Washington	6040, 7200, 9670
0415	RFI, France	9550, 9790, 9800
0430	Radio Nederland, Holland	9895
0500	DW, West Germany	5960, 6120, 9690
0500	IBA, Israel	7410, 9009, 9435
0500	REE, Spain	6055, 9630
0515	RCI, Canada	7295, 9750, 11840
0530	Radio Dubai, UAE	15435, 17775, 17830
0600	BBC, London	7150, 9640, 11955
0600	VOA, Washington	6040, 7200, 7325
0600	Radio Moscow, USSR	15130, 15385, 17730
0600	RNZ, New Zealand	9620, 11780
0630	Radio Polonia, Poland	6135, 7270, 9675
0645	Radio Bucharest, Romania	11940, 15250
0700	AFRTS, Los Angeles	6030, 11790
0700	Radio Japan, Tokyo	11955, 15230
0730	Radio Prague, Czechoslovakia	11855, 17840, 21705
0730	Radio Nederland, Holland	9630, 9715
0730	SRI, Switzerland	6165, 9535
0800	BBC, London	9410, 9510, 9640
0800	BRT, Brussels	9880, 15515
0800	Radio Pyongyang, North Korea	11830, 13650
0800	VOM, Malaysia	15295
0830	Radio Prague, Czechoslovakia	11855, 17840, 21705
0830	Radio Nederland, Holland	9715
0830	ORF, Austria	11840, 11945, 15410
0830	FEBC, Philippines	11850, 15350
0830	SRI, Switzerland	9560, 15305, 15570
0830	FBC, Finland	15115
0900	Radio Australia, Melbourne	6040, 9655
0900	BBC, London	6195, 15070, 15280
0900	DW, West Germany	15185, 17715
0900	Radio Japan, Tokyo	11875, 15235
0900	Radio Moscow, USSR	15130, 17730
0930	Radio Beijing, China	9700, 11755, 15440
0930	RSI, Sweden	15390



1000	AFRTS, Los Angeles	9530, 9590
1000	AIR, India	15335, 17875
1000	SRI, Switzerland	15305, 15570, 17830
1000	VOV, Vietnam	9840, 12035
1030	Radio Nederland, Holland	6020, 9650
1030	SLBC, Sri Lanka	11835, 15120, 17850
1100	Radio Australia, Melbourne	6060, 7215, 9580
1100	BBC, London	6195, 11750, 15070
1100	VOA, Washington	6110, 11715, 15425
1115	Radio Tehran, Iran	11790, 15084
1200	RCI, Canada	11855, 15440
1200	Radio Damascus, Syria	15345
1200	RNZ, New Zealand	6100, 9620
1200	Radio Tashkent, USSR	7340, 9650, 9715
1200	VOA, Washington	6110, 9760, 11715

ABBREVIATIONS

ABC	Australian Broadcasting Corporation
AFRTS	US Armed Forces Radio and Television Service, Arlington, Virginia, USA
AIR	All India Radio
BBC	British Broadcasting Corporation, World Service
BRT	Belgium Radio and Television Overseas Service (Belgian Radio)
DW	Deutsche Welle, Cologne, GFR (West Germany); also known as Voice of Germany
FBC	Finnish Broadcasting Company (Radio Finland)
FEBC	Far East Broadcasting Company, Manila, Philippines
HCJB	Voice of The Andes, Quito, Ecuador
IBA	Israel Broadcasting Authority
NHK	Radio Japan
ORF	Österreichischer Rundfunk (Austrian Radio)
PNG NBC	National Broadcasting Commission, Papua New Guinea (National Radio)
RBI	Radio Berlin International, GDR (East Germany)
RCI	Radio Canada International
REE	Radio Exterior de Espana (Spanish Foreign Radio)
RFI	Radio France International
RNZ	Radio New Zealand
RSI	Radio Sweden International
SIBC	Solomon Islands Broadcasting Corporation
SLBC	Sri Lanka Broadcasting Corporation
SRI	Swiss Radio International
VOA	Voice of America, Washington DC, USA
VOFC	Voice of Free China, Taiwan
VOG	Voice of Greece
VOI	Voice of Indonesia
VOM	Voice of Malaysia
VON	Voice of Nigeria
VOT	Voice of Turkey
VOV	Voice of Vietnam, Hanoi

KILOHERTZ COMMENT

BRAZIL: An unexpected newcomer to the use of Daylight Time in the Southern Hemisphere is Brazil, which commenced Daylight Time on 2 November last and continued until 28 February 1986. According to a report in a BBC World Information Bulletin, the adjustment sought to reduce the consumption of electric power at sunset and prevent the powerlines from being overloaded during peak consumption times.

CHINA: Radio Beijing, with transmission to Australia, has introduced the new frequency of 15440 kHz for transmissions in English at 0830-0925 and 0930-1025 UTC. The second broadcast is a repeat and both transmissions are available on the additional frequencies of 9700 and 11755 kHz.

DUBAI: The UAE Radio at Dubai has replaced 9565kHz with 11940 for its English broadcast from 0330 UTC. The station opens with a broadcast in Arabic at 0230 UTC and broadcasts are also carried on the alternative frequency of 11730kHz.

FRENCH GUYANA: An agreement is in force between France and China for both countries to use one another's facilities to improve their reception in various parts of the world. Radio France International, with transmitters in French Guyana is broadcasting in English to North America at 0300 UTC on 11970, 11980, 15280 and 15445kHz. This is repeated at 0400 UTC to the North American west coast on 11980, 15280kHz, and at 0500 UTC on 9565kHz. The broadcasts of Radio France International are carried on Radio Beijing transmitters, 0100-0130 UTC when using 15450kHz in English to Asia.

Radio France International has announced plans to build a relay transmitter in Sri Lanka which will consist of three 500kW transmitters. It was reported earlier that Radio France International and Deutsche Welle would operate jointly from Trincomalee, but Radio France has decided to build its own relay base in another part of Sri Lanka. The exchange broadcasts between Radio Beijing and Radio France International are on a trial basis only, according to "Media Network" from Radio Nederland.

INDIA: All India Radio broadcasting from Delhi has been heard on 15335kHz in English to Australia 1000-1100 UTC. Two other frequencies, 11810kHz and 17875kHz also carry the transmission to this area, while additional frequencies are used to beam to North East Asia.

IRAN: Radio Iran has signed an agreement for the purchase of ten 500kW shortwave transmitters with a Swiss company. The acquisition will be over five years and the transmitters will be installed in three different areas of Iran. According to the BBC, "several far away places and all countries in the region will be covered by shortwave transmissions" from Radio Iran. The station broadcasts in English at 1930 UTC on 9022 and 9765kH.

IRAQ: Radio Baghdad is using 11750kHz for its broadcast in English 0300-0500 UTC. The alternative frequency of 9565kHz is also well received.

NEW ZEALAND: Radio New Zealand broadcasts to the Pacific at 1830-2115 UTC on 11780kHz, 15150kHz; 2345-0145 UTC on 15150kHz; 0345-0730 UTC on 11780kHz; and 0145-0330 UTC on 15150kHz (Saturday only). To Australia and Papua New Guinea broadcasts are 2345-0145 UTC on 11780kHz; 0345-0730 UTC on 9620kHz; 1030-1215 UTC on 6100kHz, 9620kHz; and 0145-0330 UTC on 11780kHz (Saturday only).

The broadcast includes "Good Morning New Zealand" Sunday/Thursday 1900-2100 UTC with 'Morning Report' 1900-2000 UTC.

NORWAY: Radio Norway broadcasts in Australia at 1000-1045 UTC on 9590, 15180 and 17715 kHz. The programmes are in Norwegian but on Sunday there is a 30 minute session in English titled 'Norway Today'. A further service to Australia at 1200-1245 UTC on 15165 kHz is in Norwegian. ▶

COMMUNICATIONS TODAY

SWEDEN: Radio Sweden International, Stockholm is using the frequency 11845kHz in Swedish at 0330 UTC, and English at 0400 UTC. The service to Australia at 0930 UTC in English and 1000 UTC in Swedish on 15390kHz encounters interference from the BBC in Hungarian on Sunday 0930-1030 UTC, and on other days from 1000 UTC onwards.

TURKEY: The Voice of Turkey, Ankara now broadcasts in English: 2100-2150 UTC, 2300-2350 UTC on 6105kHz, 7215kHz, 9560kHz, 9730kHz; 0300-0350 UTC on 9560kHz, 9730kHz with 9560kHz giving the best reception.

USA: The Voice of America with broadcasts originating from a studio in Washington is transmitting its programmes to the Far East mainly from the transmitting site in the Philippines. The service to Oceania has been moved to other frequencies for primary reception, and the secondary coverage provides some good signals. The broadcast 2200-0100 UTC is now on 15305kHz and 17740kHz with coverage also available on 9770kHz, 11760kHz, 15185 and 15290kHz. The evening service for this area from 1100UTC is on 6100kHz and 11715kHz and additional frequencies of 9760kHz, 15160kHz and 15425kHz also carry this transmission.

This item was contributed by Arthur Cushen, 212 Earn St, Invercargill, New Zealand, who would be pleased to supply additional information on medium and shortwave listening. All times quoted at UTC (GMT) which is 10 hours behind Australian Eastern Standard Time; areas observing Daylight Time should add a further hour to these schedules. ●

This collection of verification cards from Canada, includes one commemorating the earliest CBC broadcast of the regional service from Montreal in 1941, and verification cards from CBC stations in Vancouver and St John's, as well as a variety of Radio Canada cards.

NEW EXTERNAL SERVICES

Two African countries, Liberia and Zimbabwe, have announced plans for external services. According to a BBC report the Zimbabwe Broadcasting Corporation plans to beam for three to four hours a day to the Far East, Africa and Europe, the Caribbean and South America. The project is expected to cost $US9.5 million. ZBC has aleady applied to the United Nations controlling agency, the International Frequency Registration Board, in Geneva, for a frequency allocation.

Liberia is planning an external service which is being paid for by the working population and a BBC report indicates that the head of state recently forwarded a cheque of $US34,000 to the Liberia Broadcasting System. The money was collected from the Forestry Development Authority and represented a 25% salary deduction. This is the third donation received by the Liberia Broadcasting System from workers' organisations, an attempt to put Liberia on the map in the shortwave broadcasting field.

RADIO CANADA REFURBISHES TRANSMITTERS

Radio Canada International, which commenced operation in December 1945 with three 50kW transmitters has recently replaced these with three 100kW transmitters. It has also added five 250kW transmitters over the period.

The new replacement transmitters are used mainly in the Northern Canada service from Montreal. Radio Canada also used the facilities of the BBC at Daventry for relaying programmes to Eastern Europe which too have been upgraded with the installation of three new 50kW transmitters.

Radio Canada uses its own Sackville transmitters as well as those at Daventry to cover Europe and Africa with daily broadcasts in French and English, originating from the Montreal studios.

When it opened, Radio Canada was unique in that the transmitting site at Sackville, New Brunswick, was some 960km from the Montreal studios. But the distance from the studio site has proved effective as the ground area in marshy land gave Radio Canada an excellent signal particularly to Europe and Latin America.

Here in the South Pacific, Radio Canada commenced a weekly service on 6 July, 1947 broadcasting for more than 20 years, more frequently towards the end of the period. Since discontinuing this direct service, Radio Canada provides us with alternative listening in the North American service, and in the morning service to Africa in French and English (heard during the afternoon in this area). From its Vancouver studios Radio Canada has used Teleglobe Canada satellite facilities to beam "Canada This Week" in Japanese and "Canadian Journal" from Montreal for rebroadcast on Tokyo's Nihon Shortwave Broadcasting and Hong Kong Commercial Radio respectively.

Background to Radio Canada

The international service of the Canadian Broadcasting Corporation is operated on behalf of the people of Canada and is financed by annual government grants.

The service was officially inaugurated on 25 February, 1945, and the writer was appointed a technical monitor who could provide weekly information to Montreal about reception of Radio Canada in the South Pacific. This monitor has also conducted monthly band surveys of selected shortwave bands for frequency occupancy information, so that Radio Canada is aware of the other users of the shortwave channels at the time it is broadcasting to North America.

The first programmes broadcast by the station were in English and French aimed primarily at the members of Canada's armed forces then in Europe. Later other languages were added and the scope of the service broadened to give shortwave listeners around the world a picture of life in Canada and Canada's role in world affairs. The shortwave transmitters at Sackville are also used to broadcast news and other programmes to people living in Canada's Far North, beyond the signal of the domestic networks.

Broadcasts from Montreal to North America also provide secondary coverage to the South Pacific with transmissions in English 0300-0330 UTC on 5960 and 9755kHz. The services to Africa in French 0500 UTC and 0530 UTC and English 0515 UTC and 0545 UTC Monday to Friday are broadcast on 6140, 7275, 9750, 11840 and 15180kHz. Broadcasts on Saturday 2130-2200 UTC include "Shortwave Listeners Digest" which is heard on 11945, 11960, 15150, 15325 and 17820kHz.

The "Shortwave Listeners Digest" is also heard on Monday in the 0300 UTC service conducted by Ian McFarland and includes contributions on various aspects of radio listening. The address of Radio Canada International is PO Box 6000, Montreal, Quebec, H2L 4S5, Canada.

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ETI READER SERVICE 23

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ETI READER SERVICE 25

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PHILIPS

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RESIN MOULDED TRIMMING POTENTIOMETERS

NEW

VTL

Manufactured in Japan these miniature trimming potentiometers offer a very low cost alternative to cermet film trimpots.

The moulded construction offers greater resistance to solder heat and flux interaction than normal types of trimpot.

This makes them ideal for automatic insertion, wave soldering and automatic adjustment and cleaning processes in accordance with the latest assembly techniques.

- ★ Pin spacing is based on the 5mm industry standard grid.
- ★ Supplied in plastic tubes for ease of handling and storage.
- ★ Volume delivery from stock in values ranging from 200 OHMS to 1 MEGOHM.

TECHNICAL INFORMATION AVAILABLE ON REQUEST.

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ETI READER SERVICE 26

Megabit EPROM

Intel is trying to ease the adoption by designers of higher density EPROMs by offering three architectures for its new 1Mb part.

The chips are intended for customers who need a clear upgrade to the higher density, for those who do not want to modify their existing designs or for those working on new designs that can take advantage of advanced 16- and 32-bit processors.

The three EPROMs consist of the 27010, housed in a 32-pin package and organised as 128K bytes by 8 bits; the 27011, which comes in a 28-pin package and is configured as eight pages of 16K bytes by 8 bits; and the 27210, housed in a 40-pin package, organised as 64K words by 16 bits each.

The 32-pin 27010 is suitable for designers who are concerned about an upgrade path from the lower-density EPROMs to ones with high densities. The lower 28 pins are directly compatible with the existing Jedec 28-pin configuration.

The 28-pin 27011 page-addressed memory is a direct replacement for the byte-wide 27513, a 512K EPROM.

The third EPROM, the 40-pin 27210 is designed to optimise the capabilities of advanced 16 and 32-bit microprocessors.

For further information contact **Total Electronics, 9 Harker Street, Burwood, Vic 3225.**

Philips zero defects warranty for ICs

The Zero Defects Warranty implemented by the Philips affiliate Signetics last August has been extended from March this year to cover all ICs produced worldwide by the Philips group of companies. Under the terms of the warranty a customer who finds a single defect in a batch will be able to return the whole batch to Philips for rescreening or replacement.

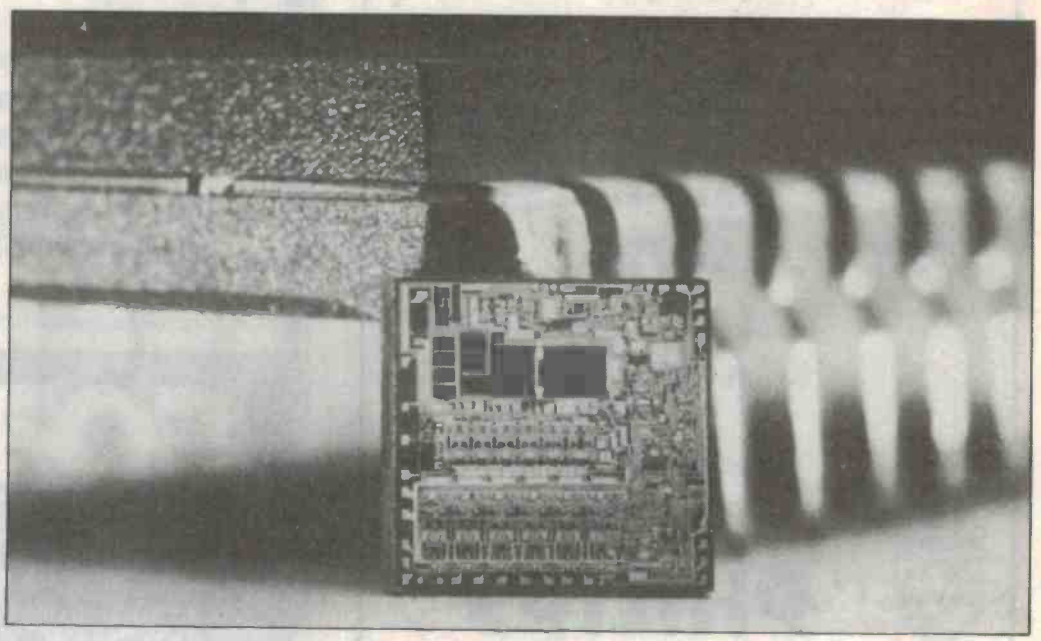
The warranty applies immediately to all standard function ICs manufactured after the implementation date. Customers have a 30 day period to report a defective batch. The warranty covers also application specific ICs (ASICs), however cooperation is required with the customer to develop correct testing procedures for each application.

Philips began a major quality improvement program in 1981, starting with the components group, to eliminate defects by designing them out of manufacturing and administrative operations. At that time, Philips claims the IC industry average outgoing electrical defect rate ran at about 10,000 parts per million; by 1985 the impact of its program was such that it could introduce the Zero Defects Warranty. This contrasts with the Japanese claim in 1981 that manufacturers had achieved a one defective part per million.

Nevertheless the Philips program is now at the point where continued improvement depends increasingly on customer interaction and cooperation. The ongoing collection of field data (and subsequent analysis) and cooperation with major customers are essential to the company's ultimate goal of the Zero Defects Warranty.

To stimulate industry-wide interest, Philips will launch an international IC promotional compaign from mid year. The campaign will centre on the use of a graphically-striking "0" symbol accompanied by the words "one standard, Zero Defects — from people committed to quality". A similar campaign has already been running in USA and in international magazines under the Signetics name.

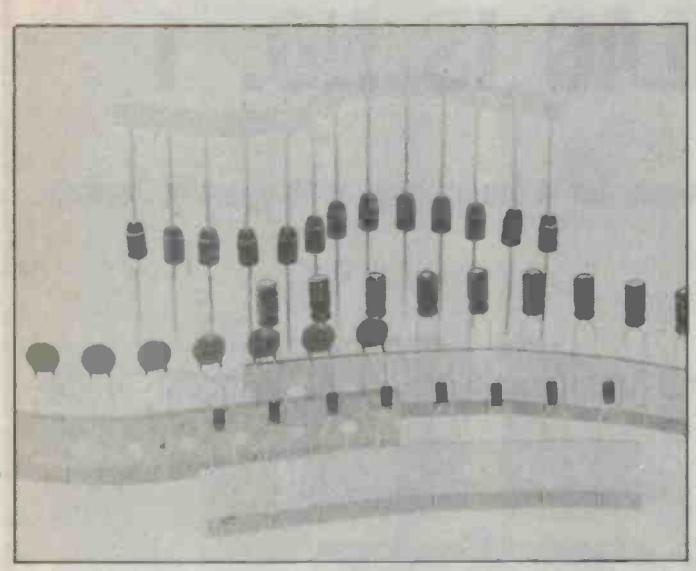
12-bit A/D converter



For the first time, the industry-standard 574 12-bit analogue-to-digital converter (ADC) is available on a single-chip.

It's the industry's first complete 12-bit ADC to include a microprocessor interface, clock and reference on one chip. The monolithic AD574A is a drop-in replacement for its two-chip predecessor, retaining performance specifications and pinout. Because of its high resolution and low price, the ADC is used in data acquisition systems for process control and test applications.

For more information contact **Parameters, 25 Paul St Nth, North Ryde, NSW 2113.**



Auto insertion components

Soanar now supplies pcb components on bandolier tape from stock.

Radial-lead capacitors will be supplied on 5mm lead-spacing tape in 'ammo' packs. Ammo packs have been chosen because of the ease in selecting the correct polarity of electrolytic capacitors and other polarised components.

Tantalum, monolithic ceramic, disc ceramic and polyester capacitors will all be supplied on radial tape.

Rectifier and signal diodes will normally be supplied on axial tape. However the radial lead format is also available for these components but on an indent basis.

For more information contact **Soanar, 30 Lexton Road, Box Hill, Vic 3128. (03)895-0222.**

Last from Motorola

Motorola has announced it is now taking the last orders on a large number of older data conversion circuits. The company is phasing out these components as part of a strategic shift of resources to its new line of video-speed data conversion devices based on its MOSAIC process.

The following parts will be phased out over the next two years.

PRODUCT	DESCRIPTION	ORDERS BY
MC1405	A/D SUBSYSTEM	31/ 3/86
MC1550G	RF/IF AMPLIFIER	31/12/86
MC3510	10-BIT DAC	31/12/86
MC3410,C	10-BIT DAC	31/12/86
MC3512	12-BIT DAC	31/12/86
MC3412	12-BIT DAC	31/12/86
MC6890	8-BIT MPU DAC	31/12/86
MC10315L	7-BIT ADC	31/12/86
MC10317L	7-BIT ADC	31/12/86
MC1506L	6-BIT MULT DAC	31/12/86
MC1406L	6-BIT MULT DAC	31/12/86
AD562	12-BIT DAC	30/ 6/86
AD563	12-BIT DAC	30/ 6/86

BRIEFS

Two colour LED key switches

Alps Electric Co has increased its range of TACT switches to include a built-in 2-colour (red and green) LED. The KEP series switch is 8 x 7 mm, dustproof, featuring a soft 'click', and comes 'snap-in' for direct pc board mounting. The switch is distributed by Autotronics, 1/3 Marshall Rd, Kirrawee, NSW 2232. (02)521-3711.

CMOS real time clock

The ICM7170 is a CMOS real time clock with automatic switchover to battery backup circuitry on-chip. It features a 128 year calendar which automatically compensates for leap years. It is only necessary for the user to enter the date and time. This clock from Intersil is available from R&D Electronics in Sydney and Melbourne.

Miniature trimmer capacitor

Murata has introduced a new compact range of trimmer capacitors, the TZ Series Trimcap. These caps are less than 5 mm in height with axle-less contraction and recommended by Murata "for excellent linear TV and capacitance drift". For further information contact IRH Components, 32 Parramatta Rd, Lidcombe, NSW 2141.

Jap semiconductor data manuals

Imark has copies of the 1985 CQ Data Manuals on transistors, transistor substitution, diodes, FETs, op-amps, linear ICs, TTL ICs, CMOS ICs and memory ICs. Other manuals in the range include the "Power & Industrial Manual" and "Interface IC/Device Manual". Imark is at 167 Roden St, West Melbourne, Vic 3003. (03)329-5433.

EEPROM with floating gate

The first model Siemens EEPROM which can be operated from a 5 V supply is now available. The SDA 2506 with 1024-bit (128 x 8) non-volatile memory can store data for over a decade, operating at low loss with a current draw below 5 mA. Siemens is at 544 Church St, Richmond, Vic 3121. (03)420-7204.

Motorola SMD

Motorola is offering 10 new bipolar and three new TMOS power MOSFET's. These new transistors come in a DPAK, the first power package designed for surface-mount applications. The DPAK offers a reduction in the size of the printed circuit board, the use of both sides of the pcb, the elimination of pcb through-holes and the ability to reliably handle power levels of over 1 watt.

SMD guide

A booklet entitled *A Basic Guide to Surface Mounting of Electronic Components* is available free from National Semiconductor. The booklet defines the types of surface-mount packaging and covers such topics as wave soldering, solder paste reflow, mixing surface-mount and insertion-mount, surface-mounting on both sides of a pc board, pc board design for surface-mounting and rework of surface-mounted components. It also includes an appendix with dimensions of surface-mount package types available and a directory of companies supplying surface mount process equipment, supplies and services.

SUPER II VZ200 MODIFICATION

Matthew Sorell

The VZ200 computer was one of the earliest of the really cheap, low performance computers on the market and as such it gained a loyal following. Over time, however, it's started to look a little too down-market. Its memory is ridiculously small, its keyboard is horrible and it lacks a number of features other computer users take for granted.

THERE ARE TWO solutions to this problem. One is to throw it away and buy a Microbee. The other is to be a bit more adventurous and see what can be done with the old carcass. In this project we show you how to increase the memory, fit a new keyboard, make it run faster, upgrade the power supply and provide a reset facility. You may carry out any or all of these modifications, as time, experience and inclination allow. It's called the Super II, for want of a better name.

Keyboard

The keyboard used in the prototype was a Digitran Golden Touch keyboard from Dick Smith. It was dirt cheap, as the keys had been coated with solder mask. Having cleaned and tinned the connections, it was as good as new. Another suitable keyboard is the Microbee.

If a numeric keypad is available, then this too can be connected, by means of the extra switches in parallel with the ones on the keyboard. On the prototype, the keypad included the digits 0 to 9, a period (.) and a RETURN key. If switches are not marked correctly, (eg, with graphic symbols), then these can be simply re-marked.

To start, remove any interface board from the keyboard. If the keys are a part of this board simply disable the interface circuit by cutting any tracks to it. By cutting tracks (on a pcb-based keyboard) and linking keys together, arrange the keys to form the matrix shown in Figure 1. With a keyboard using separate keys (eg, the Microbee), simply use wires to hook the keys together.

Extra keys, such as SHIFT–LOCK, LINE FEED or ESCAPE, should be left unconnected or removed if possible. On the prototype, only 58 of the 101 keys were used, the rest were removed and the holes covered with black insulation tape.

Additional keys such as a numeric keypad, can be wired in parallel with the key they correspond to. Shift keys should be wired in parallel.

Most keys will not be correctly marked for the VZ200. If this is the case, use Liquid Paper or similar to cover over the incorrect mark, and also over blank areas where a marking is required. Mark the key required by using a black pen or thin permanent texta.

If the keyboard is for the VZ200, then invert the colours or the graphics symbols on the keys (ie, black to white or vice versa). On the VZ300, the symbols have been corrected to the BASIC ROM. The colours can be marked on the keys 1 to 8 using the appropriate coloured permanent marker.

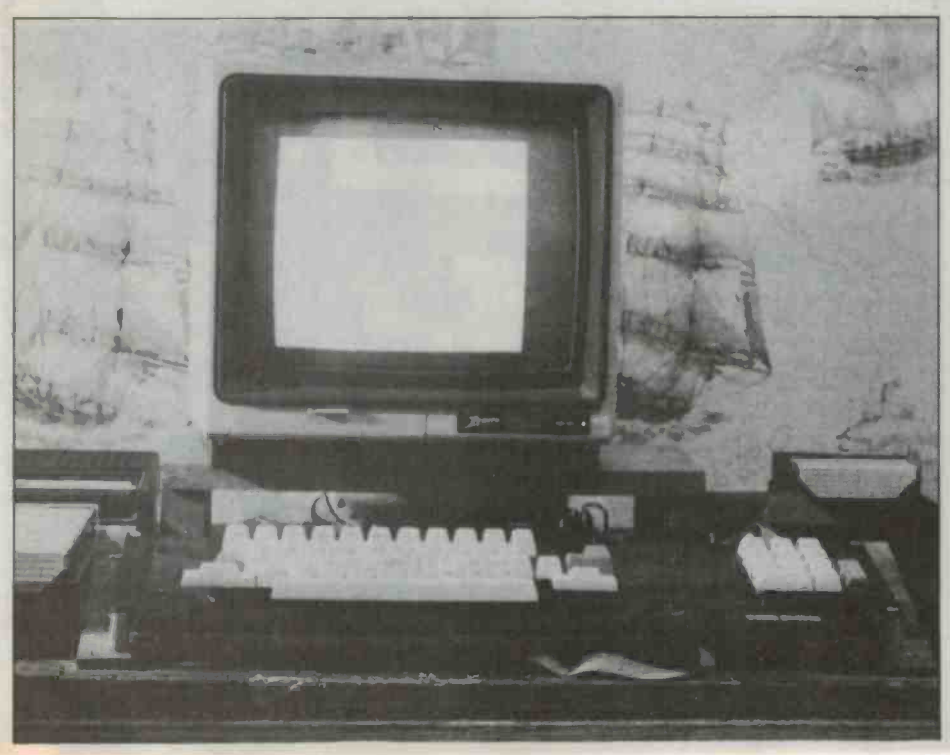
Control keys can be marked. On the prototype, only the control words for keys 1 to 8 were marked (ie, CSAVE/ CLOAD/ CRUN/ VERIFY/ LIST/ RUN/ END/ NEW). In addition, cursor control arrows, INSERT, RUBOUT, BREAK and INVERSE should be marked. Other keys may be marked, depending on your requirements.

When all the marking is complete, gently wipe each key with clear nail-polish. This protects the marking from being rubbed off, and provides a nice, silky finish to each key, if it is applied correctly!

Now that the keyboard is to your satisfaction, decide on the connector to be used. The prototype used a 16-pin DIP plug and a 16-pin IC socket. This is reasonably flat, and so can be mounted on the underside of the computer, but the IC socket is extremely hard to keep secure. Alternatively, a 15-pin D-connector can be mounted on the top of the computer (making sure it will fit when the lid is closed!), without the power supply connections.

Open the computer by removing the six back screws. Remove the four screws holding down the main pcb. Locate the 16 connections to the keyboard. Solder a wire on the track side of the pcb to each pad (see Figure 2). If +5V is required rather than the LED power signal, this can be obtained nearby. If no power indicator is required, the last two pads can be left without the extra wires.

Wire these new wires to the connector as shown in Figure 2. If a 16-pin DIP socket is used, cut a hole to suit in the bottom of the case, and use whatever you can to keep it there (Araldite, silicone rubber, plastic cement, etc). A 15-pin D connector can be mounted on the top of the case behind the "200" in the insignia. Make sure that the wire used is long enough, so that the case can be closed easily. In order to minimise wear, silicone rubber was smeared over the connections. ▶



PARTS LIST — ETI-687

MEMORY BOARD

Capacitors:
- C1 ..... 47µ, 10V electrolytic
- C2-6 ..... 100n ceramic or similar

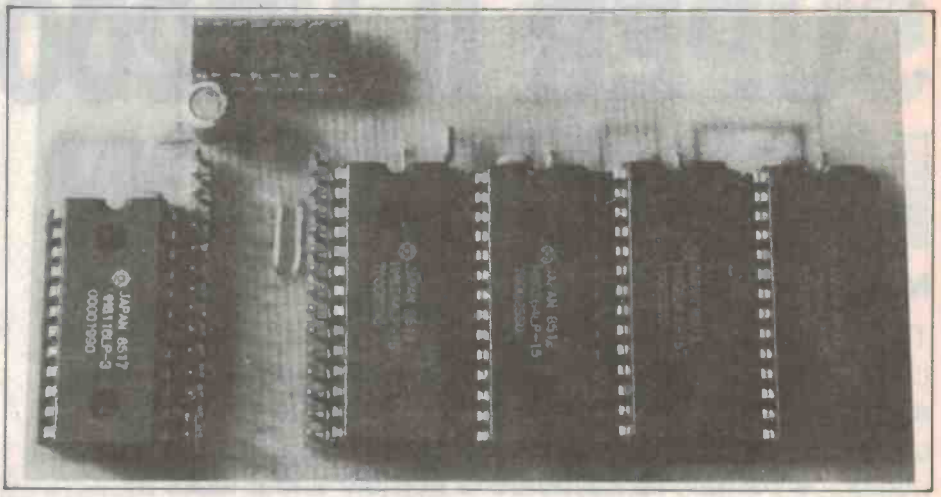
Semiconductors
- IC1 ..... 74LS138
- IC2 6116
- IC3-6 6264

Plugs and sockets:
- SK1 ..... 16-pin IC socket (for IC1)
- SK2 ..... 24-pin IC socket (for IC2)
- SK3-6 ..... 28-pin IC sockets (for IC3-6)
- SK7,8 ..... 15-pin Utilux socket (for main pcb)
- SK9-12 ..... 15-pin Utilux plugs (for both RAM boards)

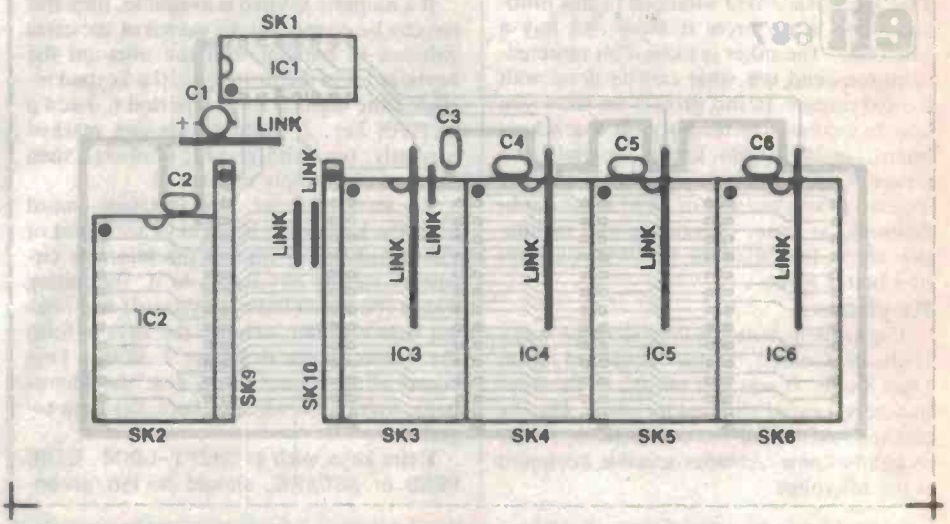
Miscellaneous:
ETI-687 pc board; wire.

Price estimate: $60

KEYBOARD
Keyboard to suit: see text;
Socket and plug top suit: see text;
Wire;
Silicone rubber (optional);
Liquid Paper;
Black pen or thin permanent texta;
Coloured textas — green, yellow, blue, red, buff, cyan, magenta and orange;
Clear nail polish.



Memory board.



Make up a cable from the keyboard, connecting the signals as shown in Figure 1 (ie, D0-D5 and A0-A7) to a suitable 15- or 16-pin connector. An LED may be connected across the power and 0V signals, if a 16-pin connector is used and these signals have been wired in place internally. The power signal, if replaced with +5V, may be used as desired.

Check your wiring. When everything appears to be correct, reassemble the computer, plug in the power and the video plugs *only*, and turn on. If the computer gives the correct sign on message, then all is well. Check that all the keys on the normal keyboard function correctly, then plug in the new keyboard.

If everything has been wired properly, then the new keyboard should work. If the machine crashed when power was applied, reopen the box and look for both short and open circuits on the pcb. A multimeter is handy here. If the keyboard does not work, check your wiring.

You now have a keyboard to your satisfaction!

Memory

The new memory board replaces the standard 6K of the VZ200 with 34K of static RAM.

The design is relatively simple, using only five random access memories and an address decoder IC. This is because of the use of high density static RAMs which require almost no interfacing (unlike dynamic RAM, which requires multiplexed address

The completed keyboard with the computer beneath.

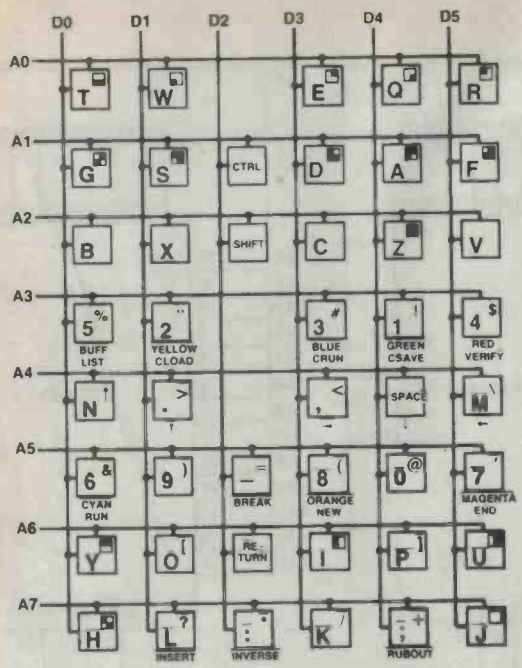


Figure 1. Keyboard matrix.

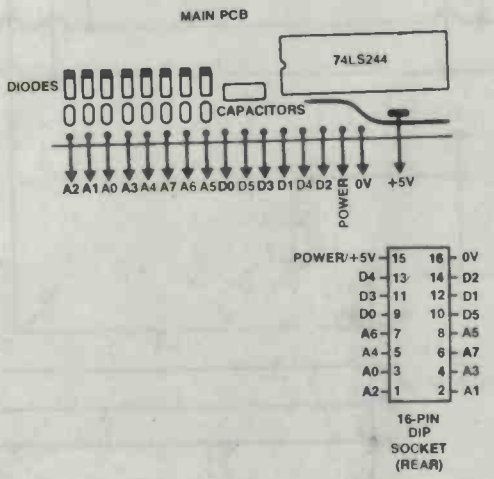


Figure 2. Wiring diagram.

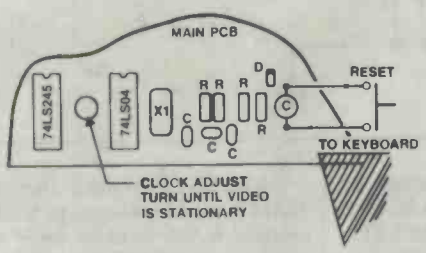


Figure 3. 74LS04 on VZ200.

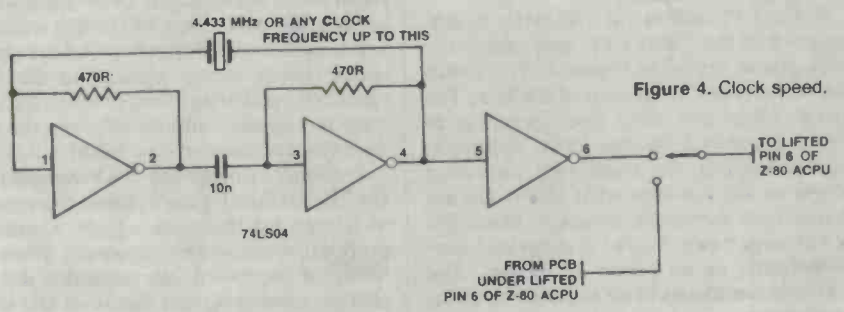


Figure 4. Clock speed.

lines plus refreshing) and are thus extremely easy to use. Two types are used: one 6116 2K RAM and four 6264 8K RAMs.

The pcb is single-sided and uses links in order to lower the cost. The board plugs in where the original board was fitted. Unfortunately, as sockets are used (the cost of the ICs makes this necessary), there is no room for the rf shield, however, I have found that there is no perceptible difference in the noise levels radiated by both shielded and unshielded computers.

34K is the maximum addressable RAM space in the VZ200 memory map. The expanded map looks like this:

0000-1FFFF: BASIX ROM 0
2000-3FFF: BASIC ROM 1
4000-67FF: reserved for ROM (eg DOS/RTTY etc)
6800-6FFF: input/output latch
7000-77FF: video RAM
*7800-7FFF: 2K user RAM (6116)
*8000-9FFF: 8K user RAM (6264)
*A000-BFFF: 8K user RAM (6264)
*C000-DFFF: 8K user RAM (6264)
*E000-FFFF: 8K user RAM (6264)

All peripherals are compatible with this set-up (except, of course, for memory expansion modules).

To begin check that the pcb has been drilled correctly and that there are no short or open circuits (a lens is handy). Solder in the eight links first. It is a good idea to use single-strand insulated wire, as some wires come very close to other contacts.

Now solder in the two 15-pin Utilux plugs. These require 1mm holes instead of the 0.8mm holes elsewhere. Then solder in the six IC sockets which are crammed together rather tightly in order to reduce board size, so be careful. The bypass capacitors should now be inserted. Take care with C1, the electrolytic. Check the board and put it aside (no ICs yet!).

Attack the VZ200. Remove the six back screws, lift the lid carefully (the keyboard will still be connected) and remove the four screws holding down the pcb. Desolder the main switch and the speaker (note the wires), and desolder the four lugs of the rf shield from the earth tracks. On the top, remove any braid to the rf shield then remove the shield. Behold! The RAM board is visible. Cut the short cables leading to the RAM board from the main pcb, remove the insulation and desolder each wire.

The contacts must be cleaned so that the connector can be inserted. I used a solder sucker, desoldering braid and a needle to clear the holes. *Be careful!* Overheating does wonders to the main pcb. If you lift any track, put in a link to replace it.

Insert the two 15-pin Utilux sockets to the main pcb. Check for lifted tracks. At the moment the computer will not work. In case anything goes wrong, it is a good idea to fit ▶

HOW IT WORKS — ETI-687

MEMORY BOARD

The RAM ICs require a simple TTL power supply. The data pins are connected directly to the data bus, as are the address lines. WRITE ENABLE is connected to the Z80 $\overline{WR}$ signal, and the OUTPUT ENABLE is connected to the $\overline{RD}$ signal. The 6116 is selected by an address decoder on the main pcb. The 6264s are selected through the 74LS138.

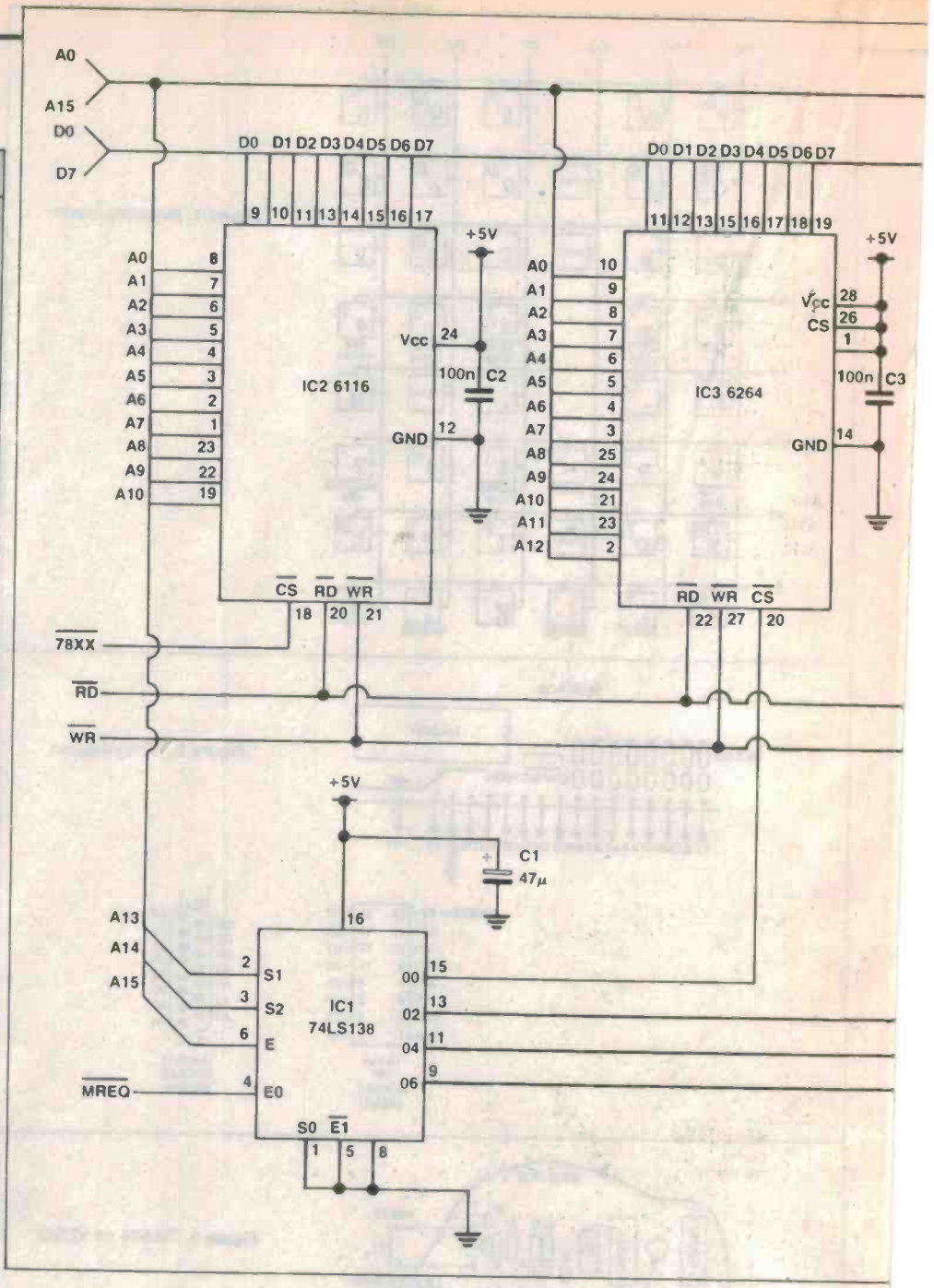
When $\overline{MREQ}$ is low and A15 is high, the 74LS138 will decode one of four combinations, depending on the status of A13 and A14. These signals are sent to the 6264s to enable the correct IC.

When any of the ICs are enabled ($\overline{CS}$ goes low), and a $\overline{WR}$ or $\overline{RD}$ signal is valid, the data bus will go out of tristate mode and either read data from the Z80 data bus into the address indicated on the address lines, or write data from the address on the address bus to the data bus. No other interfacing is required.

The decoupling capacitors are required for the stability of the power supply, as inductance occurs on the pcb with the power tracks.

KEYBOARD

The keyboard is continually scanned for any keys pressed. All address lines (A0-A7) are held low while the data bits (D0-D5) are checked. If any are found to be low then the computer knows that a key has been pressed and checks each address by holding the single address line low, and checking the data bits. SHIFT and CONTROL keys are also checked, and are used to derive the final character code.



Utilux connectors to the 6K RAM board for testing. To do this the holes must be widened to 1mm. If you do this, now is a good time to check that the computer still works by plugging in the 6K board, reconnecting the power and the speaker and turning on. If the normal message appears, then proceed, otherwise check the main pcb for short and open circuits (a lens and/or a multimeter is handy) and good luck!

If all is well, insert the ICs into the new RAM board making sure they are inserted correctly then plug the board into the socket, making sure that all pins are in the right place. The board will not fit flatly into the socket because two RAMs get in the way, however the contacts are satisfactory.

Apply power. If the message appears (it will take longer than normal), then all is well. If not, check everything. Once again, good luck!

Once everything is working, screw down the main pcb and replace the back of the box. Test once more. Your VZ200 has 36K of RAM (including video RAM) . . . more than most home computers on the market!

Some other modifications

1. If the video signal wavers, then correct the clock speed by adjusting the variable capacitor by the 74LS04 on the main pcb. (See Figure 3 for the VCZ200 location. In the VZ300, the variable capacitor is located inside an rf shield to the right of the CPU. In both cases, a hole has been punched in the rf shield for access.)

2. The CPU can run at 4.433MHz by lifting pin 6 of the Z80A CPU and adding the clock circuit shown in Figure 4. The switch can be mounted on the top of the box. The speed change will affect tape operation, as this is controlled by the CPU. However, disk operations are unaffected and most programs will run somewhat faster. Do not change over the switch, however, unless the WAIT switch (see below) is depressed simultaneously, or no power is applied. The Z80 does not like its clock signal to be interfered with!

3. WAIT. Providing that no dynamic RAM is used (apologies to VZ300 and commercial RAM module users as these depend on the CPU for refresh signals), a pushbutton between pin 24 of the Z80 and ground will cause the CPU to halt while the key is depressed. Not only will this help the speed change circuit above, but the CPU can be stopped at any time (even at a critical stage in a game!) without affecting the software (except that dynamic RAM will clear).

4. RESET. Locate the 10µF capacitor on the 74LS04 (see Figure 3; this is the same IC as is used for the clock signal). Connect a pushbutton across this capacitor. When the button is depressed, the capacitor will discharge, causing a reset signal on the CPU. This has the advantage of resetting without

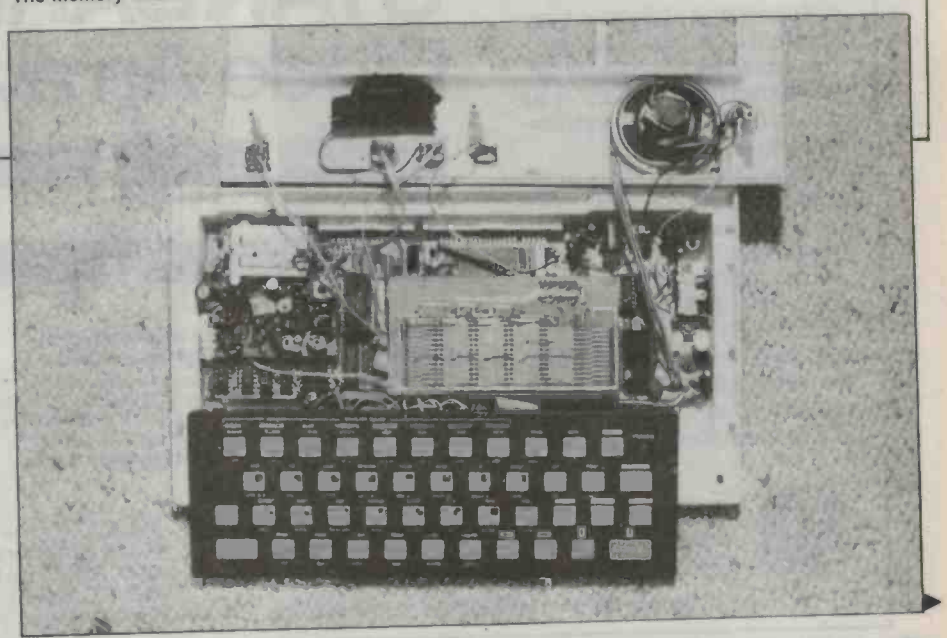
losing the memory, although all the program pointers will need to be adjusted. It is also somewhat kinder to the computer than turning off and on again.

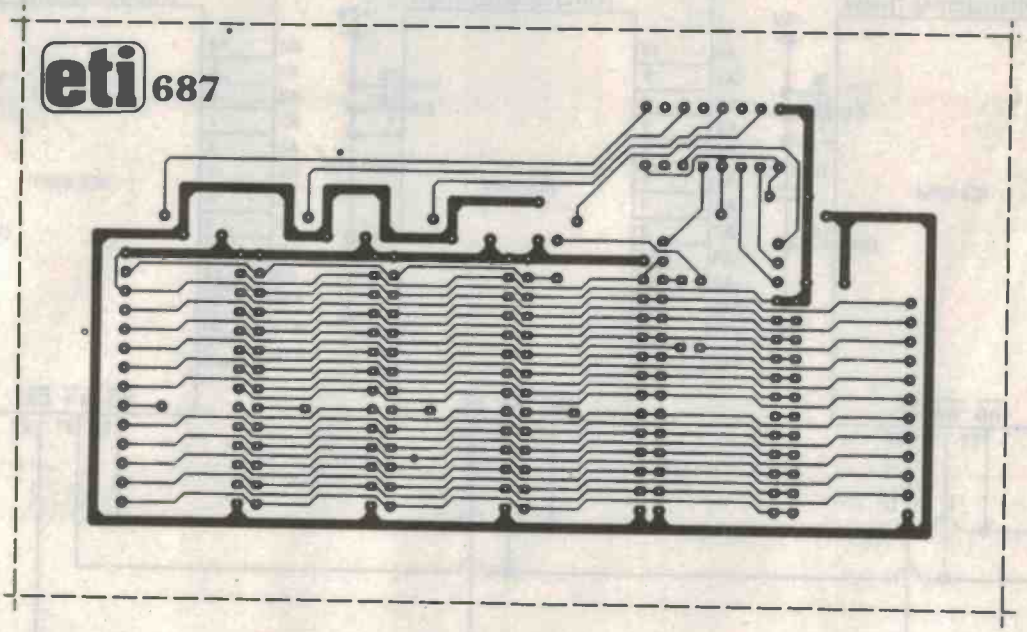
5. Power supply. I have found that the power supply runs far too hot for my liking. Therefore, I mounted a 78H05 on a heatsink on the top right of the case, removed the present 7805 and heatsink, and wired the 78H05 in its place. Not only does the computer now run cooler, it no longer packs up when all my peripherals are connected!

KEYBOARD SOCKET CONNECTIONS

Socket:	SK7/SK9/SK11	SK8/SK10/SK12
Pin Number:		
1	A15	$\overline{MREQ}$
2	A13	A12
3	A14	A11
4	+5V	A7
5	A8	A6
6	A9	A5
7	$\overline{WR}$	A4
8	$\overline{RD}$	A3
9	A10	A2
10	$\overline{78XX}$	A1
11	D7	A0
12	D6	D0
13	D5	D1
14	D4	D2
15	D3	GROUND

The memory board mounted upside down inside the VZ200 case.





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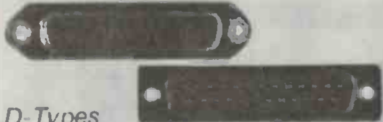

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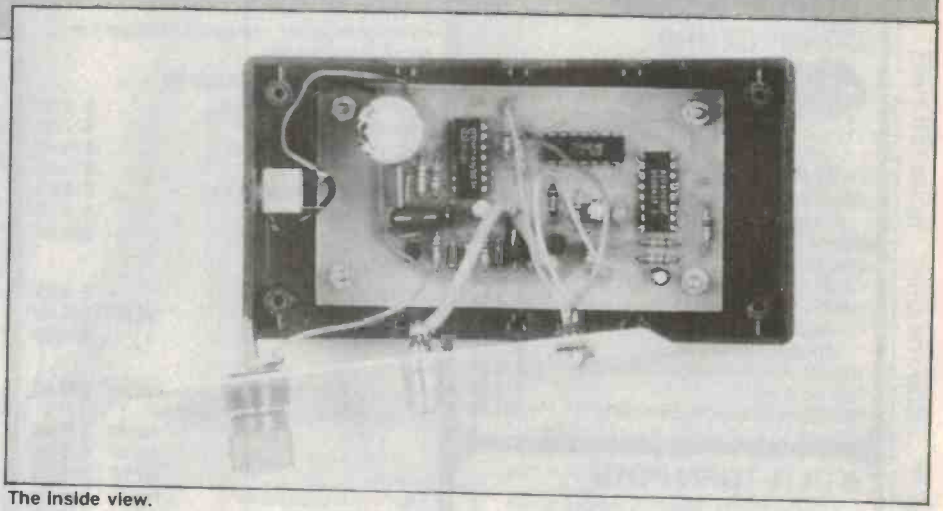
FREQUENCY STANDARD

Neale Hancock

Get the equivalent of a rubidium frequency standard by draping a piece of wire over the back of your TV set!!!



The inside view.

NO, THE ABOVE statement is not an ETI attempt at humour nor is it a figment of our imaginations. Believe it or not your humble television can provide an extremely stable and accurate reference frequency. You may ask "Oi, what's with the wire then?" (or words to that effect). Well that acts as a transducer to pick up electromagnetic radiation from the back of the set.

Normally you would need to spend thousands of dollars to achieve accuracy beyond the parts per hundred thousand you expect from ordinary meters. With this simple project, an extremely accurate 1MHz signal can be derived.

The horizontal deflection in the picture tube is achieved by applying voltage to the yoke at a frequency of 15.625kHz. These pulses are decoded by the receiver from the signal sent by the television station. The high voltage is provided by the extra high tension (high voltage) section of the TV set. Therefore, the eht section has a very strong electromagnetic field of 15.625kHz pulses around it.

The 15.625kHz pulses generated at the television station are derived from a rubidium standard (or will regularly check against one) thus they are very stable and very accurate. They provide the reference signal for our frequency standard.

Circuit overview

The electromagnetic radiation emitted by the eht section is transformed into electrical pulses by the loop of wire. These pulses are then conditioned and buffered providing a useful reference signal. When they are of an adequate level, the pulses go into a CMOS 4046 phase-locked loop (PLL). The internal oscillator of the PLL is set to run at 1MHz and is locked to the incoming 15.625kHz reference signal.

When the PLL is locked to the reference signal, its internal voltage controlled oscillator (VCO) has the same stability as the reference. Therefore the outgoing 1MHz signal will be as stable as the 15.625kHz reference except for some PLL jitter. The jitter is due to the VCO of the PLL drifting slightly then re-locking onto the reference. This jitter can be minimised by careful selection of components.

Construction

Before you commence construction, examine the tracks on the pc board for breaks and bridges. First of all, put in the wire link located next to IC4 then put in all the capacitors and resistors making sure that the electrolytic capacitors are polarised correctly.

Mount the diodes and transistors, but check their orientation against the overlay first. Except for the voltage regulator, all the ICs are CMOS so take care not to touch their pins when putting them into the board. Also check the orientation of all the ICs against the overlay before you mount them.

The case can now be drilled out, and then sockets, LEDs and pc board mounted in it. Finally connect the sockets and LEDs to the pc board using short lengths of hookup wire, but check the polarity of the LEDs. To reduce the chance of having stray signals bouncing around the case, shielded cable should be used to connect pc board to the output socket. Also make sure that the input socket is insulated from the case to prevent a short circuit between it and ground. ▶

THE BROADCAST TIME BASE

Because broadcast television studios produce a great many hours of video programmes that may need to be edited or mixed with other programmes at any time, it is vital that they have a very accurate time base or synchronising signal.

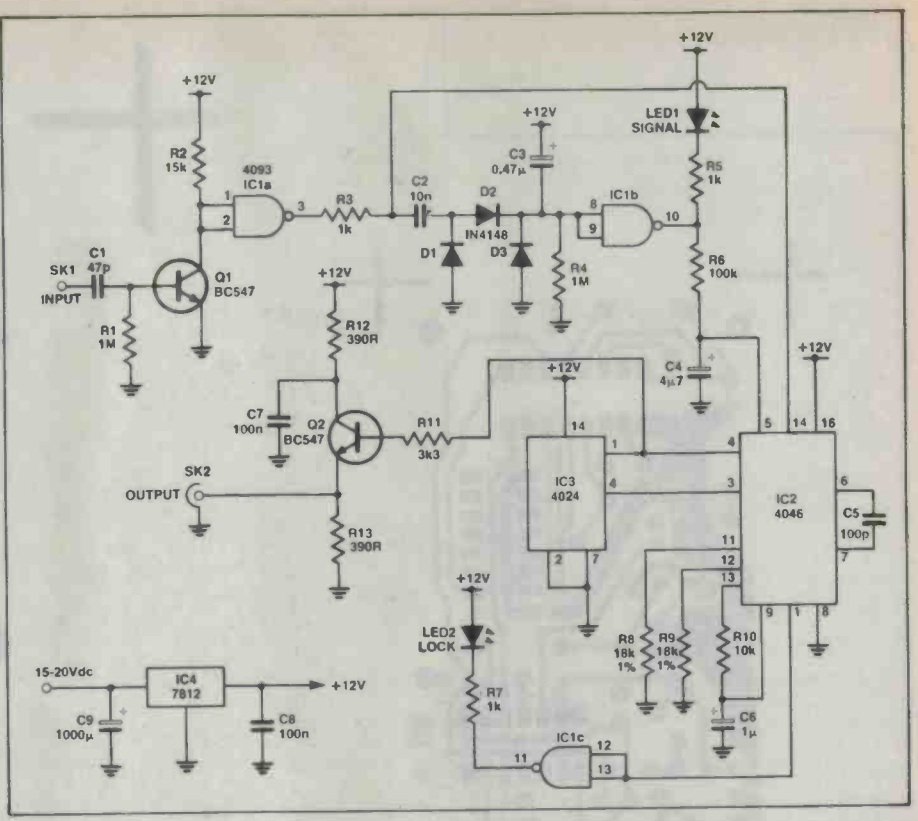
A few commercial stations and the ABC use a rubidium frequency standard with an accuracy of something like one part in one hundred billion. Most stations that don't have a rubidium standard will have an oven controlled crystal oscillator and will regularly check it against a station with a rubidium standard.

In Sydney the four VHF stations regularly compare their 4,433,618.75 hertz colour subcarrier against other stations and in virtually all instances all four are within one or two hertz of each other.

The only possible exception is that a bad video tape edit can sometimes cause a momentary phase error in the broadcast signal.

If you need the highest possible accuracy from this project then don't use it on something with a lot of video tape edits like advertising.

The system of using broadcast television signals as a frequency standard is so reliable it is used in the US by many registered laboratories. Each month the US National Bureau of Standards publishes a frequency offset for each of the networks.

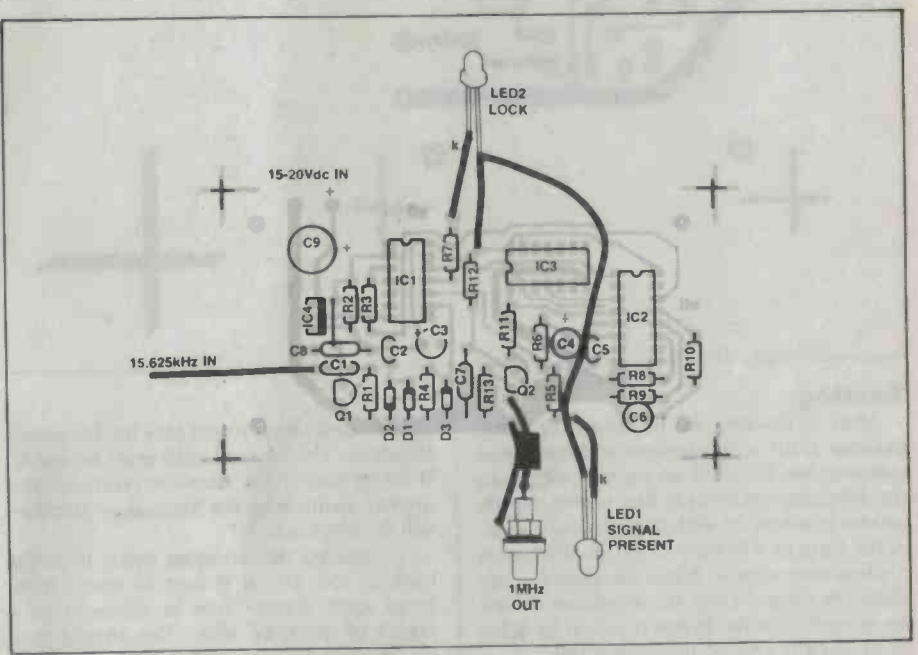


HOW IT WORKS — ETI-174

The incoming signal is filtered by C1, and R1 to remove any high frequency noise. The filtered signal then goes to the base of Q1. Providing this signal has enough level to turn Q1 on, the output from Q1 will be able to drive the inverting buffer IC1a. The signal is now at a high enough level to drive the input of the phase-locked loop, IC2. To show that this signal is present, LED1 is illuminated via IC1b.

The combination of R8, R9, and C5 sets the internal VCO of the phase-locked loop running at 1MHz. The ratio of R8 to R9 is optimised to minimise jitter. So that the internally generated 1MHz can be compared with the 15.625kHz reference, it is divided by 64. To do this, six stages of a 4024 CMOS counter are used.

To show that the VCO is locked to the reference, the lock detect output is used to illuminate LED2 via IC1c. The locked 1MHz signal goes to the output socket via the npn transistor, Q2. The voltage regulator IC4 and capacitors C8 and C9 supply the circuit with a stable 12 volts dc.



PARTS LIST — ETI-174

Resistors.....all 5%, ¼W except for R8 and R9 which are metal film ¼W

R1,4.....1M
R2.....15k
R3,5,7.....1k
R6.....100k
R8,9.....18k metal film
R10.....10k
R11.....3k3
R12,13.....390R

Capacitors

C1.....47p ceramic
C2.....10n greencap
C3.....0.47µ 25V electro
C4.....4µ7 25V electro
C5.....100p polystyrene
C6.....1µ 25V electro
C7,8.....100n greencap
C9.....1000µ 25V electro

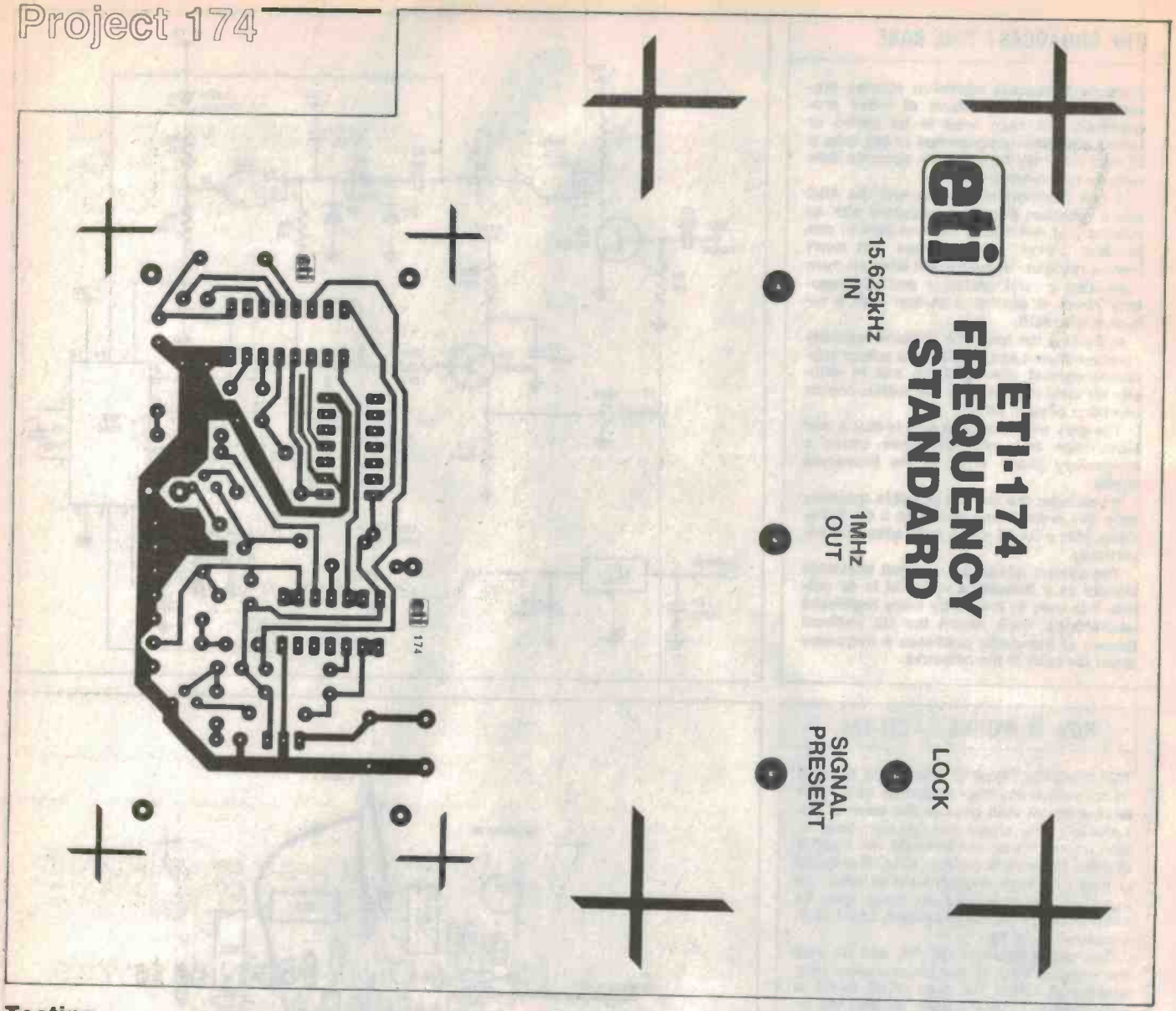
Semiconductors

D1,2,3.....1N4004
LED1,2.....red 5mm
Q1,2.....BC547
IC1.....4093
IC2.....4046
IC3.....4024
IC4.....7812

Miscellaneous

ETI-174 pc board; 41x68x130mm zippy box; female RCA socket; 4mm socket with binding post; shielded cable and hookup wire; Scotchcal or other front panel.

Price estimate: $21



Testing

After assembling the pc board, carefully examine it for solder bridges and misplaced components. Connect up a power supply to the frequency standard, this power supply can be between 15 and 20 volts and can be in the form of a battery, a plugpack or even a lab power supply. When the power is applied the output from the regulator should be around 12 volts. If this is not so look for short circuits around the supply rails.

If you want to perform an initial check on the PLL to see if it is operating correctly you can set it free running. This is done by shorting the VCO inhibit pin (pin 5 of IC2) to ground with a short (no pun intended) length of wire. The frequency at the output of the frequency standard should be between 700kHz and 1MHz (the one I tested oscillated at 850kHz).

Setting up and operation

When mounting the wire on the back of the TV set select the channel whose picture is clearest and most stable. This will provide the cleanest signal to put into the frequency standard. The vertical hold must be stable. If the picture 'rolls' then the reference frequency going into the frequency standard will be incorrect.

To pick up the strongest signal from the back of the TV, it is best to make three loops each about 12cm in diameter in a length of insulated wire. This should then be taped to the area at the back of the TV set which emits the strongest electromagnetic field. This area is near the eht section of the television and as I mentioned at the beginning of the article, this is where the field is strongest.

To find the place where the field is strongest you can use an ac reading analog multimeter with one end of the wire loop connected to the positive (or red) probe and the other end left free. As the wire loops are moved around the back of the set the needle on the meter will be at its maximum deflection where the field is strongest. If you do not possess an analog multimeter a digital multimeter will perform the same task as long as it has a 2Vac range. However, you will have to move the wire loops to a position then let the meter settle before you take the reading. This is more time consuming than using an analog multimeter, but it gives the same result.

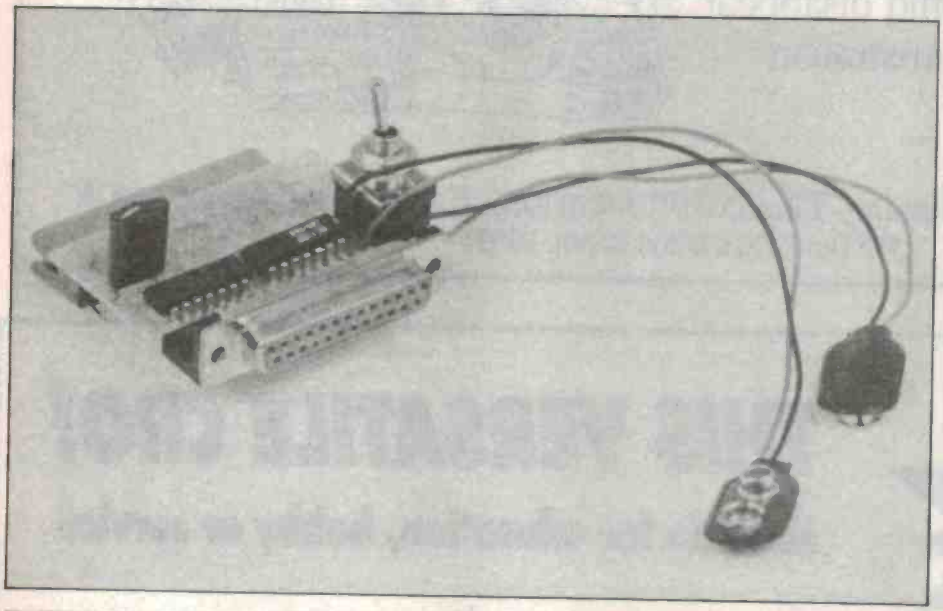
Once you have found the area where the field is strongest, and taped the loops there, connect the end of the wire to the frequency standard. The 'signal present' LED should illuminate followed shortly by the 'lock' LED. When the 'lock' LED comes on the frequency standard has stabilised and is ready to use.

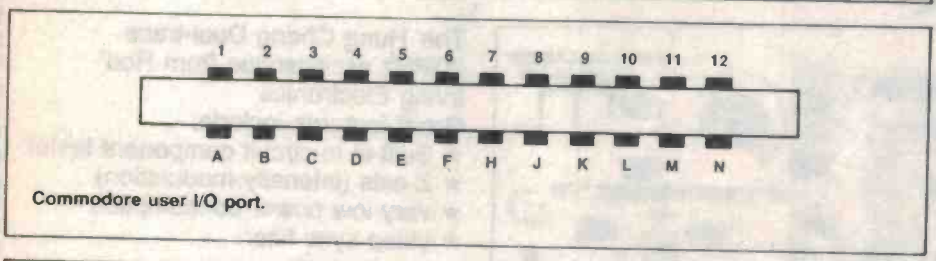
If the 'signal present' LED does not illuminate then there is not sufficient field present. To remedy this, move the wire loops until the LED comes on. If this does not help add more loops to the wire or make the loops bigger. If the 'lock' LED does not come on, check that the PLL is operating correctly using the procedure mentioned in the "Testing" section. ●

RS232 FOR COMMODORE

A simple project to give your Commodore RS232 compatibility.

Neale Hancock





Commodore user I/O port.

THE COMMODORE 64 and VIC 20 home computers are extensively used by hobbyists and hackers alike but they suffer one major shortfall: their incompatibility with hardware from other manufacturers. Commodore users can't connect with non-Commodore peripherals even though they might be better, cheaper or not yet available from Commodore.

Commodore's decision to make the Commodore 64 and VIC 20 home computers compatible only with Commodore peripherals may have made good marketing sense to the manufacturer, but has been a pain in the posterior to Commodore users.

The main reason for the Commodore's lack of compatibility with other hardware is the lack of an RS232 serial port. Sure, Commodores have a serial port in the form of a 6-pin DIN connector, but the information which comes out of this port does not conform to the RS232 standard.

RS232 is the standard format for serial information exchange by microcomputers, so the lack of one is a serious problem.

The ETI-1601 utilises the Commodore's 24-pin user I/O port to give it RS232 hardware compatibility. This port can already transmit and receive serial information using RS232 protocol, thus it is software compatible, but the output from it is TTL level (5 volts for a logic 1 and 0 volts for a logic 0), and is therefore not hardware compatible. The RS232 line requires a level between +3 and +25 volts to signify a logic 1 and a level between −25 and −3 volts to signify a logic 0.

The ETI-1601 circuit board connects to the user I/O port and converts the outgoing signals up to RS232 levels and incoming signals to TTL level.

TABLE 1a. HOST MODE

RS232 PIN	FUNCTION	USER I/O PIN No
1	GROUND	A,1
2	TRANSMIT	M
3	RECEIVE	B,C
4	READY TO SEND	D
5	CLEAR TO SEND	K
6	DATA SET READY	L
7	SIGNAL GROUND	A,1
8	DATA CARRIER DETECT	H
20	DATA TERMINAL READY	E

TABLE 1b. TERMINAL MODE

RS232 PIN	FUNCTION	USER I/O PIN No
1	GROUND	A,1
2	TRANSMIT	M
3	RECEIVE	B,C
5	READY TO SEND	H
4	CLEAR TO SEND	H
20	DATA SET READY	L
7	SIGNAL GROUND	A,1
8	DATA CARRIER DETECT	D,K
6	DATA TERMINAL READY	E

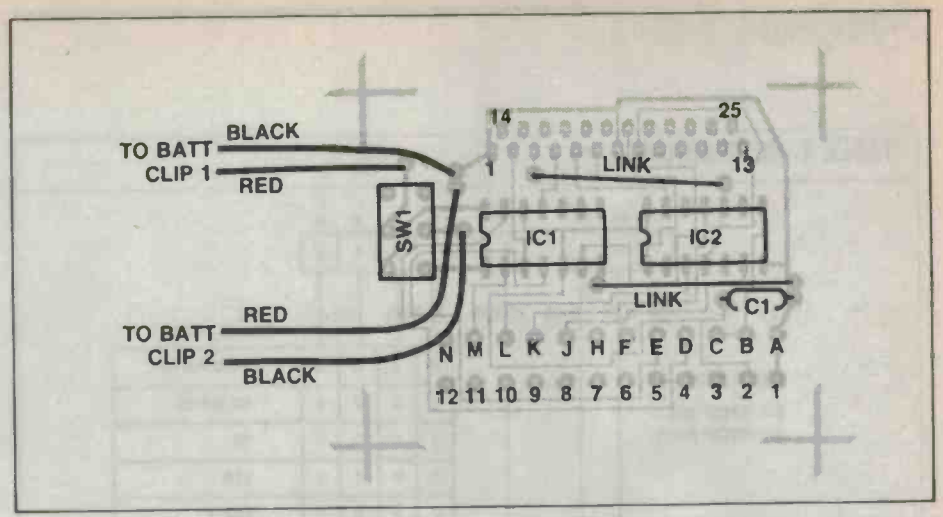
Construction

Before you commence construction, examine the pc board for defects such as bridges and broken tracks. First solder in the two wire links then solder in the ICs, but

PARTS LIST — ETI-1601

Capacitors
C1 ..... 150n greencap
Semiconductors
IC1 1488
IC2 1489
Miscellaneous
Pinted circuit board mounting DB-25 socket; 2 x 9 volt battery snaps; edge connector with 4mm pin spacing; DPDT toggle switch; ETI-1601 pc board.

Price estimate: $18

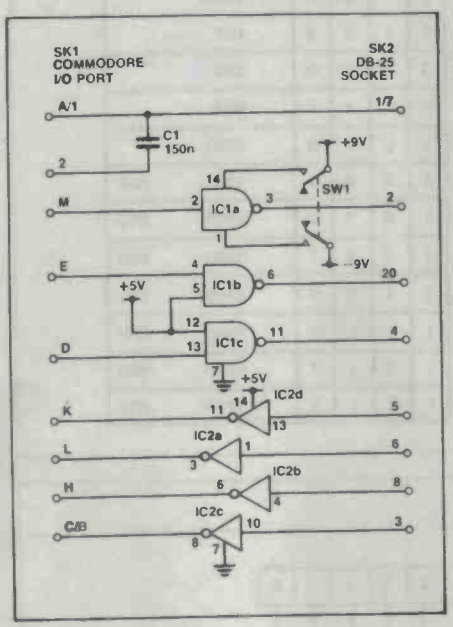


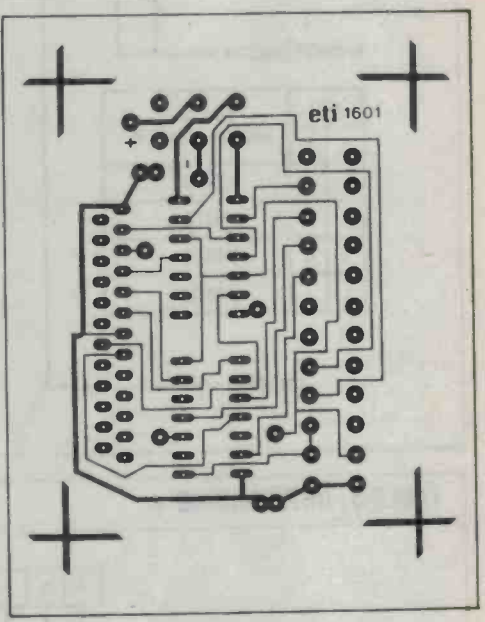
HOW IT WORKS — ETI-1601

IC1 is a 1488 RS232 line driver. This IC takes the TTL level signals from M, D, and E outputs on the Commodore's 24-way user I/O and converts them to a level acceptable to an RS232 port, in this case ±9 volts. IC2 is a 1489 line receiver which takes signals from the RS232 line and converts them to TTL levels. These signals are then sent to pins L, K, H, B and C on the user I/O port.

Table 1 shows which pins on the 24-way edge connector correspond to which RS232 pin. It also shows which pins to swap to have the Commodore acting as the host or as a terminal. The pc board is laid out to allow the Commodore to act as the host. If you want it to act as a terminal you will have to swap the lines as listed in Table 1.

Two 9 volt batteries are used to give the ±9 volt rail required to drive IC1. While there is 9 volts ac provided on pins 10 and 11 of the user I/O port, it cannot source enough current to drive IC1 and thus the RS232 line.





check their orientation before you mount them.

Solder in the capacitor and the pc mounting DB-25 connector. The 24-way edge connector requires its pins to be bent at right angles before it can be mounted correctly. Solder the pins of this connector to give greater support. A fine tipped soldering iron may be handy if you want to mount the connector on the copper side of the pc board. Finally solder in the on/off switch and the leads which go to the two 9 volt batteries.

Carefully check the pc board for solder bridges and dry joints. Without the pc board plugged into the Commodore connect up the batteries and flick the switch towards the DB-25 connector. Check that the voltage rails of IC1 are close to 9 volts; if not re-examine the pc board.

Software and operation

To enable the user I/O port to send data to a printer, it has to be opened and set up with the appropriate protocol. All of the above can be performed with one line:

```
OPEN 1,2,0, CHR$(x)+CHR$(y)
```

The OPEN 1,2,0, command opens the user I/O port. The three numbers after the OPEN statement designate that this port is the port to be opened.

The CHR$(x) command sets the stop bit, data word length and the baud rate. The CHR$(y) command sets the parity options, the duplex and the handshake. Tables 2 and 3 will enable you to determine the values for x and y. Use them to convert your particular interfacing format into two 8-bit binary numbers, then convert these numbers to decimal, and presto: you have your value for x and y.

For example, if you want to set up the Commodore's RS232 port for 1 stop bit, 7 data bits, 1200 baud, even parity, half duplex and three line handshake, the binary value for x will be 00101000 and the binary value for y will be 01110000. By using binary conversion x will equal 40 and y will equal 112.

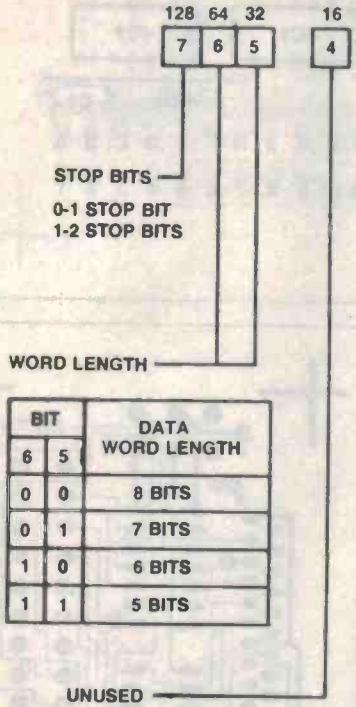
Before you connect up the pc board make sure that there is no power going to the Commodore. Then you can plug the edge connector of the RS232 interface board into the 24-pin I/O connector on the back of the Commodore. Make sure that the toggle switch on the RS232 interface board is thrown towards the Commodore as this is the off position. The Commodore can then be switched on, the batteries connected to the RS232 interface board and the board switched on.

To test if the RS232 interface board is working correctly set up an RS232 printer with the following format: 1200 baud, 7 data bits, 1 stop bit, even parity and no X on/X off. Now type in and run the following program.

```
100 OPEN 1,2,0, CHR$(40)+
CHR $(112)
200 CMD 1
300 FOR I=1 TO 10
400 PRINT ''RS232'' SPC(1)
500 NEXT I
600 END
```

The result of running this program should be RS232 typed 10 times running. If this does not occur, first carefully examine the program for errors then look for faults on the board, especially on the signal path from pin M of the Commodore to pin 2 on the DB-25 connector. ▶

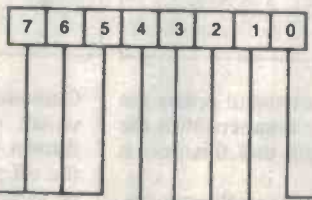
TABLE 2. DETERMINING x



BIT 6	BIT 5	DATA WORD LENGTH
0	0	8 BITS
0	1	7 BITS
1	0	6 BITS
1	1	5 BITS

8	4	2	1	BAUD RATE USER RATE	
0	0	0	0	USER RATE	
0	0	0	1	50 BAUD	
0	0	1	0	75	
0	0	1	1	110	
0	1	0	0	134.5	
0	1	0	1	150	
0	1	1	0	300	
0	1	1	1	600	
1	0	0	0	1200	
1	0	0	1	1800	(NI)
1	0	1	0	2400	(NI)
1	0	1	1	3600	(NI)
1	1	0	0	4800	(NI)
1	1	0	1	7200	(NI)
1	1	1	0	9600	(NI)
1	1	1	1	9200	(NI)

TABLE 3. DETERMINING y



BIT 7	BIT 6	BIT 5	OPERATIONS
		0	PARITY DISABLED, NONE GENERATED/RECEIVED
0	0	1	ODD PARITY RECEIVER/TRANSMITTER
0	1	1	EVEN PARITY RECEIVER/TRANSMITTER
1	0	1	MARK TRANSMITTED PARITY CHECK DISABLED
1	1	1	SPACE TRANSMITTED PARITY CHECK DISABLED

DUPLEX
0-FULL DUPLEX
1-HALF DUPLEX

UNUSED

INTELLIGENT MODEM

S.K. Hui

Here it is!!! At long last: the circuits, the boards; all you need to know to construct the definitive modem.

Part 5

THIS IS THE FIFTH part of the modem project, probably the most complex electronics project ever to appear in an Australian magazine. An explanation of the design philosophy appeared in December 1985, the auto dialling and answering in February 1986, the power supply in March and commands and memory management in June. The final chapter next month will be a detailed operator's manual.

We have attempted, in this project, to offer our readers a fully professional modem for a fraction of the cost of a bought one. The differences between this and others floating around are not easy to establish from a quick glance at the specifications; one 1200/75 modem is much like another, right?

Wrong. The features in the software can make all the difference from an operator's point of view. Just as an example, take the auto dial facility. Some modems will simply dial the number for you and sit there waiting for carrier to come back. A more sophisticated one, like ours, will sense exchange tone to ensure a free line is available and if it isn't it will let you know. It will then detect any possible tone coming back from the other phone and react accordingly. If the phone is busy it might redial; if unanswered it will ring off; if answered by a person it might do something else, and so on.

A word of warning. This is a complex and expensive project, and should be undertaken by people with experience only. However, problems should be few provided you use extra care in handling the integrated circuits and boards.

Also, check your work as you go. This is most important as it will be next to impossible to find chip level faults without the use of proper logic analysis. For this reason, it is important that you should be able to guarantee that the board itself and your soldering is fault-free.

Use your mulitmeter frequently. A good tip is to check the continuity of every component as you solder it in. Say you have two components connected by a bit of track. If you place your meter probes on the leads of the components you can check your soldering and the integrity of the track in one go. This idea can be expanded to socket level. As you solder in the socket, check each pin, making sure it's not shorted to the one next to it, nor to any adjacent tracks.

This is pretty tedious, and takes time. However, it does mean that when you plug the chips into the board you can be reasonably sure that everything is working.

If you have trouble there are some fundamental tests you can do. Check that every IC has power and ground. Do this by checking both continuity and voltage. If you have access to a CRO you can check to make sure that there is activity on all relevant pins. Note that even a multimeter can be used with some success here; expect it to show a value somewhere between 5 and 0 volts.

This level of trouble-shooting will clear up 95% of faults. We have built up two prototypes in the lab here at ETI, and found that the most common source of problem is in the feedthroughs, the connections between one side of the board and the other. Check them carefully, in fact check everything; it's the key to a successful project.

Construction

The first job is to inpsect the two boards carefully. Take your time and if possible double check with a magnifying glass, making sure there are no broken or short-cir- ▶

cuited tracks, especially on the motherboard. Bear in mind that this board will be almost impossible to debug when it is complete.

Check that the boards fit in the box. The box you need is one commonly available in electronics shops. As shown in the picture, two semicircular slots have to be cut on each edge of the boards to avoid the two posts inside the box when you lower them into it.

The plastic box separates into two pieces when you unscrew it. The bottom piece is identified as the one with several long slim slots pre-cut for the loudspeaker. Put the loudspeaker onto the slots then lower the line interfacing board onto it. The magnet of the speaker should go through the round hole on the line interfacing board. The board should then land flat onto the plastic studs. Check that the screw holes on the board line up with the studs.

Similarly, lower the motherboard into the other piece of the box and make sure the screw holes on the board line up with the studs. You might have to use a small file to trim the edges of the boards and the semicircular slots slightly before they lie flat on the studs. With the boards still lying in the box, insert the front and rear panels and check that they clear the boards. More trimming with the file is needed if the boards are too big.

Now remove the boards from the box. If they are plated-through, life will be a lot easier, as there is no need for the feedthrough links in the motherboard. If they are silk-screened you can just follow the silk-screen printing to hook up the jumper links on the interfacing board.

If you have bought a cheaper kit it will probably provide you with bare boards only. In such a case, carefully follow the overlay diagram and insert the feedthrough links into the correct holes in the motherboard. A feedthrough link joins two tracks together on both sides of the board so there must be pads on both sides. If not, you must be on the wrong hole.

The same degree of care is required on the line interfacing board when jumper links are soldered. Pads are close to each other and it is easy to insert the wire into the wrong hole.

It is very important for you *not* to put any components in at this stage since some of the feedthrough links ar sitting under some of the ICs.

Once you are satisfied with the links on both boards, you can concentrate on one board at a time. It does not matter which board you start first as long as you follow the instructions here.

Motherboard construction

The motherboard carries most of the big chips and has fairly close tracks. I recommend you use a thin soldering tip and thin solder wire. Follow the overlay diagram carefully and solder the resistors and diodes first. Double check that they are in the right places with no bridging of the tracks due to careless soldering. It's a good idea to go around with a multimeter and check that you have the correct resistance values.

Next, work on the ICs, leaving the capacitors for last. There are quite a few big chips on the motherboard such as the 6802 CPU, 6821 PIA, etc. The usual practice is to use IC sockets if your motherboard is plated-through. If not, Molex pins must be used!!!

In some places there are tracks going between pads. Be extremely careful not to short-circuit the pads to the track. During prototype development, just such an error took a few days to locate. It turned out that a small flake of solder had landed between a pad and a track and was glued in place by the molten flux. That shorted one address line to another one and even a master reset wouldn't help it.

The last things to be soldered on to the board are the capacitors. The only thing you have to watch out for is their polarity.

There are two flat cables connecting the two boards together. Cut two 16-way flat cables and 150mm long. At each end of the cables clamp a 16-way DIL connector as shown in Figure 1. Near the edge of the motherboard are pads for two 16-way DIL connectors (they look very much like ICs). Note that the copper pads are on the component side of the board. The connectors will be sitting on the soldering side when you solder them on. Because of the thickness of the connectors (which is nearly the same as the height of the studs in the box), *no* sockets should be used for the connectors on the motherboard.

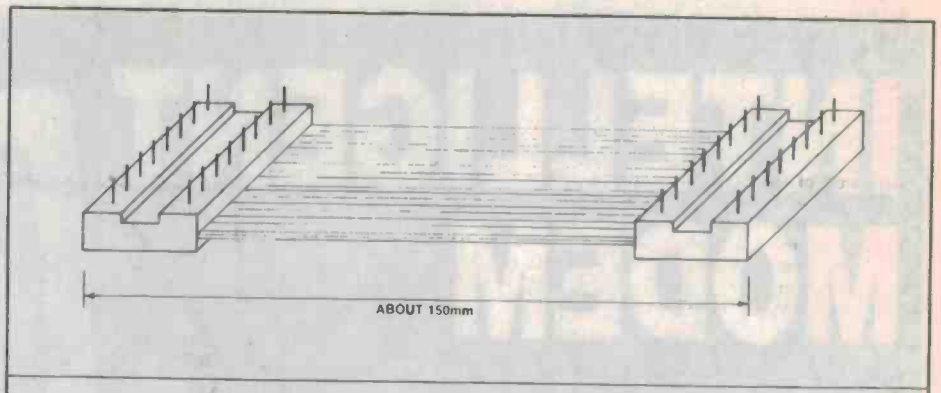


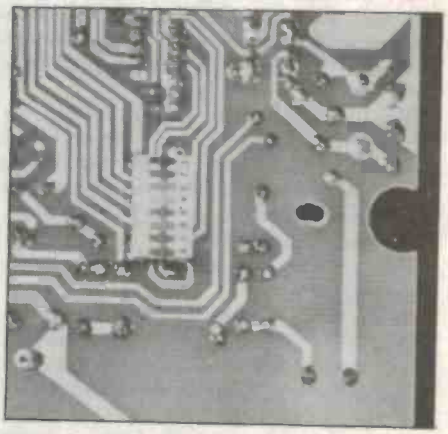
Figure 1. Two 16-way DIL connectors (header) have to be clamped to the cable with the same orientation.

Line interfacing board

This is a single-sided board; most of the tracks are pretty wide and less dense than on the motherboard. Great care should still be exercised if the board is to work first time. As mentioned earlier, be careful with the jumper links. Count the number of links soldered on the board against the ones given on the overlay to make sure you haven't left any out. Next mount resistors and diodes. Solder the IC sockets in. You don't have to use Molex pins in this board because all the IC pads are on the solder side of the board. Again, near the edge of the board, there are pads for two 16-way DIL connectors. Unlike with the motherboard, you should mount two 16-way IC sockets for receiving the two flat cables from the motherboard. The two 16-way DIL connectors at the end of the cables will be plugged into the socket when the two boards are joined together.

Solder the capacitors and resistors on in the usual fashion.

There are some components that need to be treated in a slightly different way. The optical coupler used in the line interfacing for detecting the ring is a 6-pin chip. However, there are only five holes on the board. Cut one pin (make sure you are cutting the right pin) and solder the chip directly on to board without using a socket.



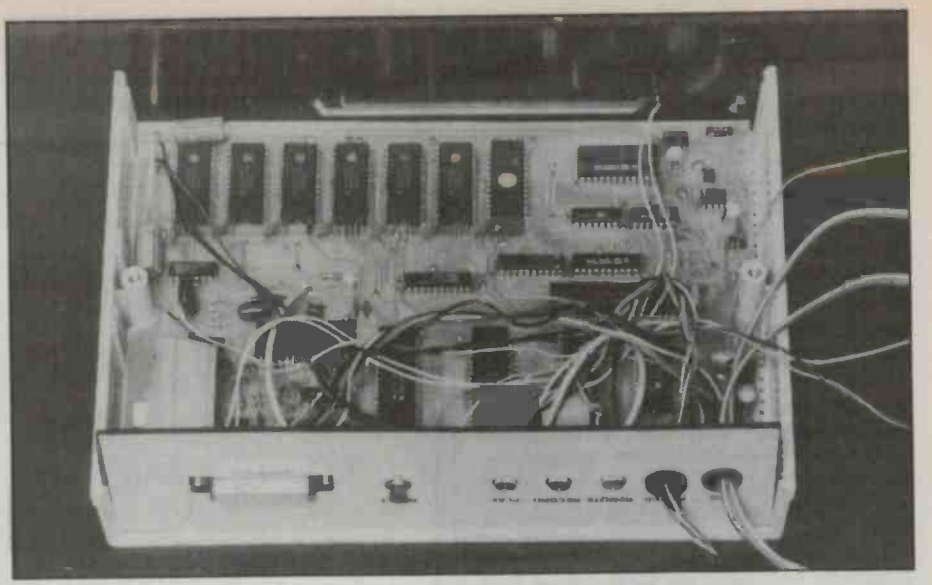
The next component to be treated unusually is the 8-way DIL switch. To solder it, turn the board over with the solder side facing up. The spot where the switch is to be

MOLEX PINS

Molex pins are easily obtained from almost any decent electronics store. They come as a long strip with 40 or 50 pins linked by a thin piece of metal. If you are making a 40-pin IC socket using Molex pins, cut two strips of 20 pins each. Insert the two strips of pins into the holes on board and solder them on both sides of the board.

Be careful! If you look at the pins closely, you will see they are not symmetrical. One side of the pin is a flat piece of metal, the other side has a slot in the middle. When you insert the pins into the holes, the flat metal side must be facing the outside. The flat metal side prevents the molten solder getting inside the pin when you solder the Molex pins on the component side of the board.

Once you have soldered the pins in, it's easy to break the thin piece of metal which links them together. Try plugging in the IC to ensure it can sit in comfortably.



The orientation of the motherboard in the box in relation to the rear and front panels.

soldered should have 16 pads with no holes drilled through them. Place the switch over the pads carefully and solder it. Now take the board and lower it on to the bottom piece of the box. The switch touches the box before the board lands on the studs.

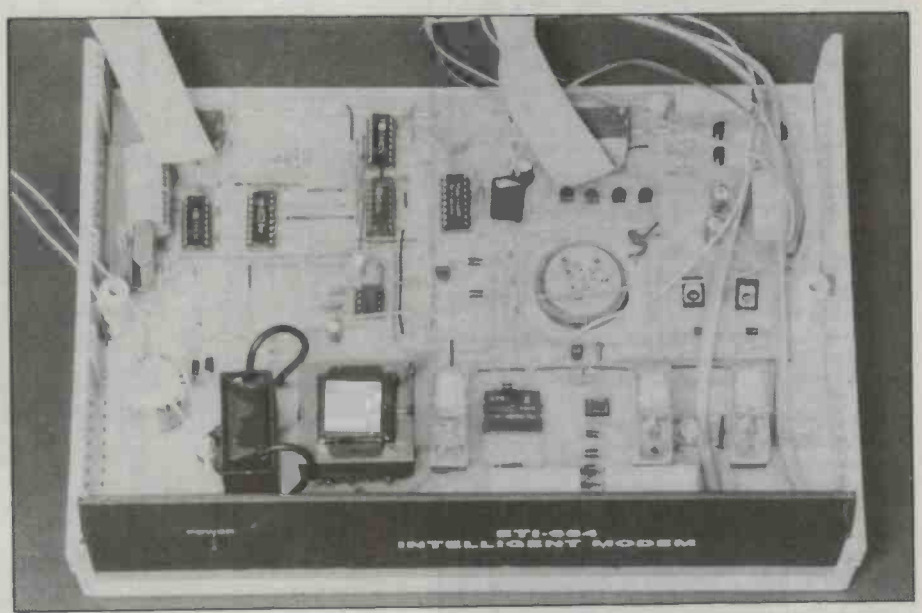
Mark the position of the switch on the box and cut a rectangular slot to match the shape of the switch.

The board should now be able to sit comfortably on the studs inside the box. The switch should either be level or sticking slightly through the bottom of the box. The idea is to allow you to change the switch without opening the box. Solder the rest of the components on, such as relays, loudspeakers, capacitors, etc.

Accessories

There are a few things to be fixed to the front and the rear panels: three 3.5mm phono jack sockets (one with on/off action), a DB25 connector, a reset pushbutton and a power indication LED, and one phono jack socket for recording. You should connect the mic input from the tape recorder to this last socket whether you are recording or not, as it carries the earth connection. To avoid earth loops, there is only one connection between the modem and the recorder, and it's through this socket.

A similar socket, but with on/off action, is used for playback. The line out, or the ear out, from your tape recorder should be connected there. When the modem is used with the line, the phono jack for playback should be unplugged. The off action of the socket connects the line to the modem chip. As soon as you plug the playback jack into the socket, the on action disconnects the line but connects the signal from the tape recorder directly to your modem chip. Remember, however, that this socket has no ground wire connected to the modem board so you must have the record phono jack plugged in during the playback to provide the ground. The wiring of the reset switch and the LED is straightforward. Just follow the overlay diagram.



The orientation of the interfacing board in the box in relation to the front and rear panels. Note how the speaker pokes through. Insulating material should be placed between the speaker and the tracks to prevent shorting.

Leads

There are several points on both boards where flying leads are soldered and then brought to one of the grommets on the rear panel. Tie a knot to the bundle for strain relief. The length of the bundle after the knot is entirely up to you. The end of the bundle is soldered into a 7-way DIN connector. This connector will be plugged into the intelligent modem power supply. (See the ETI March 1986 issue for the modem power supply circuit.)

Since the bundle of wires carries the ground, +5V, −5V, +5V STANDBY, BELL, LIVEON, DTR, it is *very important* that you get the pin connections right. A silly mistake like +5V output from the power supply connected to the −5V point on the modem board will be disastrous!! I suggest you take a meter and check the connections between the modem and the power supply with the power completely shut off.

I also recommend you get a standard telephone extension cord. On one end there is a standard Telecom female socket and on the other a male plug. Chop the cord into two halves so that the bare ends can to be soldered to the interfacing board. The cord carrying the female socket should be soldered to the phone relay (see overlay), the other should be soldered to the line relay. Two cable clamps situated next to the phone relay are provided to clamp the cords down firmly onto the board.

Depending on the type of terminal you have, the connection from the modem board to the DB25 connector on the rear panel may not be standard. See 'RS232C connections' box for more detailed explanations. ▶

ETI-684 — HOW IT WORKS

To understand how the modem works requires a lot of knowledge of microprocessor systems, assembly programming and transmission theories. It is impossible for me to detail all these theories here so the best compromise is probably to pick a few features of the modem and explain the algorithms in the software that control them.

AUTO BAUDING

As you might have guessed, the modem will adapt its baud rate to the calling modem and place itself in the answer mode. For example, if the calling modem is on 75 baud, the answering modem will automatically configure itself to 1200 baud. If the calling modem is on 300 baud (ORIG), our answering modem will set itself to 300 (ANSW). Note that if the calling modem is in answer mode, the auto baud facility will not detect any modem present, and hang up. Note that fast two-way communication is possible, but you have to reconfigure the modems to do it, ie, the originating modem must go into answer mode, and vice versa.

The software first configures the modem chip to generate the 2100Hz echo suppressor tone for a few seconds, then it waits for a short period of silence. The software then configures the 7910 modem chip to V.21 ANSW mode, taps the 300 baud from the baud rate generator and sends it to the 6850A (ACIA), and waits for the active carrier detect signal from the 7910 for two to three seconds. If there is no active carrier after the waiting period, the software reconfigures the 7910 to V.23 ANSW mode (that is, Tx-1200 Rx-75) and sends out its carrier tone, taps the corresponding baud rates to the ACIA and waits once again for the active carrier line. If carrier detect becomes active within the waiting period, the software 'locks' onto it. If not, the software will control the relays and hang up.

CASSETTE INTERFACING

A 741 op-amp acts as a buffer for the audio signal from the line. The output of the op-amp is then attenuated to drive the mic input of the cassette recorder. Most cheap data cassette recorders have mic and ear sockets. Some more expensive ones may have line-in and line-out. A line-in requires stronger signals to drive than mic so the attenuation in the attenuator may have to be reduced. This can be achieved by changing the resistance value in the attenuator.

The tape recorder ON/OFF can be controlled either locally or remotely. If you want to record something manually, plug the mic input of the recorder to the RECORD socket on the back of the modem. Any signal on the line is now connected to the mic input of the recorder.

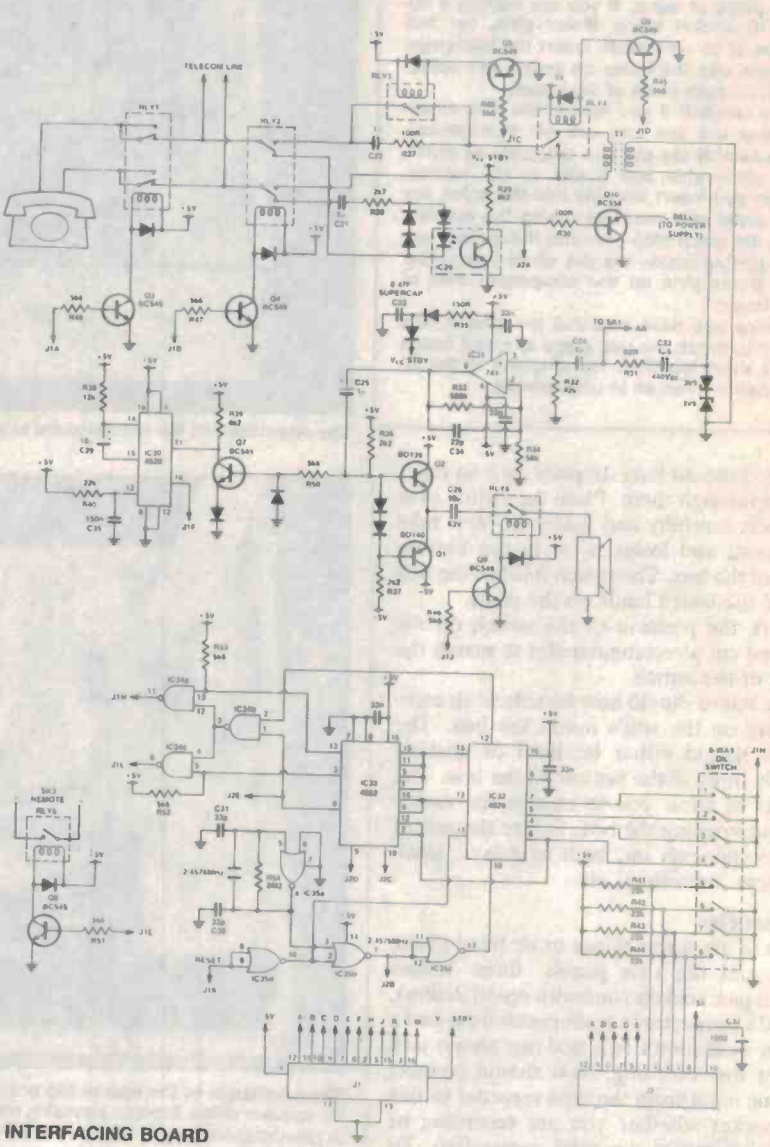
Press the PLAY and REC buttons on your recorder. The recorder does not start immediately because its remote ON/OFF is controlled by a reed switch in the modem which is normally open. This switch is controlled by two commands CSO and CSF for on/off control in the offline (command) mode. If you are in the online mode, talking to another modem, you have to offline yourself by typing a command on the keyboard, then using the CSO command to turn on the tape recorder. You can then get back to online mode and type a command to request a download from the other modem. Anything coming down the line will be recorded. To turn the recorder off, simply offline yourself and use the comamnd CSF.

There is a more intelligent way to control the tape recorder by the remote modem. The software implanted in the modem has the ability to recognise an escape control sequence as suggested by Viatel. Upon receipt of such a sequence, the software will turn the recorder on or off (if the recorder has been plugged in with the PLAY, REC buttons depressed).

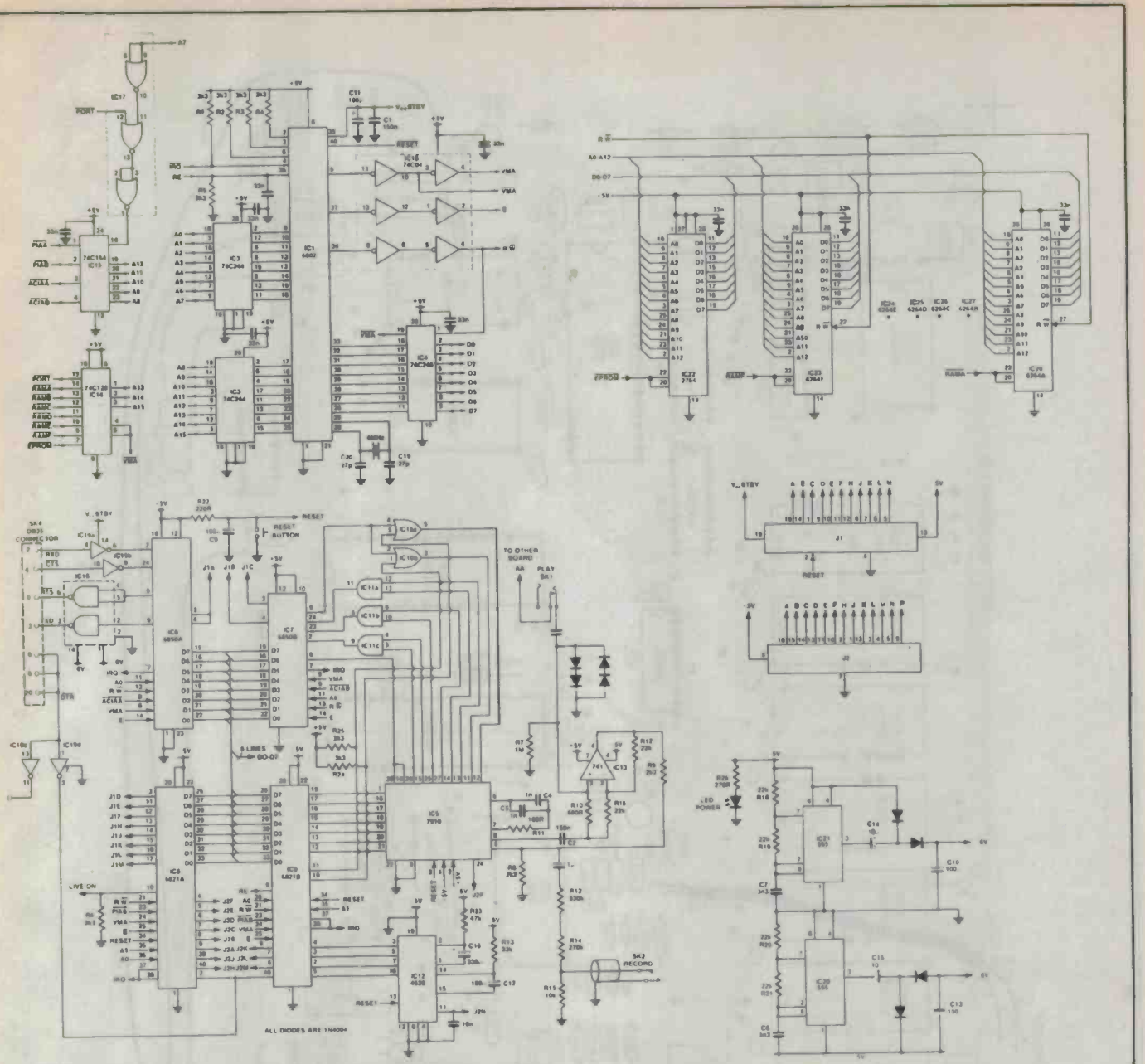
LINE MONITORING

The optical coupler is powered by the standby output of the power supply and is always active. Any voltage difference on the line will trigger the coupler output. It wakes up the power supply and the modem immediately goes into the ring detection mode. There are several different conditions which can trigger the coupler: the ringing current; a spike picked up by the line; lifting up and putting down the telephone handset; dialling on the phone. The signal generated on the output of the coupler by these is very similar.

To distinguish between them, the software relies on the different timings, for instance, if you pick up the phone a low pulse is generated on the coupler and then the output stays high for several hundred milliseconds at least. This is the delay time when you turn the dial. The software recognises this condition and ignores any more pulses on the coupler output, so the pulses on the coupler when the dial releases are ignored. The software goes into a timing loop for about half a minute and turns off the power supply. When the call is connect-



LINE INTERFACING BOARD



MOTHERBOARD

ed, the voice signal on the line is not strong enough to trigger the coupler to wake up the modem again.

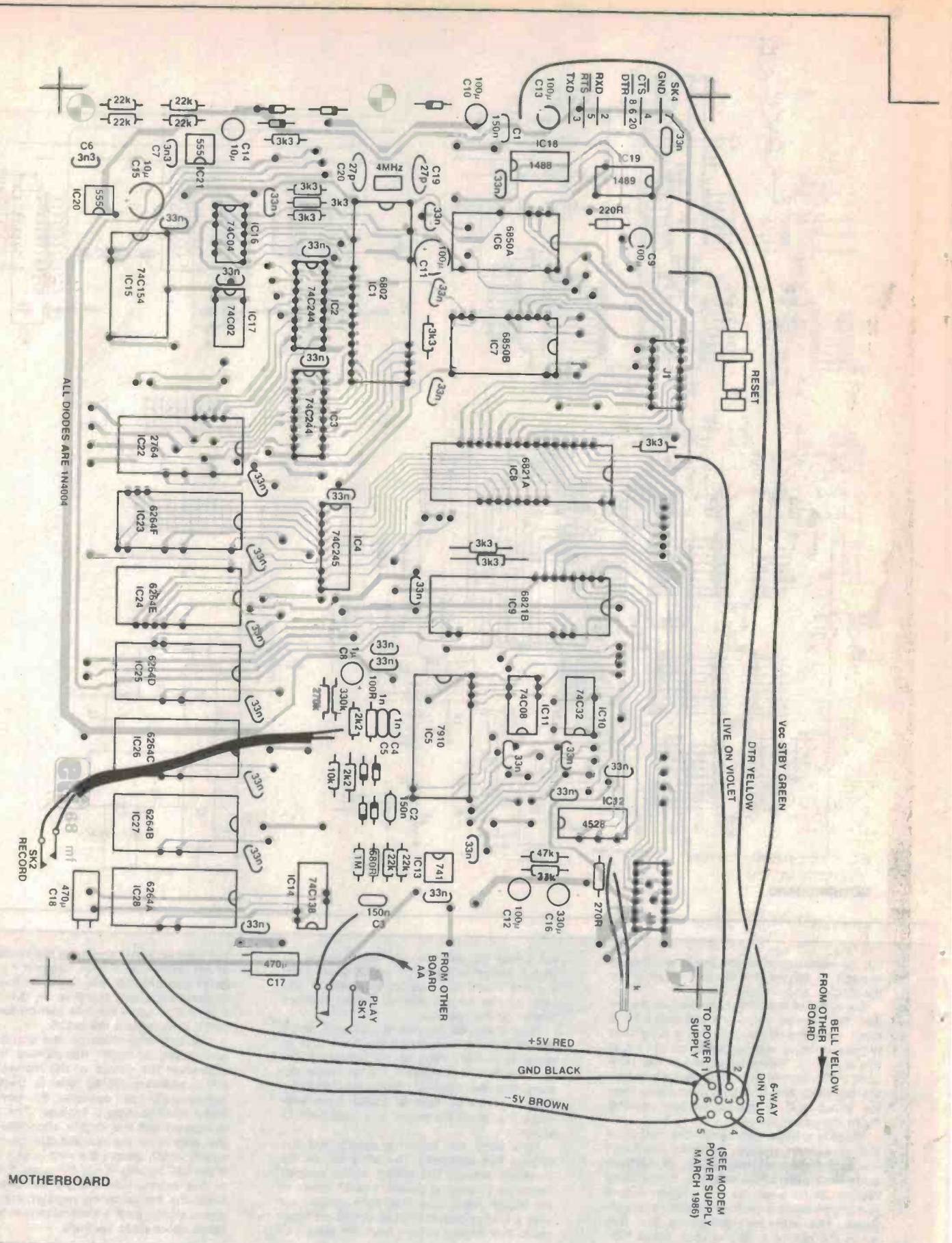
If a spike of lightning is picked up by the line, the coupler outputs a low pulse for a short time and stays high for a long time (unless there is another spike picked up at this moment). This long period (a few hundred milliseconds) of high is recognised by the software and it enters a counting loop for about half a minute before shutting down the power supply.

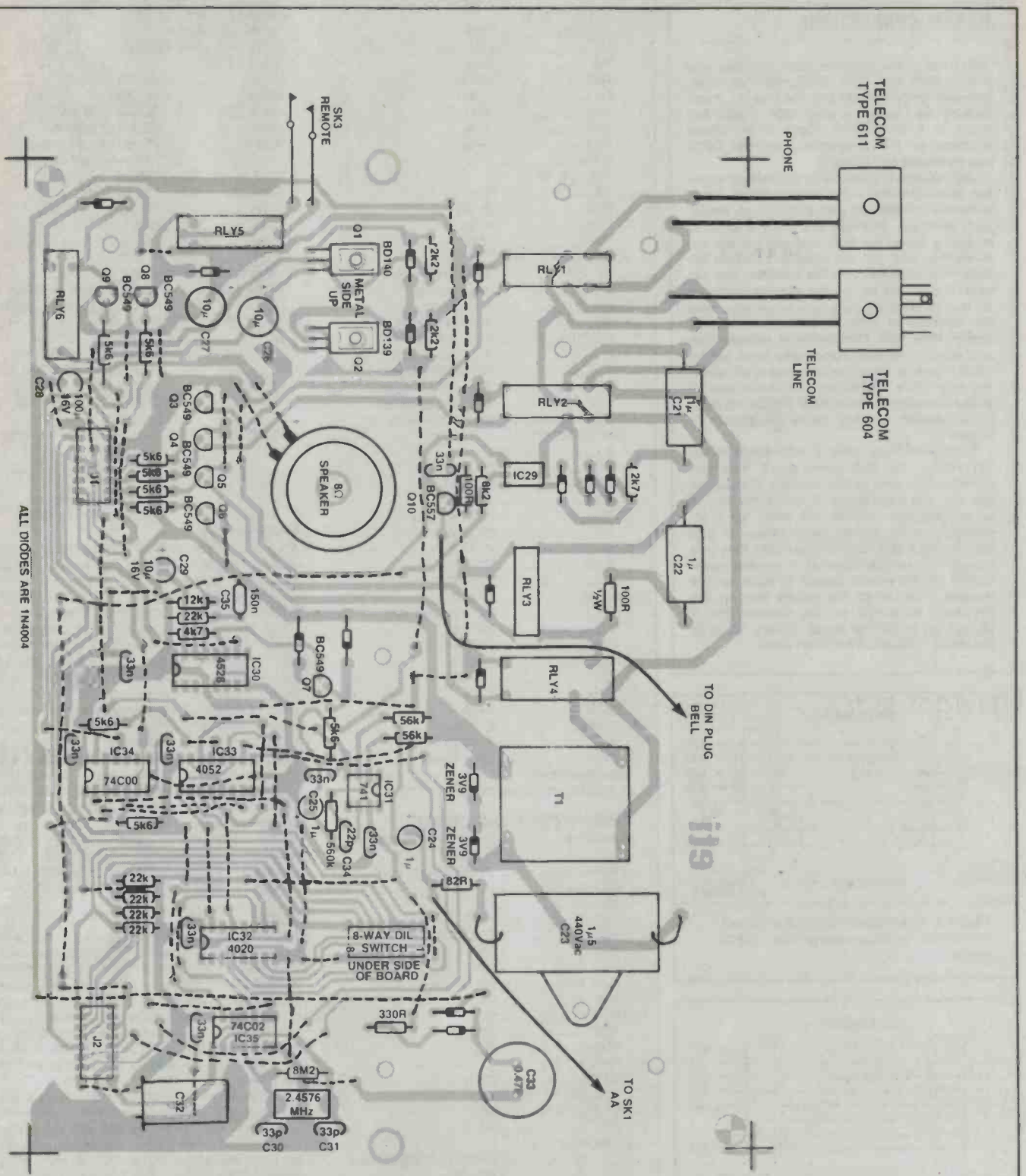
Ringing current will cause the output of the coupler to pulsate between high and low in a period of about 20 to 25 milliseconds for a total of 0.4 seconds, followed by silence for 0.2 seconds (the coupler output is high during this period) then the cycle repeats. The software recognises the ring when the output of the coupler stays high for about 25 milliseconds and returns to low. It jumps to a routine which does nothing but count the number of rings. It will pick up the phone after a certain number preset by the operator.

What if the ringing phone suddenly stops before the software loops the line? This is possible if the calling phone hangs up before the call is answered. The software detects that the ringing current has stopped after a response time of about three seconds. It cuts off the power and goes back to sleep.

How does the software detect that the ringing has stopped? The trick lies in the hardware set-up. The output of the coupler connects to several points, one of which is the trigger input of a 4528 monostable, set with a timing constant of about 40 milliseconds. The ringing pulses from the output of the coupler keep refreshing the timing cycle of the monostable until stopped by the silence gap between the rings. So the output of the monostable is active for 0.4s, off for 0.2s, active again for 0.4s and off for 2 seconds, then repeats the cycle.

The software relies on the on/off of the monostable to count the number of rings. Whenever the output of the monostable is off, a software timing loop is begun. The software will keep scanning the monostable while incrementing a register. The register is cleared and the loop is abandoned when the output of the monostable goes active again, which means the ring is still present. If the calling phone has hung up, the output of the monostable will be inactive. Meanwhile the incrementing register will reach a value higher than a maximum number. This takes about three seconds.


MOTHERBOARD
ALL DIODES ARE 1N4004
SK4
GND
CTS
DTR
RXD
RTS
TXD
IC16
1488
IC19
1489
220R
6850A
IC6
6850B
IC7
6802
IC1
4MHz
74C04
IC16
74C154
IC15
74C02
IC17
74C244
IC2
74C244
IC3
2764
IC22
6264F
IC23
6264E
IC24
6264D
IC25
6264C
IC26
6264B
IC27
6264A
IC28
6821A
IC8
6821B
IC9
74C245
IC4
7910
IC5
74C08
IC11
74C32
IC10
4528
IC12
74C138
IC14
741
IC13
555
IC20
555
IC21
RESET
J1
Vcc STBY GREEN
DTR YELLOW
LIVE ON VIOLET
TO POWER SUPPLY
(SEE MODEM POWER SUPPLY MARCH 1986)
6-WAY DIN PLUG
BELL YELLOW FROM OTHER BOARD
+5V RED
GND BLACK
-5V BROWN
FROM OTHER BOARD AA
PLAY SK1
SK2 RECORD



LINE INTERFACING BOARD

RS232C CONNECTIONS

The baud rates between your terminal and the modem are 1200, 2400, 4800 or 9600. Between your modem and the line it's much slower, the highest is only 1200. If your terminal is a dumb one, there is no speed problem so the connections on the DB25 are as shown in Figure 2.

An intelligent terminal is capable of sending (downloading) a file automatically. Most personal computers can emulate an intelligent terminal. You can ask such a terminal to find a file in the disk and send it off. Immediately, one can see a traffic problem between the terminal and the modem. The circular buffer set up by the control software in the modem to receive characters from the terminal is only 32 bytes long and is easily filled up. The software senses this and controls several handshake lines on the RS232 bus to stop the terminal from sending any more characters. To make use of those handshake lines, your RS232 connections should be like those illustrated in Figure 3.

Some terminals have a DTR (data terminal ready) line but some don't. You can connect this line to the modem if available but it's not necessary. If the DTR line is connected, the modem will wake up automatically to the offline mode whenever you turn on your terminal. Without this line, you simply turn on the terminal, press the pushbutton on the power supply to wake up the modem, then press the return key on the keyboard to signal to the modem that it should go to offline mode. Really, there is not much difference between them.

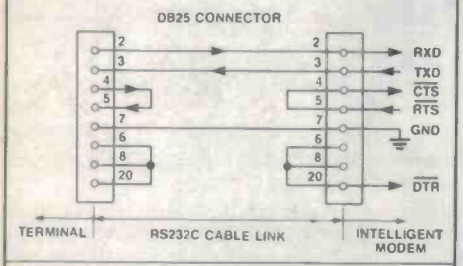


Figure 2. The simplest connection without handshake and data terminal ready (DTR) signal.

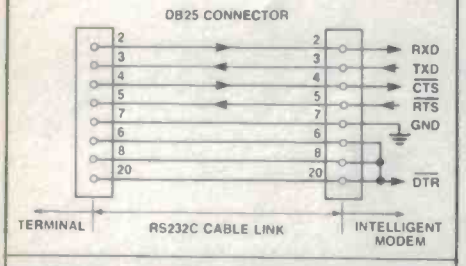


Figure 3. This configuration allows handshakes between the terminal and the modem for auto wake-up if the terminal is turned on.

ETI-684 — PARTS LIST

MOTHERBOARD

Resistors ..... all 0.25 W, 1% unless noted

R1, 2, 3, 4, 5, 6, 24, 25	3k3
R7	1M
R8, 9	2k2
R10	680R
R11	100R
R12	330k
R13	33k
R14	270k
R15	10k
R16, 17, 18, 19, 20, 21	22k
R22	220R
R23	47k
R26	270R

Capacitors

C1, 2, 3	150n greencap
C4, 5	1n greencap
C6, 7	3n3 greencap
C8	1µ/16V electro
C9, 10, 11, 12, 13	100µ/16V electro
C14, 15	10µ/16V electro
C16	330µ/16V electro
C17, 18	470µ/16V electro
C19, 20	27p disc ceramic

27 x decoupling capacitors 33n each

Semiconductors

8 x 1N4004 diodes	
IC1	6802 CPU
IC2, 3	74C244
IC4	74C245
IC5	7910 modem
IC6, 7	6850 ACIA
IC8, 9	6821 PIA
IC10	74C32
IC11	74C08
IC12	4528B
IC13	741 op-amp
IC14	74C138
IC15	74C154
IC16	74C04
IC17	74C02
IC18	1488
IC19	1489
IC20, 21	555 timer
IC22	2764 EPROM
IC23	6264 RAM

Miscellaneous

1 x 4MHz crystal for the CPU

LINE INTERFACING BOARD

Resistors ..... all 0.25 W, 1% unless noted

R27	100R (0.5W)
R28	2k7
R29	8k2
R30	100R
R31	82R (0.125W)
R32	82k
R33	560k
R34	56k
R35	150R
R36, 37	2k2
R38	12k
R39	4k7
R40, 41, 42, 43, 44	22k
R45, 46, 47, 48, 49, 50, 51, 52, 53	5k6
R54	8M

Capacitors

C21, 22	1µ/250V (Philips MKT-P 330 40)
C23	1.5µ/440V (Shizuki)
C24, 25	1µ/16V electro
C26, 27, 29	10µ/16V electro
C28	100µ/16V electro
C30, 31	33p ceramic
C32	1000µ/16V electro
C34	22p ceramic
C35	150n greencap

8 x decoupling capacitors 33n each.

Semiconductors

15 x 1N4004 diodes
2 x 1W, 3V9 zener diodes
1 x 5mm LED

Q1	BD140
Q2	BD139
Q3, 4, 5, 6, 7, 8, 9	BC549 or BC547
Q10	BC557 or BC558
IC29	SFH601 or equivalent (Siemens opto-coupler)
IC30	4528B
IC31	741 op-amp
IC32	4020B
IC33	4052B
IC34	74C00
IC35	74C02

Relays and Transformers

RLY1, RLY2	double pole 6V coil (Fujitsu 621D006) Telecom App No RA80/157
RLY3	dialling relay 5V coil (Fujitsu FRL-644E05) Telecom App No RA81/130
RLY4	single pole 6V coil (Fujitsu 611D006) Telecom App No RA80/157
RLY5, RLY6	5/6V coil on/off reed relay (Archer 275-232 or OMC-C-106H type)
T1	600:600R isolation transformer (Ferguson MT620 or Arlec 45035)

Miscellaneous

1 x 2.4576MHz crystal; 2 x 14-way, 5 x 16-way and 1 x 8-way IC sockets; 2 x 16-way DIL (IC look alike) connectors with 2 sections of flat cable 150mm long each; LED holder; 0.25W 8 ohms low profile loudspeaker, 57mm diameter (Dick Smith part No C-2222); Telecom socket (type 611) and plug (type 640) which are the same plug and socket used in your phone; female DB25 connector (SK4) for RS232 link and 6-way DIN plug for the power supply; pushbutton switch for reset; 3 x 3.5mm phono jack chassis mount sockets with on/off action (SK1, SK2, SK3): these are not necessary — it is better to use Molex pins to make a socket for chips with more than 16 pins, one pack of Molex pins should be enough depending how many 6264 RAM chips you want in your modem; 2 x rubber grommets and 2 x cable clamps; 1 x double-sided (mother) and 1 x single-sided (interfacing) pc boards; hook-up wire; self tapping screws; plastic box 260 (w) x 80 (h) x 190 (d) mm, Jaycar part No HB-5910.

NOTE

The following parts are not required in the basic model to get the modem going, but will enhance the function of it. You need 8K RAM chip (6264) in the basic model. It must be put into the position labelled as 6264F, that is, IC23 in the overlay. To expand the memory buffer (up to 48K totally), you must put the extra RAM chips in the following order: IC24, IC25 . . . IC28. So if you want to have 16K memory, put your first 6264 in position IC23, next to IC24, etc.

Only software turns off the main supply to the modem board. So long as the power supply unit is plugged into the mains, the standby power from the supply will support the backup memory (32 bytes inside the CPU) and certain parts in the modem. If the power supply is disconnected from the mains and STBY fails, there will be a total re-initialisation of the parameters in the modem. A 0.47F super cap can be placed in the circuit to avoid this.

Optional parts: 5 x 6264 RAM chips and 1 x 0.47F super cap (NEC).

Welcome to Feed Forward

We need your minds. Feed forward is a new section in the magazine that will continue the traditions of the 'letters to the editor' pages, 'ideas for experimenters', and the various computer columns. If you have any good ideas you want to share with us and the rest of the electronic community, send them to:

Feed Forward
ETI, Federal Publishing,
PO Box 227,
Waterloo, NSW 2017

Contributors can look forward to $20 for each published idea/program which should be submitted with the declaration coupon below.

Programs MUST be in the form of a listing from a printer. You should indicate which computer the program is for. Letters should be typewritten or from a printer, preferably with lines double spaced. Circuits can be drawn roughly, because we have a draughtsman who redraws them anyway, but make sure they are clear enough for us to understand.

COUPON

Cut and send to: **Scope-ETI 'Idea of the Month' Contest/Computing Column, ETI Magazine, PO Box 227, Waterloo NSW 2017.**

"I agree to the terms and grant *Electronics Today International* all rights to publish my idea/program in ETI Magazine or other publications produced by it. I declare that the attached idea/program is my own original material, that it has not previously been published and that its publication does not violate any other copyright."*

* Breach of copyright is now a criminal offence.

Title of idea/program .....

Signature ..... **Date** .....

Name .....

Address .....

..... **Postcode** .....

'Idea of the month' contest

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a 60 W portable cordless soldering iron, a 240 V charging adaptor together with a holder bracket. The prize is worth approximately $100.

Selections will be made at the sole discretion of the editorial staff of ETI Magazine.

RULES

The winning entry will be judged by the Editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

The winner will be advised by telegram. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each coupon. Photostats or clearly written copies will be accepted. You may send as many entries as your wish.

This contest is invalid in states where local laws prohibit entries. Entrants must sign the declaration on the coupon that they have read the above rules and agree to abide by their conditions.

Letters to the editor

Live chassis

I REFER TO your project 744 UHF tuner (ETI May, 1986).

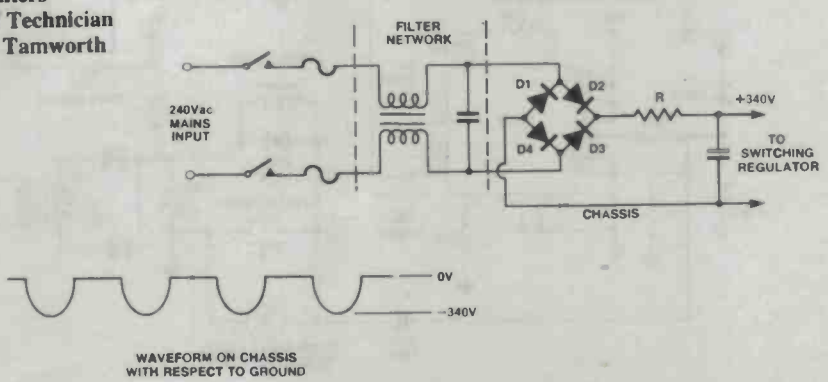
You state that "a live set is one which has the neutral of the mains connected directly to the chassis". I would like to point out that this is rarely the case. The usual arrangement is similar to that shown in the diagram.

As can be seen, the incoming mains, after being switched, passes through the mains fuses, through a filter network, then to a bridge rectifier. The negative terminal of the bridge rectifier (anodes of D1 and D4) is generally connected to the receiver chassis. The positive terminal of the bridge rectifier is connected via a surge limiting resistor to the reservoir capacitor and on to the switching-regulator.

In these receivers, no matter which way around the live and neutral mains leads are connected, neither lead is connected *directly* to chassis. Any attempt to measure continuity between mains leads and chassis (with the set disconnected from the mains!) could result in the wrong conclusions being drawn. Some meters would not forward bias the junctions of the diodes in the bridge on all ranges, even if the meter leads were applied to the circuit the right way around, leading to the conclusion that the set may not have a live chassis.

To conclude, if there is no earth pin on the power plug, or if there is an earth pin but no continuity between this pin and the receiver chassis, assume the set has a live chassis!

J. Kuiters
Chief Technician
2TM Tamworth



Mistakes in capacitor story

I WISH TO point out a few mistakes and misconceptions in your feature article "The little electric store" Sept, '85. The following is a list of brief comments regarding the section "Fields" p11.

1. (Para 2) The electron flow in a material also depends on temperature and the applied potential difference. Insulators *can* become conductors.
2. (Para 3) Electron orbits are *not* "normally circular". In fact the valence elec-

trons in metals are not even confined locally to an atom.

3. (Para 3) External electric fields do *not* produce elliptical orbits.
4. If the statement "field lines which indicate the direction of movement of a free charged particle . . ." were true, why is it that an electron beam in a cathode ray tube travels (nearly) *perpendicular* to the field lines between the deflecting plates?

D. Sidors
Northcote, Vic

1. *Quite correct. In fact some circuits use just this effect to measure temperature. All materials fall into a continuum with respect to their ability to conduct. Nevertheless, normal parlance suggests that if a material is used as a duct for current we call it a conductor, and if it's used to impede current flow we call it an insulator.*
2. *In fact it's not even clear that electrons exist in any sense that we would understand drawing on our normal experience in the macroscopic world, and they are most certainly not billiard balls in orbit like miniature planets. However, the article was not intended as a discourse on subatomic theory. It hardly seems appropriate to launch into a long rave on quantum theory in order to explain how capacitors work. For this purpose, the billiard ball model is perfectly adequate.*
3. *No. But quantum theory predicts that the probability of electron location at any given instant will form an ellipse around the nucleus in the presence of an electron field. Once again, this can be modelled quite adequately using the idea of an electron in elliptical orbit.*
4. *A charged particle accelerating down a tube at close to the speed of light is lots of things, but free it ain't. However, it is still responding to the combined forces acting on it. If it were not, it wouldn't deflect.*

Jon Fairall

ETI scores!

THERE I WAS, my third lesson at a CAE Basic Computer course for beginners, thinking I was very clever. I have a VZ300 and have tried a few simple programs at home, and I wanted to see the instructor's face when I got this colourful haze on the screen!

In went the "Dynachromics Generator" program for Apple computers (April '85 ETI) and I called the instructor and his friend over for a look see. Can you imagine my embarrassment when the screen showed "APRIL FOOL" (funny if you're at home — but not in front of a couple of professionals!!!!!).

I'd just like to thank Lindsay R. Ford for sending the program in to ETI and I hope I can get you both back when I learn enough to write my own programs.

Rhonda Harvey
Wantirna, Vic

Pleased prizewinner

JUST A SHORT note to thank you and all at ETI for giving us readers a chance to enter competitions such as the HP/ETI PC Instruments one.

Being one of the winners, my HP multimeter duly arrived and has been put to good use already. Needless to say I am extremely pleased with it, particularly as my area of interest is measuring instruments.

Keep up the good work with the magazine; it's very popular as evidenced by the trouble I'm having getting back copies!

Tom Macha
Sandy Bay, Tas

Them vs us

YOUR ARTICLE "Programmes turn on VCR" (Jan ETI) was interesting to note. It would seem that the "them vs us" mentality so pervasive in Australian society, and also evident in the continuing fight between broadcasters and the videotapers over among other things copyright materials is not the same in Europe. One wonders whether this co-operative attitude of the Europeans might have something to do with their having made so many innovations and what's generally termed 'progress'.

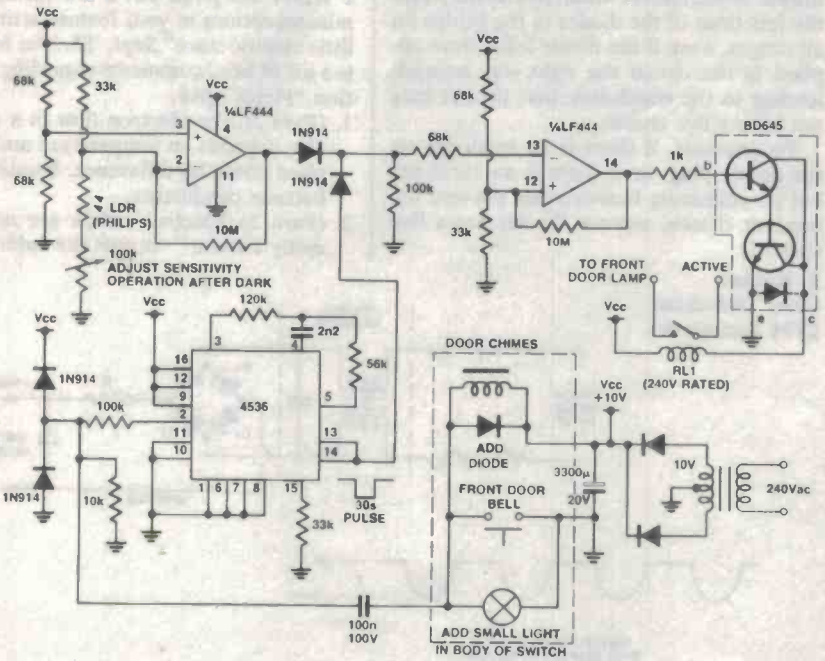
While we see the computer and automation as evils, those people seem often to see them only as tools — and get on with it.

David Miller
Maddington, WA

Idea of the Month

Light timer

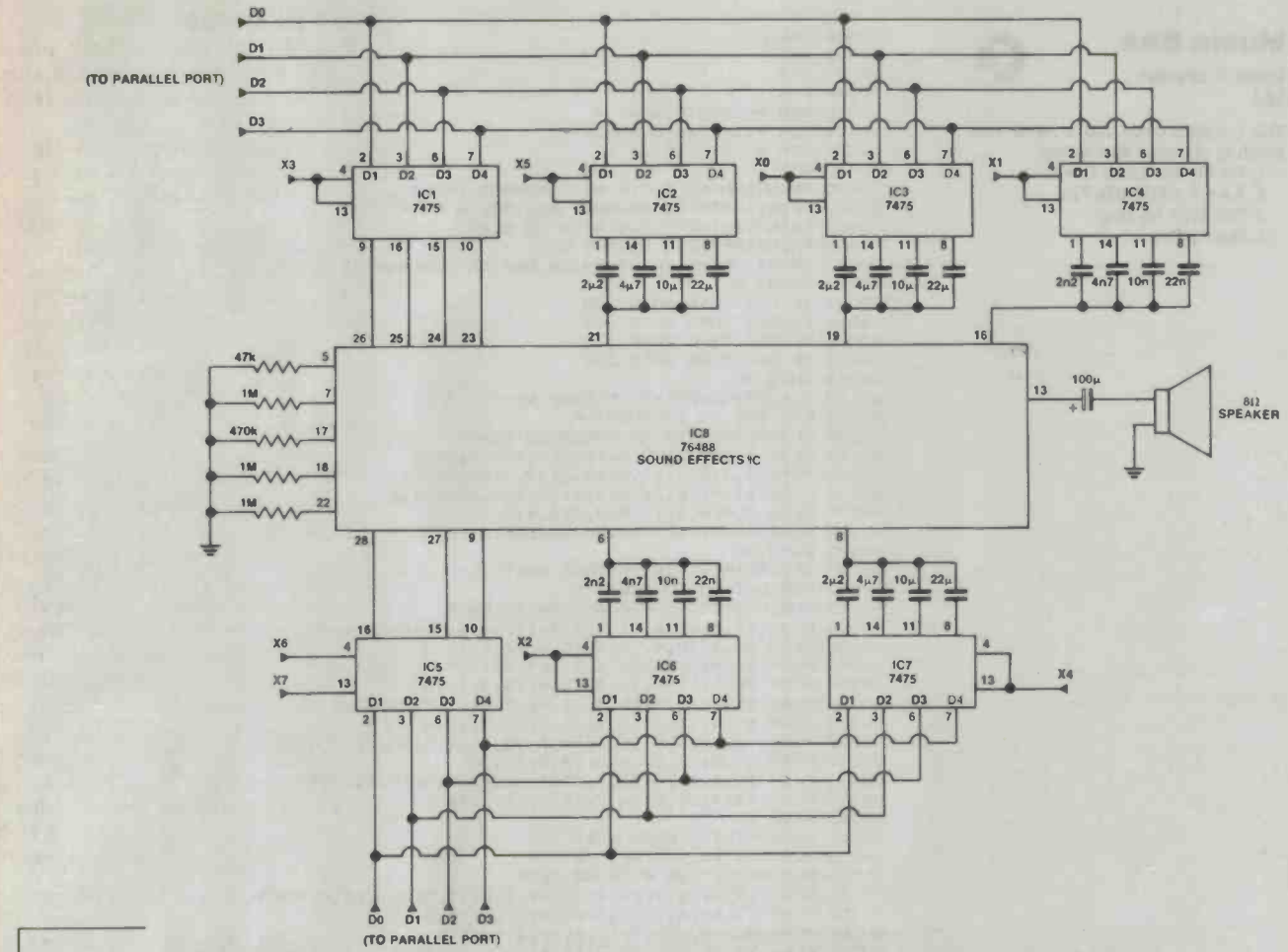
C. Allan,
Blackburn South, Vic

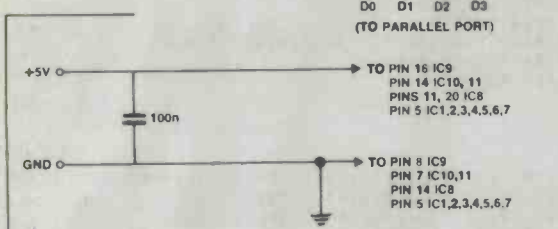


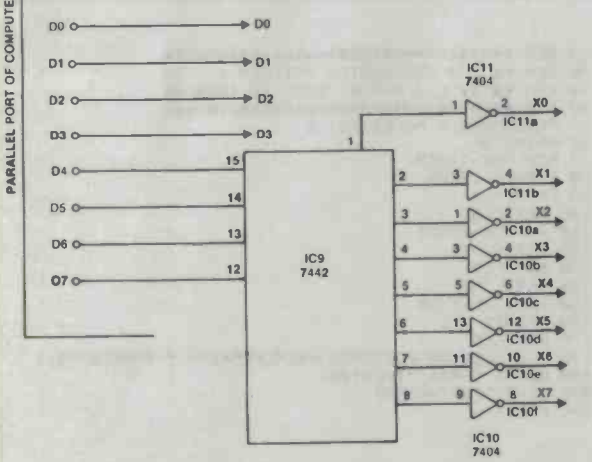
This project was developed out of the need for a light above the front door which would automatically switch off after 30 seconds.

The operating switch is the same one used to operate a door chime. In practice this means that when someone comes to the front door the outside light switches on when the caller operates the door chime. It will then stay on long enough for the call to be answered. An LDR is incorporated in the circuit to deactivate it during daylight hours.

The circuit is quite straight forward. A 4536 acts as a 30 second one shot activated by the door chime. The output pulse from the 4536 is sent to one quarter of an LF444 which inverts the signal and drives a Darlington pair, the BD645. This provides the current necessary to turn on the relay which fires the bulb. Notice that the 4536 signal is effectively gated by the LDR operating through another quarter LF444.







Sound Effects Generator

M. Sorell of Clarence Park SA 5034 sent us his idea for a sound effects generator to use with the parallel port of a micro. While most micros can make a variety of sounds on an internal speaker under software control, the advantage of this circuit is that it frees the processor from this function. This can be quite significant if the processor is trying to keep track of a fast moving game while at the sime time generating complex sound effects.

The circuit is centred around the 76488 sound effects chip. For a full description of how it works either consult manufacturer's data or ETI August 1981, where a complete explanation is given. In general, the chip is divided into a number of functional blocks, each of which can be accessed via the appropriate pins. Most of these blocks require one pin to turn them on, and two to service an RC network that regulates analogue functions like duration and intensity.

In order to use the system it is necessary to output appropriate codes into the data and address buffers on the board.

Music Box

Peter Ochman
WA

This program gives you a menu from which to choose 1 to 4 tunes:

1. Tie Me Kangaroo Down;
2. Advance Australia Fair;
3. Pub With No Beer;
4. Botany Bay.

```
00001 Z=1
00002 X=2
00003 T=3
00004 K=4
00010 REM *<<MUSIC BOX>>*
00020 REM *<<PETER OCHMAN>>*
00030 REM *<<7/8/85>>*
00040 CLS
00050 PRINT:PRINT"1 TIE ME KANGAROO DOWN"
00060 PRINT:PRINT"2 ADVANCE AUSTRALIA FAIR"
00064 PRINT:PRINT"3 PUB WITH NO BEER"
00066 PRINT:PRINT"4 BOTANY BAY"
00070 PRINT:PRINT:PRINT"WHICH ONE DO YOU WANT(1/4)"
00080 INPUT A
00090 IF A=T THEN GOTO 330
00095 IF A=K THEN GOTO 405
00100 IF A=Z THEN GOTO 120
00110 IF A=X THEN GOTO 200
00115 GOTO 80
00120 CLS:PRINT:PRINT" PLEASE WAIT..."
00123 FOR M=1 TO 100:NEXT M
00125 CLS:PRINT"TIE ME KANGAROO DOWN"
00140 PLAY 4,4;9,2;13,4;11,2;9,4;6,6;11,6
00150 PLAY 4,4;8,2;11,4;14,2;18,4;16,8;0,1
00160 PLAY 13,4;16,2;13,4;11,2;9,4;6,6;11,6
00170 PLAY 4,4;8,2;11,4;9,2;8,4;9,4
00180 PLAY 16,2;16,1;16,2;16,1;16,4
00190 GOTO 40
00200 CLS:PRINT:PRINT"PLEASE WAIT..."
00210 FOR B=1 TO 100:NEXT B
00215 CLS:PRINT"ADVANCE AUSTRALIA FAIR"
00220 PLAY 11,4;16,4;11,4;8,4;11,4;16,5;16,2;16,4
00230 PLAY 20,4;18,4;16,4;15,4;16,4;18,8
00240 PLAY 11,4;16,4;11,4;8,4;4,4;11,5;11,2;11,4
00250 PLAY 20,4;18,4;16,4;15,4;13,4;11,8
00260 PLAY 11,4;13,5;15,2;16,4;13,4;11,5;8,2;8,4
00270 PLAY 11,4;13,4;16,4;21,4;20,4;18,8
00280 PLAY 11,4;13,5;15,2;16,4;13,4;11,5;16,2;16,4;18,4
00290 PLAY 20,5;16,2;18,5;15,2;16,8
00300 PLAY 20,4;21,4;20,4;18,4;16,4;15,4;13,4;11,4
00310 PLAY 16,4;20,5;16,2;18,5;15,2;16,8
00320 GOTO 40
00330 CLS:PRINT"PLEASE WAIT..."
00334 FOR N=1 TO 100:NEXT N
00336 CLS:PRINT"PUB WITH NO BEER"
00340 PLAY 18,2;18,4;17,4;20,4;18,4;13,5;10,2;8,4;7,4;8,4
00350 PLAY 15,6;15,2;15,2;13,4;17,4;15,4;13,6
00360 PLAY 8,2;8,2;8,4;10,4;11,4;10,6
00370 PLAY 18,2;18,2;18,4;17,4;20,4;18,4;13,5;10,2;8,4;7,4;8,4
00380 PLAY 15,6;15,2;15,2;13,4;17,4;15,4;13,6
00390 PLAY 8,2;10,2;11,4;10,4;8,4;6,6
00400 GOTO 40
00405 CLS:PRINT"PLEASE WAIT..."
00406 FOR S=1 TO100:NEXT S
00407 CLS:PRINT "BOTANY BAY"
00410 PLAY 7,1;9,1;11,2;14,2;14,2;9,2;12,2;12,2;11,1;9,1;7,5;0,1
00420 PLAY 14,2;11,2;14,2;19,2:12,2;16,2;19,2;14,6;0,1
00430 PLAY 14,2;19,2;18,2;19,2;21,2;19,2;16,2;14,2;11,1;7,5;0,1
00440 PLAY 7,1;9,1;11,2;14,2;14,2;9,2;12,2;11,2;7,6
00450 GOTO 40
```

Crosshatch Pattern

L. R. Hatch
Hillarys, WA

Some years ago I built a Crosshatch Generator kit (ETI-704). Every time I went to use it I would have to make small adjustments to get it to operate satisfactorily.

Just recently I realised that the Commodore 64 could be programmed to produce a Crosshatch Pattern every time, without the need for any adjustments.

Line 50 sets both the foreground and background to black.

Lines 60-170 print the white crosshatch pattern on the screen, leaving the last two screen characters blank (to prevent the Commodore scrolling).

Line 180 pokes the characters into the last two screen positions.

Lines 190-300 wait for the user to press the F1 key before terminating the program.

```
10 REM ********************************
20 REM **    * CROSSHATCH PATTERN *    **
30 REM ** BY L.R.HATCH. SEPT 10,1985 **
40 REM ********************************
50 POKE53280,0:POKE53281,0
60 PRINT"■"
70 FORLINE=1TO12
80 FORCLM=1TO20
90 PRINT" ╱";
100 NEXTCLM
110 FORCLM=1TO20
120 PRINT"─╲";
130 NEXTCLM
140 NEXTLINE
150 FORCLM=1TO19
160 PRINT" ╱";
170 NEXTCLM
180 POKE2022,32:POKE2023,66:POKE56294,1:POKE56295,1
190 GETA$:IFA$=""THEN190
200 IFA$<>"■"THEN190
300 END
```

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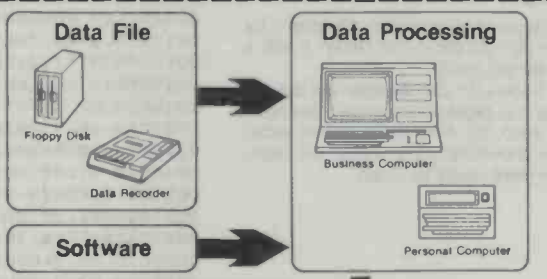

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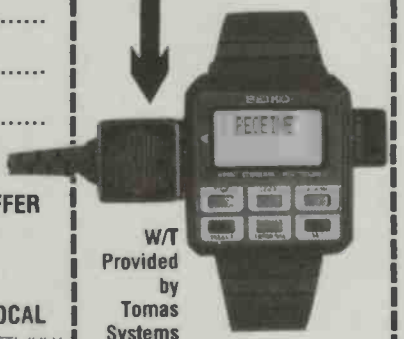

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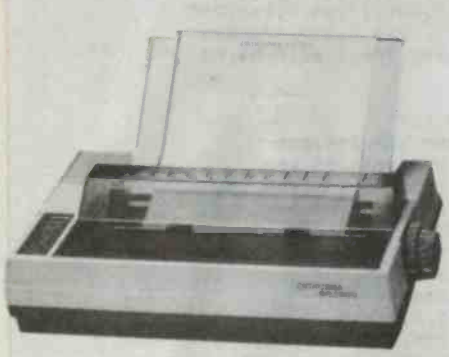

Features of SP-1000
• 100 cps (Draft mode), 20 cps (Near Letter Quality) print speed, with reduced noise level. • Pin-feed or friction-feed • Automatic paper loading function. • Right, left margin set function. • A variety of functions including: Underline, Bold print, Double Striking. • A variety of print character sets including: Pica, Elite, Proprotional, Elongated, Condensed, Italics, Super/Subscripts, and Italic Super/Subscripts.

Features of BP5200
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Koolcat

I. Florance,
Magill, SA 5072

This game is in colour. It's meant for the little people in the family. It has a keyboard option.

Tiddles the cat has been left outside and it is beginning to snow. You have to keep him from being buried under the snowflakes. The longer he lasts, the more points you gain.

```
00100GOTO120
00110 REM12345678901234567890123456789012345678901234567890123456789012345678901
23456789012345678901234567890123456789012345678901234567890123456789012345678901
234567890123456789012345678901234567
00120 REM KOOLCAT     -     by Ian Florance - (C) 1985
00130COLORBO:COLOR 7:CLS:PRINT"SNOW STORM":PRINT:PRINT:COLOR 7
00140PRINT"Tiddles the cat has been left outside and he hates SNOW FLAKES."
00150PRINT:COLOR 4:PRINT"DON'T LET HIM BE BURIED UNDER THEM!":PRINT
00160COLOR 6:PRINT"USE THE Q KEY TO MOVE LEFT   &   THE J KEY TO MOVE RIGHT"
00170COLOR 7:PRINT"You gain points with the more snow that falls."
00180RESTORE450:B=0:FORI=2320TO2465:READA:B=B+A:POKEI,A:NEXTI
00190SD 6:C=2320:D=2384:F=0:IFB<>14743THENPRINT"error in data":STOP
00200B=0:FORI=-992TO-643:READA:B=B+A:POKEI,A:NEXTI:IFB<>-14879THEN190
00210CURS1,15:COLOR 7:PRINT"HAVE YOU A JOYSTICK?"SPC(10)"(Default is yes.)"
00220A1$=KEY$:IFA1$=""THEN220ELSEIFA1$="N"ORA1$="n"THENLETB=1ELSELETB=0:OUT1,255
00230COLOR 2:COLORBO:CURS 1,16:PRINT"PRESS ANY KEY OR FIRE BUTTON TO START";
00240COLOR 7:COLORB4:E=0:P1=.05:IFB=0THEN260
00250A1$=KEY$:IFA1$=""THEN250ELSE270
00260A=IN(0):A=143-(AAND143):G=-(AAND128):IFGTHEN270ELSE260
00270CLS:PCG:N=INT(RND#52+1):CURSN+2,2:PRINT"BCDEFGHIJ":CURSN,3
00280PRINT"KLMNNOPQRST":COLOR 6:H=INT(RND#50+1):CURSH,15:PRINT"UV":COLORBO
00290NORMAL:CURS32,1:COLOR 5:PRINT"HIGHEST SCORE is ";F:PCG
00300COLOR 2:FORI=1TO63:CURSI,16:PRINT"W";:NEXTI:COLOR 7:COLORB4:NORMAL
00310IFB=1THEN420ELSELETA=IN(0):A=143-(AAND143):G=-(AAND4):IFGTHENLETH=H-1:IFH=0
THENLETH=63
00320G=-(AAND8):IFGTHENLETH=H+1:IFH=64THENLETH=1
00330FORI=1TO2:G=USR(C,257):N=N-1:IFN=0THENLETN=64
00340NEXTI:COLOR 6:A=1+INT(RND#12)#256:G=USR(D,A):CURSH,15:PCG:PRINT"U";
00350IFH=63THENCURS1,15:PRINT"V":G=1ELSEPRINT"V":G=H+1
00360NORMAL:IF PEEK(62271+H)<>32THEN410
00370IFPEEK(62271+G)<>32THEN410
00380COLOR 7:IFRND<P1ANDN<52THENCURSN+INT(RND#12),4:PRINT"*";
00390IFRND<.8THENLETG=USR(C,2563)
00400E=E+1:CURS1,1:PRINT"SCORE ";E:P1=P1+.01#P1:GOTO310
00410PLAY15,2:IFE>FTHENLETF=E:GOTO230ELSE230
00420A1$=KEY$:IFA1$="Q"ORA1$="q"THENLETH=H-1:IFH=0THENLETH=63
00430IFA1$="J"THENLETH=H+1:IFH=64THENLETH=1
00440GOTO330
00450DATA197,33,192,239,205,45,9,58,153,0,254,255,193,192,62,64
00460DATA211,8,33,192,247,205,45,9,62,0,211,8,201,4,12,17,64,0
00470DATA25,13,32,252,126,8,84,93,35,197,1,63,0,237,176,8,18,193
00480DATA16,240,201,0,0,0,0,0,0,0,0,0,62,0,184,32,2,6,1,12
00490DATA197,33,0,244,205,117,9,58,153,0,254,255,193,192,62,64
00500DATA211,8,33,0,252,205,117,9,62,0,211,8,201,17,64,0,167,237
00510DATA82,13,32,250,229,167,237,82,209,197,1,64,0,237,176,193
00520DATA17,64,0,167,237,82,16,236,124,254,248,208,1,62,0,84,93
00530DATA19,62,32,119,237,176,201
00540REM P.C.G. characters
00550DATA0,0,0,0,0,0,0,0,3,7,15,31,63,127,127
00560DATA0,0,0,0,0,0,0,31,255,255,255,255,255,255,255
00570DATA0,0,0,0,0,0,7,255,255,255,255,255,255,255,255
00580DATA0,0,0,0,0,255,255,255,255,255,255,255,255,255,255
00590DATA0,0,0,0,0,252,255,255,255,255,255,255,255,255,255
00600DATA0,0,0,0,0,0,128,224,216,251,255,255,255,255,255
00610DATA0,0,0,0,0,0,0,0,255,255,255,255,255,255,255
00620DATA0,0,0,0,0,0,0,0,0,231,255,255,255,255,255
00630DATA0,0,0,0,0,0,0,0,0,224,240,252,254,254,255
00640DATA0,0,3,31,63,127,127,127,127,63,31,3,0,0,0,0
00650DATA0,127,255,255,255,255,255,255,255,255,255,255,255,7,0,0,0
00660DATA127,191,255,255,255,255,255,255,255,255,255,255,255,255,0,0,0
00670DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,0,0,0
00680DATA255,255,255,255,255,255,255,255,255,255,255,255,255,252,0,0,0
00690DATA255,255,255,255,255,255,255,247,252,255,219,224,128,0,0,0,0
00700DATA255,255,255,255,255,255,255,255,255,255,255,255,63,3,0,0,0
00710DATA255,255,255,255,255,255,255,255,255,255,255,255,252,192,0,0,0
00720DATA255,255,255,255,255,255,255,255,255,224,192,0,0,0,0,0,0
00730DATA255,255,254,254,252,240,224,0,0,0,0,0,0,0,0,0,0
00740DATA0,0,0,132,204,252,180,254,183,135,127,3,2,2,2,6
00750DATA30,55,6,6,6,6,3,255,255,255,254,252,4,4,4,12
00760DATA85,85,255,255,255,255,255,255,255,255,255,255,255,255,255,255,255
```

Recall

Saul Clay Hruza,
Flagstaff Hill, SA 5159

If you have ever had battles with family or friends over the practical uses of your computer, this is the program for you. It simply reads a question from a data statement you have made and checks to make sure your input is the same as the following data statement (ie, the correct answer!). I have used the example of a French vocabulary test, however you may adapt it for anything you find difficult to memorise.

There are three locations you must change every time you enter a new data statement, they are lines 210, 220 and 230. To enter new questions, make the appropriate DATA statements and change the numbers in the above lines to twice the number of questions (ie, in my example I had five questions, or 10 data statements in all, so A1 and X must equal 10). I have found the program very useful especially before exams!

```
00100 POKE 257,1 :REM  FORCED UPPER CASE
00110 REM            ************************************
00120 REM            * RECALL PROGRAM FOR THE MICROBEE  *
00130 REM            *      Saul Hruza     1985         *
00140 REM            ************************************
00150 REM                        INTRODUCTION
00160 CLS :LORES :PLOT 10,35 TO 40,35 :PLOT 20,35 TO 20,10 :CURS 14,8
:PRINT "R E C A L L" :CURS 25,10 :PRINT "FOR THE MICROBEE"
00170 PLOT 0,0 TO 127,0 TO 127,46 TO 0,46 TO 0,0
00180 PLAY 6,416,211,411,411,413,413,418,615,211,6 :NORMAL
00190 CLS
00200 STRS(2000)
00210 DIM A1(10) :REM THE NUMBER HERE EQUALS THE AMOUNT OF DATA
STATMENTS
00220 FOR X=1 TO  10   :READ A1$(X) :NEXT X:REM THE NUMBER HERE EQUALS
THE AMOUNT OF DATA STATMENTS
00230 CLS :FOR X=1 TO  10  STEP2 :REM THE NUMBER HERE EQUALS THE
AMOUNT OF DATA STATMENTS
00240 LET M=INT(RND*8)+1 :IF R=2 THEN NEXT* X 270
00250 NEXT X
00260 GOTO 230
00270 INVERSE :PRINT*"What is the French for ?" :NORMAL :REM  YOU CAN
CHANGE THE QUESTION HERE TO SUIT WHATEVER FIELD YOU ARE USEING
00280 CURS2,6 :PRINT A1$(X) :PRINT :INPUT;B1$ :IF B1$ = A1$(X+1) THEN
GOTO 340 ELSE 310
00290 GOTO 230
00300 REM                          REWARD
00310 PRINT "  Sorry , you got it wrong , the correct answer was
"A1$(X+1) :PRINT "" :PLAY 0,15 :LET N=N+1
00320 IF N=5 THEN 360 ELSE 230:REM THE AMOUNT OF QUESTIONS YOU WISH TO
ASK
00330 REM                          CORERECTION
00340 PRINT "  Correct ! Very good ."":PLAY0,10 :LETS=S+1 :LET N=N-1
00350 IF N=5 THEN 360 ELSE 230 :REM  THE AMOUNT OF QUESTIONS YOU WISH
TO ASK
00360 CLS:PRINT"   Very good , your score was "!S!" out of 5"
00370 INPUT"    Do you want another go (Y/N) ?"!Z1$ :RESTORE :IF
Z1$="Y" THEN 220
00380 REM                          QUESTIONS AND ANSWERS
00390 DATA "THE RAILWAY STATION","LA GARE"
00400 DATA "CASTLE","LE CHATAEU"
00410 DATA "HELLO","BONJOUR"
00420 DATA "GOODBYE","AU REVOIR"
00430 DATA "CHICKEN","LE POULET"
00440 DATA "MORE QUESTIONS","MORE ANSWERS"
00450 DATA ......
```

ETI-666 Software Control

R. J. Martindale,
Mill Park, Vic

The article describing the ETI-666 parallel printer switch (**ETI**, February 1985) explains how it can't be software controlled from its driving port using ESCAPE sequences, as this would (i) require some means of recognising such sequences adding to the complexity of the switch, and (ii) cause some problems when sending graphics information, etc, to your selected printer or other peripheral device.

For Microbee owners, however, all is not lost: there is a way to software control the ETI-666. Some modifications will be required to the motherboard of the Microbee, but these only consist of making extra connections to spare pins of the parallel port output socket. Depending on which particular model of Microbee you have, you may even find some (or all) of these connections already exist.

The ETI-666 may be controlled by a single TTL level signal in place of the switch provided, so a ninth 'data ▶

bit' is required from the computer dedicated to this purpose.

Now the good luck for Microbee owners!

On the B side of the Microbee's Z80-PIO (the serial port side) will be found data bit DB7 at pin 34. On early model Microbees this pin was simply pulled high via a 4.7k resistor only and was unused, although it was programmed to be an input, causing interrupts to be generated as part of the networking mode of operation. No other connection was actually made to this PIO pin.

On later model 'Bees this bit is used for other functions such as regular update of the software clock provided on some models. Reference to the *Microbee Hardware Notebook* indicates that the actual connection of this bit can be altered by rearranging some links on the motherboard — one of the options being to connect it to pin 14 of the parallel port socket.

So, if this data bit is in fact connected to the parallel port socket, and it is altered to become an output by reprogramming the PIO B side, it can then be used as the required control line for the ETI-666, with a "0" selecting printer #1, and "1" selecting printer #2.

Implementation steps:

1. As the Microbee parallel port is not true Centronics, some mods may be required to make it so. The simplest way is to add the ETI-671 parallel printer interface (ETI October 1983) between the output socket and the ETI-666 switch — the arrangement shown in the circuit diagram.

(Note that on some latest model Microbees an internal circuit has been added which produces the required Centronics active low *STROBE signal at pin 6 of the parallel port socket — in this case the additional interface circuit will not be required.)

2. Connect pin 34 of the Z80-PIO to pin 14 of the parallel port socket. This may be done by rearranging board links or running an extra piece of hookup wire depending on the model 'Bee you have.

3. To power the printer switch, provide unregulated 10V at pin 9 of the parallel port socket — again note that this connection may already be in place on some models.

4. Delete the printer selector toggle switch from the ETI-666 and connect the new control line to the junction of resistors R1 and R2 using an additional conductor in the input connecting cable.

5. Reprogram the B side of the PIO to make bit DB7 an output which can be set or reset to control the ETI-666 switch.

The circuit diagram shows the arrangement.

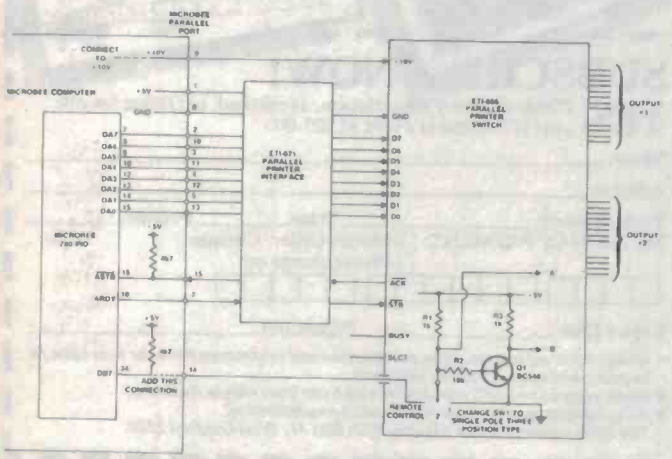
The two-position printer selector switch in the ETI-666 is replaced by a three-position type as shown. This arrangement retains the ability to manually select printers or opt for the remote control mode under control of the host computer.

Sample software subroutines to drive the modified printer switch, both in MicroWorld BASIC and Z80 Assembler, are listed. I tucked the machine code routines into the end of a customised "NET" EPROM, where they can be accessed from BASIC with the USR command or with a direct call from machine code programs.

The described modifications in no way affect the normal operation of the Microbee's parallel port. If the extra facility of the new control line is not required then simply make no connection to it.

WARNING!!!

As indicated throughout the text, a number of the required modifications or connections may or may not exist within various models of Microbee computer. Thoroughly check the circuit diagram for your particular model to determine exactly which mods must be done to your machine.




```
09000 REM *SOFTWARE CONTROL OF ETI-666 PRINTER SWITCH FROM MICROBEE*
09010 REM
09020 REM Printer Selection subroutines which can be added to
09030 REM MicroWorld BASIC programs and called as required to
09040 REM select desired printer or other peripheral.
09050 REM
09060 REM R.Martindale 31/03/1986
09070 REM
09080 REM
09090 REM Subroutine to reprogram B side of PIO to make bit 7 output
09100 REM
09110 OUT 3,130: REM set Interrupt Vector
09120 OUT 3,255: REM set Mode 3 (Bit in/out mode)
09130 OUT 3,25:  REM set bits 4,3,0 as inputs, 7,6,5,2,1 as outputs
09140 OUT 3,183: REM Interrupt Control Word
09150 OUT 3,255: REM Mask Control Word - don't monitor any bits
09160 OUT 2,32 : REM set RS232 output bit high
09170 RETURN
09180 REM
09190 REM
09200 REM Subroutine to set bit B7=0 (peripheral #1 selected)
09210 REM
09220 LET X=IN(2): REM read PIO B side data port
09230 IF X<128 THEN RETURN: REM return if B7 already = 0
09240 LET X=X-128: REM set B7 = 0
09250 OUT 2,X: REM send new value back to data port
09260 RETURN
09270 REM
09280 REM
09290 REM Subroutine to set bit B7=1 (peripheral #2 selected)
09300 REM
09310 LET X=IN(2): REM read PIO B side data port
09320 IF X=>128 THEN RETURN: REM return if B7 already = 1
09330 LET X=X+128: REM set B7 = 1
09340 OUT 2,X: REM send new value back to data port
09350 RETURN
```

```
ADDR   CODE   LINE   LABEL  MNEM   OPERAND

                00100 ;*SOFTWARE CONTROL OF ETI-666 PRINTER SWITCH FROM MICROBEE*
                00110 ;Z80 Assembler subroutines which can be added into
                00120 ;larger machine code programs and called as required
                00130 ;to select desired printer or peripheral.
                00140 ;R.Martindale 31/03/1986
                00150
EFCD            00160        ORG    0EFCDH          ;ORG where required!
EFCD            00170        DEFR   16
                00180
                00190 ;Subroutine to program B side of PIO
                00200 ;to make bit B7 an output.
EFCD F5         00220        PUSH   AF              ;save regs
EFCE E5         00230        PUSH   HL
EFCF 21E2EF     00240        LD     HL,TABLE
EFD2 7E         00250 READ   LD     A,(HL)          ;read data
EFD3 B7         00260        OR     A               ;test data for table end
EFD4 2805       00270        JR     Z,SET
EFD6 D303       00280        OUT    (3),A           ;out to port
EFD8 23         00290        INC    HL              ;inc table pointer
EFD9 18F7       00300        JR     READ            ;loop
EFDB 3E20       00310 SET    LD     A,20            ;set RS232 out bit high
EFDD D302       00320        OUT    (2),A
EFDF E1         00330        POP    HL              ;recover regs
EFE0 F1         00340        POP    AF
EFE1 C9         00350        RET
                00360
EFE2 BA         00370 TABLE  DEFB   0AH             ;Interrupt Vector
EFE3 FF         00380        DEFB   0FFH             ;Set Mode 3
EFE4 19         00390        DEFB   19               ;Set inputs and outputs
EFE5 B7         00400        DEFB   0B7H             ;Interrupt Control Word
EFE6 FF         00410        DEFB   0FFH             ;Mask Control
EFE7 80         00420        DEFB   80               ;mark end of table
                00430
                00440 ;Subroutine to set B7=0, peripheral #1 selected.
EFE8 F5         00460        PUSH   AF              ;save regs
EFE9 DB02       00470        IN     A,(2)           ;read PIO B side data port
EFEB CB7F       00480        BIT    7,A             ;test bit 7
EFED C8         00490        RET    Z               ;return if bit 7 = 0
EFEE CBBF       00500        RES    7,A             ;reset bit 7
EFF0 D302       00510        OUT    (2),A           ;send back to data port
EFF2 F1         00520        POP    AF              ;recover regs
EFF3 C9         00530        RET
                00540
                00550 ;Subroutine to set B7=1, peripheral #2 selected.
EFF4 F5         00570        PUSH   AF              ;save regs
EFF5 DB02       00580        IN     A,(2)           ;read PIO B side data port
EFF7 CB7F       00590        BIT    7,A             ;test bit 7
EFF9 C0         00600        RET    NZ              ;return if bit 7 = 1
EFFA CBFF       00610        SET    7,A             ;set bit 7
EFFC D302       00620        OUT    (2),A           ;send back to data port
EFFE F1         00630        POP    AF              ;recover regs
EFFF C9         00640        RET
                00650
0000            00660        END
00000 Total errors

SET     EFD8    READ    EFD2    TABLE   EFE2
```

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11	36	61	86	111	136	161	186	211	236	261	286	311	336
12	37	62	87	112	137	162	187	212	237	262	287	312	337
13	38	63	88	113	138	163	188	213	238	263	288	313	338
14	39	64	89	114	139	164	189	214	239	264	289	314	339
15	40	65	90	115	140	165	190	215	240	265	290	315	340
16	41	66	91	116	141	166	191	216	241	266	291	316	341
17	42	67	92	117	142	167	192	217	242	267	292	317	342
18	43	68	93	118	143	168	193	218	243	268	293	318	343
19	44	69	94	119	144	169	194	219	244	269	294	319	344
20	45	70	95	120	145	170	195	220	245	270	295	320	345
21	46	71	96	121	146	171	196	221	246	271	296	321	346
22	47	72	97	122	147	172	197	222	247	272	297	322	347
23	48	73	98	123	148	173	198	223	248	273	298	323	348
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Micro interpreter

Horizon Computer Corporation of Sydney has announced the Corvus Network Transporter, which allows Macs, Apple IIs and IBMs to connect to the same network.

Using the new Corvus Transporter, a wide variety of different types of microcomputers can now be linked to Omninet, giving users the ability to share the mass storage of the Corvus OmniDrive and permitting inter-communication between the micros.

"It is invaluable for anyone wanting to link up two networks", says Tony Bowden, General Manager of Horizon, which is distributing the Transporter. "Business networks can now be linked in the case of a merger or take-over. Very often different departments in the same company use networks of different micros — now they can share data, printers and other peripherals."

The Corvus Network Transporter can also link micro networks with mainframes, after software modification.

It retails for under $900, but for more information contact **Horizon on (02)498-6611** or **(03)662-1611.**

Hitron supplies Aust navy

Hitron Pty Ltd has won a contract to supply more than $500,000 worth of specialised data recording equipment to the Royal Australian Navy.

The equipment is part of the Australian-designed and produced Mulloka sonar systems (worth $13m) to be installed in two new RAN frigates.

Hitron, the Michael Edgley-backed computer and electronics company, will supply two Datatape multi-track tape recording systems, the Datatape AN/USH-24(V).

Mulloka sonar systems were developed by the Weapons Research Centre at Salisbury, South Australia, to overcome specific problems in local waters. Australian coastal waters are wider, shallower and warmer than most continental shelves, and contain more of the temperature layers which deflect sonar waves and cause sonar shadows in which submarines can avoid detection.

The Mulloka System is linked to the Ikara long-range, anti-submarine rocket torpedo, which was also developed by the Weapons Research Centre. Data collected by the Mulloka system can be instantly relayed to the Ikara missiles to pinpoint the target accurately.

Microbee Premium Series

Microbee Systems Limited has announced a "Premium Series" for its Microbee family of personal computers.

The Premium Series offers as standard all of the main features available as options on the existing models, such as colour video and Viatel/Videotex communications capability. In addition they boast greatly enhanced high-resolution graphics capability, four extra keys for easier cursor control and a volume control for the internal speaker.

The enhanced high resolution graphics capability of the new Premium Series Microbees allows them to display a full screen of 131,072 individually programmable pixels, eight times more than the standard models.

The new models feature a fully redesigned main circuit board with improved colour video and keyboard scanning circuitry. CPU screen accessing is now fully synchronous and transparent, giving a clearer and more stable display without 'glitches'. Keyboard scanning is now much more reliable, and disk models feaure the ability to assign extended functions to the numeric keys.

The new Premium Series Microbees retail at $100 more than the standard series models in each configuration. MSL is offering owners of existing Microbees the opportunity to upgrade them to a Premium Series version.

A brochure describing the new Premium Series Microbee models is available from Microbee Systems' Technology Centres and authorised dealers. Copies are also available from the Marketing Communications Department of **Microbee Systems Limited, PO Box 105, North Ryde, NSW 2113. (02)887-3723.**

CLUB CALL

A user group for the **Acorn BBC Microcomputer** called **OZBEEB** advises that it meets twice monthly at the Australian Film and Television School — Open Program, 3 Lyon Park Rd, North Ryde, NSW. Meetings are on the 2nd Wednesday of each month at 7 pm and the 4th Monday of each month at 6.30 pm. Annual membership subscription is $10.

The **Central Coast Apple Users Group** meets on the first Tuesday of each month at the Central Coast Grammar school, Erina Heights, from 7.30 pm. Contacts are Charles Lee (043)67-6845 or Mick Tierney (043)41-9350.

A Sharp Users Group of Brisbane has been formed, meeting on the second Wednesday of each month at the Graceville State School. For further information contact Bill Laidlaw, 51 Sandon St, Graceville, Qld 4075 or (07)379-3457.

Mbug Australia with nearly 600 financial members plus their Microbees caters for a wide variety of interests in the microcomputing area, from hard disks and fourth generation languages to computer games and educational activities. Other Victorian Microbee groups are affiliates of the club. The club publishes a monthly magazine *The Catcher*, provides a public domain disk library, a separate tape library, a modem hire facility and disk and tape copying/format conversion services to its members. Membership costs $20 for Melbourne residents ($17 country). Student membership is $15, while membership for the RCP/M is only $10.

The club also runs a 24 hour remote CP/M system bulletin board for its members on (03)873-5734.

SCUA (Sorcerer & CP/M Users of Australia) caters for Sorcerer, Excalibur, Bondwell and all machines which run the CP/M operating system. The group also has an increasing number of PC users and is forming an interest group to cater for owners of these machines. Meetings are held on the first Sunday of the month, February to December at 2pm at Victoria College, Burwood Campus, 221 Burwood Highway, Burwood, Vic 3125. The SCUA RCPM service is available to members. The number is (03)754-5081. Address all correspondence to The Honorary Secretary, SCUA, GPO Box 2402, Melbourne, Vic 3001.

Microbee Users Group of WA meets at 7pm on the first Sunday of each month in the Nurses' Lecture Theatre of the Sir Charles Gairdner Hospital at Shenton Park. Further details can be obtained from the membership officer on (09)294-1833 or by mail to GPO Box N1090, Perth, WA 6001.

IBM-JX PC expanded

IBM Australia has announced several new enhancements for the IBM-JX personal computer, including a hard disk expansion unit, a 256K cluster memory card and nearly 40 new software packages.

The hard disk expansion unit consists of a 10M, 135mm hard disk drive and three expansion board slots which can be used with optional cards such as 256K RAM and 384K RAM cards, allowing users the option of up to 512K of memory.

The new 256K cluster memory card installed on the optional cluster card, enables users in a classroom network to install up to 384K of memory in the main JX system unit.

Six proven programs developed by Canada's University of Waterloo and Watcom Systems Inc include the Waterloo Janet Version 2.2 program. This program provides network control functions for multiple JX workstations to communicate with an IBM-XT, or an IBM-JX with a hard disk installed, for data, program and printer sharing. Libraries of programs can be created and used by a number of users.

Other software packages that have been released for use with the IBM-JX include advanced text processing, personal productivity tools, and over 20 educational programs designed to introduce students to various mathematical, scientific and language topics. All of these software packages are available on convenient 90mm diskettes.

$998 voice

Visnet, the local voice recognition pioneer, has released a voice recognition package for PC/XT/AT and compatible computers at $995.

The package includes hardware, software and support. Features are a circuit board and dynamic microphone, a training program and voice recognition program that includes pop-up menus and colour windows, and starter command lists for Wordstar, Lotus 1-2-3 and other popular programs. There are also edit, compile and utility programs to tie voice recognition into all applications. A manual and 90-day warranty are included.

Visnet is a joint venture between Netmap Corp and Visionhire.

For further information call **Michael Carroll on (02)922-2711.**

BRIEFS

Viatel for Tandy 4

Software is now available for the Tandy TRS80 Model 4 or 4P to operate with Telecom's Viatel system. The Australian produced 'Viaterm' supports Viatel's real time features, stores frames for late disk recording and uses an electronic mail template to allow messages to be prepared and edited off-line. For more information contact Tandy stores or '80 Software, PO Box 86, Lyons, ACT 2606.

Range of modems

The Nokia fourth generation of medium speed modems includes stand alone units and card modems, all of which are Telecom approved and conform to CCITT standards. Baud rates are 1200/600, 1200 and 2400/1200. For further information contact EEL Communications, 33 Bellona Ave, Regents Park, NSW 2143.

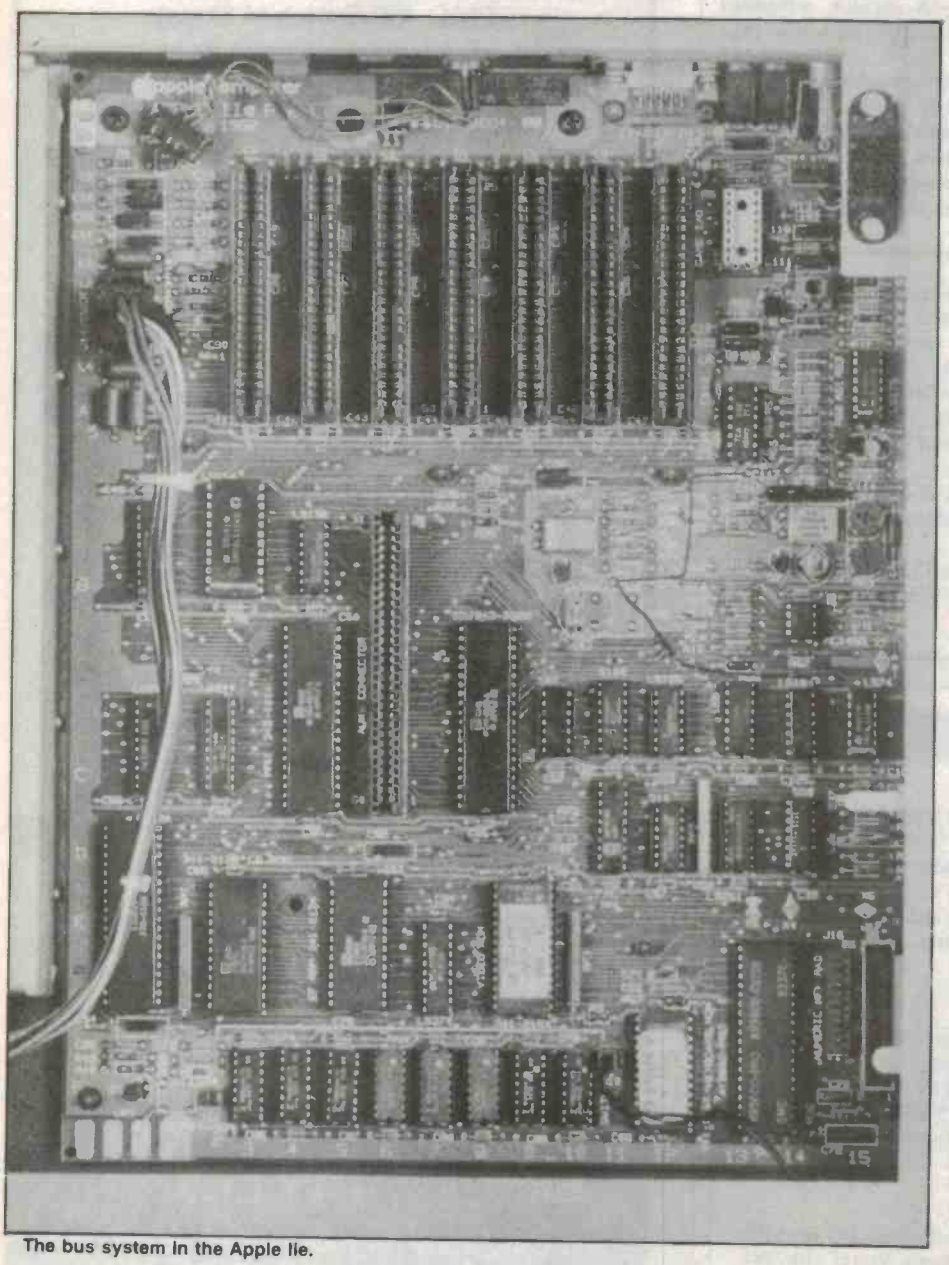
Viatel decoder

Dick Smith Electronics has introduced a decoder for the television suitable for connection to Telecom's Viatel videotex service. The unit retails competitively at $499.

CATCHING THE BUS

This month we look into the computer's public transport system, the bus, which lets one part of the computer talk to another.

Phil Cohen



The bus system in the Apple IIe.

AS MENTIONED BRIEFLY last month, a computer's memory is arranged into a large number of different locations, each with a unique number or address, and each capable of holding one character (ie, a letter or digit), or part of a step in a computer program.

This arrangement is reflected in the actual physical layout of the tracks on the computer's pcb in the following way. The word 'bit' stands for Binary digIT, and means very simply a digit that is either '1' or '0'. In the normal number system we use, a digit can be 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9, but in the binary system it can only be 0 or 1.

This means that using electrical signals, one wire can carry one bit by using 5V to represent 1 and 0V to represent 0. In our normal counting system, a two-digit number (00, 01, 02 . . . 99) can represent 100 different values. A three-digit number can represent 1000 different values. But in the binary system a two-digit number (2-bit number) can only be 00, 01, 10 or 11 — a total of four different values.

An eight-digit binary number (often referred to as a 'byte' for short) can represent one of 256 possibilities (try them all if you don't believe me!). This means that eight wires, each carrying one bit, can carry only one of 256 possible combinations of 1 and 0.

Locations

The memory in a personal computer is arranged in a number of locations, each capable of holding one 8-bit binary number or byte. When communicating that number to the processor, the memory uses a series of eight parallel wires each carrying one bit.

Each location is capable of representing one of 256 possibilities, so that it is quite usual to have one location holding one character (letter or symbol or digit). The word 'hello', for example, could be held in five successive locations as five values, each representing one character. The first address would hold a number that corresponded to 'h', the next to 'e', and so on.

All of the letters of the alphabet (both upper case 'A', and lower case 'a'), all of

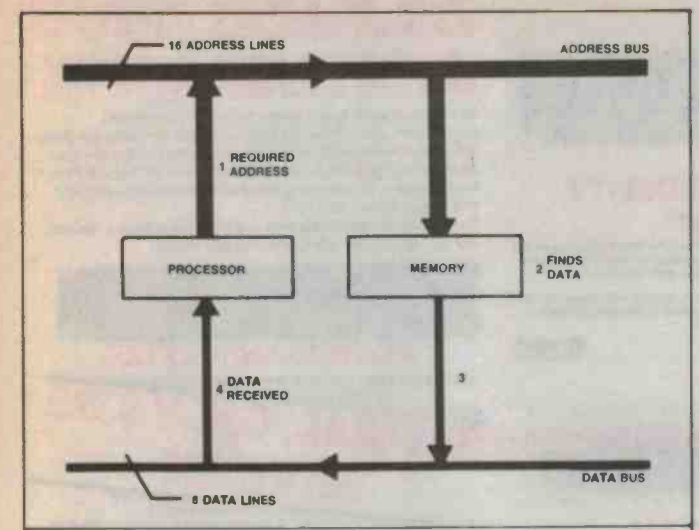


Figure 1. The processor uses the address bus to call up the contents of a particular memory location.

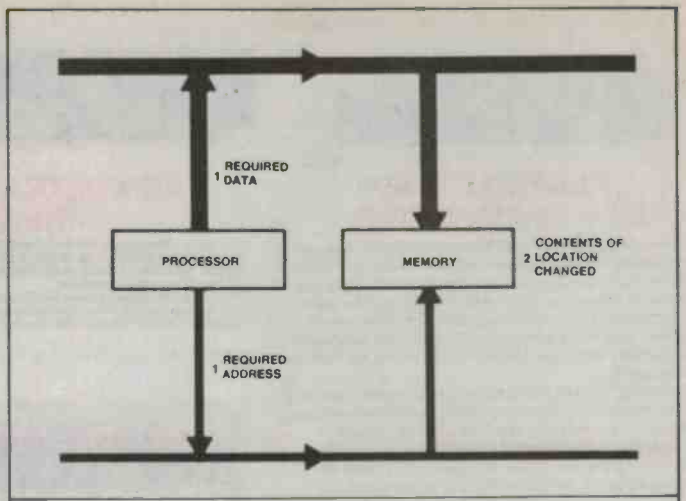


Figure 2. Putting an address on the address bus, and the required contents of that address on the data bus, the processor changes the contents of a memory location.

the symbols you are likely to need ('=', '+', etc) and quite a few other things can be quite easily accommodated in that scheme of 256 possible values.

The eight parallel tracks on the pcb are known collectively as the 'data bus', because they allow information in the form of 8-bit numbers to pass from the memory to the processor, and vice versa. The same data bus is often used to allow the processor to talk to the disk drive circuitry, the screen controller, and so on, so that it actually goes all over the computer.

Each location in memory has its own unique number or address, which again is represented as a binary number, usually of about 16 bits, which gives 65536 (64K) possible addresses — typical of a small home computer.

The processor calls up a particular location by setting 16 other lines on the pcb (known as the 'address bus') to a particular binary value which corresponds to the address of the location it wants to access. The memory responds by looking up the contents of that location and setting the data bus to the appropriate value.

When the processor wants to change the contents of a particular location, it puts the location's address on the address bus, the new value on the data bus, and sets another special line which tells the memory it wants to write instead of read the location. The memory takes the new value and stores it in the appropriate location.

System bus

The address bus and data bus taken together are referred to as the 'system bus'. The system bus is often extended to a large socket on the side of the machine (sometimes just an area of gold plated, edge connector pins) so that memory or other devices can be added later to the outside of the box.

The program that the processor follows is also stored in memory as a series of 'instructions', each taking up one, or usually two or three locations. The processor calls those instructions up from memory one at a time *just as if they were data stored in memory.* As far as the *memory* is concerned, it doesn't matter whether a particular location holds data, or part of a program.

(This is generally true for most other types of memory; disks can hold either programs or data, as can tapes or cartridges. Both data and programs can be sent via telephone lines, satellites or any other medium, without the system knowing or caring whether it is handling programs or data.)

So the processor is using the system bus both to call up its program one step at a time, and also to read from and write to memory locations.

Expansion slots

The Apple computer was a milestone in the history of computing (and perhaps the first milestone in home computing). The phenomenal success of the Apple was due to a number of factors, one of which was the system of expansion slots just under the lid.

These were basically an extension of the computer's system bus along a line of sockets, into which new add-on pcbs could be plugged.

This allowed an extraordinary variety of devices to be attached to the Apple (including things from TV cameras to robots, speech synthesisers and even air conditioning controllers), making it a very versatile machine. Most of the add-ons were made by companies other than Apple, which took the development load off Apple while at the same time increasing sales of the basic computer.

It was even possible to connect new *processors* to the Apple bus, and in fact a common add-on was a card containing a Z80 processor which turned the computer into a different machine, capable of running CP/M.

Interestingly, the new Apple MacIntosh started out with a closed box philosophy and no user-accessible bus, but the market showed clearly what it thought of the machine, and newer versions are now planned with an expansion bus!

PEEK and POKE

The BASIC PEEK() and POKE instructions allow you to actually examine and alter the contents of a particular location in memory. For example, PEEK(1234) will return the value held in location 1234, and POKE 3456, 99 will alter the value of location 3456 to 99. Of course, POKE will only allow you to alter the contents of RAM, not of ROM (so there's no danger of damaging the computer).

Glossary

Address: a number that uniquely identifies a particular location in memory.

Address lines: the part of the system bus that carries the address from the processor to the rest of the computer.

Byte: the amount of information held at one address — each byte can represent a number between 0 and 255, which allows it to store any of the letters of the alphabet, digits, symbols, etc.

Data lines: that part of the system bus that carries the data to and from the processor.

Expansion slot: an extension of the computer's system bus to a number of slots to allow extra pcbs to be plugged in.

Instruction: one step of a program.

Location: memory is split into a large number of locations, each usually holding one 8-bit number.

PEEK: a BASIC command that allows you to look at the actual contents of a memory address.

POKE: a BASIC command that allows you to alter the contents of a memory address.

System bus: a set of parallel tracks on the computer's pcb which carries information to and from the processor. ●

PLAYMASTER 60 + 60 AMPLIFIER

Enjoy the incredible performance improvement of the new low cost Playmaster 60/60. This brilliant new design by Jon Clarke and Leo Simpson has distortion and signal-to-noise specs that are unbelievable for an amp at this price AND over 60+ watts RMS per channel! Use of a fully imported TOROIDAL power transformer, state of the art components and circuit techniques makes the 60/60 amp a giant leap forward form the old Twin 25 and 40/40 amps.

The Rod Irving Electronics kit is faithful to the original. Control pots, for example, were used in the prototype. Be careful of cheap substitutions in some inferior kits! (The identical Toroidal transformer is used as well as a fully punched chassis with attractive front panel and quality fibreglass PCB.) Check the detailed specs below, we're sure that you will be surprised

SPECIFICATIONS:

Power Output: 1 channel at 2 ohms 105W, both channels 81W. 1 channel at 4 ohms 88W, both channels 72W. 1 channel at 8 ohms 74W, both channels 62W

Dynamic Power (IHF-A-202): One channel at 4 ohms 153W, both channels 120W. 1 channel at 8 ohms 105W, both channels 95W. (all measured with 240V AC regulated power supply.)

Harmonic Distortion: Less than 0.008% at 10kHz and 60W into 8 ohm loads. Less than 0.012% at 10kHz and 80W into 4 ohms loads.

Intermodulation Distortion: Less than 0.0095% for all powers up to 60W into 8 ohm loads. Less than 0.011% for all powers up to 80W into 4 ohm loads.

Frequency Response: Phono Inputs - RIAA/IEC equalisation within + −0.5dB from 40Hz to 20kHz and within 1dB from 20Hz to 40Hz. High Level Inputs −0.5 dB at 20Hz and −1dB at 20kHz.

Channel Separation: (Measured at 60W) 10kHz 66dB; 1kHz 75dB; 100Hz 79dB; (undriven inputs loaded with 1k ohm)

Input Sensitivity: Phono inputs at 1kHz - 4.3mV; Overload capacity at 1kHz - 140 mV; High level inputs - 270mV

Hum and Noise: Phono (with respect 10mV at 1 kHz) - 89dB unweighted; High level inputs (with respect to 270mV input) 103dB unweighted with 20Hz to 20kHz bandwidth.

Tone Control: Bass + −12dB; Treble + −12dB

Damping Factor: At 1 kHz) 80; at 30Hz) 80

Stability: Unconditional

(EA May, June, July '86)

Please phone for information on the availability of this new kit! **$299**

COMPACT DISC PLAYER ATTENUATOR

If you have just purchased a compact disc player your amplifier could be in trouble! CD players seem to have standardised on a 2V output level where as most Hi-Fi amps have a 500mV sensitivity for full rated output.

In order to overcome this you may need a CD Attenuator. It does not distort the signal in any way. It is inexpensive and simple to construct, making it an ideal beginners project (EA '86)

Cat. K **$7.95**

PLAYMASTER 300 WATT AMPLIFIER

This module will deliver up to 200 watts into an 8 ohm load and up to 300 watts into a 4 ohm load. Comprehensive protection is included and a printer circuit board brings it all together in a rugged easy-to-build module. It can be built in either fully-complemetary or quasi-complementary versions, so output transistor shortages should be no problem at all.

(80PA6) (EA July '80)

Cat. K80060 ..... Normally $109 **SPECIAL, ONLY $99**

SONICS ACTIVE DIRECT INSERTION BOX.

This inexpensive, easy to build DI box was designed in conjuction with Sonics magazine and is fine for both live PA and home recording work. It takes an unbalanced input and produces an output suitable for driving a balanced audio line.

SPECIFICATIONS:

S/N Ratio: 100dB (ref 0dBM)

Distortion: 0.03% at 4dBM

Input Impedance: 500k nominal (unbalanced)

Output Impedance: 600 ohm nominal (balanced)

(ETI 1401 Sept '85)

Cat. K41401 ..... **$39.95**

4 INPUT PREAMP

Easy construction and versatile operation, this preamp is for coupling with the 300W "Brute" Power Amp. (ETI 467) (ETI July '80)

Cat. K44670 **$54.95**

MOSFET POWER AMPLIFIER

Employing Hitachi Mosfets, this power amplifier features a 'no compromise' design, and is rated to deliver 150 W RMS maximum and features extremely low harmonic, transient and intermodulation distortion.

ETI 477 (ETI Jan.'81)

(Single module only)

Cat. K44770 **$79.50**

Plus power supply (No trans) $49

Plus transformer PF4361/1 $49.50

AEM ULTRA FIDELITY PREAMP

The latest, definative preamp from David Tillbrook, the man who designed the famous Series 5000! Just as his Series 5000 were an enormous leap forward 5 years ago, so to is his latest AEM 6000 Series, especially in regard to Compact Disc signal processing.

"The input noise figures subsequently obtained are significantly better than the best op-amp designs and exceed the specifications of the best commercial amplifiers" -David Tillbrook, AEM October '85

Cat K **$289**

PLAYMASTER FM/AM STEREO TUNER

The new Playmaster FM/AM stereo tuner will out perform anything presently available on the market, regardless of price. As well as including a FM tuner section which is every bit as good as any other synthesised design, it is also the only unit featuring a genuine wideband, low distortion AM stereo tuner. Naturally, it has a digital readout, 12 station memory, automatic seek and an optional infrared remote control.

SPECIFICATIONS:

AM TUNER.....

Turning range: 522 to 1611kHz

Frequency Response: −3dB at 5.5kHz

Harmonic Distortion: Mono; 0.4% at 30% modulation
Stereo; •1% at 30% modulation

Audio Output: 450mV RMS into 4.7 ohm load at 100% modulation

Stereo Separation: Typically 30dB

AGC Range: 40dB for a 6dB change in audio output

Signal to Noise Ratio: 70dB with respsect to full output for signal levels of 9 and 10 on bar graph display; better than 60dB with respect to full output for signal levels greater than 6

Usable Sensitivity: 350uV at −6dB audio level

FM TUNER.....

Tuning Range: 87.9 to 107.9 MHz

Frequency Response: −1dB at 20Hz, −0.5dB at 15kHz

Harmonic Distortion: Mono; 0.15% (100Hz); 0.15% (1kHz); 0.2% (6kHz)
Stereo; 0.4% (100Hz); 0.4% (1kHz); 0.4% (6kHz)

Audio Output: 450mV RMS into 4.7 ohm load at 100% modulation

Stereo Separation: 34dB (50Hz); 34dB (1kHz); 36dB (10kHz)

Subcarrier Product Rejection: 48dB

19kHz Rejection: 62dB

(EA Dec. '85 Jan-Feb '86 85tu12)

Cat. K86020 ..... **only $499**

PLAYMASTER 200 HI-FI MOSFET AMPLIFIER

100W/channel (RMS) into 8 ohms! "A stero amplifier that will equal or better just about any integrated commercial amplifier, regardless of price" -Leo Simpson, Editor **EA**.

Features...

- Electronic input switching
- CD player input (2 volt)
- All potentiometers, input and output connectors, PCB mount
- Screened and other wiring almost eliminated
- Special centre detent and switchable attenuator type controls
- Safety shrouded speaker connectors
- Extensive switching facilities
- MOSFET performance and reliability
- Uses Hitachi 2SC2545 low noise transistors
- Very low price for level of performance

SPECIFICATIONS.....

Power Output: 100W RMS into 8 ohms per channel

Frequency Response: 8Hz to 20kHz +0, −0.3dB. 2.8Hz to 65kHz +0, −dB

Hum: −100dB below full output

Input Sensitivity: Line 300mV 90dB S/N Moving magnet 2mV 80dB S/N CD input 2V 94dB S/N

Distortion: 0.01% maximum typical; 0.003% 20 - 20kHz

Stability: Unconditional

(EA Jan, Feb, Mar '86)

Cat. K85 ..... **$449**

MUSICOLOR IV

Add excitement to parties, card nights and discos with **EAs** Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety

(EA Aug.'81) 81MC8

Cat. K81080 **$99**

AUDIO TEST UNIT

Just about everyone these days who has a stereo system also has a good cassette deck, but not many people are able to get the best performance from it. Our Audio Test Unit allows you to set your cassette recorder's bias for optimum frequency response for a given tape or alternatively, it allows you to find out which tape is best for your recorder.

(81AO10) (EA Oct '81)

Cat. K81101 **$59.50**

SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Superb Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,000 sold!

For those who haven't the time and want a quality hi-fi, we also sell the Series 5000 kits assembled and tested.

POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER

- 1% Metal Film Resistors

SPECIAL, ONLY $329

SAVE $30

...ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms

POWER AMPLIFIER: 100W RMS into 8 ohms (+ − 55V Supply)

FREQUENCY RESPONSE: 8Hz to 20Hz +0=.0.4 dB 2.8Hz to 65KHz, +0=3 dB. NOTE: These figures are determined solely by passive filters.

INPUT SENSITIVITY: 1 V RMS for 100W ouput.

HUM: 100 dB below full output (flat).

NOISE: 116 dB below full output (flat, 20KHz bandwidth).

2nd HARMONIC DISTORTION: •0.001% at 1 KHz (0.0007% on Prototypes) at 100W ouput using a + = 56V SUPPLY rated at 4A continues •0.0003% for all frequencies less than 10KHz and all powers below clipping.

TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above).

INTERMODULATION DISTORTION: 0.003% at 100W. (50Hz and 7KHz mixed 4:1).

STABILITY: Unconditional.

Cat. K44771 ..... **$359**

Assembled and tested $549

packing and post $10

PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS"

SPECIAL, ONLY $299

SAVE $20

...We believe that dollar for ... a commercial unit available that sounds as good!

SPECIFICATIONS:

FREQUENCY RESPONSE: High-level input: 15Hz = 130KHz. +0.= 1dB Low-Level input-conforms to RIAA equalisation + =0.2dB

DISTORTION: 1KHz •0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).

S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1.2V)•92dB flat •100dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input 50ohms source resistance connected: •86dB flat/92dB A-weighted MC input, master full, with respect to full output (1.2V) and 200uV input signal; •71dB flat •75dB A-weighted.

Cat. K44791 ..... **$319**

Assembled and tested $599

packing and postage $10

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:

BANDS: 28 Bands from 31.5Hz to 16KHz.

NOISE: •0.008mV, sliders at 0, gain at 0(−...

20KHz BANDWIDTH DISTOR...

sliders at 0, gain at 0...

SPECIAL, ONLY $209

SAVE $10

...unit **$219**

$429

packing and postage $10

SERIES 4000 SPEAKERS

8 Speakers	$349
8 Speakers with Crossovers	$579
Speaker Boxes (assembled with grill and speaker cutout)	$349
Crossover Kits	$249
Complete kit of parts (speakers, crossovers, screws, innerband boxes.)	$899
Assembled, tested and ready to hook up to your system	$995

Errors and Ommissions Excepted

HI FI SPEAKERS

A comprehensive range of matched appearance speakers, all with square silver grey frames and black cones - ideal for building up low cost speaker systems that will look and sound superb.

1½" TWEETER

SPECIFICATIONS:
Sensitivity: 90dB
Freq. Response: 1.2 - 20 kHz
Impedance: 8 ohms
Power RMS: 10 watts
Magnet Weight: 2 oz
Cat. C10200 **$4.95**

2½" TWEETER

SPECIFICATIONS:
Sensitivity: 94dB
Freq. Response: 1.1 - 17 kHz
Impedance: 8 ohms
Power RMS: 10 watts
Magnet Weight: 2 oz
Cat. C10202 **$5.95**

4" MIDRANGE WITH SEALED BACK

SPECIFICATIONS:
Sensitivity: 96dB
Freq. Response: 650 - 15 kHz
Impedance: 8 ohms
Power RMS: 15 watts
Magnet Weight: 3.6 oz
Cat. C10204 **$9.95**

4½" MIDRANGE WITH SEALED BACK

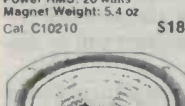
Clothed edge surrounds.
SPECIFICATIONS:
Sensitivity: 97dB
Freq. Response: 600 - 8 kHz
Impedance: 8 ohms
Power RMS: 20 watts
Magnet Weight: 5.4 oz
Cat. C10206 **$12.95**

6½" WOOFER

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 96dB
Freq. Response: 55 - 7 kHz
Impedance: 8 ohms
Power RMS: 15 watts
Magnet Weight: 5.4 oz
Cat. C10208 **$15.95**

8" WOOFER RIBBED CONE

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 94dB
Freq. Response: 55 - 8 kHz
Impedance: 8 ohms
Power RMS: 20 watts
Magnet Weight: 5.4 oz
Cat. C10210 **$18.95**



10" WOOFER RIBBED CONE

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 95dB
Freq. Response: 37 - 6 kHz
Impedance: 8 ohms
Power RMS: 25 watts
Magnet Weight: 10 oz
Cat. C10212 **$29.95**

12" WOOFER RIBBED CONE

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 92dB
Freq. Response: 32 - 4 kHz
Impedance: 8 ohms
Power RMS: 30 watts
Magnet Weight: 13.3oz
Cat. C10214 **$39.95**

12" HIGH POWER MUSICAL SPEAKER

- Aluminium die cast chassis
- Carbon fibre impregnated cone paper
- Foam edge
- Light grey cone, silver dust cap
- High temperature "NOMEX" voice coil

SPECIFICATIONS:
Sensitivity: 97dB
Frequency Response: 50-4kHZ
Impedance: 8 ohms
Power RMS: 60 watt
Magnet Weight: 30 oz
Cat. C10216 **$59.95**

PIEZO DIRECT RADIATING TWEETER

Requires no crossover, handles up to 100 watts
Sensitivity: 98dB
Maximum Imput: 24 volts
Freq. Response: 3.2 - 30kHz
Dimensions: 95mm diameter.
Cat. C12104 **$11.95**

SUPER HORN TWEETER

- Requires no crossover and handles up to 100W!
- Sensitivity: 100dB/0.5m
- Frequency Response: 3kHz-30kHz
- Impedance 8 OHMS
- Size 96mm diameter

Cat. C12102 normally $17.95
On Special at $14.95

SUPER HORN

- Wide dispersion tweeter, handles up to 100W.
- Sensitivity: 105dB/0.5m
- Frequency Response: 3kHz-30kHz
- Impedance: 8 OHMS
- Size: 145x54mm

Cat. C12103 normally $17.95
On Special at $14.95

PHILIPS SPEAKERS

"Unfortunately we cannot always guarantee Philips speakers to be in stock due to availability problems" Rod.

Cat. C12030 AD01610 T8 **$16.95**
Cat. C12040 AD02160 SQ8 **$34.95**
Cat. C12045 AD70620 M8 **$49.00**
Cat. C12050 AD12550 W8 **$95.00**
(or Philips equivalent supplied)

VIFA/AEM 2 WAY SPEAKER KIT!

This exciting new speaker kit, designed by David Tillbrook (a name synonymous with brilliant design and performance) uses VIFA's high performance drivers from Denmark. You will save around $800 when you hear what you get from this system when compared to something you buy off the shelf with similar characteristics. Call in personally and compare for yourself!

The system comprises...
2 x P21 Polycone 8" woofers
2 x D25T Ferrofluid cooled dome tweeters with Polymer diaphrams
2 pre-built quality crossovers

The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

D25T SPEAKER SPECIFICATIONS
Nominal Impedance: 6 ohms
Frequency Range: 2 - 24kHz
Free Air Resonance: 1500Hz
Operating Power: 3.2 watts
Sensitivity (1W at 1m): 90dB
Nominal Power: 90 Watts
Voice Coil Diameter: 25mm
Air Gap Height: 2mm
Voice Coil Resistance: 4.7ohms
Moving Mass: 0.3 grams
Weight: 0.53kg

P21 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 26 - 4,000Hz
Free Air Resonance: 33Hz
Operating Power: 2.5 watts
Sensitivity (1W at 1m): 92dB
Nominal Power: 60 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.8ohms
Moving Mass: 20 grams
Thiele/Small Parameters: Qm: 2.4
Qe: 0.41
Qt: 0.35
Vas: 80:1

Weight: 1.65kg

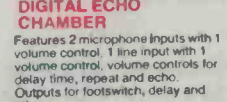
Speaker Kit Cat.K90000 .. **$489**
Cabinet Kit Cat.K90000 .. **$179**
All Together Cat.K90000 .. **$589**
(Save 79!)

MIDRANGE HORNS

Use these quality, all metal, Piezo tweeters for great top end sound in your band speakers, disco sound system, etc. Rated at 30 watts RMS, in a system they will handle over 100 watts RMS.
Two sizes to choose from:
Size: 4"x 10½"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 1.5kHz - 14 kHz
Dimensions: 102 x 267 x 177mm
Cat. C92082 **Normally $49.95**
This month only $49.95

Size: 3"x 7"
Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm
Cat. C92084 **Normally $29.95**
This month only $29.95

Dealers, OEM's, etc., phone (03) 543 2166 for wholesale prices



DIGITAL ECHO CHAMBER

Features 2 microphone inputs with 1 volume control, 1 line input with 1 volume control, volume controls for delay time, repeat and echo. Outputs for footswitch, delay and mix.
- Delay time 180m seconds
- Inputs Mic 1 and 2 -46dB, Line -20dB
- Output level 30MV (max).
- Frequency response 50 - 15kHz
- Signal/Noise ratio 40dB
- Power 9V battery or AC adaptor
- Power on LED
- Weight 950 grams
- Dimension 232 x 65 x 140mm

Cat. A12050 **$95**

VIFA/AEM 3 WAY SPEAKER KIT!

This superb 3 way speaker kit competes with systems that cost 2 - 3 times the cost of these units! (which may even be using VIFA drivers etc.) Never before has it been possible to get such exceptional value in kit speakers! Call in personally and compare for yourself!

The system comprises...
2 x D19 dome tweeters
2 x D75 dome midrange
2 x P25 woofers
2 x pre-built quality crossovers

The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

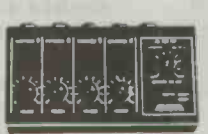
D19 DOME TWEETER SPEAKER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20kHz
Free Air Resonance: 1,700Hz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts (fc: 5,000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2ohms
Moving Mass: 0.2 grams
Weight: 0.28kg

D75 DOME MIDRANGE SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 350 - 5,000Hz
Free Air Resonance: 300Hz
Sensitivity (1W at 1m): 91dB
Nominal Power: 80 Watts (fc: 500Hz, 12dB/oct)
Voice Coil Diameter: 75mm
Voice Coil Resistance: 7.2ohms
Moving Mass (incl. air): 3.6 grams
Weight: 0.65kg

P25 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 25 - 3,000Hz
Free Air Resonance: 25Hz
Operating Power: 5 watts
Sensitivity (1W at 1m): 89dB
Nominal Power: 60 Watts
Music Power: 100 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.7ohms
Moving Mass (incl. air): 44 grams
Thiele/Small Parameters: Qm: 3.15
Qe: 0.46
Qt: 0.40
Vas: 180:1

Weight: 1.95kg

Speaker Kit Cat.K90000 .. **$779**
Cabinet Kit Cat.K90000 .. **$309**
All Together Cat.K90000 .. **$989**
(Save a huge 110!)



ECONOMY 4 CHANNEL MICROPHONE MIXER

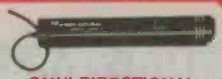
Its size and simplicity makes this mixer very portable and easy to operate.
SPECIFICATIONS:
- 4 low impedance 600 ohm microphone inputs.
- Individual gain control for each microphone.
- Master volume control.
- Power on LED.
- Inputs/Outputs - 6.3mm mono sockets.
- DC operated (9V battery only)
- Input impedance 600 ohm.
- Output impedance 1.5kohm
- Signal/noise ratio 55dB.
- Frequency response 20Hz to 20kHz plus or minus 2dB.
- Weight 320 grams.
- Dimension 148 x 46 x 86mm.
- Torque variable range 1-22dB.
- Input sensitivity 1mV.
- Output level 90mV (at input 5mV).
- T.H.D. 0.01%.

Cat. A12001 **$39.50**

ELECTRONIC RHYTHM BOX

- 8 selectable rhythms, Trot, Rock Disco, Bossanova, Waltz, Slow Rock, Cha Cha, Rumba
- Power 9V battery or AC adaptor
- Volume control
- Rhythm tempo control, 10 steps
- Power on LED
- Footswitch facilities
- Output level 150mV (max)
- Weight 750 grams
- Dimensions 190 x 52 x 132mm

Cat. A12048 **$79.95**



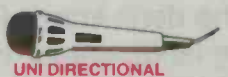
OMNI-DIRECTIONAL WIRELESS MICROPHONE

Tuneable: 92 - 104MHz
Freq. Response: 50 - 15kHz
Range: Over 300 feet in open field.
Modulation: FM
Power Source: 9V Battery
Type: Electret Condenser.
Dimensions: 185 x 27 x 38mm
Weight: 160 grams
Cat. A10450 **$19.95**

CRYSTAL LOCKED WIRELESS MICROPHONE AND RECIEVER

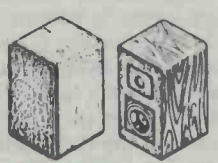
MICROPHONE SPECIFICATIONS:
Transmitting Frequency: 37.1MHz
Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

RECIEVER SPECIFICATIONS:
Recieving Freq: 37.1MHz
Output Level: 30mV (maximum)
Recieving System: Super heterodyne crystal oscillation.
Power Supply: 9V Battery or 9V DC power adapter.
Volume control
Tuning LED
Dimensions: 115 x 32 x 44mm
Weight: 220 grams
Cat. A10452 **$89**



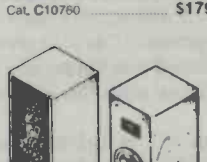
UNI DIRECTIONAL MICROPHONE DM323

Low impedance microphones that must be the best value for money in microphones! Features on/off switch and available in the following colours: White, Blue, Red, Yellow, black and Gold.
Impedance: 600 ohms
Frequency Response: 100 - 15kHz
Sensitivity: -76dB
Cord/Plug: 2.9 metre, 6.35mm phone plug
Dimensions: 50 x 200mm
Cat. A10133 **$13.95**



2 WAY MINI BOOKSHELF SPEAKERS

Designed specifically for compact disc. This 2 way bass reflex system offers incredible audio performance for its size (9.5"). Woodgrain cabinet allows it to slot in with any audio or video system.
SPECIFICATIONS:
Speakers: Woofer - 4" carbon fibre reinforced polypropylene cone 10oz magnet. Tweeter 1" soft dome 6oz magnet, damped with ferro fluid.
Power Input: 30 watts rms 82dB w/m
Impedance: 8 ohms
Frequency response: 80-20,000Hz
Size: 150 x 240 x 160mm
Cat. C10760 ..... **$179**



2 WAY MID SIZED SPEAKER SYSTEM

Designed specifically for compact disc. Excellent bass response to fully utilize the output capabilities of a compact disc. 16" high, woodgrain finish cabinet with brown cloth grille.
SPECIFICATIONS:
Speakers: Woofers 6½" carbon fibre reinforced polypropylene cone 10oz magnet. Tweeter 1" soft dome 6oz damped with ferro fluid.
Power Input: 40 watts rms 85dB w/m
Impedance: 8 ohms
Frequency response: 50-20,000Hz
Size: 250 x 400 x 240mm
Cat. C10762 ..... **$299**

ELECTRONIC CASSETTE DEMAGNETISER

Cat. A10006 **$22.95**

TDK AUDIO TAPE BARGAINS

Description	Cat. No.	1-9	10+
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AD60 TDK	A11315	3.99	3.45
AD90 TDK	A11317	5.25	4.50
AD120 TDK	A11319	7.95	6.25
ADX60 TDK	A11320	4.95	4.25
ADX90 TDK	A11322	5.95	4.95
SA60 TDK	A11325	5.95	4.95
SA90 TDK	A11327	6.99	5.50
SAX60 TDK	A11329	6.69	5.77
SAX90 TDK	A11332	8.95	7.25
MAC60 TDK	A11335	8.29	7.25
MAC90 TDK	A11337	11.50	8.95
MAR60 TDK	A11340	13.50	10.95
MAR90 TDK	A11342	16.99	14.50

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Give your parties a professional touch with the arlec "Disco Lite" Simply plug your light(s) into the "Disco Lite" and you've instant party life!
3 DIFFERENT MODES!
Music Mode: Place the "Disco Lite" in range of the speakers and it flashes the lights to the beat of the music!
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C HOW IT RUNS

For those who don't know, C is a general-purpose programming language for writing operating systems as well as numerical, text-processing, data base and other application programs.

J.P.H. Aerts
Test & Measuring Instruments Department
Philips, Eindhoven

THE LANGUAGE WAS designed in 1972 by Dennis M. Ritchie from Bell Laboratories and was originally implemented in the UNIX operating system on the PDP-11. The UNIX operating system is written almost entirely in C. In addition, the C compiler itself and practically all UNIX application programs are written in the language.

In 1977 development began on a machine-independent version of the C compiler, known as the portable C compiler, to simplify the task of moving it to new computers. As a result, compatible versions of C now run on several machines, from micro- to main-frame computers (eg, PDP-11, PMDS-II, Motorola 68000, Honeywell 6000, IBM system /370, Intel 8086, and VAX).

Naturally enough C has always been closely associated with the UNIX operating system, (although not necessarily tied to any one operating system: C is also available on some CP/M based machines) and its usage is likely to increase with the growing popularity of UNIX.

The main advantage of C is its integration within a powerful set of tools under UNIX.

How it works

In C, every variable must be declared a certain type. The four basic types are `int`, `char`, `float` (short for integer, character and floating respectively) and `double`. The programmer can define other types in terms of these.

Three qualifiers can be applied to integers: `short`, `long` and unsigned. The idea is that short and long should provide different integer lengths. Each compiler, however, is free to interpret short and long as appropriate for its own hardware. About all that can be counted on is that short is no longer than long and that the length of short and long is greater than or equal to 16 bits and 32 bits respectively.

Example:

```
char a, b, c;
float d;
double e;
short int f;
long g;
int h = 0;
float eps = 1.0e-5;
```

(note that the declaration may include an initialisation of the variable).

There are also arrays, structures, and unions of these basic types, pointers to them, and functions that return them. For example,

```
int w[50];
```

declares an array `w` with 50 elements, each of which is an integer. The first element is `w[0]`, the last `w[49]`.

Structures in C are objects consisting of one or more fields (where a field is an object of any type).

Example:

```
struct date
{ int day;
char monthname [4];
int year;
}
```

There are two variations on structures: unions and bitfields. In a union, each of the fields is mapped to the same area of storage. In a bitfield, each field is mapped to a portion of a word. A pointer in C points to an object of some particular type. The declarations

```
char *cp;
struct date *sp;
```

define `cp` to be a pointer to objects of type character (one of the four basic types) and `sp` to be a pointer to objects of type date (a structure defined by the programmer).

The dereferencing operator is `*`; `*cp` yields a character conversely, the operator `&` returns the address of an object. So

```
date birthday;
sp = &birthday;
```

is a valid assignment to `sp`.

In C, symbolic constants are implemented via preprocessor macro definitions. The definitions

```
# define DAYS 365
# define WEEKS (DAYS/7)
```

define `DAYS` to be the constant 365 and `WEEKS` to be the expression `(DAYS/7)`.

C includes practically all the common operators that appear in other programming languages, although it does not provide any operations to deal with composite objects as a whole (except structure assignment).

Only a few unusual operators will be considered here.

The language includes assignment operators for updating a variable based on its current value. The expression

```
i += 1
```

is equivalent to `i = i + 1;` however, the address of `i` is evaluated only once. Any binary operator like `*`, `-`, `>>` (shift) or `&` (and), can be used in place of `+`.

In C, increment and decrement operators

exist. The general form for increment is

```
++var
```

or

```
var++
```

In the first case, `var` is incremented by unity before its value is used, while in the second case `var` is incremented after its value is used. So, if n is 5, then

```
x = n++;
```

sets x to 5, but

```
x = ++n;
```

sets x to 6. In both cases, n will be 6 after the execution of the statement.

Logical expressions connected by AND(&&) and OR(||) operators are evaluated conditionally from left to right. This means that the evaluation stops as soon as the value or the expression is known. Hence a loop like

```
while (i<=n && x[i] != key)
i++;
```

(with n the highest index of array x) must be written in Pascal, because of the lack of conditional logical operators, as follows:

```
found := false;
while (i<=n) and (not found)
do
if x[i]= key then found
:=true
else i:=i+1;
```

(Note that the notation of assignments in Pascal differs from that in C.)

Another C operator that is worth mentioning is the conditional operator. This takes three operands: a condition, a true part, and a false part, and is used as follows:

```
(a>b) ? c : d
```

is equal to c if a is greater than b, and equal to d otherwise.

An assignment can be used in an expression like any other variable. The value of an assignment is the value stored in the left hand operand after the assignment has taken place. An example of the usage of assignments in expressions is:

```
while ((c = getchar())
!=EOF) ''process c'',
```

which executes process c for all characters entered, and

```
i=j=k=0;
```

which sets all three variables to zero.

The use of control statements in C is quite similar to that in Pascal, though the notation differs somewhat; we may take as an example the 'for' statement in C.

In C, the statement `''for (loop-initialisation; condition; reinitialisation) loop statement(s)''` is equivalent to:

```
loop-initialisation;
while (condition) {
loop statement(s);
loop-reinitialisation;
}
```

In this sequence, `initialisation`, `condition` and/or `re-initialisation` can comprise no statements, one statement or more than one. This makes C's for statement not only much more flexible than Pascal's, but also keeps the control expressions close together and clearly visible.

There are three statements in C that provide an early exit from a loop: `break`, `return`, and `continue`. The `return` statement exits immediately from the function called to its caller; likewise, the `break` statement causes the innermost enclosing loop to be exited immediately, and the `continue` statement causes the next iteration of the enclosing loop to begin.

Pointers and arrays

In C, there is a strong relationship between pointers and arrays. Any operation which can be achieved by array subscripting can also be done with pointers; the pointer version will in general be faster.

The declaration:

```
int a[10], *pa;
```

defines an array of a size 10 and a pointer pa which points to objects of type integer. The assignment

```
pa=&a[0];
```

sets pa to point to the first element of a; that is pa contains the address of `a[0]`. If pa points to a particular element of array a, then `pa+i` (with i an integer) points to i elements after pa.

Thus if pa points to `a[0]`

```
*(pa+i)
```

refers to the contents of `a[i]`.

These examples are true regardless of the type of the variables in array a. All pointer arithmetic is scaled by the size in storage of the object pointed to.

The correspondence between array indexing and pointer arithmetic is close. In fact, a reference to an array is converted into a pointer to the beginning of the array, thus making an array name a synonym for the location of the first element; the assignment `pa=&a[0];` can also be written as `pa=a;` The forms `a[i]` and `*(a+i)` are also equivalent.

So, if pa is a pointer it can be used with a subscript: `pa[i]` is identical to `*(pa+i)`.

There is only one difference between an array name and a pointer: a pointer is a variable, so `pa=a` and `pa++` are sensible operations, but an array name is a constant and not a variable, so constructions like `a=pa` or `a++` are illegal.

The C preprocessor

The C compiler contains a preprocessor capable of macro substitution, file inclusion, and conditional compilation.

The macro substitution facility is most valuable for definition of symbolic constants and to create repetitive object code. A compiler control line of the form

```
# include ''filename''
```

causes the replacement of that line by the contents of the specified file. The file named is searched for first in the directory of the original source file, then in a sequence of standard places. Alternatively, a control line of the form

```
# include <filename>
```

searches only the standard places. This facility is the method of choice for tying declarations together for a large program, and guarantees that all the source files will be supplied with the same definitions and variable declarations.

Conditional compilation allows one source file to spawn different object-code versions based upon compile-time parameters. For example, a program can be compiled either with or without diagnostic instructions.

Continued on page 107. ▶

EXAMPLE OF A 'C' PROGRAM:

Concatenation of a string s2 on to a string s1. This routine can be used to add supplementary information to a standard text, such as the amount to be paid in an invoice; s1 could then be `Amount due:` and s2 $2750.35.

The program starts with remarks explaining briefly what it is intended to do. The sign |* in the margin marks the start of the remarks, and *| the end.

The first statement in the program, `char*`, indicates that the program returns a pointer to a character string. The next line declares the function name and the parameters used in calling it (the strings s1 and s2, and the maximum number n of characters to be moved). The remaining lines in the program are numbered here for ease of explanation, but these numbers do not form an integral part of the commands as they do eg, in BASIC.

Lines 1 to 4 instruct the compiler to keep the points s1 and s2, and n, in registers to speed up execution. After initialisation of pointer `osl` in statement 7, the end of the receiving string can be found in a single statement (8).

Lines 10 to 14 comprise the copying loop, with a check on n in the body (line 11). The `while` in line 10 is controlled by `*sl++ = &s2++`, which in a single instruction copies a character, updates both pointers and gives an indication when the end of string s2 is reached. (The zero byte which marks the end of all character strings in C ends the `while` loop.) Should s2 be too long, the `while` loop is ended by the `break` in line 13, after the receiving string has been properly terminated in the previous line.

```
/*
 * Concatenate sl on the end of sl.
 * Sl's space must be large enough.
 * At most n characters are moved.
 * Return sl.
 */
char *
 strncat(sl, s2, n)
1 register char *sl, *s2;
2 register n;
3 {
4 register char *osl;
5
6 osl = sl;
7 while (*sl++)
8 ;
9 --sl;
10 while (*sl++ = *s2++)
11 if (--n < 0) {
12 *--sl = '\0';
13 break;
14 }
15 return(osl);
16 }
```

at the leading edge

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Daneva is sampling CML's new **FX409 Universal Analogue Signal Processor** to interested OEMs and Telecommunications Engineers to provide them with hands-on experience with this whippy little building block.

Unifil™ is a single **5V** supply **CMOS** device using **switched capacitor techniques.** Features include simplified setting up, an inbuilt PLL clock generator and a 2nd order multiple filter with notch, lowpass, bandpass and highpass frequency responses. The **Q is programmable to eight values between 0.54 and 8.0.**

Applications include Programmable Filters, Voltage Controlled Filters, Sinewave Oscillators, Tracking Filters, Tracking Oscillators, PSK and FSK Modems, Square to Sine and Pulse to Sine Converters.

SIERRA SEMI SINGLE CHIP MODEM IS BELL 212A and V22 COMPATIBLE

The **SC11004** is a complete **300/1200 bit per second modem** incorporating all of the signal processing functions needed for a full duplex modem. **FSK and PSK** modulators and demodulators and the highband and lowband filters are integrated on a single chip. Call progress monitoring, **DTMF and V22 guardtone generation and a two-to-four wire interface** are all included on-chip.

A complete **Hayes command set modem** can be built by combining Sierra's SC11004 and an SC11007 Modem Controller. For stand-alone applications, the SC11004, the SC11008 modem controller a DAA and an RS232 interface is all that is required.

SPEECH SCRAMBLER CHIP GIVES SNOOPERS THE FLICK

Public networks, cordless telephones and shared radio links are subject to casual and sometimes criminal eavesdropping. **CML's FX 204, a CMOS Variable Split Band encoder/decoder,** is a cost effective voice band scrambler which can be programmed to provide an extremely secure communication link. Further, by using a **microprocessor** a rolling code of almost infinite length can be generated to prevent lock-on by any intruder. Additionally, time domain scrambling could be adopted by the use of CML's new **FX609 CVSD full duplex CODEC.**

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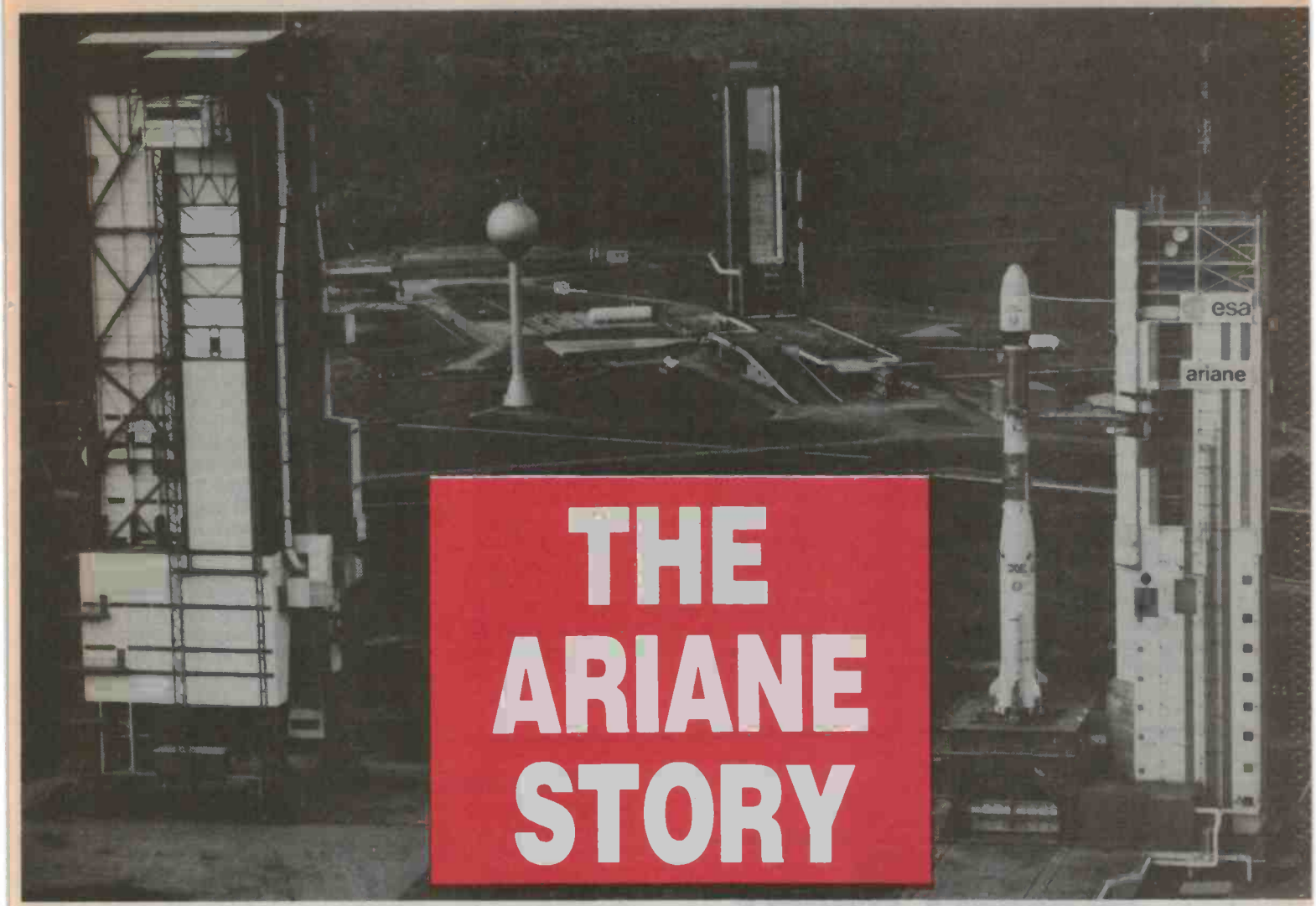


THE ARIANE STORY

Recent failure of an Ariane rocket out of Kourou has disappointed Aussat officials, but will not delay the implementation of the Aussat programs.

Jon Fairall

AUSSAT K3, the third satellite to be launched by the domestic carrier and the last of this generation was due to fly in August from the European Space Agency's launch site at Kourou in French Guyana on the northern seaboard of South America. Now it looks as though the launch will be postponed two months at least, following the failure of the third stage of an Ariane 3, four minutes into the flight.

The launch of K3 will mark the completion of Aussat's space segment plans. The ground segment is also well advanced with satellite ground stations in all major centres and most regional towns. The ABC HA-CBSS system, which uses Aussat to bring TV into the remotest outback communities, is being implemented at a steady rate, and new services are being announced all the time. According to Aussat spokesmen, capacity is already more than half booked, and the system is less than a year old.

The K3 launch is the first non-American launch entered into by Aussat. All the previous ones were on the shuttle. The decision to go European was taken early last year on economic grounds, and well before the Challenger disaster. Nevertheless, Aussat decision makers are thankful they are not still dealing with NASA. With its space program completely stalled, the US will not be in any position to put communications satellites up until at least mid-1987.

The Ariane rocket is one of the few successful results of European cooperation in technological areas. It's manufactured in numerous places across the continent, with final assembly of the first and third stages in France and the second stage in Germany.

In fact there are three current versions of the rocket, with another two planned or under construction. Ariane 1 flew in 1979, Ariane 3 last year, and 2 in 1984. Ariane 4 is due up this year and Ariane 5 will fly in 1995. There has been a steady increase in the size of the payload on each model. Ariane 1 could lift 1825 kg, Ariane 4 will carry 4200, and the planned Ariane 5 will carry the weight of Hermes, the proposed European shuttle.

Ariane 3 is a 49 metre long vehicle with a take off mass of 237 tonnes. Each stage consists mainly of a propellant tank, a motor where the constituents of the propellant are mixed together, and a bit of electronic control equipment. The stages are connected together by skirts, each incorporating explosive devices for the separation procedures.

First stage power is provided by four Vik- ▶

ing IV rocket engines, each with a thrust of 675 kiloNewtons (kN). It will reach a maximum velocity just before separation of 1850ms. The rocket burns for 140 seconds during which time the rocket will climb to 50km. Auxiliary power is provided by two strap-on boosters which are ignited 11 metres above the ground and burn for 30 seconds. Each of these develops 700kN.

The second stage uses only a single Viking IV motor but accelerates the rocket to 4700ms and an altitude of 140km. It will burn for 123 seconds.

The final stage has a cryogenic engine that burns for 720 seconds, during which time the rocket is injected into the transfer orbit, an elipse that takes it up to the geostationary parking orbit where it will spend its working life. The motor develops 63kN and the rocket reaches 9700ms.

The rocket is owned and operated by Arianespace, which was formed in March 1980. Arianespace is a private company owned by 36 European manufacturers, 13 banks and the French National Space Agency CNES. It has been a remarkable success story. Less than five years after its set-up, the company has 30% of the communications launch business. Over 45% of its customers are from outside Europe, and have included the Arab league, Brazil, and the American GTE Spacenet.

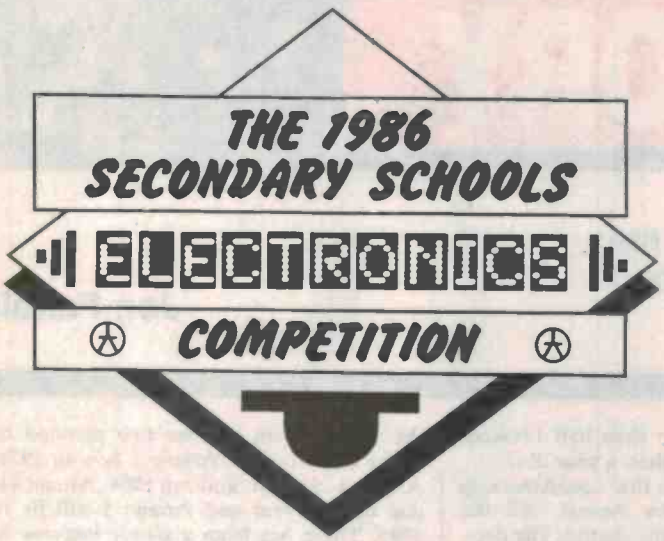
Development of the Ariane family has been, and still is, the responsibility of another cooperative European venture, ESA, (pronounced 'essa'). ESA operates satellites for Europe, does space research along the same lines as NASA, and develops rockets. It was set up in May 1975. For a long time it has been overshadowed by NASA, but the success of Ariane and its spaceflight missions like Giotto (to Halley's Comet) is starting to make the public sit up and take notice.

Ariane launch site, Kourou, was originally developed as a launch site by the French government in 1964. It's eminently suitable for the purpose, being on the seaward edge of a flat windless plain. Its major advantage from the point of view of satellite operators is its location relative to the equator. At 5.3 degrees north it's closer to the equator than any other launch site. Cape Canaveral is 25 degrees north while the Russians launch from a site at 45 degrees north.

The fact that the launch site is so close to the equator leads to substantial savings in rocket fuel, or increased satellite weight, which amounts to the same thing. The weight of the satellite is usually increased by increasing the amount of station keeping fuel supplied at the launch, and this in turn leads to a longer life on station.

The reason for this is that to be of use in communications the satellite must be parked in a geostationary orbit, ie, one perfectly circular orbit, with a 24 hour period and aligned exactly with the equator. However, when the satellite is launched it's orbit will naturally assume the same orientation to the equator as its launch site. So if it's launched from a site 45 degrees above the equator, as is the Russian launch site, the satellite will fall into an orbit inclined at 45 degrees to the equator.

Getting rid of this inclination can only be done by expanding energy. This is usually in the form of an extra long burn during the transfer orbit. It's one of the penalties of space flight everyone would rather not pay. ●



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HOW TO ENTER

Groups representing their schools should submit the attached registration form which itself brings no obligation. Entry forms and suggested project designs will be forwarded to the groups on receipt of the registration form. Entrants are required to build an electronic device to their own or one of our designs and write a report on its operation, construction (and design) and the group's involvement. The device and report must be lodged with us by 15 September, 1986. State, Territory and New Zealand finalists will be announced on 19 September, 1986. The competition winner will be announced 26* September, 1986.

** Incorrectly printed as 16 September in the last June issue.*

REGISTRATION FORM

COMPLETE AND SEND TO "SECONDARY SCHOOLS COMPETITION", ELECTRONICS TODAY INTERNATIONAL, PO BOX 227, WATERLOO, NSW 2017.

SCHOOL .....

ADDRESS .....

.....

GROUP LEADER'S NAME .....

SCIENCE TEACHER'S NAME .....

DOES YOUR SCHOOL ALREADY HAVE AN ELECTRONICS GROUP OR COURSE? .....

New TV policy emerges

After years of debate, the government has finally decided on a new way of organising TV in regional Australia.

Michael Duffy, Minister for Communications, announced recently that the government had endorsed plans to bring an additional two commercial television services to population centres in regional areas of Australia which presently have only one commercial service.

"Nearly all Australians living in regional areas can expect to have at least one extra commercial television service by 1990 and most will have two," Mr Duffy said.

On the east coast, in the three most populous states of Queensland, NSW and Victoria, the government expects to have three commercial television services operating in some centres by 1988.

In the less populous states, development is expected to be slower. In smaller, more isolated markets, only two services may initially be available.

The policy is called 'equalisation' since its aim is to give country people an equivalent service to city people. Two mechanisms have been identified that will do this:

- 'aggregate' or combine, existing markets in order to provide a population base large enough for three competitive services;
- grant multi-channel service (MCS) permits allowing non-competitive regional licensees temporarily to provide up to three services in their existing markets instead of only one.

Mr Duffy emphasised that the government's equalisation objectives include preventing any extension of existing regional monopolies.

"There will be provision however for this interim phase to be reviewed, so that stations in markets which are so small and isolated that they will never join an approved market can argue their case for continuation of MCS even after 1996," Mr Duffy said.

The minister said the government expected licensees to choose their equalisation paths by 31 January 1987 and to begin implementing their plans throughout 1987 and 1988. MCS permits in approved markets would not be reissued after 1996. By then three competitive services would be required throughout these markets.

The government is to forego $32m in revenue in encouraging regional television licensees to aggregate. Last December it decided to exempt from sales tax all UHF television transmitters bought specifically for equalisation which is expected to result in a saving for licensees of some $10 million.

In addition, the government has decided to rebate fees paid by licensees involved in aggregation under the *Television Licence Fees Act 1964* between 1986-87 and 1989-90. Foregone revenue should total about $22 million.

These rebates will be calculated on a tapered scale falling from a maximum of 100% in 1986-87 to 25% in 1989-90. The Australian Broadcasting Tribunal will monitor the progress licensees are making towards aggregation at licence renewal inquiries.

In addition, the government has agreed to upgrade Commonwealth transmitting stations. This is necessary to accommodate both the new services to be provided under equalisation, and to provide capacity for two other major programs: the ABC second regional radio network and the relocation of existing television services from channels 3, 4 or 5, in order to provide spectrum space for more FM radio services.

"The government will need to spend $16m over a six year period on capital works to upgrade transmission sites for equalisation," Mr Duffy said. "It is planned to recoup this money over time from rentals paid by commercial licensees."

All the new commercial television services planned for regional Australia transmit on the UHF band.

In most areas the existing ABC and commercial stations will remain on the VHF band.

DOC Minister Michael Duffy.

In a few areas, where the existing VHF services have to be cleared from channels 3, 4 or 5 to make way for new FM radio services, eg, in Newcastle and Wollongong, UHF may be used to provide all television services.

Use of the UHF band is essential if equalisation is to be achieved. One hundred and twenty-two UHF television services are already in operation in Australia. Recently four new services on the UHF band were opened in Gosford, with another two to come on stream later this year.

Use of both VHF and UHF channels is bringing Australian television into line with developments in Europe, the US and Japan where UHF is used extensively. In Britain, all television services are now on the UHF band.

UHF launch in Gosford

The Department of Communications is to engage in a concentrated information campaign about UHF television on the New South Wales Central Coast.

DOC Minister Duffy, said his department wanted to ensure that residents were able to make the most of their new UHF television services since Gosford will be the first 6-channel UHF only city in Australia.

Gosford district residents with UHF equipment will be able to receive four interference-free commercial television services, channel 40 for NBN (Newcastle), 49 for ATN, 52 for TCN and 55 for TEN (Sydney). Later this year they will also receive ABC on UHF channel 46 and SBS on channel 58.

None of these UHF services should interfere with any existing reception of VHF services in the area.

Because the services will be broadcast from a single translator station in the middle of Gosford, they can all be received on one small antenna (a 'band 5' UHF antenna), connected to a television set or video cassette recorder which can tune to UHF channels.

Two other multi-service UHF translator stations to serve other areas of the Central Coast are expected to open within the next 12 months — the first at Wyrrabalong, near McMasters Beach, and the second at Bouddi, near Forresters Beach.

"To help residents adjust to the new services, the DOC is placing UHF brochures in Post Offices, operating a UHF information stand in the middle of Gosford, and holding a seminar for antenna installers," Mr Duffy said.

Residents who are unable to visit the DOC stand or their local Post Office can obtain the brochures by writing to the **Director of Public Relations, Department of Communications, PO Box 34, Belconnen, ACT 2616. (062)64-4690.**

CORDLESS TELEPHONE BUYERS WARNED

A spokesman for the Department of Communications has warned buyers of cordless telephones to be on the lookout for illegal units.

"We've had reports of unapproved units being imported and sold and buyers should be aware that such models can cause interference to other radiocommunications services including radio and television broadcasts," he said.

The spokesman said use of an unapproved cordless telephone was an offence under the *Radiocommunications Act, 1983*. Substantial penalties including confiscation of equipment could be imposed.

All cordless telephones used in Australia require both DOC and Telecom Australia approval. A unit should display approval numbers from both organisations along these lines:

Telecom Authorisation
No C85/35/24
Department of Communications
No DOC 302 0999
(or RFM E002 0999)

"People who have unknowingly bought an unapproved cordless telephone can seek recompense from the supplier under Section 53 of the *Trade Practices Act, 1974*.

"Buyers unsure of the status of their cordless telephone should contact any business office of Telecom Australia or any office of the Department of Communications," he said.

Nicaraguan Radio uses well-tried format

Listeners tuning to the Voice of Nicaragua are probably aware that the type of program featured is similar to that of Radio Havana, Cuba. Indeed, it is possible to confuse the two stations, both of which broadcast into Central and South America.

The reception of the Voice of Nicaragua with its English transmission on 6015 kHz provides a picture of this problem area of Central America. The station is located in Managua and programmes from its studio include a national service which is now carried on mediumwave as well as shortwave. The international service is broadcast between 1100-1400 UTC and following these programmes the domestic service is relayed. English broadcasts to North America are at 0100-0200 and 0400-0500 UTC.

A recent visitor to the station, reporting on 'Media Network' from Radio Nederland, said he became aware of the irony of the political situation as the 50 kW transmitter of the Voice of Nicaragua was made in the United States, as was much of the studio equipment. However, the Reagan administration's economic embargo on the country has stopped the supply of spare parts to the station. Listeners letters are no longer answered by mail, but are instead dealt with on the programme 'PO Box 248'.

The domestic service, with the slogan 'Radio Sandino', broadcasts from Nicaragua on 6200 kHz and, although all transmissions are in Spanish, identification is frequently given and reception is noted around 0900 UTC.

— Arthur Cushen

CLUB CALL

The Waverley Amateur Radio Society meets at the Edgecliff Scout Hall, Cooper Park Rd, Bellevue Hill, NSW. Contact club secretary, Eric Van De Weyer VK2KUR, PO Box 126, Randwick, NSW 2031, for times.

Popular session ends

Adrian Peterson.

One of the most popular sessions in Asia for the shortwave listener, "Radio Monitors International", has ended after 11 years of broadcasting. The transmissions were carried by the Sri Lanka Broadcasting Corporation in its service to Australia 1030-1130 UTC on 11835, 15120 and 17860 kHz, and though broadcasts continue in English for that hour, the Sunday feature, "Radio Monitors International", has been cancelled.

The cancellation is due to residency qualifications required in India; Adrian Peterson who compered the session for 540 programmes has moved to the United States, and the Adventist World Radio office at Poona continues under new management but no longer is the originating point for the shortwave programme.

Adrian Peterson commenced his listening in Australia in the late 1930s. His missionary work has taken him to many countries of the world. He has been able to verify around 10,000 radio stations in the course of nearly 50 years of listening.

— Arthur Cushen

Encoding sat signals

After protracted argument, Communications Minister, Duffy, has caved into demands from the regional TV operators and agreed to ecryption of signals from Aussat.

The 'special arrangements' apply to services known as Satellite Program Services (SPS) and Remote Commercial Television Services (RCTS). SPS are programmes distributed by one broadcaster to another for conventional transmission at a later date and would include not only normal programme material, but also live news and sports coverage.

"The encoding arrangements will ensure access to at least one commercial television station for every Australian," Mr Duffy said.

"They are consistent with the industry's wishes that RCTS be encoded to protect the markets of existing terrestrial stations."

The Minister said the decision to encode SPS was announced in November 1983 and had the full support of the Federation of Australian Commercial Television Stations (FACTS).

"SPS operators are being invited to submit their proposals for SPS encoding systems to my department for evaluation before licensing," Mr Duffy added.

Political broadcasts

The United States is funding several stations broadcasting to communist countries. Among these stations are Radio Free Europe and Radio Liberty, which broadcast to Eastern Europe. A new station which broadcasts to Cuba under the slogan 'Radio Marti' has also commenced operation, using Voice of America facilities.

The latest addition to these political stations is Radio Free Afghanistan broadcasting to Afghanistan. According to the opening announcement of the station, it is "an independent radio station supported by the people of the United States of America". The station claims to operate in accordance with the 'universal declaration of human rights as accepted in the charter of the Helsinki resolution'. Broadcasts are in Dari on Tuesdays and Saturdays at 1345 UTC on 17750, 17895 and 21510 kHz, and repeated the same day at 2315 UTC on 7295, 9625, 9660 and 11790 kHz. All transmissions last 15 minutes.

The Soviet official news agency has denounced the station as interference in a sovereign nation.

— **Arthur Cushen**

New CB supplier

GFS Electronic Imports of Mitcham, Vic, recently announced a decision to further enhance its extensive range of amateur radio and commercial products by adding Citizens Band lines to its inventory.

A spokesperson from GFS said "the highly regarded 'Electrophone' branch would feature prominently amongst the 27MHz and UHF transceivers".

For further information contact **GFS Electronic Imports, 17 McKeon Road, Mitcham, Vic. 3132. (03) 873-3777.**

Wombat in stir

An unlicensed radio operator, who identified himself as "the original wombat", was driving a locomotive around a Sydney railway yards late at night transmitting obscenities.

Stopping his illegal activities was all in a night's work for Department of Communications' radio inspectors. They knew someone was operating on the Amateur Radio frequency band without authority at the Enfield marshalling yards in Sydney, so the inspectors took their VHF monitor and went to track him down.

The story ended in court. The wombat had $300 worth of equipment confiscated, and was fined $200 plus $28 costs.

In another case recently a Queensland man made repeated calls to emergency services on marine distress channels, claiming he was with several other people in a boat outside the Southport sandbar. In fact he was transmitting from his home.

As well as losing the equipment (which was borrowed from a friend who also didn't have a licence), he was fined $300 plus $30 costs.

Both of these cases were prosecuted under the old *Wireless and Telegraphy Act 1905*. Late last year the new *Radiocommunications Act* came into force, replacing it. Penalties under the new Act are more severe, as another Queensland man found out. He made hoax distress calls to the Cairns coastguard, and was fined $2500 and had a $150 marine transceiver and a $200 CB transceiver confiscated.

In recent cases involving unlicensed operations of CB equipment, the minimum fine imposed by courts has been $400. Fines of up to $750 are common.

The future looks bleak for wombats.

BRIEFS

Scanning full band VHF/UHF receiver

The new IC-R7000 has been released by Icom, claiming a continuous coverage from 25 MHz to 1300 MHz. No additional module is required to achieve coverage up to 2000 MHz. CPU based optical tuning provides 100 Hz steps over the entire range. Icom's R7000 uses multi-conversion techniques for reception of FM (both narrow and wideband), AM and SSB (upper and lower). Ninety-nine memories are available to the user, each capable of recording mode and frequency. For further information contact Icom (Australia) at 7 Duke St, Windsor, Vic 3181. (03)51-2284.

UHF community site antenna

The DU6/HU6 antenna system is specifically designed for community site operations. Comprising two combined antennas the system can cater for up to 16 UHF base stations. The HU6 is a 6 dBd colinear antenna having a bandwidth of 20 MHz. The HU6 is mounted on a DU6 which is a 6 dBd gain dual dipole array. It has a bandwidth of 50 MHz. The DU6 can be operated as a single 6 dBd array or two 3 dBd arrays. Isolation between all antenna segments is 30 dB. The array height is 5.4 metres. For further information contact Antenna Engineering, PO Box 191, Croydon, Vic 3136. (03)728-1777.

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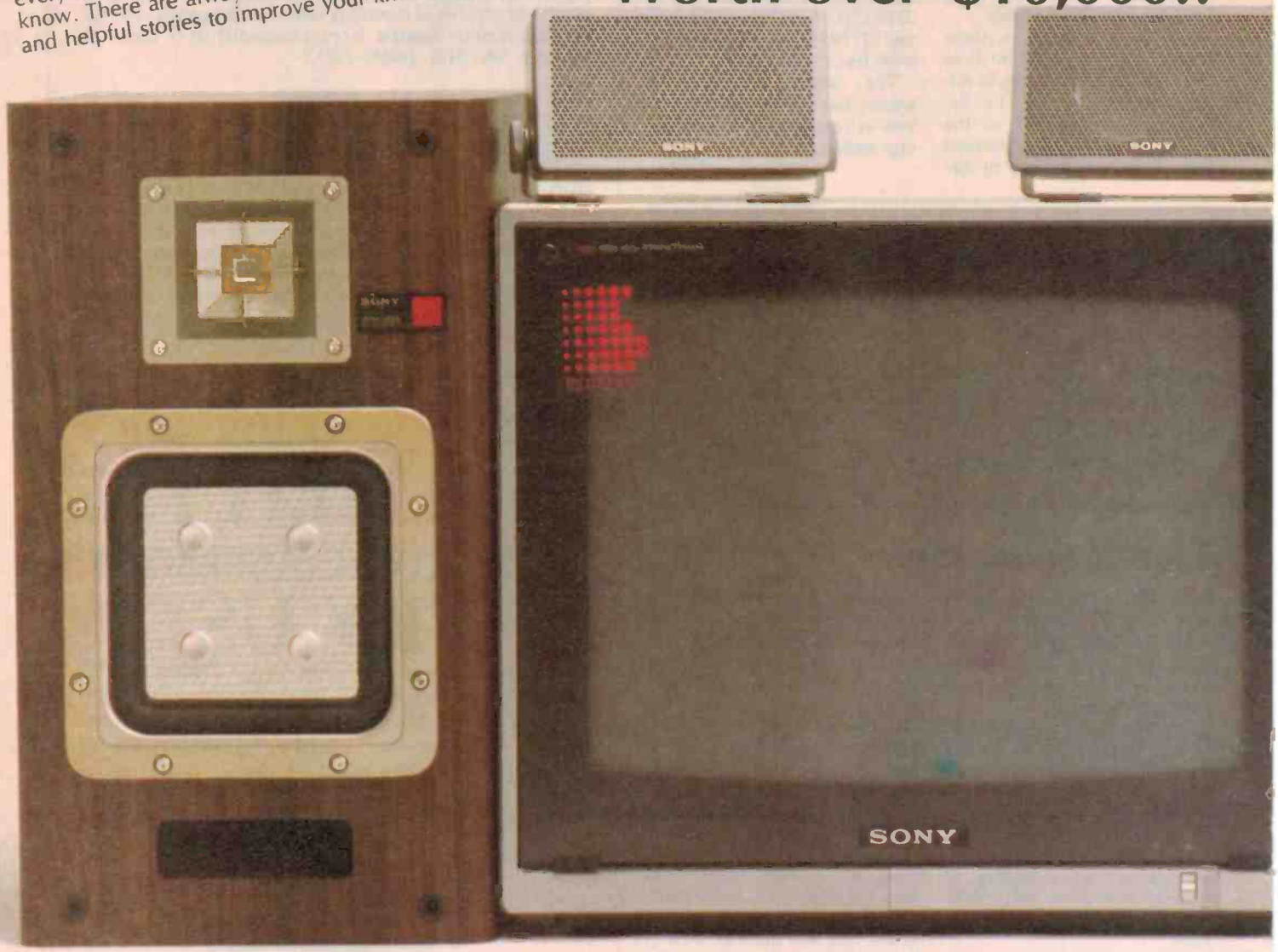

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(Offer valid until 31 August, 1986.)

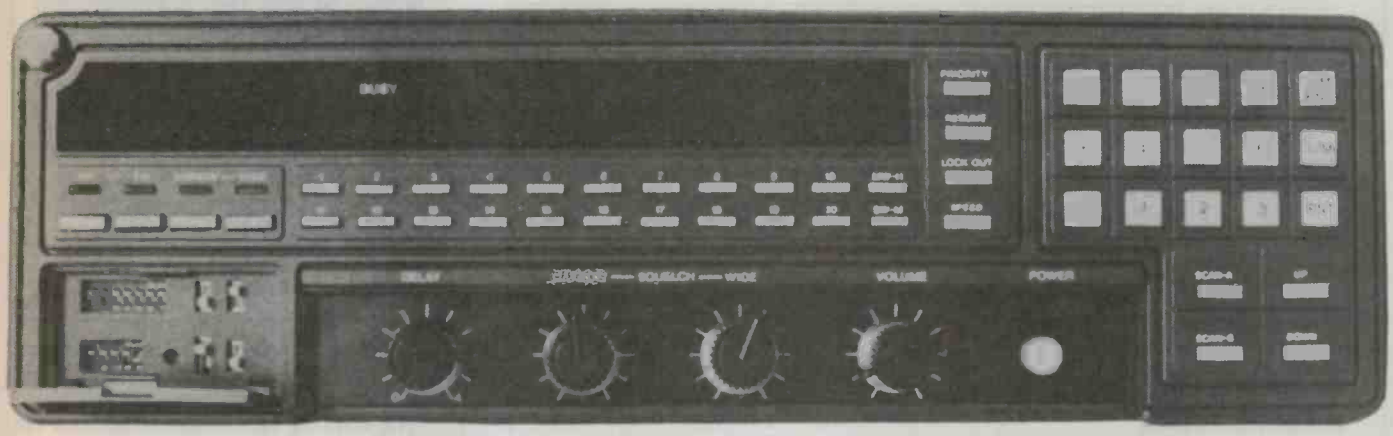
The exciting prize draw is also open to all subscribers who renew before the closing date. If the prize is not claimed within 12 months, a second draw will be run.

BIRDIE FREE SCANNING — with the JIL SX-400

Although this scanner has been around for a while now, it has taken us some time to put it to the reviewer's test. Peter Williams now tells the story.

Peter D. Williams

Peter Williams is director of Associated Calibration Laboratories in Melbourne.



SCANNING RECEIVERS are the instruments of one of the world's most popular electronics hobbies. As the name suggests scanning receivers electronically sweep or tune for signals on preset frequencies or between chosen frequency limits. Most scanners operate in the VHF or UHF bands, though HF scanners are found.

VHF and UHF scanning is also more practical. As stations in this band tend to be allocated frequencies 'for life' it is a lot easier to define the frequencies you're interested in. After all, the radio spectrum is a crowded place and you can spend much time looking in the wrong place for a station — especially on HF where stations, mainly broadcasters, continually change frequencies to suit changing atmospheric conditions.

Official view

In Australia authorities have tended to take a dim view of scanning receivers, or any receiver for that matter that can be used to listen to signals outside the broadcast band. Part of the reason is that scanners cover the frequencies used by the police, ambulance and fire services.

In the US, where authorities have a more realistic view, access to national resources such as the radio spectrum is open to everyone — provided a few rules, mostly to do with transmissions, are met.

The SX-400

With the JIL SX-400, a good antenna and a favourable location you should be able to monitor anyone who dares to take to the very or ultra high frequencies.

Probably the most important feature of this scanner is the frequency coverage, continuous from 26 to 520 MHz. The receiver covers this range in twelve segments. The broadcast band of 88 to 108 MHz makes up one segment and the aircraft band of 108 to 140 MHz is another.

The handbook that comes with the receiver claims that it is "birdie free". I was quite surprised to find in listening that none of these unwanted carriers could be found throughout the tuning range of the receiver.

The receiver has 20 channel memories and a versatile keyboard to provide complete control of frequencies, scan or manual modes, priority channels and so on. Accessories include rf converters that allow you to listen down to 150 kHz (not much there) or up to 3.7 GHz.

A useful facility is the data interface which allows remote control of the receiver by a computer. With a little programming you can scan any number of channels in any sequence and keep a log of frequencies and times.

Operating features

As mentioned, the continuous range from 26 to 520 MHz is divided into 12 segments, covering a smaller range of frequencies but one shortcoming is that SSB mode is not part of the kit, so CB on 27 MHz cannot be received.

On power up (with no memory) the receiver will automatically assume a slow scanning speed with priority channels inoperative. All memory channels are loaded with 26 MHz and the clock starts at 12 am.

The receiver is set seeking UP or DOWN depending on which key is pressed. A LIMIT SEEK function is available to set the receiver seeking between two programmed limits, such as between the limits of the police or fire brigade bands. The PRIOR- ▶

JIL SX-400 SCANNER S/N 40630662

20 CHANNEL, 26-520 MHz CONTINUOUS COVERAGE

Dimensions: *330 (w) x 90 (h) x 210 (d) mm*
Weight: *3.5 kg*
Received from: *Vicom (Australia) Pty Ltd*
Tested at: *Associated Calibration Laboratories Pty Ltd*

SENSITIVITY

Mfr's specs: HF/VHF FM (S/N = 12 dB) 0.5 μV; AM (S/N = 10 dB) 1.0 μV
UHF FM (S/N = 12 dB) 0.5 μV; AM (S/N = 10 dB) 2.0 μV

Lab test:
Each of 12 bands tested at centre frequency. Attenuator at 0 dB.

	FM 3 kHz narrow		wide		AM 1 kHz 30% modulation	
26-34 MHz	0.4 μV	= −114.9 dBm	1.27 μV	= 104 dBm	1.43 μV	= 104 dBm
34-50	0.19	= −121.4	0.54	= −112.4	0.64	= −110.9
50-60	0.21	= −120.4	0.76	= −109.4	0.76	= −109.4
68-88	0.21	= −119.3	0.76	= −109.4	0.85	= −108.4
88-108	0.24	= −119.3	0.72	= −109.8	0.72	= −109.8
68-140	0.28	= −118.1	0.78	= −109.1	0.99	= −107.1
140-180	0.25	= −119.1	0.60	= −111.4	0.76	= −109.4
180-220	0.27	= −118.3	0.67	= −110.4	0.85	= −108.4
220-300	0.34	= −116.3	1.13	= −105.9	1.13	= −105.9
300-380	0.24	= −119.4	0.55	= −112.2	0.77	= −109.2
380-460	0.76	= −109.4	1.58	= −103	1.77	= −102
460-520	0.23	= −119.7	1.0	= −107	1.00	= −107

Note: Checks at either end of the tuning range indicate that the sensitivity is maintained by tuning the rf stages with varicaps.

MINIMUM DISCERNIBLE SIGNAL (MDS)

Measured at 98 MHz:

FM narrow	FM wide	AM
0.15 μV = −123.4 dBm	0.21 μV = −120.4 dBm	0.46 μV = −113.7 dBm

SIGNAL (S) METER

Meter indicated 1 — no signal
3 — 3.79 μV, −95.4 dBm
5 — 15.1 μV, −83.4 dBm
7 — 28.7 μV, −77.8 dBm
9 — 64.3 μV, −70.8 dBm
'S9' + 20 dB 144 μV, −63.8 dBm

IF REJECTION

rf attenuator in operation
10.7 MHz − 76 dB
455 kHz not measurable

IMAGE REJECTION

Mfr's Spec: *HF/VHF −50 dB*
UHF −4 dB

Lab test:

At 98 MHz image at 119.4 MHz was −53 dB
200 MHz 221.4 MHz −13.4 dB
500 MHz 478.6 MHz −6.0 dB

Note: See text for explanation of these figures.

BLOCKING DYNAMIC RANGE (BDR)

Blocking signal 20 kHz removed* −74.4 dB
Third order IMD DR 20 kHz removed* −73 dB
In band IMD DR 5 kHz −70 dB

**These tests are normally performed at 10 kHz offset. However the SX-400 has a 'carrier centre' detector to ensure scan is stopped on frequency, similar to AFC. This inhibits audio if the signal is between 5 and 10 kHz off frequency which is the case during these tests.*

SQUELCH SENSITIVITY

Mfr's Spec: FM less than 1 μV
AM less than 2 μV

Lab test: At 200 MHz
FM wide/narrow 0.44 μV
AM 0.224 μV

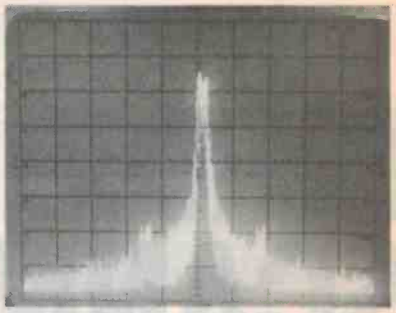
SEARCH-STOP SENSITIVITY

(FM narrow) Test at 100 MHz: The receiver stops 5 kHz low searching up in frequency, but stops on frequency searching down.
Test at 500 MHz: Stops on frequency.

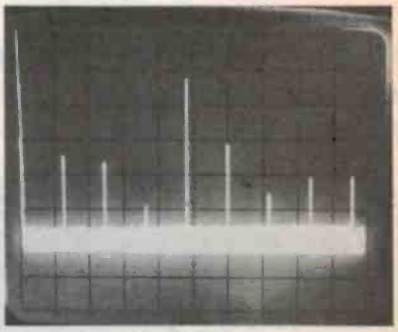
AUDIO FREQUENCY RESPONSE

At −3 dB points ref 1 kHz; −20 dB octave roll off.

FM narrow	FM (wide) 75 ms	AM
290 Hz and 1.2 kHz	240 Hz and 7 kHz	360 Hz and 1.2 kHz



Local oscillator at antenna, tuned to 100 MHz. Reference level −10 dBm; 2 kHz/div; 100 Hz resolution; 100 Hz video filter. Note FM on sidebands, especially close in to centre frequency.



Local oscillator radiation from antenna. Centre 500 MHz to which receiver is tuned. Reference level −10 dBm; 100 MHz/div; 300 kHz resolution. Note local oscillator frequency with 10.7 MHz removed on lower side of tuned frequency, in this case 500 MHz.

ITY option allows you to listen to a particular channel any time it is active, over-riding any other mode operating in the receiver.

The scanning rate is selectable from the front panel. The scan delay or 'dwell' time can be set at up to 4 seconds on a received signal.

The SCAN-STOP facility is well thought out. It is activated by the actual signal characteristics. For example, the scanner can be set to scan-stop on the carrier until the carrier disappears; to scan-stop on the carrier until the modulation ceases; or to scan-stop on modulation then resume scan when the modulation ceases. The last mode is useful when operating close to other receivers where sometimes local oscillator radiation can provide enough signal to appear to the scanner covering a programmed frequency as a received carrier.

Scanning all the memory channels in sequence is called Scan A. The channel number and frequency of a received signal are displayed. The scanner also offers a Scan B option which limits scanning to your selection of particular memory channels.

Scanning frequency steps vary between the segments or divisions of the frequency range. In the six segment range between 26 to 140 MHz, scanning is in either 5 kHz or 6.25 kHz steps; in the six segment range of 140 to 520 MHz, scanning is in either 10 or 12.5 kHz steps. Rather unfortunately the

step rate can only be changed *without* losing all the memory settings by operating a switch under the receiver's cover when the power is off. If losing memory isn't a problem a reset switch can be operated.

Power requirements are nominally 12 Vdc which means that you need a separate dc powerpack. A socket on the rear panel which outputs the local oscillator frequency is used for 150 kHz to 3.7 GHz rf converters, and another socket (for the IF output) can be used for other demodulation circuits or 'spectrum monitor' applications. The optional features are interesting and I wish there had been more information on them.

A telescopic antenna hidden in the top left hand corner of the box gives reasonable reception. A VHF connector is fitted to the rear panel for connection to an external antenna — but how much better would it be to have a BNC or similar low cost connector! Even amateur transceivers use the cheap SO-239 connectors. With an external antenna, performance is improved and for wideband coverage, a discone type antenna is recommended.

But an efficient antenna sometimes has the disadvantage of highlighting any image problem, which was evident in this case on VHF. An image problem refers to the situation when you hear two different frequency transmissions on the same frequency channel. It is due to two frequencies, which differ from the local oscillator frequency by the same IF, impinging on each other. What we found with this receiver was that listening to amateur repeaters on 146.7 MHz we also heard the police channel on 168.1 MHz. Both these frequencies differ from the local oscillator frequency by 10.7 MHz, the intermediate frequency.

Unless the input circuit is very selective, signals separated by 20-25 MHz can easily break through. The higher the frequency received, the greater the potential for images. The lower the IF also the greater the problem. The SX-400 suffers from poor front end selectivity and low IF (10.7 MHz).

Testing

To start on a less happy note, while using the receiver, we found the processor was prone to lock up at frequency intervals and we had to resort to turning the unit on and off. Another disappointing feature was the capacitor memory back-up, which it is claimed in the manual, lasts 36 hours. The best we could achieve was half that.

Audio output was to my mind not loud enough. Frequency response suffered from a severe roll off at high frequencies.

The test figures for each of the frequency blocks are quite good. SINAD tests on the end of each of the bands indicate that sensitivity is maintained by tuning the rf stage with varicaps.

The image rejection figures are not particularly good, especially for VHF. The image problem has already been mentioned. Although the front end is tuned by varicaps, much more Q or selectivity is required on VHF and UHF. A Q of 330 is required at the front end to give a −50 dB rejection figure, and our measurements showed a Q of only 11 at 500 MHz. The receiver barely passes the −50 dB image rejection figure at 98 MHz and, unless we had a bad unit, −13.4 dB at 200 MHz and −6 dB at 500 MHz must be regarded as definitely sub-standard.

An attenuator switch on the rear panel was obviously provided with good reason — to reduce input signal level which will tend to improve the image figure.

On the blocking/dynamic range we could only get a figure of −74 dB. A good VHF/UHF receiver should have a figure of around −120 dB, however, because this receiver incorporates a station centre detector, the test could not be performed with a 10 kHz offset which is the normal practice.

On a brighter side, true to the manual's claim that the receiver is 'birdie free', we could not detect any spurious signals at all. For those not familiar with them, birdies are nuisance carriers or signals which appear at odd frequencies throughout the tuning range of the receiver, generated by the oscillators in the receiver. A birdie will interrupt a scan until other keys are pressed or some manual intervention is made. There is a reasonable level of oscillator radiation as measured at the antenna (see photo), but fortunately it does not show up at the received frequencies.

Assessment

As a scanning receiver, the SX-400 does the job reasonably well. The full frequency range from 26 to 520 MHz allows all (bar SSB) services to be monitored — without interference from birdies. Unfortunately the image problems on VHF/UHF detract from its overall performance.

An interesting facility is the data interface which enables you to control the unit remotely from a computer. It is a pity the manufacturer did not make more of this computer facility and produce a standard RS232C serial interface. The lack of SSB may not be much of a problem if CB channels are of little interest.

Ergonomics needs to be considered too. The front panel of the receiver is vertical, making it difficult to read unless you have it at eye level, patently impossible in a car.

Technically the design appears to be in need of a little updating. Improvements are needed in the area of local oscillator injections to give a higher IF to improve the image response. At $910, JIL is capable of better.

●

From page 95.

Functions

Communication between the functions is by arguments, external variables, and values returned by the functions. Functional arguments are passed by value. However, when an array name is passed as an argument to a function, it is actually the address of the first element that is passed, and so elements of the array can be altered by the function by subscripting from this location. Pointers are used to permit functions to affect non-arrays in calling functions.

An advantage of passing addresses explicitly in this way in C is that the function call indicates which of its arguments can be modified.

I/O routines are provided in the standard C library; they are not specified in the C language. The standard library includes routines for reading and writing data in blocks of arbitrary size, and for reading and writing formatted text.

Some final remarks

When the design philosophies of C and Pascal are compared, two major differences are found:

1. Pascal, being restrictive, emphasises program reliability and readability, while C, by its absence of restrictions, emphasises programmer flexibility, eg:
   (a) Pascal contains more restriction on pointers, which leads to safer programs but also reduces the use that can be made of the pointers; and
   (b) the ability to perform assignments within expressions tends to make C programs more compact than the corresponding Pascal programs, but less readable.
2. Pascal attempts to hide the underlying machine as much as possible, while C tries to provide a convenient way of controlling the machine. This is illustrated for instance by the operators the two languages provide: C has operators to manipulate the bits of a word, while Pascal has operators to manipulate sets.

Some consequences of these differences are that Pascal is better than C for teaching programming; some C programs cannot be written conveniently (or at all) in Pascal, because of the restrictions in the latter; and C can be used in more programming domains than Pascal.

For situations where strong type checking is desirable, a program called `lint` can be used. It detects type mismatches, inconsistent argument usage, unused or uninitialised variables, potential portability difficulties and the like.

The main reason for the growing popularity of C are: its flexibility; its limited size which makes it easy to learn; its close link with UNIX programming environments; and the strict checking provided by the program `lint`.

●

MACHINE VISION

"I see" said the nearly blind computer, optimistically. Computers are seeing only light and dark and discriminating just a few shapes; and if machine vision isn't exactly failing vision, it's with a lot of ingenuity from the designers.

PROBABLY NO TOPIC in computers or electronics is quite so capable of arousing the layman's interest as machine vision, computers that see: misty images of C390 looming over the desert sands, of R2D2 with his little head spinning; popular dreams of the times.

But machine vision is proving a thoroughly intractable beast. Twenty years after the pioneering efforts at Stanford University in the US, the goal of the seeing machine still proves elusive. There are vision machines around, indeed, some world class units are in production in Australia but the technology necessary for R2D2 type vision is barely even a twinkle in some mad professor's eye at this stage.

Machine vision is all about number crunching; doing it fast and doing it effeciently. It's an area where parallel processing (using a number of microprocessors in parallel) is almost standard procedure, and where developing new and more efficient algorithms to manipulate memory is the route to glory as a practitioner of the art.

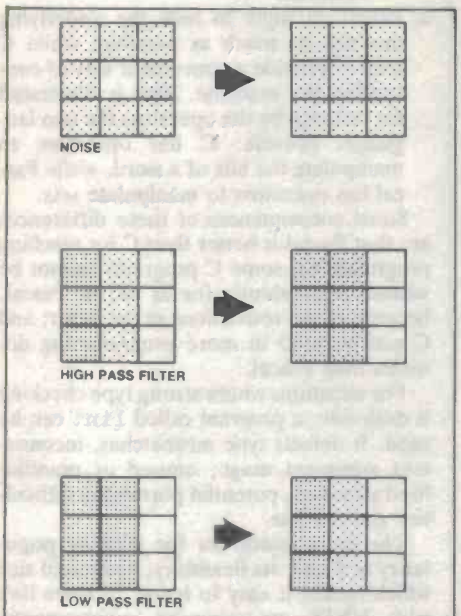


Figure 1. Image enhancing.

Binarization

There are a number of manipulations now well established in the literature. One of the most important is 'binarization', in which all values in memory below some arbitrary figure are turned into zero, and all above turned into one. This, of course, produces a black and white image, which is most importantly used in template matching.

Template matching is the technique used by industrial machines that are now starting to appear on conveyor belts and as quality control devices. Essentially, the situation is that an object is presented to the camera in such a way that its outline is clearly visible and this is matched against a 'template' that already exists in memory. At its simplest level, the comparison might consist of matching memory byte for byte.

For instance, we may wish to carry out quality control of bolts coming out of a foundry. The bolts, still hot, are mechanically placed on a conveyor belt. It's not mechanically difficult to ensure that at any given time only one is present in the field of view of a camera sited directly above the belt.

The first task of the system is to make up an analogue of the scene on the belt in the computer memory. To do this, the lighting levels must be set such that the visual response of the camera to the bolt is quite different from the response to the belt. Hopefully, the frame store will hold bytes with values close to (say) zero, corresponding to the background and close to one, corresponding to the bolt. However, it's unlikely that this ideal situation can be achieved by lighting alone, so the image is binarized to assist in defining the object, before being processed further.

The exact nature of this process depends on the application. For example, it's possible to determine the area of any object on the conveyor belt. Since the number of memory bytes with a certain value is directly proportional to the area of the bolt, it's possible to check the size of each bolt as it comes out of a forge, thus forming a useful quality control device. Indeed, a device just like this has been developed by Vision Systems in Adelaide.

Another useful application is in quality control of IC packaging. The system can check the size of the package, the location and orientation of pins and even the numbering on the top of the package.

The idea of template matching has been developed for a number of other situations. Vision Systems has recently announced a security device consisting of a camera monitoring a protected area. A computer receives a light value from the camera for every pixel in the scene, and the alarm is triggered if any of these values change.

Image enhancement

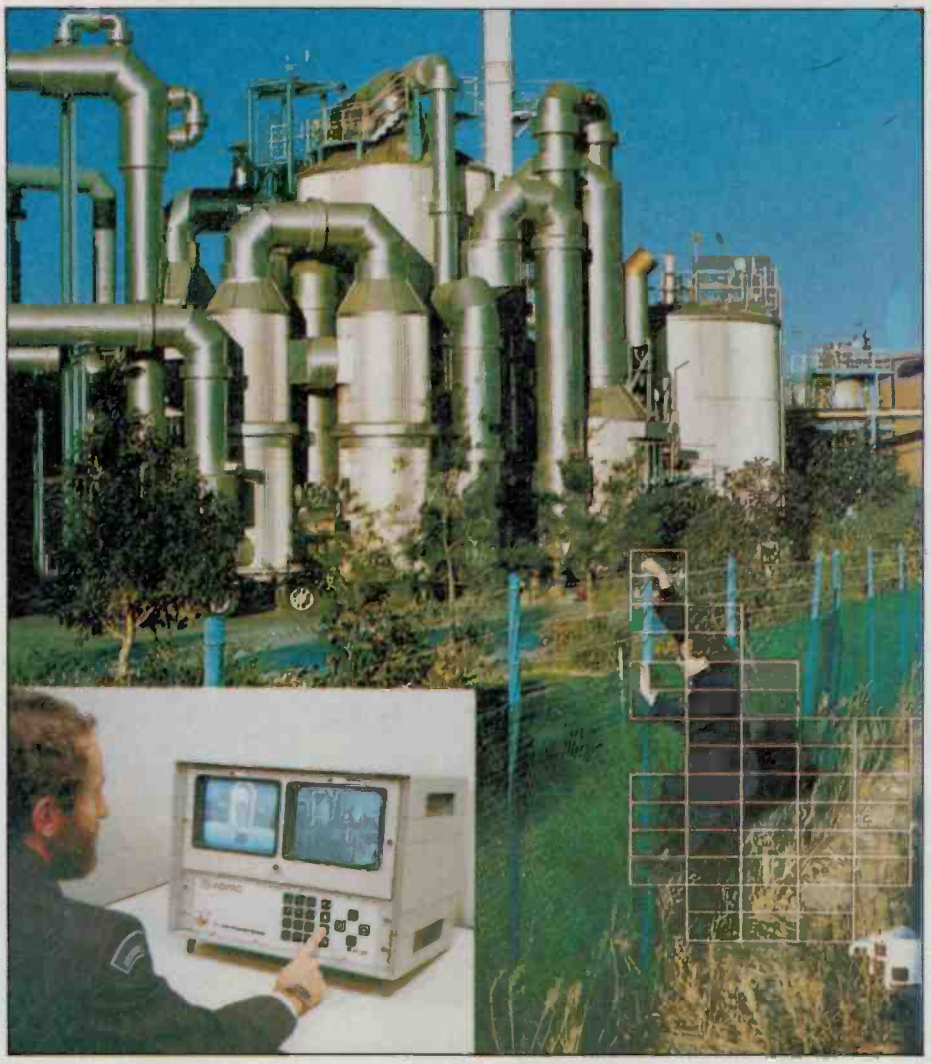
Other forms of image manipulation result in image enhancement. Image enhancement is often part of the preprocessing of robot vision. Sometimes it's an end in itself, as in the outputs from scanning electronic microscopes and spacecraft.

Exactly what is involved in image enhancement depends to a large extent on what aspects one wants to enhance. The details can be very complex, but the fundamentals are simple enough. In fact, there are only two major processes at work.

On the one hand the picture should occupy the whole dynamic range available, ie, the brightest parts of the image should have the highest value we can assign to a pixel, and the darkest parts should have the lowest value. On the other hand, the parts of the image with the interesting details should have the most contrast.

Implementing these features is an exercise in changing the relationship between the numbers stored in the bytes of memory, and the brightness of any given pixel. According to Pang Chew, who is working on

Jon Fairall



The Pro 1600 video motion detector in action. (Courtesy Vision Systems.)

Melbourne-based Dindima Group's first image enhancing system, the process begins with a histogram which examines the distribution of brightness in the scene. If the histogram is skewed towards one side or the other, pixel values are changed so that the histogram is stretched out across the range. Details leap out of a dark image. A meaningless grey blob becomes defined. It looks like pure magic.

However, even when the full dynamic range of the system is employed, the contrast between individual picture elements might be too small for human consumption. So another technique is used. This involves changing the linearity of the pixel-to-memory conversion. To do this one has to identify the level of brightness in the image where the wanted detail exists and increase the contrast range.

Other techniques of image enhancement are utilised. Noise reduction is probably the simplest as well as the most common. Generally all that is involved is that the light levels in a nine-by-nine block of pixels are compared. If the centre pixel is found to be substantially different from the others around it, it is assumed that it represents noise on the image. The problem is overcome by making the centre pixel the average of all the surrounding ones.

Another common technique is the high pass filter, so called because it creates an analogous effect to the use of a high pass filter in a video system; it enhances sudden changes in the light levels in the image, ie, the edges of objects.

This is also achieved by taking blocks of nine-by-nine picture elements. Edges are identified by looking for blocks in which pixels on one side have different values from ones on the other side. When this happens the centre is assigned firmly to one side or the other.

The opposite technique, called the low pass filter, blurs the image by making the centre pixel the average value of the two outer ones.

In a practical imaging system, all these

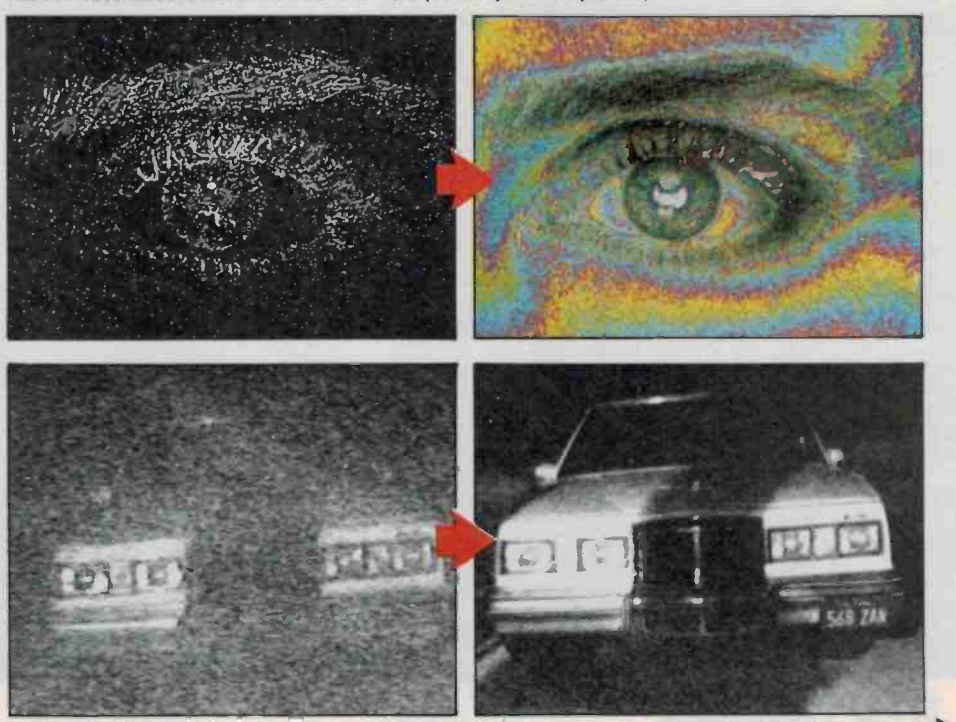
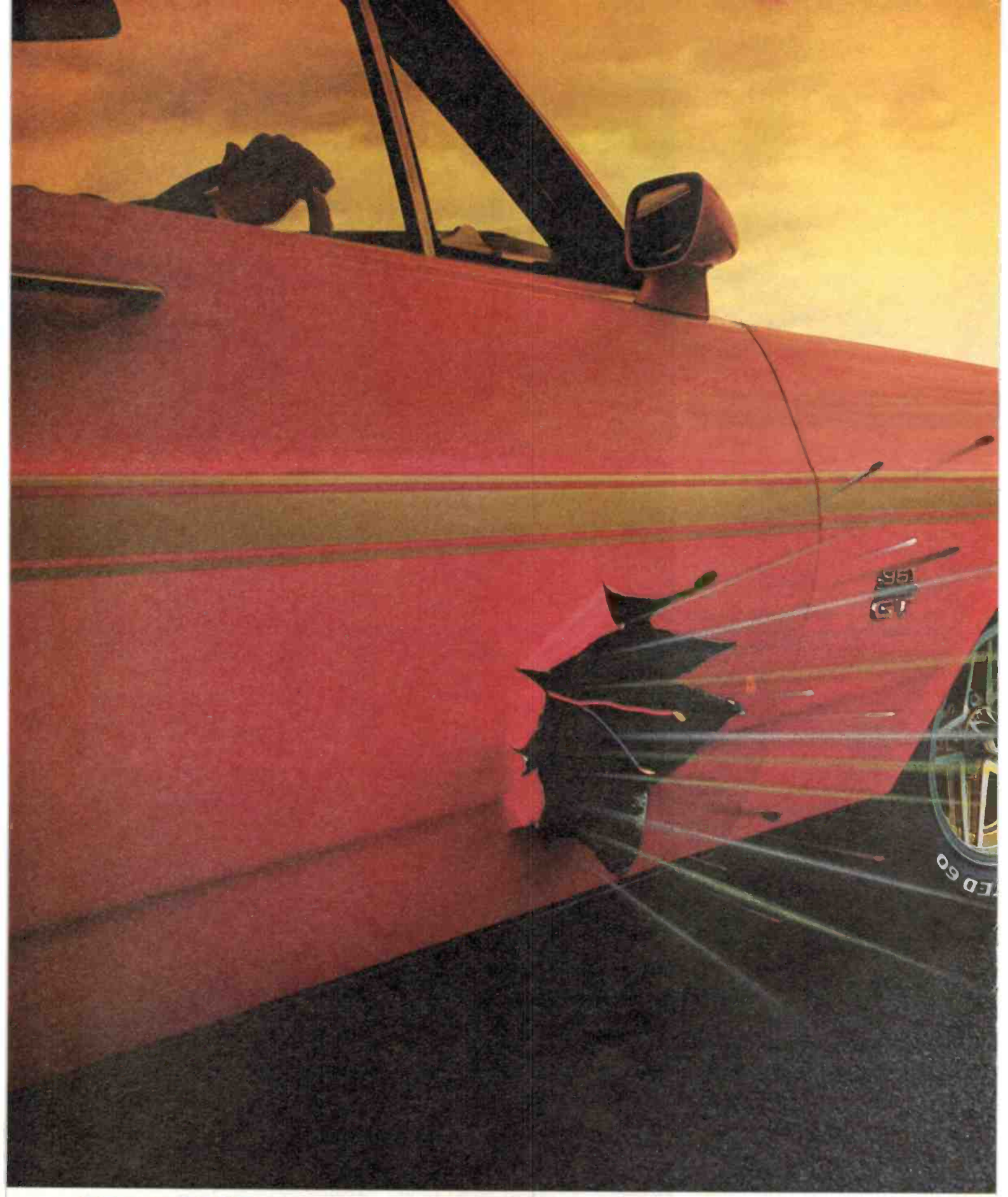


Image enhancement before and after. (Courtesy Dindima).



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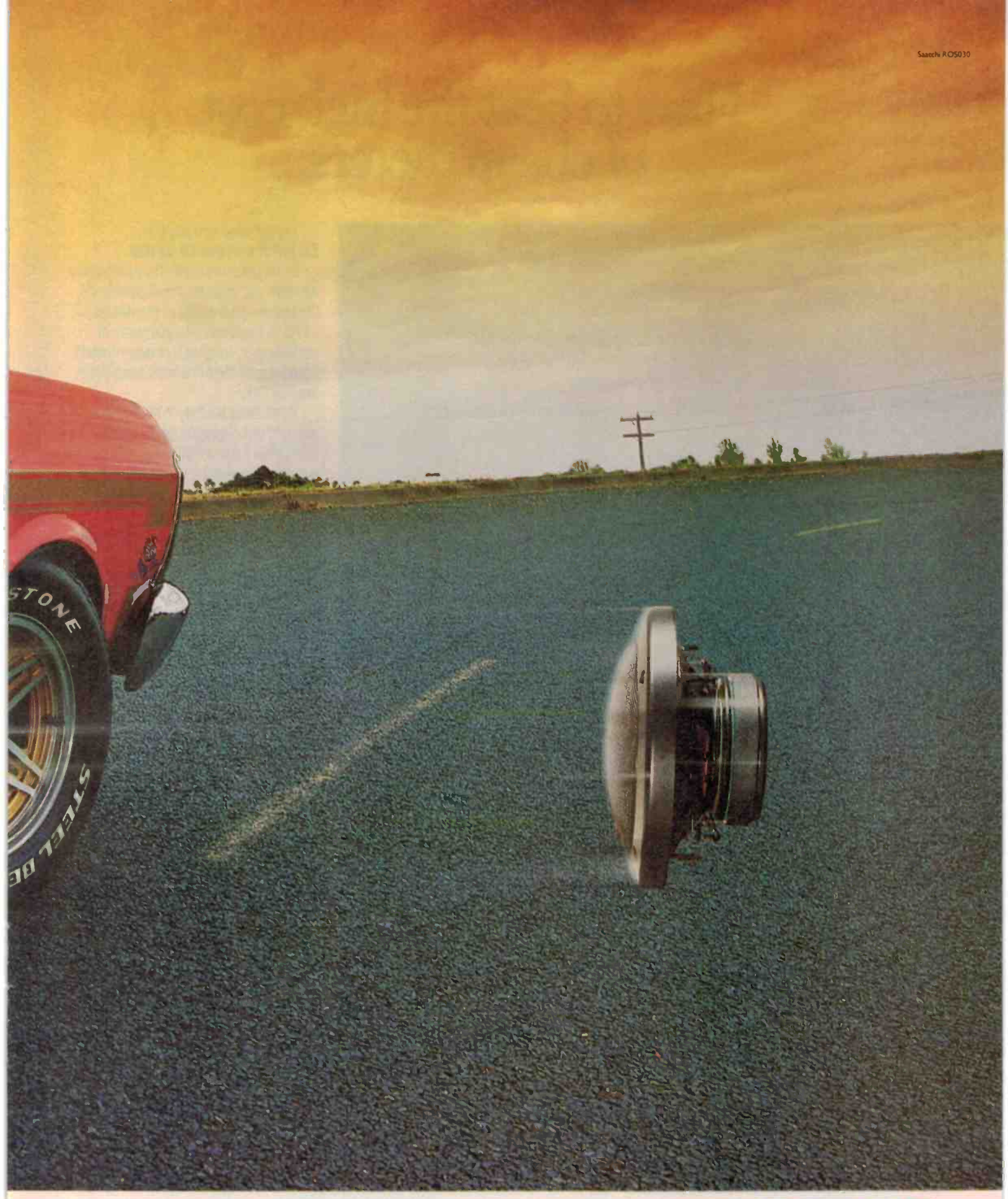

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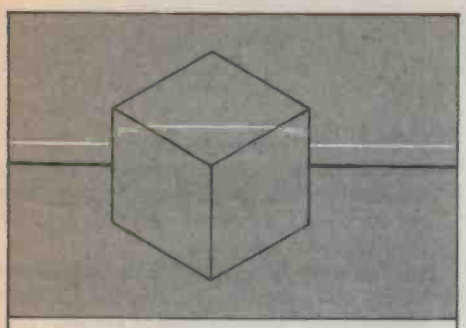

Figure 2. Light striping.

techniques, including binarization, are available. Just which combination is used, and in what order, depends on the image and the desired result.

Object recognition

So, given that the original image has been turned into usable form, what is it good for? Simple template matching is very restrictive. What we want is the ability to recognise an object, irrespective of its orientation. Simple template systems require that the object be positioned in a very precise way with respect to the camera. While this is not a great concession in some industrial applications, one of the driving forces behind machine vision is that it should increase the flexibility of robots on assembly lines.

The expectation of machine vision is that it will allow a robot to mimic the human operator in its ability to pick up a part, irrespective of how it is lying on a container belt.

The standard way to tackle this problem is to look for a particular recognizable feature on the object, a corner say. One can then infer that some other feature will be found in only a restricted number of positions. Once two or three such parts are found the computer can infer the position of an object in a completely random orientation.

This technique has one interesting side effect: not only can it recognise an object irrespective of its orientation, it can also recognise an object from incomplete information. This means that if the object is partially covered, or badly lit, the computer will still recognise it.

3D

So far, these are all two dimensional systems, perfectly adequate so long as we are considering only two dimensional problems, like locating an object on a conveyor belt. But the real world's not like that.

To make the computer understand that it is dealing with an object that has extension away from the camera or exists at some indeterminate distance from the camera is a far more difficult problem.

At the moment, the most promising technique for determining 3D shapes involves projecting light rays onto the object. It's called light striping. A proponent of the technology in this country is Professor Ray Jarvis of Monash University. Work is also going on at Stanford and MIT in the US, the University of Tokyo, and at the CSIRO.

The usual installation requires a projector reasonably close to the camera. The projector sends out a fan of light, so that a thin line is projected onto the object in front of the camera (see Figure 2). The light will be curved depending in a complex way on the relationship between the angles and distances of the projector, the camera and the object. Since only the object is unknown, it is possible to calculate the shape under the line. By moving the line up and down and looking at various combinations of line the entire body can be described.

One application of this already installed in the US is for quality control of motor car body panels. The vision system tracks the behaviour of a line as it moves over the complex body shape. By comparing it with information it already has the vision system can tell whether the panels are the correct shape.

In theory, it's possible to describe any surface, no matter how complex, in this manner. The problem is one of computing time: there isn't enough of it. It can take several minutes to analyse a particular screen. This might be practical in situations where the process can be stopped for a few minutes, but it's clearly useless in real time applications with plenty of movement.

As with sophisticated template matching, the key is not to try and do the whole job, but to fill in the missing bits with a certain amount of understanding.

Imagine, for instance, that the task is to detect a cube somewhere in the space in front of the camera, and to detect its orientation. One solution, instead of trying to detect the position of all the sides of the cube, might be the much simpler task of detecting one corner of it. Having detected the vertices that make up the corner, it's a relatively simple task to determine both position and orientation.

In fact this type of processing was amongst the earliest ever attempted in the machine vision field. The problem is that it's 'semantically driven', that is, the machine has some knowledge of the meaning of what it sees. It understands that a vertex is part of a cube for instance. However, that is all it understands. Show the machine some other shape and it's absolutely useless.

A light striping system is 'semantically free', since it doesn't need to know anything about the object in front of it. Obviously, semantically free systems are the goal of research in the field, but this is not to say that a practical semantically driven 3D machine tied to a robot would not be extremely valuable.

Such a device would be capable of assembling a unit out of, say, a dozen parts starting with all the parts scattered on the bench in front of it. It would be able to recognise the position and orientation of all the parts from information about the position of only a few key points on each object. After putting the parts together it could even check that it all looked correct.

One big problem would be the amount of programming overhead necessary to instruct the machine in only one manufacturing process. A recently suggested answer is to use the output of CAD systems to give meaning to a vision system.

In this scenario, the information fed into the CAD system would completely describe, say, a bolt. The vision system would then be able to identify the position and orientation of the bolt from detecting just one arc of the screw thread.

Practicalities

Machines with some of these capabilities are in existence now. It goes without saying that they are not particularly common. According to Tony Weir, R&D Manager at Vision Systems, much of the tiny market penetration is due to a simple lack of engineers' knowledge of the advantages that machine vision confers.

However, he concedes that other factors enter into the equation. Machine vision systems are extremely expensive and difficult to maintain. And since they are not common, servicing back-up is not easy. In fact imported systems may very well have no local servicing available at all.

Another problem is that practical systems tend to be very inflexible. They recognise a small number of situations and react in a limited number of ways. Often alternative, non-visual technologies do the job cheaper and better.

There is very little doubt that most of these problems can be solved within a reasonable time. According to Tony Weir, fully operational 3D systems will be on assembly lines within 10 years.

When they do arrive, their first use will almost certainly be to provide the final link necessary to fully automate factory processes. The most complex robot assembly operations will become possible.

Even then, however, the 'world' of such a robot is likely to be a very small place, made up of a few dozens of objects that it 'understands'. Everything else will be completely beyond its ken. A device able to navigate through the world like a human being and manipulate random objects is much further off.

However, it may be that the problem in 10 years time will be not a lack of computer algorithms to do the job, but simply a lack of computer time to do the computations. No field of endeavour will benefit quite so much from fast processing architectures. It's a field that bears watching. ●

DREGS

ALMOST EVERYONE IN the Australian electronics industry has a view on why the Japanese are so good at the game. The way they organise their companies, a natural facility for copying everyone else, easy money, or whatever.

The dregs hack has a new theory, culled straight from the Japanese Asahi news service. This reports on one Takashi Aoki, a semiconductor application engineer with Toshiba. Of late Aoki has been feeling mega creative, so much so in fact that he recently patented a circuit for electric power amplification using semiconductors.

According to Aoki, his brush with fame was fuelled by the ancient Japanese art of Danjiki, or fasting to remove the body of impurities. He attended a lecture by a Miss Shoko Takahisa of the Happiness Association in which Danjiki was explained, and found it so convincing that he signed on for the full eight week course.

Does Shoko have a happy customer? You bet. She cured the hay fever that has plagued him for the last 26 years, he's doing great at work, he feels fantastic.

Danjiki means more than going without food. At the Happiness Association, Shoko gives students four weeks of lectures on why Danjiki works and other essential health factors. They are advised to drink only mineral water and persimon leaf tea washed down with manganese hydroxide. Theory has it that the mineral water and tea provide essential nutrients and the hydroxide acts as a laxative. Sort of intellectual input/output.

In the fifth week of the course they go on to a full time fast while maintaining a normal daily routine. In the next three weeks they study how to maintain the health gained by Danjiki.

It's not kids play, by all accounts. Danjiki can be very dangerous if you don't know how to do it properly. There have been some deaths at other schools, although Shoko is reportedly very happy that none have come from the Happiness Association, which has about 30 core members and 1000-odd names on the books.

Success stories are not uncommon. According to practitioners, fasting affects more than just physical conditions. "While you fast your brain waves run very slowly" says Shoko. It's a state similar to that of a Buddhist priest in deep meditation. This psychic state allows one to become more 'in tune' with the universe.

"The underlying principle is that human beings are linked to the universe by their subconscious. Human desires are also generated in the subconscious, so the art of Danjiki is to provide a pathway between the universe and the subconscious.

"Danjiki allows a person to link physical and spiritual health. It allows people to recover their natural healing power through a complete cleansing of the body. Advanced practitioners can increase their latent ability in a physical sense. They can also increase their intuitive ability."

Well, that's the theory anyway. The hack doesn't believe a word of it, but as he heads out the door looking forward to a pie and a beer for lunch, he must confess to no patent applications, no semiconductors, and not feeling at one with the universe.

PURGE . . .

By Paul Jones

```
A>ERA B:DATAFILE.COM
syntax error
A>PURGE B:DATAFILE.COM
password:XXXXX
password – CORRECT – proceed
A>PURGE A:DATAFILE.COM
purge file, *A:DATAFILE.COM* (Y/N)
A>Y
purge file, *A:DATAFILE.COM*
created: 23/07/86
creator: Annabelle. J
account number: AGS30011560
purge (Y/N)?
A>Y
are you sure that you want to
(Y/N)?
A>Y
i can give you a few seconds to
think on it, if you wish.
A>N
oh, good, you did change your mind.
A>PURGE A:DATAFILE.COM
ah, you didn't change your mind.
purge file, *A:DATAFILE.COM*
(Y/N)?
A>YYYYYYYYYYYYY
ok, ok, i'll do it.
purging file, *A:DATAFILE.COM*–
NOW.
sorry, but . . . um . . . i can't
find it.
A>DIR
DATAFILE.COM : PIP  .COM : DBASIC
.COM :
SYSOP    .COM : DRUN .COM :
.COM :
well, that's where it is,
purge file, *A:DATAFILE.COM*
(Y/N)?
A>Y
look i've got to admit that i like
that file and it did take a fair
amount of time to put together and
it does cover a large amount of
disk space, just keeping track of
it makes me feel useful. please be
human, leave it alone and start a
new disk, huh (Y/N)?
A>N
no i won't!!!
A>PURGE ALL.
drastic step, ok, i'll purge A:DATA
FILE.COM, i'll kill off an old and
dear friend, i'll take the 'thirty
pieces of silver', it means nothing
to you that a file serves you for
years without error and now it will
be cast into the deep abyss that is
the lot of all files that are no
longer 'useful', but i'll
remember, I'LL REMEMBER!
*A:DATAFILE.COM* purged, at 'USER'
request.
A>DIR
            : PIP          .COM :
DBASIC .COM :
SYSOP    .COM : DRUN     .COM :
            :
DATAFILE.RIP : LESTWE4 .GET :
            :
A>
```

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