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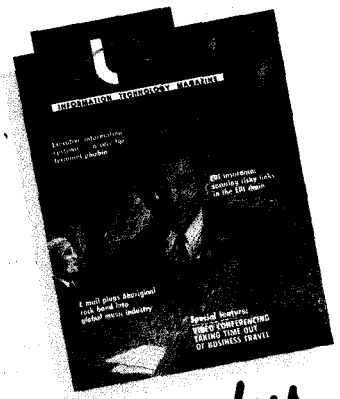

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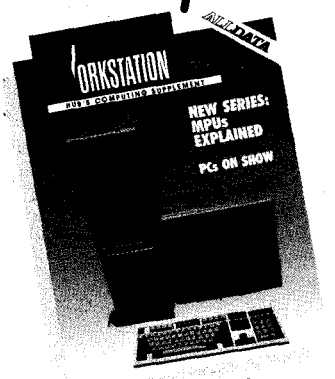

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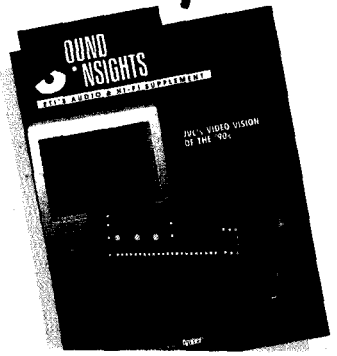

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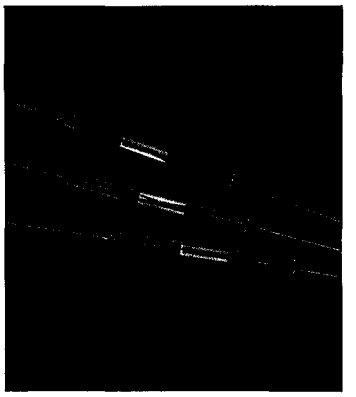

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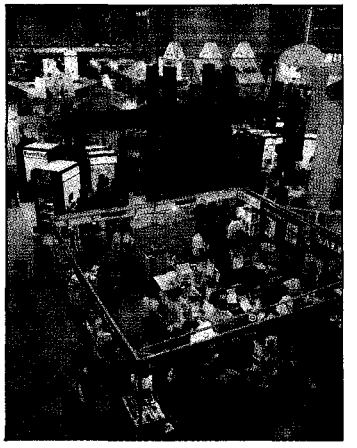

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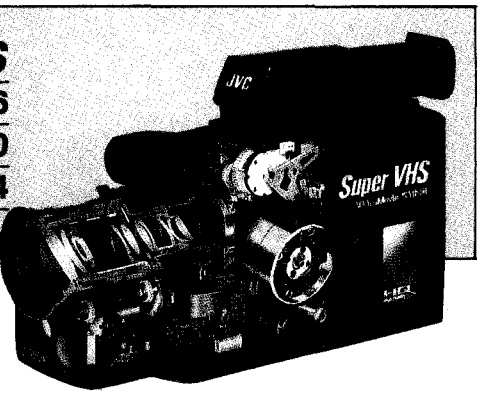

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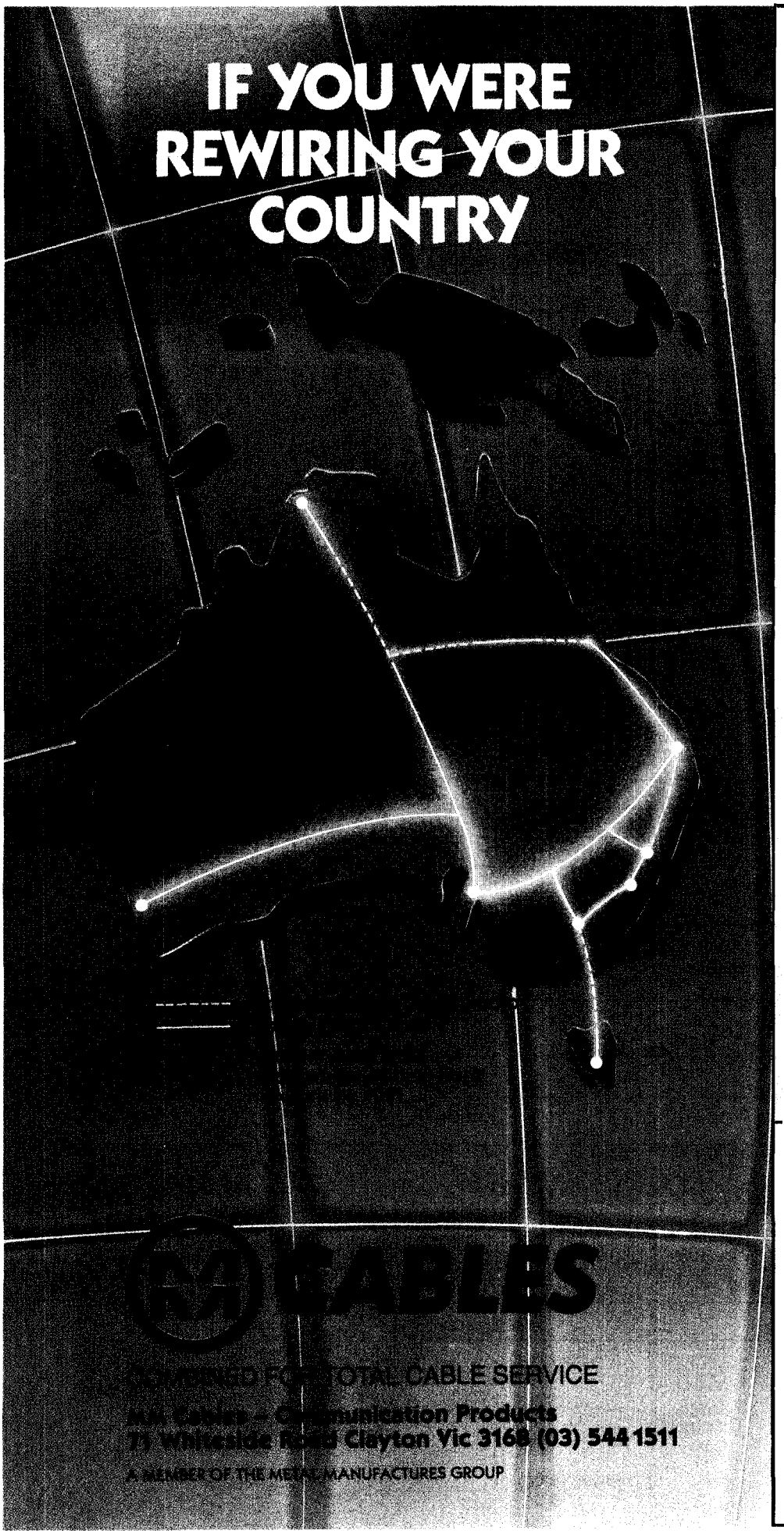

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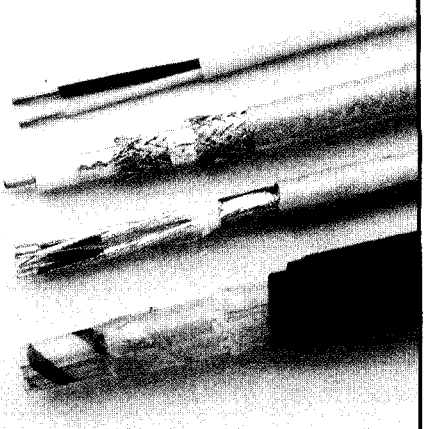

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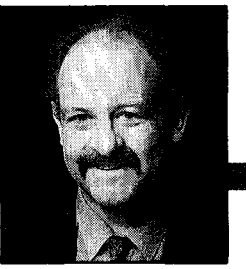

KIM BUCKNOLE

Crystal balls, not crystal spheres

I like James Burke. I have been watching him on television for years. Right from the time when he was offsider to Raymond Baxter on the BBC's *Tommorrow's World* – the progenitor of *Towards* and *Beyond 2000*.

Currently on Sunday nights his *The Day the Universe Changed* is shown on SBS. If you haven't seen the program (or read the book of the series), then what Burke does is to trace the impact – of a thought, a new insight, an invention, a discovery – on society from the time it occurred, say 500 years ago, to the present day. Of course, he does this with the benefit of hindsight. He is lucid, entertaining and educative.

The next James Burke I seek will be lucid, entertaining and educative. However, I want him to have foresight, not hindsight. I don't want him to discourse on crystal spheres, but I do want him to have an accurate crystal ball.

In Burke's programs the knock-on effect of the initial "discovery" can take hundreds of years. This was so in the past because of the slow speed of communications, the heavy hand of the church in Rome, political, military and other social factors. The first two of these factors do not apply in the present age.

Nowadays, communications are fast and getting faster. The R&D departments of the industrial giants from which issue the modern breakthroughs aim to deliver a product that can be exploited as soon as possible. What I want the next James Burke to do is to predict accurately the social implications of new technological developments.

What started this line of thought was the recent pilot's dispute. Because of the lack of air transport, demand for two-way video links between Melbourne and Sydney increased markedly. NEC reports that some businesses are *buying* packaged video- and tele-conferencing systems. It will be interesting to see if this reflex reaction to the airline strike firms into a solid trend and, in time, becomes *the* way to conduct interstate business in the nineties.

Here's a Burkean link in action, I thought. It may be that the pilots have caused an idea's "time" to arrive a little earlier than might otherwise have been the case. If it proves to be so, may I ask who would have predicted six months ago that a claim for a 30 percent pay increase by a small group (pilots) would have had such a consequence?

Whilst pondering this, I read a survey in the SMH on the number of people opting for the life of the long distance commuter, leaving Sydney's metropolitan suburbs for the Blue Mountains, the Central Coast and the Illawarra. Some face up to 4 hours travel by car or rail each day. Of course, they pay less for housing, and at the weekends enjoy a better lifestyle.

As is happens, I know a number of people who live and work in the Blue Mountains. They are writers, composers, musicians. They communicate by telephone, fax and modem. What catalyst would it take for more of us to opt for the domestic workstation scenario? What would it take for employers to consider taking the office to the worker as a serious alternative to the present (opposite) norm? ISDN? Doubled CBD rents? No petrol?

En masse, would we and our employers want us to be home-based? Would our marriages survive the increased intimacy? Would community spirit usurp company loyalty? Would we miss the social intercourse of the workplace? In short, how would we react?

It is arguable that developments in electronic technology point to the home-based human. And not just in terms of the phone, fax, modem and PC. Consumer electronics is all *home* entertainment systems and components. Big screen, HDTV, VCRs – predictions of LCD TV screens as big as you like to be hung like a painting. Small format camcorders – video postcards. It all says, "Stay at home, we'll bring the world to you. Don't visit people, send them a video".

Consider, too, the question of goods and services. We can now (or will soon be able to) order and pay for goods and services from home. When we no longer go shopping and no longer go to work, what will prompt us to go through the front door?

And this is where I want a James Burke to step forward and lucidly, entertainingly, accurately educate me, with the benefit of foresight.

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ELECTRONICS TODAY INTERNATIONAL is published and distributed monthly by The Federal Publishing Company Pty Limited, Inc. in NSW, 180 Bourke Road, Alexandria, NSW 2015 Ph: (02) 693 6666. Printed by Hannanprint, 140 Bourke Road, Alexandria, NSW 2015. 1989. Distributed by Newsagents Direct Distribution, Alexandria, NSW 2015.
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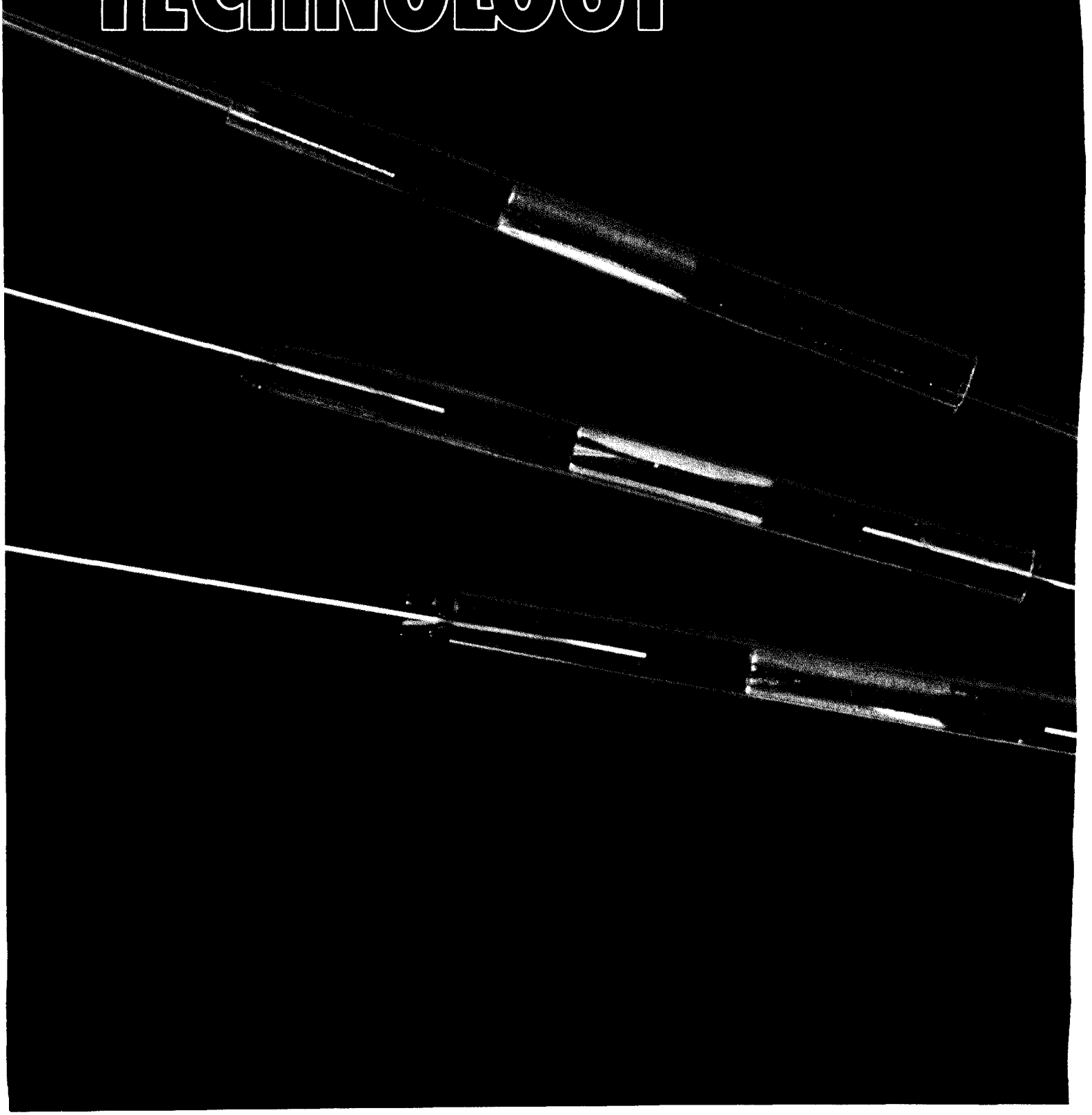
FIBRE OPTICS, NOW AN OFF-THE-SHELF TECHNOLOGY



Now you can "wire up" a fibre optic system using off-the-shelf cables and components, in virtually the same convenient manner as you can with electronic components. Roger Harrison writes.

A power plant uses fibre optics to transmit data securely over a long distance. A coal mine uses them to protect its important outdoor cables against lightning strikes. A car assembly plant installs a fibre optics system to protect data against interference from nearby equipment.

The many uses of fibre optics technology continue to proliferate, along with a growing range of solutions to industrial problems as diverse as those just mentioned. Used to transmit information, fibre optics are challenging traditional copper cable wiring systems in some industrial applications and opening exciting new possibilities in others. That challenge has grown, and will continue to grow, because fibre optics is now literally an "off-the-shelf" technology.

Copper cable has, for many years, been the most widely used means of transmitting electric current, whether for power reticulation or for communications. Iron and aluminium wire were also used briefly in the telecommunications industry, with aluminium still popular for high-voltage power transmission.

One of the main problems with copper wiring is its voltage drop, especially over long distances. It can only be counteracted by using copper wire with a large diameter. The more copper required, of course, the more expensive the wiring becomes.

As well, radio frequency interference (RFI) and electromagnetic interference (EMI) have played havoc over the years with more sensitive copper wire circuits, and major problems can occur when lightning strikes current-carrying copper cable.

For many years, engineers and manufacturers have sought an alternative way of transporting electric energy from Point A to Point B. Although optical fibres carry light rather than electric current, they provide a medium that can transmit information in the form of light instead of electric current. This overcomes the inherent problems of electrical conductors and the current flowing through them, because light inside a non-metallic cable is not subject to electromagnetic or RF interference and is unaffected by lightning.

A mechanical splice for fibre optic cable. The product in this picture is the Dorran Mechanical Splice, which can be used to splice any combination of 250 um and 900 um coated fibre. From 3M Australia.

However, copper wiring has not been superseded as a means of providing power at Point B – in this case there is no alternative but to transmit electric energy itself.

The ability to change electronic signals to photons, through the simplicity of LEDs or the more sophisticated lasers, initiated the development of fibre optics technology. In industry, optical fibres were first used in the telecommunications field. They proved ideal, owing to the small core diameters of optical fibres which enable a very large bandwidth and thus extremely high information-carrying capacity.

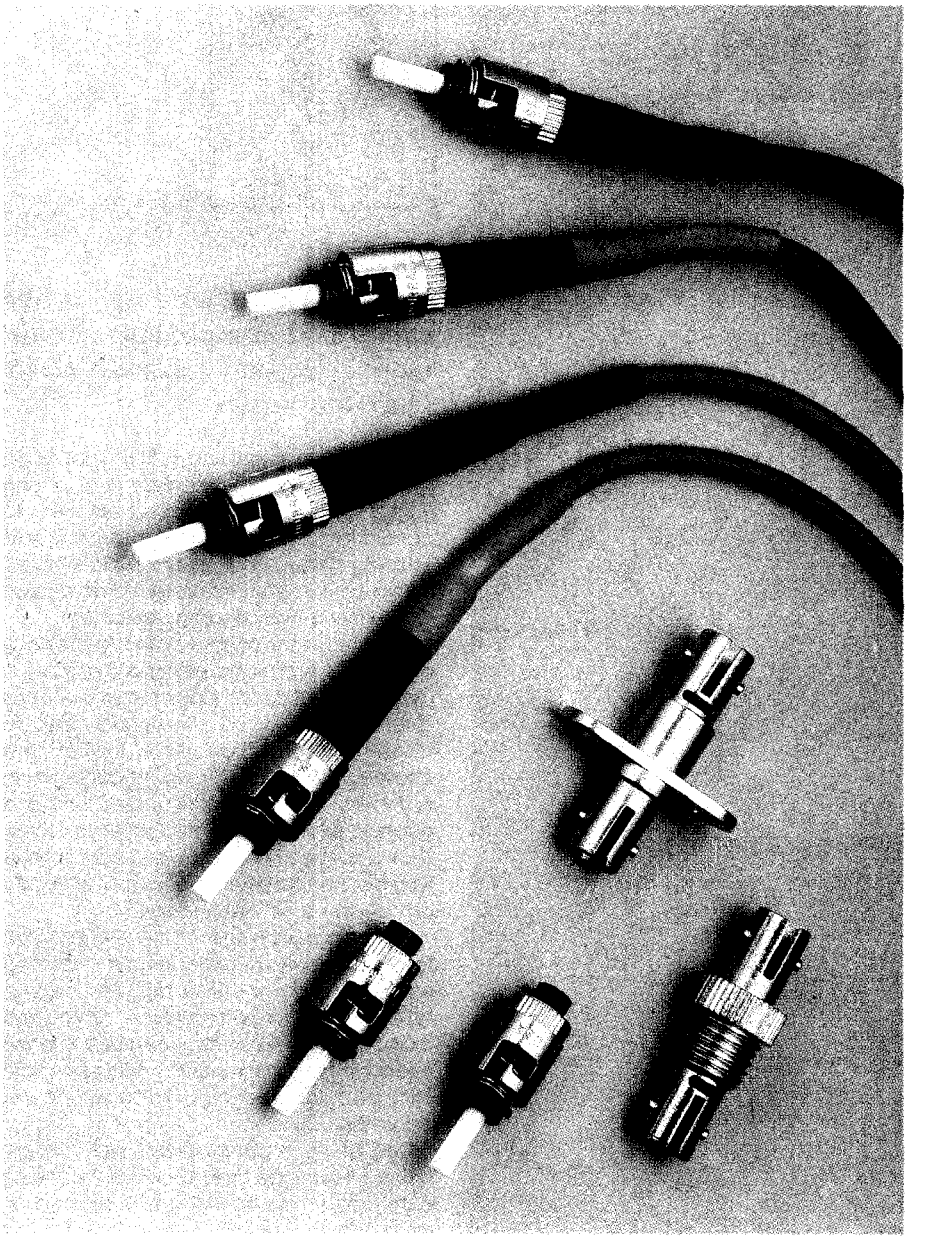
"A valuable use of fibre optics is for transmitting information through hazardous environments."

The telecommunications industry around the world has begun to use optical fibres to replace long-haul trunk routes. This move was extremely successful, and the research and development ironed out enough bugs to allow the use of optical fibres across a broader spectrum of industry.

A valuable use of fibre optics is for transmitting information through hazardous environments, such as petrochemical plants, where safety considerations are paramount. Optical fibres can also be used, with sensors, to measure the level of petrochemicals in a tank. Because there is no electric current flowing through optical fibres, they are safe to use in any area, particularly in potentially explosive situations where the possibility of a spark from a current-carrying copper wire system would be dangerous.

In underground mining, the safety of

Off-the-shelf fibre optics



A variety of ST compatible fibre cable connectors available from 3M. (ST is a trademark of AT &T).

optical fibres make them a good alternative to copper. As well, they eliminate the repeaters normally needed to transmit the low voltage electricity used underground.

In large industrial sites, fibre optics are also used because they can carry signals over long distances without using repeaters. Saving money and installation time are two of the advantages here.

Avoiding the problems

The use of optical fibres in industry helps avoid many of the problems long associated with EMI and RFI interference. On sites where computer-controlled equipment is used, it is important that information is received by the computer in the form it was sent. Using copper wiring, any interference from EMI or RFI (e.g. from a plane flying overhead, or nearby drilling) can disrupt a signal transmission and cause the machine itself to malfunction. Accurate information and improved productivity are important benefits.

Immunity to lightning was a major reason for installing fibre optics in a West Australian bauxite mine to control a 40 km conveyor-belt system. The area is often struck by lightning, and if a single copper control cable were struck, the belt stoppage would cause an extremely expensive delay. Lightning immunity has also been a factor in installing fibre optics in paint, gelatine and chemical plants in the United States.

The light flowing through optical fibres can also be used for illumination, especially during a localised power failure. For example, a

series of fibres is often run through mines so that if a blackout occurs an external light source can be shone through the fibres to illuminate a safe route out of the mine.

Many aircraft are using the same principle today. On-board safety procedures often mention that in the case of a total blackout you should follow the lights to the nearest exit – these lights are in fact provided using optical fibres.

Fibre optics can also be used in video applications, with up to 3000 metres of optical fibre connecting camera and monitor, for example. Video applications include process monitoring, security monitoring and airport facilities such as flight schedule monitors.

In the office environment, optical fibres can be used to transfer information such as computer data much more efficiently than through copper wiring. The broader bandwidth allows the transmission of higher data rates within the system, giving faster response times. This enables large and more efficient systems to be supported on a fibre "backbone".

Backbone wiring, as it has been called, is becoming more popular in many highrise office buildings. Fibre optics enable local area networking to be extended five to 10 times the normal capacity, allowing more areas within the building to be coupled together. Described as "intelligent buildings", these offices incorporate hightech communications, automation and security services. The justification is perhaps that advanced communication and information systems contribute to greater productivity.

"As business becomes increasingly dependent on information being transmitted rapidly, fibre optic technology is making light work of the transition."

The costs of installing optical fibre systems are not prohibitive, with optical fibre now costing a similar amount to copper wiring. Manufacture and installation costs are also comparable, but termination and splicing costs are somewhat more for optical fibres than for copper.

However, it is generally considered that the long-term cost savings and advantages of a fibre optics system in appropriate situations are significantly greater than any incremental installation costs.

While fibre optics are unlikely to ever replace copper cables entirely, they will certainly continue to make inroads in the information-carrying areas of many different industries. As business, government and society in general become increasingly dependent on information being transmitted rapidly and with total reliability, fibre optic technology is making light work of the transition.

Fibres

Having reviewed the development of fibre optics technology and its applications, let us look at the practical technology now available for implementing fibre optic communications links.

Optical fibres are constructed of a core of glass "thread" typically 124 to 140 microns diameter (about the thickness of a human hair), surrounded by a cladding layer of glass with a refractive index lower than that of the core. Light injected into the core, provided it enters below a certain critical angle, will be reflected at the core-cladding interface by the well-known process of total internal reflection.

Because glass is a dielectric substance, optical fibres are immune to electrical interference from external sources and do not radiate signals, either. Perhaps surprisingly, optical fibres are also very strong.

Just as you can buy standard types of copper wire and cables, coaxial cables,

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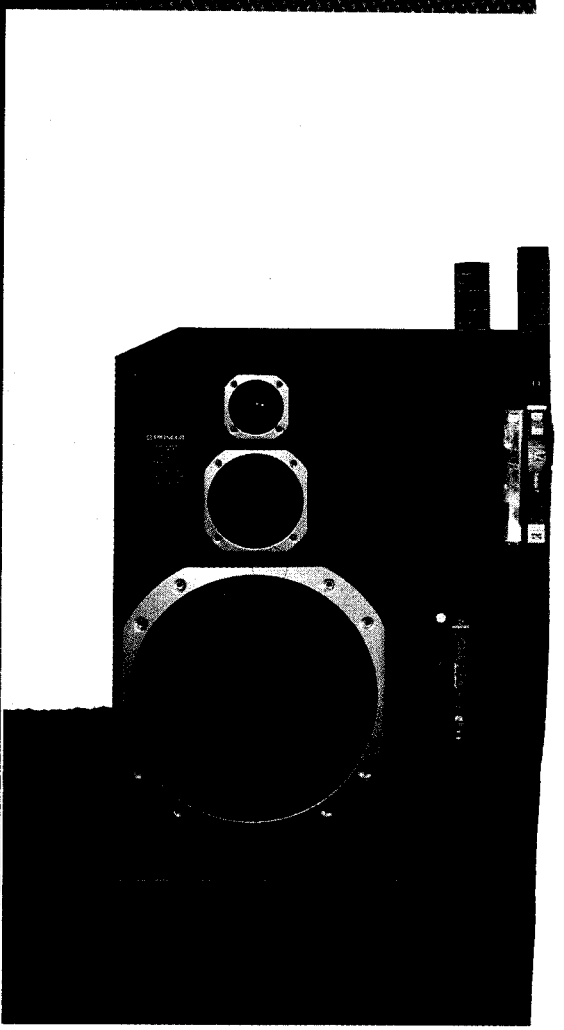

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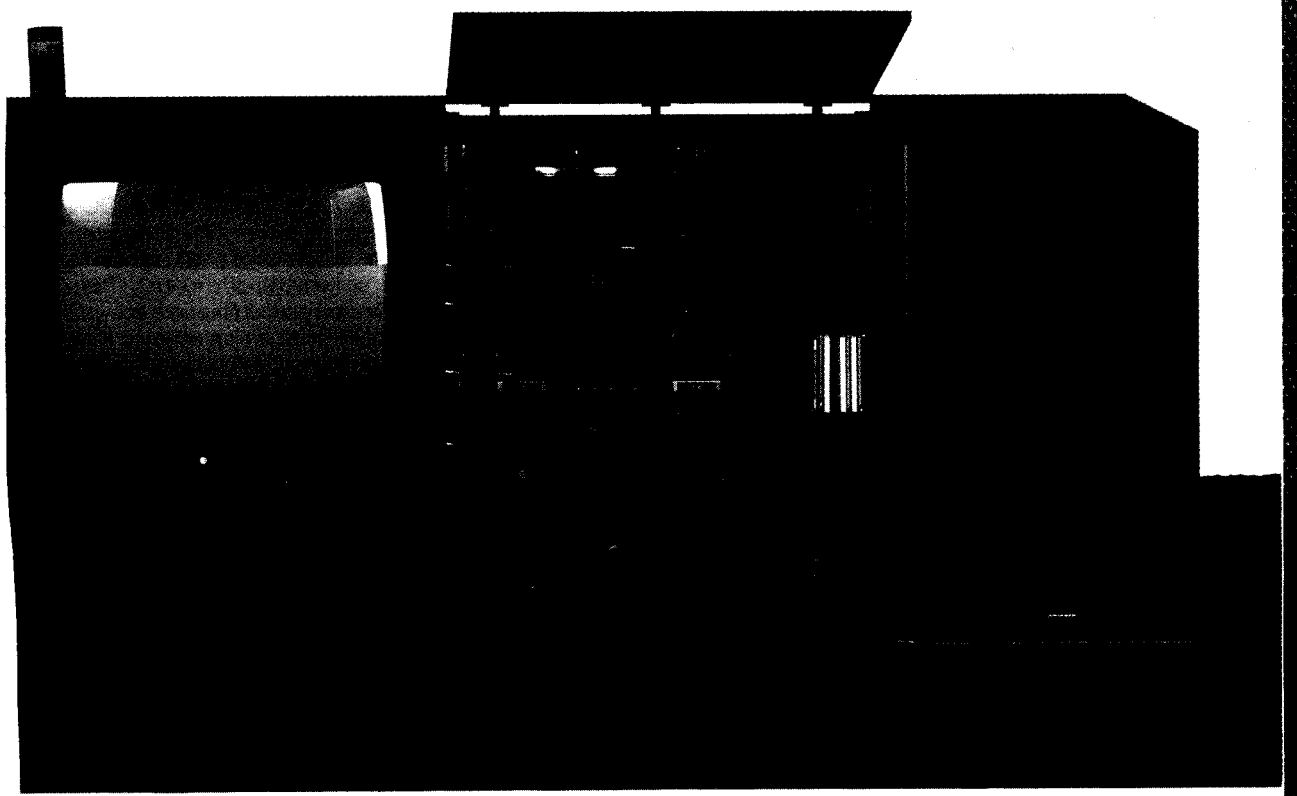

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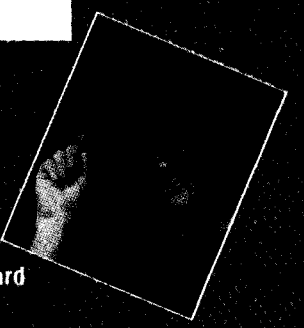

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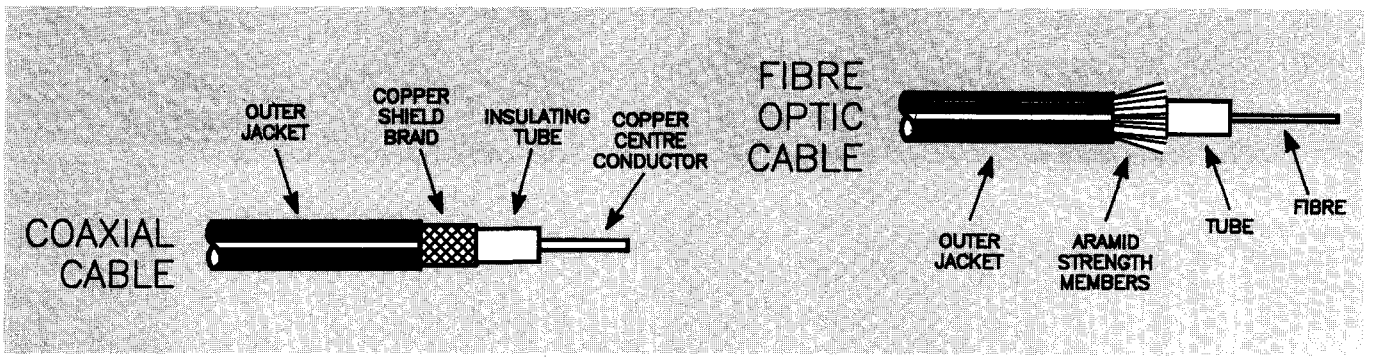


Illustrating the differences between the construction of coaxial cable and today's fibre optic cable.

twisted pairs, flat ribbon cable and the like – all produced for differing applications – a variety of optical fibres are available to suit various applications.

Fibre optic systems employ light transmitters of a variety of wavelengths – 400, 500, 630, 850, 1060 and 1300 nanometres being typical – and fibres are produced for applications at specific wavelengths or wavelength ranges. The most generally used optical fibres are known as "single-mode" types, which refers to the manner in which the light is conducted down the fibre. So let's have a brief look at some of the various optical fibre types, their characteristics and applications.

ST Series. This series has a 125 micron diameter core and operates at 630 and 850 nm. It is widely used in optical communications systems as it suits the use of many standard connectors.

VS Series. This series has been optimised for operation down in the visible end of the spectrum, at wavelengths of 400 and 500 nm. It is widely used for visible wavelength sensing applications.

SC Series. Used in acoustic sensing systems and interferometric sensors (e.g: in gyroscopes), its main feature is low sensitivity to loss when bent in a tight radius. It is available for operation at 630 and 850 nm.

HB Series. This type has an elliptical, rather than a circular, cross-section and maintains the polarisation of the light signal. It is designed for applications requiring a stable state of polarisation, such as in coherent communications systems.

FL Series. Another polarisation maintaining type, this has a flat fibre design and allows a preferred lay on a coil to inhibit fibre twisting, which substantially affects its polarisation maintaining properties.

LB Series. This is an experimental fibre specifically designed for advanced sensor systems. The LB Series operates at 500, 630 and 850 nm wavelengths and may also be used for ultra-high bandwidth applications. The LB stands for "low birefringence".

In addition, special power-core optical fibres are produced for power laser delivery applications in medical laser, video and data communications systems. Coverage of these

is beyond the scope of this article.

Components

In assembling a fibre optic communications line or link between two points, a number of things have to be considered. Firstly, the fibre needs to be coupled to the transmitting/receiving electronics at each end; it may need to be terminated at some point in between to provide for the connection of alternate equipment or the inclusion of additional equipment, and the fibre may need to be joined in some manner. Fibre cable joints may be made in two basic ways: with connectors, or by means of a splice.

Connectors butt the ends of two fibre cables together. Early connectors provided for no space between the cable ends, and many still are like this, while more recent connector developments space the fibre ends apart, avoiding loss by using a special technique. The ends of a fibre to be terminated have to be first specially cut and faced. A range of tools for doing this has been produced.

Quite a range of connectors is available, for different applications and conditions and to suit different cable types. Some connectors require special equipment for attachment and are thus not suited for use in the field, while others are specifically made for reliable field attachment. Splices are made in one of two basic ways: by mechanically butting the fibre ends or by fusion. Mechanical butting is the preferred method of making splices in the field.

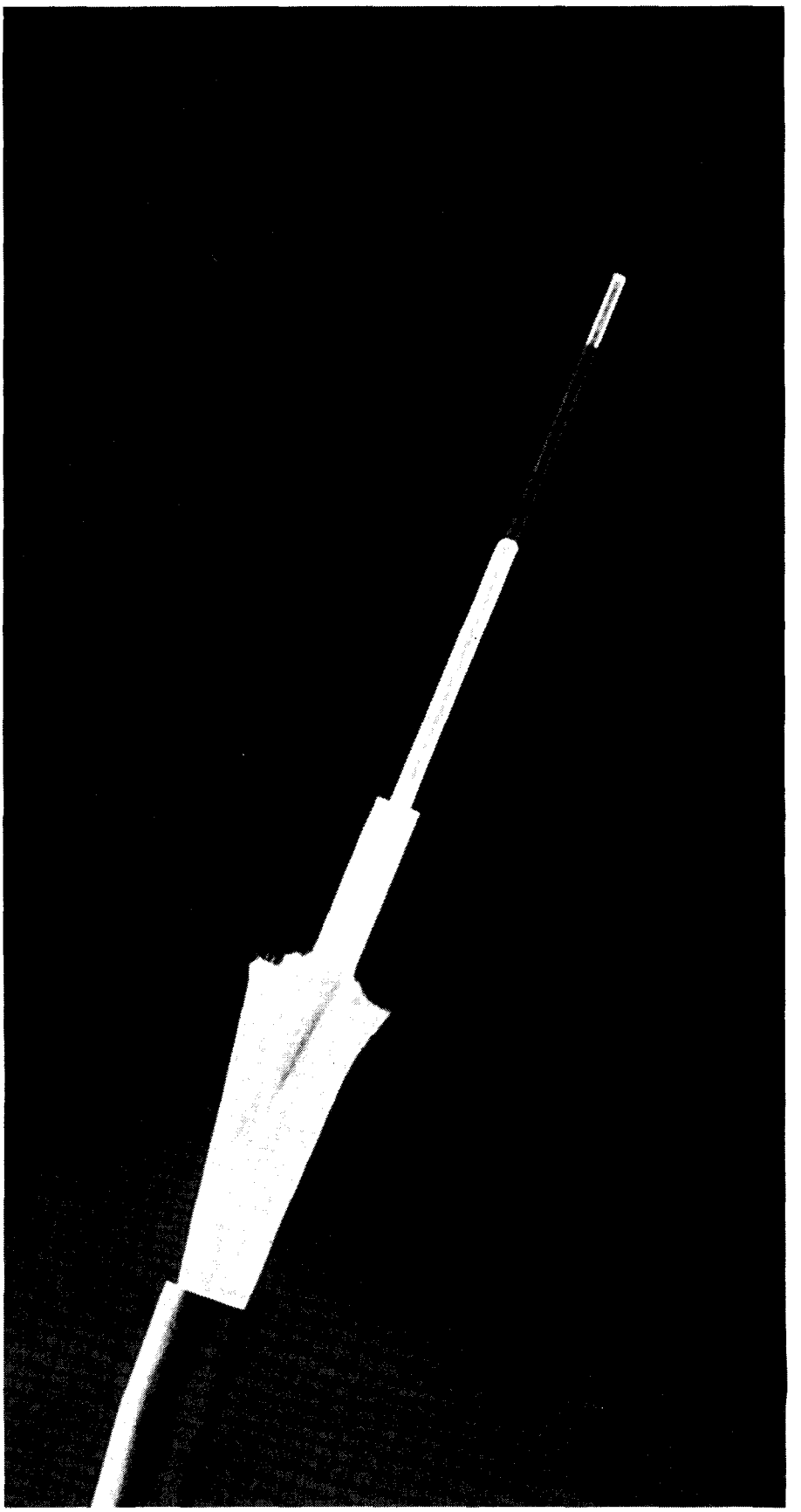
The "biconic" connector is one type widely used. It gets its name from its construction, where the end of each fibre is held in a cone inside the two parts of the connector. Some connectors provide a keyed coupling which prevents rotation. Some connector types feature all-plastic construction, others metal and plastic. A feature of all fibre optic connectors is the internal spring which provides coupling pressure for stability.

Adaptors to allow coupling between connectors of different types are available.

There are a number of criteria that must be considered when selecting a connector or a splice for specific applications. These factors include:

1) attenuation
2) return loss (reflection)
3) durability
4) repeatability
5) ease of field termination
6) ease of connecting
7) environmental conditions
8) size
9) types of stress encountered
10) price and availability

Many of these factors are characterised by *return loss*, or reflection, and attenuation. Reflectance is created when some of the light travelling along a glass fibre gets



Fibre optic cable is distinguished by fibre type, number of fibres per cable, cable construction and application.

Off-the-shelf fibre optics

reflected back towards the transmitter from the end of the fibre or from a discontinuity in the fibre. Even more light is reflected back if there is another fibre into which the light must enter after passing through an air gap. Reflectance can be reduced, however, if the two fibres are in intimate contact, eliminating any change in media through which the light must pass.

In high speed single-mode systems (over 400 megabits), it is important to keep reflections to a minimum, since they can interfere with the laser pulses. This, in turn, can cause unacceptable bit error rates in the transmitted signals. Reflectance is measured using an Optical Time Domain Reflectometer (OTDR) unit which provides indications of reflection. Reflections, as shown on the OTDR's screen, are used to locate cable faults.

Conditions that cause reflectance include broken fibres, joining two fibres with connectors or splices, an unmated connector, attenuators that separate fibres, and even imperfections within the actual optical fibres themselves.

When fusion splices are used to join two fibres, the glass is actually melted together. When their alignment produces attenuations below 0.1 dB, there is no measurable reflection produced. The drawback to fusion splicing is the high cost of the equipment.

Mechanical splices also achieve low reflectance by using "index matching gel", which is similar to the material of the fibre. This is applied at the joint and allowed to set.

To achieve low reflectance in fibre optic connectors, it is important to have good end finishes on the fibres and to have them contact to the point of actually compressing each other. Polishing procedures are now available that provide super fine finishes, and the domed shape of a positive contact (PC) ferrule end enables fibres to contact properly.

Ceramic ferrules are rapidly becoming the preferred material for straight ferruled connectors due to their precision and durability. Alumina ceramic was used initially by many manufacturers; however, zirconia ceramic has proved to be even better. It is three times more impact-resistant than alumina ceramic, has ten times finer particles, and is twice as compliant. The compliance is significant, since it allows the ends of the ferrule to compress along with the fibre. This improves contact during temperature changes or during lateral stress.

Reflectance has been improved with standard biconic connectors using a similar

Part of 3M Australia's range of fibre optic products for commercial and industrial applications.

super polish procedure. This, coupled with the compliant material, also results in more repeatable matings.

To have a good low reflectance connector, you must have intimate fibre contact. The end faces must be perpendicular, and of course the fibres must be straight within the connector. There is now one connector that breaks all of those rules and still has low reflectance along with several other unique desirable features. It is called the SPA and is made by 3M.

In this biconic style connector, the fibres are mounted at a slight angle within the connector. The ends are then polished to beam the light back on the centre axis of the connector and the fibres do not touch. Light that would normally be reflected back up the fibre from perpendicular ends now gets reflected out of the fibre. Since the light is beamed back on the centre axis on the connector, it is unaffected by rotational orientation.

Since fibres do not touch, there is no danger of fibre damage and temperature changes have little effect on this design. Reflectance is also unaffected by the use of attenuators which can seriously affect connectors that normally contact.

In addition to all of these benefits, the SPA even offers excellent reflectance of −44 dB when left unmated. Any other connector would produce a high reflectance at about −14 dB.

It should also be noted that conditions that produce good reflectance conditions also provide better attenuation performance.

Good connector and splice selection involves matching your current applications with the characteristics of the different connectors on the market. During this process, however, be careful to avoid limiting your future capabilities by installing products with high reflectance or high attenuation.

Conclusion

Optical fibre today is often quite cost competitive with copper cable systems in communications applications, when comparing the costs of electronics and cable. When other factors are taken into account – such as fibre's intrinsic noise immunity, safety, security , low weight and small-size, optical fibre has the edge every time.

Fibre optic systems are now easy to procure and install, thanks to the development of standard components, making it an off-the-shelf technology. eti

We would like to acknowledge the assistance of 3M Australia Pty Ltd in providing material used to compile this feature.

Contributed by The Apogee Group

TECHNOLOGY

Reduced Instruction Set Computers offer computational power, speed and processing productivity that was unheard of a scant few years ago. RISC processors offer much that conventional microprocessors cannot — and that includes the latest super chips. This report compiled by Roger Harrison.

IN THE REALM OF RISC TECHNOLOGY

Speed demons drive this new thrust in microcomputers!

Perhaps the most important topic to arise in the computer industry over the past few years has been the emergence of the Reduced Instruction Set Computer (RISC), touted as the next generation of high performance processor technologies. A number of different computer chip and system suppliers have announced new computers based on these newly-emergent RISC chips. All claim that RISC offers much higher performance than more traditional Complex Instruction Set Computers (CISC).

There is much talk of Dhrystones and Whetstones (sounds like they're sharpening their whits for an almighty clash!) and boasting about chip die sizes and geometries. But not the sort of talk you'd associate with traditional male boasting – they're all into a "my chips are smaller than yours" philosophy.

The common denominator among these suppliers has been a systems approach to the processor design in which the CPU is considered as a single unit. When multi-chip solutions are involved (as most are), interfaces are defined around performance and bandwidth requirements more than functional blocks, the 'partitioning' found in most commercial microprocessors today.

With RISC technology rapidly moving from the laboratory into the commercial environment, when new applications arise that cannot be addressed cost-effectively by the sort of approaches and technologies typical of CISC, this new technology may provide the only solution.

Evolutionary tales

Most commercially available computers today would generally be classified as CISC. Many of these machines have existed for more than a decade, and have their foundation in technology that was radically different from that we see today. When most existing machines began, logic and memory were expensive. In addition, software development was limited by the programming ability of assembler language and lack of efficient high-level language compilers.

Early system designers were forced to heavily encode their limited instruction sets to minimise memory requirements of the system. Many processors began with what was then considered as large address spaces of 64K words or bytes of memory. Of course 64K of assembler language code did represent a very large programming effort at the time!

Greater integration in semiconductor technology brought down the high cost of logic and memory. Soon, computer designers found they could build an equivalent system more cheaply, with lower power requirements, and having more reliability than what had come before. Also, integration allowed them to add enhancements to the instruction set to improve performance of key customer applications for less cost than before. Assembler language programmers wanted more features that moved some of the computing functions from software to hardware. In addition, it improved programmer productivity by reducing the number of lines of assembler language necessary to code programs. Less lines per function meant more functions could be coded in the same time, resulting in higher productivity. High-level languages were available but generally were too inefficient to use except in the most complex applications level.

Hardware designers began adding new instructions and addressing modes to meet the programmer requests while remaining compatible with previous generations of software. Soon, system designers realised that they could provide more performance if they could sacrifice backwards compatibility and redefine their instruction sets to exploit new technologies.

Instruction complexity by this stage had increased to the point where decoding multi-word, multi-format instructions was the limiting factor in processor speed. Unfortunately, customers had huge investments in software and were reluctant

to change to hardware that could not execute their installed base. New computer architectures were limited to new customers and applications.

Then, high-level language efficiency and hardware performance improved dramatically and became useful for most applications. This helped two areas of concern in computer systems: programmer productivity and program transportability. High-level languages helped programmers write code that was hardware independent, at least in theory, as compilers stood between the programmer and the 'execution environment' – the physical hardware and its operating system. Compiler differences and ambiguous language specifications caused some portability problems, but in general it was practical to port programs between machines.

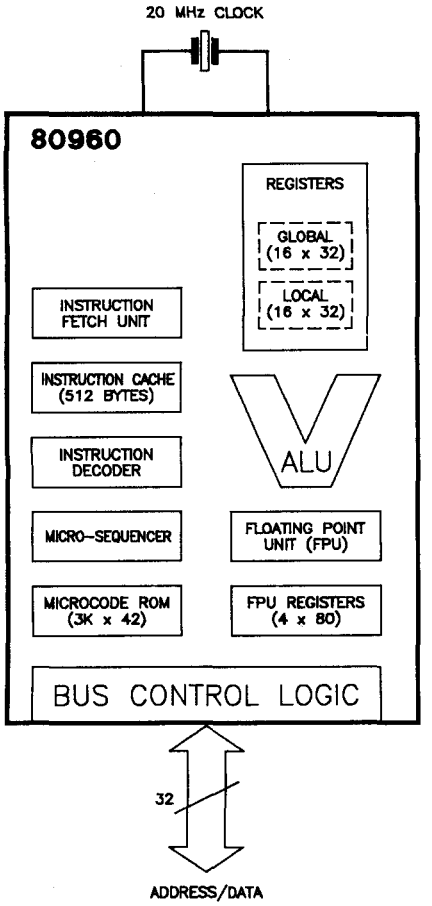


Figure 1. Architecture — or block diagram — of Intel's 80960 RISC processor. Bit of a mix of RISC, CISC and microcontroller.

With more high-level language programs being written, hardware suppliers felt pressured to add even more complication to their instruction sets to support compiled code. Many architectures added hardware implementations of high-level operations directly into the instruction set. The problem arose as to which language to support because each is different. As a result, most computer architectures may support only one language well or are so general that the compiler cannot exploit them efficiently.

In the mid-seventies, computer scientists began to investigate new methods to support all high-level languages more efficiently. It was becoming apparent that most problems were too complex to be written in assembler language and no one high-level language was sufficient to support all applications.

The essence of RISC

From these development efforts came the RISC methodology for the design of processors. What constitutes a RISC computer is yet another area of debate, but most emerging machines do have some characteristics in common.

First, most RISC machines are based on single-cycle instruction execution. Unlike their CISC counterparts that may take up to 100 clock cycles to complete complex instructions, the RISC machines' instruction set is limited to primitive functions that can execute in a single or extremely few machine cycles. Compiler writers have suggested that it is more efficient to provide such 'primitives' to build solutions rather than include solutions in the instruction set.

When instructions are too complex in themselves, the high-level language and the processor's instruction set clash, introducing inefficiency and increasing compiler complexity. There are other advantages to single clock execution of instructions which makes the system more responsive in networked systems or where the computer is time-shared. A prime goal of RISC processor technology is to let nothing stand in the way between the high-level language compiler and the hardware.

Another common trait of RISC machines involves streamlining of the addressing modes which helps simplify the decoding of instructions, and speeds other actions. Most RISC systems have added larger register files to improve performance. Two factors bring about significant performance increases from added registers: (1) register operations execute much faster, and (2) memory references are reduced because registers can hold temporary results.

In general, RISC machines are tightly coupled to their memory. The simple instruction set translates into a higher effective instruction execution rate, meaning the processors demand a high bandwidth from their memory systems to provide peak performance. In order to provide this bandwidth most, but not all, systems have implemented very sophisticated techniques of caching – or temporarily storing – data which increases system cost and complexity dramatically.

The players

A number of major chip suppliers have developed RISC devices, aimed at one market or another. Chief among them are: Intel, Motorola, Advanced Micro Devices (AMD), Sun Microsystems, Texas Instruments, MIPS Computer Systems, Acorn Computers and VLSI Technology Inc.

To get an idea of the form and function of RISC processors, let us 'compare and contrast' a few representative devices available. As you read through this and peruse the diagrams, you will notice the many similarities between devices of considerably different architectures (the architecture of a processor simply refers to its structural arrangement – its block diagram, if you like).

One thing Intel is well-known for is its series of one-chip microcontrollers – the 8048/8051/8096 series of 'microcomputers on a chip' designed for low device count controller applications. They're also known for their 80386 and 80486 high performance CISC processors which are slated to dominate this arena well into the 1990s.

Intel wanted to get into RISC technology without affecting their existing CISC line and the 80960 satisfies this requirement in really being an extension of their microcontrollers up to 32 bits. The 80960's architecture is shown in Figure 1. By comparison with other RISC chips, this is a bit of a maverick. There's microcode used in several places, which

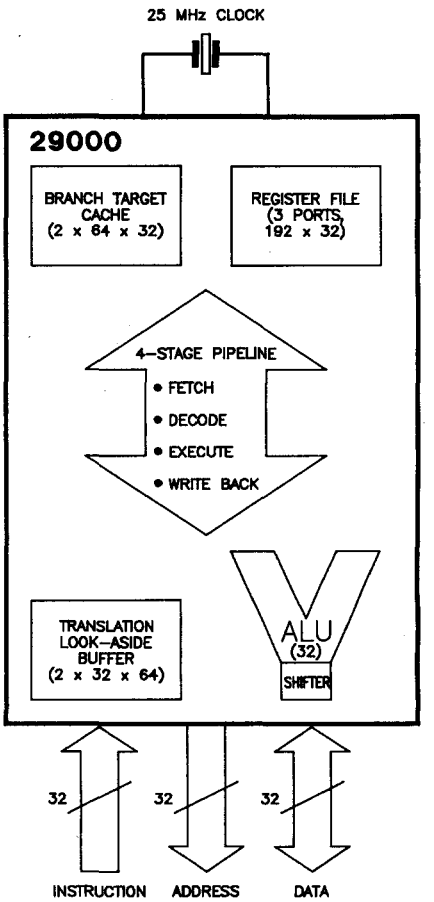


Figure 2. AMD's 29000. Note the 4-stage pipeline and large register file, features you'll see in other RISC processors.

owes more to CISC architecture than RISC, and a floating point unit on-chip – which other RISC makers only offer as a peripheral device. In essence, the 80960 is a bit of a mix of RISC, CISC and microcontroller.

AMD's 29000 is considered by some to be a "stripped-back" CISC chip. While all RISC processors carry on-board data registers in one form or another, the 29000 can boast more than most. But the feature prominent in the 29000's block diagram (Figure 2) is the 4-stage pipeline. A pipeline, put simply, speeds processor operation by queuing instructions, ready for execution when called on. It's like having spare football players waiting on the sideline, ready to run on at a moment's notice, rather than having to call them on from the dressing room.

Sun Microsystems wanted a high performance processor that would interest many chip makers so that they would be well assured of processors at keen prices on which to base their workstations and related product lines, so they created the Scalable Processor Architecture and their RISC device was dubbed the SPARC (Figure 3). It was purposely kept simple and clearly resembles the 29000 in many respects: it has a large number of data registers an arithmetic logic unit (ALU) for the data path and a 4-stage pipeline.

Motorola, a late entrant to the field, opted to give its RISC device a performance edge. But it comes at a price which has probably slowed its acceptance in some application areas. It hasn't stopped Tektronix designing a family of graphics 'superworkstations' (XD88 product line) based on the 88000, though. Motorola say they have provided in the 88000's architecture 'hooks' for adding-on more 'function units' to the chip itself; it can support up to 11 function units, the company says. This provides a built-in upgrade strategy. in this way, a graphics floating point unit can be added, or an MS-DOS emulation unit, for example. Cunning.

As you can see from Figure 4, the 88000 has a reduced number of data registers but compensates by having a 'scoreboard' which keeps track of which registers need to be readied to receive data. The 88000 is rated at 14-17 MIPS, 7-12 MFLOPS.

British personal computer manufacturer, Acorn, collaborated with US chip specialist VLSI Technology Inc in the design of a RISC processor for their Acorn Archimedes personal computer, dubbed the ARM (Acorn RISC Machine). VLSI Technology has since

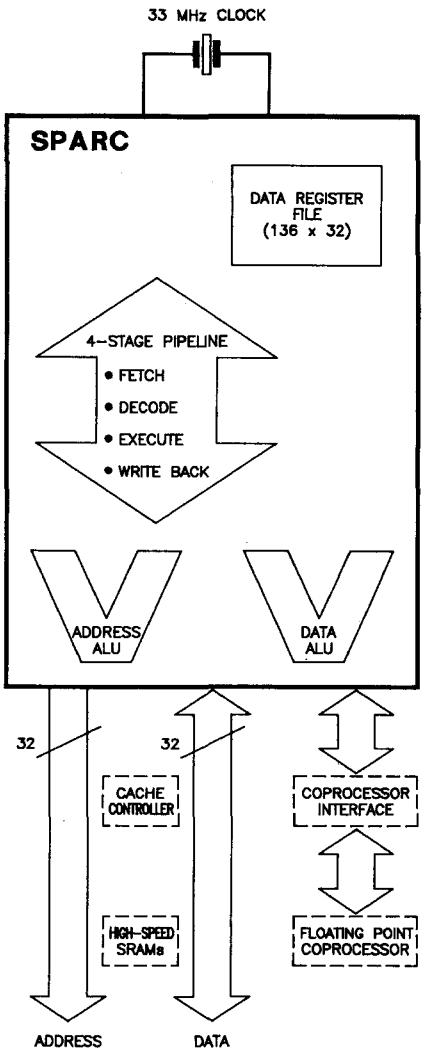
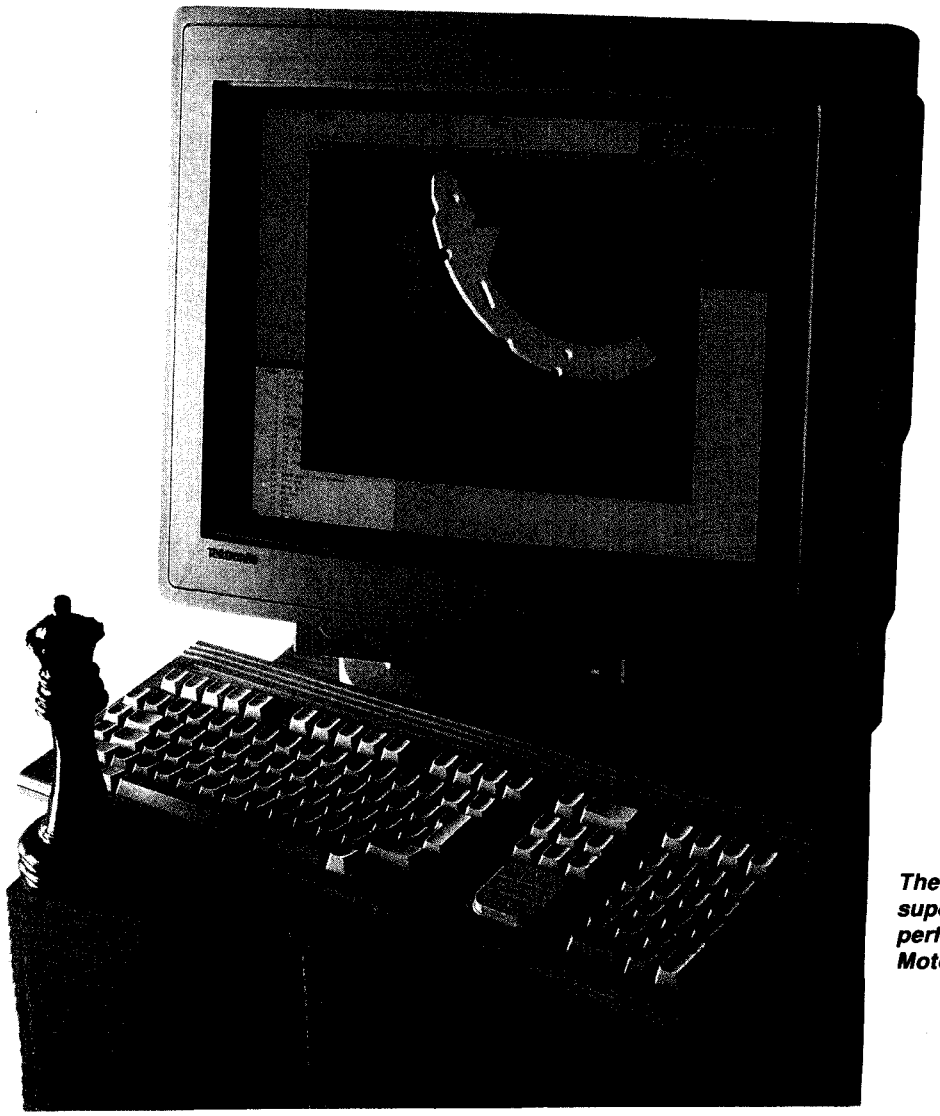


Figure 3. The SPARC — purposely a 'minimalistic' design.

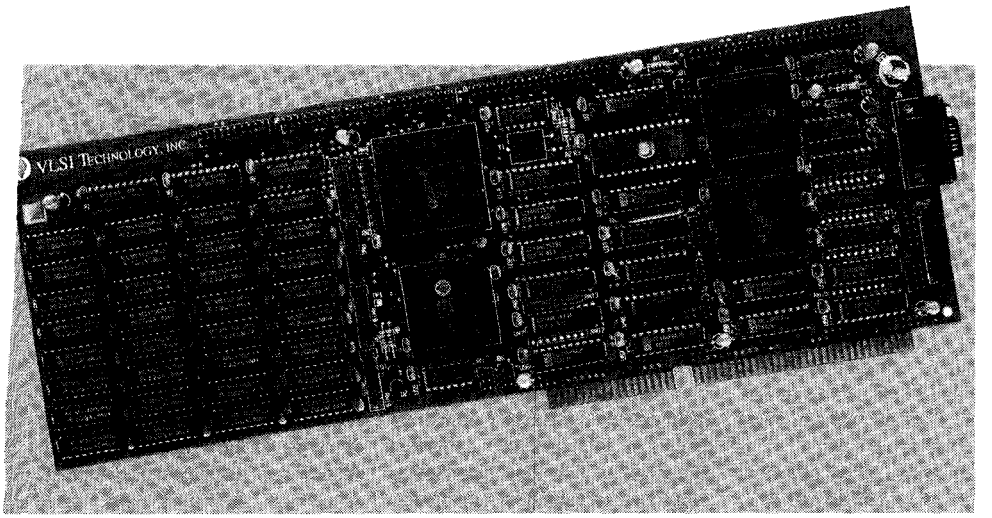
acquired the ARM microprocessor and architecture from Acorn and released the VL86C010.

Figure 5 shows this processor's block diagram. This chip illustrates true RISC simplicity. It is a full 32-bit device with an elementary 3-stage pipeline and only a 27-register data file, which is much, much smaller than the others discussed here. This makes fabrication easier and thus keeps the cost down. It would most probably be the lowest-cost RISC processor currently on the market – like tens of dollars, compared to hundreds or thousands of dollars. But it's no slouch, either – it boasts an average instruction execution rate of 5-6 MIPS.

The only way to get a real understanding of RISC technology is to get your hands dirty. Accordingly, in a forthcoming issue we will



The Tektronix XD88 graphics superworkstation is a high performance unit based on the Motorola 88000 RISC processor.



A glimpse of goodies to come — an add-in card for an IBM PC/AT or close compatible with which you can explore RISC technology without breaking the bank or burning your brain cells.

present a RISC demonstration/development board based on the VL86C010.

A RISC project!

This forthcoming project, shown in the accompanying picture, describes an add-in card for an IBM PC/AT or close compatible that will allow you to explore the world of RISC technology, turning your PC into a RISC development workstation. It uses the low-cost VL86C010 from VLSI Technology plus memory controller (MEMC) and I/O controller (IOC) devices with memory ranging from 1M up to 4M on-board. Software support includes ANSI C, Fortran and assembler. A board-resident assembly debugger permits debugging of programs on the RISC itself with download capability on the target system.

MIPS, megaflops and other mysteries

Performance of high speed RISC processors is not discussed in terms of processor or system clock speed as is common with micros. Rather, performance is measured in terms of millions of instructions per second – or MIPS. Not much mystery there!

As floating point operations are often associated with RISC processors and systems, performance is often discussed in terms of millions of floating point operations per second – megaflops, often abbreviated to MFLOPS.

Then there's the mysterious Dhrystones and Whetstones. Suffice to say that the Dhrystone is a benchmark test, an operating speed parameter that allows comparison between differing systems. The Whetstone is more a computational performance figure that, likewise, allows comparison between differing systems. This is a simplification, yes, but there's not the space nor justification to go further into the subject(s) here. eti

The author wishes to thank Motorola, Texas Instruments and Energy Control International for supplying information used in the compilation of this feature.

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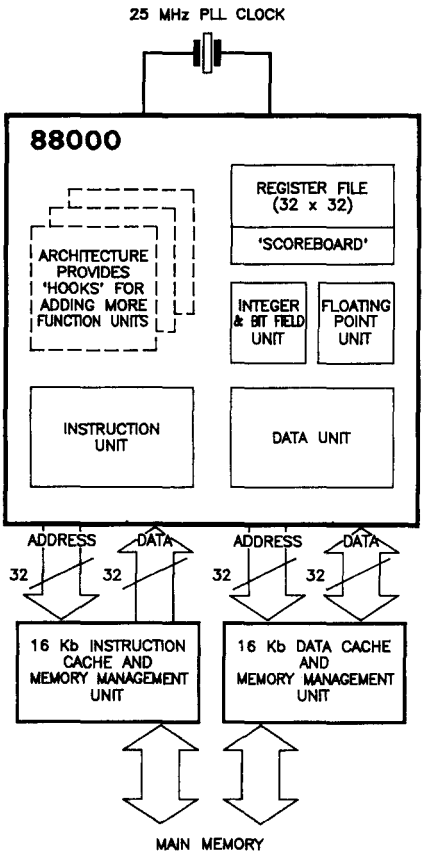


Figure 4. Motorola's 88000; designed to have a performance edge. But it's a pricey device.

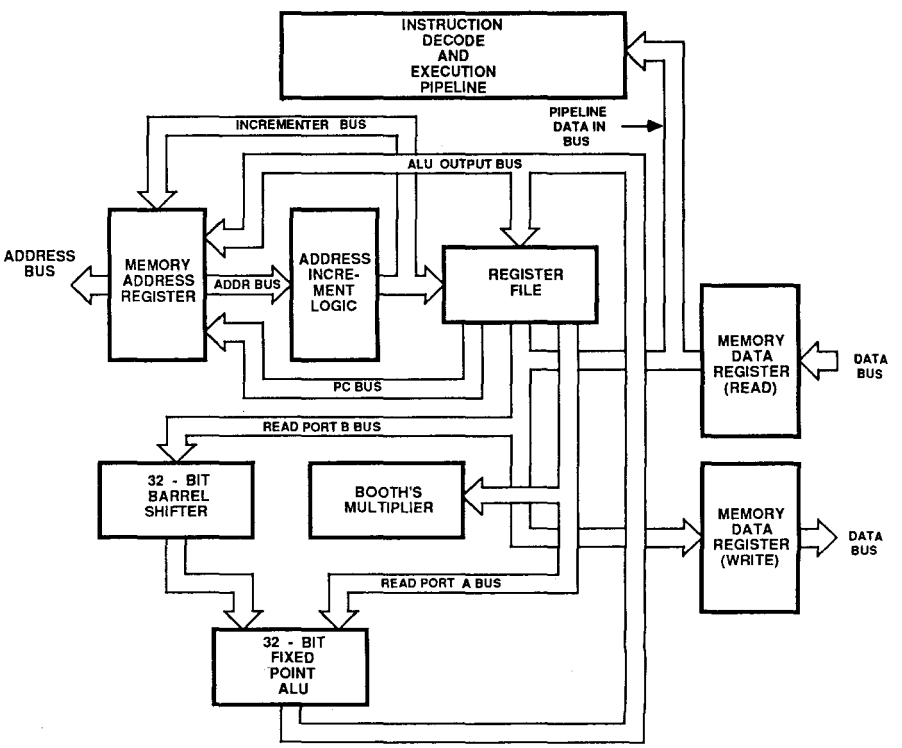


Figure 5. Block diagram of the VLSI VL86C010, a low cost RISC processor.

CHINA: NO QUICK BUCKS

Adam Slonim, Director of the International-China Business Centre, gives his views on business opportunities in China today.

After so much effort and patience by foreign companies and governments in the last decade, China has, so it seems, sacrificed its short to medium term development for the sake of suppressing a student cabal in Tianamen Square in June last year. Did China lose more than it gained?

The immediate effects of the suppression include US and European arms sales embargoes, tourism falling away to a trickle, vital international bank loans being suspended, contracts being interrupted and foreign investors casting their attention elsewhere.

It was not only moral revulsion at the massacre in Beijing and elsewhere that brought into question the investment value of "the largest market on earth", but the political uncertainty and instability flowing from this event. Radical political change may occur at any time.

Consequently, the general consensus is that China just ain't worth the investment effort – and for anyone attempting to do business in the Middle Kingdom, the effort required is immense.

Phenomenal growth

On the other hand, the Chinese economy has experienced a phenomenal growth rate in the 'eighties, unmatched anywhere else in the communist world.

The investment opportunities have been many, encompassing a wide range of industries, notably electronic communications and consumer goods manufacturing.

In the period 1981 – 1988, China averaged more than nine per cent growth in real terms, compared to the Soviet Union's two per cent and Eastern Europe's one per cent.

Although simplistic, these figures lend weight to the argument that in (what was, till recently) Communist Europe, political reform has to accompany, if not precede, economic reform. This relationship is a natural outcome of an historically shared European culture at loggerheads with an imposed non-popular Soviet hegemony.

The Chinese communist revolution was home-grown and much more pragmatic in application than the Soviet model. It has been well described as "a new set of clothes for a new mandarinate".

The Deng-initiated economic reforms of the last decade created their own political momentum for change which were not to be tolerated for a variety of reasons. What matters in the long run is that the forces for change (political and economic) were not dissolved.

China will be suffering from instability for some time yet, especially in the lead up to, and after, Deng Xiaoping's death sometime this decade.

> *"Chinese leaders viewed the world as being bi-polar."*

China's place in world affairs has also been jilted in two additional ways by the events in Eastern Europe.

First, global investment focus has inevitably shifted from Asia to the gutted economies of Eastern Europe. In Hungary and Romania for example, trained and highly skilled labour is abundantly available at about a quarter of the cost as in Western Europe. The restructuring that is about to take place will take years of intense concentration and will absorb a lot of European and American finance and investment.

Second, in a post-Malta world, there is no longer a China card.

Chinese leaders (like their counterparts everywhere), viewed the world as being bi-polar for some time, but inevitably becoming poly-centric. As an emerging power, China expected to gain a greater role in this new order. But the transition was expected to be protracted, over many decades, giving China time to build its economic momentum.

This is obviously no longer the case. It is hoped that during the realignment of State relationships, China does not emerge as the ringleader of the remaining hardline communist regimes. North Korea and Albania are not the most exciting bedfellows, nor the most popular spots for foreign investors!

Vision and patience

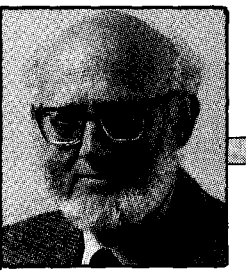
Given this background, what role can China thus play for the Australian business person? Are there any opportunities, and is it worth the effort involved? When it comes to doing business with China what really matters is vision and patience. There is no doubt that China will again emerge as one of the key players in our region and globally – the country's sheer force of size demands a greater presence in both political and economic spheres.

For those who have learnt something of the Chinese concept of time, whose vision concerns reaping the fruits of ventures planted now for the time to come, there will be great reward.

The Chinese gave a barren rock to the British for 99 years to let them do with it as they wished. The Brits thought they had engineered the deal of all deals. The Chinese waited. In a few years they will have picked up one of the world's greatest financial centres.

Success will not have to wait 99 years in every case! But patience, the right approach, an understanding of who you are dealing with, and an appreciation of Chinese business culture is absolutely essential.

To do well in China (and there are always opportunities for business in such an enormous market) preparatory homework is absolutely essential. eti



JOHN COULTER

IMMIGRATION: THE MYTHS

John Coulter explodes some of the more common myths about Australia's present immigration program.

Some matters are difficult to sensibly discuss in public because they occasion vociferous and prejudiced opposition. Immigration and population are such subjects. Last year, public discussion of the Fitzgerald report on Australia's immigration program quickly descended into an ignominious debate about race; the important matter of numbers became totally submerged. Hopefully, sufficient time has now passed for a more rational discussion to occur. But first it is necessary to lay to rest a number of myths.

It is often asserted that because the net reproduction rate has fallen below one, the population of Australia is already falling or will shortly fall. This assertion is then used to justify the present high immigration intake. It is said by many that, without this intake, the population would plummet and Australia would cease to exist.

This is not so. Australia's population is substantially younger than a population at equilibrium. There are many more young people entering their reproductive years than those in the older age groups who are dying. Thus, even though the net reproduction rate is only .87, (i.e. each person is only being replaced with 0.87 people) the indigenous population is growing strongly even without immigration. In fact, with no immigration at all the population would continue to grow until about 2031 when it would be about 3.1 million more than at present.

Should the reproduction rate remain at 0.87 in 2031 still with no immigration there would, even then, not be a precipitate fall. The population would fall quite slowly and would not reach 16 million, the present population, until almost a century from now.

Secondly, it is often claimed that we need immigration to stop the population ageing. Immigration makes very little difference to the average age of the population. Remarkably enough, immigrants age at precisely the same rate as native-born Australians! Only while a high rate of intake of immigrants of average age less than resident Australians is maintained is this slight decrease in average age achieved.

Australia has a very low dependency ratio compared with most other industrial countries. This is partly because of the smaller number of births and therefore of young people.

Moreover, the dependency ratio will remain lower than at any time since the second world war for about 30 years. Thus if we have coped with our dependency ratio in recent decades, we can certainly cope with the expected lower ratio well into the next century.

It is also a fact that the entry and re-entry of women into the work-force has done more to reduce the dependency ratio since 1947 than the admission of migrants. Extending this observation, it follows that successfully employing more people in whom Australia has already made a large educational and other investment, is likely to be a more productive strategy than bringing in more immigrants.

The best population profile is one that has roughly the same number of people in each age group. This is achieved with a slow, steady modification of population growth rates. Remember, for example, the post-war baby boom and the problems that caused for the provision of services for the young. A large number of schools were suddenly needed. Several years later we had too many school buildings and too many teachers. When the baby boom population entered its reproductive years these problems were repeated, but in a somewhat attenuated form. It is for this, as well as other reasons, that a much lower but sustained migration rate would be easier to cope with.

Immigration is good for the economy? Actually there are no rigorous studies which show that this is so. What studies are available are equivocal or suggest that immigration is damaging to the Australian economy. The most widely quoted studies are the CEDA study done in 1985 and the CIE study conducted for the Fitzgerald Inquiry into Australia's immigration in 1988. Both used a computer model of the Australian economy called ORANI. One of the authors of this model has been very critical of the use to which his model was put, and has questioned the results of both studies. Even so, the CIE study was doubtful whether immigration could be justified on economic grounds.

As well as the gross overall effect on the economy, immigration may have more specific detrimental effects on particular aspects of Australia's economy and social fabric. For example, in 1987-8, 140,000 immigrants brought between $2 and $3b into Australia. However, these same migrants needed about $11b in infrastructure: houses, roads, schools, police, communications etc. Thus, it is estimated that this demand may have increased Australia's foreign debt by about $8b in just this one year. This is the total value of all resources which may be mined from the whole of the contentious 'conservation zone' in stage three of Kakadu National Park over the whole of the life of that mining.

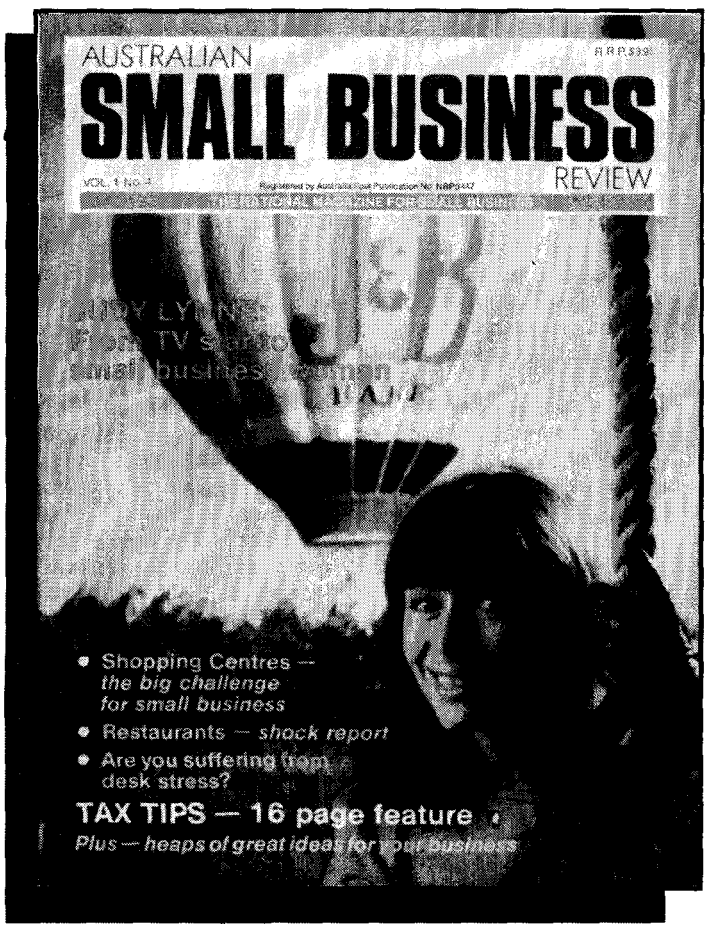
Moreover, the gross amount does not tell the whole story. Infrastructure expenditure does not add to Australia's manufacturing capability. It would be much better for this country's industrial development if that money were invested in developing better and more export oriented industry rather than providing more roads, schools, telephones, houses, water supply and sewage treatment.

In fact, to the extent that pressure on the services is increased by the arrival of immigrants, high house prices, high interest rates, (which the government says are necessary to control excessive demand) may be seriously decreasing the material quality of life of existing Australians. These pressures may partly explain the low reproduction rate of the indigenous population and the delay in starting a family which is now widely evident.

There are, of course, quite different reasons why Australia may wish to have a program of active immigration. What is important is to understand that many of the reasons commonly used to support this program are not supported by evidence. eti

Senator John Coulter is the spokesman for the Australian Democrats on Science and Technology.

ATTENTION ALL SMALL BUSINESS OWNERS



Running a small business, at times, can be a bit like walking through a mine field. With government regulations, bureaucrats, unions, taxes, you name it. Sometimes it feels as though everyone is out to get you! Let's face it, whilst the rewards are great for those who make it, you need all the help you can get. AUSTRALIAN SMALL BUSINESS REVIEW is cram packed with useful information and practical ideas, that can help you with your small business. Whether you're a battle scarred veteran or a new recruit, you'll find heaps of helpful hints and inspiration to soldier on.

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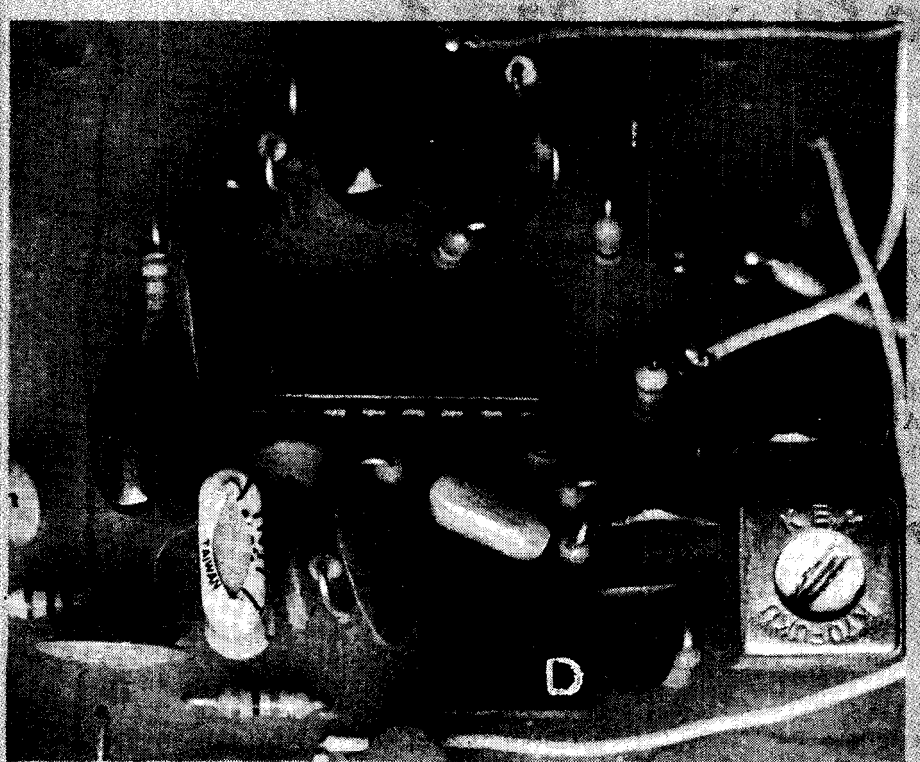
Part 8

BUILDING BLOCKS OF ELECTRONICS

Limiters, detectors & current amplifiers

In this instalment, we pass out the back end of radio receivers and get onto current amplifiers, which are truly used as 'building blocks' in a huge variety of applications. By Jack Middlehurst.



This shows a limiter-quadrature detector stage in a solid-state FM receiver. It employs an IC specially designed for the purpose, an MC3357, from Motorola. The coil with the adjustable slug you can see here is for the quadrature detector stage (see accompanying panel).

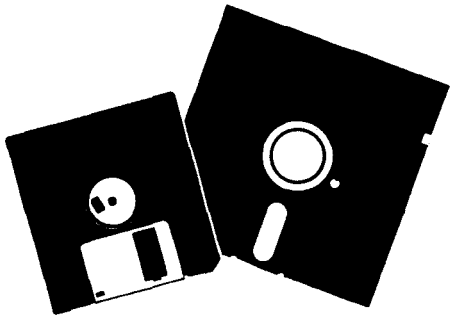
Before we leave the common sort of circuit blocks found in radio receivers, there are a few more items to cover, found at the detector end.

Limiting amplifiers

Since FM receivers respond to changes in frequency rather than changes in amplitude, it is common to include amplitude limiters in the IF amplifier chain to make life easier for the FM detector. Such limiters are shown in Figures 8.1, 8.2, and 8.3 for a pentode, a PNP transistor, and the CA3028A integrated circuit respectively. Each circuit uses the active device in a non-linear part of its operating characteristics, so the values of the components in the limiter are comparatively critical.

Testing consists of checking the dc voltages. If an RF generator is available, also check that the output is independent of the input level (that is, it remains constant) over a considerable range of input levels.

Modern ICs, such as the LM3089E, contain a string of limiter stages, each one of which detects the level of its output and maintains that level constant using dc negative feedback in a form of AGC to control the gain. In this way, particularly smooth limiting can be obtained with a good signal-to-noise ratio. This form of limiter has the additional advantage that no tuned transformers are needed for



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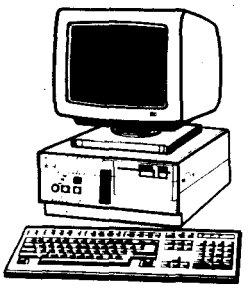

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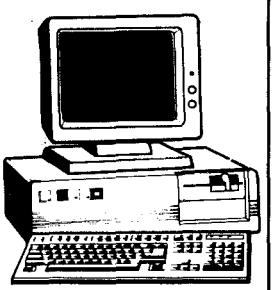

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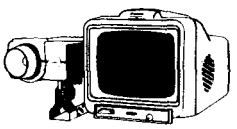

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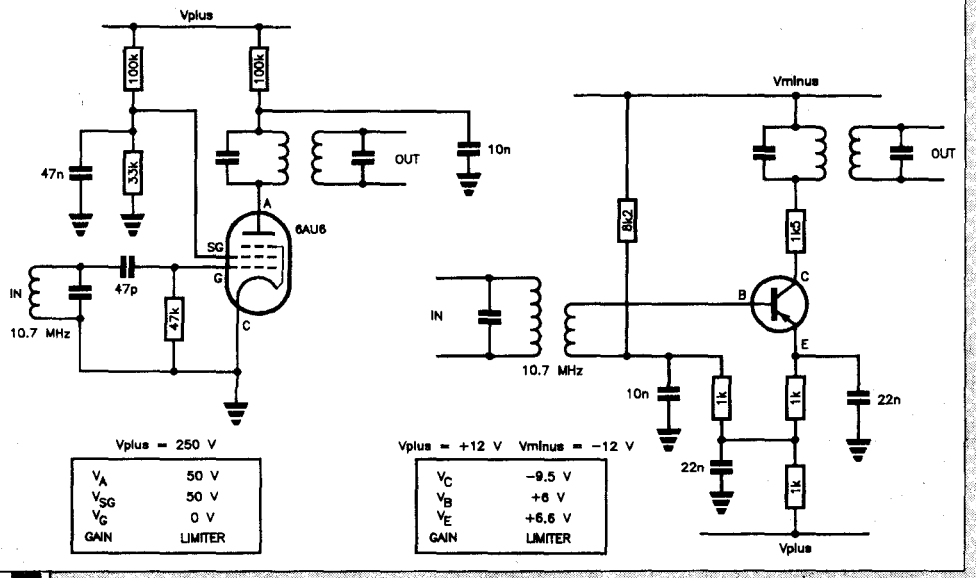


Figure 8.1. Valve RF/IF limiting amplifier.

Figure 8.2. PNP transistor RF/IF limiting amplifier.

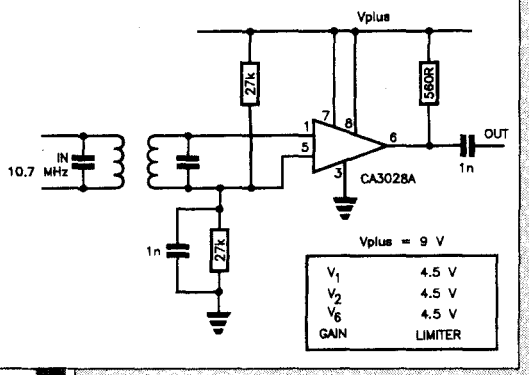


Figure 8.3. IC RF/IF limiting amplifier.

any of the limiter stages except the first and last.

Valve reflex amplifiers

To conclude our expedition into voltage amplifiers that use only one active device, we look at so-called reflex circuits such as that of Figure 8.4, in which a pentode is used as an RF or IF voltage amplifier and then later in the circuit the same valve is used as an audio voltage amplifier.

In these circuits, perfect bypassing with exactly the correct values of capacitors is essential. Do not try and 'improve' the bypassing of these circuits by increasing the values of the bypass capacitors, particularly those marked 470 pF.

The component values shown are typical. The dc testing of these circuits should give the voltages expected of an AF amplifier except that Va is usually about 75 per cent of Vplus.

These amplifiers can be tested as IF amplifiers in the manner already described and then tested as an audio amplifier by injecting at the point marked "AF in" and using the signal tracer at the AF output. Because of the high output impedance (about 20k), the tracer will load the output, so the measured gain will be somewhat lower than the correct value.

AM detectors

The simplest form of AM detector is the half wave rectifier shown in Figure 8.5, in both valve and semiconductor form. The capacitor C is the filter capacitor to remove the RF/IF from the audio out. C has to have a low impedance at the RF/IF but a high impedance at audio frequencies compared to the load on the audio output. For transistor circuits, a typical value for C is 1nF to 10 nF if no RC filter is used, and 100 pF to 330 pF if the RC filter shown is used. An AGC voltage is available at the audio out connection.

The 'Infinite Impedance' detector

A circuit block that was popular in TRF (tuned radio frequency, a type of receiver that preceded the superhet) and high fidelity receivers is shown in Figure 8.6. This looks like a cathode follower but behaves entirely differently.

The RF voltage, which has to be several volts, is applied to the grid, which is otherwise at earth potential. The large cathode resistor means that for positive-going grid voltages, the cathode voltage follows the grid voltage as in a cathode follower, but for negative grid voltages, the cathode voltage cannot follow, but remains almost at zero. This means that the circuit acts as an almost perfect diode, with the added advantage of high input impedance and low output impedance as well. The FET version is shown in Figure 8.7.

Testing diode detectors consists of first establishing that there is RF or IF going in using the RF probe on the signal tracer. If there is a signal, check the audio coming out using the tracer. If there is none, the transformer, the diode, or C is faulty. In any case, a simple test with an Ohmmeter will establish which is the faulty component.

With infinite impedance detectors, the RF/IF signal level has to be quite high, about two volts or more. If this is correct but there is no output, check the voltage on the anode (or drain). Unless this is a little less then Vplus, the active device is faulty.

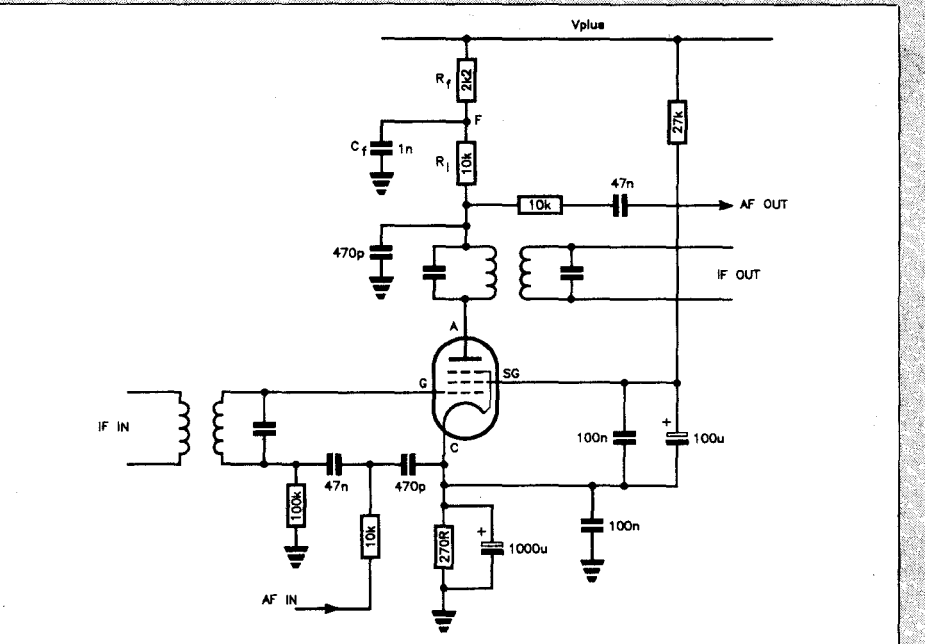


Figure 8.4. Reflex amplifier that amplifies both IF and AF voltages.

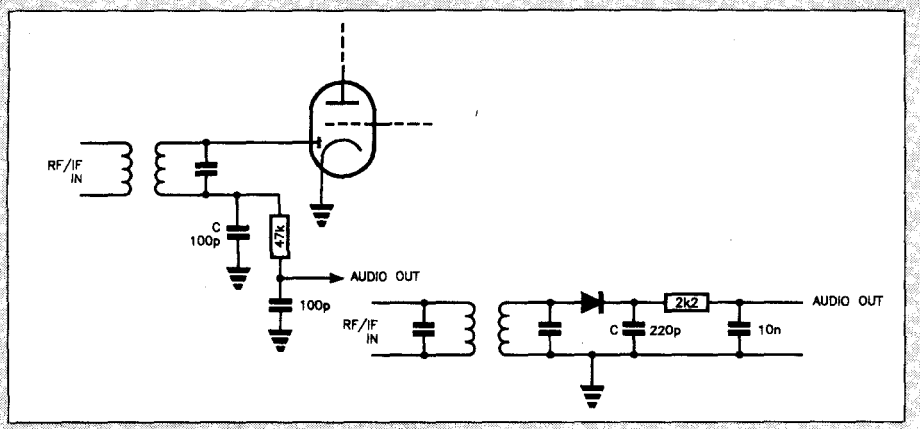


Figure 8.5. Diode AM detectors.

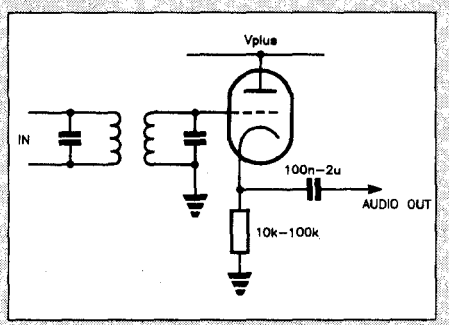


Figure 8.6. Valve infinite impedance AM detector.

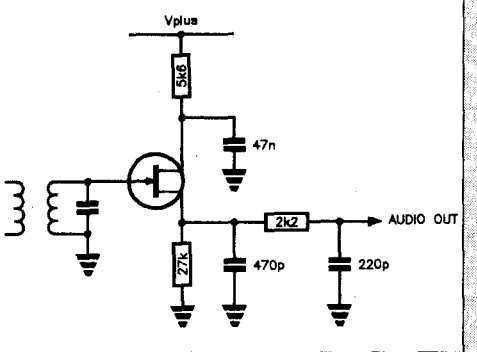


Figure 8.7. FET infinite impedance AM detector.

FM detectors

Before the advent of stereo on the FM bands, the *phase discriminator* was the block used to transform the frequency modulated signal into audio. The circuit of such a detector is shown in Figure 8.8.

The tuned circuit C1L1 is tuned to the centre of the IF band. If the incoming signal is at this frequency, the output of L2 is exactly 90 degrees out of phase with respect to that of L1C1. This makes the voltages across C2 and C3 identical, so there is no output. If the signal is at a lower frequency, the phase of the voltage on the tuned circuit will alter in such a way that the voltage across C2 will increase and that across C3 will decrease, though their sum will be constant. So there will be a nett dc voltage out from the junction of C2 and C3.

This nett voltage is the recovered audio, the high frequency boost of which is de-emphasised by R and C5. The output voltage is proportional to the amplitude of the IF voltage so the preceding stage must be a limiter if AM signals are to be rejected.

To avoid the use of limiters, the *ratio detector* of Figure 8.9 was introduced. This has one of the diodes reversed but otherwise works in a similar way to the phase discriminator, except that the two outputs have opposite polarities; and instead of subtracting, they add. The audio output is taken from the junction of the output resistors, so it is zero for an input signal at centre frequency. The capacitance of the 8 uF stabilising capacitor is fairly critical, so do not alter it.

Because of the ease of making limiter IF stages using ICs, modern FM receivers do not need to use the ratio detector, they use a simple phase discriminator called a *quadrature detector*. This simply uses switching transistors instead of the diodes in Figure 8.8, the switching being controlled by the 90 degree out-of-phase signal provided by L2.

ICs such as the LM3089 contain a string of limiting amplifiers together with a quadrature detector, and provide outputs for AFC and a tuning meter, together with delayed AGC for the tuner.

Current amplifiers

The main use of any current amplifier is to change the impedance of a circuit from a high impedance to a low one, without changing the signal level. In other words, they take very little current from the voltage source and can deliver substantial current to the load, and have a voltage gain of one (1).

Some current amplifiers are designed especially for dc, in which case there is no difference between the dc level at the input and the dc level at the output. Most simple dc coupled current amplifiers have a difference between their input and output dc levels that is a function of the bias needed by the active device.

Valve current amplifiers

For valves, the current amplifier circuit is called a cathode follower; it is shown in Figure 8.10. A triode, or a triode connected pentode is used. Figure 8.11 is the ac coupled version in which the bias is provided by the cathode resistor Rc. The output impedance of both of these circuits is a few hundred Ohms.

With dc coupling, the voltage at the cathode is about 4 V higher than the input voltage, which depends on the output voltage of the previous stage. In the ac coupled case, the voltage at the cathode is usually 30 V less than Vplus/2. Very low values mean that Rc has gone high or the valve emission is low; high values mean that Rc is low, the cathode bypass capacitor is shorting, or there is an internal short in the valve.

If the circuit is functioning properly, the ac signal at the output should be about 90 per cent of that applied to the input.

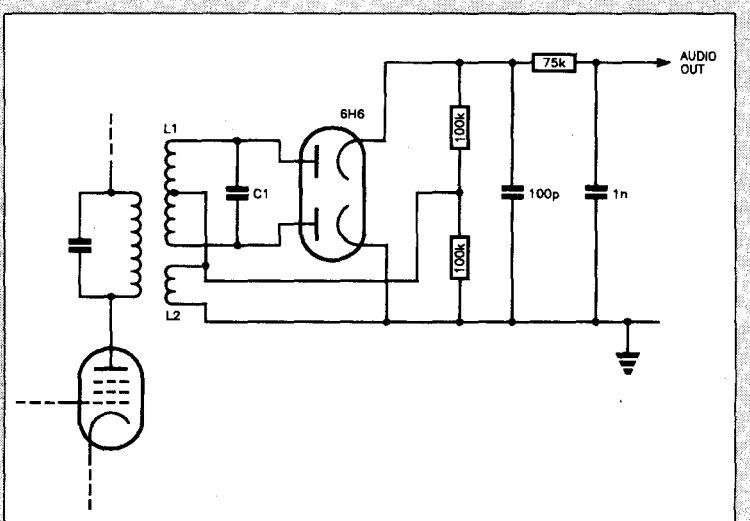


Figure 8.8. Phase discriminator FM detector.

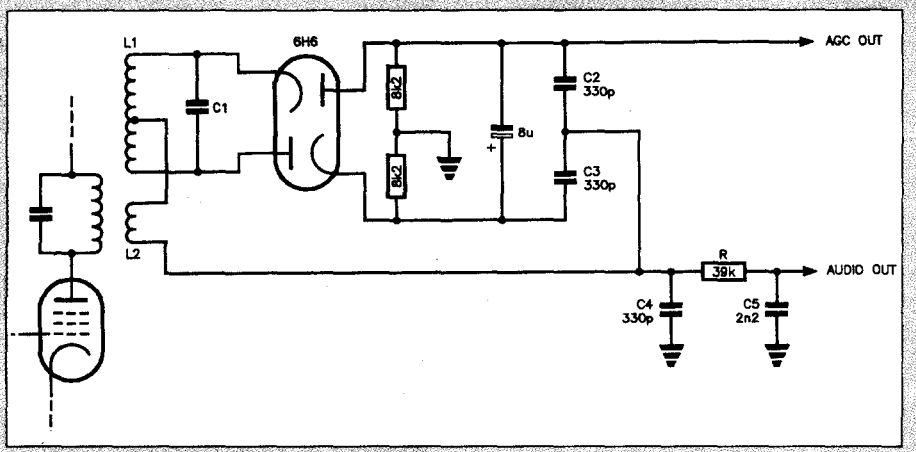


Figure 8.9. FM ratio detector.

Transistor and FET current amplifiers

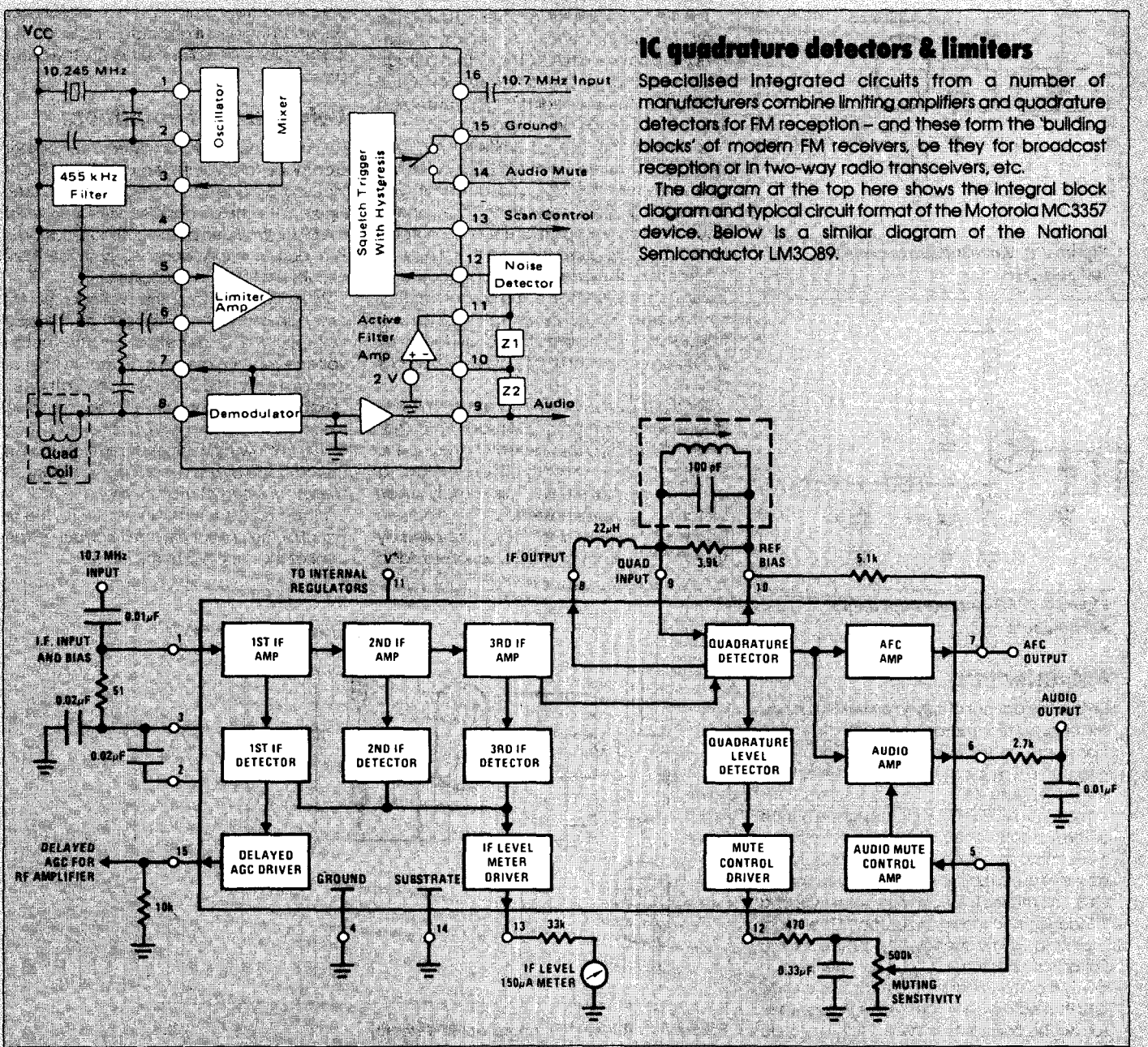
Figure 8.12 shows dc and ac coupled NPN current amplifiers. These are known as emitter followers. PNP versions simply have Vminus instead of Vplus. The equivalent FET versions, known as source followers, are shown in Figure 8.13. Occasionally there is an inductor in series with the emitter resistor to increase the bandwidth.

The input impedance of all of these circuits can be very high indeed, approaching the limit of the insulation of the printed circuit board on which they may be mounted. For this reason, some circuits use a 'guarding' technique, in which the printed circuit board traces to the gate are completely surrounded

IC quadrature detectors & limiters

Specialised integrated circuits from a number of manufacturers combine limiting amplifiers and quadrature detectors for FM reception – and these form the 'building blocks' of modern FM receivers, be they for broadcast reception or in two-way radio transceivers, etc.

The diagram at the top here shows the integral block diagram and typical circuit format of the Motorola MC3357 device. Below is a similar diagram of the National Semiconductor LM3089.



by an area of copper connected to the source. This considerably reduces any electrical leakage across the board. The output impedance in these circuits is only a few Ohms.

The voltage gain of all of these circuits is about 0.95 or more (but never greater than 1). Because the input impedance of this amplifier is complex, it is possible for it to oscillate, particularly if it has a capacitive load.

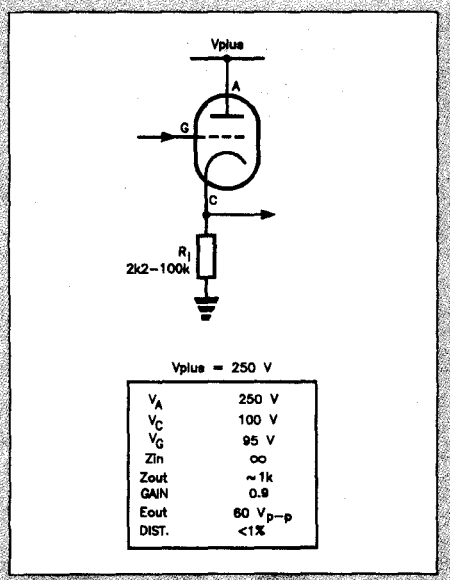


Figure 8.10. The dc coupled cathode follower.

If you have this problem with a piece of commercially made equipment, it means that the bypass capacitors on the power supply leads have probably changed in capacitance. Finding the right one to replace

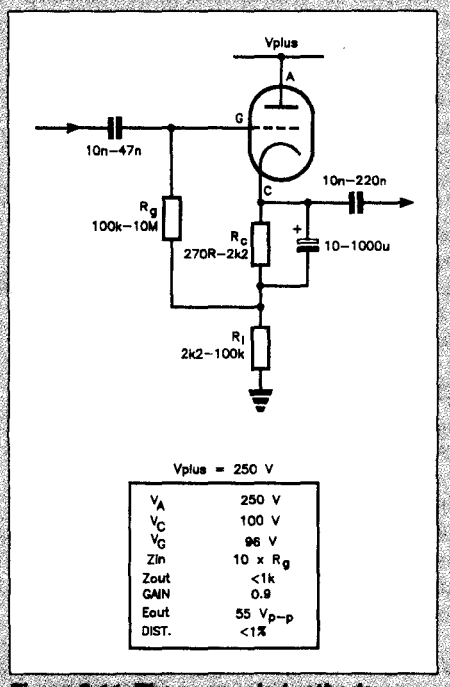


Figure 8.11. The ac coupled cathode follower.

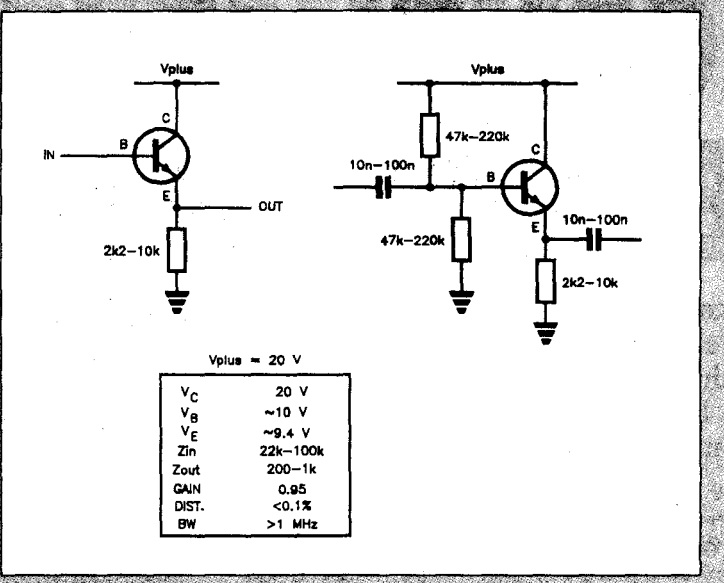


Figure 8.12. These are dc and ac coupled emitter followers.

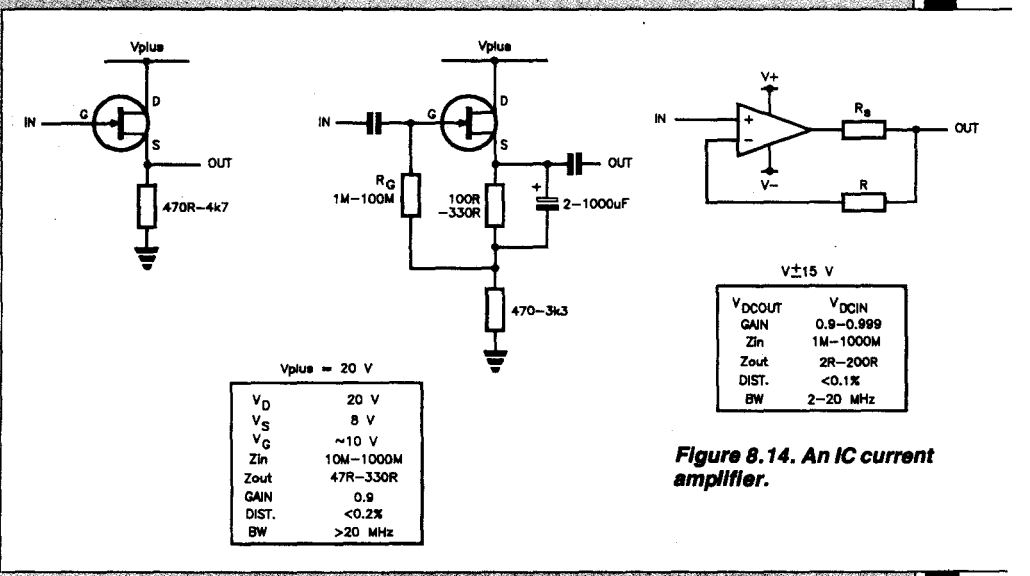


Figure 8.13. These FET source followers are dc and ac coupled.

Figure 8.14. An IC current amplifier.

can be a problem, so sometimes one has to cheat and insert a 1k resistor in the base (or gate) lead as close as possible to the base (or gate). This usually suppresses the oscillation.

IC current amplifiers

The IC current amplifier shown in Figure 8.14 is simply a non-inverting amplifier with a gain of unity (1). For many ICs there is a lower limit to the value of R of about 5k, for the rest, the output can be directly connected to the inverting input terminal. Rs is to prevent a disaster if the output is accidentally short-circuited. It has no effect on the performance of the amplifier.

FET amplifiers such as the LF353 have an input resistance of 1000M or more when used in this circuit. Such amplifiers typically have a frequency response extending to more than 100 kHz and an output impedance of a few Ohms, although some expensive types (LH0033 and similar) are flat to 20 MHz or more with an output impedance of about 0.1 Ohm.

Apart from the correct power supply voltages, there are no other dc tests. If you wish to, you can use a variable power supply, or a linear volume control (say 20k) connected from the positive to the negative supply, as a source of voltage to check that the output dc level follows any changes in the input dc level over a range within two volts of either power supply voltage. For ac testing, applying the injector to the input should produce an output ac voltage equal to the input voltage.

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ACCENTUATED BEAT METRONOME

Here's an economical electronic metronome with a true accentuated beat facility. It features both loudspeaker and visual (LED) output, one LED to mark the time, the other for the accentuated beat. By Roger Harrison.

A colleague of mine, another technical journalist, took up music a few years ago as a hobby. Well, as is the way with some things, his pastime grew to be somewhat more than a hobby. Got involved with a group, didn't he! This meant he had to get *serious* about practice. Following a discussion on the 'phone one day about other matters, he asked me if I had any circuits for a metronome; ".....something simple," he said. He had been borrowing one, an old-fashioned but perfectly serviceable clockwork-lever kind, but felt that buying a metronome when he was perfectly capable of building his own electronic version was an anachronism.

So, I scribbled out the circuit of a two-transistor oscillator – all of seven components totall – and faxed it to him. It wasn't long before I got a fax in reply, which said:

"Thanks for the metronome circuit. I knocked up a (really!) rough one to get me by and noticed what was missing straight away. You might care to consider:

"1/ A separate sound to indicate the **beat,** switchable for 1st/2nd/3rd/4th in the bar etc – I'd forgotten how useful this was;

"2/ **Two** LEDs – one to show the time, the other for the beat – I used to look at the swinging arm.

"3/A digital readout of time would also be nice, but probably much too expensive!"

Well, this project fulfils all those requirements, with the exception of the digital readout – which he was correct in surmising would be too expensive.

It's quite a long time since we described a metronome project in ETI, and certainly, we've never published one with the facilities offered by this unit.

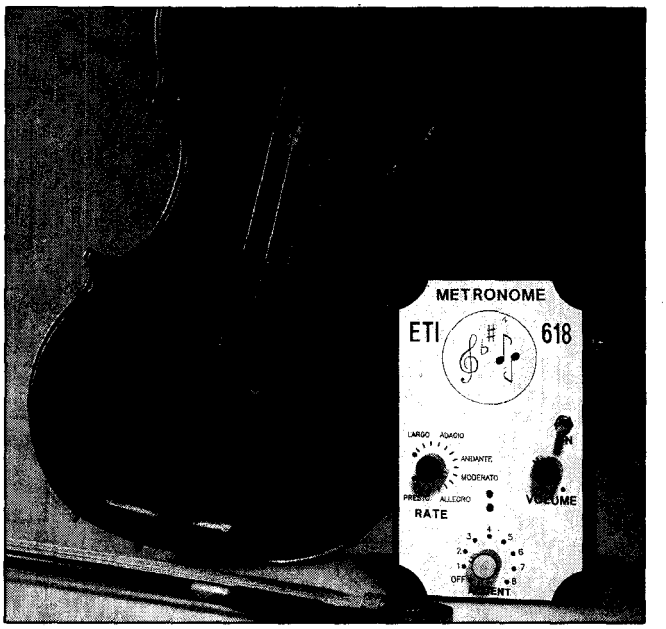
Requirements

Six major beat rate 'ranges' are employed in musical notation, plus two special sub-ranges slipped in at the bottom and top end of the range. Table 1 illustrates.

TABLE 1.

BEAT RATE RANGE	NAME
40-60 beats/min.	**Largo**
60-66	***Larghetto***
66-76	**Adagio**
76-108	**Andante**
108-120	**Moderato**
120-168	**Allegro**
168-200	**Presto**
200-208	***Prestissimo***

So, we need an oscillator which can be varied over the range from around 40 cycles per minute – about ⅔ Hertz – to 208 cycles per minute – about 3.5 Hertz. Then we need to be able to emphasise, or accentuate, selected beats or cycles, ranging from every other beat to every eighth beat, or whatever.



The metronome needs a loudspeaker output giving sufficient volume to be heard above the instrument, or instruments, and for convenience, it must be portable. This means battery operation, ruling out powering it from the mains.

I also consulted my youngest son, Corey, who plays violin and viola, about the sort of requirements he needed in a metronome. Basically, he agreed with my colleague, emphasising the usefulness of having LEDs to show the beat rate and the accent. In addition, I rang around several kit suppliers and discussed the matter with them. Several pointed out that customers had asked for a headphones output socket, to allow mixing the metronome output with the headphones output of their electronic musical instruments, for 'silent' practice.

Then there was the matter of cost. The project would have to be comparatively inexpensive, or at least good value for money, easy to build and use common, off-the-shelf components.

So, rolling all that together, we came up with the ETI-618 Accentuated Beat Metronome!

About the circuit

The circuit employs three ICs – two 555 timers and a 4017 decade counter. One of the 555s is used as a gated, or triggered, oscillator, to derive the "toc-toc-toc" sound, reminiscent of the traditional clockwork-lever kind, that sounds like tapping a block of wood. I've called this the "tock" oscillator. It drives a transistor which drives the loudspeaker, or headphones, as required.

The other 555 is used to gate the tock oscillator at the required rate, varied by means of a potentiometer. I've called this the "rate" oscillator.

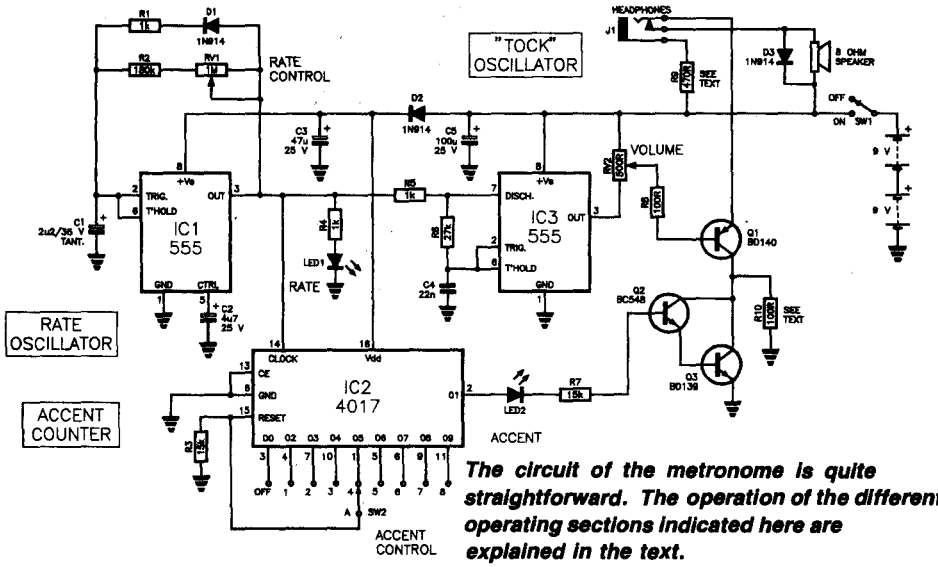
The 4017 counter is used to count the required number of "beats" (the count being selected by means of a switch) and then emphasise – or accentuate – that beat; every second, every third, every fourth beat, etc. It does this by making the sound louder

ELECTRONICS
ETI - 618

at the selected beat. Thus, for example, if set to accentuate every third beat (3/4, or waltz, time), the metronome goes tock-tock-TOCK-tock-tock-TOCK-tock-tock ... etc. The 4017 circuit I've called the "accent counter".

The rate oscillator can be varied over the range from 40 beats per minute to around 210 beats per minute – from largo to prestissimo, or from Tomita to Paganini! A front panel LED flashes on each beat, while another front panel LED flashes on each accentuated beat.

A volume control is provided to vary the loudness of the "tock". The project is powered from two 9 V No. 216 "transistor radio" batteries. As it only draws around 20-25 mA, the batteries will last



The circuit of the metronome is quite straightforward. The operation of the different operating sections indicated here are explained in the text.

The metronome is housed in an all-plastic jiffy box, with the front panel dressed up with a Dynamark escutcheon.

eti SOUND INSIGHTS

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quite a long while.

As all the parts are stock-standard items with most electronics retailers, you should have no difficulty sourcing parts. And it's economical to build. All-up cost is estimated to be between $32 and $38.

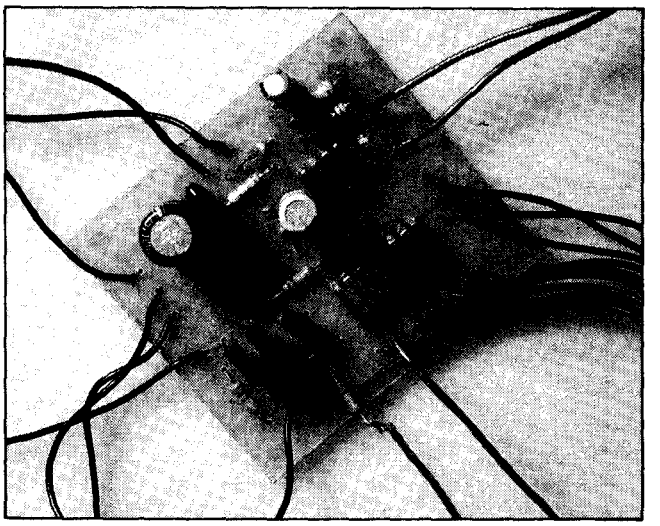
Construction

I housed the project in an all-plastic jiffy box measuring roughly 50 x 90 x 150 mm. The ICs and all the minor electronic components are mounted on a small pc board that measures 55 x 62 mm. The major components – pots, switches and loudspeaker – I mounted to the front panel which can be 'dressed up' with a Dynamark (or Scotchcal) escutcheon. The 6.5 mm headphones jack I mounted on one wall of the jiffy box's bottom.

A printed circuit board is not essential to the construction. Indeed, you could mount the minor electronic components and ICs on a small square of matrix board and wire them together on the rear side. However, a pc board not only provides a convenient way to physically secure the components, but effects most of the interconnections as well, reducing the possibility of wiring mistakes.

The first thing to do is examine your printed circuit board, whether you've bought a ready-made one or you've made it yourself. Check that all the holes are drilled and are the right diameter to fit the components. See that there are no small whiskers of copper between closely-spaced pads or tracks, particularly around the ICs. It's better to discover and fix any small problems at this stage than after you've completed the rest of the assembly.

Once you're satisfied all's well with the pc board, you can proceed to mount and solder the small components in place. The component overlay here shows their locations. You can proceed in any order, but check your work as you go. Take note of the orientation of the two integrated circuits and the diodes. This is important; get one or more wrong and it won't work, apart from the possibility of damaging an IC, for instance. Note that the 4017 (IC2) is a CMOS type and, while it features protected inputs, follow the usual precautions for handling CMOS: only pick it up by the ends and avoid touching the pins. Solder its ground (pin 8) and supply (pin 16) pins before the others.



With the pc board completed, give it a final check, looking for dodgy soldered joints, solder bridges between closely-spaced pads, etc, particularly around the IC pins. Correct any suspicious joints or problems you discover. It will save time and heartache later. Put the completed board aside and tackle the box next.

Using the front panel artwork (or ready-made Dynamark escutcheon, if you're using one) as a template, mark out and drill the jiffy box's front panel. It is good practice to centre-punch each hole before you drill, as it stops the drill bit 'wandering'. As it's a plastic box, use a slow drill speed if you can.

The holes for the potentiometers can be drilled with a small, say 6 mm diameter, drill first and then reamed-out, as the plastic is quite soft. One blade of a pair of scissors makes an excellent reamer! The speaker mounts on the box's front panel *behind* the escutcheon, in the top section, in that area depicted by a circle enclosing some musical notation. The sound from the speaker is transmitted through the escutcheon, which also serves to protect the speaker.

Put the box's front panel face down on the bench or table. Position the speaker in the centre-top section of the front panel and run a soft lead pencil around the rim. Then about 5 mm inside of this circle, mark out another. The speaker cutout is made by drilling a series of small holes around the inside edge of this second circle, then carefully breaking out the centre piece. File the edge with a smooth half-round or moon file. Take care, or you may damage the panel.

If the potentiometers and rotary switch don't have short shafts, you'll need to cut them down to suit the knobs you're using. As a trial, mount the potentiometers, the rotary switch and on/off toggle switch to the front panel to see all is well.

Tackle the mounting of the Dynamark escutcheon next. Whether you've made it yourself, or obtained a ready-made one (if you've bought this project as a kit, one will most likely be supplied), first place it over the front panel and see that it lines up and that no trimming is required. If there is, carefully trim it now, after determining where and how much to trim. A steel rule and a sharp hobby knife are best for this.

Dynamark/Scotchcal has a sticky rear face, used to glue it to the surface you want it applied to. The sticky side is protected by a paper backing. Problem is, when applying the escutcheon, you only get one chance to get it right! But there is a way around this limitation, which I learned from Peter Ihnat, one of the staff engineers who worked on ETI a few years back.

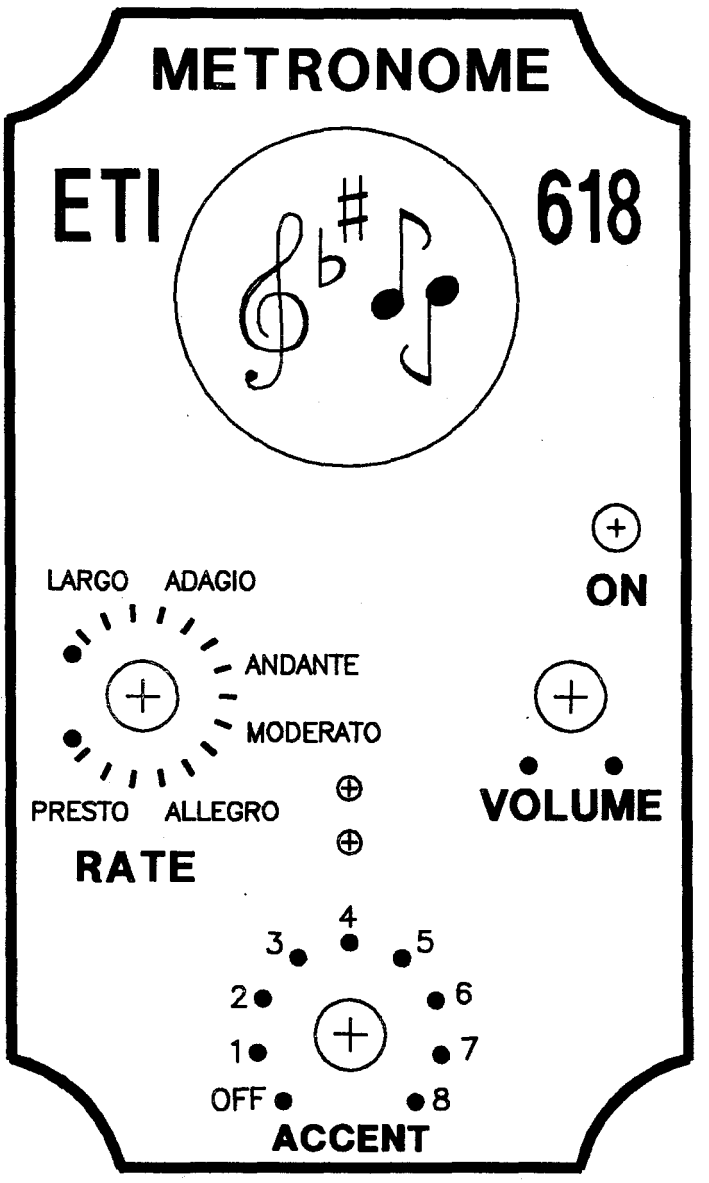
You soak it in water first, which softens the glue. About 10 or so minutes is ample. Leave the paper backing on it while you do this, or you're likely to get into all sorts of strife! When it's ready, wipe a wet sponge over the face of the panel, peel off the escutcheon's paper backing and then carefully apply it to the wet panel. You can then slide it into the exact position. Using the wrung-out sponge, smooth the escutcheon in place, pushing any bubbles towards the edges. When you're satisfied, put it aside to dry.

When it's thoroughly dry, cut the escutcheon away from the holes carefully with a sharp penknife or hobby knife – but *not* around the speaker hole, remember! Take care not to damage it. Now mount the switches and two potentiometers, taking care that you don't damage the Dynamark panel when tightening the nuts. Screw the knobs on last. The loudspeaker I glued in place using Super Glue. Take care not to get it on the cone, particularly at the edge suspension.

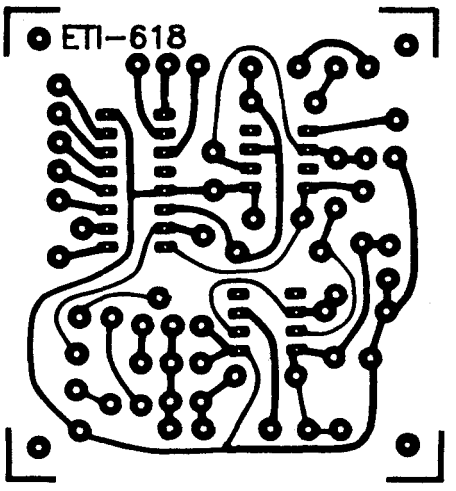
The two 3 mm LEDs, one for the beat rate and the other for the accent, I inserted from the panel's rear and glued into place, again using Super Glue.

As mentioned earlier, I mounted the headphones jack on a side wall of the box's bottom, located high on the right hand side, as you can see from the photograph.

Now you can complete the wiring between the board, the two pots, switches and speaker, the headphones jack, LEDs and battery 'snaps' using suitable lengths of light duty hookup wire. Make sure you wire them all in the correct way, as shown in the wiring details, or things will first operate quite differently to what you expect. The LED that indicates the accentuated beat is the lower one on the



Same-size reproduction of the front panel artwork. This suits a 150 × 90 × 50 mm plastic jiffy box.



Same-size reproduction of the metronome printed circuit artwork.

panel. At least, that's the way I wired it.

Check your wiring carefully upon completion.

Trying it out

Set the accent switch to the off position, the on/off switch off, and connect up the batteries. Set the volume and rate controls to about mid-travel. Switch on and you should be greeted by a tock-tock-tock sound at a rate of about one/second or so. Vary the volume and rate controls to confirm that they operate correctly: turning them clockwise produces an increase. The top LED (beat rate) should flash with each tock. Switch the accent switch to position 1 and the metronome should respond with a tock-TOCK-tock-TOCK, the accent LED flashing on each accentuated beat.

If you don't get these results, switch off again and carefully check your wiring and pc board assembly. Particularly check the orientation of all the diodes, the transistors and ICs.

Advice for fiddlers

No, I don't mean of the violin variety! I mean, those who like to experiment.

If you find the difference in loudness between the normal and accentuated tocks is too great, decrease the value of R10, going down one standard value at a time (82R, 68R etc) until you get the desired result. However, varying this interacts with the effect of the volume control you'll notice, which may involve deciding on what is the best compromise.

Likewise, when using the headphones output, you may need to experiment with the value of R9 to set the appropriate output level and difference between the normal and accentuated tocks.

The tock sound can be varied by a number of means. Increasing the value of R1 increases the period of the pulse output from IC1, allowing more cycles of IC3's oscillation to be applied to the loudspeaker. This results in a sound that's more of a "bonk" than a tock. So, if you'd rather a bonking metronome, increase R1 to 2k7 or so.

PARTS LIST ETI-618

SEMICONDUCTORS
IC1 555
IC2 4017
IC3 555
D1-D3 ..... 1N914, 1N4148
LED1, LED2 ..... 3 mm high brightness LEDs

RESISTORS ..... all 1/4 W, 5%
R1 ..... 1k
R2 ..... 180k
R3 ..... 15k
R4, R5 ..... 1k
R6 ..... 27k
R7 ..... 15k
R8 ..... 100R
R9 ..... 47OR see text
R10 ..... 100R see text
RV1 ..... 1M/lin. potentiometer
RV2 ..... 500R/lin. potentiometer

CAPACITORS
C1 ..... 2u2/35 V tantalum
C2 ..... 4u7/25 V RB electro.
C3 ..... 47u/25 V RB electro.
C4 ..... 22n greencap
C5 ..... 100u/25 V RB electro.

MISCELLANEOUS
J1 ..... 6.5 mm switched, mono jack socket
SW1 ..... SPDT or DPDT miniature toggle switch
SW2 ..... single-pole, 12-position rotary switch
ETI-618 pc board; 8 Ohm, 57 mm diameter loudspeaker; 2 × No.216 battery snaps; 2 × No. 216 9 V "transistor radio" batteries; plastic jiffy box – 150 × 90 × 50 mm (e.g. Ritronics H10111); 3 x pointer knobs; Dynamark (Scotchcal) front panel escutcheon; hookup wire, etc.

Approximate cost: $32-$38.

How it works

There are four sections to the circuit: a variable "rate oscillator", a gated "tock oscillator", an "accent counter" and a speaker driver circuit.

IC1, a 555 timer, forms the rate oscillator. Here it is configured as a free-running (or astable) oscillator giving a narrow output pulse at a low frequency. It works like this: when power is applied, C1 will appear as a short circuit on the trigger pin (pin 2) of the 555. This will cause the output (pin 3) to be high (near the supply rail voltage). Capacitor C1 will then start to charge via diode D1 and resistor R1. It will charge quite rapidly – in a few milliseconds – because R1 is a fairly low value (1k).

When the voltage on C1 rises to about two-thirds of the supply rail voltage, the 555 will 'trigger' and the voltage on the output pin will drop to almost zero volts. C1 will then start to discharge, but now it will do so via R2 and RV1 because D1 will be reverse-biased. Because R2-RV1 is a comparatively high value, C1 will be slow to discharge. When the voltage on C1 now falls to about one-third the supply rail voltage, IC1 will reset and the output, pin 3, will go high again. The process then starts all over again.

Each time pin 3 of IC1 goes high, it gates on the tock oscillator, IC3. This 555 timer is also arranged as an astable oscillator, but its timing components – R5, R6 and C4 – only operate when pin 3 of IC1 goes high. C4 charges through R5 and R6, and IC3 oscillates so long as pin 3 of IC1 remains high. Because this is only a short period (determined you remember by the value of R1 in conjunction with C1) the output of IC3 will be a short burst of a few cycles. IC3's oscillation frequency is set at a comparatively high audio frequency, determined by R5-R6-C4.

The output of the tock oscillator, IC3, is impressed across potentiometer RV2, the volume control. The wiper of RV2 feeds pulses to the base of Q1, a PNP emitter follower which has the speaker (or the headphones) connected in series with its emitter circuit. While IC3 is not oscillating, its output – pin 3 – is high and since Q1 is a PNP transistor, it will not conduct. Q1 acts as a current amplifier, the short burst of pulses appearing at its base when IC3 is gated on being applied as current pulses through the speaker or headphones.

To visually indicate the selected metronome beat rate, LED1 is arranged so that every time pin 3 of IC1 goes high, current flows via R4, causing the LED to flash briefly.

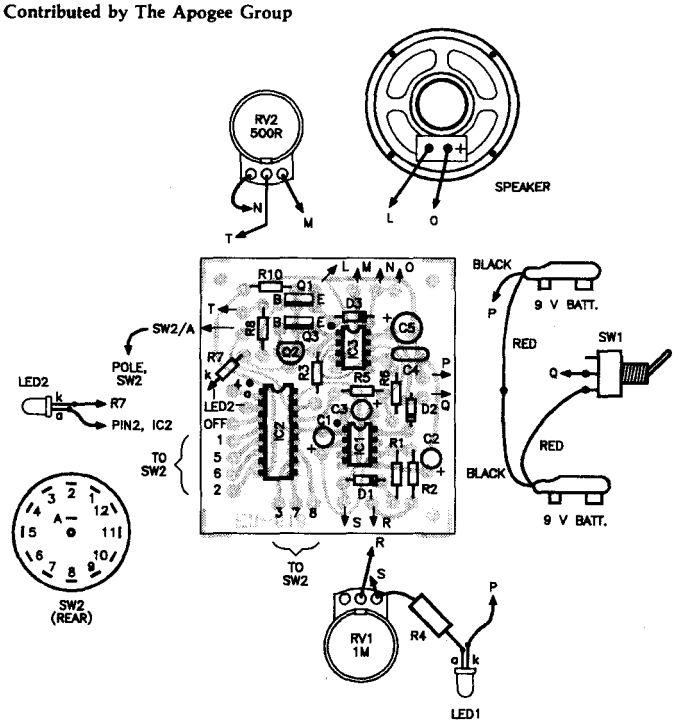
Now, how is the selected beat accentuated? Well, the pulses from the output of IC1 are also applied to the "clock" input (pin 14) of the 4017 accent counter, IC2. This is a decade counter having ten outputs (0 to 9), each of which goes high, then low, in turn with each successive clock input cycle. A switch, SW2, is used to select an output and connects it back to the reset input, pin 15. When SW2 is set to select, say, output 3, the counter resets itself on every fourth input pulse. If output 5 is selected, it resets itself every sixth input pulse, and so on. If output 0 is selected, IC2 is reset every cycle and no pulses appear at output 1. Hence, this switch position is labelled OFF.

Output 1 of the 4017 goes high on the next input pulse immediately after that which caused the reset, and this output is used to accentuate the beat. When the 4017's output 1 goes

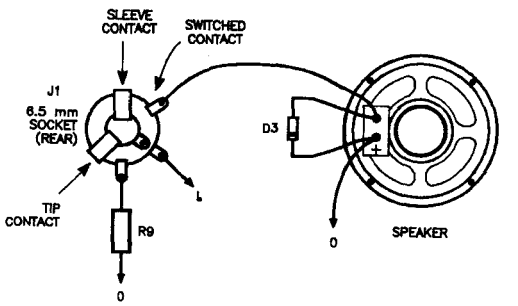
You can increase the pitch of the tock oscillator by decreasing the value of R6. A value of 15k-18k will yield a "tink" sound.

I also experimented with drilling some small 'sound holes' in the top of the box, to allow sound radiation from the rear of the speaker to escape the box, increasing the volume. eti

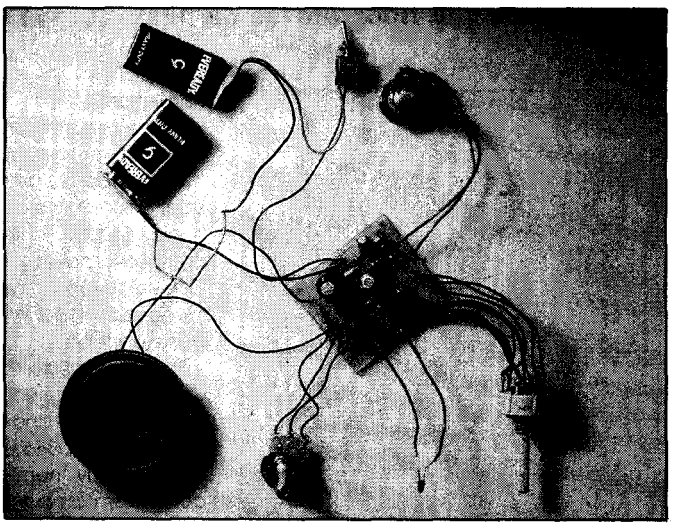
Contributed by The Apogee Group



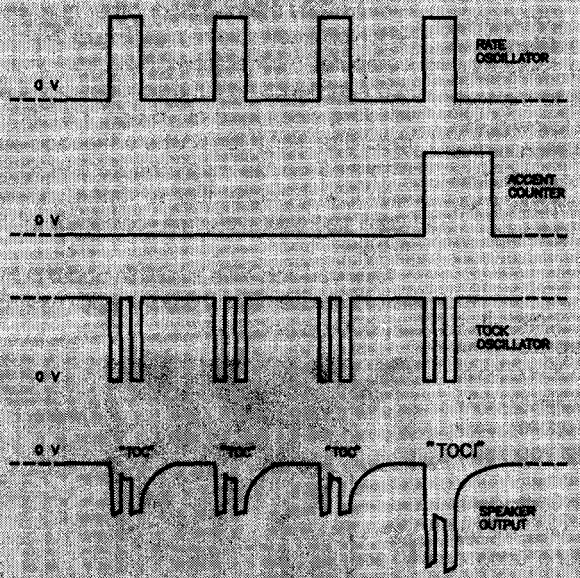
Component overlay and wiring diagram for the metronome, showing where the minor components are positioned on the board and the interconnections between the board and major components.



Here's how to wire-in a 6.5 mm jack socket for a headphones output, if you need it.



Showing the assembled prototype. Note that the rate LED was not wired-in when this picture was taken.



Graph 1. Showing how the two oscillators and the accent counter work together.

high, it applies base current to Q2 via LED2 and R7. Thus, LED2 lights on each accentuated beat. When Q2 conducts, it causes Q3 to conduct, which shorts out R10. This allows more speaker current to flow while output 1 of IC2 remains high, and the tock heard will be louder – and thus accentuated.

Graph 1 here visually illustrates the operation of the metronome, showing the relationship between the rate oscillator, the tock oscillator and the accent counter, and how the output is produced.

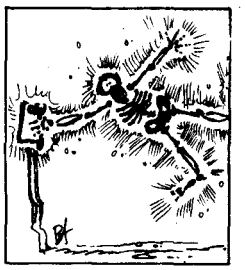
The difference in loudness between the normal tock and the accentuated TOCK is determined by R10. You can change the value of this resistor to suit yourself, or to improve results with various loudspeakers or headphones. The value shown was found to give good results with the eight ohm speaker specified. To provide adequate volume and sufficient range of loudness between the normal and accentuated tocks, a supply voltage of at least 15 volts was found to be necessary, hence the choice of two 9 V batteries connected in series to supply the project.

Good supply rail filtering is necessary when using several 555 timers in a circuit. This is achieved here using D2 and capacitors C3 and C5. The high current pulses drawn from the supply by the output circuit of IC3 and the speaker drive circuit (Q1-Q3) are prevented from affecting the operation of IC1 by the action of these three components.

When the speaker is pulsed, the supply rail will momentarily drop a volt or two. This reverse-biases D2 momentarily, while C3 maintains the supply rail voltage on IC1 and IC2.

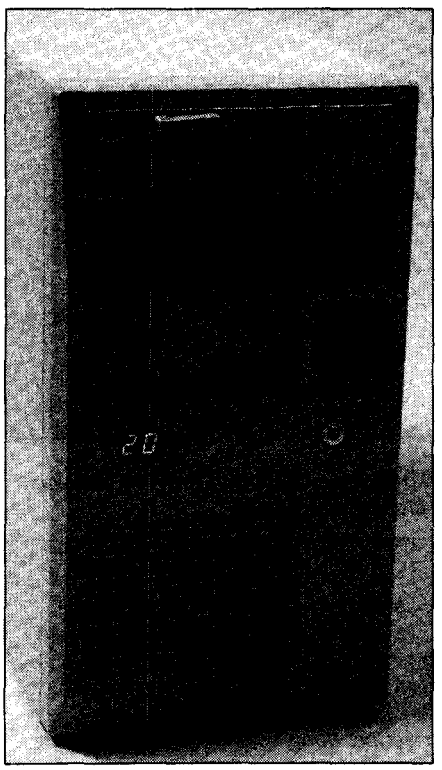
Diode D3 "clamps" reverse voltage swings created by the voice coil action of the loudspeaker that would otherwise threaten the base-emitter junction of Q1, which has a reverse voltage breakdown limit of only a few volts.

'TOWERING' YOUR PC



ELECTRONICS

Desktop computing was a misnomer, foisted on us by the marketing departments of computer manufacturers. Release more desk space by putting your PC in a tower case which can stand on the floor out of the way. Jamye Harrison shows how.



This case is of the mini-tower style, and is supplied by Energy Control International. It stands only about half as tall as the full-size tower cases.

Have you ever longed for that immense hunk of metal on your desk, commonly known as your PC, to relinquish its hold on your precious desk space? Do you day-dream of the day when you may be able to evict your electronic companion, banishing it from sight? Where would you put it? Why not on the floor?

Not long after the advent of the ubiquitous IBM-PC and its antecedents, the XTs and ATs of the world staked their growing claims on the invaluable desk space of the world. Soon people realised that it would be advantageous to free their desks and banish their PCs to the floor. This frend has especially flourished during the 'bolt-together revolution'.

However, merely standing the conventional metal box, especially one of the cheaper Asian-made enclosures, on its side, presented a couple of problems. Firstly, it didn't quite look right. Secondly, some computer cases, especially those of the 'Baby-AT' variety, don't lend themselves to being balanced on their sides, becoming quite unstable.

So, we come to the advent of the 'Tower Case'. No doubt you've seen them. Most of the electronics and computing retailers are selling their 80386 computers in them. You can also buy them alone, to bolt your own computer components inside.

It seems these cases come in just as many shapes, makes and sizes as do the 'conventional' variety, each presenting their own special features, advantages and disadvantages. So we adopted three such cases, from three different computing retailers, and tried installing three different AT computer systems, one in each enclosure.

Although we put three cases to the test, the step-by-step pictures which follow guide you through only one such installation, as the process was much the same for each style of case. Where I found differences I will endeavour to point them out to you.

Be prepared

Before dismantling your new case, it is important to correctly prepare your computer system for relocation. If you have a hard disk, or perhaps two, installed in your system it is important to back up ALL your data onto floppy disks first, using your usual back up method.

After this is done and you have verified the back up disks are restorable, you should 'park' your hard disk. This is done using a program most likely to have been supplied with your computer system. These go by various names: PARK.COM, SHIPZONE.EXE, SHIPDISK.EXE to name a few. Once the hard disk is parked, and the program tells you to do so, turn your system off.

It is now time to remove the computer from its old home. The opening of the case will depend on what type of case you have already; it may require you to remove a few screws from the rear of the unit or just flip the lid.

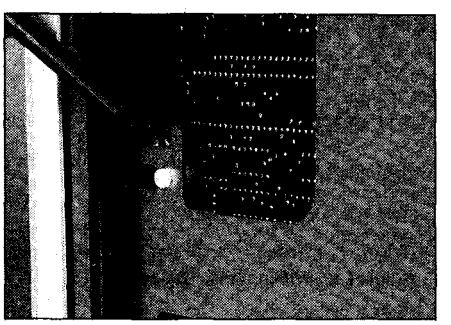
It would be wise to observe anti-static procedures at all times when you're handling the computer pc boards.

You should first remove any add-on cards from your system, taking careful note of any cables attached to them. Make notes as to which cable was connected where, and which way it was oriented, so as not to reverse the polarity of any wires or cables when re-installing the cards.

Next step is to remove the storage devices, taking out floppy drives first before tackling the hard disk(s). This is usually done by unscrewing some fasteners on either side of the drive and sliding the drive out of the front of the case. The same can be done to the hard disk. However, EXTREME CARE should be taken so as not to jolt or bump the drive. This can cause data loss at the very least and IRREPARABLE DAMAGE in the worst cases. The hard disk should be laid to rest on a thick piece of foam rubber somewhere out of the way.

After removing the drives you should remove any metalwork or other hardware which obstructs you from getting at the main computer motherboard. Next, disconnect any flying leads from the board one-by-one, labelling each lead as you go. You should record on each label where the lead was attached on the motherboard and which way it was connected, so that its polarity won't be reversed when reassembling the system.

Now you can take the main board out of its old box, remembering my early warning on static precautions.



1

As can be seen in the picture the case provides for the mounting of the main computer board using copper and nylon

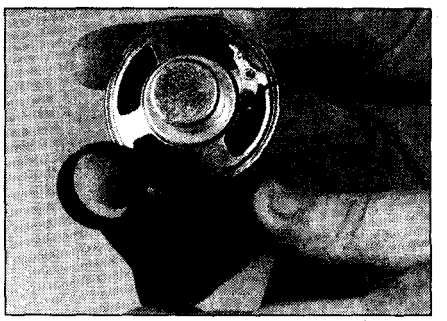
spacers lodged into special holes under where the motherboard sits. Depending on your motherboard, you may or may not need to use all of the spacers provided with the case. Your first step, after ensuring the power supply is secure, is to carefully position the motherboard where it is to sit (your tower case may or may not come with a power supply – if it does it may or may not already be mounted in the case).

Some careful observation will reveal where the mounting holes on the motherboard line up with the mounting holes for the spacers on the case. The strangely shaped, elongated slots, which are narrow at one end, are designed to take the nylon spacers, which simply slide in from the wide to the narrow end. About seven or eight (depending on which case you have) threaded holes can also be found; these are for the copper spacers, which not only help to secure the pc board but also provide a ground to the case. Note well how many of each type of spacer is required and where each spacer is to sit.

Now remove the motherboard from the case. Count out the required spacers and mount them in the enclosure, sliding the nylon spacers into position and screwing the copper ones into place.

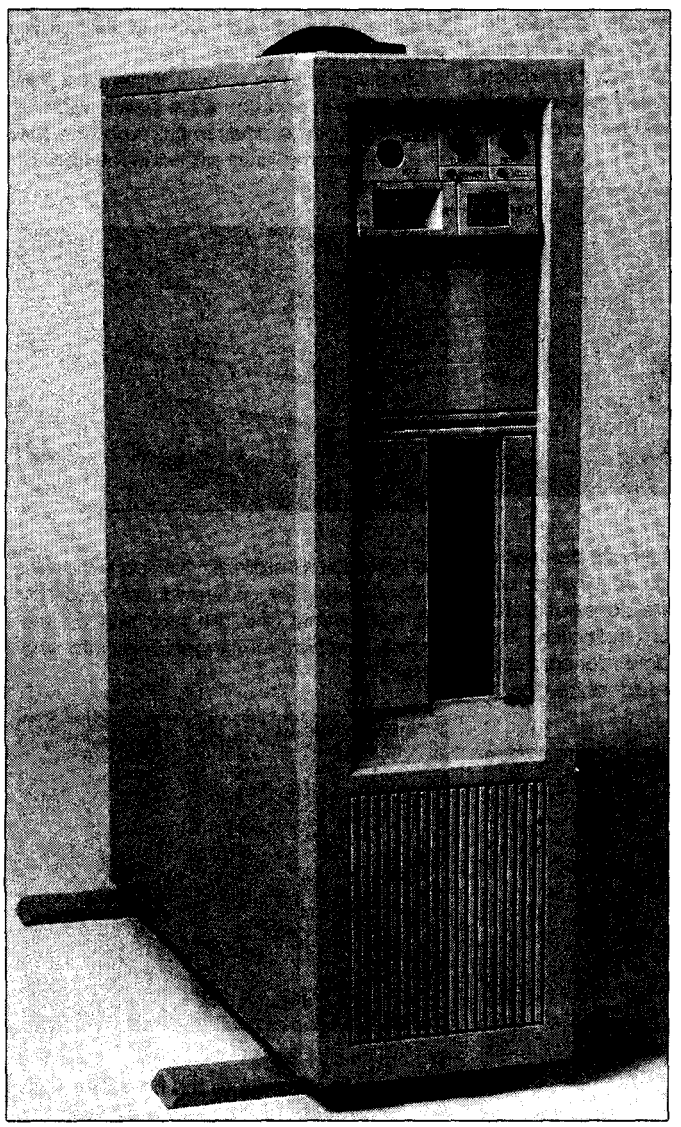
2

After putting the required spacers in place you may now secure the motherboard in the case. This must be done cautiously so as not to flex the pc board in such a way that it may be damaged. Probably the best way to go about mounting the motherboard in the enclosure is to work from left to right, 'clicking' the motherboard onto the nylon spacers. After the board is secured using this method you should screw it to the copper spacers. This is best done using the smaller, threaded, short screws with the wide, relatively flat heads.

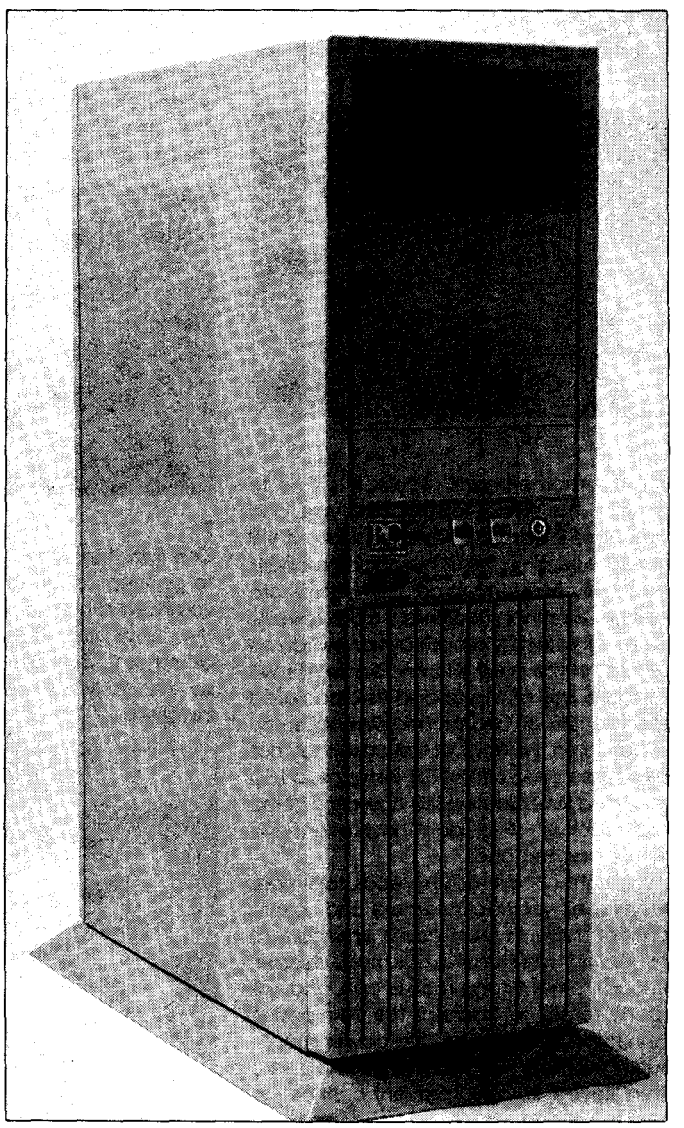


3

In the case supplied by Energy Control

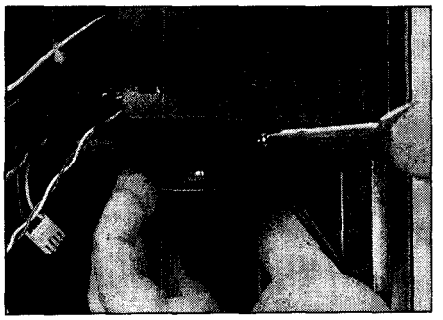


The tower case available from Rod Irving Electronics. Note the display panel at the top.



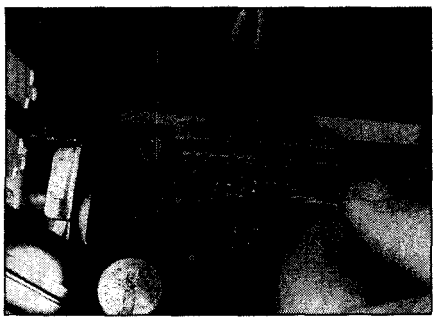
The 'maxi-tower' case from PC Marketplace. This locates the drives at the top and a display section in the middle.

International was a rather strange looking black plastic attachment. After some investigation this was found to be used for mounting the speaker in the case. This is done by first placing the rear of the speaker in the hole at one end of the attachment, as shown here.



4

The speaker and its mounting hardware are then secured, using a self tapping screw, to the plate of metal protruding from the underside of the drive enclosure inside the case.



5

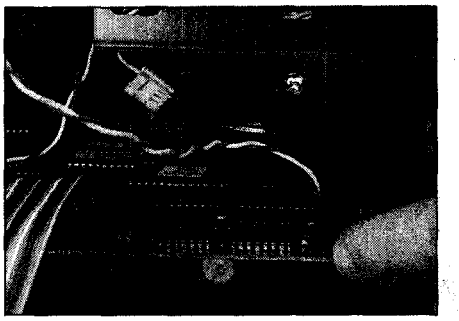
With the motherboard secure, it is time to connect the flying leads. The type and number of leads you have to connect will largely depend on the make of motherboard you have. Most AT type computers are capable of running at different clock speeds, usually selected by a push-action switch on the front of the case. XTs, and some ATs, will not make use of this and so its associated leads may be left unattached. Similarly, some indicators on the front of the case may not need to be used either. For instance, a LED is provided for indicating the operation of the hard disk drive – if you don't have one, leave this unattached also.

When attaching the flying leads, take note of the labels you kept of where and how to connect them. In most cases an incorrect connection won't result in any major disaster, although other wrong moves can, and will!

Don't forget to connect the two power connectors coming from the power supply, usually labelled "P8" and "P9". These are often 'keyed' so as to prevent connecting them the wrong way round; however, there is nothing to prevent you from transposing which connector is which. This would have disastrous consequences when you turn the power on for the first, and last, time – BE WARNED!

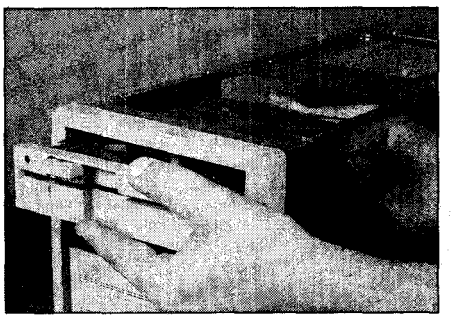
6

Re-installing the add-on cards is the next step, after checking all flying leads are properly connected. This is a simple matter of sliding the card into an appropriate slot and 'rocking' the card slightly in order to secure it in the edge connector on the motherboard. Be careful not to put too much pressure on the motherboard as it may flex the board to a point where it cracks, or breaks a track.



7

One flying lead you may not have been able to connect, depending on whether or not you have a hard disk, is the connection for the hard disk operation indicator. This attaches to the hard disk controller card and so can only be connected once this is installed.



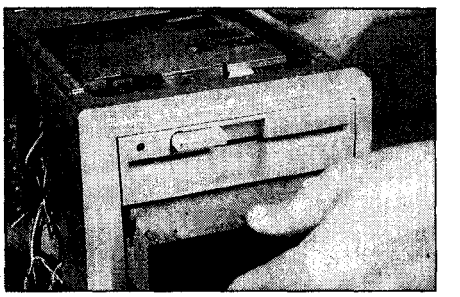
8

Next step is to mount the drives in their enclosure, starting with the floppy disk drive. The first part to mounting the floppy drive, or drives if you have more than one, is to slide the drive in from the front of the unit in the fashion shown in the picture, supporting the drive from the front and back.

9

Once the drive is in position, four screws are needed to secure the drive to the case. I have noticed in doing the three different installations that the types of screws needed to do this vary from drive to drive. If there are no suitable screws in the hardware supplied with the new case you should use the screws left over from your old system.

Don't tighten the screws all the way until all four are in and you have positioned the front face of the drive so it is flush with the existing 'dummy' drive panels in the front of the case.



10

The hard disk is installed in the same manner as the floppy drives. However, only hold it by the front panel and the rear skirt on the chassis. Don't let your fingers stray into "the works".

11

Four screws also secure the hard disk. Take the same precautions as you did with the floppy drive(s).

(Continued on page 95)

WORKSTATION

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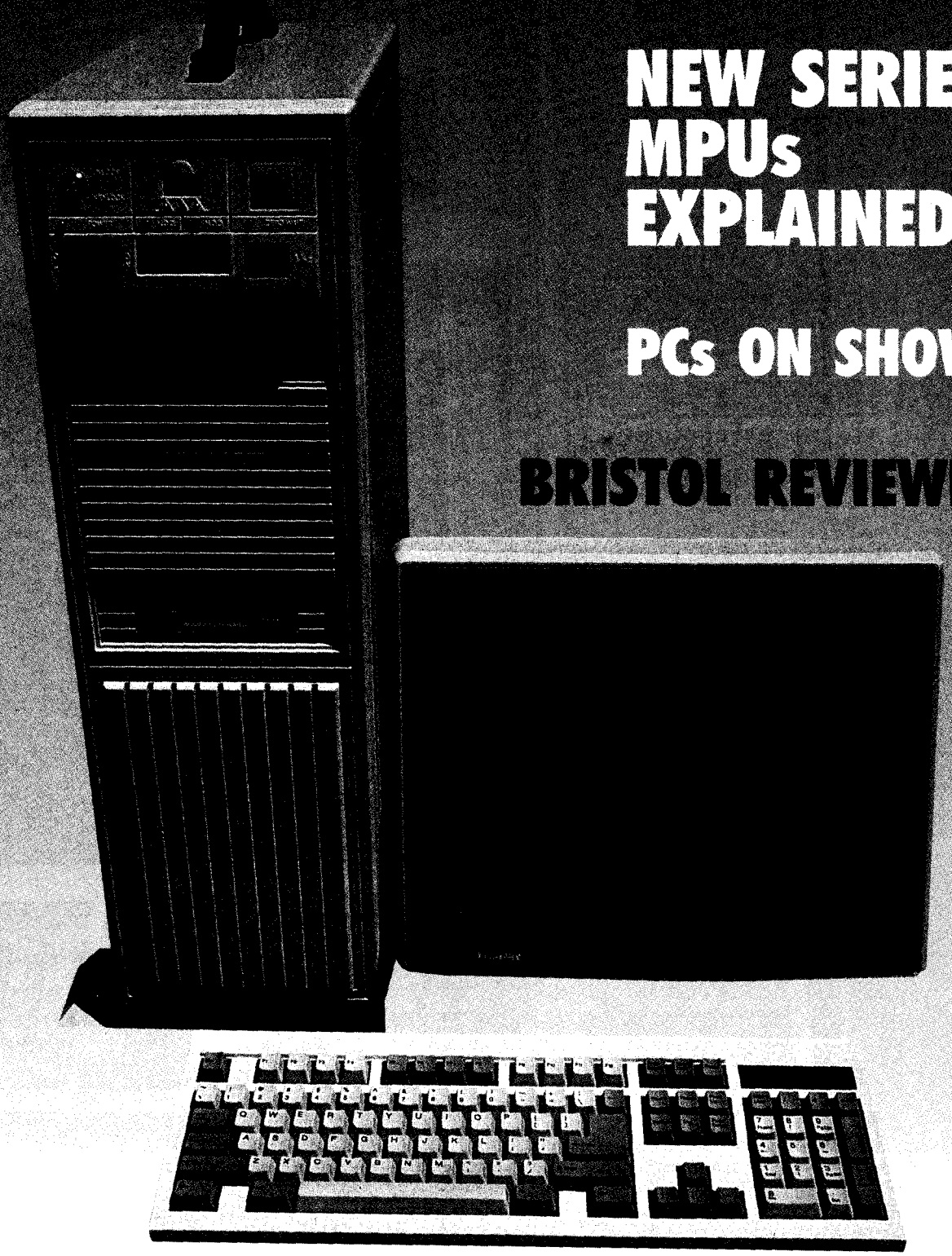
NEW SERIES: MPUs EXPLAINED

PCs ON SHOW

BRISTOL REVIEWED



The Rolls Royce of All Data's range of PCs — the Bristol Research 386-33.

Kester Cranswick reviews the Bristol Research 386-33 from All Data, one of the more powerful PCs on the market.

SHIPSHAPE WITH BRISTOL

There is something about speed that invites, no, demands, attention. But while the quest for speed has absorbed humanity for centuries, just why it is so enticing defies analysis.

In the world of personal computers, speed has definite advantages. Place a computer in a network of its peers and even the fastest machine will suffer performance degradation. Set a computer aided design program to do some solids modelling and, with some computers, you can make lunch before it is halfway through.

It is a truism among computer users that the more power you have, the more you want, while to a novice, any computer is a magical aid to getting the job done. Experienced users dread the delay in loading up a large program, hate the time it takes to print out a page and yearn for the power to run several tasks at once.

Enter the Intel 80386 processor. It is able to gobble up data from memory 32 bits at a time. And it has microcode that enables multiple applications to be run at once, courtesy of operating systems such as Unix and OS/2.

The first 80386 processors were rated at 16MHz. Put up against the original 4.77MHz 8086-based IBM PC, this was like pitting a Ferrari against a horse and cart. But Intel has kept increasing the performance of the 80386 — a 33MHz version was launched last year, and has found its way into a growing number of top end PCs.

The business of building a PC is technically not that difficult. It is a matter of selecting the right building blocks from the hundreds of disk drives, displays and other components available.

One company that has been doing that very well of late is All Data Australia, based in Dandenong, Victoria. It began life two years ago as a PC retailer, then moved into the design and assembly of a range of PCs. More recently it has started selling its own range of printers and monitors.

All Data sells two brands of microcomputer. The Arrow range is aimed at the budget conscious buyer, while the Bristol Research marque is the company's Rolls Royce line. The Bristol Research 33MHz 80386 computer is one of the most powerful PCs on the market.

Software to enable expanded memory is provided, and works reasonably well.

The review machine had a $10,008 price tag and came in a tower case, with 8MByte of RAM, two floppy disk drives, a 150MByte hard disk, a Tystar branded 14 inch VGA display and MS-DOS 4.01 as an operating system.

It is certainly possible to spend far more on a similarly configured PC from a better known manufacturer. Brands such as Compaq and AST Research can cost more than twice as much. But at the end of the day it is not the name on the front that counts but how well the PC does its job.

Fold-out legs

An immediately distinguishing feature of the Bristol's design is a large handle on the top of the thigh-high cabinet. Without it, moving the machine would be a cumbersome business indeed. The exterior is attractive and functional. At the bottom of the case are fold-out legs to give it more stability. All relevant controls are at the top of the casing. There is an illuminated display of the CPU speed (in case passersby are in any doubt as to the speed of the computer!) the usual socket for a key to disable the keyboard, an on/off switch, reset and turbo buttons. The turbo button is largely unnecessary, being a hangover from the days of badly behaved software that would crash with super fast CPUs. In the case of the Bristol, it slows the CPU down to a mere 20MHz.

Red lights glow brightly when the disk drives are being accessed; a green light indicates power on and an amber light points out that the memory is zero wait state. There is also an LCD clock thrown in for good measure.

The back has all the ports, input and output sockets. There is a keyboard socket, two 25-pin serial ports, for modems, mice and the like, a parallel printer port and a games port for a joystick.

Getting inside the Bristol is fast and simple. Single screws hold on each side of the metal cabinet, though removing the right hand plate reveals just the underside of the Micronics 386 motherboard.

The interior is roomy, and uncluttered by cabling — just what you need if you intend to use the computer to its full extent. The massive 220 watt power supply is at the top, behind the five storage bays. It has a power-out socket if you can find a male/female cord to connect to the monitor.

The motherboard sits vertically at the base of the case with the 35mm square 80386 processor clearly marked. There is a large, empty socket next to it for an optional Intel or Weitek maths coprocessor.

The review computer had 8MByte of 25 nanosecond, zero wait state, 32-bit RAM, most fitted to a card. Memory is automatically checked when the computer is turned on. The amount of memory can be doubled should the need arise, though 8MByte is more than enough for even the most demanding of modern applications.

Boosting performance even further is an Intel 82385 cache controller with 32KByte of RAM. This stores data from the disks, so it takes less time to get to the CPU. A cache is a fairly common feature in power PCs these days.

The motherboard also features a real time clock, a BIOS from Phoenix and an array of switches and jumpers that control various system parameters.

Three options

Three storage options were presented on the review computer — standard 1.2MByte 5.25 inch and a 1.44MByte 3.5 inch drives, plus a 150MByte hard disk from Priam. The disk controller is the standard Western Digital issue. I had no complaints about the hard disk and 5.25 inch floppy, but the 3.5 inch disk was not too keen on reading some of my disks. This is a problem with some of the new format disks and all you can do is get a new unit.

There are plenty of expansion slots tagged on the 8.25MHz bus. The bare board has one 32-bit, five 16-bit and two eight-bit slots. The memory board occupies the 32-bit slot while the video and two I/O cards fill three 16-bit slots. That still gives you plenty of space for internal modems, network controllers and other cards. All the slots have the standard 16-bit AT-bus architecture. The advent of 32-bit processors has seen two new 32-bit architectures emerge — Micro Channel and Extended Industry Standard Architecture, or EISA. MCA is well established but EISA is still new. Unfortunately this will be purely academic to Bristol users who will be unable to fit any of the new 32-bit cards that are around, but this is not a major limitation, yet. The AT-bus still has years of life in it.

The fitted VGA video card is branded MVGA. It has 512KByte of video RAM and output ports for both a 15-pin analog monitor cable and a 9-pin TTL monitor cable. It also comes with four disks of utilities.

SPECIFICATIONS: BRISTOL RESEARCH 386-33

Processor: 33/20MHz Intel 80386, Intel 82385 cache controller, optional Intel 80387 and Weitek 3167 maths coprocessors
Memory: 8MByte 25ns RAM, expandable up to 16MByte, 32KByte cache RAM
Keyboard: 101-key AT style
Expansion slots: one 32-bit memory slot, five 16-bit AT-bus, two 8-bit XT-bus slots
I/O: two 25 pin serial, one 25 pin parallel, one joystick port
Storage: 1.2MByte 5.25 inch and 1.44MByte 3.5 inch floppies, 150MByte Priam hard disk, Western Digital ESDI controller. Two free half height storage bays.
Video: MVGA VGA video card, 512KByte VRAM, analog and TTL output, driving 14 inch Tystar VGA monitor
Power: 220 Watt
Software supplied: MS-DOS 4.01
Price as supplied: $10,008
Supplier: All Data Australia ☎ (03) 794 6714.

The extra memory allows the card to drive a 16 of 256 colours display with a resolution of 1024 × 768 pixels, or a 256 colour display of 640 × 480 pixels. Drivers are supplied for popular programs such as AutoCAD, Lotus 1-2-3, WordPerfect, Ventura and Windows to let them take advantage of the extra display potential.

Other utilities change the video mode to CGA, EGA and Hercules, for some applications that don't like VGA graphics.

The actual monitor is All Data's own, branded Tystar. Made in Taiwan, it has a 14 inch display, tilt and swivel base, contrast and brightness knobs.

The keyboard is a standard 101-key, AT compatible affair, a mite smaller than many available. It has two small legs to raise the back, a positive action, and is a typical Taiwanese keyboard — the Taiwanese rarely build a keyboard of the calibre found on IBM PCs.

System and the video BIOS can be optionally relocated to high speed RAM. There is RAM to spare so this is a useful way to up the performance.

As might be expected, performance is impressive. My own measurement was getting Isys, an Australian text retrieval package, to index 77,000 words. On my 20MHz 386, it takes 19 minutes, 44 seconds. On the Bristol, the same job took 13 minutes, 57 seconds, a real performance boost.

Between rival 33MHz 386 PCs there is little difference in raw number crunching performance — after all, they use the same processor. But it is a slightly different story when it comes to peripheral devices, where the choice of graphic cards and disk drives does make a difference. Here, the Bristol doesn't do so well against other 33MHz 386 PCs. Based on the widely used PC Tech Journal benchmarks, the 33MHz Compaq Deskpro 386, with the Compaq video card, was over twice as fast in scrolling and 25 per cent faster at graphics. On the other hand, against a 33MHz Acer equipped with a Video 7 board, the Bristol was three times faster in scrolling. In general, the better known names were faster.

The Priam hard disk was also a little on the slow side, compared to 150MByte disks from Miniscribe, Control Data and Rodime. The Priam delivered 60-70 per cent of their speed. Clearly the Bristol could be

made even more powerful by changing some of the peripherals.

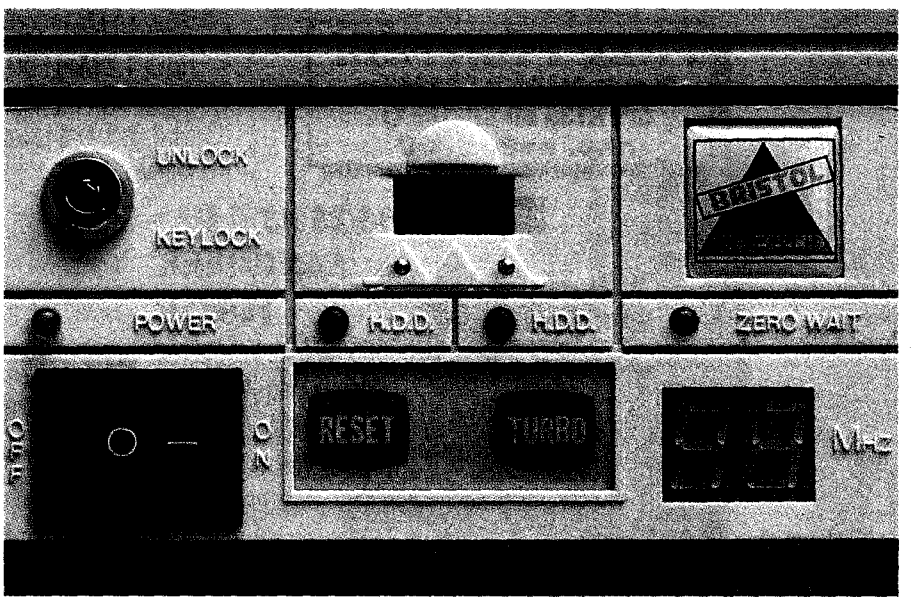
Software to enable expanded memory is provided, and works reasonably well, but you would be well advised to buy a memory manager such as 386Max if you really want to control how the memory is used.

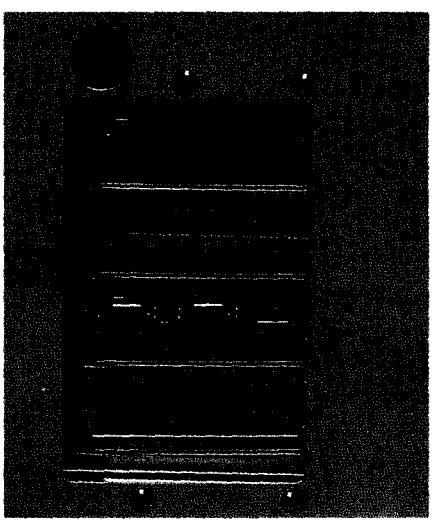
The computer has system setup software supplied on disk, rather than stored on a motherboard EPROM. This is used to change the system clock, disk drive, memory and peripheral specifications. Other utilities control the relocation of BIOS and the use of the cache.

MS-DOS 4.01 is the latest incarnation of the industry standard operating system. It has a better interface than 3.X versions, with lists of files and a menu to make managing files easier. As far as applications go, the Bristol is as compatible as any modern PC. In other words, compatibility is not an issue.

The documentation accompanying the Bristol is pretty sparse. Microsoft's excellent MS-DOS manuals are a good start, but the rest is just manuals for the motherboard, video and I/O cards. Still, considering the PC is likely to end up in the hands of a power user, Mickey Mouse Meets the Micro manuals are perhaps unnecessary.

There is no doubt that if it is PC power you want, the 33MHz 386 Bristol has it in abundance. At a shade over $10,000, it is not as expensive as some of its better known competition either.





If it's performance and power at a comparatively low cost that you're after, the Bristol comes well recommended.

But 33MHz 386 PCs are being overshadowed by the new breed of 486 PCs. The Intel 486 processor combines a 386 processor and a coprocessor on one powerful chip, running at 25MHz. There is still a shortage of 486 machines, and they are pricey, but a 25MHz 486 is more than a match for a 33MHz 386.

That said, the All Data Bristol can be well recommended to users after inexpensive power.

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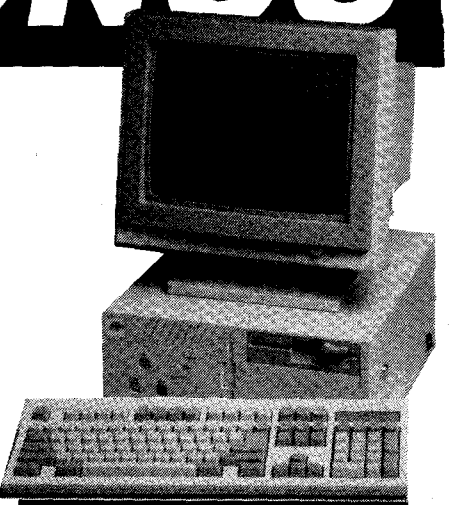

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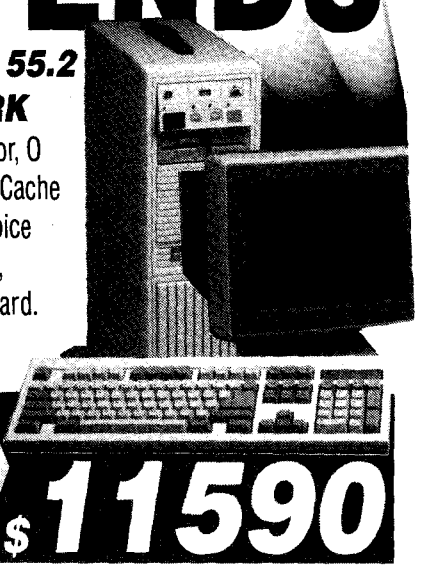

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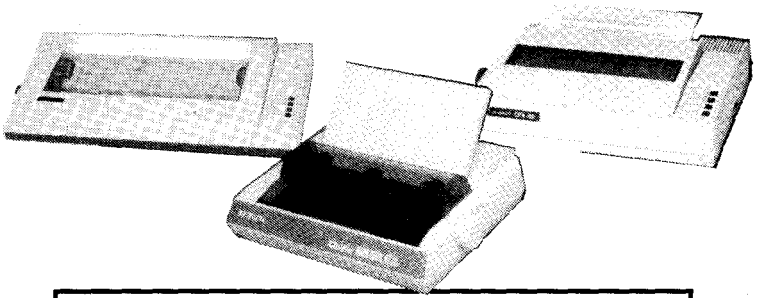

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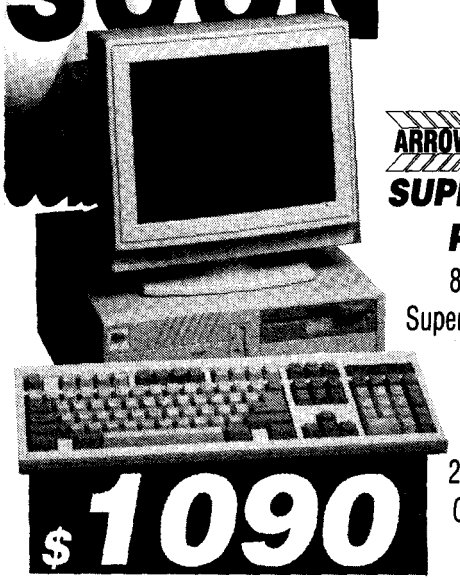

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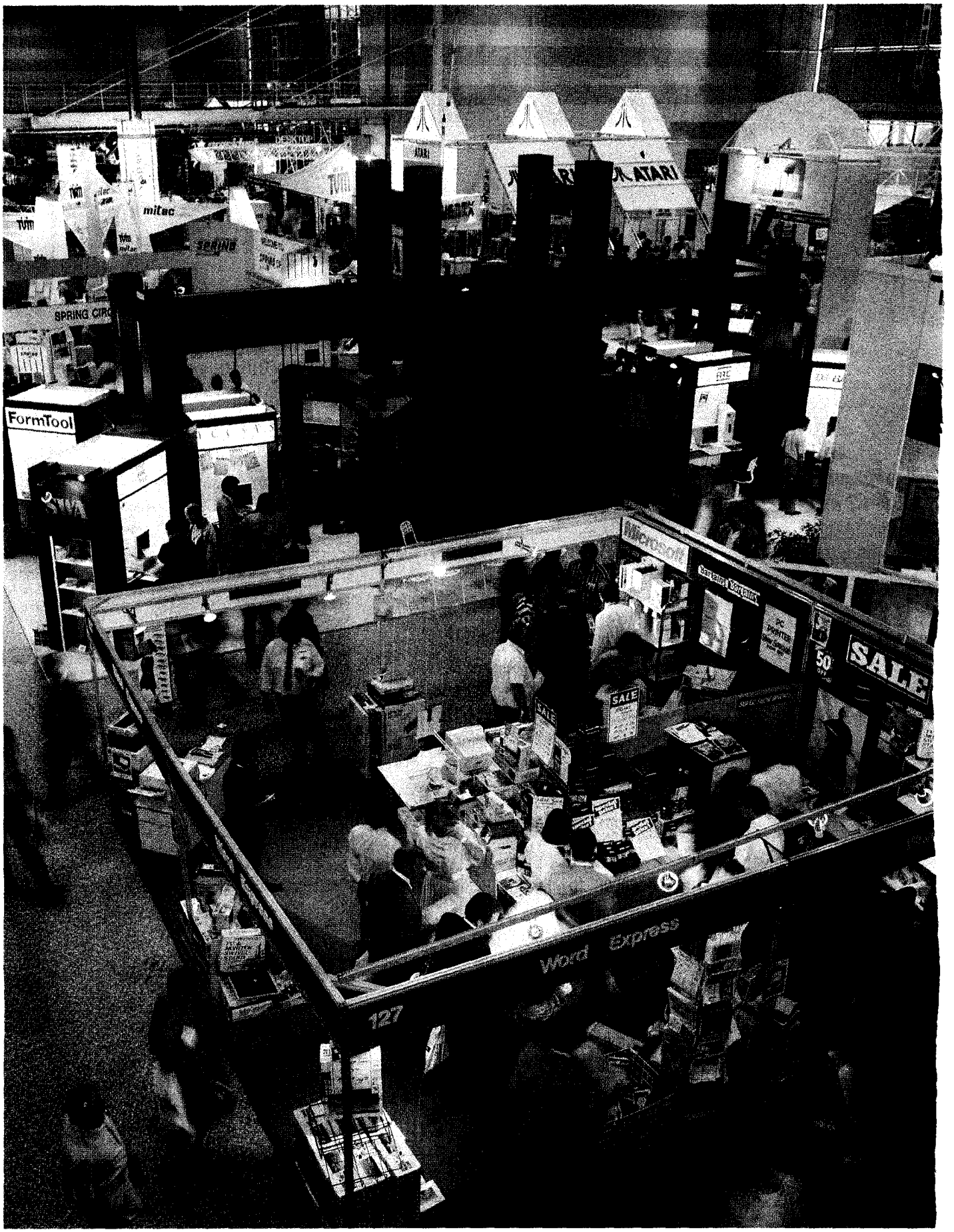
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Word Express

Australia's computer shows may not be as big and glamorous as their US counterparts; nevertheless, Kester Cranswick predicts this month's PC Show at Sydney's Darling Harbour will be a successful bash with something for everybody.

PCs: PUTTING ON A SHOW

By overseas standards, Australian electronics and computer shows are small affairs. Last November, the organisers of Comdex in Las Vegas saw 110,000 visitors push through the turnstiles to wander through the 86,000 square metres of exhibition, filled with 1740 exhibitors.

But Australia is doing its best in early March, when PC90, Office Technology 90 and Communications 90 come together at Sydney's Darling Harbour. The triple header will be the fourteenth PC show to be held in Australia since 1983.

The 200 exhibitors, including companies from as far afield as Taiwan, Malaysia, Singapore, the USA and Canada, will fill three of Darling Harbour's huge halls, and the organisers, Australian Exhibition Services, are confident of success.

According to Graham Selby, managing director of AES, PCs are an ideal exhibition subject, with the magnetism of the personal computer attracting visitors to the allied shows, dealing with office equipment and communications products.

Why attend a show? "Attending a show like this will save people time and money if they are in the market to buy a computer," said Selby. "They get the chance to look at a range of products and to get to know the people who sell them."

Two hundred exhibitors, including companies from as far afield as Taiwan, Malaysia, Singapore, the USA and Canada, will fill three of Sydney's Darling Harbour's huge halls, and the organisers are confident of success.

In recent years, many of the big manufacturers have steered clear of direct participation in shows, being represented instead by their principal dealers — who are usually given every assistance in showing off products to their best advantage. And after all, it is product that shows are all about.

Overseas, a major trade show is the opportunity for vendors to launch new products and preview future products. In Australia, which has few local manufacturers, world firsts are a rarity. More common is the first Australian showing of a product already debuted overseas.

This year, the headlines will be grabbed by 486 processors. These new PC powerhouses, rivalling minicomputers in brute power, are being rushed out by every vendor of note. There will be a 486 laptop made by Dolch on display on the Guardian Data stand.

Still in the laptop vein, Sharp will be showing one of the world's first

laptop computers with colour display.

Other firsts expected at PC90 include the first MS-DOS computer with a CD-ROM drive as standard, a new personal facsimile from Amstrad, the latest expert system from Level5, a new version of Advanced Revelation which is a very powerful database, the first showing of the latest Windows word processor, Ami Professional, an update of the low cost CAD package called Cadkey and the latest version of the Multiware 386 networking operating system.

The atmosphere of a successful computer show is hard to beat. You are bound to meet fellow enthusiasts. User clubs often take stands, acting as social gathering points for like-minded individuals and hoping to recruit new members. There are product demonstrations, seminars where you can learn about computers, competitions and always something interesting to investigate.

Computer shows have had to adapt to the times; in the early days,

ROLL UP! ROLL UP!

When PC90 opens its doors at Sydney's Darling Harbour, there will be plenty of new technology for PC fans to cast their eyes over. And as Workstation went to press, details of some of the new releases were starting to leak out.

In short, the major features of PC90 will be 486 PCs, a laptop with a colour LCD display, CD-ROM and Windows software.

Most attention will be focused on several 486 PCs, expected to be shown for the first time in Australia. Many were released at Comdex last November.

AST Research will most likely show its new 486 PCs, which can be upgraded from 386 hardware, and Aridyne Corporation has built new computers using AMI Voyager/486 and Gemini/486 motherboards (the Gemini/486 being suitable for both 386 and 486 processors). Eastern Micro Electronics will be showing the Taiwanese-built Profound 486 tower computer while Apricot will show its 486 VX FTservers — which were the first 486 computers in the world.

PC90 will also see the local debut of the first 486 laptop, the Dolch PAC 486-25, distributed locally by Guardian Data. It features electroluminescent VGA graphics, three 16-bit expansion slots and 100M or 200M hard disk.

Sharp will attract plenty of attention from laptop lovers, with its first showing of the PC-8081 colour laptop, boasting a 14 inch colour LCD screen, 80M hard disk, two expansion slots and a 386 processor.

CD-ROM should be one of the main drawcards at PC90, particularly the first PC to come with a CD-ROM as standard. The AT-compatible Headstart III CD-ROM PC will be launched on the Computer Equipment News stand. It features a built-in 680M read only CD-ROM drive and a CD with $2000 worth of software, such as the Grolier Encyclopedia, an atlas, a music sampler and a customised operating system.

Zenith should attract power users with the first Australian showing of its revolutionary multiprocessor-based Z-1000 computer, while at the opposite end of the market, Olivetti is hoping to beat Amstrad at its own game with the launch of its PCS budget PCs. They are, apparently, four times faster than Amstrad equivalents. Olivetti will also take the wraps off a 16MHz 386SX laptop, the M316. It weighs 6.8kg and has up to 5M RAM and an AT expansion slot.

Among the new printers, Sharp and Olivetti will introduce six page-per-minute personal laser printers; Kyocera will be debuting two new 18 page-per-minute laser printers, and Olivetti will have four new dot matrix devices. Sharp will also have a new colour scanner, the JX100, and an impressive colour printer.

Windows software will be all the rage at PC90. Software Suppliers will lead the charge with Ami Professional, the new Windows word processor on show for the first time at PC90. In addition to the usual word processor it has graphics, charting tools and excellent font capabilities.

There will be other Windows software too, such as a new project planner called TopDown Project Planner, and ABC Flowcharter, which has 30 standard symbols, 64 arrowhead styles, 32 fill patterns and good text handling capabilities. Wholesale Technology will introduce Simple Win, an iconic Windows management product.

Stepping back from Windows, PC90 visitors will be able to see version 2.0 of Advanced Revelation, which has an SQL interface, version 4.2 of Dataease (which is a best seller in Europe) and Open Access III, an all-in-one package with 3D graphics, a relational database, an SQL interface, a programming language, spreadsheet, word processor and communications modules.

One of the most interesting stands will be that of Alloy Computer Products, which will set up a live network to simulate a busy travel agency, with its PC simultaneously online to databases around the world and running word processing and spreadsheet packages.

These are only some of the likely highlights of PC90. Show visitors are bound to find more to interest, amaze and amuse them. See you there!

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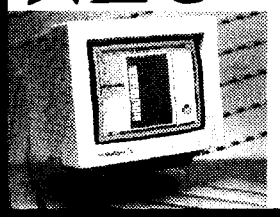

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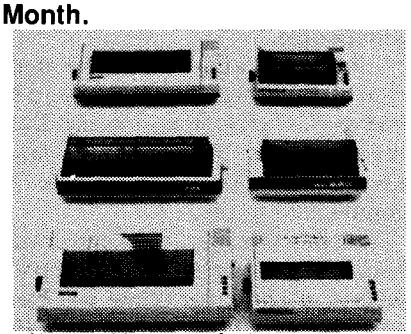

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the major computer vendors supported every show in their battle to get to new customers. Now the computer market has matured, new customers are harder to find and vendors have therefore changed tack. PC shows are really the vestiges of the boom days of computer. Along the way, the Australian showgoer has seen the rise and fall of Comdex and the Australian Computer Exhibition, which was a part of the annual Australian Computer Society conference.

Modern shows are more carefully targeted. Some, such as Macworld, are PC shows for one brand of computer. Others, such as IBM's Solutions Marketplace last year, are an opportunity for a vendor and a selected range of software suppliers and dealers to reach invited customers.

In fact, the vendor-sponsored show is becoming more common. Hewlett-Packard, IBM, Canon, Epson and Compaq are all in the game. The shows tend to be smaller, and have less razzle dazzle, but they are aimed at the serious business user who wants to discuss problems at length.

Another phenomena of the eighties is the seminar. Some are little more than day long sales pitches; others are genuinely useful and have a range of speakers to shed real light on an issue of importance. Seminars may be sponsored by a vendor, or independently run, with admission by ticket only.

If you are new to the computer game, take time to attend an education seminar. At least you will get to know some of the acronyms and develop an idea of what to ask the sales staff populating the stands.

If you are new to the computer game, take time to attend an education seminar. At least you will get to know some of the acronyms and develop an idea of what to ask the sales staff populating the stands. Go through the show catalogue to see who is at the show. Some of the bigger names might not be in the hall you expect. The catalogue also has a brief listing of what exhibitors will be showing.

Visit the 'must see' stands first. Have some specific questions if possible — stand staff like to know why you are interested in a product. And be prepared to come back to a stand if the expert you need to talk to is tied up.

With obligations out of the way, go for a wander. Try not to get too burdened down with pamphlets, and don't put a business card in the numerous barrels unless you want unsolicited phone calls from eager salespeople.

If you can afford to, take a credit card — there are often bargains to be had at PC shows. Some exhibitors use their stands to sell software, accessories and peripherals at competitive prices.

Whether you are a dyed in the wool hacker or just a babe in the computing woods, a computer show will have something for you.

March 1990
Vol 2 No 3

ICP

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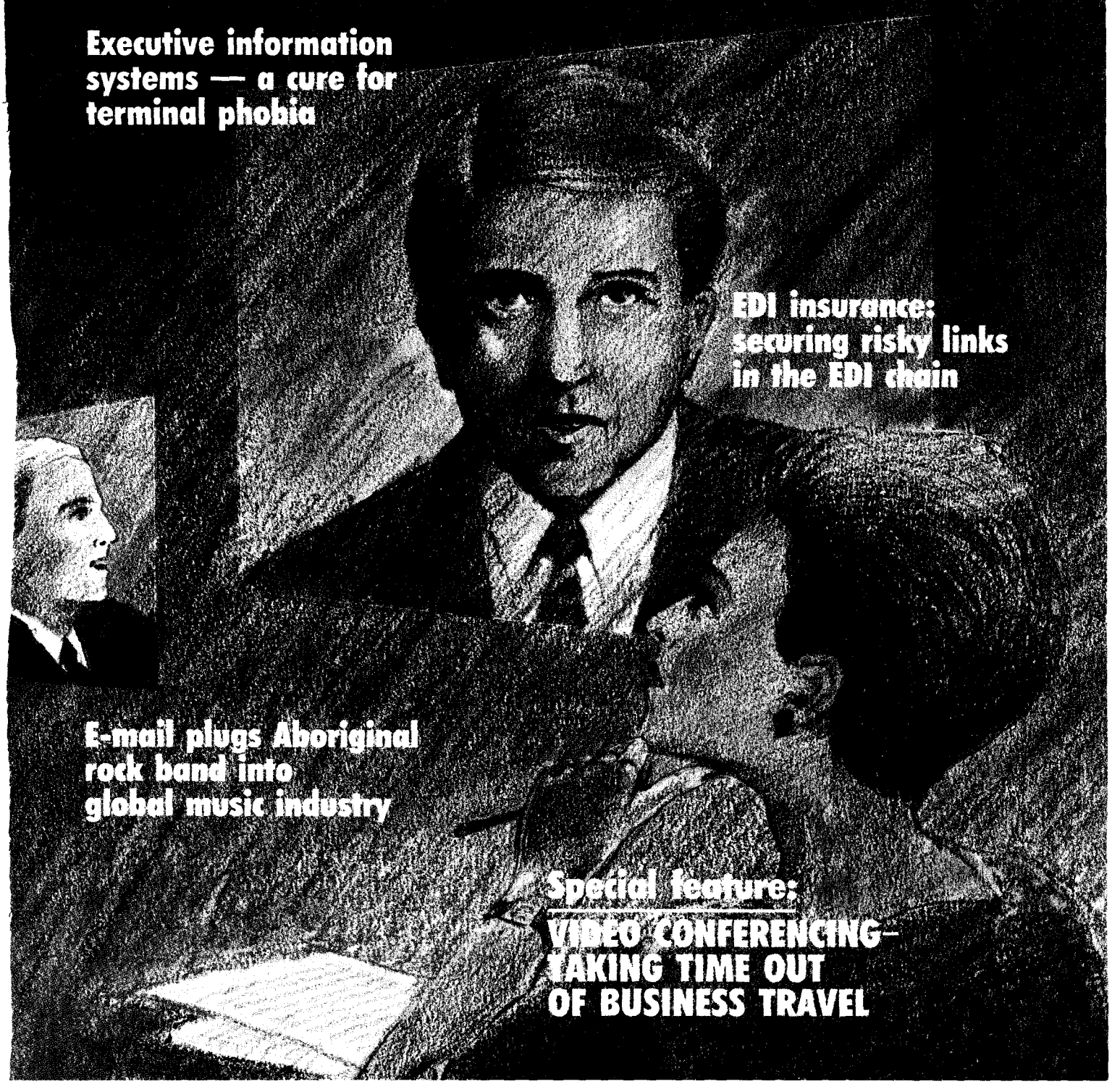

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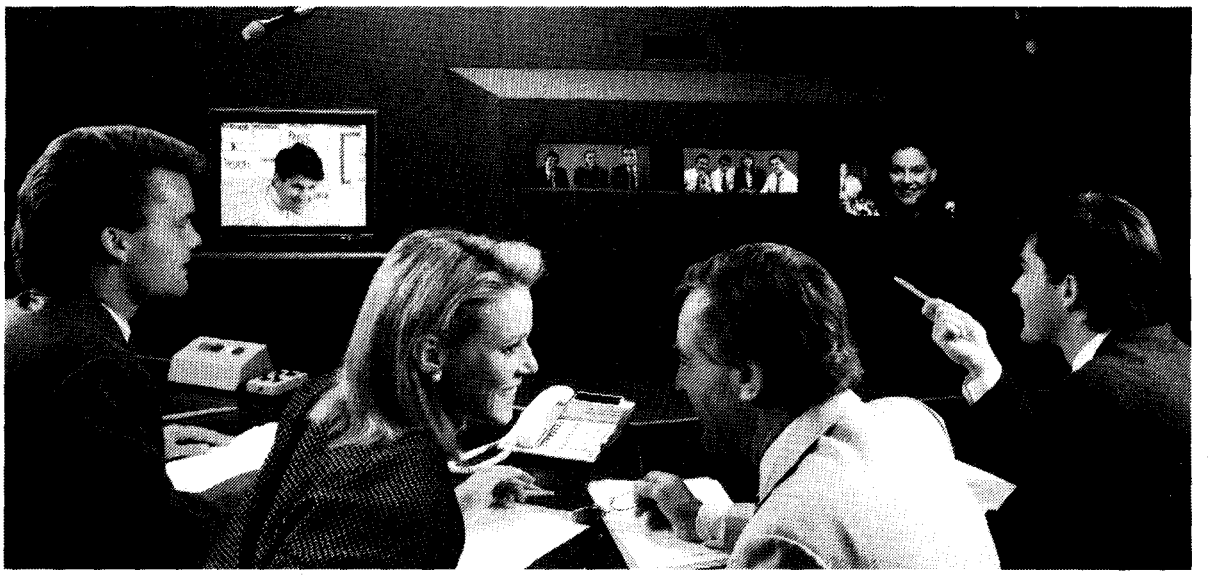

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HUB is published and distributed monthly by The Federal Publishing Company Pty Ltd inc. in NSW, 180 Bourke Road, Alexandria, NSW 2015. Ph: (02) 693 6666. Printed by HANNANPRINT, Sydney. Distributed by Newsagents Direct Distribution, Alexandria, NSW 2015. Distributed in New Zealand by Network Distributors Ltd, 67-73 View Road, Glenfield, Auckland. Ph: 443 0245. Fax: 443 0249.

HUB is distributed with ETI magazine or separately by subscription. Subscription rate for 12 issues post paid is A$48 (A$62 New Zealand, A$75 other overseas countries).

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Cover by Ron Glenister

INDUSTRY REVIEW

VAS HYPOTHETICALS

BY JOHN GRIFFITHS AND PHILIP STRICKLAND

Blake Dawson Waldron, Solicitors, Sydney.

Much has been said in the wake of the partial deregulation of the Australian telecommunications industry about the importance of the "level playing field", and the opportunities for free and open competition in areas not reserved for the common carriers – particularly the supply of value added services (VAS), private network services, cabling and customer equipment.

The Telecommunications Act, 1989, proclaims, for example, that all players are equal in the VAS field – but the commercial reality is that some players seem to be more equal than others. Some players have already complained about alleged anti-competitive behaviour by Telecom. Attention has been drawn to the risk of Telecom competing unfairly in the VAS area by cross-subsidising from its reserved services. In addition, cablers have complained about alleged predatory pricing by Telecom, and about the difficulties they have experienced (unlike Telecom) in obtaining supplies of telephone sockets.

Companies seeking to challenge Telecom for competing unfairly in the supply of VAS and customer equipment may do so either through Austel or the Trade Practices Commission. This article examines avenues under the Trade Practices Act 1974 (TPA).

Trade Practices Act 1974

Telecom is subject to the provisions of the TPA because it is a Commonwealth statutory authority which carries on a business: s2A, TPA.

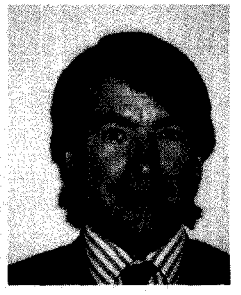
Part IV of the TPA is concerned with the promotion and maintenance of competition in trade and commerce. This Part prohibits corporations from engaging in anti-competitive conduct which, in general, substantially lessens competition in the relevant market.

Let us take two hypothetical examples of companies in competition with Telecom, or its subsidiary in the VAS industry.

These are relatively clear-cut, in order to highlight the relevant principles of trade practices law. In practice, such problems are rarely so straightforward!

Hypothetical 1

Radiodays Pty Ltd has been marketing a product called "Visulink" since January, 1989. Visulink provides the video industry with a network for user access to their services. By February 1990, a number



John Griffiths

of clients in the industry have purchased, and are using, Visulink. Telecom, through one of its marketing arms called Teledays, has developed a similar VAS, called "Linkup".

Telecom is attempting to break into this particular market and, therefore, has made special offers to potential customers.

Telecom's major offers are as follows:

First offer:
The customer is to be to charged only $4.50 per hour for the use of Linkup, which is marginally below cost price. Visulink costs $8.00 per hour to use.

Second offer:
Linkup has been allocated the 010 number on a nationwide basis. However, Visulink has been allocated different and longer numbers for each State.

Third offer:
Customers who use Linkup are promised better service calls and repairs, because Telecom will not only service any defects or malfunctions in Linkup, but will at the same time, and for free, attend to any problems with the network.

Radiodays, fearing that its share of the VAS market is significantly threatened by Telecom's dazzling offers to its clients, could apply to the Federal Court for an interlocutory injunction, restraining Telecom from selling Linkup to the public on the basis that Telecom has contravened s46 of the TPA, which prohibits a corporation from misusing its market power.

Alternatively, Radiodays might urge the Trade Practices Commission (TPC) to investigate any possible breaches of the TPA. The TPC is fully empowered to investigate any such complaint by a private company or individual, and to take appropriate action.

Does Radiodays have a reasonable chance of success?

There are three basic ingredients of s.46 liability:
(i) Telecom must have a substantial degree of power in a market;
(ii) Telecom must have taken advantage of its power in that market; and
(iii) Telecom must have done so for a prohibited purpose.

There are three prohibited purposes:
(i) eliminating or substantially damaging a competitor of the corporation in that or any other market;
(ii) preventing the entry of a person into that or any other market; or
(iii) deterring or preventing a person from engaging in competitive conduct in that or any other market.

Although Telecom has not yet sold any Linkup products, the first ingredient of s46 liability would probably still be satisfied. In the case of Tytel v Telecom (a case in 1986 involving the alleged misuse of market power by Telecom), the Federal Court held that Telecom, by virtue of its monopoly of the telecommunications network in Australia, was in a position to substantially control the market for supplying certain telecommunication

services, even though it had not yet actually entered that specific market.

As for the second ingredient, the High Court held in Queensland Wire v BHP (1989) that "taking advantage" merely meant making use of an opportunity. It did not require predatory or unfair conduct.

Most attention needs to be focused on the third ingredient.

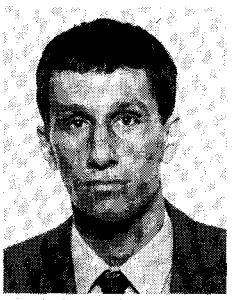
In respect of Telecom's first hypothetical offer, the proposal to charge customers for the Linkup service at less than cost price appears to be a classic form of predatory pricing. Predatory pricing involves a company pricing its goods or services at a level which does not necessarily reflect the company's efficient production or economies of scale, but rather is designed to damage competitors. Predatory pricing is a clear example of misuse of market power.

The level of Telecom's pricing is only one factor to be taken into account in deciding whether Telecom has a prohibited purpose. The timing of the pricing, and the manner of its calculation, can also be relied on as evidence of a prohibited purpose.

With the second offer, Telecom may be in breach of s46 by refusing to supply Radiodays with access to a single, nationwide number if there is a prohibited purpose in that refusal. Prima facie, the fact that Telecom is offering the service to its operating arm, Teledays, but not to Radiodays, is evidence that at least one substantial purpose in Telecom's conduct is to prevent Radiodays from engaging in competitive conduct in a VAS market.

As a defence, however, Telecom might submit that there are legitimate technical reasons why an equally accessible number cannot be offered to private telecommunication companies.

Regarding the third offer, Telecom might be held to be projecting its monopoly in the provision of telecommunications networks into the deregulated areas for the purpose of either eliminating or substantially damaging Visulink, or preventing Visulink from being competitive in a VAS market.



Philip Strickland

Hypothetical 2

The same facts exist as in Hypothetical 1, except that Teledays Pty Ltd is now a separate company, in which Telecom has a substantial shareholding. Telecom's offers, as specified in Hypothetical 1, are now being made to customers by Teledays. These offers are made by virtue of informal arrangements between Telecom and Teledays.

In addition to challenging Telecom's and Teleday's conduct on the basis of s46 of the TPA in the manner discussed above, Radiodays could also attack the legality of the arrangements between Telecom and Teledays, on the basis of possible breaches of ss45(2) and 47(6) of the TPA.

Subsection 45(2) of the TPA prohibits a corporation from giving effect to a provision in a contract, arrangement or understanding which has the purpose, or has or is likely to have the effect, of substantially lessening competition. Informal arrangements, which may be no more than an expectation created by Telecom in Teledays that Telecom will offer certain services to Teledays on a preferential basis, are caught by s45 of the TPA. In s45(2) cases, the courts will examine the impugned arrangements in the light of their effect on the VAS market rather than their effect on Radiodays. If Radiodays is the only, or a significant, player in that market, an arrangement which substantially damages Radiodays will probably have a substantial anti-competitive effect in the market. Subsection 45(2) will not apply, however, if Telecom has a greater than 50 per cent interest in Teledays (sub-s.45(8),TPA). However, s46 may still apply.

Subsection 47(6) prohibits third line forcing. Third line forcing involves a corporation supplying goods or services subject to a condition that the acquirer will acquire goods or services directly or indirectly from *another* person. It is possible that the courts could interpret Telecom's offer to customers of free telephone repair or maintenance service as an offer to supply services on the condition that the customers acquire Teleday's products or services. The practice of third line forcing may exist even if Telecom itself does not impose the condition. The condition may have arisen, by implication, from all the circumstances in which Telecom's services were offered to the customers. Sub-section 47(6) applies to Telecom even though it is the supplier "forcing" the services of a subsidiary or associated company.

Assuming that the court finds that all of Telecom's offers are a contravention of s46, what remedies are available to Radiodays against Telecom or Teledays? The court might issue an injunction against Telecom and/or Teledays restraining them from engaging in the offending conduct. The court might also award damages to Radiodays to compensate it for losses it has suffered by reason of Telecom or Teledays' contravention of the TPA.

If there is a contravention, the court also has the power to declare void, or to vary, any arrangement as it sees fit. Hence, it may vary the sweetheart arrangements between Telecom and Teledays so that Teledays is forced to compete on a more equal footing with Radiodays. Another, less likely, possibility is that the court will order Telecom to provide services to Radiodays on the same basis as it supplies those services to Teledays. ■

The Department of Transport and Communications is conducting a wide-ranging telecoms policy review to determine a viable market structure for carrier competition. **Liz Fell** reports.

NO QUICK FIX FOR AUSSAT

The Federal Government has decided to wait until after the elections before applying radical surgery to its financially troubled satellite company whose debt to equity ratio has skyrocketed to a massive 22:1.

Aussat's gearing is "frightening" and "far above what any normal enterprise would regard as commercially acceptable — very far above," Minister Willis admitted last December. He even expressed "grave doubts that a satellite technology enterprise only will ever be fully commercially viable."

This crisis of confidence in Aussat's viability as a "stand-alone, single-technology company operating within a highly regulated market" was echoed by Telecom's corporate strategy boss, Dr Terry Cutler.

A more balanced view of the strengths and weaknesses of satellite technology has emerged since the early 1980s, Cutler said, and optical fibre and mobile radio are replacing it as "the glamour technologies" of the 1990s.

The Minister and Cutler were at a seminar organised by the Centre for International Research on Communication and Information Technologies (CIRCIT) to discuss a policy research paper prepared by Dr Sam Paltridge analysing Aussat's parlous financial state and positing a range of future options.

Willis chose to disagree with Paltridge's assessment that Aussat's performance had fallen "far" short of expectations. This "sounds to me like we are saying it has been a failure," he said. He did, however, concede that it certainly had "fallen short" and that expectations were "possibly a bit high blown".

As beneficial owner and policy-maker responsible for Aussat's regulatory regime, the government has now established a departmental telecoms policy review to examine and report on, among other issues, the structural, regulatory and ownership arrangements between Telecom, OTC and Aussat by June 30.

Among the options for Aussat the Minister canvassed were: modifying its second generation plans; providing a better financial base; allowing it to compete in a wider range of markets domestically and/or internationally in areas such as Southeast Asia; merging it with Telecom or OTC.

In a series of questions that must have been posed and answered only 18 months before, when the Minister and his colleagues placed their imprimatur on Aussat's contract to purchase second generation satellites which required a $695 million financing package, Willis asked:

- can Aussat, with its history of rising prices, match terrestrial services in terms of cost?
- can some services be delivered more cheaply by other satellites?
- what sources of additional demand are there for satellite services?
- what are the prospects for Aussat servicing its debts, which will become bigger with the next generation?
- is the second generation capacity excessive and, if so, what are the implications?

Representing Aussat's largest private sector user, Judi Stack from Bond Communications launched a scathing attack on Aussat's planning and marketing. Her position was crystal clear: Aussat isn't viable and won't be over the life of its second generation "Rolls Royce, all bells and whistles system.

"Remember we are talking about 65 per cent more capacity than exists on the first generation which, over its life to date, we estimate has been less than 60 per cent utilised," she said. This estimate contrasted with that supplied by the Minister, who cited the lease of 70 per cent of current capacity as evidence of Aussat's considerable success.

Stack said both the satellite company and the government had ignored television industry advice on how second generation capacity exceeded market potential. In fact, Aussat had never produced evidence of future demand except to say it would be consistent with current use levels and anticipated growth.

"Few projects would ever get off the ground in the private sector with that sort of understanding of the market," she told the seminar. "The concept of a national satellite system, justified on the grounds of community spirit and not financial viability, is an

(Continued on page 13)

TELECOMS POLICY REVIEW

Minister Willis wrote to industry organisations at the end of December announcing that the latest telecoms policy review would examine, among other issues:

1. The costs and benefits of structural change to the relationship between Aussat, Telecom and OTC including:
   (a) the scope for and costs and benefits of merging one or more carriers into a single organisation;
   (b) the desirability of maintaining the present cross ownership and cross Board membership arrangements among the three carriers;
   (c) the capital structure of Aussat and options for meeting its financial needs;
   (d) consideration of whether satellite services should continue to be delivered by a single technology enterprise.
2. The future requirement for satellite services in Australia, including the extent to which these could be met by other satellite systems and the scope for, and desirability of, modifying Aussat's second generation satellites either by rationalisation or by altering the footprint to allow a wider geographical reach;
3. The appropriateness of the boundaries of the respective carriers' monopolies including the desirability of regulatory and legislative change to allow greater competition between the carriers both domestically and internationally.

The review will also take account of developments in broadcasting policy having a bearing on the role of the carriers, and any government decisions in relation to the current references before AUSTEL. The deadline is June 30.

NZ is set to adopt nationwide teleconferencing should current NZ Telecom trials prove successful.

A SOLUTION LOOKING FOR A PROBLEM

BY JANE McSWEENEY

Teleconferencing is not widely used in New Zealand, but many companies say they are examining the technology and expect to be using it as an everyday tool in the mid 1990s.

However, moves to adopt teleconferencing could be sped up by current Telecom New Zealand trials. If they prove successful, a public nationwide service will be introduced about June.

The trials were initiated by a Telecom staff member's university project for his Master of Business Administration degree. His project was to find out whether teleconferencing would be used in New Zealand as a travel substitute.

The project was picked up by his employers and now has three full-time staff working on the feasibility of introducing teleconferencing nationwide.

Wasted time

Project manager William Waterworth says the team did a survey of business communication requirements and found many business people complained of time wasted in transit between meetings. However, he says, teleconferencing is not a substitute for travel but, rather, a time management tool which improves productivity.

The Telecom project has five stages. The first is a trial audio conference within Telecom head office and extending to its regional companies. More than 50 per cent of Telecom meetings will be conducted this way and will be evaluated in May. This second stage will introduce telewriting aids for audio conferences and will be used for internal training. The next stages will be progressively more sophisticated, from one-way video and two-way audio through to full multipointed videoconferencing links between Auckland and Wellington using 2.048 megabit lines. Codecs at each end will digitise and compress the signals.

As costs drop, social videoconferences become more common.

Waterworth says that while the video will not be television broadcast standard it will be of high quality. He believes the cost of teleconferencing will inhibit its spread in the short term.

Waterworth says the set-up costs and time involved are considerable. The trial is using GPT codes which cost NZ$100,000 each, and the leased line between Auckland and Wellington is NZ$284,000 a year. The line has to be booked in advance and then for a minimum two week period.

Telecom's Network International company is considering setting up a line specifically devoted to videoconferencing should there be sufficient demand. It will be tariffed differently to other leased lines and will not have as many restrictions on its use.

The project is also evaluating the use of audio visual equipment including cameras, monitors and sound systems and how best to rig up conference rooms. "Few companies will have the sophisticated audio visual equipment necessary, but Telecom is considering leasing such equipment as a package deal," says Waterworth.

Telecom has researched the worldwide market for teleconferencing and found a burgeoning market within the United States. Audioconferencing has grown fourfold over several years and is widely used by hotel chains, AT&T, McDonald's and US Sprint, among others.

In New Zealand, several corporations have indicated their interest. Fletcher Challenge cabled up its head office two years ago in readiness for videoconferencing but has never used it because of the expense. However, it is an enthusiastic user of audioconferencing.

Attractive tool

Manager of Fletcher Intelligent Buildings, Terry Ballard, says videoconferencing is an attractive communications tool, but a one time tie up with London made the company baulk at the cost. That conference cost NZ$29,000. Almost $20,000 of that went into paying for the international link. Fletcher Challenge has its own video projection equipment.

Ballard says videoconferencing will never replace face-to-face communication but has proved its worth, particularly during the Australian airline pilot's strike, as a way to link people who need to use their time productively.

IBM New Zealand is also considering videoconferencing but is waiting on IBM Australia's trials with its interactive satellite education network. The trials use instructors teaching in studios equipped with television and microphones. A video

(Continued on page 25)

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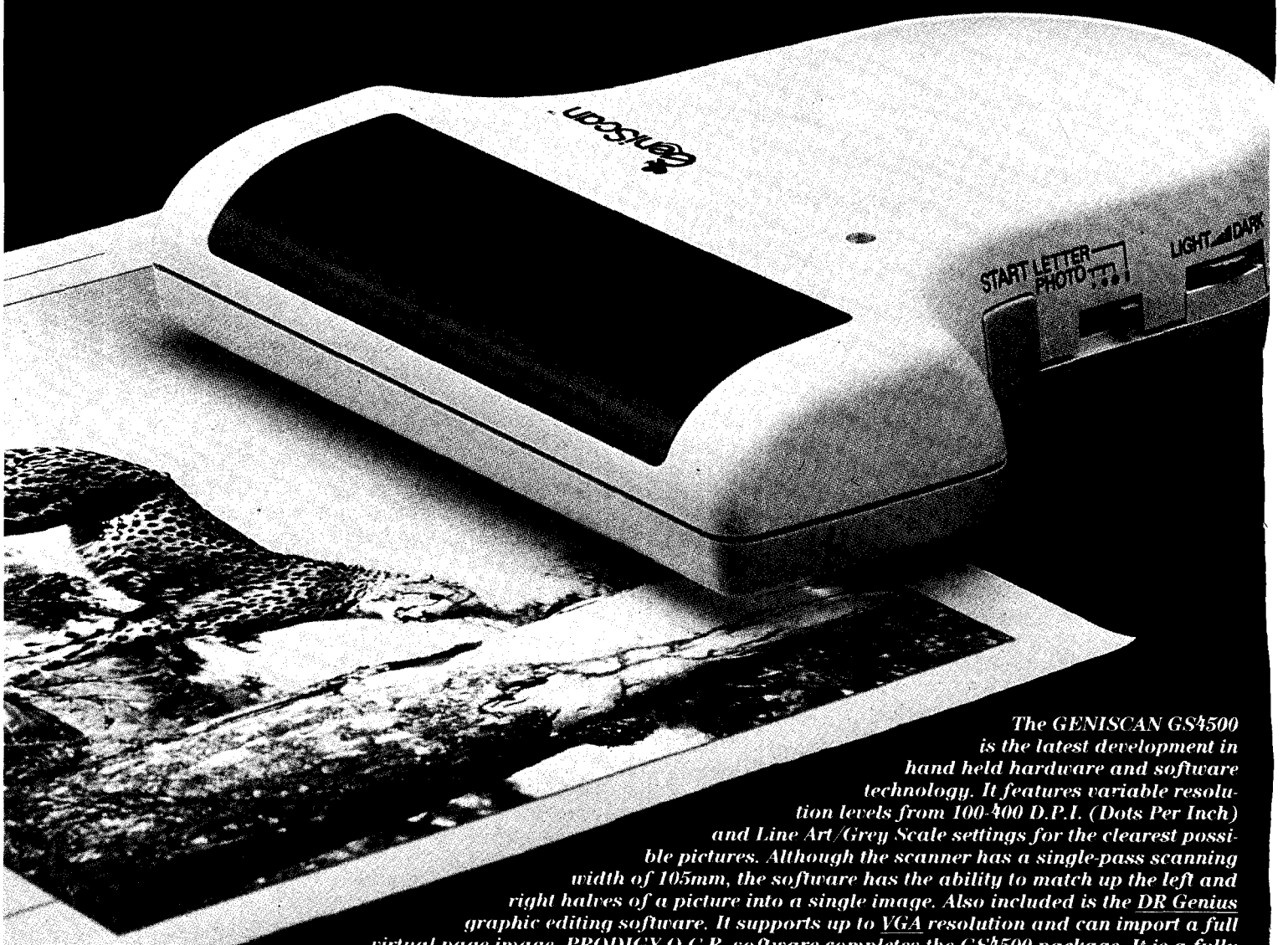

The GENISCAN GS4500 is the latest development in hand held hardware and software technology. It features variable resolution levels from 100-400 D.P.I. (Dots Per Inch) and Line Art/Grey Scale settings for the clearest possible pictures. Although the scanner has a single-pass scanning width of 105mm, the software has the ability to match up the left and right halves of a picture into a single image. Also included is the DR Genius graphic editing software. It supports up to VGA resolution and can import a full virtual page image. PRODIGY O.C.R. software completes the GS4500 package. It is a fully trainable Optical Character Recognition programme. Unlike cheaper, generic character recognition softwares, the British written PRODIGY programme will read and recognise not only Monospaced, but Proportional and Typeset text as well. It's accuracy is unbelievable, its value is unsurpassable.

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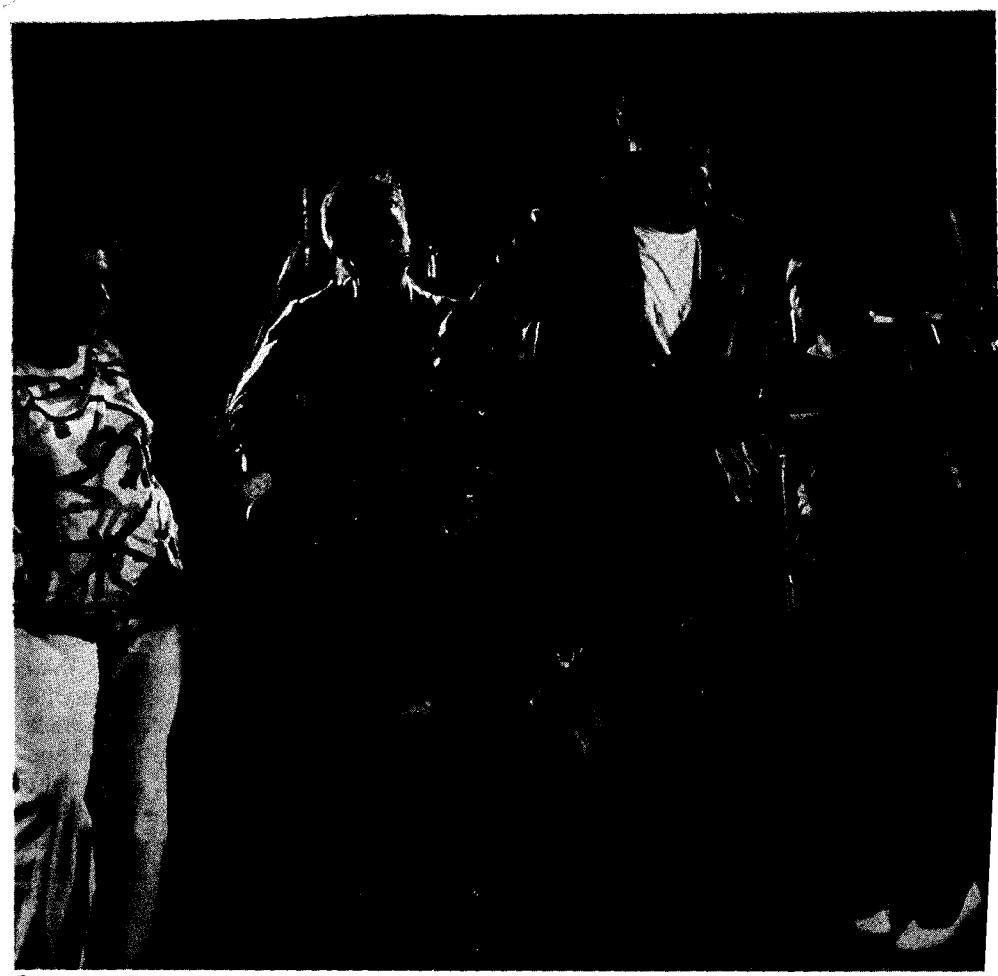
WHITEFELLA MEDICINE

business... new cellular ...rt to embrace ...ronic shirtpocket ...rap Metal — an Ab... ...l rock band based in Broome, WA — is leaving them behind with their innovative use of electronic mail and global communications. Using a seven-year old Tandy Model 100 notebook computer, they're surmounting the tyranny of distance between the outback, the mainstream music industry in Sydney and the rest of the world, through an innovative sponsorship from Network Innovations — the electronic mail computer network of OTC/Dialcom.

In July 1989, Network Innovations granted the band a year's free use of their electronic mail system E-mail; it allows the band to link up with their Sydney-based management company as well as the global music industry which has embraced E-mail for more than five years as a primary communications tool. The valuable sponsorship arrangement that gives the band access anywhere in Australia to the E-mail network not only affects the way they do business at home and on the road, but also provides them with the flexibility and capability to put together deals which help them break through the 'Kangaroo Curtain' into overseas music markets.

When the airline strike threatened to keep them from playing a crucial festival in Darwin, a series of messages between the band, their Sydney manager and publicist, plus the Northern Territory Arts Council, snagged the band a rerouting of a BHP Petroleum charter plane that took them to Darwin to complete their dates. A return trip on a corporate jet facilitated their previously booked tour plans to Perth and allowed them to schedule a demo recording session in tandem, leading to a major record deal. In addition, they were able to



Broome band, Scrap Metal: **surmounting distance through the electronic mail network of Network Innovations.**

finesse a seven camera video shoot which will see the band in a one hour concert special simulcast on ABC TV and the JJJ Youth Network. And during all this, E-mail communications between the band and their equally mobile publicist, Denise Officer Brewster, made possible a PR campaign which supported the release of their album "Broken Down Man" and single "Nimunburr (Flying Fox)" through their distributor, Polygram Records.

A simple start

It started simply enough. When the sponsorship was secured for the band by Main Act Management, it was both an experiment for Network Innovations and a critical progression in the band's career. If an Aboriginal band from the outback could take a basic computer and modem, utilise E-mail with its Faxmail and Telex facilities and become technically conversant with the computer network, then it would serve as a microcosm of big business use of OTC/Dialcom and an inspiration to corporate users to use the same technology for their mobile and office business needs.

It took only a few weeks for personal and road manager Duncan Campbell to become reasonably proficient with the simple wordprocessing features of the Tandy 100, at the same time mastering the

inbuilt telecommunications package and the intricacies of electronic mail. "It was a bit daunting at first," Campbell admits, "because I'd never really used a computer before, and the concept of transmitting and receiving text files and other messages over telephone lines was what we jokingly called 'heavy whitefella medicine'. But with only an hour or so of instruction from an OTC technician based at a satellite station in Broome, a day's reading through the excellently simple and comprehensively documented OTC/Dialcom manual, I was on-line and confident enough to explore the capabilities of this wondrous new tool. It was like a keyboard player getting a cutting edge synthesiser and almost instantly being able to compose and play it with style and ability."

During the first awkward week or so, messages poured back and forth between Broome and Sydney. Their manager was on the road at times — both interstate and internationally — yet the band was able to keep daily contact with him due to the interconnection to the global Dialcom network. Meanwhile, their publicist arranged interviews with print and radio journalists, sending daily updates to the band on its outback itinerary.

As Campbell relates, "Before leaving Broome on the band bus, we'd download all the messages from Main Act and then type responses on the road. A few hours later, we might stop for gas, and I'd head for the pay phone to plug in a simple acoustic coupler. I'd send our responses as well as pick up more messages. After a few more hours on the road, we'd stop for a billy of tea next to a solar powered phone booth and again send and receive communications, perhaps do an interview with a Melbourne paper, confirm a contract that had been sent through, as well as direct shipments of merchandise (e.g. shirts) and alter our touring itinerary to accommodate new bookings."

The band also used the storage facility of the E-mail system to file their messages and created an on-line file structure for keeping copies of necessary information. Says Campbell: "We first set up files to store E-mail messages — simply typing .FI MANIN to put management messages into one category an[illegible] to store our mail [illegible] chronological manner. It [illegible]DOUT documented our communications [illegible]a later recall, but also showed us the power of E-mail for a number of other band business functions. We created textfiles on-line to store a copy of our bio, contracts for venues and promoters, song lyrics for both the past album and the new tunes we are working on for the next release, plus a variety of stock letters and 'boilerplate' paragraphs to create letters that we can send by E-mail to other users in our business — by fax through the Faxmail facility of our mailbox or even by Telex."

When the airline strike threatened to keep them from playing a crucial festival in Darwin, a series of messages snagged the band a rerouting of a BHP Petroleum charter plane that took them to Darwin to complete their dates.

The OTC/Dialcom Faxmail facility has proved to be a boost to their communications abilities because the music industry has embraced facsimile machines as the major contractual and communications method. Previously, the band had used the local Aboriginal resource centre's fax machine, but it was over two kilometres away from the office and they would only find out about incoming messages if they were called, or checked in daily. Plus, they would have to wait until the next day to send after hours faxes, missing the overseas recipients due to time zone differences. And because the resource centre's fax was used by a number of people, confidentiality of fax messages was a concern.

Faxmail, an outgoing facility only, cured the outgoing fax problem. For incoming faxes, nonconfidential messages could still be received at the resource centre or at hotels on the road; and the more crucial fax replies were sent to the Sydney management office, where they were outlined and sent by E-mail (or rekeyed entirely in the case of contracts for consideration). It was then easy to alter the contract a few minutes after receiving it, in the office, or on the sponsorsh[illegible] Scrap Meta[illegible] discovering new w[illegible] technology available to case of performing new com[illegible] we receive an annual royalty APRA, the performances collectio[illegible] society, after we send in song lists from all our shows. The lists are used to compute share of a common income for songwriters," Campbell says. "Before, we would keep slips of paper from each gig, collect them at the end of the year and send them in, often having lost quite a few on the road. Now, we enter each night's songs in the computer, file them in an on-line APRA file and print out the report in one shot, making our accounting easier to document and verify.

"Another thing we are starting to do is create an on-line forms system which will database all of the venues we play at and all of the promoters and booking agents we deal with. We can call up a particular venue, find out the contact numbers, load in logistics, stage and power requirements as well as access info on hotels in each town. This, in turn, leads us to create financial files that track our daily expenses and weekly cash flow for later reconciliation after the touring is over."

Scrap Metal intend to take their use of E-mail much further in the future. If a planned North America and European tour eventuates in the northern summer of 1990, their portable communications system will interface with the international Dialcom system in each country they plan to tour through.

Just for the record, this article was typed on a Tandy Model 200, E-mailed to Scrap Metal for correction and approval and E-mailed back within a few hours to be then sent to the editor's Network Innovations box for editing and typesetting. ■

Music industry entrepreneur and freelance writer, Phil Tripp, is an accomplished user of mobile communications and a member of 'Club Dead'.

Faced with executives too busy to learn to access information but no money for information specialists? Executive Information Systems (EISs) could prove the circuit breaker.

EXECUTIVE INFORMATION SYSTEM: TOOL OR TOY?

BY KESTER CRANSWICK

The average executive is suffering from information overload. As businesses get more and more computerised, as databanks become larger, managers who want to stay on top are finding that data does not necessarily equal information.

Worse, they are too busy to master the skills needed to get personal access to the data in their organisations. Meanwhile, pressures on overheads are such that employing armies of staff just to get that information is no longer possible; so executives *must* learn to access the information themselves.

One answer to the problem is an Executive Information System, or EIS. An EIS lets a non-technical user (typically a senior manager) call up and manipulate data from anywhere in the corporate computing network, with a minimum of fuss. It digests the masses of data in the belly of the mainframe and spits it out in a clear, concise, instantly understandable form.

The EIS market is already well established in the US. Analysts predict it will be worth $US125m by 1992, with software companies such as Cadet Executive Information Systems, Comshare and Pilot Executive Software vying for a share of the business.

Vidis Kulinsais manages IBM's range of office products, including EIS systems, and to Kulinsais they are the flavour of the month. Statisticians and mathematicians have been using them for many years, but progress has brought new opportunities.

"Previously, the sort of people using these tools weren't executives," said Kulinsais. "There are systems now that are comfortable enough for executives to use, with most having an enthusiasm to understand what EIS is about."

The interface is the key to this top end market, where things such as mice and touch screens help overcome QWERTY phobia.

There is more to an EIS than just calling up a few charts. "Users are saying they want to massage figures," said Kulinsais.

IBM's EIS solutions include Executive Decisions/VM and Data Interpretation System, which run on networked PCs and allow mainframe data to be called up, analysed and presented in a graphical form. The interfaces use a desktop metaphor with icons to represent files, tasks and so on.

"The strategy is that we have a series of files, with tools to extract information from them and tools to present a report or a graph," said Kulinsais.

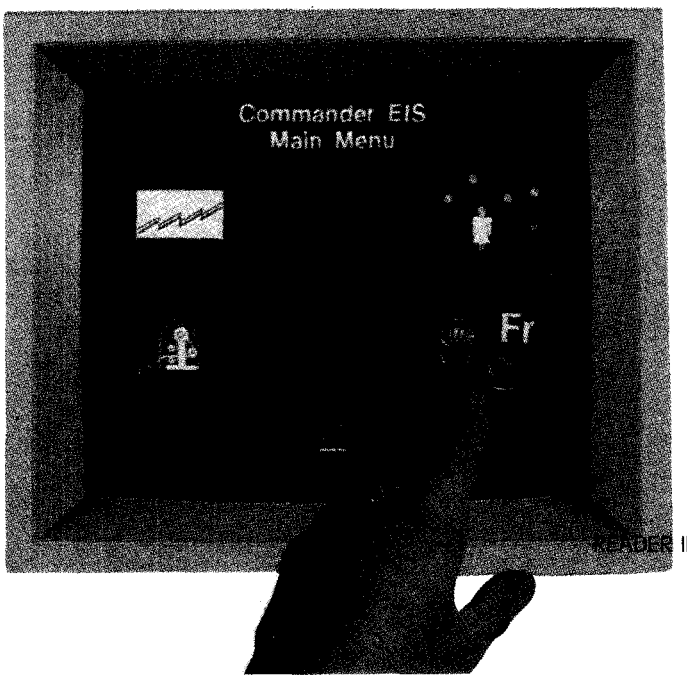
In the US, EIS users include Duracell, Westinghouse, Xerox and Motorola, and, in Australia, EIS is beginning to infiltrate some organisations.

Des Harvey, manager of information technology for the West Australian Water Authority, is three years into a five year plan to greatly enhance the use of computers. The 1800 office staff of the Water Authority are served by a Hitachi mainframe, nearly 1000 PCs and 400 terminals. EIS is a major part of the computerisation strategy and is at the heart of a Performance Management System.

The first stage was implemented last November, serving around 20 managers. "We expect to have 30 to 40, as we roll it down at least two levels of management," said Harvey. "But that is just the tip of the iceberg. Eventually, we will have up to 150 users."

Harvey evaluated a number of EIS products in the eight month leadup to project implementation. Eventually he settled on Commander, an EIS distributed locally by SPL. The Water Authority has it running on Olivetti and NEC PCs, equipped with mice. Commander interacts with a mainframe-based report generator called System W.

But choosing the product was only the beginning. "You are delivered a set of tools, but there is still a large amount of work in developing data definition standards," said Harvey. "A lot of people lose sight of the effort involved in collecting data



from a range of sources and making sure it is consistent," he said.

In these early stages, the system presents fairly static data in a consistent and up to date form. "As people become familiar with what it can do, we will see more original concepts emerge," said Harvey. He believes that EIS is now a viable technology, though not cheap. The Water Authority implemention cost around $1m.

Bernie Green, regional director of advanced technology at KPMG Peat Marwick, is less convinced of the need for off-the-shelf EIS solutions. He has been advising a number of major banks on putting together EIS solutions using more general purpose software, like Apple Macintoshes, networked into the corporate computing network in such a way that they can access data from anywhere. The interface is provided by Hypercard and SuperCard, novel software packages that guide a user through data intuitively and often pictorially.

Opal, an Australian-developed software package, is used to manage the communications links to other types of computers, while Wingz, a powerful spreadsheet with excellent programming features, is used for presentation of data. "Doing it this way, the client probably spends the same amount of money on consultancy as on the licence fees for the custom EIS products," said Green. But, he maintains, they get a better system.

"The information required to be implemented is not uniform," he explained. "The only approach is to do it in a modularised fashion, examining the information needs for each part of the business and then working out ways to exchange information between the different groups."

It is a case of one product trying to be all things to all people, and Green does not believe it can.

EIS is still in its early days. The concept and products are still evolving. But organisations that choose to pioneer EIS could find themselves with executives who have the cutting edge. ■

NO QUICK FIX FOR AUSSAT

(Continued from page 6)

honourable but unrealistic and, dare I say, irresponsible sentiment.

"No option provides an alternative to writing off the losses — and believe me, The Bond Group knows the pain of it — but it must be faced," she said. Meanwhile, she recommended the government put the new satellites on hold while it found out the cost of cancelling the contract, scaling them down or selling them off. It should then call for new satellite tenders from the public and private sectors.

Aussat supremo, Graham Gosewinckel, seized the opportunity provided by CIRCIT to outline a long-term plan to open up the market completely by:

- allowing competition in all forms of domestic and international telecoms services with service providers operating on a fully commercial and equal basis;
- removing any possibility of cross-subsidies or special powers vested in competitive service providers;
- ensuring that no organisation providing telecoms services should be restricted to one technology; and
- removing any possibility of a conflict of interest between provision of facilities and provision of services.

Clearly prepared for Gosewinckel's call for a free-for-all market, and possibly mindful of his interest in a new cellular mobile telephone service, Telecom's Cutler asked whether the government was acting as the ultimate shareholder or policy-setter in this review.

"Introducing more nominal competition between the commonly-owned carriers to solve the balance sheet problems of one or more carriers would reduce shareholder value, according to all my initial 'back of the envelope' calculations, by the order of half a billion dollars," he said. "The introduction of a new entrant would increase this loss to closer to one billion dollars."

Arguing that the review would need to address both ownership structure and market structure in a coherent and tightly linked manner, Cutler said that among the issues that must be resolved to establish a competitive framework were:

- whether competitors should be allowed simply to resell trunk capacity leased from Telecom or to invest in and use alternative trunk networks or media;
- establishing interconnect arrangements, pricing structures, quality and performance standards;
- establishing whether competitors should provide national coverage; and
- deciding how the cost of Community Service Obligations should be borne.

With foreign carriers such as Cable and Wireless and the US "Baby-Bells" poised to secure a slice of Australia, departmental bureaucrats face a challenging task in this review which will help determine our future position in the global market.

As Cutler warned: "The domestic telecommunications network services market is an $8 billion industry; international traffic generates a further $1 billion. Aussat is to this domestic market what Australia is in the world telecommunications market: a less than 2 per cent player." ■

To maximise the efficiency of a LAN or WAN effective management is needed; but choosing from the plethora of network management products is bewildering. A logical approach is to look at the situation from the top down.

NETWORK MANAGEMENT IN PERSPECTIVE

Continuing our February LANS feature

BY GRAHAM STARKINS

There are many products in the LAN and WAN marketplace which claim to fall into the network management category. These range from simple monitoring devices through to full-blown, standalone network management systems. This provides a bewildering set of cost options to anyone considering the introduction of some form of management into a network system.

A network is a business investment. While the network in itself does not produce revenue, it has the ability to affect bottom line profitability by a combination of improvement in efficiency and minimisation of hardware and software investment. To maximise this efficiency on a day-to-day and long term basis, like any business investment, your network needs to be managed.

A logical approach to network management is to look at the situation from the top down, first addressing the business requirement, and then seeking an integrated set of tools which will address problems associated with planning, configuring, monitoring and trouble shooting the network.

Management of any large network is like looking at an iceberg. Much of what needs to be managed is not immediately visible. Obvious candidates for management are the network resources such as fileservers and mailservers, etc; much of the resource management can be addressed by existing de facto standards such as IBM's Netview, DEC's ENMA and Hewlett Packard's Openview. However, in a large network, management of the physical carrier system is also important to ensure day-to-day error free operation and efficient use of the bandwidth.

Management systems for WANs tend to be more advanced in this area, due to the fact that large sums of money are paid to Telecom for the privilege of using their services — there is nothing like a hefty bill falling on the doormat to ensure efficient use of that for which you are paying! However, management of LAN carrier systems tend to be sadly ignored due to the "hidden" nature of

Computer vendors have been slow to bring their OSI solutions to market. It needs organisations with clout to start dictating what is required.

OSI — THE FREE BEER TOMORROW SYNDROME?

There has been much written about OSI (Open Systems Interconnection) over the last 10 years. A great deal of that verbage has a similar message to that of the fly-specked sign seen in some pubs announcing *"Free Beer Tomorrow"*. Of course, when you eagerly enter the pub the next day, the sign has not changed — tomorrow never comes!

So, as we enter the tenth anniversary year of the publishing of ISO 7498, the Open Systems Interconnection Basic Reference Model, it is appropriate to review what OSI has done to change our lives in the last decade, and look at what it is going to do for us in the future.

One of the common misapprehensions of a person getting involved with OSI for the first time is that the OSI Model is a panacea to all data communications problems. Unfortunately, this is not the case, as the OSI Basic Reference Model is purely as described — a reference model, which sets out a layered approach to the architecture for a set of further standards, dividing the complex overall problem of communication into a series of simpler problems, and defining the relationships between them.

Part of the reason for the slow uptake of OSI has been the length of time it takes to ratify these additional standards. However, a number of standards, such as the IEEE set of local area network standards (802.3, Ethernet; 802.5 Token Ring, etc) and X.25 from the CCITT, are well established. These mainly cover the lower layers of the OSI model, addressing the physical transmission of information.

What this means, of course, is that in 1990, organisations can reap some of the benefits of OSI. Taking IEEE 802.3 CSMA/CD (Ethernet) as an example, the user can mix and match network components from vendors such as BICC Data Networks, Synoptics, 3COM, Ungermann Bass etc with a high degree of certainty that the products will interoperate. If those people who have been in the industry long enough cast their minds back ten

the service the carrier system provides.

There is now a network management standard for LAN carrier systems provided by the IEEE 802.1 committee. There is also an industry standard known as SNMP which has found favour amongst a number of vendors, because of its simplicity to implement. SNMP stands for Simple Network Management Protocol — with the emphasis on simple; and because of this, SNMP does not really provide the same levels of sophistication as IEEE 802.1. Many vendors get over this lack of depth by providing a flash graphics interface, which is impressive when first seen (ie during the buying cycle) — but the system as a whole will not provide all the necessary management functions.

Central to the process of effective network management is a clear strategy for the network's future development, which will provide the foundation for a diverse cross-section of equipment to be integrated into a single logical entity.

While a user-friendly interface is important, there are five other interrelated activity areas that need to be addressed. These major areas provide a framework for developing a management strategy:

Monitoring: summary and detailed network statistics must be available at all times for monitoring purposes.

Fault management: fault detection, diagnosis and correction are essential for addressing specific problems and providing preventative maintenance.

Resource management: full reporting on the location, status and configuration of all the elements of the network at all times.

Security: all aspects of access control to sensitive data.

Forward planning: analysis of past and present experience to help manage future growth.

Obviously all of these facilities need to be backed up by a sophisticated database and report generator.

Graham Starkins; **companies should insist they get what they want.**

So, at this point in time, a two-pronged approach to total management is required. However, the increase in the number of interfaces being developed by vendors to provide interconnectivity between previously proprietary resource management facilities, and the advent of OSI standards, bodes well for the true opening up of network management both at the resource and the carrier level.

The final step in establishing sound network management procedures is selection of a product which addresses the areas outlined in the strategy.

The final choices should offer:

- a standards-based management protocol;
- an industry standard operating system to allow for full integration;
- a windows-based user interface;
- a robust database with full querying facilities.

Following these guidelines will ensure the network's stable and controlled growth into a highly dynamic future. ■

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years, this was certainly not the case in 1980.

The other cause of the slow uptake of OSI is more fundamental. The upper layers of the OSI Model will tend to be machine dependent. This, of course, requires that the major computer vendors produce the software for these layers. While a number of companies have been successful at providing vendor independent networking at the lower layers, there is really no such thing as a vendor independent computer. Traditionally, the way the major computer vendors locked users into their solutions was via proprietary software and proprietary networks. Now, along comes OSI, allowing the user to say: 'I have a standard networking architecture, and off-the-shelf applications to use it. I can now buy the computer which meets my requirements, as opposed to the computer I have been locked into through history.' I wonder why computer vendors are laggard in bringing their OSI solutions to market?

While a number of companies have been successful at providing vendor independent networking at the lower layers, there is really no such thing as a vendor independent computer.

Users are not to be misled. For some applications, the standards work is complete enough that an OSI implementation is possible; and the fact is that many computer vendors already offer OSI-based products in other marketplaces. In Europe, for example, where OSI is specified as a matter of course by all government departments, the combined buying power of the EEC governments is not to be ignored. If vendors cannot offer OSI-based solutions today, they have to show a *real* commitment to OSI within a defined timescale, as opposed to the vague murmurings heard in this neck of the woods. In the US, many large manufacturing organisations are using the OSI-based MAP and TOP (Manufacturing Automation Protocols and Technical Office Protocols) protocol stacks provided by some of the same vendors who, in Australia, claim that OSI is still five years away.

OSI is useful, and the users are the big winners. If users wish to get away from the *Free Beer Tomorrow* syndrome associated with OSI, and start reaping the full benefits, then organisations with clout need to start dictating to the computer vendors what is required. If the combined buying power of Federal and State Government computing organisations, Telecom and the Top 100 Australian companies all started specifying OSI in defined timescales, many would be surprised how quickly it could be implemented. Let's be novel, and start insisting that we get what we want from the computer vendors, rather than what they want to sell us! ■

Graham Starkins is BICC Data Networks' business manager for the Pacific region.

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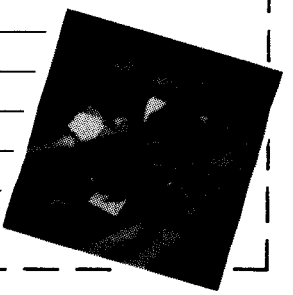

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NO RISK EDI

There are risks with EDI as there are with any system, including those activities which will be replaced by EDI. But they may be different risks. **Barry Jones*** outlines the many aspects of security and considers their implications for users of EDI.

You can see a picture of your company in 1992 — a picture in which 90 per cent or more of your routine business transactions are exchanged electronically with your customers and suppliers. Your company is booming with lower operating costs, increased market share and new international markets. Indeed, it has survived in a competitive market place which has seen a number of companies fall by the way. But this last thought leads you to consider the risks that might be involved because, although you like to win, you are not a gambler.

Security costs money. It requires management commitment and co-operation between users and a number of vendors. The higher the level of security demanded, the higher the cost. Ultimately this cost will be born by the users, so demand only the level of security which is justified by the risks involved.

And security starts at home. If, for example, slack procedures within a company enable an unauthorised person to have access to procedures to fraudulently draw a cheque, which in all respects appears authentic, then the most secure delivery system in the world may deliver that cheque with absolute certainty, neither lost nor altered and with complete confidentiality. But it will not rectify the initial fraud.

Aspects of security

Security can be subdivided into four aspects:

- data integrity;
- access and authentication;
- audit trails;
- failure protection and recovery.

Data integrity: where data sent is delivered intact — no change, no loss of data or new data introduced as a result of telecommunications problems.

By its very nature, this is a communications issue. The parts of the security matrix most involved are the communications hardware and software, but hardware and software at each user's site will also be included.

Defined international standards exist and are available in Australia now.

Make sure appropriate standards are in place, not only for your link to the clearing house, but also for links between your trading partner's site and the clearing house, as the messages you receive and send will also pass over their lines. In this respect minimum standards, laid down by the clearing house vendor, should be looked for as you should not have to 'police' the procedures of each trading partner.

EDI may provide opportunities for more stringent automated procedures.

Access and authentication: two different but interrelated concepts. *Security of access* is the validation that a user attempting to deal with the clearing house is correctly identified and registered with the service. *Authentication* refers to the validation of individual messages so that the receiver can be certain they come from an authentic source.

In pre-EDI systems some of the methods used include preprinted stationery, pre-numbered forms, use of order numbers or contract numbers, control of access to paper documents or signatures.

Within an EDI system there are levels of elaborateness for achieving the same thing. They range from the simple identifiers and passwords to passwords that vary on an agreed basis or, at the more secure end of the scale, some form of electronic signature. Two of the more advanced techniques are encryption and a method to authenticate transactions.

Encryption is the 'scrambling' of data before it is transmitted and the 'unscrambling' at the other end. Its primary purpose is to keep the transmitted data confidential.

A method of message authentication used within bank networks is the *DES Algorithm* — a very complex set of rules for processing a message to generate a field of information, called a *message authentication code* (MAC), which is appended to and transmitted with the message. At the receiver's end the MAC is re-computed and checked against the one in the message — if they differ the message is rejected.

Both encryption and message authentication, to be effective, use *keys*, which must be applied by the algorithms and must be maintained absolutely secret. The method of issue and control of these keys is the challenge — they are similar in security function to the PIN for a credit card.

Various methods of identification are applied by the clearing house systems involving passwords and physical location.

Existing EDI standards define user identification and passwords in the envelopes and the various message sets provide for identification within the body of the document.

Firstly I will consider messages other than cheques. At the clearing house the access codes which identify a company should be checked for consistency with the envelope address. If this is done the receiver can have confidence in the address information and hence the origin of the message.

This validates the origin of the message to the company level but does not validate that the message was not fraudulently prepared within that company. So at the originating company, security must be applied to the EDI systems programs and to the application programs which develop the messages in much the same way as at present. The methods are —

physical access control to the computer systems, software security systems to prevent unauthorised access to particular application functions such as raising an order or an invoice, and internal audit procedures.

For cheques, the above procedures may be considered inadequate because the potential gain from fraud in this case is very much greater. You may require some form of identification that the bank can look at to confirm authentic initiation of the message. The obvious method is the application of the DES Algorithm.

Two important considerations are — control of keys and when to apply the DES. The keys will be issued by the bank and must be strictly controlled and changed at frequent but unpredictable intervals. One way is to have the bank send messages to the company specifying new keys. Another is the use of plastic cards with the keys encoded and with a PIN to enable access. An application program which simulates the current process of signing cheques would be required. This program could demand the presence of the plastic card and the entry of the PIN, then use the DES Algorithm to append the MAC to the message.

Finally, an opinion on encryptions which could be used to enhance confidentiality. I consider it would be much more difficult to violate confidentiality in an EDI system than in existing methods of document exchange such as mail, fax or phone. So for EDI of normal business messages I don't think it is warranted. However, if keys associated with the DES Algorithm are transmitted on the network then it would be necessary.

Audit trails: are interwoven with the topic of authentication because internal audit procedures are used to discourage or discover fraudulent activities and this will continue to apply with EDI. The type of security/audit procedures that I would recommend should already be in place with paper based systems but they may need some rethinking.

EDI may provide opportunities for more stringent automated audit procedures to guard against unauthorised transactions being constructed outside the application programs and introduced into data files. A feature of EDI systems is the availability of acknowledgement messages. You know that delivery has occurred or, if within a defined time there is no acknowledgement, contingency plans can be put into action.

The other reason for mentioning audit trails with respect to security may be less obvious — it is because of legal implications with respect to evidence.

The maintenance of adequate archives is basically the responsibility of each user, so the adequate logging of data by the EDI software is important. In some systems this is done centrally and the reports so developed are sold back to the customers. In others, the EDI software, installed at your site, maintains logs as the messages are transmitted to or from the clearing house.

Let's say we have captured the data we need. How do we store or archive this? Will magnetic media such as magnet tape or diskette be satisfactory or will we have to print out the audit trails? Perhaps computer output to microfilm could be used.

Demand only the level of security which is justified by the risks involved.

Failure protection and recovery: sometimes called *disaster* recovery, but I have intentionally used the word *failure* so as to include less major events which are damaging but might not be regarded as disasters.

How critical is EDI? How long could we tolerate the inability to get EDI messages through? EDI is a store and retrieve system with trading partners not clearing their messages for several hours or more. So a few minutes off the air is unlikely to cause any problem; even a few hours could probably be tolerated by most users. A few days would be intolerable for most users.

I think between a half to one day would be the normal range that could be tolerated. So what could cause such a loss of service? Well any of the links in the chain — your computer, the local phone line to the company's office, the trunk network, the central clearing house or, with less pervasive consequences, a trading partner's computer.

Your computer. I can see no difference in the impact of a failure of your computer on EDI or paper based trading.

You will have to notify trading partners and request an alternative form of documents from them.

The local phone lines. This may introduce a new risk. If, however, you currently use phone or fax for some transactions then it is much the same. Of course this impacts more than just EDI.

The trunk network. If Austpac is used there is redundancy in the network. A major failure, multiple failures or a failure of the dedicated line to the clearing house would need to occur to impact the service. But it could happen, so we need to consider it.

Clearing house. Most clearing house operations use computers with some form of backup or fault tolerant capability.

Nevertheless, when selecting a clearing house, ask searching questions about their operation and plans to cover a major failure.

Trading partner's computer. Such a failure is the most likely event. Not because their computers are less reliable than yours, but because there are simply more of them, so a single failure is more likely.

In any case, you should have a contingency plan. You will need to be able to selectively produce paper documents for nominated partners then mail or fax them and/or use the phone.

The next most likely event is failure of your own computer. Most companies don't have a satisfactory plan for recovery in such an event and, regardless of EDI should consider this risk.

I don't consider the risks are high but plans should be made. These should include guidelines on the length of down time or other considerations which will cause the plans to be invoked. You will need agreement with your trading partners for some rules to apply.

Back-up procedures should be tested. At first you may not have large volumes on EDI and the back-up procedures may be very similar to existing manual procedures. However, in time, volume will increase and staff familiarity with manual procedures will diminish. So staff training and periodic "fire drills" may need to be done. ■

* *Barry Jones is a senior EDI consultant with Ferntree Computer Services.*

VIDEO KILLED THE

Interactive digital videoconferencing has brought us to the verge of the videophone age. It is becoming a legitimate business tool which some Australian companies have found leads to more structured, disciplined and cost effective meetings and helps forge a stronger corporate culture for nationally and internationally dispersed organisations.

OTC's Sydney studio: expensive public studios will be replaced with rollabout units in meeting rooms.

It was the pilot's strike that did it . . ." *The* closing lament of '89 has worn thin as the excuse for failed or failing businesses. But as it turns out, the business breaker that closed the eighties has proved a boon for videoconferencing; it has achieved what no amount of advertising and marketing managers have been able to do — create an awareness of videoconferencing as a legitimate business tool that, by industry estimates, could be as commonplace as the fax by 1995.

Any meeting can be held via a videoconference and, according to regular users, can be more effective because it is more structured and disciplined.

Longterm player in the local industry, Jan Land from Land Space Communications, quotes a study by Harvard University carried out some years ago, which costed an average in-house meeting of middle managers, without travel expenses, at $US5000. The study estimated that 112 hours of any business person's time is taken up in meetings and, of that, over 100 hours was actually wasted time.

"In a videoconference you know you have a set time; you focus carefully on what you are going to address, you make sure you have an agenda and you distribute it, along with the names of the people attending, in advance," says Land. "Consequently, attendees know in advance what is expected from the meeting and they come prepared."

The inhibiting factor to widespread growth is the whole quagmire of transmission speeds and standards.

Videoconferencing has been around for almost 20 years — Telecom had their first public studios in Sydney and Melbourne as early as 1972 operating at full bandwidth — but until the recent advent of compressed digital signal transmission, exorbitant costs put it outside the realm of regular business use.

That's changing. But now the major inhibiting factor to widespread growth here in Australia is the whole quagmire of transmission speeds and standards. It is the codec (the box that codes and compresses an analog signal from the studio cameras to digital and then decodes the digital to analog at the receiving end) that determines the bit rate, and the algorithms used in the coding and decoding that make one box compatible with another.

The global market is divided and lined up behind various manufacturers. The UN backed CCITT (the body which decrees worldwide standards on telephony and broadcasting) standard, called H120 but commonly known as COST211, is eight-10 years old and has been outpaced by technology. So while European-based manufacturers have continued to basically adhere to those standards for ease of interconnectivity (they do add enhanced features that are not compatible with other brand names), US manufacturers have gone their own way and developed proprietory standards (proprietory codecs will only talk with their kind).

The CCITT standard originally recommended the transmission speed be 2Mbit/s. The codecs that conform to COST211 include GEC Plessey, Philips and NEC, available in Australia, and Alcatel and Sepa which are not.

Compression Labs International (CLI) from the United States has optimised its codec at 384kbit/s and now holds a position (similar to IBM in the computer industry) of having a defacto standard in the industry.

Each of these codecs is capable of being switched to the different speed. With the COST211 standard the picture quality is optimised at 2Mbit/s and the CLI at 384kbit/s. If you compare CLI with COST211 at 2Mbit/s then the COST211 will be better quality; if you compare the COST211 with CLI at 384kbit/s then the CLI will be better.

(Another manufacturer from the

TRAVELLING SCAM

US, Picturetel, has gained wide acceptance for its proprietory codec which is optimised at 128kbit/s and can be switched to 384kbit/s. It cannot operate at 2Mbit/s.)

Looking globally, usage is about 50/50 between COST211 and CLI, given that the US market is a lot more advanced than Europe in terms of the number of public studios.

Why the different speeds? It may be an idea to backtrack here and consider this from an historical viewpoint. There are two styles of videoconferencing — event and meeting style. Originally, we had event style conferences, which were analog, operating at 140Mbit/s and traditionally one-way to a large number of people. They were really just an adaption of broadcast TV used in a corporate context. It is this style most people in Australia are familiar with.

As technology has progressed, digital conferencing has been introduced; this is traditionally two-way meeting style conferencing carried in a compressed form. Interestingly, it was Australia that introduced this mode to the world just two years ago when, during the Bicentennial Australia Day celebrations, a live cross was made to Antarctica.

Not so long ago, the world was agog at the possibility of being able to compress the signals to 2Mbit/s; now it has progressed to the point where it can be compressed even further with minimal degradation in picture quality. Compression is possible in this format because only movement is transmitted, ie the top and bottom thirds of an image, where there is little movement, is not continually transmitted.

Public studio set-ups, as we know them today, will be out of date in five years time.

Currently, the 2Mbit/s bandwidth gives acceptable picture quality, but the industry is divided on whether the quality is acceptable at the lower rates. They are agreed, however, that the speeds will drop considerably in the future and the quality of performance will increase.

The imperative in reducing transmission speeds, and hence bandwidth, is to reduce costs to the point where videoconferencing really is as common as fax; and ultimately to the point where we have videophones on our desks and in our homes.

Land points out the bandwidth/speed issue is no problem if a company is operating solely within its own corporate environment. "They can operate at whatever speed they want, and it doesn't matter because they have an in-house network," Land explains. "Where it does matter is when they have to interconnect to other networks, either in Australia or

VIDEOCONFERENCING LENDS NEW LEASE OF LIFE TO BUSINESS

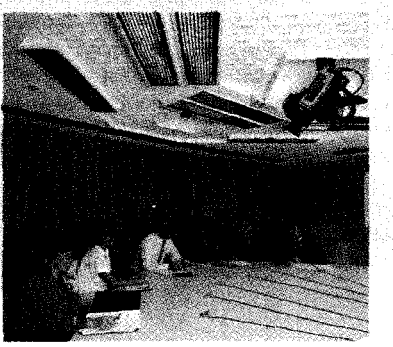
As early as 1987, Lend Lease Corporation twigged to the opportunities inherent in digital videoconferencing. It installed videoconferencing rooms in Sydney, Melbourne and Brisbane — its major office locations — to reduce the 'dead time' associated with interstate travel, thus increasing productivity and reducing associated financial commitments. But, primarily, Lend Lease hoped to improve communications within the corporation's group of companies, and with its interstate and international clients.

Videoconferencing manager, Greg Bird, says Lend Lease takes the attitude that the videoconferencing rooms are not solely the realm of senior management. "Our experience has been that greater value is achieved when all levels of personnel are able to gain access for meetings and presentations."

The rooms are used for any kind of meeting including:

- corporate presentations;
- management reviews;
- information exchanges;
- design and project reviews;
- marketing meetings and presentations;
- general business meetings;
- finalisation and acceptance of business negotiations.

Two-and-a-half years later, Lend Lease has found the high capital set-up costs have been adequately compensated against cost benefits such as savings in travel and, more importantly, enhanced productivity. "We have found videoconferencing to be a tool that creates business," says Bird. "It increases and improves efficiency of communications within the organisation, which, in turn, shortens decision-making time frames and gives the corporation a competitive edge. It reduces the risk of lost business activity due to airline travel disputes; provides greater access to key people and key skills; ensures senior executives are able to be involved in more decisions geographically and allows them the flexibility of ad hoc meetings with remote sites."



The Sydney, Melbourne and Brisbane videoconferencing rooms were designed, specified and installed by Lend Lease Communications in conjunction with Lend Lease Interiors. The three studios are linked by Aussat satellite and Telecom land lines, and have GPT codes.

Each room caters for up to 10 participants who are filmed by two cameras for easy interaction. Two other cameras enable documents and graphic images to be transmitted from one party to another, and all cameras are designed to be operated by participants with hand-held infrared controls.

Foreseeing increasing interest from other organisations, Lend Lease has extended its facilities for external hire at an hourly rate, and has become involved in providing companies with a total turn-key solution.

overseas."

And that brings us back to the realm of international standards and the CCITT. Since 1984, the major manufacturers from both sides of the Atlantic, and Japan too (interestingly, Japanese companies appear to have expended energies on the actual video equipment rather than on becoming major players in codec manufacturing) have participated to develop a new standard — H261 — that will provide a base for codecs to talk to each other.

Although not expected to be ratified formally until the second half of this year, it was foreshadowed in November 1989 that the new standard would be px64. What that means is you will be able use variable speeds in multiples of 64kbit/s. Land calls this the 'soft option' and believes it will further impede growth because it will cause "considerable confusion in the minds of the companies who want to interconnect both locally and internationally". The original standard codecs will not talk to the new standard codecs.

OTC's product manager, video, Michelle Laidlaw, however, sees it as preparing a path for the introduction of ISDN. For instance, Picturetel already has that capability in that you can dial-up two ISDN lines, giving you 128kbits/s, although at this stage the picture quality at that level is questionable.

And it is the dial-up capability, together with the lower speeds, that is the ultimate aim. Dial-up capability means that rather than calling up a carrier — like OTC, Telecom or AAP Reuters — and giving 48 hours notice so they can patch together the circuit (often involving microwave, terrestrial and satellite links), a user will be able to use the service as simply as the fax or phone. Only then will the service be economical and convenient enough for smaller areas.

In the current environment, however, people wanting to hold a video conference must either sub-lease a videoconferencing facility from companies with private facilities or use one of Telecom's public studios or, if going international, use OTC's. To

A LEGAL VIEW

Australia's busiest videoconferencing network is the private network of Corrs, Australian Solicitors, one of Australia's largest legal firms. Operational for less than six months, it already clocks up an average of six hours use per day between any of its four Australian offices.

Corrs has always looked to communications technology to differentiate it from its competitors and, for a number of years, has been perceived as the leading law firm in the use of computers. For them, videoconferencing is not merely a useful time saver; it saves doubling up on specialists at each office and goes some way to melding the geographically dispersed arms into one culture.

It is used for:

- work group meetings in the legal and administrative areas, enabling problems to be dealt with as they arrive;
- client/solicitor meetings, giving access to legal opinion regardless of where the client or legal operator is located;
- meetings between the opposing parties so negotiations may be carried out across state or national boundaries;
- internal training — particularly in keeping up legal education. Often, a video cassette covering an area of law is played and the firm's expert on that area answers questions from junior solicitors.

Corrs chose a satellite network, installed by AAP Reuters Communications and a Philips codec running at 2Mbit/s, installed by SVT Video Systems. The codec was chosen because it conforms to the COST211 standard, which most European organisations adhere to (thus Corrs' London office can interconnect easily); the satellite infrastructure for its flexibility and cost effectiveness in linking the four offices in Sydney, Melbourne, Adelaide and Perth; and the 2Mbit/s bandwidth for quality pictures and motion handling.

Peter Stephenson, Corrs' national manager MIS, says the clients they are dealing with expect the best. "We paid a premium for the network to give quality service to our clients."

Instead of straight 2Mbit/s capacity, Corrs' opted to install high capacity tails at 8Mbit/s into each office to cater for future expansion. "With our planned business growth," explains Stephenson, "it is conceivable that we will end up with two studios in Melbourne and Sydney running concurrent conferences.

"Now that we have the satellite infrastructure and microwave capacity, we can overlay the national voice and computer data networks on top. The satellite medium is not a cheap exercise but it gives enormous flexibility."

For further flexibility, Corrs and AAP Reuters Communications have developed a videoconferencing switching network, believed to be a world first. (Corrs put forward their requirements and AAP designed the unit. All the terminals are now installed and are being trialled.)

The visual side of the switching network is a touch screen monitor with each studio in the network denoted by a box, or icon. To move the satellite link anywhere between the four studios you simply touch the appropriate box on the screen.

"The switch gives us complete control of where the link is and allows us to go beyond the conventional point-to-point videoconference to multipoint," explains Stephenson.

Multipoint videoconferences are very controlled and not strictly interactive, but they give tremendous scope in terms of being able to hold a truly national conference. One studio will have the floor and talk while the other studios see and hear the speaker. If someone on the receiving end wishes to contribute they push a bid button and the chair of the meeting responds by moving the link.

Capital costs in setting up the four studios were in the vicinity of $1m, and the recurrent costs are running in the "hundreds of thousands of dollars per year".

"It is difficult to put a cost benefit to it," says Stephenson. "It's a matter of trying to develop a national law firm from a merger of three distinct firms and service our clients."

Corrs already had an extensive and highly developed computing and communications network for which, impressively, they have made it mandatory for every member of the firm to undergo training. For every dollar spent on the hardware, a dollar is spent on training support. They now have the rarest of all internal networks — one that is used by everyone. But that's another story . . .

date, these all operate at the 2Mbit/s level, although it is possible to buy a permanent 384kbit/s link from Telecom for domestic use.

You have to buy permanent links because there is no itinerant (ad hoc) capacity at either 384kbit/s or 2Mbit/s nationally; and there is no itinerant 384kbit/s capacity internationally.

Intelsat, the international satellite organisation, offers itinerant 64kbit/s (for ISDN) and 2Mbit/s capacity as part of their International Business Services (IBS). This means any rate in between is not commercially viable because the slot on the satellite is 2Mbit/s and to use a portion you have to take the lot. Getting a signal up to 2Mbit/s internationally goes by the delicate name of 'bit stuffing' which is really just stuffing with blank bits.

Australian options

To compound the confusion, in Australia we have two domestic network providers — Telecom and AAP Reuters — each with different proprietory codecs, and the international carrier, OTC, with, until recently, only a COST211 codec. Aussat provides the links and can provide rollabout videoconferencing facilities at the 2Mbit/s level. (See box)

Too many people are concentrating on the cost and not the benefit — if they concentrated on the benefits they would find they outweigh the costs.

When OTC built its studio it chose a GPT codec: Telecom, on the other hand, has elected to go the CLI path.

OTC's Laidlaw says all international carriers, except the US, chose from the compatible COST211 codecs so OTC, to ensure wider connectivity to public rooms globally, also chose that option.

OTC has now installed a CLI codec at its international video-conferencing control centre (IVC) in Paddington so they can support CLI transmission overseas. Laidlaw explains it is possible to convert the signals, but not without some risk. "US Sprint, for example, offers a conversion facility where they have both a CLI and COST211 codec in their IVC. The digital stream coming in (from a CLI codec) is decoded to analog through US Sprint's CLI codec, and passed through the COST211 codec where it is again digitised and transmitted.

Les Carmichael, Telecom's executive manager wideband integrated networks, says Telecom saw a significant advantage in going CLI "because CLI didn't have a market in Australia so were anxious to be cooperative, and guaranteed a transition phase to new standards".

Both carriers have chosen 2Mbit/s. OTC again because the current standard recommends it and the majority of PTTs have embraced that; and because Intelsat only offers itinerant digital IBS at 64kbit/s and 2Mbit/s. It is now estimated that videoconferencing usage is over 60 per cent international.

Telecom because, according to Carmichael, "our technology is based on 2Mbit/s — our maintenance activities, spare parts and everything is there to support 2Mbit/s."

But both acknowledge the 2Mbit/s standard will soon be a thing of the past. Laidlaw says the technology is moving at such a pace that in the future we won't need 2Mbit/s to keep picture quality.

Carmichael agrees: "I call this a kind of platform product. The long term aim is to allow the customer to negotiate with the other party the speed at which they want to transfer information and therefore to negotiate the quality of the picture — they can go all the way from 2Mbit/s to 64kbit/s".

Telecom set about establishing a public service that allowed full feature compatibility across the network by providing the codecs on a lease basis. "We made a decision to offer a network which terminated at the analog side of the codec — the customer just provides the equipment

THE AMAS LINK

ASTA Military Aircraft Services (AMAS), a newly created business unit of Aerospace Technologies of Australia, found they had to very quickly come up to speed to compete in the highly sophisticated world of international aerospace and associated services.

Taking a cue from their counterparts in the US, they chose to enhance their existing communications network with a videoconferencing network.

Winning contracts to build aircraft such as the F18 for McDonnell Douglas and, currently, the Sikorsky Seahawk Helicopter for the Royal Australian Navy, it goes without saying AMAS would normally have a track worn to the US. Close contact is necessary at all levels — from senior executives during the negotiating and contract stage to shop floor supervisors during the building and interpretation of plans stage. The videoconferencing link provides opportunities for instant feedback on technical hitches or design changes; reduces overheads by reducing travel costs and time wasted travelling; and provides the ability to transfer large amounts of technical data.

The installation and certification of the facility was carried out by Telecom Australia and was commissioned in April 1989. To date AMAS has held over 20 conferences, primarily international. The codec chosen was CLI Rembrandt, making it easier to communicate with the US and compatible with Telecom's public studios in Australia.

Peter Fraser, program planning superintendent with AMAS, described the move to install a videoconferencing facility as a 'business decision'. "When you are dealing with major customers like the US Air Force it is a big plus to be able to communicate on their terms.

"It is probable that the ability to communicate face-to-face with just a few hours notice may go some way to helping to win further contracts."

The AMAS studio cost less than $25,000 for the total package which includes, above the normal facilities, a high definition camera which can be panned and tilted from a remote control; a super VHS video recorder to record the outgoing or incoming videoconference; and a computer interface providing the ability to display and transmit graphics (eg spread sheets) from a PC.

By displaying a fixed output such as a spreadsheet or graphic and then focussing the overhead high definition camera on the monitor screen it is possible to transmit the display to the other end and store it in a memory. At the distant end, this picture can be recalled from memory and displayed as a still picture on one of the large screen monitors — technically known as displaying in 'high resolution graphics' mode.

Now the facility is well established AMAS is keen to have other organisations in the Geelong area make use of it for either international or national meetings.

in the room." What this means for the customer is that when the new standard codecs arrive they won't have to pay for the upgrade — Telecom is guaranteeing compatibility and maintenance of service.

Telecom's service is a two option service. The first option is where a company installs its own private conferencing rooms and then has the rooms let by Telecom as public rooms in addition to the public rooms Telecom itself owns. This means when a room is not being used by the company that owns it, it can be leased to other companies, providing the opportunity to amortise the cost of installation.

The other option is to install a totally dedicated private network. If a company wants added security of signal and isn't worried about getting a rebate on its investment through the sub-lease of the room, they can enter into a private room contract. Telecom will install the room (or advise on the equipment), and provide permanent megalinks between the corporate offices. The drawback is, of course, that you pay full time lease charges for the megalinks even when they are not in use.

A third carrier, AAP Reuters Communications, has chosen another proprietory codec from the US — a Picturetel codec which is optimised at 128kbit/s but is running at 384kbit/s. They have a hybrid network which is primarily satellite, based on partial transponder use from Aussat as required, with 2Mbit/s links from Telecom on a permanent lease basis, plus their own microwave links.

AAP Reuters Communications is really looking to the market post formalisation of the new standards. National technical manager, Bill Egan, believes the 2Mbit/s systems are a starting point only. "We have taken the view that the way technology is going, very soon the speeds will reduce because the costs of transmission links are significantly less at lower speeds. We anticipate the new standards will allow us to work over the new ISDN networks. So if someone buys a codec such as ours they can simply dial up the other party and take advantage of the lower rate offered through ISDN.

There are essentially three markets, says Egan. Top level executive systems are typical of what Telecom and Lend Lease are running, complete with luxurious studios, broadcast quality cameras and 2Mbit/s transmission. At the bottom end of the market there is the desktop, which has a lot of difficulties. What Picturetel is aiming at is the rollabout (a moveable unit which contains the monitor, one camera and a codec so people wanting to link up at the working level simply roll the unit into an existing conference room.

One of the innovative developments to be offered with AAP's Picturetel system has been developed here in Australia. It is a

The technology is moving at such a pace we won't need 2Mbit/s to keep picture quality.

real-time control for switching between sites during a multipoint videoconference. The chair, situated at any site, can select which site is going to speak via a touch screen. For instance, in a conference between Melbourne, Brisbane and Adelaide, Adelaide will make a bid to talk by pressing a button and alerting the chair of the fact; the chair sees the bid and

BETTER THAN A LETTER

Of the many ways to reach its 40,000-strong membership, the NSW Teachers' Federation declares teleconferencing the most effective and cheapest. On three occasions in 1989 it held truly statewide meetings with a live video cross, via Sky Channel, of the Federation's senior officers to members, who then had the opportunity to respond and question by phone.

Members were located at Sky Channel outlets across the state at meetings ranging in size from two to 800. The wide reach of Sky Channel — TABs, Police Stations and licenced venues (pre-opening times) — enabled the Federation to reach remote areas and involve members to a degree not previously achieved. And, according to the Federation's John Hennessy, for less per member than it would have cost with a letter.

While the teleconference proved the most satisfactory in terms of disseminating information to far-flung members, it was a winner in terms of concluding the matter at hand speedily and efficiently. "The meeting concluded with a resolution being put and the result of the voting was known within one hour across the state.

"The spontaneity and involvement of this process makes them (teleconferences) difficult to beat," said Hennessy.

"All up, the teleconferences cost less than $25,000, including the services of television personality, Jane Singleton. For 40,000 members that amounts to $0.63 per member — cheaper than writing a letter and far more comprehensive with one hour's information."

Mass communication teleconferences such as these are the particular domain of Sky Channel. With a 30 watt transponder on Aussat dedicated almost solely to teleconferencing and five and a half thousand receive dishes across Australia, teleconference manager, Andrew Hill, estimates Sky Channel carries 90 per cent of all teleconferencing in Australia. In particular, one way video at full bandwidth (broadcast quality) and two way audio.

Clients include many of Australia's largest corporations, and government departments, at least one political party at the state level, and a number of multi-nationals.

Being one-way video, the delay from two, and sometimes multiple, satellite hops for international links is no problem according to Hill. A worldwide link for one yoga school, for instance, originated from an inland city in India, was uplinked to a satellite over India and downlinked to London; from there it was uplinked to a transAtlantic satellite and sent to New York; from New York it went via a US domestic satellite to Los Angeles where it was then uplinked to Intelsat and sent down to Sydney; from OTC in Sydney it went via fibre optic cable and a standards converter (NTSC to PAL) to Sky Channel; by microwave from Sky to the Aussat satellite; and finally downlinked to five mobile dishes across Australia. True astral travelling?

EXPANDED DIMENSIONS

The introduction of satellite technology with the launch of the Aussat satellites in 1985 significantly expanded video conferencing capabilities in Australia.

Flexibility, cost independent of distance and multipoint networking are key advantages of the satellite service, allowing users to choose from a complete range of options including full two-way, broadcast quality services to 64kbit/s digital services with virtually any combination in between.

Aussat also provides a range of transportable earth stations that offer full television transmit facilities and other trailer mounted receive-only antennas that can be located anywhere in Australia.

Since the introduction of the satellites, many large video conferences have been held. One of the largest, involving over 47 locations and including the provision of a full two-way video broadcast from Thredbo, provided a national video conference for shareholders of the Lend Lease group of companies for the group's annual general meeting.

The network allowed a mix of full two-way broadcast and receive only locations with return audio-only sound to enable audience participation in the event from any location, and is a classic demonstration of just how flexible satellite based networks can be.

Similar conferences to more than 20,000 Australian medical practitioners located in 30 plus venues, and linking up to seven overseas venues, have been organised by Merck Sharpe & Dome on several occasions.

More recently, Aussat has expanded into the Business Television market and is able to offer a range of transmission facilities for Business Television customers.

Based on the concept of "rollabout" codec and video camera/monitor units Aussat is able to offer services based on 2 mbit/s, 384 kbit/s and 64 kbit/s transmission rates.

Again, flexibility and cost efficiency are the prime criteria allowing users to establish board room facilities linked by microwave or cable to an Aussat "gateway" earth station (or transportable if necessary). These locations can also be expanded to include other receive only locations at low cost, using small TVRO antennas and decoders in a manner similar to large scale broadcast conferences.

Costs for Aussat's Business Television services, excluding initial capital costs, range from $330 per hour for a full 2 mbit/s service to $150 per hour for a 384 kbit/s service.

at the appropriate time simply presses the Adelaide icon on the screen and Adelaide comes up.

Currently the legal firm, Corrs Australia, is trialling that system with AAP Reuters.

Upgrades

Laidlaw cautions that although manufacturers are claiming they will offer an upgrade, at minimal cost, they are unlikely to be able to do so without throwing the old codecs away and replacing them with new ones. The 'minimal cost', therefore, is likely to be in the vicinity of $20,000.

Through Telecom's public room option this cost won't be borne by the user. According to Carmichael, the new CLI codecs will be backwards compatible and software upgradeable for future developments.

AAP Reuters Communications, however, claims the current Picturetel product is software upgradeable — you simply take out the cartridge and plug in another.

Costs

Going internationally you pay in half circuits; ie, a fee for the half circuit from Australia to the destination, a fee for the circuit back into Australia which is set by the other party's carrier, plus a fee for the studio hire at both ends. OTC's fee for the minimum one hour is $1750 and, typically, rates for the incoming circuit are in that vicinity. In effect, an international digital conference will cost approximately $3000 per hour.

Charges from Telecom public rooms between Sydney and Melbourne are approximately $700 per hour; and, over the greatest distance between Perth and Brisbane, $950.

The standards issues have inhibited the fact that it is just becoming recognised as an operational tool.

To set up a private studio it can cost anywhere between $100,000 (the low end cost for a rollabout unit) and $1m for an executive 'bells and whistles' dedicated studio. Transmission link costs are on top of that once-off capital outlay. ■

Shelley Spriggs

A SOLUTION LOOKING FOR A PROBLEM

(Continued from page 7)

encoding system transmits the signal via satellite to 11 classrooms. Each classroom has up to 12 students and is equipped with sound systems and video screens.

IBM New Zealand spokesman, Phil Dunning, says IBM is considering a receiving station in New Zealand which will pick up education services from Sydney. These could be beamed into Auckland and Wellington. The course could be for IBM staff and customers.

Looking for a market

In all discussions of teleconferencing one must not forget Datapoint's multimedia information network exchange system, Minx. Introduced in 1985, Minx is still looking for a market — as telecommunications costs drop and videoconferencing becomes popular, it could come into its own.

Minx uses colour monitors, cameras, viewfinders, and microphones. Users can see and hear each other, transmit colour graphics or data to each other through an attached microcomputer and send pictures and documents using an auxiliary camera. The terminals can be used in clusters and be brought together into a local area network.

Minx can be connected over long distances through communications gateways and interfaced to high frequency radio links and satellites. Two years ago, the New Zealand Justice Department began evaluating Minx for use in child sexual abuse cases. A briefing paper to the Minister of Justice suggested complaints be isolated from the court and their evidence recorded and simultaneously broadcast to the courtroom.

In the last few months, social workers and police sexual abuse units have researched Minx, abilities and have lodged an application for its use with the Wellington High Court.

Datapoint managing director, Kerry Meehan, said Minx is, however, still a solution looking for a problem. Despite the interest from the Justice Department, Meehan believes there is little interest from the business sector to invest in innovative systems. He says the economy is stale and there is little business growth. ■

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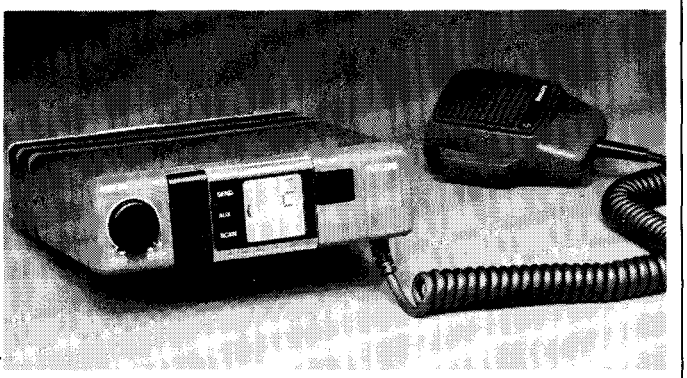
MOBILEBITS

VERBATIM



Less wires, more reliability

Two new mobile radios being produced by Philips Radio Communications Centre in Victoria have been released around Australia. One is a hand-held personal portable (PR710), the other an in-car model (PRM80 Series).

The production process employs the latest surface mounted technology (SMT), which has reduced the wires and mechanical interconnections by more than 90 per cent and improved the operational reliability.
range of mobile phones.

The PR710 personal portable is designed for use in the construction industry, emergency services physical distribution areas and other applications demanding the utmost in reliability and ruggedness. It incorporates a highly efficient sealing system to protect the transceiver from dust and water ingress, as well as speech processing circuitry for improved intelligibility when transmitting from areas of high ambient noise levels such as airport tarmacs.

The PRM80 Series of in-car mobile radios, designed and manufactured in Australia by Philips, has been released in a nine-channel (PRM80) version with fixed signalling and a 40-channel (PRM8020) signalling version, with variable signalling and operator selectable scanning.

The programmable features

of the PRM80 make it particularly useful for fleet owners, enabling fast, on the spot customisation of the mobiles. Different frequencies within the network may be accessed by using external computerised programming.

READER INFO No. 306

Now for the mobile office

Telecom is currently working with several private companies testing sophisticated new modems that use the mobile phone network, Telecom MobileNet, to transmit data.

Telecom's research has centred on extending and refining technologies used for facsimile transmission and database retrieval. The key advance is development of special error-correcting modems, which allow faster and more reliable data transmission.

READER INFO No. 305

Latin countries go private

South America's first privately owned cellular telephone network went on-line late last October in Buenos Aires. The 20,000-line system, a $50 million, three-way venture of Motorola, Citibank and Bell South International, has gone into operation as Argentina, along with many other Latin American countries, turns its inadequate state-owned telephone system over to local and foreign investors.

READER INFO No. 304

Philips teams up with Siemens

Belgium's PTT, RTT has awarded an alliance between the Philips/Bosch DMCS 900 consortium and Siemens with the contract to supply phase one of its national GSM digital cellular radio network.

Phase one will support some 1000 channels, 20,000 Belgium subscribers and some 4000 visitors to the country, and will come into service in 1991. The equipment will be supplied through Philips' Belgian subsidiary, MBLE, and Siemens' subsidiary, ATEA. The total capacity of the completed Belgian GSM network is expected to be for 350,000 Belgian subscribers and 70,000 visitors, using 18,000 radio channels and 10 exchanges.

READER INFO No. 303

Geostar $US10m contract

Burlington Motor Carriers (BMC) of Hurst, Texas, has awarded a $US10m contract to Geostar Corporation and its licenced manufacturer and system integrator, Hughes Network Systems Inc.

The contract is to fit BMC's fleet of 2000 units with HNS' Skyrider — a two-way mobile satellite communications unit designed to be used exclusively with Geostar's satellite-based nationwide positioning and two-way messaging services.

READER INFO No. 302

MILESTONES AND FORECASTS

VERBATIM

New Spectrum

Spectrum Technologies Limited has been formed as a wholly owned subsidiary of British Aerospace plc and will operate as an independent company within the structure of British Aerospace Enterprises Limited.

Spectrum Technologies has been established to exploit the market in laser and electro-optic systems for advanced manufacturing application. The company will concentrate on developing machine tools and systems based on the recently emerged industrial technology of 'excimer' lasers, which offer new and unique materials processing capabilities. The launch product is the CAPRIS (Cable Printing and Identification System) cable marker.

READER INFO No. 301

Video conferencing reaches Eastern Europe

Eastern Europe's first videoconference studio has been installed in Moscow by Philips, and will officially become operational in March.

The contract for the complete videoconference studio and related equipment was won by Philips following a visit by Mr H Asmirnow, director of the State Operations and Research Centre for the Soviet Post and Telecommunications Authority, to Philips Kommunikations Industrie (PKI), Nuremberg, last July.

Installed in just three weeks, the Moscow studio provides video contact within Europe via Intelsat. Other satellite connections will be used for links with the rest of the world.

READER INFO No. 328

Moscow's international payphone service

To mark the inauguration of the Comstar joint venture company between GPT of the US and MGTS (Moscow Telephone Network), Mr E Pervyshin, Minister of USSR Ministry of Posts and Communications, made the first direct international public telephone call to Mr Zamyatin, Soviet Ambassador to the Court of St James, at the Soviet Embassy, London, from a payphone in the USSR to London.

The international payphone service is the first of many advanced telecommunications services to be offered in Moscow by Comstar. This Soviet-British JV company is poised to exploit further opportunities in Moscow and elsewhere in the Soviet Union.

The payphones accept both prepay and major international credit cards and are to be located at the international airport, all major hotels and other central Moscow locations.

READER INFO No. 348

CONTRACTS AND AGREEMENTS

First CD-I application

Philips and Renault have announced that they have jointly developed four Compact Discs Interactive (CD-I) for use in Renault's service training programs. The overall program is called 'EDIRIS'.

The four programs comprise subjects such as electrics, fault finding methods, carburation and ignition. The discs are intended to be used in Renault's service stations worldwide. This is possible because the same disc can be used in seven languages (French, English, German, Spanish, Italian, Dutch and Portugese). The system will be available in the first half of 1990.

CD-Interactive combines — in a digital form on a 120mm optical disc — audio, video, moving pictures, computer data, graphics and text. Interactively the system starts the dialogue, proposes choices, asks questions, suggests answers, gives advice etc, under user control.

READER INFO No. 329

Spider products in Australia

MM Data Networks, a major distributor of LAN products through third party resellers, has announced a sole distribution agreement with Spider Systems Limited, based in the United Kingdom.

The agreement covers all Spider products, but to be immediately released are the Spider Terminal Servers and LAN Monitor and Analysers.

READER INFO No. 330

Motorola and TCG agreement

Motorola Computer Systems Division has signed an agreement with TCG in Sydney, appointing them as Australian and New Zealand distributor for the Motorola Delta series, a UNIX based system.

The Delta series makes use of open architecture design, which not only allows systems to be easily tailored to individual needs with flexibility of configuration, but also provides a growth path to the future. Systems can be easily upgraded as technology evolves.

Motorola is one of the top ten Unix suppliers in the world.

TCG is the largest privately held high-tech company in Australia, with offices in all the major Australian cities and customer support services in over 50 towns Australia wide.

READER INFO No. 331

Global ISDN

A global initiative to develop, manufacture and distribute advanced terminals for the world's ISDN telecommunications networks of the 1990s was recently announced with the creation of a strategic collaboration between GEC Plessey Telecommunications (GPT) of the United Kingdom and Hayes Microcomputer Products, Inc. of the United States.

The agreement, which will see the two companies addressing the United States, UK and the European markets, will reflect the commitment of both companies to standard, open interfaces, which will ease the interconnection of differing equipment, databases and software.

GPT dominates the liberalised United Kingdom market and its ISDX product has been sold in Australia, China, Holland and Scandinavia.

Best known in the microcomputer modem market, Hayes develops, supplies and supports computer communications equipment and software for personal computer communication networks.

READER INFO No. 332

OTC's Malaysian agreement

Australia's OTC Limited has signed an agreement with Syarikat Telekom Malaysia (STM) to pursue business opportunities in the rapidly growing South East Asian communication services market.

Under the MOU both organisations will collaborate in a range of areas, including: the expansion and enhancement of services; provision of new services; training of staff; exchange of information and personnel; and joint undertaking of projects.

READER INFO No. 333

Australian designed telecommunications system

Trials are about to begin in South Australia of a new satellite-based system, SA-SATCOM, a prototype system developed jointly by Adelaide-based British Aerospace Australia (BAeA) and the South Australian Government to enhance domestic telecommunications.

When the system is operational, BAeA will be designing, developing, manufacturing and marketing wholly Australian satellite earth terminals for communications via the national satellite system Aussat.

The technology will provide governments and private enterprise with a reliable and competitively priced telecommunications alternative to existing terrestrial systems, and allow them to more easily extend their activities from the metropolitan areas to the country.

READER INFO No. 334

NEW PRODUCTS AND SERVICES

Network control extends

The latest version of the ISOVIEW Network Manager, BICC Data Networks' fully integrated network management system, provides administrators with full information and control right down to the individual user level.

Distributed in Australia by MM Data Networks, the ISOVIEW Network Manager version 1.1 is a fully IEEE 802.1 compliant windows-based hardware/software solution designed to support the continuous operation of large distributed LANs with centralised control. It offers a wide range of essential services including network fault management and traffic control, resource management, full access control and network planning.

READER INFO No. 335

Voca M900 sets new standard

Priced at $1299 the M900 facsimile comes fully equipped with an integral handset and copying function, and can simply plug into an ordinary telephone line extension, making it useful for small or home business operators.

There is no need to dedicate a telephone line to the M900 as the manual answer mode allows the unit to double as a telephone.

READER INFO No. 336

NetWare Programmer's Workbench

Network computing leader, Novell Inc., has announced the NetWare Programmer's Workbench, a comprehensive collection of software development tools for developing client/server applications in networked environments.

The product includes the Novell/WATCOM C Network Compiler for developing client-side applications and the C network Compiler/386 for developing server-side applications. Both products include the Btrieve API (Application Programming Interface) allowing developers to provide record management capabilities in their applications.

READER INFO No. 337

Aussie safety device

Telecom and Safety Innovations International Pty Ltd have developed a safety device called the Tilt Alarm which alerts drivers of tractors, bulldozers or four wheel drives by means of a shrill alarm that a vehicle is in danger of overturning because of an unsafe tilt-level.

In a study of tractor accidents, the Workcare Prevention Report from the Victorian Department of Labour showed that three out of four deaths were caused by tractors overturning.

The Tilt Alarm was first designed by Telecom Research Laboratories in response to a request from the Victorian Forestry Commission, then refined and marketed by inventor/entrepreneur Chris Baker's company Safety Innovations International Pty Ltd.

Because different vehicles have different percentages of rollover tilt, it can be tailor-made to suit the individual vehicle. It is accurate to 1.5 degrees.

READER INFO No. 338

Waterfront EDI

The Port of Melbourne Authority has completed the first phase of a major project which addresses the problems of documentation and communication delays on the waterfront.

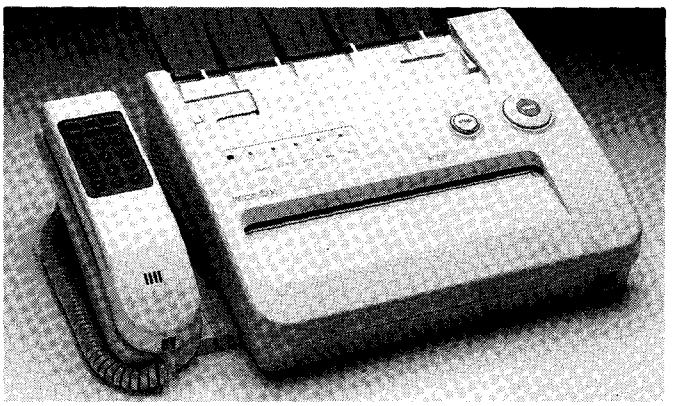
The PMA's Port Community Systems team in conjunction with consultants from Computer Power Group, has been investigating and creating an enterprise model of the import and export flow process.

The completion of this first phase will form the basis of EDI and Port Community initiatives which will be taken by the PMA, in its role of EDI facilitator for the Victorian Port Community over the next two years.

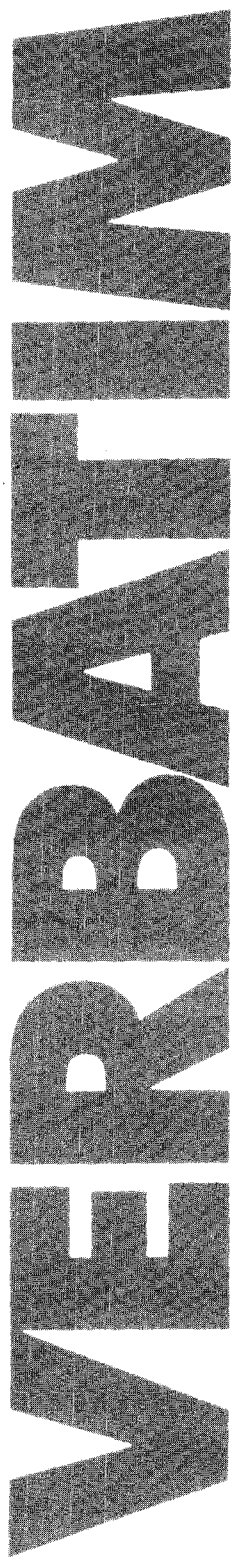
Graeme Murphy, Executive Chairman, Unimodal Australia Pty Ltd said: "The ports of Los Angeles and Long Beach in the US indicate savings of US$3 for every telephone call we won't have to make, US$3 for every document we won't have to mail and US$5 for every document we won't have to re-key into our systems because of electronic receipt through EDI."

The next step in the introduction of EDI will be a detailed consultative business needs analysis and functional requirements study this month.

READER INFO No. 339



GOING UP GROWING OUT



Apple Computer appoints marketing director

Apple Computer Australia has appointed Tony Fraser to the position of marketing director.

Fraser joined Apple UK in 1985, transferring to Australia at the beginning of 1988.

READER INFO No. 340

BTOS — no home should be without it

The Home Building Society (HBS) in Perth has ordered a network of 116 BTOS workstations from Unisys to pave the way for the eventual introduction of electronic document transfer (EDI) and automatic monitoring of equipment performance.

Home Building Society will use the B28 teller workstations, based on the BTOS II operating system, to run Version 2.1.1 of FINESSE, the Unisys banking and financial accounting package.

It will also run Unisys Professional Word Processing and Remote Access File which will allow head office to look at, or take control of, any terminal on the branch or agency system.

READER INFO No. 341

INFONET appointments

Global data service INFONET has appointed Ian Jardine as Southern Region manager. He has had 20 years experience with Telecom Australia, including several years with AUSTPAC, as a communications consultant.

Diane Hall has joined INFONET as manager, Customer Service.

She joins after having spent three years in Telecom's Value Added Services area consulting on Keylink electronic mail and customising applications programs.

READER INFO No. 342

CSC to sell 30 per cent ownership of INFONET

Australia has increased its shareholding in the global data service, INFONET.

US parent company Computer Sciences Corporation (CSC) has agreed to sell its 30 per cent ownership in its affiliate, INFONET Services Corporation. Twenty-five per cent is to be bought by the leading American communications carrier, MCI Communications Corp. The sale is subject to clearance by the US Justice Department.

The remaining five per cent will be taken up by the nine telecommunications agencies around the world that already own 70 per cent of INFONET.

Other participating countries are Belgium, France, the Netherlands, Spain, Sweden, Switzerland, West Germany and Singapore.

INFONET is the world's largest value added network, operating a global telecommunications and computing service with access in 100 countries and local support in 34 countries.

READER INFO No. 343

Consultel strengthens NSW office

Martin Smith has been appointed senior consultant with Consultel Australia with special responsibilities for PABX activity. He will work on the company's accounts with the State Authority Superannuation Board, Krone and CIBC.

Smith was previously with the telephone manufacturing company, Tytel, where he was product manager responsible for the hardware section of the research and development department.

Ben Mettes, DRS (Nijmegen — Dutch equivalent of PhD) has joined Consultel as senior consultant with special responsibilities for data processing activities. He was formerly with Roger Auld & Associates, data communications consultants in Auckland.

READER INFO No. 344

AT&T executive appointments

AT&T has made two senior management appointments in Australia.

John MacDuffie has been appointed managing director of AT&T Communications. MacDuffie was previously national account manager with AT&T in Los Angeles.

Andrea Galloway has been appointed general manager for AT&T Data Systems Group. Galloway was previously in account management with AT&T in San Diego.

READER INFO No. 345

Prime's new managing director

Tony Weber has been named the new managing director of Prime Computer of Australia.

Weber returns to Australia from Prime's US headquarters where he was director of finance and administration for Prime's international operations.

His appointment to the top Prime post culminates a career in the computer industry which spans more than 25 years.

READER INFO No. 346

Mining set to benefit from OTC's electronic document transfer

OTC's EDI/EDGE electronic data interchange (EDI) package has received a marketing boost through an agreement with software house Mincom to develop facilities for mining and large capital intensive industries.

EDI/EDGE allows users to transmit any type of document in any EDI format using any accepted EDI standard.

The package can prepare documents for transmission to both EDI and non EDI destinations and can integrate data from internal and external sources.

EDI/EDGE readily interfaces with new and existing applications, runs on virtually any computer from the largest mainframe to a small PC and allows efficient management of transactions between trading partners, including the electronic transfer of invoices, orders, correspondence and other documents.

READER INFO No. 347

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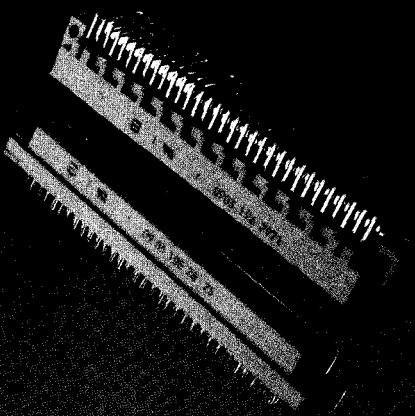

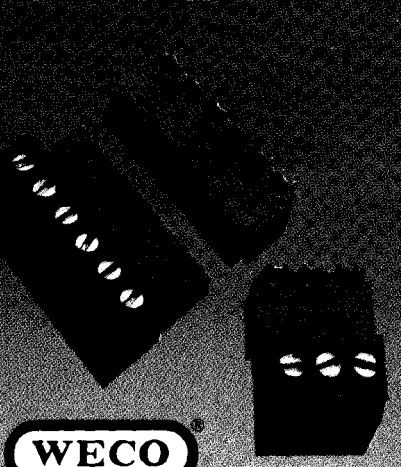

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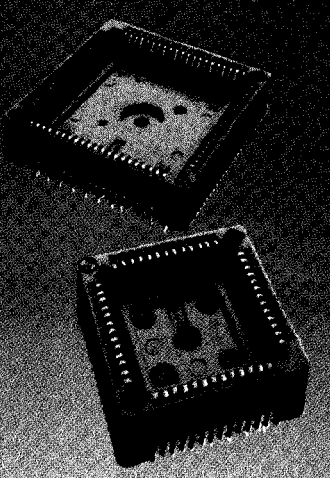
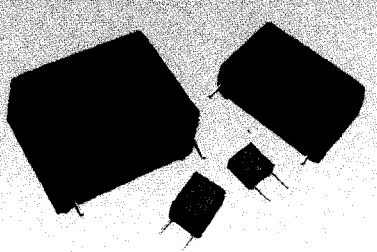
Recent developments have been a range of Electronic devices for use on mounting rails to DIN EN 50022-035 and 045.

Also the new series 120 and 150 Multilin screw connectors for printed circuits featuring lift terminals that guarantee high pressure contacts and allow countless wire disconnections.



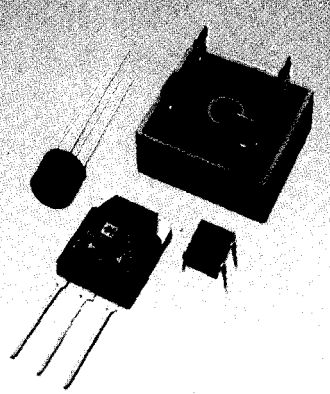


WIMA

Wilhelm Westermann are recognised as the world leader in the development and manufacture of miniturised plastic film capacitors. Materials used include polyester, polycarbonate, polypropylene and the new polyphenylene sulfide for high frequency applications.

In addition their MP3, Metallised Paper, Capacitors are internationally approved for use across the mains in RFI suppression applications.

These units are superior to capacitors with thermo plastic film dielectrics due to their high corona inception level and they have excellent active and passive flame retardent properties.



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In this, Part 1 of a five-part series, Elmo Jansz explains the fundamentals of the 6502 microprocessor, found inside many of today's 8-bit microcomputers.

THE BASICS OF MICROPROCESSORS

A microprocessor is a programmable logic device; that is, its functions and performance can be altered by modifying the instructions or program driving it. In this series of articles we shall refer to the microprocessor as the MPU.

Some of the more common MPUs currently on the market are the 6502, 6809, Z80, 6800, 68000 and 8086. MPUs are classified as 8, 16 or 32-bit devices, depending on the word size they are capable of handling. In this article we will study the 6502, which is a typical 8-bit device found in many microcomputers.

The MPU has brought about a significant change in the techniques of digital system design, in that the designer can now select large blocks of already prefabricated system functions, making the design of the overall system simpler and easier to structure. Any change to the overall system objectives merely requires a rearrangement of the functional blocks and the controlling program or software. In contrast, discrete logic systems require piece by piece fabrication. If the overall system objectives change, the entire system has to be redesigned and built to meet the new objectives. This could become time-consuming with a complex system.

Unfortunately, MPUs are sequential devices, which means that they are capable of handling only one task at a time. They also lack the speed of discrete circuitry, whose only limiting factor is the propagation delay through the individual chips. A good analogy of an MPU-based system is a child's tool kit, which consists of a handle into which can be fitted various attachments to give a saw, a hammer, or some other tool.

Interchanging

The words microprocessor and microcomputer are frequently used interchangeably. The microcomputer is the entire computer system. The microprocessor, on the other hand, is a single component found inside the microcomputer. The MPU has also come to mean the central processing unit, or the CPU, of a microcomputer.

The 6502 is found inside many 8-bit microcomputers, for example the Apple IIe.

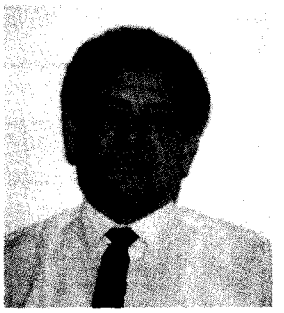
Typical microcomputers always include the following components or blocks.

1. An MPU — for example the 6502;
2. A system clock that synchronises all operations performed by the MPU. The system clock can be compared to an army sergeant calling out commands at exactly the right moment, and is normally a crystal oscillator. The Apple IIe uses a clock of the frequency of 1.023 MHz.
3. Read/Write Memory (R/W Memory). This type of memory is frequently called RAM, an acronym for Random Access Memory. It is preferable to confine the terminology to Read/Write only, as memory which is not capable of being written into is still random access. Information in RAM is destroyed when the system power is interrupted.
4. Read Only Memory (ROM). This is memory requiring permanent storage in the computer, remaining even in the absence of power. A good example is the system monitor which is a supervisory program, permanently stored in ROM. Information stored in ROM remains even when the computer is switched off.
5. Input/Output (I/O) Devices. These are the peripheral equipment that link the computer to the outside world. Examples are keyboards, visual display units and so on. All the components in a microcomputer system are connected by systems of conductors called buses, of which there are three sets.

(a) The address bus: sixteen address lines comprise the address bus in most 8-bit machines. The Apple IIe, for example, has an address bus that is 16 bits wide. The address bus is unidirectional; that is, information can pass in one direction only from the MPU to any other device.

(b) The data bus: 8-bit wide microcomputers use an 8-bit wide data bus. Unlike the address bus, information can move along the data bus in both directions.

(c) The control bus: the number of lines in the control bus varies depending on the system and may have both unidirectional and bidirectional lines.



Elmo V Jansz is Head of Electrical Engineering at Hobart Technical College, Tasmania. He is a professional electronics engineer with over 15 years experience in Electronics and Communications Engineering.

Basic system

Let's look at a basic microcomputer system to see how information is read out of, and written into, memory. Figure 1 shows a portion of an 8-bit microcomputer with a Read/Write memory holding 256_{10} memory locations. Notice that the memory locations are labelled in hexadecimal. $FF_{16} = 255_{10}$, i.e.

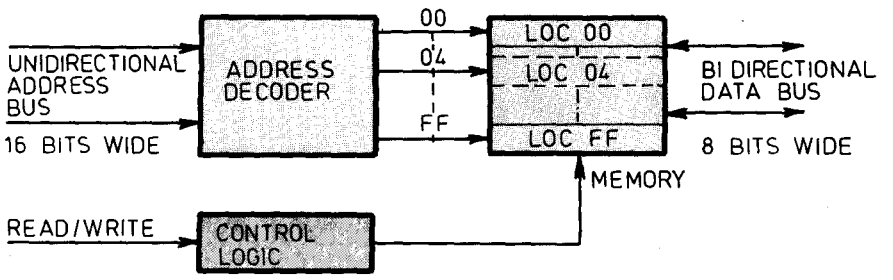


Figure 1

location 00 to location FF gives 256_{10} memory locations.

Let us assume that the MPU needs to read the contents of address location 04. The following sequence of steps is carried out by the system.

1. The MPU places the address of the location to be read on the address bus.
2. The decoder decodes the address and selects the proper location, 04 in this case.
3. The MPU sends a read signal via the control logic to memory.
4. The contents of address location 04 are placed on the data bus.

After a read operation, the contents of the location read do not change. Now let us examine how the MPU writes information to memory. Refer to Figure 2 and assume that the MPU needs to write information into location 04.

The following sequence of steps is carried out by the system.

1. The MPU places the address of the location to be written into on the address bus.
2. The decoder decodes the address and selects the proper location, 04 in this case.
3. The MPU places the data to be written into memory on the data bus, OA in this case.
4. The MPU sends a write signal to memory via the control logic and OA is written into memory location 04.

Two phases

Let us now examine a concept called the Fetch/Executive Sequence. The operation of a microcomputer can be broken into two phases. When initially switched on, it enters the fetch phase, during which an instruction is taken from memory and decoded by the MPU. Once the instruction is decoded, the MPU switches to the execute phase. During this phase, the MPU carries out the operation dictated by the instruction.

The fetch phase always consists of the same series of operations, thus always taking the same amount of time. The execute phase depends on the instruction and the time taken varies.

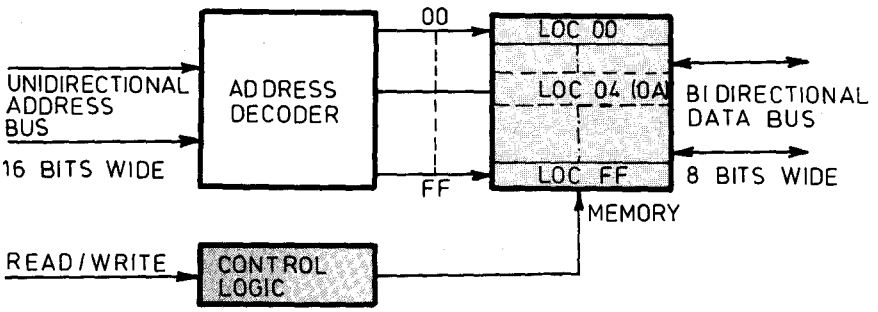


Figure 2

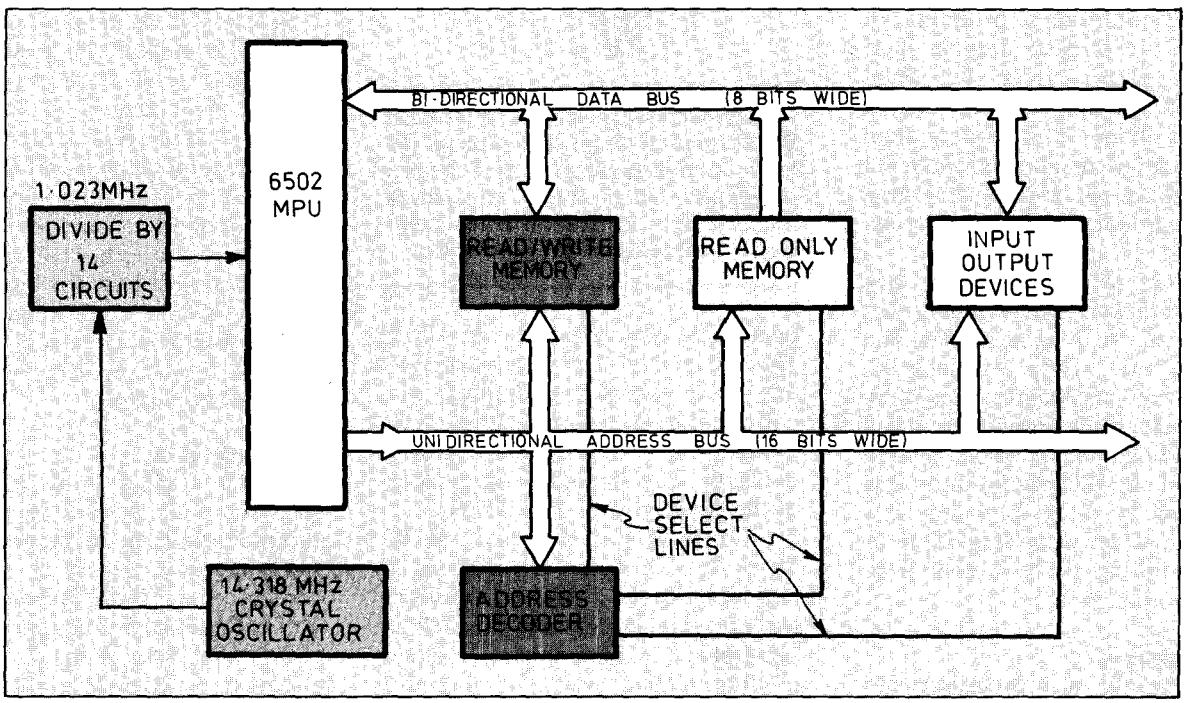


Figure 3

The real thing

We will now examine a real system. Figure 3 shows how the 6502 is incorporated among other digital circuitry to form a computer system. This is the basic structure of the Apple IIe computer.

The system clock is devised from a 14.318 MHz crystal oscillator, the output of which is put through a divide-by-14 circuit to give a clock frequency of 1.023 MHz. The 6502 MPU is shown on the left hand side of the diagram, connected to the circuitry and buses. Note the 8-bit wide bidirectional data bus and the 16-bit wide unidirectional address bus.

Observe that the arrow connected to the ROM block points only out of it, in keeping with our definition that information can only be read out of it. The input/output ports can also be connected to the address and data buses so that they can be allocated addresses and treated as part of normal memory. This type of input/output organisation is said to be memory-mapped.

MPUs are sequential devices, which means that they are capable of handling only one task at a time. They also lack the speed of discrete circuitry, whose only limiting factor is the propagation delay through the individual chips. A good analogy of an MPU-based system is a child's tool kit, which consists of a handle into which can be fitted various attachments.

Let us now understand how the actual memory space is organised. The 6502 has 16 pins dedicated to forming addresses. Each pin can be in one of two logic states, i.e. '0' or '1'. With 16 pins available for address formation and each pin having a possibility of one of two states, it is possible to have 2^{16} = 65,536 unique combinations.

From this point onwards we shall symbolise hexadecimal numbers by the prefix $. The address space can therefore be symbolised by $0000 to $FFFF. For those not familiar with the hexadecimal system, the decimal numbers 0 to 15 are listed below with their hexadecimal equivalents.

Decimal
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Hex
0 1 2 3 4 5 6 7 8 9 A B C D E F

Conversion from hex to decimal is quite easy and is carried out as follows:

$\$FFFF = F \times 16^3 + F \times 16^2 + F \times 16^1 + F \times 16^0$

Since $F = 15_{10} + 16^0 = 1$

$\$FFFF = 65{,}535_{10}$

Any address in the address space requires two hex digits or two bytes for its representation. A byte is a group of eight binary digits. We can now refer to a 16-bit address as being comprised of a High Order Byte and a Low Order Byte, or an ADH and an ADL as shown below.

1010 1111 0010 0101
A F 2 5
ADH ADL

The address space is normally divided into blocks. The smallest block size is comprised of 256 memory locations and is called a page of memory. Figure 4 shows how the pages of memory are organised.

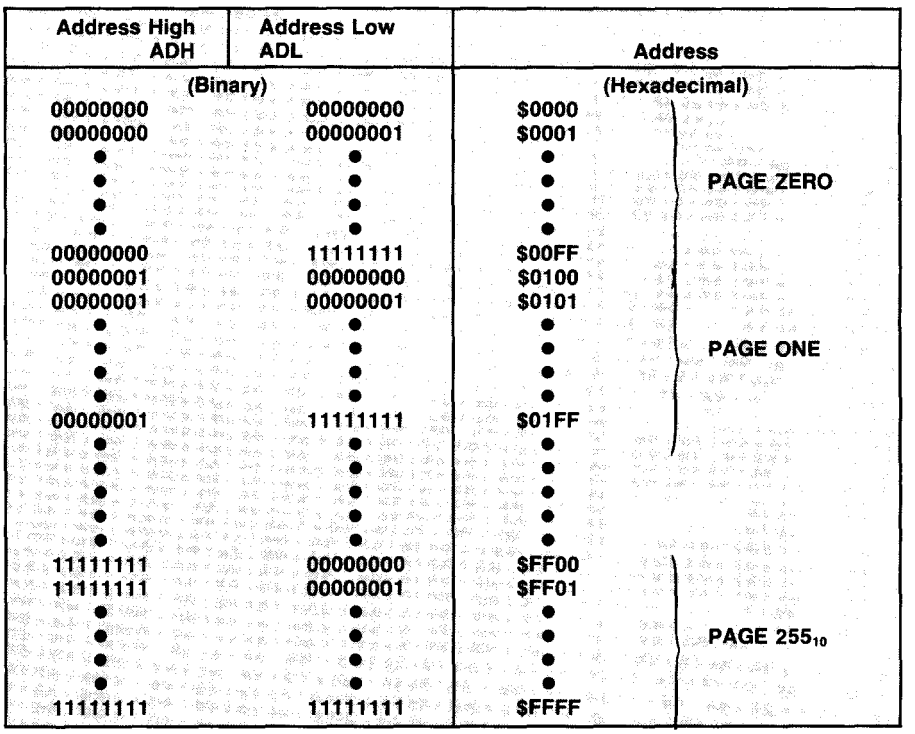


Figure 4

Page zero consists of locations $0000-$00FF, page one of locations $0100-$01FF, and so on up to page FF, which contains location $FF00-$FFFF.

The next largest block size after a page is the unit of 1024 = 2^{10} and is called 1K of memory.

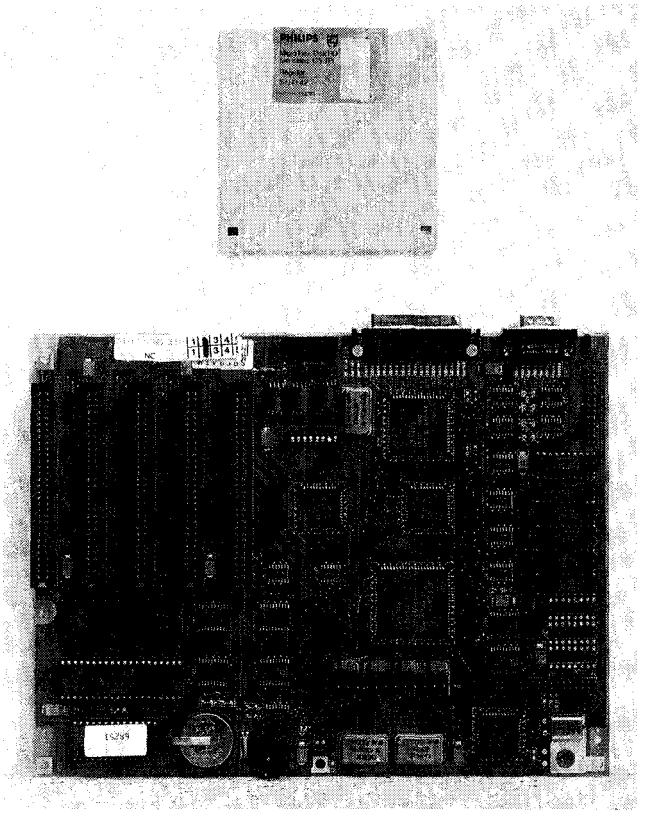
Since 2^{10} = 1024, 10 address lines are required to identify any location within a 1K block of memory. The balance of six lines, from the total of 16 address lines, can therefore be used to identify a 1K block.

Six address lines can identify 2^6 = 256 blocks of memory; therefore there are 256 1K blocks of memory — each capable of holding one byte or eight bits of information.

Memory is normally sold in K units, that is 16K, 32K etc, and applies to R/W as well as ROM. The Apple IIe is organised with 64K of memory, while the older Apple II plus has 32K of memory.

The Apple IIe is organised so that R/W is at the low end of memory, ROM at the top and Input/Output in the middle. The address space organisation is normally shown on a diagram called a Memory Map. eti

(Continued next month)



Philips' entry level PC

Philips' P3120 uses Intel's 8088 processor running at 10MHz, and has the following base configuration: 768Kb of memory (the standard 640Kb plus 128Kb for a RAM disk); 1.44Mb 3½ inch floppy drive; DOS 4.01; colour graphics adaptor; two serial ports; and one parallel port.

With the exception of the disk drive, the whole configuration is mounted on a motherboard slightly larger than two 3½" — this includes the parallel port and two serial ports.

The base level machine — a monochrome model — is priced at $1939 (inc tax) and includes a 15 hour training tutorial. With a 20Mb hard disk, VGA adaptor and colour monitor, the recommended retail price for the P3120 is $3470 (inc. tax).

The training tutorial, suited to the novice user or new staff member, comes with all models. It is a specially developed 15-hour self-training software package, providing an introduction to PCs and standard business applications.

For further information contact Barry Bridge, Philips TDS ☎ (02) 805 4444.

Enhanced programmable sound generator

The AY8930 APSC is an LSI circuit that can produce a wide variety of complex sounds under software control. The AY8930 is manufactured in the Microchip Technology Inc. n-channel silicon gate process. Features include improved frequency range and noise synthesis and independent control of each channel's envelope and duty cycle.

The PSG is easily interfaced to any bus-oriented system. Its flexibility makes it useful in applications such as music synthesis, sound effects generation, audible alarms, tone signalling and home computer usage. In order to generate sound effects while allowing the processor to perform other tasks, the PSG can continue to produce sound after the initial commands have been given by the control processor. The fact that realistic sound production often involves more than one effect is satisfied by the three independently controllable analog sound output channels available in the device. These analog sound output channels can each provide five bits of logarithmic digital-to-analog conversion.

All circuit control signals are digital in nature and can be provided directly by a microprocessor/microcomputer. Therefore, one PSG can produce the full range of required sounds with no change to external circuitry. Since the frequency response of the PSG ranges from sub-audible at its lowest frequency to post-audible at its highest frequency, there are few sounds which are beyond reproduction with only the simplest electrical connections. For further information contact Fairmont Marketing ☎ (03) 471 0166.

PC/XT/AT GPIB Boards

The B&C PC488A is a short card that can be selected by means of a jumper to be configured as a Controller or Talker/Listener. DOS installable device drivers are provided with the card together with samples of low and high level programs in Assembly language, Basic, C, Pascal and Fortran.

The PC488A has a data transfer speed of over 300k bytes/sec., 6 selectable interrupt lines, 2 selectable DMA channels and 4 choices of selectable base I/O address. It uses the NEC 7210 controller chip making it compatible with the National Instruments GPIB-PC11 card.

The B&C PC488A is priced at under A$300 (sales tax excluded). Further details from Current Solutions ☎ (03) 720 3997.

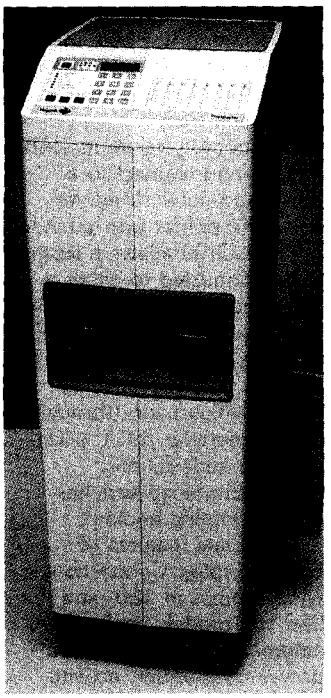
Intelligent emulator

The B&C ROMEM is a development tool for anyone who develops firmware for

EPROM or ROM based systems.

The ROMEM substitutes RAM for ROM during firmware development, thus avoiding the need to burn EPROMS. In addition, instant code changes may be made by editing the RAM buffer using Display, Edit, Fill, Write commands. ROMEM has other built-in intelligent features such as Address Compare, Address Snapshot, Trigger Input and Reset Output. The ROMEM emulates 2716 through 27512 EPROMS in a single unit and connects to a standard IBM-PC printer port. Up to 65k bytes of code may be down-loaded to the ROMEM in under 10 seconds on an IBM-AT.

A 12V AC/DC power adaptor and target interface cable with 28 pin DIP plug plus 2 E-Z hook chips for reset output/trigger input are provided in the price of $645 (sales tax excluded). An all CMOS version is also available with rechargeable battery backup for stand alone operation. Further information from Current Solutions, ☎ (03) 720 3977.



Pixelmaster

The Pixelmaster is a full capability colour printer that delivers brilliant colours, high resolution, integrated text and images, on most standard plain paper, at an affordable price, according to Mitsui Computer.

Up to 262,000 different colours can be printed. PostScript language and QuickDraw compatible, the Pixelmaster is the perfect printer for your Mac based DTP, business graphics, presentation graphics, graphic arts/design imaging, and CAD says Mitsui.

Pixelmaster uses solid plastic inks in cyan, magenta, yellow and black, which are automatically heated to liquid form before an image is actually printed; it is designed around a highly efficient method of placing dots via ink-jet on to the paper.

For further information, please contact David Wallis, Mitsui Computer, ☎ (02) 452 0452.

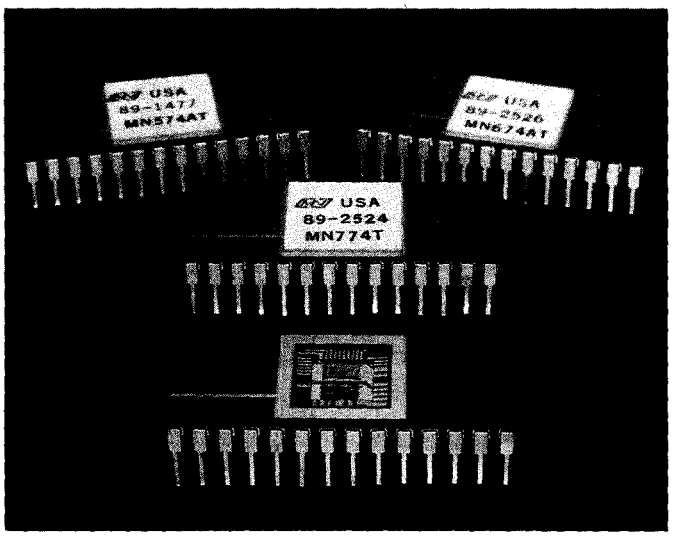
New 674A and 774 offerings

The Micro Networks' 574A (25usec conversion time), 674A (15usec conversion time) and 774 (8usec conversion time) family of 12-bit, microprocessor-interfaced, A/D converters are the largest-selling 12 bit A/Ds of all time, says the company. With total annual sales exceeding $20m, these devices are truly multi-sourced industry standards.

The new MN774 is faster than the original Harris HI-774, with guaranteed maximum conversion time, over all temperature ranges, of 9usec. This means that Micro Networks' units can achieve critical 100kHz sampling rates (even when used with a T/H amplifier). The new Micro Networks' units draw less power than competing devices and their 450mW max is significantly less than other brands, the company claims.

The new MN674A and MN774 offer all the features and user benefits that made the 574A a success:

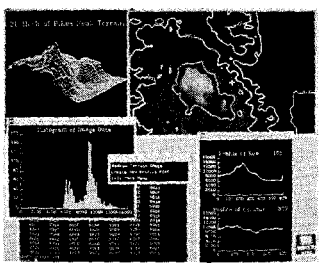
- The MN674A and MN774 are complete A/D converters with internal clock, reference and control logic.



- They mate directly with 8-, 16- and 32-bit microprocessor control, address and data-bus lines to operate totally under processor control.
- They are fast: MN674A, 15usec max conversion time; MN774, 8usec max conversion time.
- They are packaged in standard 28-pin, double-DIPs and operate from either ±15V or ±12V supplies.
- They offer 6 different electrical grades specified for either 0°C to +70°C or −55°C to +125°C operation.
- They are available with MIL-STD-883 "hi-rel" screening performed in Micro Networks MIL-STD-1772 qualified facility.
- They are multi-sourced and low-cost.

The devices are truly TTL compatible over all temperature ranges. Their CMOS logic is not prone to "latch-up" at power-on . . . at any temperature, and the clock oscillator circuit employs a current-controlled architecture that is not prone to drift with temperature. Bus access time, a critical parameter when interfacing with faster processors, is guaranteed not to exceed 150nsec. The A_0 line may be toggled freely with no fear of output-data overlap, thanks to break-before-make action on our output buffer.

The devices are distributed locally by Priority Electronics, ☎ (02) 905 6024 or (03) 521 0266.



Interactive software

PV-WAVE is an interactive environment for the filtering, analysis, reduction and presentation of technical, scientific or other complex data. It is designed for scientists, researchers, engineers and analysts in all fields who want to use the computer as a tool for data reduction without getting bogged down in programming details.

PV-WAVE excels at the interactive manipulation of large, multidimensional datasets from a variety of sources and can quickly produce line charts, contour plots, mesh surface plots and images. The speed of processing and image display makes PV-WAVE an exciting new facility for data analysis and scientific visualisation, according to the distributors. For information, please contact Praxa ☎ (03) 690 3811.

Catalogue

The Contec 1989/90 Product Handbook details their whole range of interface boards for data acquisition and control in laboratory and factory environments for compatible PC/XT/AT and PS/2 computers.

The range of products includes analogue and digital I/O interfaces, counter/timers, communication interfaces, virtual memory boards, distributed data acquisition and control systems and support software.

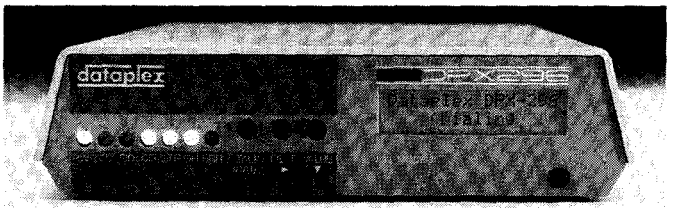
For information contact Inspek Technology ☎ (02) 609 1333.

Laptop link to Arcnet LAN

SMC's Laptop Connection (Arcnet-LC100) provides the travelling laptop computer user with an office-site connection to an Arcnet LAN. Having a miniscule chassis (approx 6" square × 1.5" high), it fits readily on any desk, and can remain permanently attached to network cabling. When the laptop is returned to the office environment, it is able to connect with the LAN through its parallel printer port. The laptop can then simultaneously retain its LAN linkage and connect to a local, non-network printer using the printer port provided.

The LC100 allows a laptop to be connected to either a coax network in a star or bus configuration (through its BNC connector) or to a twisted pair network in a star or daisy-chain configuration (through its two modular RJ11 jacks). External node ID and cable/technology switches further simplify hookup.

Additional features of SMC's Laptop Connection, which comes in 120- and 240-volt models, include: an external, wall-mounted AC power transformer, activity, status and power LEDs; and workstation driver software for NetWare. For further information contact Email Electronics, ☎ (03) 544 8244.



PC viewer

The PCV5 colour viewer has been designed to project computer screen images in colour, using the same colours as computer screens. Using subtractive colour technology Liquid Crystal Displays (LCDs) the PCV5 has eight colours — red,blue, green cyan, magenta, yellow, black and white to project computer screens.

The PCV5 uses proprietary subtractive colour technology similar to the technology used in printing and colour photography. Each full pixel generates a solid colour.

The PCV5 is suitable for use with the full range of IBM PCs and compatibles (including laptops). Using a small adapter the PCV5 can also be attached to the Apple MacIntosh II, SE and Plus computers.

The PCV5 colour viewer is priced under $9,000. For more information call Electroboard ☎ 02 957 5842 or ☎ 03 525 1413.

Unicorn PCs

The Unicorn series includes an 80386 system capable of 40 MHz performance, two AT machines and a fast XT.

The Unicorn XT-10, is an IBM XT compatible which, while based on the same 8088 processor as conventional XTs, utilises advanced engineering which upgrades its speed from IBM's standard 4.77 to 10.00 MHz.

It incorporates two floppy disk drives — supporting both 3.5" 1.44Mb/720Kb and 5.25" 360Kb floppy disks — as well as a 30Mb hard disk.

Priced at $2500 (including tax) with a monochrome monitor and $3400 with a VGA screen, the Unicorn XT-10 also includes standard features such as 640K of memory, two serial, parallel and games ports, three eight-bit expansion slots, a 1150 Watt cooling fan and a 12 month warranty.

For further information contact Mike Pratt, SME Systems, ☎ (03) 874 3666.

Dataplex 9600 BPS dialup modem

Dataplex has dramatically reduced the price of the DPX-296 which features MNP Level 5 data compression, which can boost ansynchronous data throughput by up to 200%, achieving data rates of 19.2 Kbps over Telecom dial lines. End-to-end MNP Level 4 error correction ensures data integrity on noisy phone lines.

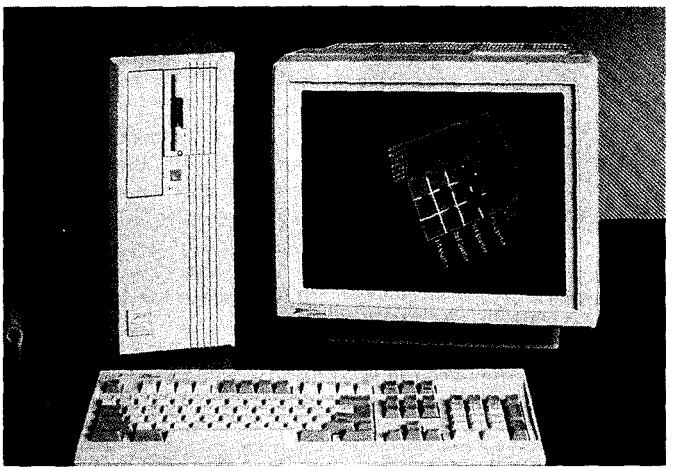
The DPX-296 also offers benefits to IBM mainframe synchronous modem users, where Hayes AT commands cannot easily be sent to the modem. An LCD display allows configuration from the modem's front panel, allowing entry of phone numbers and communications parameters. Dialling of up to 20 stored telephone numbers can be accomplished by selecting the numbers from the front panel display.

Typical applications where benefits can be realised include remote CAD/CAM systems, overnight electronic point of sale data collection (EFTPOS), graphic image file transfer in medical and desktop publishing environments, and bridging LANs betwen remote offices.

The DPX-296 is compatible with lower speed V.22bis, V.22 and V.21 modems at 2400, 1200 and 300 bps.

Designed and built in Australia, the DPX-296 is priced at $2070 tax paid. For further information, please contact, Douglas Noble, Dataplex, ☎ (03) 735 3333.

WORKSTATION



Zenith 386SX laptop and desktop

The SupersPort SX battery operated 386SX portable offers Page-White VGA display. The Z-386SX desktop runs at 16MHz with 1Mb of RAM and VGA video.

The SupersPort SX comes standard with 1Mb of RAM (up to 8Mb optional). It also features a new 2Kg rapid-charge battery which offers more than three hours of operation and can be recharged in three hours instead of the usual six to 12 hours. It is available with a 3.5in. 1.44Mb floppy drive and either a 40Mb or 100Mb hard drive at a recommended retail price of $10,399 and $11,799 (including tax) respectively.

The Z-386SX desktop is housed in a small 14-inch wide cabinet with four open ISA slots for expansion. It has a 3.5in., 1.44Mb floppy drive and either a 40Mb or 80Mb hard disk. Recommended retail prices are: 40Mb $6499; 80Mb $7699 and floppy only version $5299. (All prices include tax). For further information contact Stephen Hague, Zenith Data Systems (Australia) ☎ (02) 502 2566.

Cermetek Spectrum 9600 range

The Cermetek Spectrum 9600 combines both V.32 and V.22*bis* CCITT standards.

The Spectrum 9600 modem range delivers speeds of 4800 and 9600 bps and can also accommodate speeds of 2400, 1200 and 300 where necessary.

Spectrum provides automatic communications backup in the event of a network failure.

The Spectrum modem

CLONE INDUSTRY UNDER LEGAL THREAT

Australia's software industry is facing a crisis which may see companies fold, jobs lost and a myriad of products disappear, according to Melbourne law firm Clayton Utz.

Anna Sharpe, one of the firm's specialists in technology and intellectual property law, says the crisis results from a much publicised but poorly understood decision made by the Federal Court last year.

"The decision places at risk those thousands of software programs which try to emulate and outperform existing programs," Ms Sharpe said.

"We are looking at a scenario in which the copyright owners of existing programs can force so-called 'me too' programs off the market," she said.

Ms Sharpe said the threat arose from a judgement handed down by Mr Justice Northrop on August 7, 1989, in a case initiated by American company Autodesk Inc and its Australian subsidiary Autodesk Australia Pty Ltd.

The case involves AutoCAD, a hard wired cryptographic device used to prevent Autodesk's computer-aided drafting program from being used on equipment not fitted with the lock.

Infringed copyright

Autodesk successfully claimed that a device, known as Auto-Key, which performed the same function, infringed the AutoCAD lock copyright.

"The decision means that any clone program which substantially copies the functionality of another program could be the victim of similar action," Ms Sharpe said.

"The risk spreads across the entire software field, with obvious targets being in the areas of spreadsheet accounting packages and word processing.

"This judgement could have enormous impact on how much the clone industry, and its financiers, will be prepared to spend on future research and development."

Ms Sharpe said there are two particularly worrying aspects to Mr Justice Northrop's decision.

"First, the AutoCAD and Auto-Key locks were classified as software programs, even though they were not computer programs in the commonly accepted sense," she said. "Second, Auto-Key was found to have infringed copyright in the AutoCAD lock because it performed the same function, even though its design was dissimilar.

"Until now, the law has always looked at content, not functionality, when determining copyright infringements. In the computer industry, most market leaders compete with look-alike products which perform similar functions. We now have a situation in which the very foundation of our software development is threatened and the future of many software companies, and the jobs they create, are at risk," Ms Sharpe said.

incorporates 'smart' software that automatically switches from leased line operation to an alternate PSTN line in the event of a failure. The whole process is transparent to users.

The Cermetek Spectrum 9600 provides full duplex asynchronous and synchronous communications over PSTN or leased lines.

Priced from approximately $3000, further information is available from Colin Warry, Linkware, ☎ (03) 578 0821.

SENDFaX on your PC

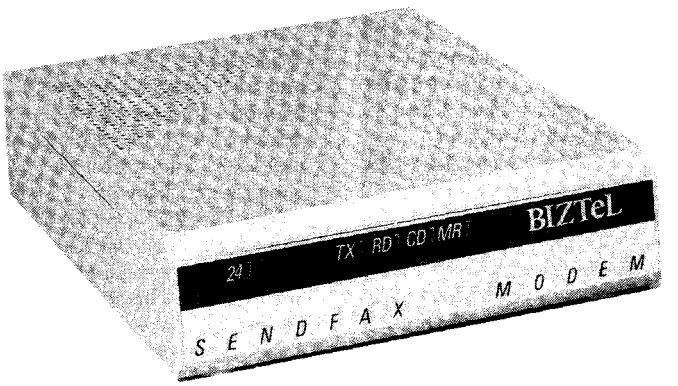
SENDFaX is an Australian designed and manufactured product which incorporates the BIZTeL Allegro 2424.SA Intelligent Modem, with the new SENDFaX CCITT V.27 Module, BITCOM modem software and BITFAX software.

The new package allows users to send a fax direct from any PC equipped with SENDFaX. SENDFaX can be programmed to auto-dial to any one of five different sub-groups available within the dialling directory, giving the user advanced multi-user fax communication options.

BITFAX software stores numbers, names and addresses which can be accessed and sorted by phone number for distribution. The Phone Book feature is compatible with Dbase III format.

A log of despatched faxes is automatically recorded by your SENDFaX package. The built-in 'Report and Log' file keeps a detailed log of the party called, any error and completion status, plus the duration of the transmission, which is particularly necessary for PC users wanting to charter their communication costs carefully.

The retail price for SENDFaX is $699 (including sales tax). For further information, contact Bob Singleton, BIZTeL Products, ☎ (02) 607 0255.



PRODUCTS AND NEWS

Xircom pocket Ethernet adaptor

Data Networks has announced a distribution agreement with Wholesale Technology to distribute the Xircom Pocket Ethernet Adapter.

The adaptor eliminates the installing of an internal Ethernet adaptor by allowing convenient connection of any IBM compatible personal computer to an Ethernet or IEEE 802.3 local area network, connecting to any parallel printer port. The fact that it can be quickly and easily moved from computer to computer makes it an economical choice for infrequent network users and ideal for laptop computer users.

With no configuration switches the adaptor completely avoids the problems of address and interrupt conflicts common with other Ethernet adaptors. Drivers for Novell version 2.0 and 2.1 are included. For further information call Data Networks ☎ (02) 488 8799.

Frame grabber

The Arlunya FG.302 TV frame grabber PCB occupies a single slot of the IBM PC or AT bus. Its function is to store one field of a TV frame in 256 × 256 pixel resolution (7 bits grey scale per pixel), and to transfer the image data to the computer memory under DMA.

The FG.302 works with any VGA display with a transfer rate of 8 images per second or more. Images can be stored as a file on diskette or hard disk. File size of an image is 51.2Kbytes.

The FG.302 accepts video input from most black and white cameras including CCIR and RS170. This enables images from a video camera to be displayed almost live on the computer VGA screen without the need for a second monitor.

Applications include computer image database, surveillance systems, desktop publishing, image analysis, inspection systems, and more. For more information, please contact The Dindima Group, ☎ (03) 873 4455.

Price reductions

Western Computer has announced price reductions on its range of Hauppauge 386 upgrade motherboards due to greatly increased purchasing volumes with Hauppauge Computer Works Inc. and a world-wide reduction in DRAM pricing.

Pricing of the Hauppauge motherboards will be considerably less across the entire range. For example, the 80386SX 20MHz Vantage motherboard, including 1 megabyte of zero wait state DRAM has been reduced to $1,000 RRP.

For further information, contact Richard Fraser, Western Computer ☎ (07) 262 3122.

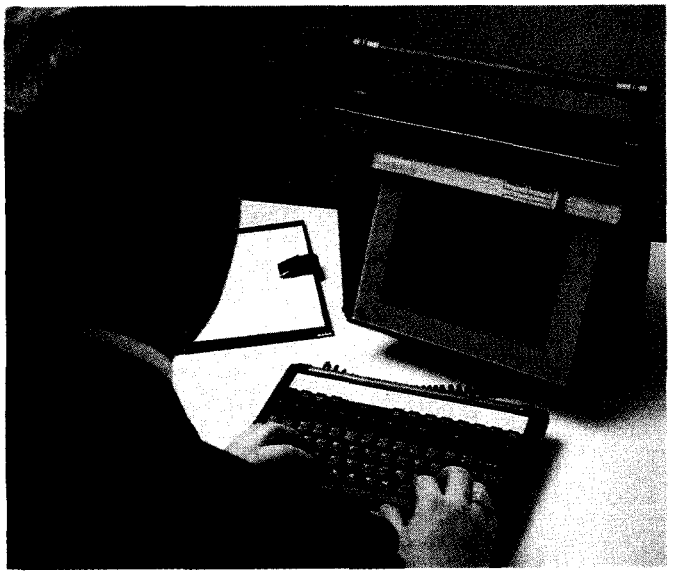
Canon breaks bar code barrier

Canon Australia has developed a means of creating and printing bar code labels at a fraction of the normal cost.

The codes are created on a personal computer under DOS using a program written by Guian Young, an Adelaide-based Canon laser beam printer technician.

The program, which is priced at $400 per family of fonts, covers all the major bar code standards and is designed exclusively for the Canon printer, which costs from $3995 depending on the model.

The software is in two parts. One is a communications program which downloads bar code fonts to the laser printer. The other is a memory-resident controlling program that helps the user assemble the bar code. Enquiries to Roger Pyne or Deane Palmer, Canon Australia, ☎ (08) 352 5366.



Transportable

Canon is to release a 386SX-based "transportable" computer, the A-200 TP/16.

The A-200TP/16 runs at 16MHz and has a standard 2 Mb of RAM expandable to 4Mb with optional memory cards.

Also standard are a 40Mb hard disk and 1.44Mb 3.5in. floppy disk drives, EGA display adapter and serial, parallel and mouse ports. Up to four 16-bit expansion boards (two full and two half-size) can be added.

The tilting plasma screen, which can be adjusted, sits in an upright cabinet which leaves a small (38cm by 13.5cm) footprint.

The A-200TP/16 folds into a compact 9 kg package with a detachable carrying handle. More information from Canon Australia, ☎ (02) 887 0166.

Sprint Expert

Sprint Expert, developed by SMS Mikrocomputer Systeme of West Germany, offers a cost-effective alternative to expensive 'mainframe' device programmers.

Sprint Expert uses ASIC technology and proven programming algorithm design to produce a combined memory and logic programmer which can be installed in a designer's PC.

Sprint Expert provides programming with Intelligent and QuickPulse algorithms, and supports a wide range of devices, including PROMs, EPROMs, EEPROMs, ZRAMs, PALs, EPLDs, EEPLDs, GALs, EPLAs and MCUs.

Priced at approximately $4500, Sprint Expert includes software for memory and logic chips, PLDASM macro assembler, universal POD base and 40 pin TOP as well as an IBM PC/AT plug-in card, 90cm cables and comprehensive manual.

For further information contact Neville Westbury, Dynamic Component Sales, ☎ (03) 873 4755.

Process monitoring with a PC

The OS 32 (operator system) is the new Siemens PC-based operator communication and monitoring system. It operates with interactive graphics under the MS DOS operating system, with the GEM operator interface and windowing. This ensures simple user control during configuration and in process applications.

The OS 32 is used for visualisation and archiving of process data and offers additional operator functions. It is "open" to the extent that the user can implement specific routines such as logic algorithms. The OS 32 can be easily integrated via a point-to-point link or the Sinec L1 bus in Simatic S5 automation systems.

"Full graphics" windowing is available to the user for the visualisation of process data; this allows a display of up to four windows with additional or detailed information in parallel in the system image. For displaying measured values, there is a choice of horizontal and vertical bar representaion and curve representation with zooming and a ruler.

The user can operate the process by entering data via the keyboard in configured fields and by direct switching in the digital screen element using mouse or function keys. An error message system is available with functions comprising acquisition, storage, displaying, printing, acknowledging and sorting. The monitoring features are extended to include a special alarm window, alarm counter and a facility for assigning six alarm priorities.

The OS 32 acquires process data at a one-second rate, with freely selectable compression cycles from one minute onwards. These data are stored as hourly, daily or monthly mean values for standard logs. The data can be converted to the DIF format for external processing. For further details contact Michael Gough, Power Engineering and Automation, Siemens, ☎ (03) 420 7218.

Multi-platform film recorder

Mitsui Computer has launched the new Mirus FilmPrinter Plus 35mm film recorder.

Fitting into the desktop presentations market, the FilmPrinter Plus claims a number of important firsts with its support of all leading personal computer platforms in its standard shipping configuration.

This desktop digital 35mm slidemaking system supports Apple Macintosh, IBM-PC/AT, and PS/2 computers with specific software drivers — MirusImage-MAC, MirusImage-DOS, and MirusImage-WINDOWS.

The Mirus FilmPrinter Plus features a fully automatic camera to provide users with on-screen display of camera status such as the number of frames remaining and the number of frames imaged. The camera is also engineered to prevent accidental exposure of imaged film. Loading and rewinding film is completely automatic. The FilmPrinter Plus is fully compatible with and supports Apple's 32-bit Color QuickDraw — and when combined with a RasterOps ColorBoard 224 or 264, provides brilliant rendition of the entire 24-bit colour spectrum. The FilmPrinter Plus is capable of resolution of up to 8,000 scalable lines. It has the complete family of LaserWrite Plus fonts, scalable to any size, and with professional quality typographic kerning.

The FilmPrinter Plus has a recommended retail price of $13,495. For further information contact David Wallis, Mitsui Computer, ☎ (02) 452 0452.

Computers clean up

Computers were used to help organise more than 100,000 volunteers for the first ever national clean up of Australia on Sunday, January 21, 1990.

The computers were donated to Clean Up Australia, Ltd, the national co-ordinating body by Datapoint, a Clean Up Day sponsor.

The computers, which were networked, kept a file of all the 150 organising committees throughout Australia and produced appropriate documentation, using Tracker database software and WordPerfect word processing software. Further information from John Winters, Datapoint, ☎ (02) 922 3100.

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360K X 100 (DB)	70.00	1		
1.2M X 10	15.00			
1.2M X 100 (DB)	145.00	1		
1.44M X 10	53.00			
1.44M X 40 (DB)	200.00	1		
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PRINTER STAND 15"	16.00	1		
COMPUTER STAND	16.00	1		
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PRINTER	9.50			
MODEM	10.00			
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STAR NX1000	8.00			
EPSON LX800	8.00			
EPSON LQ500	8.00			
Panasonic, Super 5	9.00			
SUBTOTAL (1)				

ITEM	UNIT PRICE	SC	QTY	TOTAL
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5.25" 1.2M	190.00	2		
3.5" 1.44M	190.00	2		
MOUSE	75.00	1		
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DIGITISER TABLET	590.00	3		
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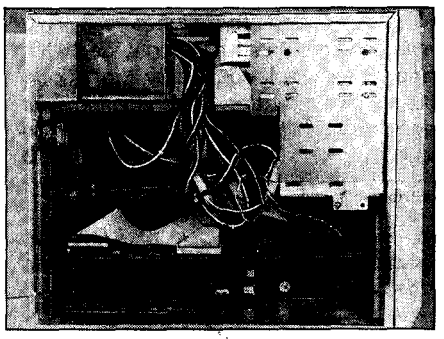
READER INFO No. 16

(Continued from page 38)



12

There are several small jobs to do before closing up the case and testing the computer. Connect the data and address cables to the floppy disk and hard disk drives, ensuring you get them around the right way. Also to be connected to the drives are the power cables coming from the power supply. These are keyed and so you are unable to connect these incorrectly.

Another job left to be done before closing the case is to install the spare slot brackets in the space where you do not have any peripheral cards installed.

Notes

You may notice from the pictures that a black plastic battery holder, for 4 × AA size batteries, is provided with each of the three cases. I didn't need to use these in my installations as one of the computers had a detachable NiCad battery, another had an onboard lithium battery and the other featured a DIL real time clock module, which includes its own minature lithium battery.

You may also notice from the pictures showing the rear of the cases some extra cutouts, near the same area for the round hole for the keyboard connector. These are designed to mount additional D-type connectors. There are provisions for both D-9/15 and D-25 connectors. These are handy where you have a multifunction card which provides more than one serial and/or parallel port. Rather than taking up an extra slot space where other add-on cards can be mounted it would be advantageous to mount the extra connector(s) in these extra slots – good thinking.

Both the tower case from Rod Irving Electronics and that from Energy Control included in their front panel a display section containing two seven-segment displays. By connecting them correctly with the appropriate connectors on an AT-type motherboard, these can be used to display the speed at which the computer is operating. No instructions for the operation of this display were provided with the Rod Irving case and a one-sheet instruction sheet – which wasn't very helpful – was provided with the Energy Control unit. The operation of these displays is similar in principle to the ETI-1624 project by Mick Gulovsen, which appeared in ETI's July 1989 issue. A bit of exploratory work proved successful in getting the displays operating correctly.

If your tower case came with a power supply, the power switch on the front panel may or may not already be connected to it. If it isn't, take note of the warning sticker on the power supply which tells you which pair of the four leads going to the switch are the inputs, and which are the outputs. After noting this, it is a simple matter of checking the operation of the switch with a multimeter and connecting the leads to the rear of the switch by pushing the lug connectors over the metal contacts on the switch and sliding the little insulator sleeve over each connection. Check it, for safety's sake.

Your case will be supplied with a "hardware" kit, containing screws, pc board spacers, battery holder, slot brackets, blanking panels, slot guides and other paraphernalia.

The finale

Once you have re-assembled the casing around the whole unit and have screwed it back on securely it is time to test your machine.

Re-connect your monitor, serial and parallel cables (if you have any), keyboard and any other peripheral devices. Also connect the IEC cable to supply power to the machine.

Ready? Switch on, and stand back!

It should be reasonably evident whether or not the computer is working. Ensure the RAM test is successful and the computer boots off the drive it normally does, i.e. your hard disk or floppy disk.

Once you have booted up the machine, you should run CHKDSK (see your DOS manual) to check any hard disks on the system and ensure that all your data is still intact. Also check your printer port – simply print something out – and your serial port – use your mouse or test your modem.

If all seems OK you should test the RESET button on the front of the case and test the TURBO switch if this is intended to be operational.

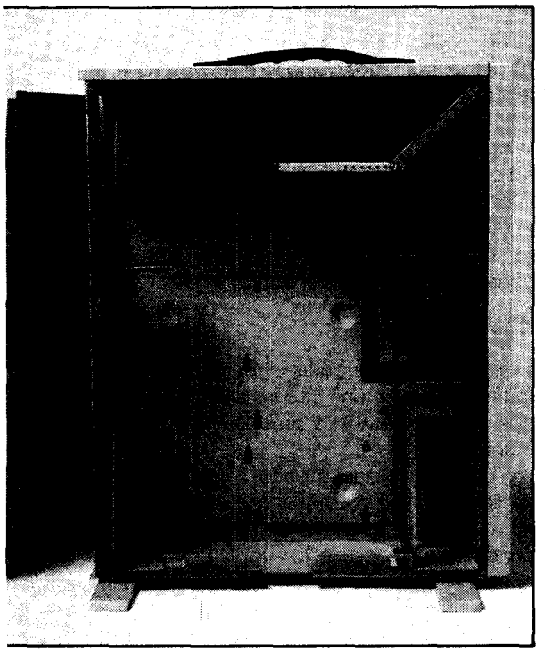
Conclusion

Although computer cases are one of the cheaper computer accessories on the market, they can't exactly be bought out of your spare change. So you all want to know which one I thought was the best.

Well, I'm sorry to disappoint you, but I couldn't single one case out as the Grand Case of all cases. You will have to choose the one most suited to your needs.

The computer case from Energy Control International was of the 'mini-tower' variety and so was the most compact of the three. The push buttons on the front had good, clean operation and the case on the whole presented quite well. Be warned, however, not all computer boards will fit into this housing as it is a rather tight fit. It would be best to measure your board first and check with Energy Control to see if the case is suitable for your application.

The ECI case had provision for two 5.25-inch drives, say one floppy disk and one hard disk drive, and two of the 3.5-inch variety – probably all you will need. A distinct advantage for this case was the power



The naked insides will look like this. This is the Rod Irving case.

supply was quite compact, reducing overall weight, and one of the power leads for the disk drives had a connector fitted, suitable for 3.5-inch drives; very handy if have an existing 3.5-inch drive or intend to fit one in the near future. For the other cases, adaptor cables are available from most major retailers.

The tower case from PC Marketplace was of the full-size variety. It had a good, sturdy flared metal base, making your system quite stable. The internal framework was reinforced with a metal bar running from the front to the back of the case.

No less than six disk drives were able to be mounted in the unit, although the spaces for each of these were all for the 5.25-inch variety. However, many 3.5-inch drives are supplied with adaptor kits which allow them to be mounted in the space usually allocated for their larger counterpart.

On the particular unit supplied to us the RESET button on the front face had a tendency to get stuck 'on' after pressing it; a slight touch usually freed it up however.

The power switch on the face of the computer was different to that on the other cases – it was of the push-on push-off variety. These, I don't think, have any particular advantage or disadvantage, it's just a matter of personal preference.

As the previous two cases had their controls and indicators placed in the middle of the front panel of the unit, the tower case supplied by Rod Irving Electronics had its paraphernalia located at the top of its front panel.

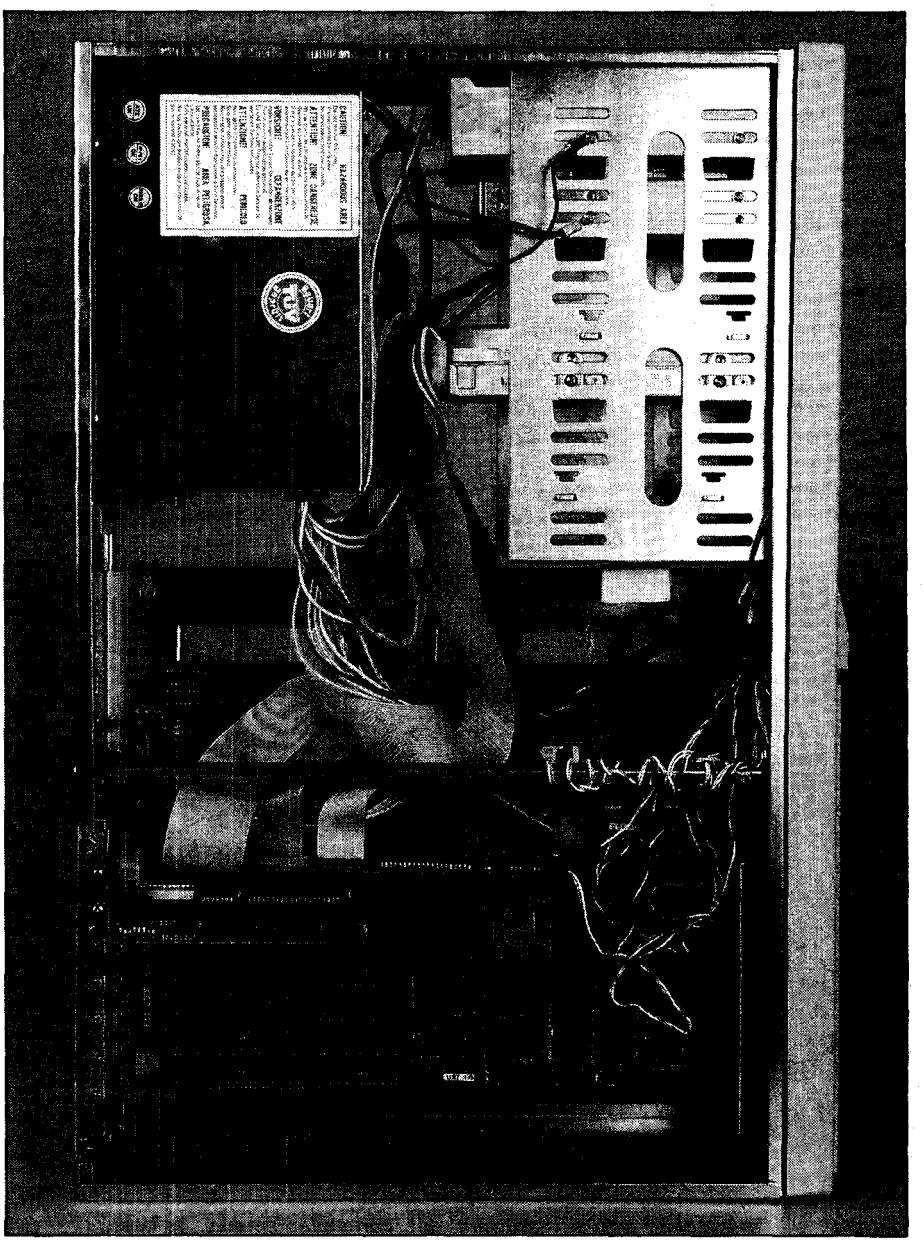
This had the advantage that when reaching for the case just under your desk the controls were right at the top, easiest to reach. However, this meant that the floppy drive(s) were more out of the way than those on the other cases.

Room was provided for two 5.25-inch drives and three 3.5-inch drives in the case from Rod Irving's. Two sets of rectangular 'feet' were attached to the underside to stabilise it when standing on the floor. Also, a handle was present on the top of the enclosure – although once the drives and computer are installed (and considering the size of the case) I'm not sure too many people would be keen to carry it around with them.

Anyway, there it is – your step by step guide to 'Towering your PC'. Obviously some procedures and techniques will vary between computers but the basic idea is the same. As for which one to buy, that's up to you; it's just a matter of considering your needs and making a choice based upon them. eti

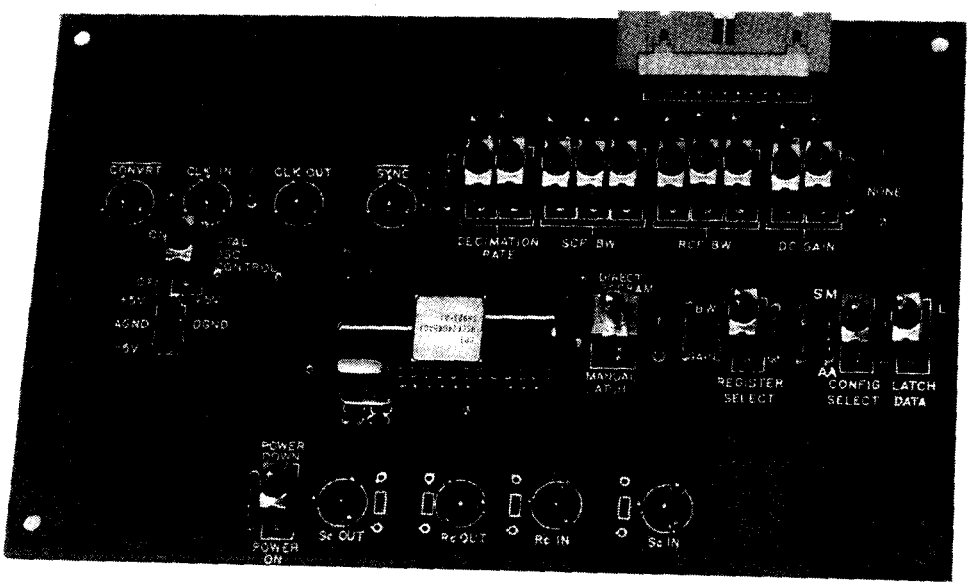
Contributed by The Apogee Group

We would like to thank the following companies for supplying the cases depicted in this article. Energy Control International, 26 Boron St, SUMNER PARK QLD 4074 ☎ (07)376-2955; Rod Irving Electronics, 56 Renver Rd, CLAYTON Vic 3168. ☎ (03)543-7877; PC Marketplace, PO Box 1100, LANE COVE NSW 2066 ☎ (02)418-6711.



One completed tower! This shows the completed PC Marketplace maxi-tower.

PROGRAMMABLE ACTIVE LOW PASS AUDIO FILTER



ELECTRONICS
ETI-1428

Here's a technology demonstration project from Energy Control, with rather a different flavour. By Craig Wiley and Richard D. Davis of Signal Processing Technology, a Honeywell company. Part 1.

This project provides hands on experimentation and evaluation of Honeywell's HSCF24040 programmable 7th order active low pass filter chip which features a programmable cut off frequency up to 20 kHz, and 85 dB dynamic range, stopband attenuation greater than 76 dB, programmable dc gains of unity, two, four and eight and microprocessor interfacing. It may be used in a wide variety of applications, including: audio spectrum analysis equipment, data acquisition systems, speech analysis and synthesis, test equipment and instrumentation, medical filtering, 12-bit signal processing systems and more. In part 2, next month, the data sheet provides more information on this versatile, high performance device.

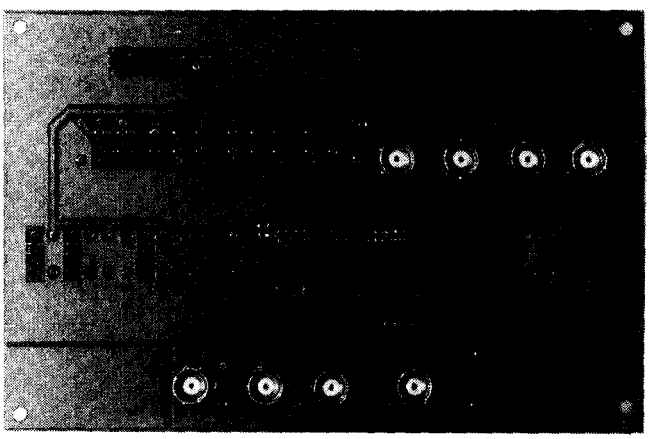
It is constructed on a double-sided pc board with through-plated holes and featuring copious groundplane areas – separate groundplanes being provided for the analogue and digital sections to minimise coupling between them. It only requires a dual supply rail of +/—5V.

Programming and control of the device is conveniently enabled by on-board toggle switches. Alternatively, programming and control can be accomplished by a microprocessor system through the on-board ribbon cable connector, allowing full software control.

As the HSCF24040 features both an RC active filter and a switched capacitor filter, the board provides analogue input and output for both. And note that both filters are fully programmable. The HSCF24040 provides an internal oscillator for crystal control and the board utilises this feature. There is the option of using an external timebase, too.

On-board BNC connectors are provided for the analogue interfacing, to minimise noise and coupling from the digital circuitry. On-board BNC connectors are also provided for external clock input and clock output, for the CONVRT output and the SYNC control line. Again, on-board BNC connectors are used to minimise digital to analogue coupling.

Figure 1 and the above photograph show the general



Underside of the pc board, showing the BNC connectors.

Audio filter

layout of the board. Power is supplied via an on-board 6-way keyed Molex connector, the digital and analogue grounds only being connected together *at the power supply.*

About the HSCF24040

The HSCF24040 is a monolithic active filter system. Its analogue signal path contains a 3rd order lowpass active RC filter (RCF),

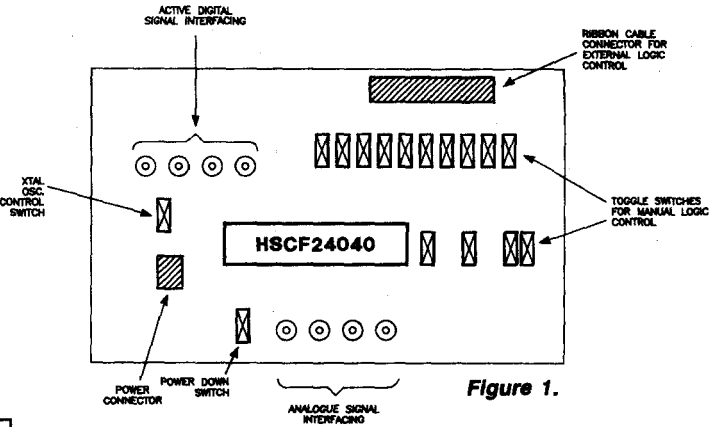
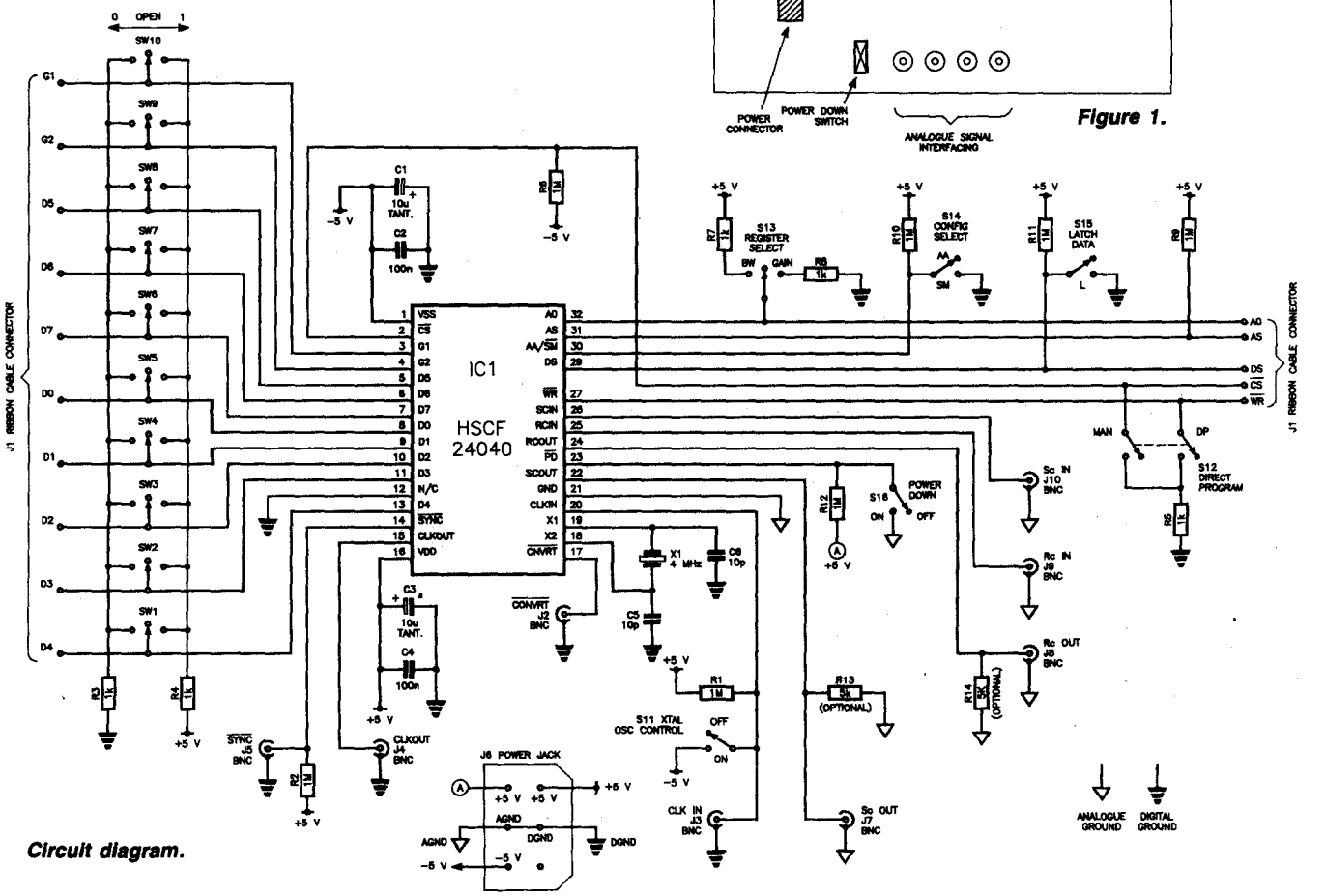


Figure 1.



Circuit diagram.

a 7th order lowpass switched-capacitor filter (SCF), and a sample-and-hold (S/H) stage. The HSCF24040 is intended to provide front end filtering for instrumentation systems of up to 12 bits. The basic function provided by the device is to bandlimit an input signal so that unwanted out-of-band components are not aliased or folded into the desired passband upon sampling by an A/D converter. For this application, the input signal to be bandlimited is applied to RCIN (pin 25). The output of the RC filter, RCOUT (pin 24), is connected internally to SCIN by forcing the AA/SM\ digital input (pin 30) high. The output of the S/H is provided at *SCOUT* (pin 22). This output is a sampled-and-held signal suitable for input to an A/D converter. The analogue signal path for this configuration is shown in Figure 2.

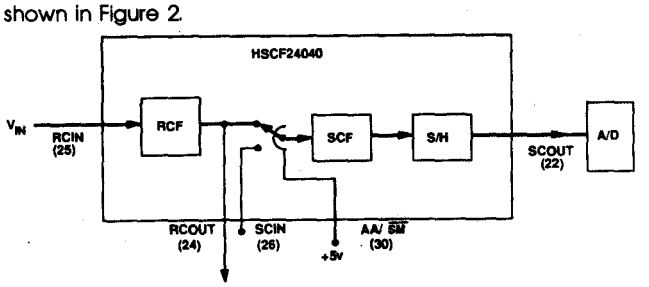


Figure 2.

For applications where the user wishes to input signals directly into the SC filter, the *AA/SM* digital input must be forced low. This disconnects the internal path between RCOUT and SCIN and allows independent use of the RC filter and SC filter.

The bandwidths of the SC filter and RC filter and the DC gain of the SC filter are user programmable. In addition, the hold-time of the S/H output, SCOUT, is programmable. These analogue attributes are controlled by 10 data inputs, DO-D7 and G1-G2. Synchronisation between the HSCF24040 and the external system (A/Ds, D/As, S/Hs etc) is provided by the CLKOUT and CNVRT\ outputs and the SYNC\ input.

The details of how these digital inputs control the filter attributes are described later.

Switched capacitor filter basics

Switched-capacitor (SC) filters are sampled-data filters that provide extremely stable and precise filter responses. This is due to the fact that their internal time-constants depend only on the filter's switching frequency and the ratios of monolithic capacitors. The switching frequency is normally derived from a crystal oscillator and is therefore very precise. Ratios of on-chip capacitors are nominally accurate to 0.1%. Therefore, high order/sharp rolloff filters can be manufactured without requiring any post-production trimming. Furthermore, since the SC filter's time-constants are

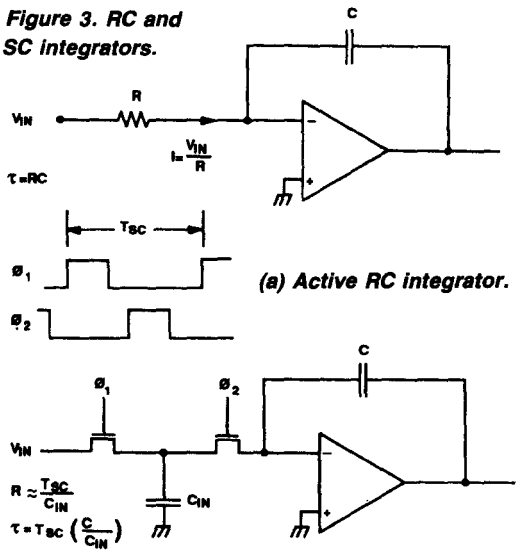
inversely proportional to the switching frequency, the filter's bandedge can be programmed simply by varying the frequency of the SC filter clock.

SC filters operate by transferring charge packets rather than continuous currents. Consider the RC integrator shown in Figure 3(a). A voltage V_{in} causes a current V_{in}/R to flow into the feedback capacitor C. The SC integrator shown in Figure 3(b) replaces the resistor R with a switched capacitor, C_{in}. The MOSFET switches periodically toggle the capacitor between the input V_{in} and the input node of the op-amp. This is accomplished via the two-phase, non-overlapping clocks: Ø1 and Ø2. The period of these clock signals is T_{SC}.

Every T_{SC} seconds an amount of charge equal to $C_{in}V_{in}$ is transferred to the feedback capacitor. The average input current is therefore $C_{in}V_{in}/T_{SC}$ and the effective resistance is T_{SC}/C_{in}. The time constant of the RC integrator is given by $\tau = RC$. The time constant of the SC integrator is given by $\tau = T_{SC}C/C_{in}$. Thus the time constant of the SC integrator (and therefore the filter response of an SCF built from such integrators) depends only upon the clock frequency and the ratios of on-chip capacitors.

The input to the SC filter on the HSCF24040 is double sampling, as shown in Figure 4. In this case, charge is transferred on both phases of the filter clocks. Therefore, the effective input sampling rate is $f_{sample} = 2/T_{SC}$.

Figure 3. RC and SC integrators.



(a) Active RC integrator.

(b) Switched capacitor integrator.

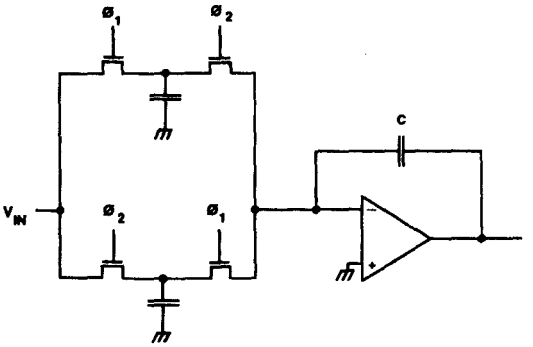


Figure 4. SC double sampling input.

Filter clocks and the SCF bandwidth

A partial block diagram of the HSCF24040's logic, SC filter, and

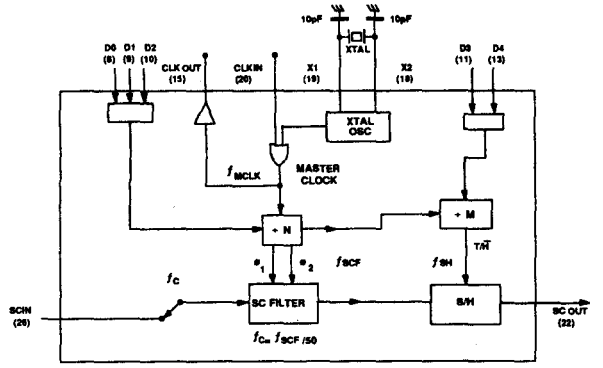


Figure 5. HSCF24040 Partial block diagram.

S/H is shown in Figure 5. The master clock is either provided by the user via the CLKIN input (pin 20) or by using the on-chip crystal oscillator. The crystal oscillator is enabled by forcing the CLKIN input to the negative supply, VSS. The crystal oscillator is disabled as long as the CLKIN input remains between ground and the positive supply, VDD. (Thus, whenever CLKIN is being driven by an external [0-VDD] clock signal the crystal oscillator is disabled). Let us define the frequency of the master clock signal as f_{MCLK}. The master clock first enters the programmable divide-down section. This section also generates the two-phase, non-overlapping clock signals used by the SC filter. Define the frequency of the SCF clock signals, Ø1 and Ø2, as f_{scf}. The relationship between the master clock frequency, f_{MCLK}, and the SCF clock frequency, f_{scf}, depends on the input data bits D0-D2 that control the divide-down factor.

Define the bandedge or cut-off frequency of the SC filter as f_C. The relationship between the SC filter bandedge and the SC filter clock frequency is fixed and is given by:

$$f_C = f_{scf}/50$$

The relationship between the master clock frequency, the SC filter clock frequency, the SC filter bandedge, and the programmable bits D0-D2 can now be given by:

$$f_{scf} = f_{MCLK}/N$$

$$f_C = f_{scf}/50 = f_{MCLK}/(50 \cdot N)$$

where N is the divide-down factor determined by D0-D2. These relationships are further specified in Table 1.

D0	D1	D2	N	f_{MCLK}/f_{scf}	f_{MCLK}/f_C
0	0	0	4	4	200
0	0	1	8	8	400
0	1	0	16	16	800
0	1	1	32	32	1,600
1	0	0	64	64	3,200
1	0	1	128	128	6,400
1	1	X	256	256	12,800

X=don't care

Table 1.

The output of the SC filter is a sampled-and-held signal that changes values on the rising edge of each Ø1 clock and remains constant between these times. This is shown in Figure 6.

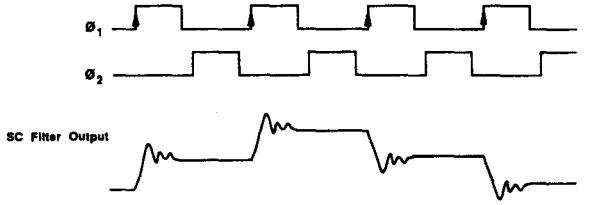


Figure 6. SC filter output.

S/H and programmable decimator

The output of the SC filter is sampled by an on-chip sample-and-hold circuit (S/H). The S/H samples the output of the SC filter only during the time when the SC filter clock Ø2 is high. This is illustrated

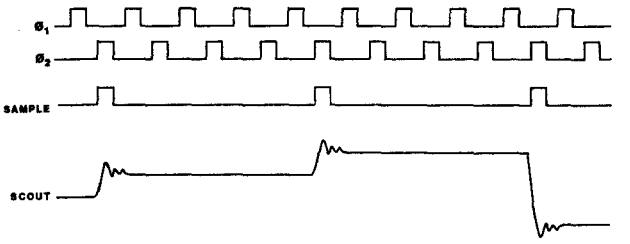


Figure 7. S/H sampled SC filter output.

in Figure 7. The S/H holds the input value until it takes another sample during a subsequent Ø2. This process is controlled by the S/H logic shown in Figure 5. This section contains programmable divide-down logic that is controlled by the programming inputs D3 and D4.

The S/H can be programmed to wait a certain amount of time before taking another sample from the SC filter. The amount of time that the S/H waits is determined by the programming bits D3 and D4. When D3 = D4 = 0, the S/H samples on every 2nd Ø2. When D3 = 0 and D4 = 1, the S/H samples on every 4th Ø2. When D3 = 1 and D4 = 0, the S/H samples on every 8th Ø2. Finally, when D3 = D4 = 1, the S/H samples on every 12th Ø2.

The sampled-and-held output at SCOUT (pin 22) therefore changes values at a rate that is a submultiple of the SC filter clock rate f_{scf}. Let us define the sample rate of the S/H output at SCOUT by $f_{s/h}$. The relationship between the sample rate at SCOUT and the SC filter clock rate and SC filter bandedge is given in Table 2.

Because the S/H reduces the sample rate at the output of the SC filter, it is also called a decimator. The point to remember is that the S/H samples every 2nd, 4th, 8th, or 12th output provided by the SC filter and holds this value at SCOUT until another sample is taken.

An example will now be given. Consider the case where a 10 kHz SC filter bandwidth is desired. The output of the HSCF24040 is to be fed into a 12-bit A-D convertor that converts in 20µ sec. The master clock frequency is fixed at 4 MHz.

Solution: By programming D0 = D1 = 0 and D2 = 1, a 10 kHz SC filter bandwidth is achieved. The output of the SC filter changes at a rate of 4 MHz/8 = 500 kHz. The hold time of the SC filter is thus only 2µ sec and must be further increased by the on-chip S/H. If the HSCF24040 is programmed with D3 = D4 = 1, the sample rate at SCOUT 500 kHz/12 = 41.667 kHz which results in a hold time of 24 µ sec. This meets the requirements for the A/D convertor. Also note that we are converting the (now bandlimited) input signal at a rate slightly greater than four times the bandedge frequency of 10 kHz.

Synchronisation

We discussed earlier how the SCOUT output of the HSCF24040 is a sample-and-held signal with a programmable hold time. In order to synchronise this output with an external S/H or A/D converter, CNVRT\ output is provided. This active low digital output tells the user when the SCOUT output has settled to a new value and can be externally sampled or converted. The timing for CNVRT\ is shown in Figure 8. CNVRT\ goes low on the rising edge of the SC clock Ø2 that follows the Ø2 period when the on-chip S/H took its sample. CNVRT\ goes high on the falling edge of the SC clock Ø1 that precedes the rising edge of the Ø2 when the next sample is taken by the S/H. Thus the hold time as indicated by the CNVRT\ output is either 1, 3, 7 or 11 SC filter clock periods long. The falling edge of the CNVRT\ signal is coincident with the rising edge of the master clock. It is intended that the falling edge of the CNVRT\ output be used as a strobe for triggering an external S/H or A/D converter.

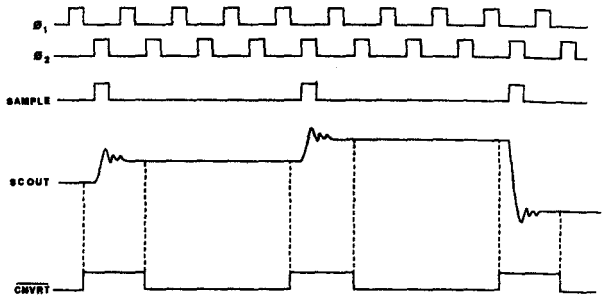


Figure 8. CNVRT\ timing.

The master clock signal is driven off-chip via the CLKOUT output (pin 15). This digital output functions independent of whether the user is supplying an external clock via the CLKIN input or is using the on-chip crystal oscillator.

The other part of the synchronisation issue involves telling the HSCF24040 which master clock period should be aligned with the falling edge of the CNVRT\ signal. As an example of why this is necessary, consider the case of multiple HSCF24040s that feed a MUX prior to A/D conversion. This is shown in Figure 9. If it is desired

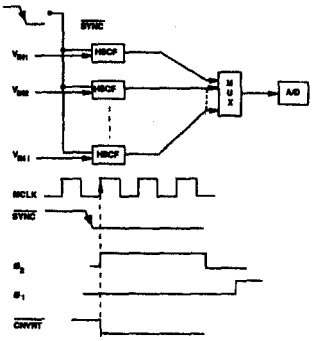


Figure 9. Multiple HSCF sync.

that all of the HSCF24040s sample their inputs simultaneously, then they must all be synchronised to each other. This can be accomplished by using a common master clock for all filters and by tying all of the SYNC\ (pin 14) inputs together and supplying a negative edge on this common SYNC\ input. On the next rising edge of the master clock, two things happen: (1) the Ø1 and Ø2 SC filter clocks are reset beginning with the rising edge of Ø2, and (2) the CNVRT\ output goes low.

Note that all of the HSCF24040 SC filter clocks are now synchronised and their CNVRT\ outputs change at the same times. (This assumes of course that all of the HSCF24040s have the same values for D0-D4 and are using a common master clock.)

The actual sampling instant of the individual HSCF24040s may differ somewhat due to differences in the delay between the externally applied master clock and the on-chip generation of the Ø1 and Ø2 clock signals. This difference should typically be less than 10 nsec.

In order for proper synchronisation to occur, the falling edge of the common SYNC\ input must occur at least 75 nsec after the rising edge of the previous CLKOUT period and must occur at least 75 nsec before the rising edge of the next CLKOUT period.

Once the HSCF24040s have been synchronised via the SYNC\ input, they *do not* need to be re-sychronised every $1/f_{s/h}$ seconds. This is because an on-chip SYNC\ signal is generated every $1/f_{s/h}$ seconds. It is required, however, that the external SYNC\ input return to a logic high level at least 1 master clock cycle prior to the falling edge of the next CNVRT\ output. (Otherwise, the on-chip SYNC\ will not function.) If the user does not need the synchronisation feature, the SYNC\ input should be tied high.

It should be noted that whenever the HSCF24040 is resynchronised, the SC filter clocks, Ø1 and Ø2 are RESET. This will cause a transient in the SC filter which must die out before a valid output is obtained which takes $1/f_c$ seconds to occur, worst case. Therefore it is best to synchronise the HSCF24040 only during a power-up reset or system set-up period, and subsequently allow the internal synchronisation signal to control the S/H timing.

The dc gain of the SC filter is programmable via the programming inputs G1 and G2. The relationship between SCF dc gain and these inputs is given in Table 2A. Note that the internal

D3	D4	$f_{sc}/f_{s/h}$	$f_{s/h}/f_c$
0	0	2	25.0
0	1	4	12.5
1	0	8	6.25
1	1	12	4.1667

Table 2.

G1	G2	SCF DC Gain
0	0	8.0
0	1	4.0
1	0	2.0
1	1	1.0

Table 2A.

signal swing of the SC filter is ±3 volts. This means that if a gain of 8.0 is used the SC filter input must be limited to ±0.375 volts in order to prevent clipping or distortion.

The active RC filter

The HSCF24040 also contains a 3rd order, active RC, lowpass filter. The dc gain of the RC filter is trimmed so that the gain through both the RC filter and SC filter is unity ±0.1%. The RC filter's input/output signal swings are limited to ±3 volts. The 3 dB bandwidth of the RC filter is programmable via the programming inputs D5-D7.

Eight different bandwidths are available ranging from 7 kHz to 80 kHz. The accuracy of the RC bandwidths is +5% and -0% from nominal. The bandwidths are set to this accuracy by laser trimming on-chip resistors during wafer test.

The relationship between the inputs D5-D7 and the RC filter bandwidths are given in Table 3. The system aspects of how to

D7	D6	D5	RCF 3dB Bandwith
0	0	0	80kHz
0	0	1	56kHz
0	1	0	40kHz
0	1	1	28kHz
1	0	0	20kHz
1	0	1	14kHz
1	1	0	10kHz
1	1	1	7kHz

Table 3.

choose the proper RC filter bandwidth for a particular SC filter bandwidth are discussed later.

Data input, including microprocessor interface

As mentioned earlier, there are 10 data inputs, D0-D7 and G1-G2, that control the analogue attributes of the SC filter and RC filter. This section explains how these data inputs are read by the HSCF24040.

The HSCF24040 has two basic modes of data input: *direct program* and *data latch*. The direct program mode is entered by forcing the *CS* input to the negative supply, VSS. This disables the remaining data control inputs, *DS, WR\, AO,* and AS. At the same time, the internal data latches for D0-D7 and G1-G2 are made to be transparent. This causes the values for D0-D7 and G1-G2 to be transmitted directly into the HSCF24040 and modify the filter attributes immediately. The direct program mode is useful for those aplications where the 10 data inputs can be hardwired or are driven by a dedicated set of external latches. Note also that the *CNVRT* and *CLKOUT* outputs and *SYNC* input are not

Audio filter

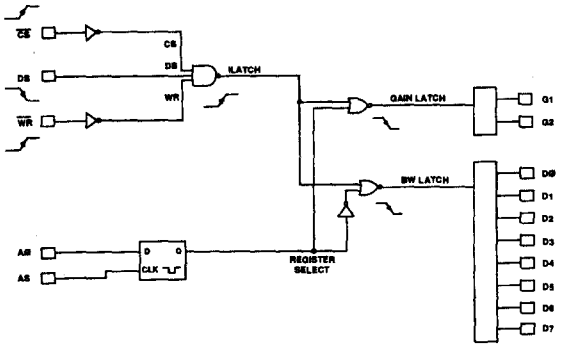


Figure 10. Equivalent latch logic.

effected by which programming mode is used.

The data latch mode is characterised by having to latch the 10 data inputs into their internal data registers. This process is controlled by the five microprocessor inputs *CS\, DS, WR\, AO,* and *AS.* All of these signals must range between ground and the positive supply, VDD, when in the data latch mode. An equivalent logic diagram is shown in Figure 10. The three input signals *CS\, DS* AND *WR* are used to generate the actual latch signal. The *AO* and *AS* inputs are used to determine which group of data inputs are being latched into the HSCF24040: DO-D7 representing bandwidth information or G1-G2 representing DC gain information.

The internal latch signal, ILATCH, is generated by inputting the signals *CS\, DS,* and *WR* into a NAND gate. Thus Table 4 shows

$\overline{CS}$	DS	$\overline{WR}$	ILATCH
0	1	↓	↓
0	↓	0	↓
↓	1	0	↓
1	X	X	1
X	0	X	1
X	X	1	1

Table 4.

the three ways to generate a rising edge on ILATCH.

The rising edge on ILATCH generates a falling edge latch signal on either GAIN LATCH or BW LATCH, depending on the value of the internal REGISTER SELECT signal. If REGISTER SELECT is high, the BW LATCH is enabled. If low, the GAIN LATCH is enabled.

The D flip-flop, that has *AO* as its D input, is only a half latch. Therefore, where *AS* is high, *AO* propagates directly through to the REGISTER SELECT signal. When *AS* goes low, the value of *AO* that was present just prior to the transition is latched into the flip-flop. The relationship between *AO, AS,* and which register is selected is given in Table 5.

A0	AS	Internal Register
1	1	BW Register D0-D7
0	1	Gain Register G1-G2
X	0	BW or Gain depending on latched value of A0

Table 5.

When using a microprocessor where the address information is valid during an entire bus cycle, there is no need to latch the value of *AO* using the *AS* strobe input. The *AO* input can simply be connected to one of the microprocessor address bits and the *AS* input can be tied high. A typical connection to a Motorola 8-bit non-multiplexed microprocessor bus is illustrated in Figure 11. The timing diagram for this case is shown in Figure 12. Note that two write cycles are required to write new data into **both** the gain and bandwidth registers.

When using a microprocessor where the address information is time-multiplexed with the data information on the same bus, the *AS* input must be used. An example would be the case of a

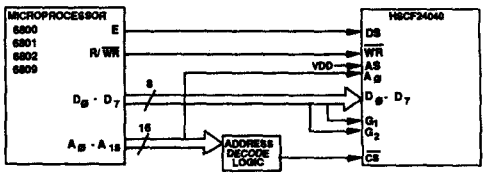


Figure 11. Motorola 8-bit bus connection.

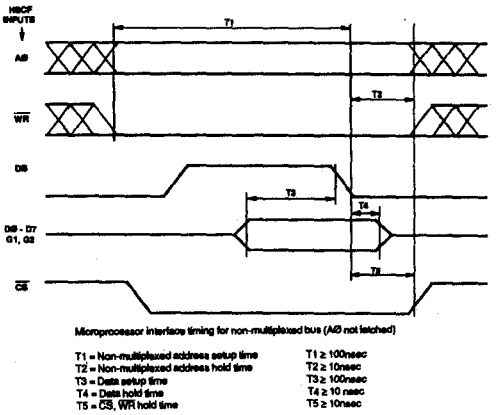


Figure 12. Timing diagram for non-multiplexed bus.

Motorola 8-bit multiplexed microprocessor bus as illustrated in Figure 13. Figure 14 shows the connections necessary for an Intel 8-bit multiplexed microprocessor bus. The timing diagrams for the multiplexed bus case (both Motorola and Intel) are shown in Figure 15.

Choosing bandwidths

The SC filter in the HSCF24040 is a 7th order Chebyshev lowpass. The passband ripple is less than ±0.1 db. Additionally, the loss for

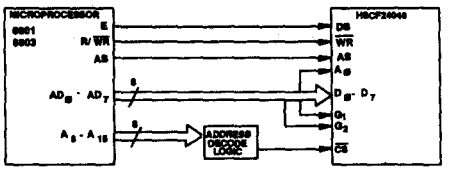


Figure 13. Motorola multiplexed bus.

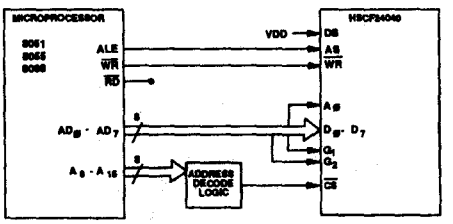


Figure 14. Intel multiplexed bus.

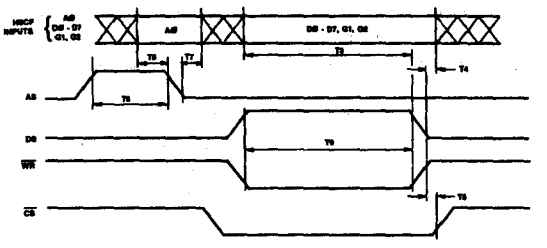


Figure 15. Timing diagram for multiplexed bus.

frequencies greater than three times the SC filter bandedge is better than 76 dB. Because of this, the *SCOUT* output can be converted by an A/D (or re-sampled) at a rate as low as four times the filter bandedge while guaranteeing that all out-of-band signals aliased into the passband are smaller than ½ LSB at 12 bits. This is illustrated in Figure 16.

Although the SC filter provides excellent filtering and protection against aliasing, it does have one drawback. Because it is a sampled-data filter, it can fold or alias out-of-band energy into the desired passband just as an external A/D converter (or external S/H) would. We are aided in this case, however, by the fact that the SC filter sampling rate is many times greater than the bandedge of interest. Recall that the SC filter input sampling rate is 2*fscf* = 100*fc*, where *fc* is the SC filter bandedge. This implies that frequencies within the band from 99*fc* to 101*fc*, if present at the input to the SC filter, will be folded into the passband.

In order to prevent aliasing by the SC filter, it is preceded by a 3rd order, lowpass, active RC filter. The magnitude response of the RC filter must simultaneously satisfy *two* conflicting constraints. The first constraint is obvious from the preceding discussion. The RC filter must provide at least 72 dB of loss at 99 times the SC filter bandedge frequency. The second contraint is that the RC filter

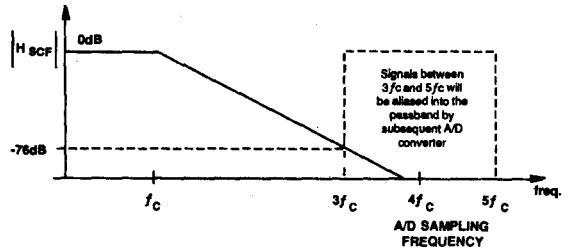


Figure 16. SC filter bandedge loss.

must have less than 0.05 dB of *droop* at the SC filter bandedge frequency. This guarantees that the passband response of the cascaded RC filter and SC filter is dominated solely by the SC filter passband response.

Because these two constraints on the RC filter are widely separated in terms of frequency, this goal can be met with only a 3rd order lowpass filter. Let the 3 dB frequency of the RC filter be defined as f_O(RCF) and the SC filter passband be defined as f_C as before. The RC filter has 0.05 dB of droop at f_O(RCF)/4 and greater than 72 dB of loss at 17.25•f_O(RCF). This relationship is true for all eight programmable RC filter bandwidths.

If an SC filter with a bandedge $f_C = f_O$(RCF)/4 is used, the first constraint is met exactly. The second constraint is met with room to spare since the RC filter loss at $99f_C = 99f_O$(RCF)/4 = $24.5f_O$(RCF) is greater than 72 dB. (Recall that the RC filter loss is greater than 72 dB for frequencies greater than $17.25f_O$(RCF).

In fact, this implies that the same RC filter bandwidth setting can be used with an SC filter whose bandwidth is $f_C = 0.7\,f_O$(RCF)/4. For this second case, the first constraint is met with room to spare. The second constraint, however, is met exactly since the loss at 99 f_C = (99)(0.7)f_O(SCF)/4 = $17.3f_O$(SCF) equals 72 dB.

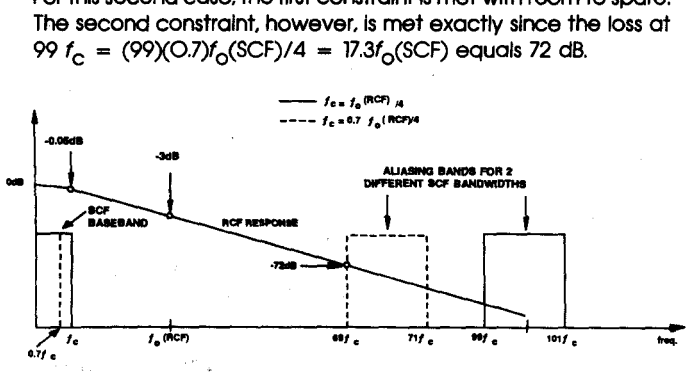


Figure 17. Alias dampening from RC filter.

This ability of a single RC filter bandwidth to accommodate a range of SC filter bandwidths (and still guarantee that any aliases are greater than 72 dB down from full scale) is illustrated in Figure 17. Indeed, the available bandwidths that can be programmed into the RC filter (Table 3) allow for a continuous range of SC filter bandwidths ranging from 1.225kHz to 20 kHz. Table 6 lists the possible range of SC filter bandwidths that can be used with the eight programmable RC filter bandwidths *and* still insure full anti-aliasing protection.

The condition is somewhat more complicated when the user desires an SC filter bandwidth that is less than 1.225kHz. In this case, the anti-aliasing protection provided by the RC filter will be less than 72 dB. Figure 18 illustrates the frequency bands that can be

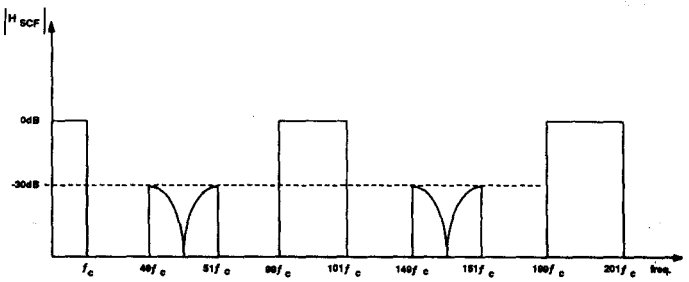


Figure 18. Frequency bands aliased into passbands.

aliased into the passband by the SC filter. One set of bands occurs at *m*50 $f_C \pm f_C$ where *m* is an *even* integer. Therefore, these bands occur at (99*fc* to 101f_C) (199f_C to 201f_C), (299f_C to 301f_C), etc. Aliases in these bands are folded back with no attenuation from the SC filter.

Another set of frequency bands occurs at *n*50*fc* ±*fc* where *n* is an *odd* integer. Therefore, these bands occur at (49f_C to 51f_C), (149f_C to 151f_C)(249f_C to 251f_C), etc. Aliases in these bands, however, are folded back with 30 dB of attenuation.

The aliasing protection provided by the RC filter with respect to the *even* aliasing bands is equal to the loss of the RC filter alone at those frequencies. The aliasing protection provided by the RC filter with respect to the odd aliasing bands is equal to the loss provided by the RC filter at those frequencies *plus 30dB*. In order to calculate the loss of the RC filter at any frequency, the following equation can be used:

$$RCF\ LOSS = 20\ log\ (1 + x^2)(1.10803x^2 + (1 - x^2)^2)$$

Where $x = f/f_O$(RCF), *f* is the frequency, and f_O(RCF) is the 3 dB frequency of the RC filter.

Consider an example where the SC filter bandwidth is 312.5 Hz. This can be achieved with a master clock frequency of 4 MHz and DO = D1 = D2 = 1. Table 7 lists the RC filter loss, the SC filter loss, and

RC Filter 3dB Bandwidth	Range of SC Filter Bandwidths		
80kHz	14kHz	to	20kHz
56kHz	10kHz	to	14kHz
40kHz	7kHz	to	10kHz
28kHz	5kHz	to	7kHz
20kHz	3.5kHz	to	5kHz
14kHz	2.5kHz	to	3.5kHz
10kHz	1.75kHz	to	2.5kHz
7kHz	1.225kHz	to	1.75kHz

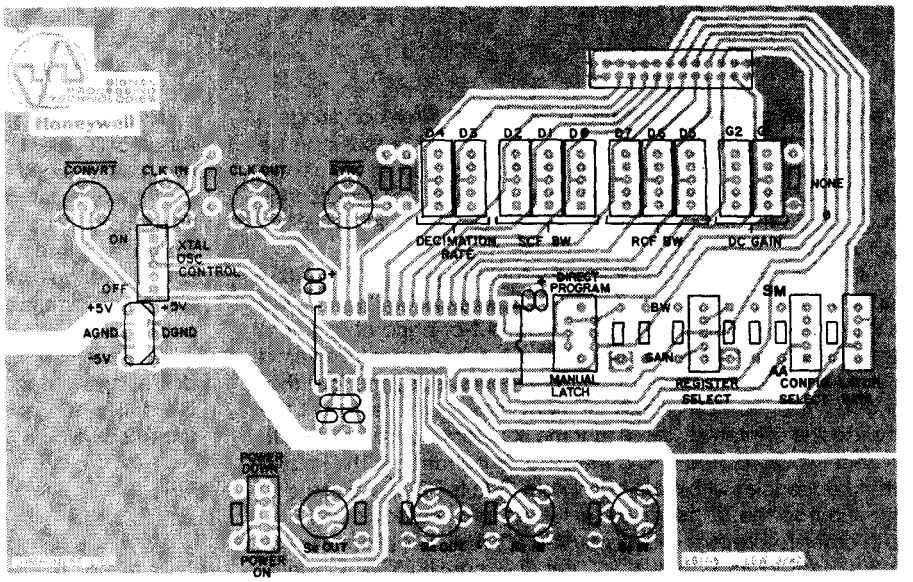
Table 6.

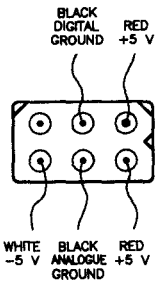
Aliasing Frequency	RCF Loss	SCF Loss	Total Loss
49fc = 15.313kHz	20.5dB	30.0dB	50.5dB
99fc = 30.938kHz	38.8dB	0.0dB	38.8dB
149fc = 46.563kHz	49.4dB	30.0dB	79.4dB
199fc = 62.188kHz	56.9dB	0.0dB	56.9dB
249fc = 77.813kHz	62.8dB	30.0dB	92.8dB
299fc = 93.438kHz	67.5dB	0.0dB	67.5dB
349fc = 109.063kHz	71.6dB	30.0dB	101.6dB
399fc = 124.688kHz	75.0dB	0.0dB	75.0dB

Table 7.

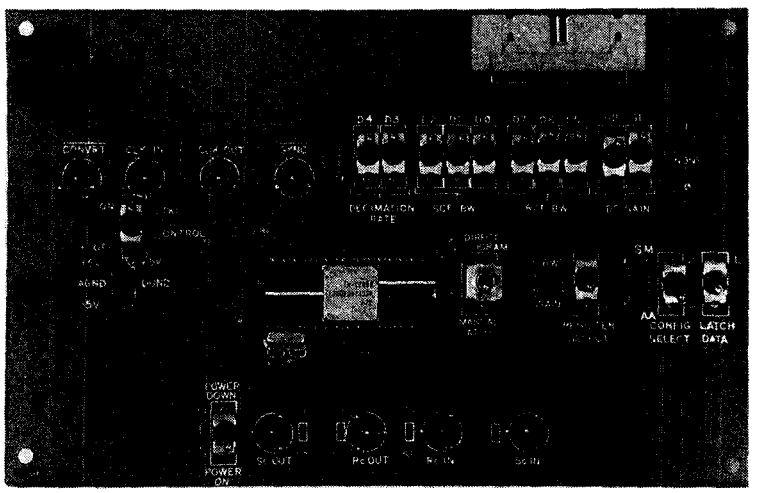
the combined RC + SC filter loss, at the critical aliasing frequencies. The RC filter bandwidth is set to 7 kHz. The numbers in the RCF Loss column were found by using the formula given above.

In this example, the user will have to worry about full scale, out of band signals in a ±f_C band about 50f_C, 100f_C, 200f_C, and 300 f_C. In practice, full scale out of band components do not occur due to the natural bandlimiting of the physical phenomena being measured. Any additional bandlimiting due to signal characteristics will help in preventing aliasing.





TOP VIEW



PARTS LIST — ETI-1428

SEMICONDUCTORS
IC1 ..... HSCF24040

RESISTORS all ¼ W, 5%, unless noted
R1, R2 ..... 1M
R3, 4, 5 ..... 1K
R6 ..... 1M
R7, R8 ..... 1K
R9, 10, 11, 12 ..... 1M
R13, 14, 15, 16 ..... 5kΩ (optional)
(note R15 and R16 are provided on the board as loads for Rc IN and Sc IN, but left off the circuit for clarity)

CAPACITORS
C1 ..... 10u/25 V tant.
C2 ..... 100n monolithic ceramic
C3 ..... 10u/25 V tant.
C4 ..... 100n monolithic ceramic
C5, C6 ..... 10p ceramic

MISCELLANEOUS
SW1-SW10 ..... single-pole, triple-throw (SP3T) pc mount toggle switches
S11 ..... SPDT pc-mount toggle switch
S12 ..... DPDT pc-mount toggle switch
S13 ..... SP3T pc-mount toggle switch
S14 ..... SPDT pc-mount toggle switch
S15 ..... SPST spring-return pc-mount toggle switch
S16 ..... SPDT pc-mount toggle switch
X1 ..... 4 MHz crystal
J1 ..... 26-way right-angle pc-mount male ribbon connector
J2-J5 ..... pc-mount BNC sockets
J6 ..... 6-way, pc mount, keyed Molex plug
J7-J10 ..... pc-mount BNC sockets

EB105 pc board; 32-pin machined-pin IC socket; 26-way female IDC; 6-way Molex in-line socket; hookup wire, ribbon cable, etc.

Assembly

Assembly of the board is quite straightforward. The passive components should be soldered in place first, followed by the IC socket and crystal. Then all the switches may be soldered to the board, finishing up with the ribbon connector, power connector and BNC sockets. Clean the board of flux after completion.

Note that, whenever the board is to be powered-up, the power supplies should be connected to the board before turning the supplies on. Consumption is typically 15 mW.

Using it

Operation of the board must be preceded by device programming in order to establish operating characteristics. This can be accomplished manually by use of the on-board toggle switches or by software though ribbon conenctor jack J1. The following section on "Toggle Switches" summarises their settings, most of which are directly related to device programming. The direct programming mode, established by switch S12, allows the HSCF24040 characterisics to be changed "on the fly" by register logic switches S1-S10.

Register programming and device control can also be accomplished externally though jack J1, the ribbon cable

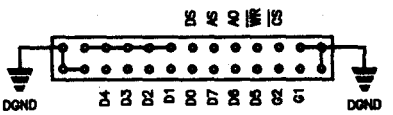


Figure 19. Ribbon connector pinout.

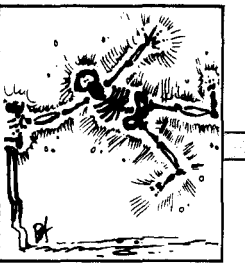
connector. Figure 19 shows the pinout of jack J1. Note that each pin of jack J1 is connected directly to the corresponding pin of the HSCF24040. When using jack J1, ensure switches S1-S10 and S13 are in the open (centre) position and S12 is in the "DP" position.

Analogue interfacing

The HSCF20404 is a low power CMOS analogue device intended for applications that require driving adjacent circuitry only. The minimum output drive capability is limited to 5 kohm in parallel with 50 pF. However, as much as 100 pF seldom creates a problem. Since most coaxial cable has approximately 30 pF capacitance per 300 mm, test leads connected to RC OUT or SC OUT should be kept as short as possible. Excessive load capacitance will cause excessive clock feedthrough noise since the stability of the output operational amplifier is affected.

Part 2 follows next month.

Contributed by The Apogee Group



ELECTRONICS

CIRCUITS

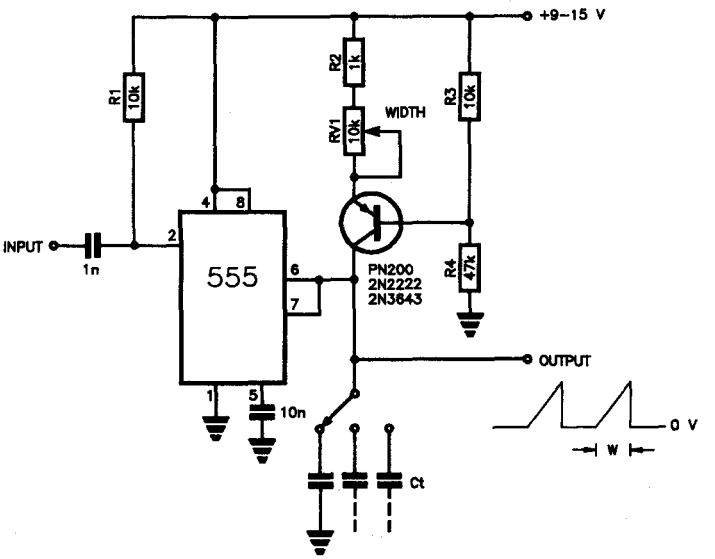
Ramp generator

This circuit will generate a ramp or sawtooth waveform from a pulse input. The width of the ramp (or its slope, really) can be varied by means of a potentiometer (RV1).

The trigger input of a 555 has the input pulse applied via a differentiating network (the 1n capacitor and R1). The negative-going pulses at pin 2 then trigger the 555, which is operated in its period timer mode.

The 555's timing capacitor has its charging current 'linearised' by the constant-current circuit comprising the PNP transistor, RV1, R2, R3 and R4. The timing capacitor, Ct, is switch-selected to suit the input pulse frequency range.

This circuit is useful for adding-in to a sine/square oscillator or a pulse generator. Note that the CMOS version of the 555 – a 7555 or TL555CP – may be substituted.



IDEA OF THE MONTH

Programmable frequency divider

Very often, it is desirable to divide a frequency by a decimal amount, the most common dividing factors being 2, 5 and/or 10. Usually, this is achieved using flip-flops, counters, and logic gates in a specific configuration. However, once the circuit has been developed, it is very difficult to change the dividing factor. This limitation is not present in this design.

The circuit is based on a programmable BCD counter (IC1) which is initially programmed via a BCD thumbwheel switch (SW1). After the divisor (that is, the division ratio) has been selected, the program push-button (SW3) is pressed to load the information into the counter and switch SW3 is pushed to the start position, thus enabling the counter.

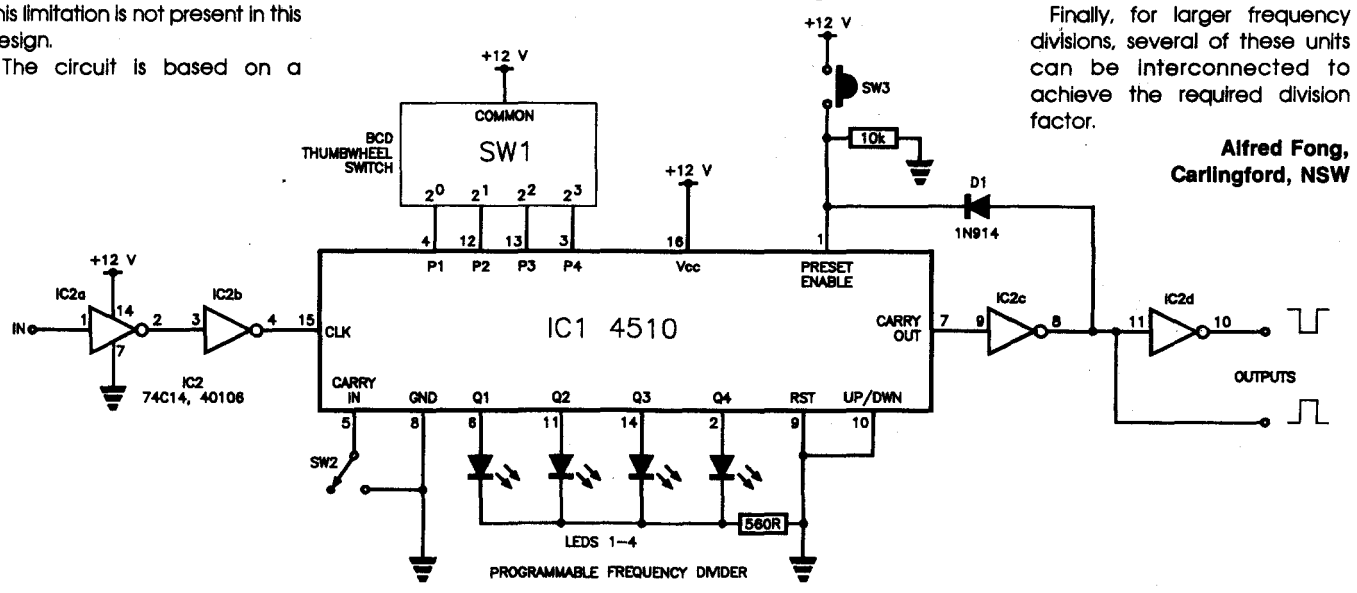
The counter is set to decrement from the pre-set value when this is done. When the minimum count is reached, pin 7 of IC1 will go low and provide a complementary set of buffered output frequencies. Simultaneously, the signal on pin 7 loads the previously determined dividing factor into the counter via diode D1.

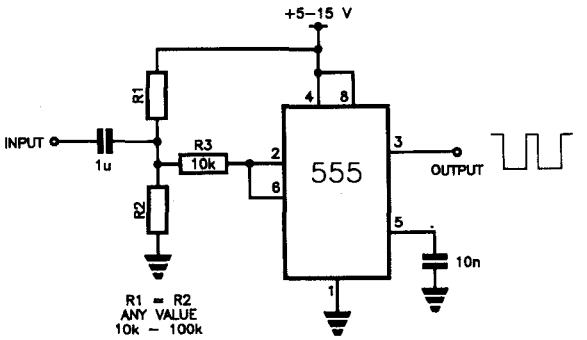
The input signal is conditioned and buffered using IC2. This eliminates any unwanted noise and transient signals associated with the input signal. It also 'amplifies', or squares-up, slow rising signals.

A visual display of the division process is provided in the form of LEDs 1-4. At low frequencies, the LEDs will light in BCD form; at high frequencies, they will all appear to be lit.

Finally, for larger frequency divisions, several of these units can be interconnected to achieve the required division factor.

Alfred Fong,
Carlingford, NSW





555 'squarer'

This simple circuit will square-up virtually any input signals, providing the signal swings between one-third the supply voltage at minimum and two-thirds of the supply at maximum. It will work over the range from tens of Hertz to a hundred kilohertz or so. The rise and fall times are very fast, limited principally by the switching speeds of the 555's internal comparators.

The 555's trigger and threshold inputs (pins 2 and 6, respectively) are biased at half the supply rail voltage by R1 and R2, the input being applied at the junction. R3 provides a bit of impedance build out for the input.

A 7555, or TL555CP, CMOS version of the 555 timer may equally well be used in this circuit (and has the added advantage of being able to operate on supply voltages down to 1.5 V).

PROGRAMS

```
0 'Universal Time by M.Roberts for IBM pc's or
10 'Basic or quickbasic compatible machines.
20 CLS:INPUT"Australian Time HH,MM "; HH, MM$: MM = VAL(MM$)
30 IF HH < 1 OR HH > 12 OR MM < 0 OR MM > 60 THEN 20
40 PRINT "AT "; HH; ":"; MM; " IT IS "
50 FOR A = 1 TO 11: READ c$, N, M
60      H = HH + N: IF H > 12 THEN H = H - 12
70      IF H < 1 THEN H = H + 12
80      M = MM - M: IF M > 60 THEN M = M - 60
90      IF M < 0 THEN M = M + 60 ELSE IF M = 60 THEN M = 0
100     M$ = STR$(M): H$ = STR$(H)
110     LOCATE 5 + A, 20: PRINT RIGHT$(H$, 2); ":"
120     LOCATE 5 + A, 23: PRINT RIGHT$(M$, 2), "in  "; c$
130 NEXT
140 DATA HONG KONG        ,-2,0,LONDON          ,+2,0
150 DATA MOSCOW           ,+5,0,SINGAPORE       ,-2,0
160 DATA TOKYO            ,-1,0,PARIS           ,+3,0
170 DATA *NEW YORK        ,-3,0,ADELAIDE        ,-1,30
180 DATA DARWIN           ,-1,30,PERTH          ,-2,0
190 DATA *WASHINGTON D.C.,-3,0
200 PRINT : PRINT "* - Denotes previous day"
210 PRINT "Adjust to summertime where applicable".
```

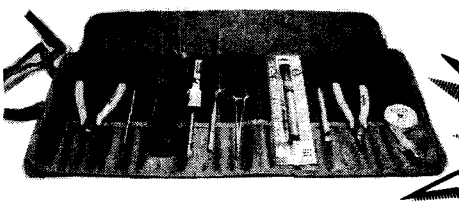
Universal time calculator for IBMs

This BASIC program calculates the current time in ten other cities around the world after you input Australian Eastern Standard time.

The program works on IBM GWBASIC and Quick BASIC. It should run on most compatibles.

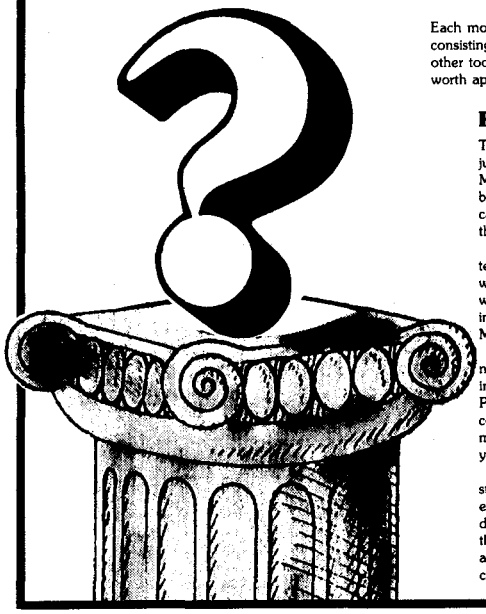
Murray Roberts,
Eltham, Vic.

"IDEA OF THE MONTH" CONTEST



TO WIN THIS $150 KIT ENTER NOW!

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, proudly sponsors 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 Scope Presentation Tool Kit, consisting of a Scope Soldering Iron, a Desoldering Tool and various other tools from Scope all neatly presented in a tough durable tool roll worth approximately $150.00

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 you wish.

This contest is invalid in states where locals 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.

COUPON

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

"I agree to the above 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** .....

ELECTRONICS

ETI PROJECT BUYERS' GUIDE

Shoparound lets you know which firms are stocking kits for current projects published in the magazine, those firms stocking printed circuit boards, and companies that carry components used in projects we've published, along with interesting and useful snippets of news about products and services of interest to electronics enthusiasts.

ETI-1428 Programmable Active LP Filter

Another "technology demonstration" project from Energy Control International. This one has rather a different flavour, though, to those we've presented previously.

This project provides 'hands on' experimentation and evaluation of Honeywell's high performance HSCF24040 programmable 7th order active low pass filter chip. This device features a programmable cut off frequency up to 20 kHz, 85 dB dynamic range, stopband attenuation greater than 76 dB, programmable dc gains of unity, two, four and eight and microprocessor interfacing.

It may be used in a wide variety of applications, including: audio spectrum analysis equipment, data acquisition systems, speech analysis and synthesis, test equipment and instrumentation, medical filtering, 12-bit signal processing systems, and more.

Short form kits, comprising the pc board, chip and crystal, are available from:

Energy Control International, 26 Boron St, SUMNER PARK QLD 4074 ☎ (07)376-2955.

ETI-618 Accentuated Beat Metronome

Here's an economical electronic metronome with a true accentuated beat facility. It features both loudspeaker and visual (LED) output, one LED to mark the time and another for the accentuated beat.

This economical project can be built for a cost of less than $40 in components, all of which are widely stocked by electronics retailers.

Our prototype was housed in a 50 x 90 x 150 mm all-plastic jiffy box which was supplied by Rod Irving Electronics (cat. no. H10111). Most suppliers carry similar-sized all-plastic jiffy boxes. The pointer-type control knobs used feature a coloured plastic top, and these too came from Rod Irving Electronics. These come in two sizes – 15 and 20 mm diameter. We used the smaller, 15 mm diameter ones which have caps in five colours – red, blue, green, yellow and grey. These knobs allow you to visually 'colour code' the three controls as well as providing some bright relief to the stark black-and-white box and panel.

The Melbourne firm of All Electronic Components indicated they may be interested in stocking a complete kit for this project, but a final decision had not been made at the time this went to press.

PCBs and panels

Printed circuit boards for ETI projects are generally obtainable from these suppliers:

All Electronic Components, 118-122 Lonsdale St, MELBOURNE Vic 3000 ☎ (03)662-1381.

Acetronics, 112 Robertson Rd, BASS HILL NSW 2197 ☎ (02)645-1241.

However, these firms are not able to supply boards for projects where the pc board copyright is retained by the author or kit supplier. Check the details in the article first or, if they're not to hand, check with one of the suppliers above to see if they do stock it.

Don't forget that Dynamark (Scotchcal) escutcheons for front panels and meter scales, etc can also be supplied, where available, by the above firms. ETI

Contributed by The Apogee Group

NEXT MONTH

The "Blue Streak" RISC computer board

This time, it's *really* here! Our feature project had to be held over due to lack of space, unfortunately, but Part 1 starts next issue. This project enables you to explore the world of RISC technology at minimum cost – and should we say, minimum risk? It uses the low-cost VL86C010 from VLSI Technology, plus memory controller (MEMC) and IO controller (IOC) devices with memory ranging from 1M up to 4M on-board. All you require is an IBM PCAT or close compatible for a terminal. The card plugs in. Software support includes ANSI C, Fortran and assembler. A board-resident assembly debugger permits debugging of programs on the RISC itself with download capability on the target system.

Budget two-way speakers

Do-it-yourself electronics does not always involve soldering, making pc boards and wiring things up. With high quality veneered fibreboard available quite cheaply these days, you can assemble yourself a creditable pair of loudspeakers and save hundreds of dollars. Here's an article on a two-way loudspeaker project that shows you how to "do it all" – including the cabinets! It really is easier than you think.

Portable 'scope review

The Kikusui COM3100 is a compact, portable digital storage oscilloscope that looks set to challenge many an analogue portable in the same price class.

ROGER'S COLUMN

ROGER HARRISON

ANSWERS & ARGUMENTS

This column is intended as a forum for exchange between you, the readers, and the magazine. Via this column I'll answer queries on projects, general questions on electronics and related subjects that may puzzle or concern you, engage in a little argument on topics of interest, or discuss subjects you might like raised. It's up to you! Short letters will be appreciated, long ones may be edited; if asking questions, confine your letter to one or two topics please. Send your letters to: Locked Bag 888, Rozelle NSW 2039.

Page numbering

I wish to complain about the location of the page numbers in your magazine. They are much easier to view in the outer lower corner of the page, rather than in the centre, which is inconvenient if you are looking for a specific page.

C.W., Concord, NSW.

There are those that like it, and those that don't and those that don't care either way!

Building Blocks

An excellent and informative magazine. You are to be commended especially on the series "Building Blocks of Electronics" which has so far been very good.

P.J., Werrimull, Vic.

Thank you! Building Blocks, I can assure you, will continue to be very good, and shows signs of getting even better.

Time, gentlemen

I spotted the deliberate mistake in November Dregs. Everybody with a little intelligence knows that 1.23 pm is really 1323.

However, this year an easy one happens at 12.34.56 on 7 Aug. 90 – 12.34.56. 7/8/90. It's amazing what you can do with a few numbers! How about a free subscription?

How about an article, or articles, on defence electronics e.g. the new radios and communications systems being developed for army use, electronic advances on the new ships, subs and planes. It would make great reading.

R.W., Dallas Vic.

You found the OTHER mistake! Sorry, no free subscription. Close, but no cigar, as they say.

So you'd like to read something on defence electronics? Maybe you missed the articles that ran around this time last year? We'll look into it.

Notes and errata on the '422 amp

After a long delay I am continuing the construction of my ETI-422 amplifier kit. I would greatly appreciate it if you could let me know of any errata, mods, updates, etc, articles/letters that have been published since the original article. Thanks for a great magazine. Keep up the good work.

J.S., Belgrave, Vic.

This 50 W stereo amp was published in 1975. That IS a long delay! I guess you bought it some years after it was published.

Each January issue (the Yearbook) in recent years has featured a cumulative project index which includes the published notes and errata on projects. Check it out, none are listed. I also scanned my (voluminous!) collection of back issues, but there's nothing I can find. Proceed with confidence!

Prices

A suggestion. Quote prices when reviewing or advising of new products. Failure to disclose prices suggests vendor fears the item is overpriced, or that the price is adjustable.

B.C., Semaphore Park, SA.

With reviews, prices are invariably included – usually the recommended retail price. With new product items, price information is not always available at the time of preparation. I doubt this is because the vendor fears the product is overpriced – they're going to have to disclose the price sometime!

I don't quite get what you mean by "...the price is adjustable." When new products are released, particularly consumer-type products such as VCRs, CD players, etc, the distributors will set a "recommended retail price" but will have an idea, as will the retailers, of what price the product will actually sell well at – known as the "go price". The latter, for clear reasons, is a lower price. Quoting this price in a new product item would be irresponsible to readers because it is speculative and the actual price will vary from time to time, and in the usual way, from retailer to retailer.

Often, the price will change quite rapidly within weeks to months after the product's release, depending on market acceptance (customer buying) and marketing/pricing policy of those selling the equipment. And with lead times between preparation of the new products copy and the on-sale date of the magazine being some three months, prices that may be quoted on new consumer products are likely to be irrelevant.

But not all products are affected this way. When the magazine is sent information (a "press release") on a new product, the final selling price may not actually have been determined. This can happen for a number of reasons, but not because the price is "adjustable" for some sinister reason. Firstly, on imported items (which is most things in electronics), the level of import duty may not have been settled at the time the press release was sent out (magazine lead times need to be taken into account). The same goes for sales tax. Both of these depend on arguments between the importer and the various government departments as to which category the item will be considered under.

Often, the purpose of disseminating a press release to magazines such as ETI is to generate interest in the trade (resellers) as well as among customers. ("Here is my better

mousetrap! Who wants to buy/sell it?")

So you can see that, because prices are not included in new product items published in the magazines, there can be many reasons for it. Vendor fears of over-pricing may well exist, but that would most likely be a very small percentage. "Adjustable" pricing could mean anything, but I seriously doubt that any large-scale sinister policy exists about 'withholding' price information – and I've been around one sector or another of this side of the industry for 15 years to have seen it if it existed.

Plenty of press releases DO come in which include prices. But we can get caught out by price movement – both up and down – that occur between receipt and publication. And guess who gets castigated for it?

And then there are those readers who browse through a six-month old magazine, see a new product item (not an advertisement) with an attractive price, call the supplier and are indignant when they find the price has changed.....

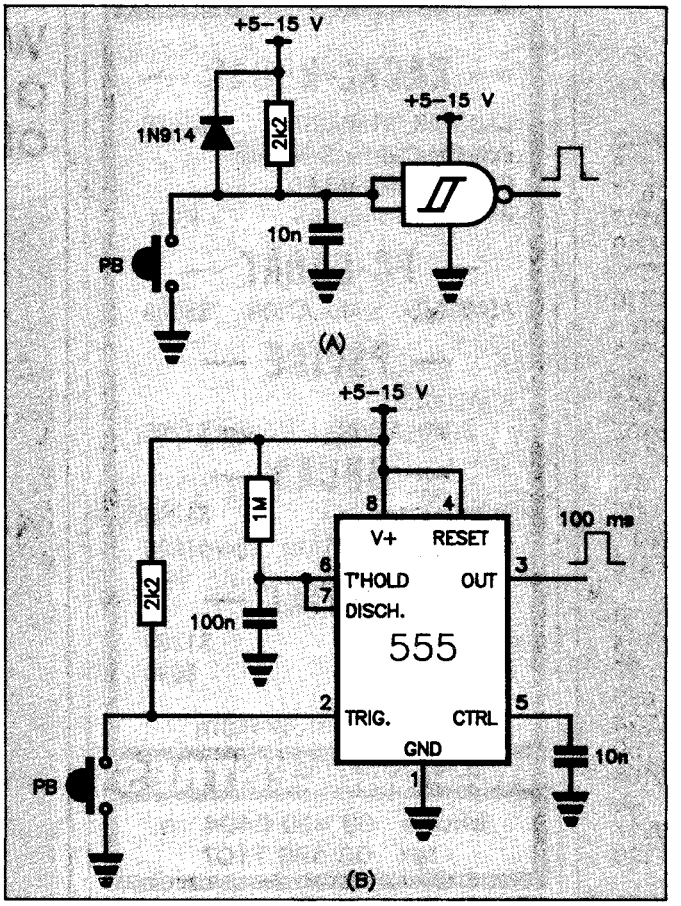
Switch 'debouncing'

I'm looking for a circuit to debounce a pushbutton switch. I've tried a resistor-capacitor which I saw in a circuit somewhere, but it's no good. Can you help?

P.D.,
Hobart, Tas.

Here are no less than two circuits you could use! The circuit marked A uses a single Schmitt NAND gate as an inverting buffer, such as from a 4093. With power on, the 10n capacitor is charged, the 2k2 resistor holding the gate's inputs high and the output low. When the pushbutton PB is pressed, it discharges the 10n capacitor and pulls the gate's inputs low, driving the output high. Any bounce in the switch contacts is covered by the time it takes the 10n capacitor to charge via the 2k2 resistor. The gate's output will go high for as long as PB is held operated.

The 1N914 diode is optional, it simply provides for rapid discharge of the capacitor when the circuit is powered down. A Schmitt-type gate is recommended because of its noise immunity; the pushbutton could be located at the end of a long pair of leads here.



The circuit at B is a little more elaborate, using a 555 timer, or its CMOS version, the 7555 or TL555CP. It is configured as a period timer. This circuit offers the advantage that you can determine the period for which the output goes high, no matter how long or short the time PB is held closed.

Here, the 555's trigger pin (pin 2) is held high by the 2k2 resistor to the supply rail and PB is used to pull pin 2 low. The 1M resistor and 100n capacitor give an output pulse period approximately given by

$$t = 1.1RC$$

which works out at 110 ms. As switch bounce may be in the order of a few milliseconds, it is best to set the 555's period at no shorter than about 10 ms if you just want any sort of pulse response to the switch action. The 555 can't be triggered again while the output is high.

If the pushbutton is to be located some distance from the circuit and connected via a long pair of wires, this 555 circuit offers very good noise immunity. If you wish, a 10n capacitor between pin 2 and ground can be added for extra peace of mind.

Note that, if you use the CMOS version of the 555, you can operate the circuit from supply rails as low as 1.5 V, i.e: a single dry cell.

For the 'high bucks' hobbyist?

I used to buy ETI every month – for the Feedforward column, for the readers' circuits and programs. I no longer buy this magazine other than for special articles (e.g. the Stepper Motor article, Oct.).

This magazine is now for the high bucks hobbyist, not for the average high school electronics hobbyist (like me) – without much money. It was a bad move on your part. I now buy another magazine every month.

S.W.,
Normanhurst, NSW.

The column of reader's circuits and programs "went missing" from two issues late last year for two reasons: lack of sufficient publishable contributions (and I'll discuss that shortly) and to prepare a new contest coupon. There was no intention to remove it permanently, especially seeing as Scope has been so willing over the years to support the contest with practical, useful prizes for hobbyists.

But it's now back (not that we ever took it away), with a good mix of circuits and small programs. Just look at this month's Ideas For Experimenters Column! And what about Jack Middlehurst's "Building Blocks of Electronics" series? Then too, you'll find the odd circuit in this column from month to month.

OK, so you're on a budget. We appreciate that. We aim to publish a variety of simple, low-cost projects throughout the course of a year, and if you look through recent issues, you'll see many examples of that policy in action. But we can't service all our readers' interests with budget projects. Some projects can be comparatively costly – different people have different budgets – and a certain sector of readers are interested in such things and prepared to pay for them. What we do aim for is value for money.

Now – contributors to Ideas For Experimenters (formerly Feedforward, and formerly Ideas For Experimenters!). If you're submitting a circuit, please include a short explanation of what the circuit does, what its features are and brief details on how it works, if needed. It's no use sending a circuit with "... this is a square wave oscillator", and virtually nothing else.

If you're sending a program – short ones are preferred to long ones. If the listing is longer than an A4 page (and not in compressed type), it's probably too long. Put a NEW ribbon in your printer, too many programs cannot be published because they are just too faint. Don't try and correct them with liquid paper and pen/pencil – DO IT AGAIN. Always print your listing on a separate piece of paper – the forests won't suffer too much, I'm sure.

A bouquet!

I really enjoy your computer related articles/projects. I'm glad that there is now also a supplier in Qld. Just keep those mags coming.

W.M.,
Toowoomba, Qld.

Whew! A happy customer. eti

Contributed by The Apogee Group

ADVERTISER INDEX

TECHNOLOGY

CSIRO PRESSURE SOUNDER — THE WORK GOES ON

A CSIRO team of scientists faces a variety of problems in its efforts to develop a working Atmospheric Pressure Sounder (APS) — not least a lack of funding from the government. Ex-editor Jon Fairall writes.

The CSIRO's Office of Space Science and Applications (COSSA) is fighting a rearguard action to keep alive one of its more interesting proposals, an Atmospheric Pressure Sounder (APS). It's a remote sensing device that will one day allow meteorologists to determine the air pressure on the ground from a satellite in space.

The device was developed in Melbourne by Dennis O'Brien, at the CSIRO division of Atmospheric Research. Original funding for the project came from both Atmospheric Research and COSSA, and allowed the development of a laboratory prototype.

It also included funding for the next step, to fly the device in the CSIRO's research aircraft. However, according to COSSA's Chris Graham, the development must be funded either by the Space Office, or the Department of Meteorology, or some combination of both.

After the government's derisory funding of the Space Office (less than $5m in the last economic statement) funds for APS are by no means secure. According to Graham, the bill for APS would be around $20m.

Why bother?

Why should anyone bother? Meteorologists have been looking for some time for a viable way of remotely determining air pressure. This need is especially acute in Australia where, unlike American or European nations, we are surrounded by vast stretches of uninhabited and rarely traversed water. As a result, weather forecasting in Australia is much more difficult than it needs to be, and certainly more difficult than in the northern hemisphere.

A space-based system could log the pressure in remote and inhospitable sites, where measurement stations are few and far between. Flying an instrument in a satellite would be far cheaper than attempting to gather the information from the ground using manned stations. It would also be far easier than attempting to implement a comprehensive series of unmanned stations.

CSIRO scientists argue that by better understanding the way the atmosphere works, we will improve our ability to forecast weather changes further ahead. It may also turn out, given the Greenhouse effect, the attenuation of the ozone layer, acid rain and other environmental factors, that understanding the atmosphere is one of the critical issues of our time.

The device works by examining the spectra of sunlight reflected off the surface of the Earth. Oxygen absorbs molecules in the A band, a wavelength of 760 nm. This radiation is visible to the naked eye as a deep red. Interestingly, there is a correlation between the amount of oxygen in the air and the air pressure. CSIRO scientists reasoned that by looking at the spectrum of the oxygen and measuring its intensity, they ought to be able to make some measurement of the amount of oxygen present, and hence of the air pressure.

An automatic instrument to do this is not too difficult to produce. The optics consist of a spectrograph slit followed by a diffraction grating which forms a spectrum of sunlight reflected back up from the surface of the Earth. This spectrum is projected back onto an array of 512 photo diodes, each 2.5 mm high and 25 micrometres wide. By recording the intensity of the light falling on the diodes, it is possible to recreate the spectrum of the light very precisely.

"Weather forecasting in Australia is much more difficult than it needs to be."

The optics are such that, from a low Earth orbit, the instrument would see a patch of the surface 10 km long by just 100 m wide. However, the motion of the spacecraft would smear this out to a square 10 km on a side.

Bits of tin foil

In a laboratory, it is comparatively simple to build an instrument like this. O'Brien's first prototype was built on a workbench and

CSIRO pressure sounder

had a "system of mirrors and bits of tin foil" to duct light in from the nearest window – but it certainly detected something.

In an aircraft, it is extremely difficult, especially if the aircraft is the CSIRO's research plane, an old Fokker F-27. Operation of the device turns on the measurement of distance on the nanometre scale. However, the aircraft vibrates over a much greater distance, introducing significant errors in the instrument.

In theory, this is not a difficult problem to solve. However, since it requires industrial rather than scientific expertise, funding needs to come from sources outside Atmospheric Research.

Meanwhile, work continues on understanding the data collected by the device. Getting a meaningful reading is rather more complex than simply measuring the A line in the spectrum. The unit responds to several different signals. The wanted (Sun-Earth-spacecraft) signal is certainly there – but so is sunlight, reflected off the rest of the atmosphere and scattered by Raleigh scattering into the front of the spectrograph.

Another problem is that the surface of the Earth reflects differently, with vegetation, earth, buildings and so on having discrete reflection profiles.

The challenge facing the CSIRO team is to disentangle the various signals. Currently, they are working on developing a model of the backscattering, so as to be able to predict its frequency distribution. In theory, at any rate, the method is then straightforward. Subtracting the known backscatter leaves the wanted signal, including the vital A band.

Errors likely

However, even when this is done, problems still remain. The amount of oxygen in the air is a function of temperature, so that unless watching technicians can calibrate every observation for temperature, errors are likely to develop. O'Brien says this is not an insurmountable problem. Modern remote sensing satellites contain a whole suite of instruments, all designed to be compatible. Any satellite likely to carry the pressure sounder will almost definitely have a temperature sounder as well.

The problem of differential reflection from the ground will be solved, at least initially, by restricting operation to oceans. In fact, the instrument looks for sun-glint on the sea. The problems of data acquisition in the presence of the strong ground-based reflection system is too difficult at this time. It's always a good idea to have an idea for a Mark 2 on hand.

If they can make their system work, the researchers are hopeful that they can beat US competition in supplying the ADvanced Earth Observing Satellite (ADEOS) which is due to fly in the early 1990s. ADEOS will be Japan's successor to the current generation of Japanese meteorological satellites that supply our weather maps.

The CSIRO approach is by no means the only solution, however. A US group has been looking at a laser system, which fires a laser beam down into the atmosphere. A proportion of the signal is scattered straight back up to the instrument. The intensity of the backscatter is then a measure of the gas pressure. The technique is actually much the same as that developed in optical time domain reflectometers, an instrument developed to check the health of optical fibres.

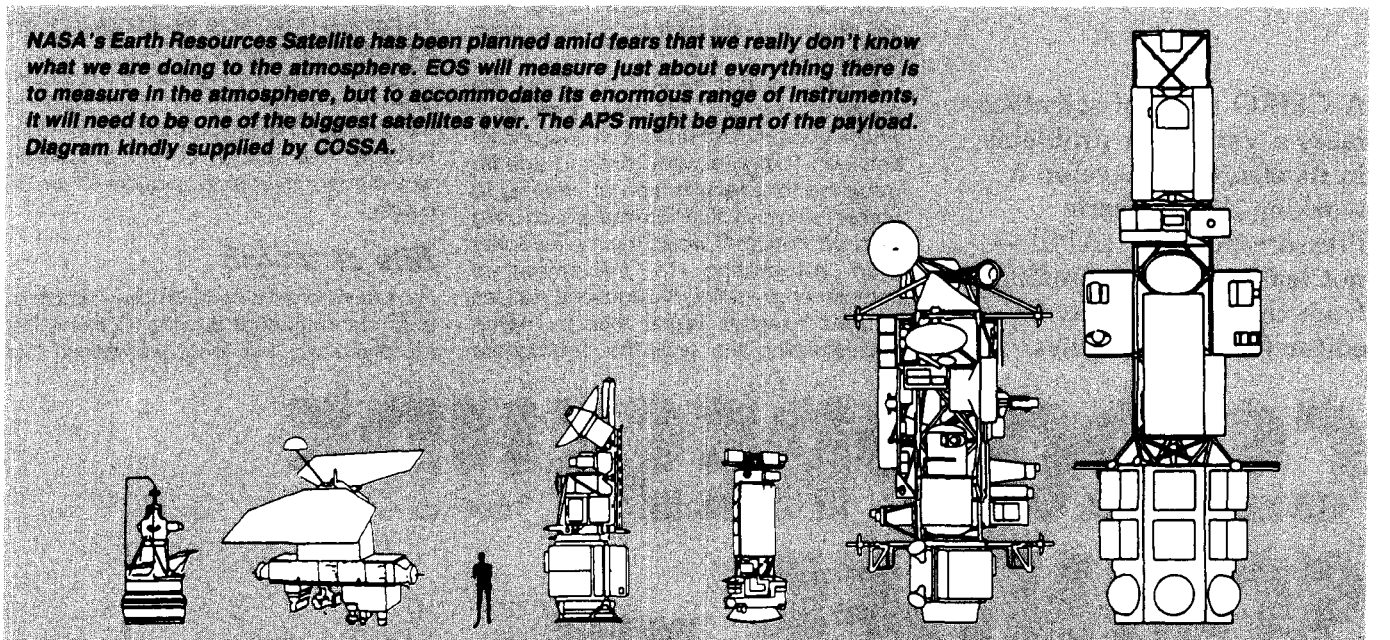
The American system has the advantage of being a true sounder, that is: giving the watcher an analysis of pressure all the way through the atmosphere – vital meteorological data. Also, data processing will be much easier than on the CSIRO device since it is possible, by appropriate filtering, to restrict observation to the wanted signal.

However, it suffers two constraints: power requirements and weight. A laser powerful enough to punch a beam of light down to the surface, and give usable amounts of backscatter will need large amounts of both.

In some instances, this might not be a huge disadvantage. NASA's proposed EOS (Earth Observing Satellite), due to fly in the late 1990s, will be as big as several double decker buses, and carry a wide variety of instruments. The power and weight of a laser could well be accommodated.

However, the bill for EOS is likely to be in the billions of dollars. Other countries, with more modest proposals, may well find the advantages of the Australian system definitive. It would also be an ideal instrument for any future Australian-built remote sensing satellite. eti

NASA's Earth Resources Satellite has been planned amid fears that we really don't know what we are doing to the atmosphere. EOS will measure just about everything there is to measure in the atmosphere, but to accommodate its enormous range of instruments, it will need to be one of the biggest satellites ever. The APS might be part of the payload. Diagram kindly supplied by COSSA.



SEMICONDUCTOR WATCH

Roger Harrison reports on what's happening in the world of semiconductors.

Solar cells approach 40 per cent efficiency

A NEW approach to solar cell technology that employs two energy conversion layers, one of gallium arsenide and the other of gallium antimonide, has achieved an energy conversion efficiency of 37 per cent. Current solar cell technology employing silicon achieves efficiencies of half that, at best.

Scientists, working at Boeing's High Technology Centre in Seattle in the United States, are now exploring potential applications for these new cells.

By using gallium antimonide rather than silicon to make the second layer, they have beaten the previous record of 31 per cent efficiency, set by Sandia National Laboratories in New Mexico. The characteristics of the semiconductor were more closely matched to the solar spectrum, says Lewis Fraas, Boeing's solar cell project manager.

Solar cells generate a current when light (e.g: from the Sun) excites electrons from a semiconductor's valence band, pushing it into its higher-energy conduction band. The energy generated by each photon is the difference between the two bands (called the band gap). For gallium arsenide (GaAs) this is 1.42 electronvolts, but only 1.2 electronvolts for silicon. While silicon is cheaper than GaAs and can use light at longer, infra-red wavelengths than gallium arsenide, its smaller band gap makes it less efficient.

Sandia's researchers used a sandwich of gallium arsenide and silicon. They made gallium arsenide chips transparent to photons whose energy is smaller than the semiconductor's band gap, thus making use of photons whose energy the cell could not otherwise convert to current. Infra-red light at wavelengths longer than 900 nanometres then generated a current in a silicon layer behind the gallium arsenide.

This trick boosted efficiency from 27.2 per cent for gallium arsenide alone to 31 per cent for their dual cell, but no further gains could be made because silicon only absorbs wavelengths of up to 1100 nanometres.

Gallium antimonide, with a much smaller band gap of 0.72 electronvolts, can use light at 900 to 1700 nanometres, transmitted through the gallium arsenide in a sandwich cell construction.

Boeing pushed the efficiency further up, to gain an overall efficiency of 37 per cent, by using grooved covers to bend light away from the necessary conductors laid on the surface of the cell, which collect the flowing current. This allows the light to strike active areas on the cells which are only 2.5 millimetres across.

It was reported that both types of sandwich or dual-layer cells are able to operate at many times the normal solar flux of about 1 kW per square metre at mid-latitudes. It is cheaper to build large collecting optics or reflectors to focus light onto small-area solar cells than to make a large array of single solar cells.

Fibre LAN chips

A PARTNERSHIP between Digital Equipment Corp., of Massachussetts, and Motorola's Microprocessor Products Group, Austin, Texas, is building momentum for chips that serve the Fibre Distributed Data Interface (FDDI) local-area network standard.

FDDI pushes data-transfer rates to 100 Mbits/s for high-performance distributed computing, greatly improving on Ethernet's maximum of 10 Mbits/s.

The technology exchange between DEC and Motorola covers the design of an ANSI-compliant four-chip set, which will be manufactured and sold by Motorola this year.

DEC is furnishing the technology for two chips. The alliance allows Motorola to enter the FDDI components market for the first time. DEC's two chips have already been designed, and implement the protocol portion of the standard. Motorola will supply clock-recovery and system-interface circuits needed to complete the four-chip set.

Meanwhile, DEC and Advanced Micro Devices of Sunnyvale, in California, have an agreement that allows AMD to manufacture and market the same two DEC-designed FDDI devices. AMD, which already markets its own FDDI chips, will use DEC's technology as part of a very-low-cost Supernet-3 family aimed at high-volume desktop computer applications.

IBM's latest RISC chip

WITH the release of details of IBM's second-generation reduced instruction set computer (RISC) workstation has come more details of the new RISC CPU chip that drives the system.

The RISC chip uses IBM's one micron (1 um) CMOS process which the company also uses to build its 1- and 4-Mbit dynamic RAMs. It is understood that IBM designers achieved considerable instruction overlap for integer, branch, and floating-point operations so that the chip has an effective efficiency of less than one cycle per instruction.

In addition, the processor boasts separate instruction and data caches, hardware features to assist database operations, and a high-speed floating-point unit.

On-chip, 32-bit integer and 64-bit floating-point units execute each of their instructions in one clock cycle. Internal and external buses many data lines wide make it possible for one-cycle operand transfers, the company says. Also, with a 64- or 128-bit memory interface, two or four words can be loaded in one cycle.

Three-legged RAM!

WE'VE had three-terminal regulators for many years now, but what's this about a three-terminal RAM? Well, Dallas Semiconductor has squeezed a 256-bit low-power RAM into a low-cost plastic TO-92 package

that has just three leads: power, ground and signal.

A *novel, highly* multiplexed signalling scheme combines the data, address, and control signals onto one pin. As a consequence, a host processor needs only one I/O line to access the RAM's 256 locations.

To multiplex all of those signals, designers developed an internal timing system that encodes or decodes the digital signals by comparing pulse lengths.

The three-legged RAM, known as the DS2222, employs a low-power CMOS process, runs from a 1.5 V supply and consumes just 50 nA in its standby mode. A pea-sized battery will power the RAM for over 10 years and permit over a million accesses, Dallas claims. Dallas Semiconductor is represented in Australia by Veltek, 22 Harker St, Burwood Vic 3125. ☎ (03)808-7511.

READER INFO No. 208

Colour-cache chip

ONE of the major problems with displaying computer colour graphics is the enormous amount of data that a system must write. In a 256-colour system, each screen pixel requires eight bits sent to it. Tektronix has developed a proprietary CMOS gate array that they say optimises bit-mapped colour performance.

Used in the company's 32-bit XD88/10 graphics workstation, Tektronix's colour-cache chip serves as an interface between the workstation's 32-bit system bus and the 256-bit pixel data bus that leads to the system's frame buffer, which holds the pixel-by-pixel display information. The chip stores the up to 32 colours to be displayed. The processor can then display them by sending just a single bit of data, rather than the eight bits originally needed.

READER INFO No. 209

Bio-chips?

CALL it a cell on a chip. A tiny, ingenious device, developed by a Menlo Park firm, combines living cells and a slice of silicon in an extremely sensitive "Biosensor." Among other things, the device can:

- quickly screen toxic chemicals.
- measure the effects of growth factors on normal cells.
- determine which drugs are most effective in treating a tumour.
- find out which cosmetics are most likely to irritate the eyes, reducing the need for controversial animal tests.
- watch cells respond to viral infection – and measure how effectively drugs clear up the infection.

These tests require only a tiny sample of material, about 1000 cells trapped in a bit of fluid about 500 times smaller than a drop of blood.

And, with further miniaturisation, it may be possible to measure biochemical changes in a single cell, according to a summary of the work last week in the journal *Science*.

The cells are like microscopic guinea pigs. Bathed in a flow of fluid, they can be exposed to all sorts of substances, from viruses to toxic chemicals.

As they react, they produce chemical changes that are picked up by the electronic part of the gadget.

The device was invented by scientists at Molecular Devices Corp in Menlo Park, who say they hope to put it on the market sometime this year.

"It's incredibly clever: when I first read about it, I was absolutely amazed," said Leon H. Bruner, a toxicologist who is evaluating the device for the Proctor and Gamble Co. in Cincinnati, Ohio.

"The instrument has a lot of unique characteristics that allow us to do a lot of things with test materials that other systems don't supply."

The device – formally called a "Silicon microphysiometer" – is one of a new generation of sensors that rely on the inherent sensitivity of living things.

The field got its start in the mid-1960s, when Leland Clark, now at the University of Cincinnati, coated an electrode with an enzyme.

Enzymes are catalysts that promote chemical reactions in living things. Each enzyme binds only to one compound – in this case, the sugar glucose. In Clark's device, an electrode picked up subtle indications that this binding had occurred. The bigger the signal, the more glucose was present.

Glucose electrodes are now used to monitor the blood sugar of patients in hospitals and the sugar content of foods in processing plants, Clark said.

Scientists are trying to develop sensors with other enzymes: some have used sensitive organs, such as the antennules of blue crabs, as sensors.

But not many of these biosensors have been successful in the market, Clark said. "The fact of the matter is, practical devices that are easy to use are few and far between."

In *Science* magazine, a team headed by J. Wallace Parce of Molecular Devices described possible applications of their system.

In a series of tests at Stanford University in Palo Alto, Californic researchers put tumour cells ir the device, added chemo-therapeutic drugs and found out which killed the cells.

Some tumours are drug-resistant, the team noted, and patients sometimes have to take several drugs, with potentially serious side effects, until they find one that works.

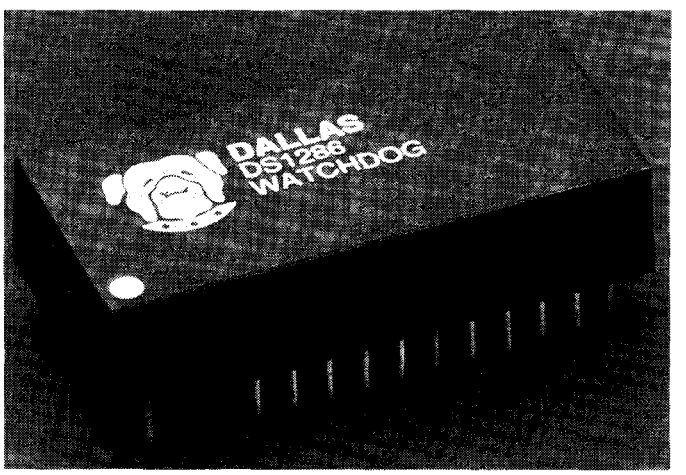
A quick screening test could help doctors design better therapies. The device is also one of four being tested at Proctor and Gamble, where Bruner is in charge of finding alternatives to using live animals for tests of eye irritation.

"Our goal is eventually to replace our need for animals," he said.

"More likely," Bruner said, "the company would use a battery of tests to weed out the most irritating compounds, so that only the most innocuous ones would be tested in animals."

READER INFO No. 210

Watchdog Timekeeper



THE DS1286 Watchdog Timekeeper from Dallas Semiconductor keeps track of time with its 400-year calendar and features a watchdog timer that guards against computer malfunction.

Packaged in a standard 28-pin DIP, the DS1286 can be plugged into an existing memory socket. Calendar information can be read or written in the same manner as bytewide static RAM.

Equipped with an internal lithium battery, the watchdog timekeeper lasts for more than 10 years in the absence of system power.

The watchdog timekeeper information includes hundredths of seconds, seconds, minutes, hours, day, date, month and year information. The date at the end of the month is automatically adjusted for months with less than 31 days, including correction for leap years.

Details from Alfatron, Unit 5, 14 Jersey Rd Bayswater, Vic. 3153. ☎ (03) 720 5411.

READER INFO No. 211

Contributed by The Apogee Group

SOUND INSIGHTS

ETI'S AUDIO & HI-FI SUPPLEMENT

JVC's VIDEO VISION OF THE '90s

GOODBYE RABBIT'S EARS

In my review of the Akai AT-93 tuner last November, I commented on the shortcomings of "wire dipole" antennas supplied with FM tuners, saying " . . . there has to be a better way, some day." That day has come. By Roger Harrison.

Unsightly, unwieldy and underperforming wire dipole antennas, supplied with virtually every hi-fi FM tuner, and set-top "rabbit's ears" and the like, will soon be a thing of the past, according to local importer, Lawrence Rodny of Communications Power Inc.

Just before Christmas last, he launched a revolutionary indoor FM antenna that does away with the disadvantages of the wire dipole and which avoids the necessity of having to install a special FM antenna in or on your roof.

The "pi" antenna, from Terk Technologies in the USA, is disc-shaped, measuring just 130 mm in diameter and 28 mm thick. It can stand either vertically or horizontally, atop your hi-fi equipment rack or cabinet, or flat on a shelf.

Its size means it is unobtrusive, but the technology employed means it will outperform the usual wire dipole supplied. Wire dipoles are meant to be taped to a wall, forming a "T" about one and a third metres across. Many people just drop them down the back of their equipment rack and hope for the best, putting up with poor results on some stations.

The "rabbit's ears" style of set-top TV/FM antennas have similar disadvantages, if not worse, because they are not tuned to the FM band.

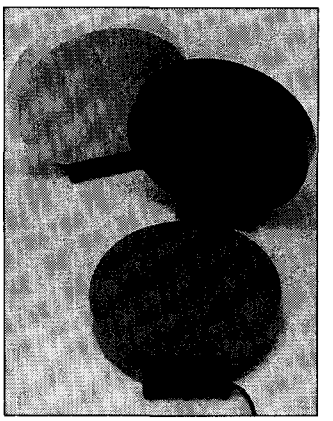
The Terk pi indoor FM antenna overcomes all these problems and has an acceptable appearance to boot. Designed by renowned US engineer Larry Shotz, the antenna element is shrunk, using communications antenna technology, to a small circular form known as a "gamma-loop".

An amplifier is added, directly at the connection point to the gamma loop. This provides an amplification of 38 dB, while circuitry associated with it rejects unwanted signals and noise outside the 88-108 MHz FM band. The Terk pi antenna outperforms wire dipoles and may equal or better the performance of an outdoor FM antenna in some circumstances.

When used standing vertically, the Terk pi antenna shows a small amount of directionality, allowing it to be rotated for best reception on weak stations. It does not have the sort of directionality exhibited by a wire dipole. Placed horizontally, it picks up stations from every direction.

The makers have provided a gain control, which lets the user adjust the received level of signals between full gain (38 dB) right down to a loss of 20 dB. This allows you to get good reception on a station when the FM tuner or receiver may be overloaded by another, very strong, station signal, which creates crossmodulation interference within the receiver.

On weak, low-powered stations the Terk pi antenna is claimed to reduce noise, which is a problem with wire dipoles, rabbit's ears and even outdoor antennas, making reception either much clearer or entirely banishing the noise.



The Terk "pi" indoor FM antenna is available in white, black and grey.

The Terk pi antenna has enjoyed phenomenal sales success in the USA since its release there, and was recently upgraded. The later model is the one to be released here by Commununications Power Inc, which represents Terk Technologies in Australia.

Along with the pi antenna, another model, the "FM+", is to be released. This employs the same technology as the pi but does not include amplification. It is square, not circular, measuring 130 mm a side. The pi is powered from a standard 12 volt dc plug pack power supply. The pi is available in black, grey and white. More details are available from Communications Power Inc., ☎ (02)357-2022.

BASF bats on

BASF has released two new audio tapes, both Type II chrome formulation tapes. The Maxima II is said to have performance "close to CD" – obtained, the company says, from the use of an azimuth stabilised shell, 12-strut reinforcement for the magnetic head area, unique starwheel stopper, high precision tape guide elements and a special two-layer magnetic media.

To enable the dynamic range of digital recordings to be transferred effectively, BASF says it has optimised its specially developed micro-coating process. The packing density and the magnetic alignability of the chrome dioxide particles has been significantly increased, they say.

Two precisely defined layers of chrome dioxide are applied for bass and treble frequencies, resulting in a spectacular dynamic range over the entire audio spectrum and providing excellent recording characteristics, BASF says. At the same time, the print-through ratio has been improved by 2 dB.

For the enthusiasts who transfer the contents of their CDs to tape, for use in the Walkman or car stereo, this should be good news.

The second tape is a two hour (C120) cassette, known as the "Chrome Extra II". BASF claims to have overcome the limitations of earlier C120 tapes, which had a reputation for poor mechanical stability and inferior sound quality. You can record the equivalent of two CDs on it.

The Chrome Extra II boasts a high capacity housing and a tape which is 12 per cent thicker than that used in conventional two-hour cassettes.

BASF says its engineers have increased the Chrome Extra II's magnetic layer thickness by 30 per cent, to four microns, which compares to a layer thickness of five microns on a C90 cassette. They have also used a particularly stable and stretch resistant polyester film substrate. These measures, combined with new tape guides and SM levers, are said to provide optimum performance even on portable equipment. eti

Contributed by The Apogee Group

Holy Cable, Batman!

AUDIO OZ has been appointed the sole Australasian agent for the range of Gotham Cable.

Gotham is one of the most prestigious audio cables in the world market today, with many major microphone manufacturers using it as their standard connection cable.

Audio Oz will be carrying a complete range of Gotham Cable with applications ranging from studio wiring, instrument cable, stage microphone cable, PA multicore cable, intercom cable, sophisticated audio lines, internal equipment wiring, patch panel wiring, balanced and unbalanced audio lines, XLR extension cables and fixed installation wiring. Information from Audio Oz, ☎ (03) 696 5690.

READER INFO No. 206

World's smallest camcorder?

SONY has launched the CCD-TR55 camcorder, weighing a mere 790g. It is a palm-size unit providing high quality performance and full features. Compact and multi-functional, this camcorder is well suited to travel use. Its size and lightweight design allow easy transport in a brief case or handbag and its wide range of features opens new possibilities for shooting sports, travel, leisure and business scenes without the need for cumbersome equipment. Playback is simple because the CCD-TR55 can be connected to any television.

Its range of capabilities includes features such as six times power zoom lens, digital superimpose titling with scrolling, a variable speed shutter up to 1/4,000th of a second and a fader for both sound and picture. And with its fully automatic function even beginners can pick it up and begin to enjoy the wonders of personal video.

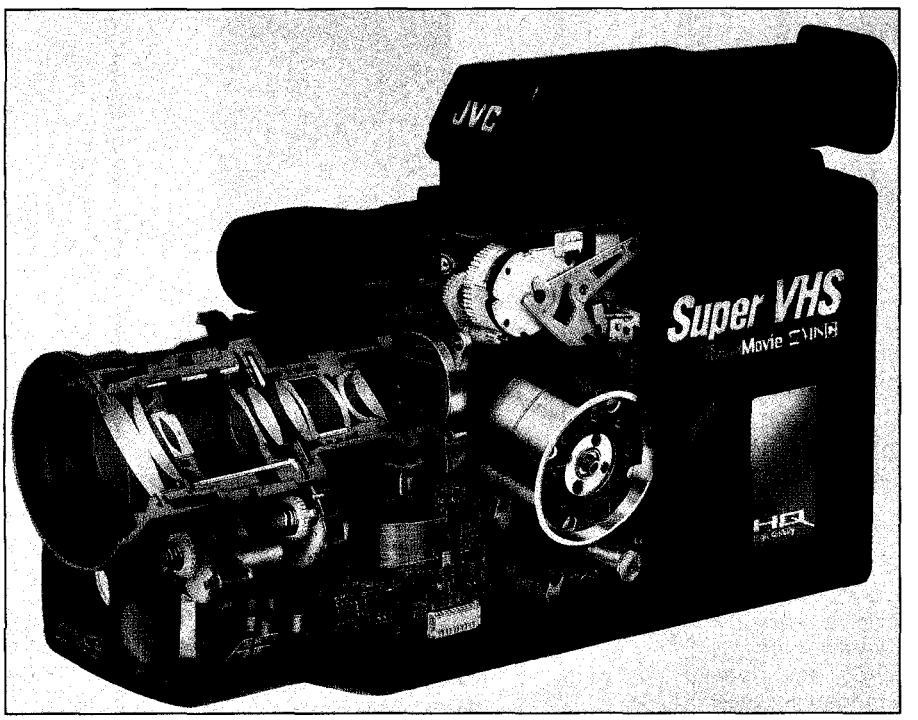
The CCD-TR55 has been developed from the very latest computer aided design technology. Using newly developed micro-components, the camcorder was physically designed by a computer so that no space was left unused. Even the microphone, a prominent exterior feature on most camcorders, is within the overall casing.

The TR55 camcorder is available through the Sony dealer network at a S.R.P. of $2,499. For further information please contact Garry Beauchamp, Sony Australia, ☎ (02) 887-6666.

READER INFO No. 205

JVC— SHOOTING INTO THE 1990s

Life's tough as a writer, says Barrie Smith — what with smoked salmon lunches at Sydney's Darling Harbour and sneak previews of the latest and greatest developments in video technology. . .



Super VHS looks set to be the 16mm of the professional, semi-professional and commercial video worlds.

On the business of writing about 'what's new' in video technology, things can certainly get tough. The difficulty lies in threading our way between the hospitality lavished upon men of the pen and, simultaneously, soaking up all the necessary information on product developments presented for our delectation and dissection.

Picture this: lunch at Darling Harbour, Sydney, late in 1989 – a heady mix of smoked salmon, ocean trout, splashes of Tyrrell's white wine and JVC's bundles of video advances which the company intends to unleash on the world's markets during 1990/91.

At one time, you could be excused for dismissing developments in the brigade of 'amateur' gauges – VHS, S-VHS, Video 8, Hi 8 – as being relevant only to the home videoist, and dropping them into the same 'out tray' as such technological revolutions as silent lawn mower blades and recyclable egg crates. But not today.

Super-VHS looks set to be the 16mm of the professional, semi-professional and commercial video worlds, in direct opposition to Betacam SP and Matsushita's almost invisible MII format, as video originating mediums for broadcast transmission.

You'd be absolutely correct if you concluded that something was up, when you can walk into your local video store, throw down $2 – 3,000, and walk out with an S-VHS video camcorder that will reproduce a picture on an S-VHS receiver better than the one you're getting from Channels 2,7,9,10 or any in between!

Top contender

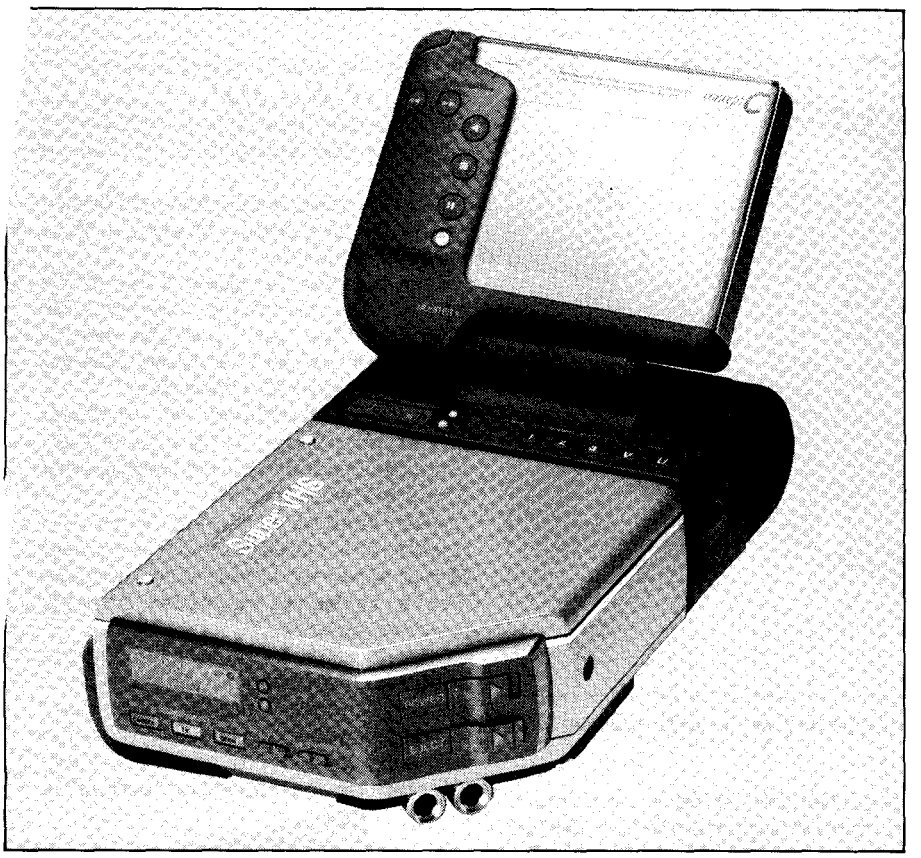
Super-VHS material, dumped on to digital tape and post-produced in the conventional manner, is now well inside the ring as contender for Top Tape Format. It would be difficult for anyone – layman or technician – to pick it from the rest, without resort to instruments or test benches. Once it's on one inch, or digital, it looks like it had never had a life anywhere else.

> ***"When a company promises a camera that is palm-concealable and slings out 42 lines, I start to listen."***

And JVC, along with its S-VHS co-developers, is determined to convince its customers that the gauge won't just go away. It is, and will remain, far more than a medium for electronic snapshots.

As recently as 1988, the PAL version of S-VHS arrived to a less than expectant market, still partially grieving over the demise of Betamax, and unwilling in the majority to pleasure 'yet another home video standard'.

Professional considerations (and users) aside, the advances presented by the 63-year old Yokohama company demonstrate its conviction that S-VHS will be the dominant consumer standard for the 1990s – and beyond.



Top — high resolution LCD monitor. Bottom — hi-fi S-VHS-C recorder/player is able to run VHS and S-VHS tapes through a standard receiver.

Concept C

Well meant, but smacking a little of 'marketingese', is Concept C, a new concept in shooting, recording and viewing video. A modular approach is envisaged, giving the user a choice of equipment configuration in his pursuit of video activities.

The main component in the scheme is a standalone hi-fi S-VHS-C recorder/player able to run VHS and S-VHS tapes through a standard receiver, and not quite two packs of cards in size. Ranged beside it is a small, high resolution, active matrix colour LCD monitor, a palm-sized CCD high res colour camera, a snap-on tuner, and a battery pack. The whole family could fit inside a cigar box!

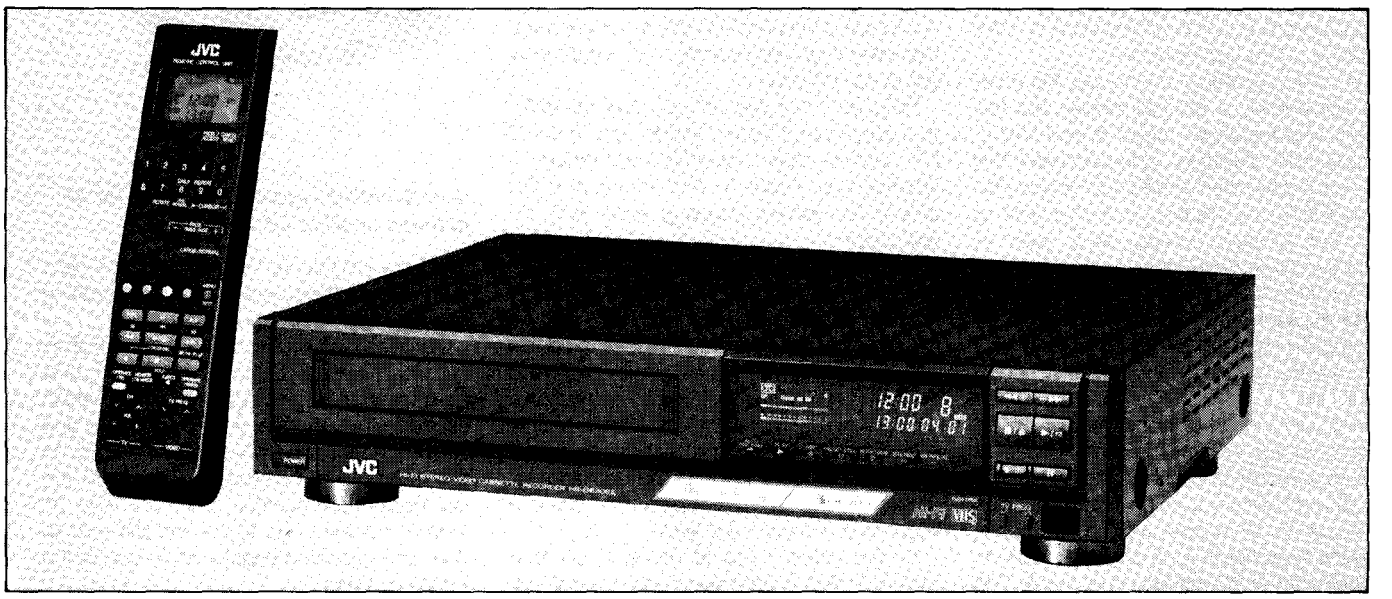
Personally, I am no longer dazzled by mini cameras, having seen a couple over the last few years that have earned the label 'lipstick cameras' – but with a less than earth-shattering horizontal resolution of 250 lines or so.

When, however, a company promises a camera that is palm-concealable, and slings out 420 lines, I start to listen.

Individually, the modules are of great interest, but the attraction for the consumer is that they are all designed to work together as a single device. It is totally up to the consumer to decide whether to use the assemblage for viewing, for recording, for shooting (as a camcorder), or hi-fi stereo audio replay; each component snaps together, Lego-like, to suit the purpose in mind.

The tiny, high tech novelties are, so far, only non-working prototypes, but show the path of thinking the company is following. And they have gone thoroughly into the task of packing so much into so little, ensuring the myriad circuit boards, CCDs, LCDs, micro-motors and associated transport systems will all fit in, with no bits left over.

The modular philosophy, when applied to a unit such as a camcorder, has immense appeal to this writer. Having grown up with 35mm SLRs, and their capacity to accept multiple add-ons such as lenses, viewfinders, data backs, motors (even remote control devices and video image transmitters) it's odd to stalk your pictorial prey with a box of electronics so all-embracing, so comprehensive you need an hour's tutorial each morning to remember all the access codes and modes. Taking JVC's approach further, how much better to hive off the departments (AF, titling, sound, mixing, replay, etc) to a bundle of clip-on modules. And, how about trusting us with the ability to click in a lens of our own choice?



The S-VHS VCR model HR-D830EA incorporates a Teletext decoder.

How JVC sees the 1990s

The GRS707 Camcorder displays the actual F stop selected by the user and also features time lapse and animation functions.

S-VHS camcorders, or 'Compact Video Movies' to employ the precise company nomenclature, number three in all. They offer features for nearly all users' needs and weigh as little as 1.2 kgs, some simply optioned, others incorporating such photographic niceties as time lapse, self-timers, intervalometer functions, editing and a variable iris that displays the actual F number selected.

One model, the GR-A1EA, claims to possess the ultimate in user-friendliness in its unique ability to continually focus down to a few millimetres from the lens; yes, that's right, Infinity to full macro in one beautifully controlled auto focus swoop. Why we didn't have it before on every camcorder on the market is utterly beyond me.

And to the question of who has the most – it's not entirely a betting matter, but the current war between Video 8 and VHS-C could partially swing on who can pack the most tape into each variety of camcorder.

Video 8 has led, till now, in being able to offer the longest running time with its diminutive 8mm wide tape creeping along at 20.051mm/sec and 10.026 mm/sec in SP and LP respectively; as I write, the maximum tape length currently available will see your camcorder whirring away for two hours in LP mode.

VHS-C, on the other hand, has struggled valiantly along with its 12.65mm width, at 23.39 mm/sec in SP and half that in LP. Until now, the maximum running time has been one hour in LP mode with a C format cassette. Now, the SE-C45 cassette offers 45 minutes in SP, or 90 minutes in LP mode. The longer running time has been achieved by using a thinner, highly durable base called Polystone. Not only has the new base much higher tensile strength, but a stiffer binder has been included to ensure coating stability. Looking quickly, and dangerously, ahead, I would hesitantly predict that JVC would like to discard the current standard, rather largish VHS tape format entirely and new plastics and adhesives like these may be the way to do it by giving the C format cassette a capacity of two, three or even four hours in the next year or so.

None the wiser

To run a C format cassette in a standard VHS VCR you must load the former into a battery-powered metal shell that slips into the loading well, leaving the machine none the wiser that little brother is whizzing away inside its transport.

Now, JVC has seen fit to produce VCRs that can accept both cassette sizes. The VHS F/C feature uses a 'skating' mechanism or loading tray similar to that found in a CD player, the player handling either with no distinction.

The user simply puts a regular VHS or compact VHS-C cassette in the tray (which features indentations, so no mistake can be made as to where the tape should be which size of tape is in the loading tray and performs the required take-up operation.

Interestingly, the company states that in effect, all boundaries between differences in VHS tape will be completely eliminated, giving the user the ability to choose whichever cassette he likes.

At this point, I should mention another matter which is bubbling in my crystal ball.

Sony threw handfuls of yen at Columbia Pictures in 1988 and took control of what is arguably the world's biggest inventory of Hollywood classics – aside from wrapping its corporate arms around a world major in the production and distribution of new feature films.

JVC, with a deal less publicity, also bought into a US production company – Larry Gordon Productions.

What bubbles? My guess is that in the coming years we'll see the major hardware producers Sony, JVC, and who else? – infiltrating the world of software: creation, origination, production, distribution.

Imagine this: *Ghostbuster Ten – Available at your video store – Only on S-VHS.* Or: *Crocodile Dundee Five – On Video 8 – Get it now!* See what I mean?

Which leads us to the last of the new niceties: HDTV is the technique that promises all to all. All new technology, all new cameras, recorders, telecines, transmitters, domestic receivers – the lot.

Once the USA, Japan and Europe have settled on a standard (or standards) for a clearer, sharper, bigger and more rectangular video picture we'll see a lot of beavering in a lot of burrows – from manufacturers to producers to broadcasters,

New S-VHS-C cassettes will play for 45 minutes or 90 in LP mode.

right down to the humble (and, currently, less than over-active) retailer eagerly awaiting new product to line his shelves.

Creating and promoting a High Definition TV system calls for big bikkies and demands co-operation on a national scale, which explains why we have, on one side, Sony and Japan's national broadcaster, NHK, and, on the other, the combined forces of the European communities, with the USA still waiting for someone to fire the first shot so they can declare a singular approach to the whole question.

I've yet to see any market research on the proposition. Do we, as TV viewers of the

orld, really want a 'clearer, sharper, bigger nd more rectangular' (and painfully more xpensive) picture?

If the answer to such a global survey was majority yes, then there's more than one vay to stuff a turkey, as much as there's nore than one way to install an improved picture in the home, without the need to spend billions and coerce the world's population into a massive fire sale of their domestic electronics.

No fuzz

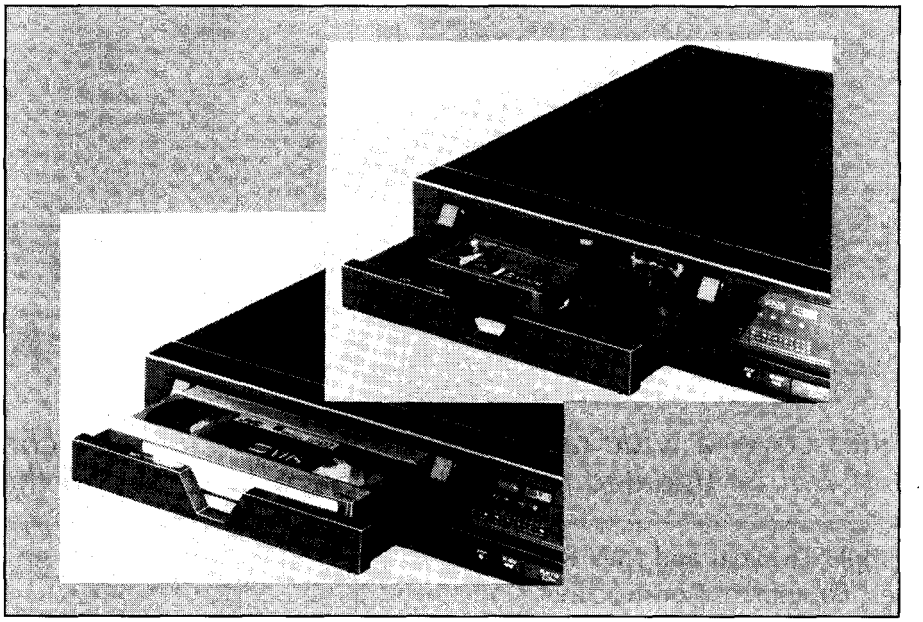
For me, one of the best answers to the problem is a video projector, capable of arge screen home presentation. No, not one f those rhomboidal, fuzzy, washed out nodels you watch at the pub or the club, ut a device that brings a feel of the cinema o your lounge room – with an image free f that ever-present scanning raster.

JVC's new LCD projector is one of the best 've seen; it is also one of the smallest and easiest to set up.

The projector uses a single lens system (unlike the fiddly three beam of most others), and is capable of throwing a larger picture than its competitors – anywhere from 90cm to three metres, measured diagonally. There is no need for the precisely positioned, curved screen many employ; a clean, white wall will do. The internals use three LCDs to provide the three colour images, plus an audio circuit that pumps out Dolby Pro-Logic surround sound.

I found the picture from this little unit – barely larger than a home VCR – superior to most. Plus, the designers appear to have eliminated the scanning raster completely, so the picture takes on a cinematic texture. Colour, though, at this point in its development, is a little under-saturated – but there again, it was an NTSC model.

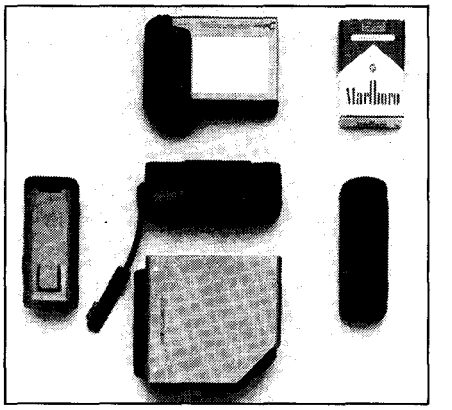
Other specs are: three LCD panels, each 4.5cms in area and with 210,000 pixels. The zoom is a six to one ratio. Image quality is improved by using a double density non-interlaced scanning pattern. Horizontal definition is 350 lines, vertical 440 lines. The colour circuits use a built-in enhancer.



The VHS F/C feature uses a skating mechanism or loading tray similar to that found in a CD player, enabling it to load standard VHS and VHS-C cassettes.

What swung me whole heartedly in its favour was an add-on, thought up by the fellows at JVC. A test tape had been shot on one of the consumer S-VHS camcorders just prior to the show, and was replayed on the LCD; an anamorphic front element adaptor lens was clipped onto the camcorder, and its complementary 'unsqueeze' unit strapped onto the projector. Result: Cinemascope.

At this stage, the marketing people seem to think the unit will sell locally for a touch under $10,000, which price should appeal to the pro and semi-pro user. If they get it down around $2,000 they'll have a winner in the home market as well. True, it's a projected picture, so daylight viewing is less than stunning. But the signal processing within it offers much improvement to any video image – broadcast, home video or satellite – and, who knows, there may be some important new technology in reflective screens that will burst upon us any day now.



Concept C — clockwise from bottom left: high resolution camera, active matrix colour LCD monitor, battery pack, stand-alone hi-fi S-VHS-C recorder/player and (centre) a snap-on tuner.

The LCD projector has three panels, each 4.5 cms in area and with 210,000 pixels, throwing a picture up to three metres diagonally across.

Late but great

A postscript: a final 'late, but great' idea from JVC is that some of its VCR models now incorporate a Teletext decoder. So far, only Channel 7 is running AUSTEXT, with great shards of up-to-the-minute news, weather, stock exchange and sports information.

The JVC version takes Teletext a step further: call up a 'page' showing the day's TV programming, select a channel, a program, set it... and the VCR will place the instruction in memory to record later in the day. No more byzantine routines with irrational buttons and confusing LED readouts. As I said, 'a late, great idea'. eti

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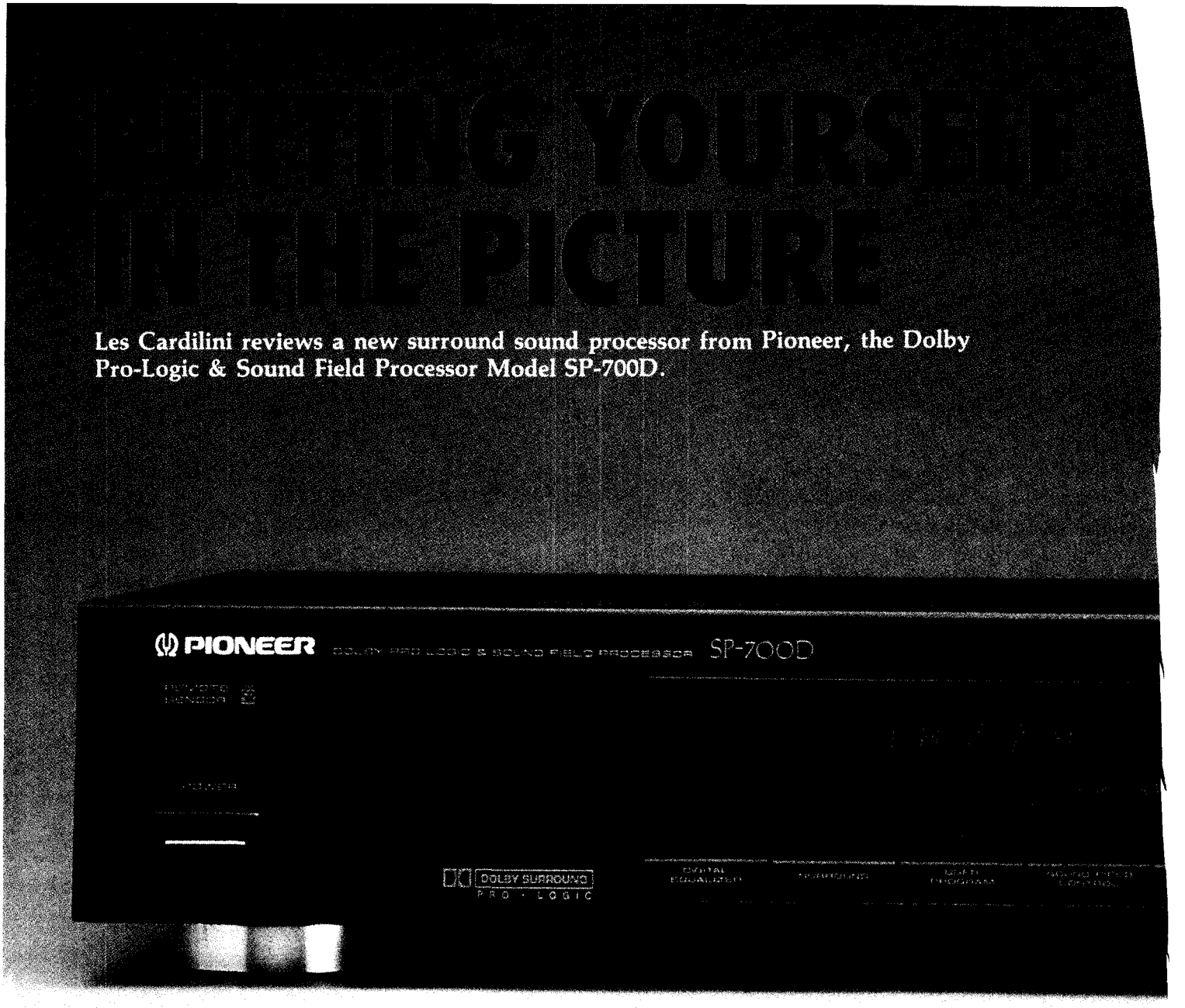
HEAR YOURSELF IN THE PICTURE

Les Cardilini reviews a new surround sound processor from Pioneer, the Dolby Pro-Logic & Sound Field Processor Model SP-700D.



Audio traditionally has tended to be the poor relation of the picture in television at home, yet many of the shows we watch on TV have the same soundtracks that attract and excite moviegoers in theatres.

We really are missing out.

One has only to look at the loudspeaker in the average TV set to get some appreciation of how casually we are inclined to take our TV sound.

The size and shape of the speakers, for example, seem to be determined generally by where the speaker will fit, rather than what will provide a full tonal range. As well, in some models, the speakers face outward from the side of the cabinet rather than towards the viewer/listener – hardly a technique conducive to bright, fresh, treble reproduction.

But treble is not the only casualty in TV sound at home: extended bass is almost a non-event, with small speakers housed in relatively thin cabinets peppered with holes for ventilation. With bass response, it is difficult to experience the natural throb of traffic and other outdoor activity in street scenes, for example.

Bass response in any speaker system relies on efficient baffling – isolating the front of the speaker from the back, acoustically – and the typical TV cabinet simply does not provide this isolation at lower frequencies. In fact, the audio hardware provided in many TV sets is a stark contradiction, generally, of the inherent high fidelity nature of the frequency modulation (FM) used for transmitting TV sound.

Basically, with the right equipment, you should be able to listen to TV sound and hear the same clarity and crispness that you might expect of the FM radio band – including stereo, if the TV station is transmitting stereo sound.

A convenient and relatively economic means of improving TV and video sound with existing sets at home is to integrate the audio from TV sets and VCRs into the home hi-fi system, with its higher power and wider frequency response. This, at least, should restore some body and life to the "boxy" quality of TV sound that many of us have, unfortunately, learned to live with and tend to accept as being normal.

To begin with, the audio output sockets on VCRs or monitor style TV sets may be connected to the AUXILIARY (AUX)

connector on the system amplifier. Suitable leads and connecting cords for the purpose can be obtained from most audio and video accessories bars in retail stores. Mono VCRs will have only a single audio output and so an adaptor might be needed to feed the video sound into both channels of a stereo hi-fi system.

Alternatively, the video sound can be connected to the amplifier using a spare TAPE or TUNER input. Then, by selecting TV programs on the VCR channel selector the sound will be directed to the hi-fi system as well as the TV set.

In order to keep the sound together with the video action on the screen, the hi-fi system speakers should be placed on each side of the TV set (but not too close, as the colour in the picture may be affected by the magnets in the speaker boxes). Ordinarily, a minimum distance of about 600 millimetres (two feet, approximately) between the set and each speaker box should be sufficient. In any case, having the speakers further apart will give wider stereo images and create a greater sense of spaciousness.

Time differences

But the stereo pair of speakers 'up front' cannot provide all the spaciousness we experience in real, live sound. Our hearing process determines the likely environment in which sounds are created by analysing the time differences in the order of only thousandths of a second by which reflections occur (or do not occur) from obstructions and room boundaries such as walls and ceilings. We also make subconscious decisions about the texture of surrounding surfaces and furnishings by the way different frequencies linger momentarily and die away.

The behaviour of sound waves in an enclosure can be compared with the smooth surface of water in a pool and the events that follow when a stone is dropped into the water. At first, a DIRECT wave moves outwards from the source of the disturbance. The direct wave eventually arrives at the nearest point on the boundary of the pool where an INITIAL REFLECTION occurs. Other, EARLY reflections follow and the reflected waves travel back across the pool and are reflected again. Before long, the pool surface is awash with reflected waves which die away until the surface of the water becomes smooth again.

Putting yourself in the picture

Similar events occur with sound waves in air, but where the waves on water travel slowly, and the lapse in time between reflections is more apparent, sound waves in air travel much faster – about 340 metres per second, or approximately one metre in three thousandths of a second.

Our hearing process is nonetheless able to compute the intervals between direct sound, early reflections from room boundaries and the sustained reflections (REVERBERATION) that follow. Armed with this 'data' our brains are able to put together a mental picture of the likely nature of the surroundings in which the events are occurring. A very simple example of this is the reverberative sound of someone speaking in a long corridor or tunnel, compared with the total absence of reverberation for a voice out in the open air: it is not difficult to tell the difference, even blindfolded.

Similarly, when what we hear on TV complements in greater detail the visual action on the video screen then we gain a sense of added realism. If, on the other hand, the two conflict, or something is missing, then we are likely to be instinctively puzzled or fatigued instead of being soothed or entertained.

Two-channel stereo, of course, is the next step up from mono in building a more realistic sound stage, and is something we take more or less for granted nowadays. Stereo gives an impression of mainly width, by spreading out individual apparent sound sources between the speakers in front of the listener. The notion of depth in a stereo system can be conveyed by the reverberation mixed in with each instrument or other sound source at the time of recording. Most of the stereo performance', nevertheless, remains in front of the listener.

The next step up from stereo, then, has to be surround sound, where the listener appears to be located naturally within the total sound field, instead of observing the effect from a distance. In a surround sound field the main stereo sound stage is still in front of the listener, who experiences, as well, the general ambience and other effects created by the recording environment. Surround sound does not mean necessarily that the listener sits, in effect, among the performers, which could be quite unnatural in many instances.

Some of the simpler surround sound systems are based on the use of two additional channels, or, perhaps more correctly, signals which already exist or are implied in a regular two-channel stereo system – that is, in addition to the obvious LEFT and RIGHT channels.

One is a CENTRE channel which plays mono sound as an apparent sound source located centrally between the LEFT and RIGHT speakers in a stereo pair. For example, sound from a mono source such as AM radio will appear to emanate from between the stereo speakers in a hi-fi system, even though there is no speaker box at the apparent sound source. Sound from the CENTRE channel is nevertheless characteristically solid.

In surround systems such as the Dolby Pro-Logic theatre surround system, for example, the CENTRE channel sound is fed to a real speaker located under or behind the screen, in order to keep the apparent source of 'mono' sound appropriately with the picture, especially as far as listeners seated to the sides of the auditorium are concerned. A single sub-woofer in a hi-fi stereo system is in effect, a bass CENTRE channel.

The Phantom

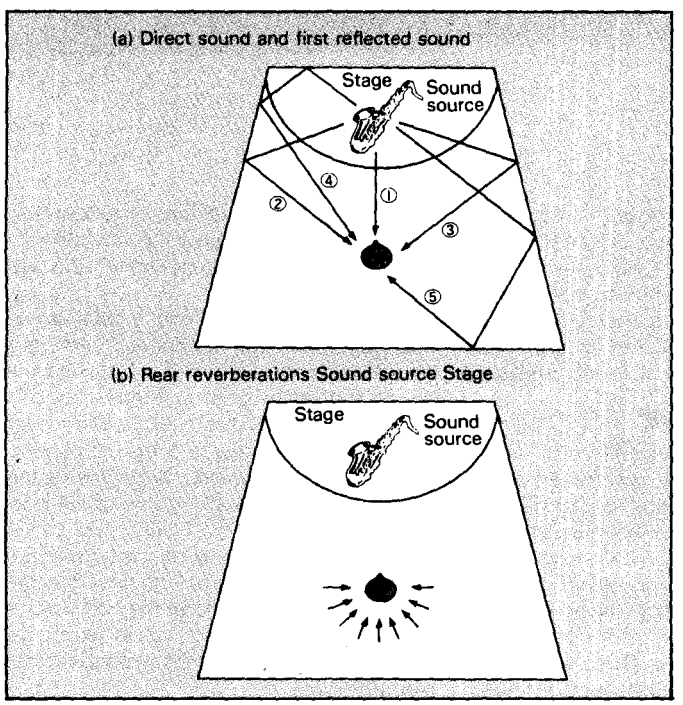
The second 'additional' channel in a stereo system is the ambience or PHANTOM channel. The PHANTOM channel can be brought to life by connecting a speaker (say, 16 ohms) between the positive speaker terminals of the respective LEFT and RIGHT channels on a conventional stereo amplifier.

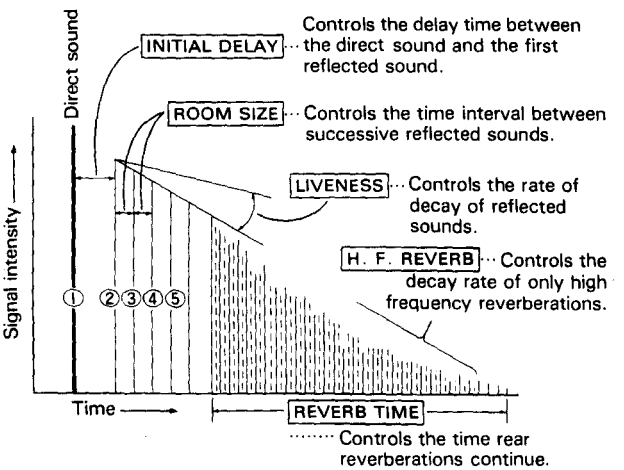
The PHANTOM channel plays the 'difference' between the two main channels. Accordingly, it is most active when there are different sounds playing in the main speakers. Conversely, when the LEFT and RIGHT channel signals are the same (mono) there will be no difference, and therefore little or no sound will be heard in the PHANTOM channel speaker. Sound from the PHANTOM speaker is characteristically 'thin' and reverberative, having no apparent fixed source.

Typically, the speaker connected to the PHANTOM channel is placed behind the listening area and provides an ambience, or impression, of being in a larger room, or hall. The resulting sound is often called HALL EFFECT, for that reason.

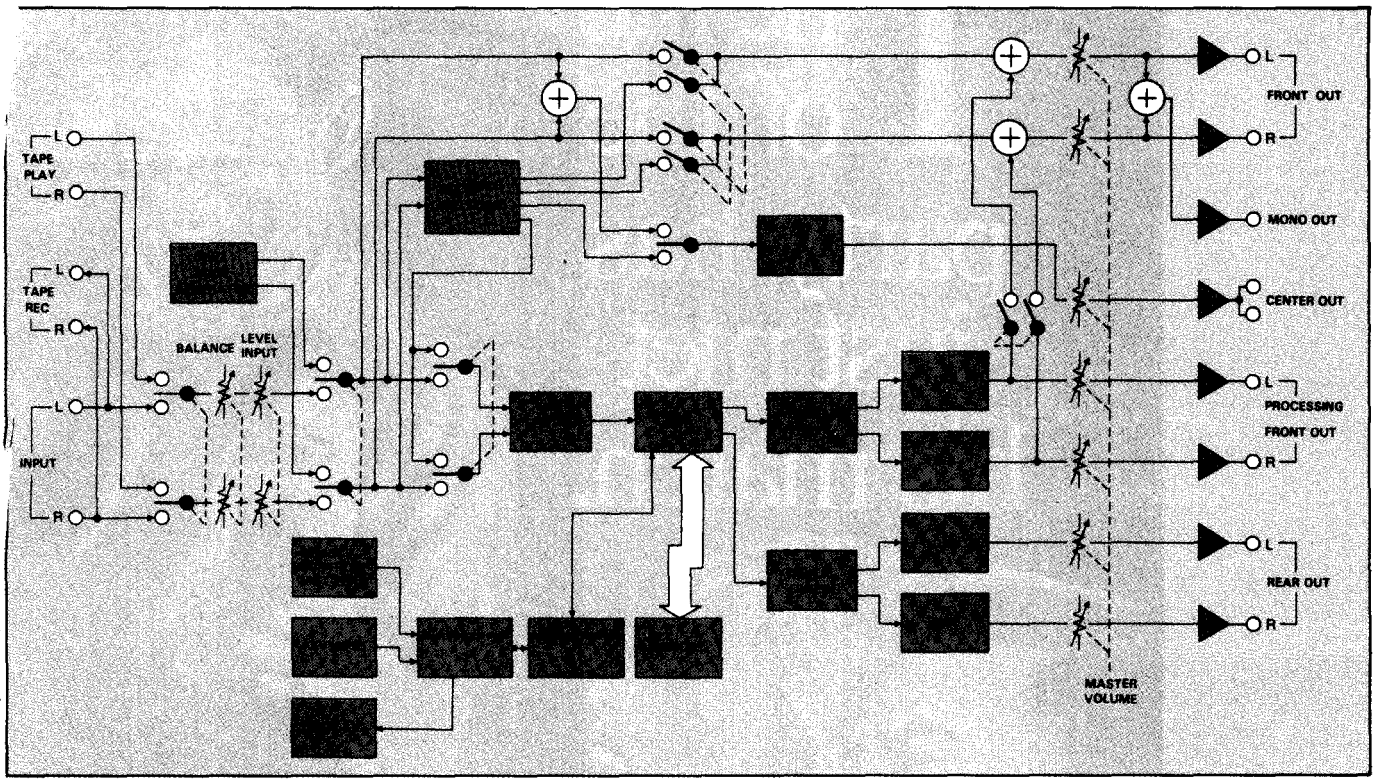
Sounds that appear predominantly in the CENTRE channel will not appear simultaneously in the PHANTOM channel, and vice versa.

With all channels active then, the system becomes more dynamic, with focal points in a stereo program moving from LEFT to RIGHT and from the main channels to the CENTRE and PHANTOM channel rear speakers, depending on the stereo separation.





By changing the parameters of a preset program, you can create different sound fields. The six parameters are: 1) Initial delay; 2) Room size; 3) Liveness; 4) Reverb time; 5) HF reverb and 6) P front EQ, rear EQ.



Block diagram of the SP-700D.

Of course, in a conventional two-speaker stereo system the additional channels are implicit rather than physical, but in many surround sound systems the 'side' signals derived from otherwise normal stereo recordings, are amplified and processed to achieve a variety of sounds characteristic of large listening rooms, stadiums, theatres and studios. These are often referred to as simulated surround sound systems.

Theatre surround sound systems such as Dolby Pro-Logic, on the other hand, are far too sophisticated in their encoding and decoding of the desired sound field effects to be recreated in theatres. Up to six channels, including FRONT LEFT and RIGHT channels, a CENTRE channel, CENTRE LEFT and CENTRE RIGHT channels and a Surround or Audience Participation (AP) channel are utilised. Audience Participation, which implies involvement, perhaps better describes the objective of this kind of surround sound, which often carries definitive program sound rather than just a simple ambience.

And, just as the stereo system 'hides' a mono CENTRE and PHANTOM ambience channel, sophisticated surround sound processors can pack even more channels into appropriately encoded stereo soundtracks.

Surround sound systems do, however, require an additonal amplifier and loudspeaker system in each channel and, depending on the model, the surround channel amplifiers may come as part of the processor package or have to be obtained separately. Often, this is related to the all-up cost, where a simple processor has additional power amplifiers on board, while a more complex and therefore costly processor might provide only several channels of processed surround sound at Line Level. Processors are available with and without additional amplifiers, as add-on equipment for use in existing stereo systems.

With the right kind of processor, and the requisite complement of amplifiers and speakers at the ready, you can even listen to full bodied, threatre-like surround sound at home, with suitably encoded soundtracks on stereo TV and videomovie tapes. Many contemporary movies shown on TV nowadays bear the Dolby Stereo logo and most commercial metropolitan TV channels, at least, are broadcasting in stereo. Some earlier mono soundtracks are converted to a pseudo stereo format prior to transmission, to maintain a stereo 'flavour' when received on stereo TV sets and VCRs.

Lively Carols

Live concerts on TV also come to life with suitable surround sound effects. Carols By Candlelight in Melbourne, for example, took on a wider dimension on TV with a variety of surround sound effects created by a new surround sound processor from Pioneer, reviewed here. Listening to Carols again in 'plain ole stereo' will not be the same.

But it is not necessary to always have to tune in to stereo TV for surround sound. Direct stereo and Dolby Surround encoded movie soundtracks can be fully decoded in hi-fi systems employing a suitable surround sound processor, amplifiers and speakers to recreate the same sound effects you would hear with the movie at the theatre. Most stereo recordings on disc and tape, for that matter, would be capable of providing impressive surround sound effects in a system incorporating a surround sound processor.

Pioneer's new Dolby Pro-Logic & Sound Field Processor Model SP-700D incorporates many of the above features and also has eight Surround Effect and 16 Sound Field Programs. The Surround Effect modes include both Dolby 3-Channel and Dolby Surround with Pro-Logic decoder, as used with movie soundtracks.

Pro-Logic is a feature of the Dolby system which minimises crosstalk between channels and provides channel separation of up to 20dB, compared with around 6dB without Pro-Logic. The Pro-Logic decoder derives LEFT and RIGHT front channels, a CENTRE channel and a processing channel for the Audience Participation speakers.

Eight line-level outputs from the Pioneer SP-700D provide the foundation for a truly extensive surround sound system. They include FRONT LEFT and RIGHT, REAR LEFT and RIGHT, CENTRE, and FRONT LEFT CENTRE and RIGHT CENTRE channels. The eighth output is a Mono output combining the front Left and Right outputs.

On the input side, the Pioneer SP-700D may be connected into an existing system via a switched adaptor if available on the

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ection Music Calendar. You can also make a dom programme of up to 20 tracks to access y the selections you want to hear.

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e Unity System is completed by a single ıte Control that operates every function including the volume level.

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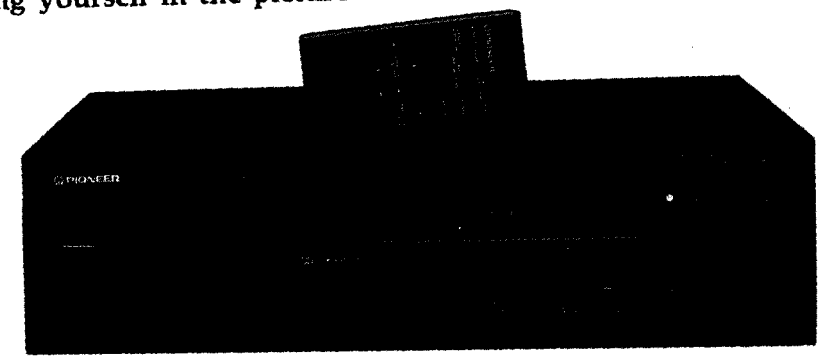
READER INFO No. 24

Putting yourself in the picture



The VSP-555, part of Pioneer's add-on range, offers audio and video switching, Dolby, Stadium and simulated surround modes and built-in rear amplifiers.

amplifier or, as is more likely to be the case for many prospective users, via a spare Tape Recording output on the main amplifier. In the event that an existing amplifier has only one Tape Recording connection, additional, switched Tape Record and Tape Play connectors to accommodate an otherwise evicted tape deck are provided on the SP-7OOD.

Besides the register of fixed surround effects and surround sound settings in the Pioneer processor, the various program parameters, such as initial delays and delays between reflections, reverberation time, room liveness and high frequency (treble) reverberation, can be varied using the infra-red remote control, to create your own acoustical effects and trim the system sound for a particular room and setting.

In fact, with some 51 easy to operate (with practice) buttons on the remote control, the front panel on the SP-7OOD itself is simple and uncluttered. Much of the program selection can nonetheless be carried out at the set, using UP-DOWN selection of program details rather than individual pushbutton control, as is available on the handheld remote.

In any case, setting up a surround system can be done more quickly and effectively from the listening position. Using the remote control is therefore a much more practical way to select functions and adjust the system parameters.

One of the more important adjustments in any surround sound system is the balance of the volume levels in the several channels. A noise test signal is provided in the Pioneer SP-7OOD and, when selected, automatically steps sequentially through front, rear and centre channels, while the individual levels are adjusted from the listening position. As a test signal for assessing volume levels, pink noise, which contains many frequencies, is less likely to be influenced by room dimensions and standing waves than a single tone might be.

The current channel in which the test signal is playing is displayed on the front panel of the SP-7OOD during the test mode and the test signal continues to step repeatedly through the channels until cancelled at the remote control. A single button on the remote control selects and cancels the test signal.

A digital 7-Band Graphic Equaliser is also provided in the Pioneer SP-7OOD Dolby Pro-Logic & Sound Field Processor. The equaliser is switched in and out of the circuit and adjusted from the remote control. The equaliser response is adjusted, again by stepping, through frequencies from 65 Hz to 12.5 kHz using + and – buttons on the remote control. A second pair of pushbuttons allows adjustment of the equaliser response between plus and minus 12 dB in 2 dB steps. The equaliser response is displayed on the frequency +/ — select buttons on the remote control unit. An equaliser ON-OFF button is also provided on the remote.

The illuminated display panel on the SP-7OOD normally shows only essential information such as which sound field or mode is currently active, whether the equaliser is on and if processing is switched in or out. (Sound field processing can be switched off at the remote control, leaving the system in a normal stereo mode – useful for listening to news commentary and that occasional interesting commercial). The display can, however, be cycled to display other information by repeatedly pressing the display button on the handheld infra-red remote control.

Whilst the volume level on each amplifier (not supplied with the SP-7OOD) in the system can be adjusted individually during the noise test mode, the processing and overall volume of the total sound field can be controlled separately. The analogue MASTER VOLUME control in the SP-7OOD is motorised and can be operated either manually at the set or via pushbuttons on the remote control. An illuminated index mark on the master volume control knob allows the current setting to be observed without leaving the listening position.

One of seven

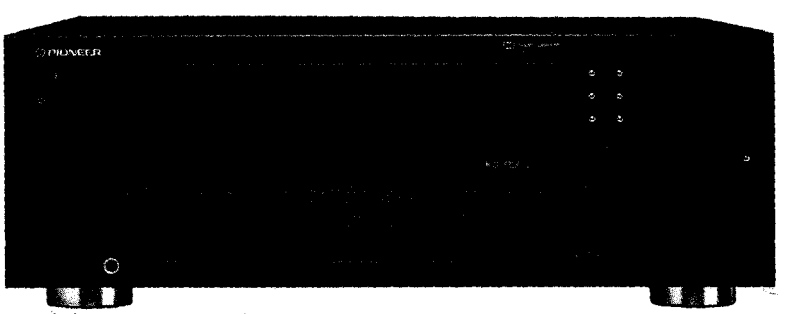
The SP-7OOD is one of seven models in Pioneer's current range of products featuring surround sound, in a variety of options and mixes. The SP-7OOD, for example, is virtually fully optioned from simulated surround sound through to 3-Channel Dolby, and Dolby Surround with Pro-Logic, and preset and user sound field functions. Recommended retail price for the SP-7OOD is $1299 which does not include additional amplifiers or speakers. Other models in the add-on range include the VSP-555, with audio and video switching; Dolby, Stadium and Simulated surround sound modes and built-in rear amplifiers. The VSP-555 sells for $499 RRP.

Comprehensive operating instructions (26 pages in English) are provided with the processor and are easy to follow and generously supported with diagrams showing cord connections and suggested system layouts.

At the top of the range is the Audio/Video Receiver Model VSX-95OO. Major features include on-board front, surround and centre channel amplifiers and Dolby Pro-Logic Surround with digital delay and Smart Remote Control. The VSX-95OO has six video inputs (with S video terminals), two-way dubbing, and five audio inputs. A video selector which mates desired audio with desired video is also provided in the VSX-95OO, which is ready for use in Pioneer's Multi-Room Remote System. RRP is $1799.

Two video switching surround sound amplifiers with features similar to those in the receiver are also included among Pioneer's current range of sound field models. eti

Further information: Pioneer Electronics (Australia) Pty. Ltd., 178-184 Boundary Road, Braeside, Victoria 3195, ☎ (03) 580 9911 or, toll-free on (008) 338 439.



Top-of-the-range model VSX-9500 is an audio/video receiver with on-board front, surround and centre channel amplifiers and Dolby Pro-Logic Surround with digital delay and smart remote control.