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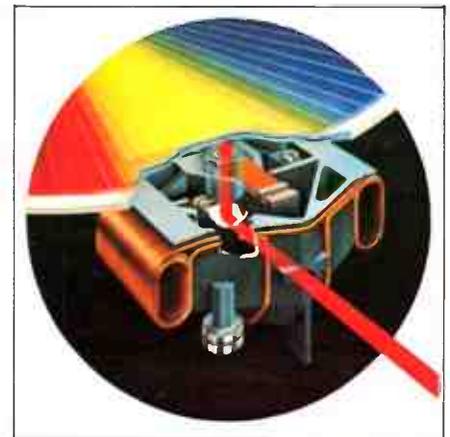
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# SIEMENS

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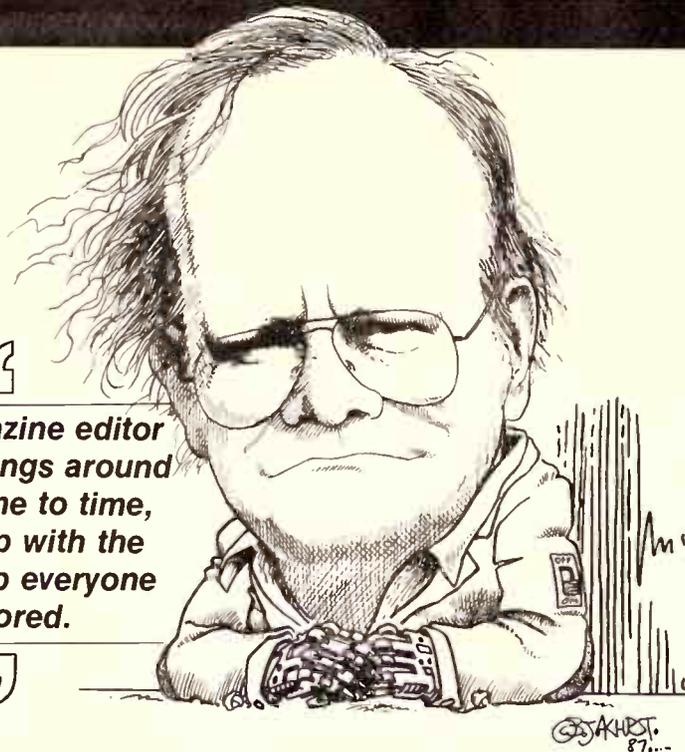
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## Frequency



**An astute magazine editor likes to hack things around a little from time to time, just to keep up with the trends and stop everyone getting bored.**



ETI is one of the more successful examples of electronic publishing. It's been around for sixteen years, which of itself is something of a miracle, surviving the booms and bumps with equal aplomb. It's also gone through innumerable stages of content and appearance, as a glance through the collected files will show. Why?

It occurs to me that magazines are a little like frocks. Perfectly serviceable, they nevertheless wind up on the scrapheap at the end of every year, replaced with something a little more fashionable. An astute magazine editor likes to hack things around a little from time to time, just to keep up with the trends and stop everyone getting bored.

This is our attempt at 'hacking things around'. The front section of the magazine will be devoted to the latest and most exciting trends in science and technology, written by some of the best writers in the business. The central section is turned over to hi-fi and all those other little gadgets you wish someone would buy you for Christmas, and up the back, the traditional do-it-yourself projects and articles on electronics. And for those of you who only buy the mag for the ads, there will be more of those in the future too.

We hope you like it. If you do, tell a friend and tell us.

**Jon Fairall**  
Editor

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## DoA plays catch-up

The Department of Aviation invited a party of journalists to Canberra recently to review the work being done in conjunction with Aussat to implement a new communi-

cations system for the aircraft and ground controllers. Currently, aviation communications are woeful over most of Australia, but according to the department, new technologies will bring aviation communications into the twentieth century.

As things stand, communications between aircraft and

the ground are confined to two bands, VHF and HF. VHF provides reasonably high standard voice links, but is limited, essentially, to line of sight communications. For longer range voice channels the aviator relies on HF radio. This has long range, but very poor noise performance. World wide, there has been

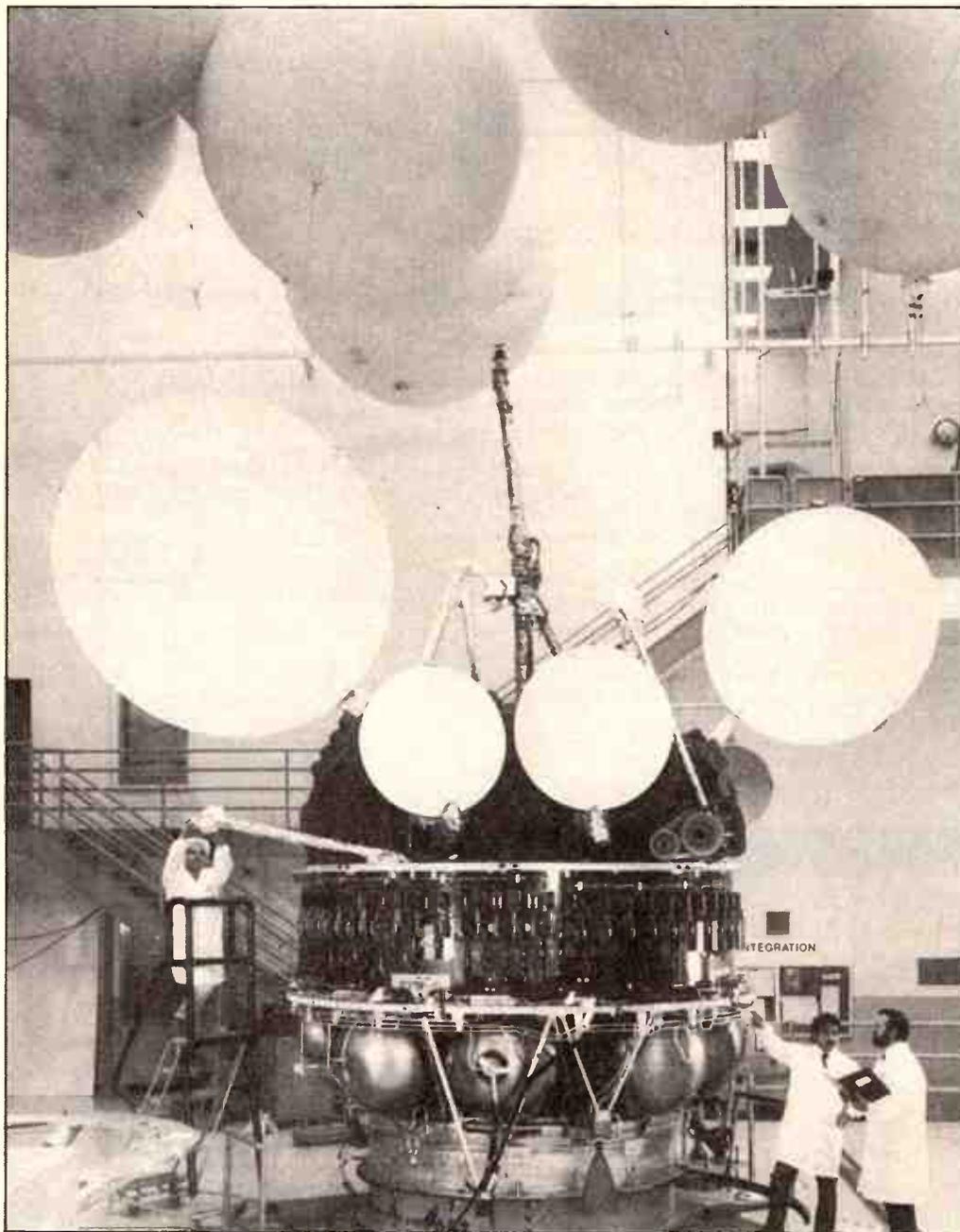
a move to replace HF links with VHF links wherever possible.

Across Australia, all manned airport control towers communicate on both wavelengths. In the more populous East coastal regions, VHF translators are used away from the field to extend the range of the system. Signals are fed to the translator by landlines from the control tower. Thus for some time it has been possible for aircraft flying at jet altitudes, say 30 000 feet, to communicate during their East Coast trips on VHF throughout the flight. However, in the Centre, HF communication is the order of the day for Australian, Ansett and Qantas. Light aircraft, flying at lower altitudes, find the range of the VHF stations considerably reduced because the lower altitude at which they fly. They typically use HF even in the East, and most certainly on trips west of the Blue Mountains.

Now, new communications techniques will go some way towards changing this situation. The DoA is in the middle of a re-organisation plan that will use Aussat 1 and 2 to communicate with a number of remotely sighted VHF stations throughout the continent. The distribution of these stations will bring VHF communications to all aircraft flying over continental Australia at 30 000 feet, and considerably improve communications for light aircraft down to perhaps 5 000 feet.

For reasons of economics and servicing most of the stations have been located at existing airports or strips. However some are located in areas with four wheel drive access only. In such systems power is provided by solar panels and batteries, with a diesel generator for backup.

Each downstation consists of two satellite dishes supplied by Andrews Antennae, a mast for the VHF antenna and a climate tolerant shed. The shed is designed to provide a reasonable habitat for communications gear even in the Dead Heart where temperatures of 50 C are not uncommon. Most of the equipment inside was supplied by NEC.



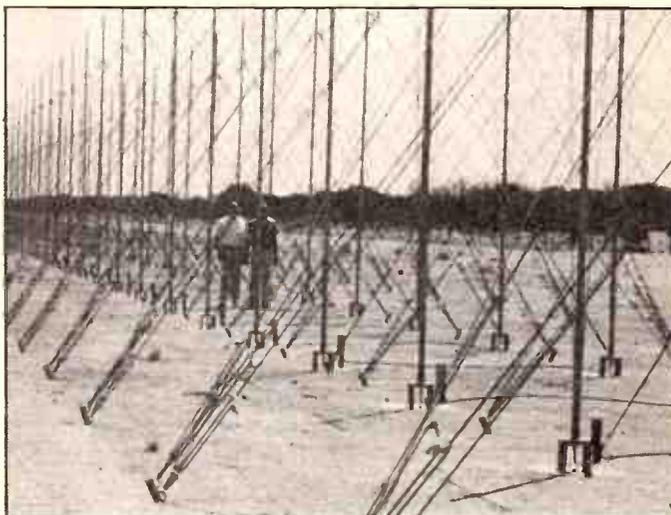
*Intelsat VI* nears completion in the big room at the Hughes plant in Los Angeles. Satellites of this class will be able to transmit nearly 120 000 telephone calls and three television services at any one time. The balloons are filled with Helium and are used during construction to support the weight of antennae and other protrusions. Without them they would collapse under their own weight. The craft is scheduled for launch in 1989.

The new system will also be used to communicate between towers. At present, all Air Traffic Control towers are linked on a telex network running at the traditional 50 baud. This system will now be carried on the satellite. There is also a plan to allow pilots access to this network for filing flight plans and receiving weather information.

The use of satellites for communications, although relatively unsophisticated, at this stage, puts the DoA on track for the next bout of technological change expected in the early 1990's. This will be the use of Direct Broadcast from the satellite to aircraft. As envisaged, the

aircraft would use a conventional phased array buried in the wings and across the top of the fuselage to talk to the satellite. The DoA is monitoring this technology as it develops overseas, and has had considerable input into the design of the second generation Aussat satellites.

Currently there is spectrum space allocated for this purpose in the UHF band around 1500 MHz. However, it is under a great deal of pressure from other mobile users who would like to take advantage of existing, rather than promised satellite services. One such application is truck dispatch and messaging.



The arrival of the world's first high resolution flat, thin cathode ray tube (CRT) — just 50mm thick, and so rugged that it could be dropped without breaking — is likely to alter aircraft cockpit and armoured vehicle design as well as create a need to re-design present day processing displays.

Seen here in a Royal Navy Lynx helicopter, this 200mm wide screen can give the pilot immediate access to information on navigation, flight management, weapons and storage. It has the added benefit of low heat dissipation, less than 20W, removing the need for forced air cooling and ducting.

The Thin CRT Electronic Display (TCED), developed by Mullard, will shortly be demonstrated in three colours and is likely to be available in full colour later in the year. The company says it is the forerunner of large area flat cathode ray tubes or TV screens.

The advantage of CRT's are high performance, high resolution images which combine brightness with flexibility. The major drawback however is their bulk — especially their depth. Engineers at Mullard have overcome this by folding the beam, and using a totally different means to define each line of the display. They have separated the low-voltage scanning from the high-voltage screen image creation functions.

## Jindalee brings jobs

Computer Sciences of Australia has begun work on a \$6 million project to convert experimental software developed for the Federal Government's Jindalee Over-The-Horizon Facility into an operational system.

Up to 30 CSA software engineers will be employed on the contract over the next three years at the Defence Research Centre in Adelaide.

Jindalee is a revolutionary radar technique which enables the defence force to carry out surveillance over immense areas far beyond the limits of conventional radar by bouncing HF waves off the ionosphere. The reflected energy is gathered by very large antenna arrays and analysed by sophisticated computer systems.

The analysis involves complex computational tasks which have to take into account the frequently changing characteristics of the ionosphere.

Testing of the Jindalee system will continue to be carried out at Mt Everard, 40km north west of Alice Springs.

The Department of Defence intends to build up to three operational Jindalee systems which will become an integral part in Australia's defence program.

For more information please contact Brian Lovelock on (02) 439 0033 or Brian O'Shea on (02) 958 2936.

## Telecom charges up

As predicted in last months ETI, Telecom has introduced a new charging system for dial-up data calls through the public switched telephone network.

Dedicated Network Services Manager, David Gannon, has announced Telecom will bring in the new system based on timing of local data calls by mid 1988.

Justifying the new impost, he said: "The past few years have witnessed a dramatic rise in the use of the public switched telephone network for data applications.

Some of these applications involve maintaining connections through the local network which last for hours, or even days. We are effectively providing the benefits of a semi-permanent link for the price of a local call."

Mr Gannon said Telecom needed to ensure information

service providers made a fairer contribution to the maintenance and upgrading of the public switched telephone network.

"Long-hold data traffic cannot reasonably and economically be accommodated on the telephone network. The network has been developed on the basis of carrying voice traffic with the average call duration of less than three minutes.

It must be recognised that these long data calls impose a high cost on Telecom — one which is being met directly by all telephone customers.

It should also be recognised that further growth in the number of data calls would restrict Telecom's ability to contain costs and could lead to a general increase in tariffs," Mr Gannon said.

We said the new system would not affect charges for voice calls. It would also have no effect on data calls of similar average duration.



"Commencing mid-1988, exchange access lines rented by information service providers for client access to computer processing, database and other bureau services will be metered for usage.

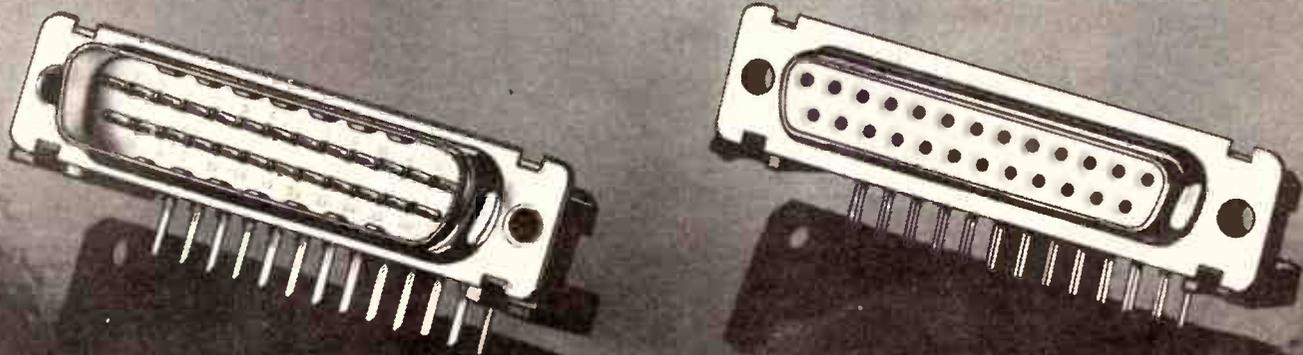
The calling client will pay only the initial meter registration of 18 cents, and the information service provider will

be charged for any excess holding time."

"We will be providing further information as charging and implementation details are finalised. Customers affected by the change will be advised of operational details at least six months before the new system is introduced," Mr Gannon said.

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## Government-led resurgence

The government has been active recently encouraging some new industrial developments.

The Australian computer industry has received an unprecedented boost with two of three companies named as preferred tenderers for a multi-million dollar Federal Government contract being locally-owned and controlled.

The preferred tenderer status will see the two — Melbourne-based Computer Power and Queensland manufacturer Computer Corporation of Australia, along with the Australian subsidiary of US manufacturer Digital Equipment Corporation — install a pilot central computer system for Canberra's new

Parliament House.

Once this has been evaluated contracts will be entered into for a complete networked system for the new building.

In the meantime, Computer Power has been nominated as the prime contractor and systems integrator for the entire system, while CCA has been nominated to supply workstations and DEC to supply central processors.

Meanwhile, the government is trying to develop a strategy to achieve improved export performance by the aerospace industry.

The Minister for Industry, Technology and Commerce, Senator John Buton, and the Minister for Trade, Mr John Dawkins have released a report designed to foster future growth of the Australian aerospace industry. They said it was clear the industry needed to develop overseas markets if it was to grow, particularly given the declining level of dependence on domestic defence pur-

chases.

Dawkins pointed out that the implementation of the aerospace strategy would complement work AUSTRALIA was pursuing in developing export strategies for other technology-based industries that had links with the aerospace industry. These included communications equipment, scientific instruments and computer software and hardware.

Key points include more aggressive use of the offsets policy, foreign aid and concessional finance, government procurement and more government to government agreements.

The latter was highlighted recently following seminars on 'Space Opportunities with France', organised jointly by the Australian Space Board (ASB), the French Space Agency (ONES) and ACTIM, the French agency for technical, industrial and economic co-operation.

Arranged specifically to explore the possibilities of

closer co-operation between Australia and France in the space industry, the seminars created a base from which future joint projects between the two countries may be achieved.

"While Australia is already involved with French companies in projects such as the Endeavour and Lyman space telescope programs, there is room for much greater collaboration," said a French representative.

Nor is the government's enthusiasm for high technology projects limited to aerospace. The Department of Industry, Technology and Commerce (DITAC) has released a report which finds that Australia had internationally recognised strengths in Expert Systems research and development.

The report highlights strong support for Australian industry, academia and government to apply Expert Systems and system tools (be they totally developed or foreign) to existing industries.



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## Profits

Intel Corporation, the US semiconductor maker, returned to profitability in the first quarter of 1987 after several quarters of losses, the company said recently.

Revenues totalled \$395 million, up over 40% from \$280 million for the first quarter of 1986. Net income was \$26 million, compared to a net loss of \$22 million a year ago.

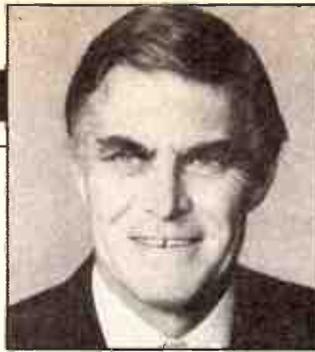
There is one fly in the ointment, however. During extensive testing, Intel has discovered that not all 80386s correctly perform a certain 32-bit maths function. Personal computers running 16-bit DOS programs are not affected. First quarter 1987 results include charges to cover the financial impact of the potential replacement and extending its replacement warranty to two years.

Intel is not alone in feeling bullish. STC reports a group result for 1986 of \$357 million

turnover and an increase in net income to \$21.4 million. Growth rate for the second consecutive year has exceeded 26%.

In releasing the results for the year ended 31st December, STC's Chairman, Mr Bill Page-Hanify, said that this strong, substantial performance for 1986 is in spite of the problems of exchange rates, noting that although the falling Australian dollar has caused some "difficult short-term effects, particularly in the prices of imported components, the net result is a positive one. For export," Page-Hanify said, "the long-term outlook is good."

During 1986, STC's total capital outlay for the design and introduction of new products was \$30 million. Of this, \$13.1 million was spent on research and development, a significant 30% increase over last year. The remaining \$17 million was invested in manufacturing and test equipment, up \$3 million



Bill Page-Hanify

on 1985 and running counter to the general fall in investment in the industry which is apparent in recent statistics.

1986 was also a strong export year for STC, with major sales of Gold Phones to Fiji and Touchtones to Papua New Guinea, Samoa and Greece. In addition to completing a \$15 million contract to manufacture electronic repeaters for the AIS cable, linking Australia, Indonesia and Singapore, the year also saw STC receive a letter of commendation from Senator John Button, Minister for Industry, Technology and Commerce, for the successful completion of the \$78 million ANZCAN submarine cable offset program.

## Merger

Hills Antenna Systems Division, Adelaide and Antenna Engineering Australia, Melbourne, a subsidiary of Kabelmetal Electro Germany, have joined forces to form a new Company.

The new organisation will be a member of the worldwide RFS (Radio Frequency Systems) Group. RFS, in its field, the world's leading source of Radio Frequency Antenna Systems and Components.

Hills have acquired a 30% interest in the new Australian Company which will operate under the name of Radio Frequency Systems Pty. Ltd. The combined Broadcasting activities will be centred in Adelaide under the responsibility of Mr Chris Jaeger. HF, Landmobile, Cellular and associated equipments will be centred at Kilsyth, Victoria. Group General Manager is Dieter Rullmann.

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## Fax VS couriers

Electronic document interchange (EDI) is starting to hurt the courier industry. According to a recent report by IRD, the US market research company, up to 30 percent of overnight package service traffic consists of documents which are directly vulnerable to replacement by EDI.

According to the IRD study, the standardized nature of the EDI messages, and the fact that they must be transmitted over government-controlled transmission facilities will inevitably attract a tax on document transfer in some European and Third World countries. The prospect of government control and taxation of EDI "may slow it down in some places," says the report. The report includes Electronic data interchange, funds transfer, point of sale information, electronic mail and digital file transfer within its definition of EDI.

## Autocad

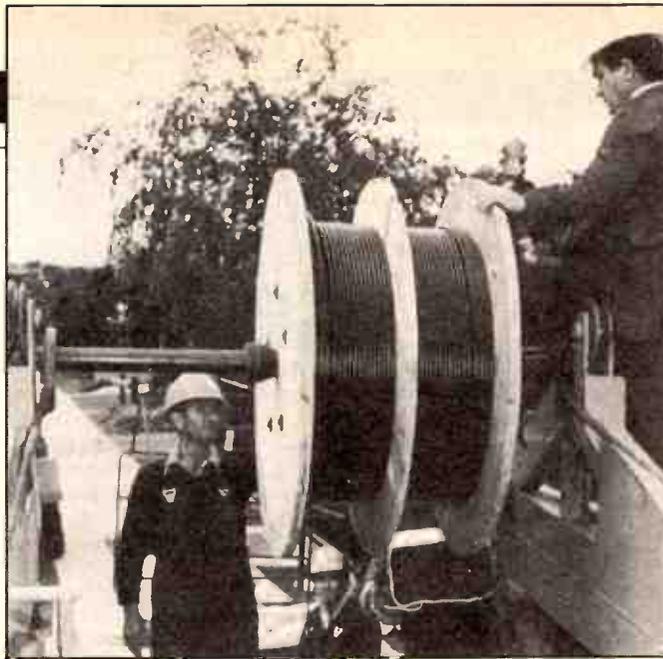
Autodesk Inc., the California based creator of AutoCAD, the world's most widely used computer-aided design and drafting software, is setting up a subsidiary in Australia to develop, market and distribute its products.

The distributorship agreement between Melbourne based Entercom and Autodesk has been terminated and certain assets transferred to Autodesk. A new wholly owned subsidiary of Autodesk will be formed, to be called Autodesk Australia Pty. Ltd.

Autodesk intends for the new company to extend the current range of CAD/CAM products distributed in Australia and to manufacture and carry out any necessary research and development in Australia.

The Australian operation will be staffed by Australians and will include the existing Entercom personnel.

Autodesk currently claim a marketshare in excess of 70% of all PC-based CAD in Australia.



## Optical fibre

Olex Cables has passed the 2,000 kilometre mark on contracts for optical fibre cable for the Central Queensland Main Line Rail Electrification Project.

The project, which began in 1984, is to duct communications along the electrified rail system in the coal producing region of central Queensland. Optical fibres are immune to the electrical noise produced by the system, so they have a natural advantage as a communications medium in this environment.

The cable provides voice and trunk communications as well as data for supervision and control of signalling and overhead traction supply systems. It consists of six fibres in a slotted core construction.

The Manager of Olex's Networks Division, Mr Brian Wright, says by the end of April 1987 more than 1,200 kilometres of the cable will be in operation.

Queensland Railways expects the four-stage project to be completed next year. Further electrification projects, using optical fibre for communications, are already being planned.

Meanwhile, a contract has been signed for the world's longest unboosted optical fibre communications cable. It will run 135 kilometres between the British island of Guernsey, near the northern French coast, and Dartmouth, in south west England.

It will travel the entire distance without the benefit of a repeater which is a costly device sometimes necessary every 50 kilometres on undersea optical communications systems to strengthen fading pulses.

The secret is in the use of a new wavelength — 1.535  $\mu\text{m}$  where glass is exceptionally pure.

## Not for lovers

Researchers in Japan soon expect to release the first chip based on Diamond thin film (DTF). DTF coated knives for electron microscopy are already being shipped by Shinetsu Chemical Company, and Sony is marketing a loudspeaker tweeter which uses diamond film. The chips, by Sumitomo, are for applications involving hostile environmental conditions (such as in spacecraft or automobile engines).

In the US, IBM scientists have been investigating diamond films for at least three years, which suggests that IBM's Yorktown Heights research facility is increasing its efforts in this area.

It was researchers in Moscow in 1977 who came up with some key insights into how to manufacture synthetic diamond in thin-film form. They discovered that dia-

mond film possesses unique mechanical, electronic and optical properties, which have applicability in a wide range of military and commercial markets. For example, it seems that Diamond Thin Film (DTF) chips will be superior in speed and in environmental resistance properties to Gallium Arsenide. Coatings for lenses and radomes can be made very strong and, at the same time, transparent to infra-red and microwave radiation. But today, the Japanese are undoubtedly away in the lead. Not that the market is very big. Shipments in 1987 will be only \$17 million, all from Japanese vendors. However, development of the commercial DTF market will skyrocket over the next few years, approaching the \$400 million level by 1993 according to industry pundits. Added to this will be a large and healthy military market.

## MIC progress

The Management and Investment Companies Licensing Board (MICLB) passed two significant century marks recently with news that \$100 million has now been invested in over 100 Australian businesses.

In the 33 months the MIC Program has been running, the 11 MICs have invested and firmly committed \$102 million (\$91 million in equity and \$11 million in loans).

In total, 104 businesses have received MIC funds as well as management support in such areas as marketing, production, financial control and quality control.

Photo Advertising (International) Limited became the 100th business to receive MIC support.

Senator Button said the Government was well pleased with the high-quality management support provided by the MICs.

"It is significant that there have been only five failures out of the 104 businesses which have received MIC assistance." However, critics of the program have argued that the low failure rate demonstrates that MICs are not taking sufficient risk.

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## Small earth station

Communications from remote sites has been made easier with the recent introduction by Aussat of an easy to use, transportable earth station.

According to Aussat, field staff can set up and operate the earth station within 20 minutes, giving immediate access to telephone, fax and telex transmission.

When it comes time to move camp, the antenna can be hitched up to a four wheel drive vehicle and towed to the next site.

Aussat has leased the first of these new generation transportable earth stations to Shell Australia and it is being used for communications between a base camp in the Great Sandy Desert south of Halls Creek, WA, and the company's head office in Melbourne.

Called an Interface AM2400, the station measures 2.8 m by 2 m and stands 3 m high with the 2.4 m dish in the operating position. It weighs

just over a tonne, making it easily towable by a vehicle such as a Toyota Land Cruiser.

Specifically designed for rugged off-road work, it has air bag suspension on the axle and drawbar. Two shock absorbers between the drawbar and baseplate further reduce impact stress.

The sensitive electronics have been made more rugged and are located in a dust- and water-proof housing which is rubber-mounted on the baseplate.

It was designed by Aussat engineers and constructed by Vicoach and Aussat personnel at the Vicoach plant in Melbourne.

The electronics were manufactured by the Adelaide communications equipment company, Codan, while the aluminium dish was made by the Melbourne based Andrews Antenna. Five have been ordered so far.

# HERE, THERE AND EVERYWHERE

*Over the last few months the press has been full of stories about international espionage. Americans bug Russians. Russians bug Americans. In Australia, we bug each other. How is this done?*

**Simon O'Brien**



*A classic listening station*

**U**ndoubtedly the most common form of electronic surveillance used by the secret services of the world is the ubiquitous 'bug' or miniature radio transmitter. Not only have these been used to eavesdrop on the private discussions of the superpowers but they have also been used in the world of industrial espionage and blackmail.

In the old spy movies bugs were simple devices which could be installed anywhere and were usually easy to find and frustrate. In a recent ABC program about spy Guy Burgess, for example, one of the leading characters notices a bug on her bedroom

light. She frustrates it by masking her conversation with the sound of running water. Unfortunately the technological explosion of recent years has made the humble radio microphone a much more sophisticated device which has become almost impossible to detect and just as hard to defeat.

Radio microphones available on the open market come in various forms. One of the most interesting is the 'Probe' microphone which is designed to detect the vibrations caused by sounds in a room. They detect acoustic waves either by means of a spike drilled almost entirely through a wall or they can be placed

inside a piece of plastic tubing and inserted into a keyhole or a convenient water pipe. Another type is the 'drop' microphone. This type of bug is one of the most popular and can be concealed almost anywhere, such as light fittings, air conditioning ducts and chimneys. A new type is the 'contact' microphone which can pick up soundwaves transmitted through solid material such as walls and windows.

Most bugs, such as those outlined above contain, as well as a miniature microphone, a tiny fm radio transmitter, power supply and aerial. Of these components it is the last two which provide the greatest difficulty for the would be 'spook' since they are so bulky. The bug needs to be attached to the mains or it must contain batteries. The trouble with attaching the device to the mains is that this takes time which is usually in pretty short supply in the world of espionage. Furthermore the use of wires increases the risk of the device being detected.

Two solutions to this problem have been worked out. Some bugs are powered by low power batteries but include a voice operated switch which ensures that the device only actually uses power when someone begins to speak. Other bugs are attached to the mains power supply by wires so thin that they can be woven into carpets without any obvious effects.

Aerials provide more problems. There have been several ingenious ways devised to overcome this particular shortcoming. Some bugs use metallic paint which has been used as an undercoat on the surrounding walls. Others use ultra thin wires which are attached directly to the power cables turning the entire mains supply into an aerial.

Of course all the bugs mentioned above transmit their information using radio frequencies. New types of bugging devices however use fibre optics. They convert sound into light at the microphone. The signal passes down the fibre to a receiver, usually located outside the room, where it can be retransmitted over wire or radio link.

## **Telephones**

Telephone tapping is another form of electronic surveillance with a long and dis-

honourable history. The simplest form of telephone tapping involves linking a couple of wires in parallel with the line. This can be done almost anywhere, but in Australia it seems to be done most often at the telephone exchange with the apparent connivance of either the government or police.

Another way to intercept telephone calls cheaply and easily is by use of a coil which picks up the magnetic field along the telephone line. These signals are then fed to an amplifier for local monitoring. An even simpler way to tap a phone is to place a small radio bug in the headset itself.

These methods of telephone tapping are relatively old. With the development of cellular telephones exciting new avenues have been opened to the electronic eavesdropper. This involves the use of radio scanners. A cellular phone is basically a radio which receives messages from a transmitter installed within each particular cell. It is relatively easy for such conversations to be monitored by use of a radio scanner which can be bought on the open market. As with most devices scanners come in a range of shapes and sizes and it is possible to buy units that cover the whole UHF (which is the band on which cellular telephones work) as well as the VHF range.

The scanner that picked up the conversation of politicians Andrew Peacock and Geoff Kennett was a hand held model and it seems to have picked up the conversation largely as a matter of chance. As a sidelight to this Telecom has only recently admitted that it cannot guarantee at present the security of conversations held by cellular telephone. Telecom had argued that since transmit and receive channels use different frequencies, the worst that could happen would be that one side of a conversation would be overheard. In addition, since frequencies change as the mobile enters a new cell, any eavesdropping would be short and fortuitous. However, it transpires that if the scanner is sufficiently close to the transmitter, the separation of channels is not sufficiently large.

Considering the enormous cost involved in maintaining and installing these devices this is quite a startling admission to make and one that ought to be born in mind by any intending purchaser of the 'cellular' telephones.

### Eagles and Lasers

Electronic surveillance does not end with radio microphones and telephone taps. Recent developments at the US embassy complex in Moscow reveal a whole range of new surveillance devices. One of the most ingenious is the apparent beaming of



*Mata Hari or Margaret Zelle. 1876-1917*

lasers at the embassy windows. These beams pick up the vibrations caused by people talking in the room. Bugging the room then turns into the problem of using the vibrations of the glass to modulate the returning laser beam. So prevalent is this form of eavesdropping that the windows of the Pentagon apparently have 'noise-makers' attached to them which shake the windows to blur any laser signals.

In addition to this there are ways in which radio emissions from computer terminals can be received, using a suitably powerful receiver. These can be decoded by another computer to reveal the data as it is processed. It is possible to put preventive shields around each terminal to prevent such surveillance but these cost in the region of \$200,000 US each and are thus not economically practical.

Finally there are microwaves. Recent examinations of the walls in the new Russian built US embassy in Moscow have revealed a strange arrangement of cone shaped cavities and steel rods. It is theorised that these cavities are designed to pick up the vibrations of conversations which are then detected by microwaves beamed at the building. The microwaves are modulated by the impact of the voices on the rods and cavities and the received signal is decoded by a computer.

In case these seem far fetched something very similar took place in the US embassy quite recently. About two or three years ago supposedly inspired by feelings of fraternal generosity the Soviets gave the American embassy a wooden wall plaque in the shape of the US eagle. Suspicious of Soviets bearing gifts, US officials had the plaque carefully X-rayed to see if any microphones were contained inside. When it received an apparent clean bill of health it was installed in one of the embassy offices. Soon afterwards the embassy began leaking like the proverbial

sieve. Recriminations abounded until worried officials resolved to examine the eagle once more. Closer inspection revealed that the device was hollow. Apparently the eagle acted in much the same way as the mysterious cavities. It functioned as a reverberation chamber, modulating the incident microwave beam with the acoustic signals from the room.

### Debugging

If you should feel bugged what can you do to combat the situation? The most common form of defeating bugs is the use of electronic sweeps. Most transmitters can be located by using field strength meters which simply measure the intensity of electromagnetic radiation at radio frequencies. The bug hunter simply scans all frequencies that might be used by the eavesdroppers, thoroughly surveying the whole room until he gets a meter reading.

Another way to check for miniature microphones is simply to use an fm radio receiver. When the receiver picks up the bugs transmissions it produces sound which the bug picks up again. A feedback situation results with the fm receiver screaming loudly. Professionally made debugging devices exist which can automatically scan a wide range of fm frequencies.

As efficient as these systems are they are not foolproof by any means. Some of the newest bugs available do not transmit radio frequencies at all. Some are attached to wires which lead to listening posts outside the building. The connecting wires can in fact consist of anything that will conduct electricity such as a metallic paint under the surface paint of a room, normal electric wiring etc. These can still be detected electronically, however. The latest state of the art listening devices use fibre optics to send messages which do not broadcast any radio energy at all. The only way they can be ferreted out is by X-raying the whole room, a costly and expensive process.

Trying to defeat bugs by making background noise and talking under it, has also been shown to be futile. For the computers which receive the bugs' transmissions can easily identify and isolate the important sounds from the unimportant.

Despite the relatively advanced nature of most modern electronic surveillance methods the old ways are clearly still the best. For even with all the knowledge Americans possessed concerning debugging devices and electronic surveillance generally, the Russians were able to break the security of their embassy in Moscow by the simple expedient of sleeping with the staff. Mata Hari lives on.



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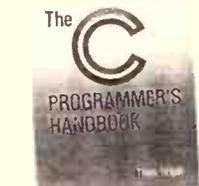
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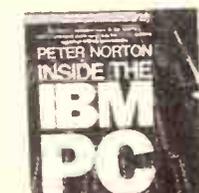
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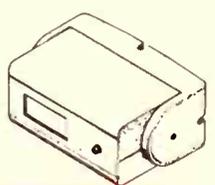
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Accuracy: 0.1% + 1 digit  
Linearity: + 1 digit  
Samples/sec: 3  
Temp. Stability: 50 ppm typical  
Temp. Range: 0 - 50°C  
Supply Voltages: 5 - 15V DC  
Supply Current: 50uA typical  
Max DC Input Volts: 20V  
Cat. Q15510 ..... \$99.95



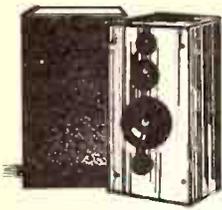
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This superb 3 way speaker kit competes with systems that cost 2-3 times the cost of these units! (which may even be using VIFA drivers etc.) Never before has it been possible to get such an exceptional value in kit speakers! Call in personally and compare for yourself!

The system comprises...  
 2 x D19 dome tweeters  
 2 x D75 dome midrange  
 2 x P25 woofers  
 2 x pre-built quality crossovers  
 The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, gill clips, speaker terminals, screws and ports

### D19 DOME TWEETER SPEAKER SPECIFICATIONS:

Nominal Impedance: 8 ohms  
 Frequency Range: 2.5 - 20kHz  
 Free Air Resonance: 1.700Hz  
 Sensitivity 1W at 1m: 89dB  
 Nominal Power: 80 Watts (to 5.000Hz, 12dB Oct)  
 Voice Coil Diameter: 19mm  
 Voice Coil Resistance: 6.2ohms  
 Moving Mass: 0.2 grams  
 Weight: 0.28kg

### D75 DOME MIDRANGE SPECIFICATIONS:

Nominal Impedance: 8 ohms  
 Frequency Range: 350 - 5,000Hz  
 Free Air Resonance: 300Hz  
 Sensitivity 1W at 1m: 91dB  
 Nominal Power: 80 Watts (to 500Hz, 12dB Oct)  
 Voice Coil Diameter: 75mm  
 Voice Coil Resistance: 7.2ohms  
 Moving Mass (incl. air): 3.6 grams  
 Weight: 0.65kg

### P25 WOOFER SPECIFICATIONS:

Nominal Impedance: 8 ohms  
 Frequency Range: 25 - 3,000Hz  
 Free Air Resonance: 25Hz  
 Operating Power: 5 watts  
 Sensitivity 1W at 1m: 89dB  
 Nominal Power: 80 Watts  
 Music Power: 100 Watts  
 Voice Coil Diameter: 40mm  
 Voice Coil Resistance: 5.7ohms  
 Moving Mass (incl. air): 4.4 grams  
 Thiele/Small Parameters:  
 Qm 3.15  
 Qe 0.46  
 Ql 0.40  
 Vas 180 l  
 Weight: 1.95kg

Complete Kit Cat K16030 **\$1,199**  
 Speaker Kit Cat K16031 **\$949**  
 Cabinet Kit Cat K16032 **\$349**



### VIFA/AEM 2 WAY SPEAKER KIT!

This exciting new speaker kit, designed by David Tillbrook (a name synonymous with brilliant design and performance) uses VIFA's high performance drivers from Denmark. You will save around \$800 when you hear what you get from this system when compared to something you buy off the shelf with similar characteristics. Call in personally and compare for yourself!

The system comprises...  
 2 x P21 Polycore 8" woofers  
 2 x D25T Ferrofluid cooled dome tweeters with Polymer diaphragms  
 2 pre-built quality crossovers  
 The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, gill clips, speaker terminals, screws and ports

### D25T SPEAKER SPECIFICATIONS:

Nominal Impedance: 8 ohms  
 Frequency Range: 2 - 24kHz  
 Free Air Resonance: 1500Hz  
 Operating Power: 3.2 watts  
 Sensitivity 1W at 1m: 90dB  
 Nominal Power: 90 Watts  
 Voice Coil Diameter: 25mm  
 Air Gap Height: 2mm  
 Voice Coil Resistance: 4.7ohms  
 Weight: 0.53kg

### P21 WOOFER SPECIFICATIONS:

Nominal Impedance: 8 ohms  
 Frequency Range: 26 - 4,000Hz  
 Free Air Resonance: 33Hz  
 Operating Power: 2.5 watts  
 Sensitivity 1W at 1m: 92dB  
 Nominal Power: 60 Watts  
 Voice Coil Diameter: 40mm  
 Voice Coil Resistance: 5.8ohms  
 Moving Mass: 20 grams  
 Thiele/Small Parameters: Qm 2.4  
 Qe 0.41  
 Ql 0.35  
 Vas 80 l  
 Weight: 1.65kg

Complete Kit Cat K16020 **\$799**  
 Speaker Kit Cat K16021 **\$649**  
 Cabinet Kit Cat K16022 **\$209**



### OMNI-DIRECTIONAL WIRELESS MICROPHONE

Tuneable: 92 - 104MHz  
 Freq. Response: 50 - 15kHz  
 Range: Over 300 feet in open field  
 Modulation: FM  
 Power Source: 9V Battery  
 Type: Electret Condenser  
 Dimensions: 185 x 27 x 38mm  
 Weight: 160 grams  
 Cat A10450 **\$19.95**



### CRYSTAL LOCKED WIRELESS MICROPHONE AND RECEIVER

MICROPHONE SPECIFICATIONS:  
 Transmitting Frequency: 37.1MHz  
 Transmitting System: crystal oscillation  
 Microphone: Electret condenser  
 Power Supply: 9V Battery  
 Range: 300 feet in open field  
 Dimensions: 185 x 27 x 38mm  
 Weight: 160 grams  
 RECEIVER SPECIFICATIONS:  
 Receiving Freq: 37.1MHz  
 Output Level: 30mV (maximum)  
 Receiving System: Super heterodyne crystal oscillation  
 Power Supply: 9V Battery or 9V DC power adaptor  
 Volume control  
 Tuning LED  
 Dimensions: 115 x 32 x 44mm  
 Weight: 220 grams  
 Cat A10452 **R.R.P. \$113**  
 Our price, **\$99**



### WIRELESS MICROPHONE RECEIVER WA100

Made by Piezo (Arden) of Japan, this device will turn any microphone fitted with a Cannon Type male socket into a wireless microphone. The receiver will plug into any 6.35mm microphone input. Both transmitter and receiver can be tuned from 76 - 81MHz  
 Freq. Response: 50 - 16kHz  
 Tunable: 76 - 81MHz  
 Field Strength:  
 Transmitter: 10uV/100 metres  
 Receiver: 15mV (100%)  
 Battery: Transmitter LR44 (1.5V)  
 Receiver 3 x UM4 (4.5V)  
 Instructions: Japanese (English not available)  
 Cat A10520 **R.R.P. \$199**  
 Our price, only **\$189**



### SUPERB NEW VIFA/EA 60+60 SPEAKER KIT!

The new Vifa/EA 60+60 loudspeaker kit has been designed to completely outperform any similarly priced speakers. This is a 2-way design incorporating drivers which give a deeper, more natural bass response and 19mm soft-dome ferro fluid cooled tweeters which provide clear, uncoloured sound reproduction.

These Vifa drivers are identical to the ones used in such fine speakers as Mission, Rogers, Bang & Olufsen, Monitor Audio and Haybrook just to name a few. Some of which cost well over \$1,000 a pair!

The dividing network is of the highest quality and produces no inherent sound characteristics of their own; they simply act as passive devices which accurately distribute the frequency range between both drivers in each speaker.

The fully enclosed acoustic suspension cabinets are easily assembled. All you need are normal household tools and a couple of hours and you've built yourself the finest pair of speakers in their class!

### D19 TWEETER SPECIFICATIONS:

Nominal Impedance: 8 ohms  
 Frequency Range: 2.5 - 20kHz  
 Free Air Resonance: 1.700Hz  
 Sensitivity 1W at 1m: 89dB  
 Nominal Power: 80 Watts (to 5.000Hz, 12dB Oct)  
 Voice Coil Diameter: 19mm  
 Voice Coil Resistance: 5.2 ohms  
 Moving Mass: 0.2 grams  
 Weight: 0.28kg  
 Cat C10301 **\$38**

### C20 WOOFER SPECIFICATIONS:

Nominal Impedance: 8 ohms  
 Frequency Range: 35 - 6,000Hz  
 Resonance Frequency: 39Hz  
 Sensitivity 1W at 1m: 90dB  
 Nominal Power: 50 Watts (12dB Oct)  
 Voice Coil Diameter: 25mm  
 Voice Coil Resistance: 5.5 ohms  
 Moving Mass: 15 grams  
 Cat C10322 **\$89**

K85092 (speakers only) **\$379**  
 Cat. K85091 (complete kit) **\$449**



### PHILIPS SPEAKERS

This month we are offering 20% off these prices! But, you'd better be quick as this offer is limited!

Description	Cat.No.	Price
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AD070620M8 (C12045)		<b>\$69.95</b>
AD12250W8 (C12050)		<b>\$129.00</b>



### PORTABLE MINI P.A. AMPLIFIER

A completely portable system, sets up anywhere in seconds. Inputs for microphone, electronic organ and cassette players. Variable echo makes this an ideal unit for buskers and budding singers.

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Output power: 1W RMS, 2W max  
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 Power Source: 6" D size batteries (position for power adaptor also)  
 Size: 280(H) x 120(W) x 180(D)mm  
 Weight: 1.3kg  
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### SENNHEISER HEADPHONES!!

The world's best headphones are now available from Rod Irving Electronics! 3 models to choose from, other models are available on request! (Phone Tony DiPaolo on (03) 543 2166)



### SENNHEISER HD 40

The HD40 is leather light, at just 60g! This HiFi stereo headphone is uncommonly convenient to use. Its systems can be rotated so it can fit into any drawer. It is also available as a TV headphone.  
**SPECIFICATIONS:**  
 Frequency Range: 22 - 18,000Hz  
 Impedance: 600ohm  
 Distortion Factor: Approx. 1.5%, pressure on ear, approx. 1.3 N  
 Weight: Approx. 60g  
 Length of lead: 3 metres  
 Cat A10515 **\$49.95**



### SENNHEISER HD 410 SL

The HD 410 SL embodies all the advantages of the new "Slim-line" concept: brilliant sound characteristics with an optimum of sound volume combined with high wearability.  
**SPECIFICATIONS:**  
 Frequency Range: 20 - 18,000Hz  
 Impedance: 600ohm  
 Distortion Factor: Less than 1%, pressure on ear, approx. 2.5 N  
 Weight: Approx. 82g  
 Length of lead: 3 metres  
 Cat. A10518 **\$74.95**



### SENNHEISER HD 540 REFERENCE

The HD 540 reference headphones are open dynamic stereo headphones. They are among the best ever made. Designed according to latest findings in acoustics, their reproduction is of extraordinary transparency and the highest transients fidelity. The test with a CD player shows: their acoustic properties are outstanding. The ear cushions play a major role. They provide a completely resonance-free treble reproduction up to 25 kHz and assure an impressively clear bass reproduction down to 16 Hz.  
**SPECIFICATIONS:**  
 Frequency Range: 16 - 25,000Hz  
 Impedance: 600ohm per capsule  
 Harmonic Distortion Factor: Less than 0.4%  
 Contact Pressure: Approx. 3 N  
 Weight: Approx. 250g  
 Length of lead: 3 metres  
 Cat A10519 **\$199**



### 1" DOME TWEETER SPEAKER

Mylar diaphragm  
**SPECIFICATIONS:**  
 Sensitivity: 96dB  
 Frequency Response: 2-20 kHz  
 Impedance: 8 ohms  
 Power RMS: 15 watts RMS  
 Magnet Weight: 5.4z  
 Size: 96mm diameter  
 Cat. C10234 **\$10.95**



### 2" HORN TWEETER SPEAKER

Mylar diaphragm, aluminum voice coil  
**SPECIFICATIONS:**  
 Sensitivity: 95dB  
 Frequency Response: 1.5-20 kHz  
 Impedance: 8 ohms  
 Power RMS: 10 watts RMS  
 Magnet Weight: 2.5oz  
 Cat C10232 **\$8.95**



### 5" MIDRANGE SPEAKER

Sealed back, foam edge, black cone, silver dust cap  
**SPECIFICATIONS:**  
 Sensitivity: 98dB  
 Frequency Response: 500-8 kHz  
 Impedance: 8 ohms  
 Power RMS: 10 watts RMS  
 Magnet Weight: 5.4oz  
 Cat C10230 **\$12.95**



### 6 1/2" TWIN CONE FULL RANGE SPEAKER

Foam edge, black cone, black whizzer cone  
**SPECIFICATIONS:**  
 Sensitivity: 99dB  
 Frequency Response: 60-15 kHz  
 Impedance: 8 ohms  
 Power RMS: 10 watts RMS  
 Magnet Weight: 5.3oz  
 Cat C10222 **\$14.95**



### 8" TWIN CONE FULL RANGE SPEAKER

Foam edge, black cone, black whizzer cone  
**SPECIFICATIONS:**  
 Sensitivity: 98dB  
 Frequency Response: 45-16 kHz  
 Impedance: 8 ohms  
 Power RMS: 30 watts RMS  
 Magnet Weight: 13oz  
 Cat C10224 **\$23.95**



### 8" HIGH POWER SPEAKER

Cloth edge, dark grey cone, rubber mounting seal, cloth dust cap  
**SPECIFICATIONS:**  
 Sensitivity: 90dB  
 Frequency Response: 60-4 kHz  
 Impedance: 8 ohms  
 Power RMS: 50 watts RMS  
 Magnet Weight: 20oz  
 Cat C10226 **\$34.95**



### 10" HIGH POWER SPEAKER

Cloth edge, dark grey cone, rubber mounting seal, cloth dust cap  
**SPECIFICATIONS:**  
 Sensitivity: 93dB  
 Frequency Response: 50-2.5 kHz  
 Impedance: 8 ohms  
 Power RMS: 100 watts RMS  
 Magnet Weight: 30oz  
 Cat C10228 **\$59.95**



### 12" WOOFER HIGH POWER SPEAKER

Cloth edge, dark grey cone, rubber mounting seal, cloth dust cap  
**SPECIFICATIONS:**  
 Sensitivity: 97dB  
 Frequency Response: 28-4 kHz  
 Impedance: 8 ohms  
 Power RMS: 50 watts RMS  
 Magnet Weight: 30oz  
 Cat C10229 **\$69.95**



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# CQ DU: Amateur Radio With a Filipino Accent

*We have all heard about the various guerilla wars and military coups wracking the Philippines, but what do we know about the state of amateur radio in the troubled Republic? Thomas tells us the latest.*

by Thomas E. King

For a few fleeting days in February 1986 the amateur bands in the Philippines were ablaze with extraordinary news flashes about a major transition in the country's government. The bloodless change from a repressive regime to a 'new spirit' was a once-in-a-lifetime event that no amateur in the Philippines had ever participated in before although for years Filipino hams have been used to dealing with another explosive issue.

In late September 1984 amateurs throughout the Philippines and particularly those located in the southeastern part of Luzon Island mobilised to provide emergency communications and relief man power for victims of the erupting Mayon

Volcano. This wasn't the first time, however, that local hams had responded to the fury of what's considered to be the world's most perfect cone shaped volcano. The 8000 foot high awesome wonder has terrified villagers with its ash, lava and red hot rocks 38 times since its most violent and destructive eruption in 1814.

## Amateur Activity

While volcanic activity has occurred regularly over a long period of time amateur radio activities comparatively have also had a long history in the Philippines.

By 1917 a small group of enthusiasts had established 'listening posts'. They were prohibited from two way communi-

cations, however, because of the WWI American transmitting ban. (The Philippines were administered on a caretaker basis by the USA from 1898 to 1946). Those early stations used hammock-type antennas, variable tuning coils connected to crystal detectors and headphones purchased locally or by mail order from the USA.

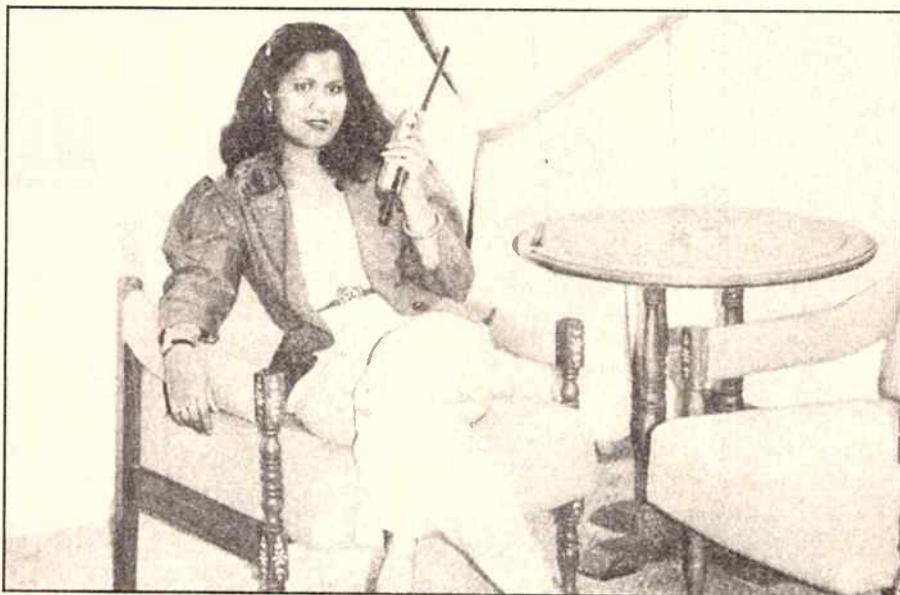
The communications ban was lifted in October 1919 and soon after Fred Johnson Elser was among the first to obtain a transmitting permit. Using the call sign "FE", a Ford spark coil and a photplate condenser young Fred blitzed the 200 metre band. Others joined this pioneer and the Amateur Radio Club of the Philippines was created in 1922.

In 1924 the ARCP was absorbed into larger organisation, the Philippine Radio Club. Headed by Lt Haydn P. Roberts, the club was a hive of activity and achievement including Roberts' own first trans Pacific conversation between Manila and San Francisco. (For over 15 years on a virtual daily basis ham radio was used to pass thousands of amateur-relayed messages between the two countries.)

Prior to 1931, the year the General Radio Law was enacted and the year which saw the beginning of active participation by Filipinos in operating their own amateur stations, amateur communications were maintained mostly by US military personnel stationed in the Philippines.

In those early days the call sign prefix was 'OF' and later 'PI'. From 1930 it was 'KZ' for the commercial service and 'KA' for the amateur service. It was again changed in 1949 to 'DU'.

At the start of WW2 licensed amateurs were all drafted into the military, naval



Amateurs staying in Manila ought to meet with Cecille Guanzon, the Director of Human Resources of the lush Holiday Inn Hotel.

and marine transport services as they were the only men available with the much needed training and experience in radio communications. Understandably amateur radio was prohibited during Japan's 2 year occupation but the hobby was not curtailed by the 9 year period of martial law inaugurated by former President Marcos in September 1972.

### Mr & Mrs Marcos

During their privileged position of power both Ferdinand and Imelda were supportive of amateur radio activities in the Philippines. The former First Lady actually subscribed to "The Amateur Radio-world" (PO Box 76, Legazpi City, Albay, Philippines 4901), a monthly magazine in English devoted to promoting hams in the country and throughout Asia. Time after time from the Malacan Palace the former president sent messages to delegates attending national and international amateur radio conferences and seminars. His support of the hobby was probably most succinctly expressed when he said:

"I wish to take this opportunity to commend you for your continuing assistance to people and communities, especially during times of calamities and disasters when normal means of communications usually break down. In your proficiency to communicate internationally, the "hams" as you are called have also made friends for the Philippines and, in a modest way, fostered the ties of friendship and understanding with the outside world."

He expressed sentiments similar to these in a souvenir program released to commemorate the 50th anniversary of the Philippine Amateur Radio Association. Founded on November 27, 1932 and admitted the same year as a Member Society of the International Amateur Radio Union, PARA, as the 55 year old successor to the two previous amateur organisations of the 1920s, is recognised as the national federation of accredited district and local clubs.

### PARA

PARA is composed of some 33 radio clubs (out of a total of 50 or so clubs). It represents the interests of about 600 licensed individuals (not including those operating under reciprocal agreements) out of the approximate 2300 licensed hams in the Philippines. About 30 per cent of these are HF equipped with the remainder



*The Philippine Amateur Radio Association's birthday celebrations in late November are events to remember.*

devoted to VHF activities. Some 1000 station licenses have been issued. A rival organisation, the Philippine Chamber of Amateur Radio Societies which, at times, has claimed to be the rightful IARU-recognised Philippine ham voice, has a number of the remaining DUs as members.

Fifteen members on the PARA Board of Directors steer the course of amateur radio in the land of 7107 islands, headquartered on the 17th floor of the Philcomcen Building, Ortiga Avenue, Pasig. PARA maintains DUIPAR, a Manila 2 meter repeater on 144.140/740; arranges the annual birthday celebrations in late November (a few VKs are usually present at these gala affairs); publishes the monthly 4 to 8 page PARA Newsletter and the "Amateur Radio Operator's Review Manual"; plans field days, the VHF DX Contest and swap meets; coordinates Philippine participation in the annual Scout Jamboree of the Air and oversees communications during periods of emergency.

To properly coordinate these activities PARA members participate in the DU net. This countrywide amateur radio communications network has been operating on 7.045 MHz every morning at 0630 local (2230 UTC) for nearly 30 years. (This is in addition to the first Sunday of the month 7 pm, 7.045 MHz meeting on the air.) The DU net is still the mainstay of amateur radio communications in the Philippine ar-

chipelgo especially when natural calamities touch its shores. As well, the morning (and an evening) net on 7.045 MHz also passes weather information to and from distant parts of the country.

### Illegal hams

Apart from these overt activities, PARA works behind the scenes to improve conditions and privileges for DU hams. Two issues have been of major concern to PARA officials: the congestion of the amateur bands due to illegal operators (estimated to number 15,000 to 20,000 alone in metro Manila) and reducing the length of time between taking the exam and receiving the licence. It's not unusual for this process to take up to 1½ years as forms wind their way through the bureaucracy of the National Telecommunications Commission. (Such delays coupled with unavailability of equipment continue to be the two biggest obstacles to overcome in the Filipino ham race!)

The NTC administers amateur exams on the first Wednesday of the month in Manila and once or twice a year in other populated centres. Candidates sitting for exams are eligible for three classes of amateur radio licences:

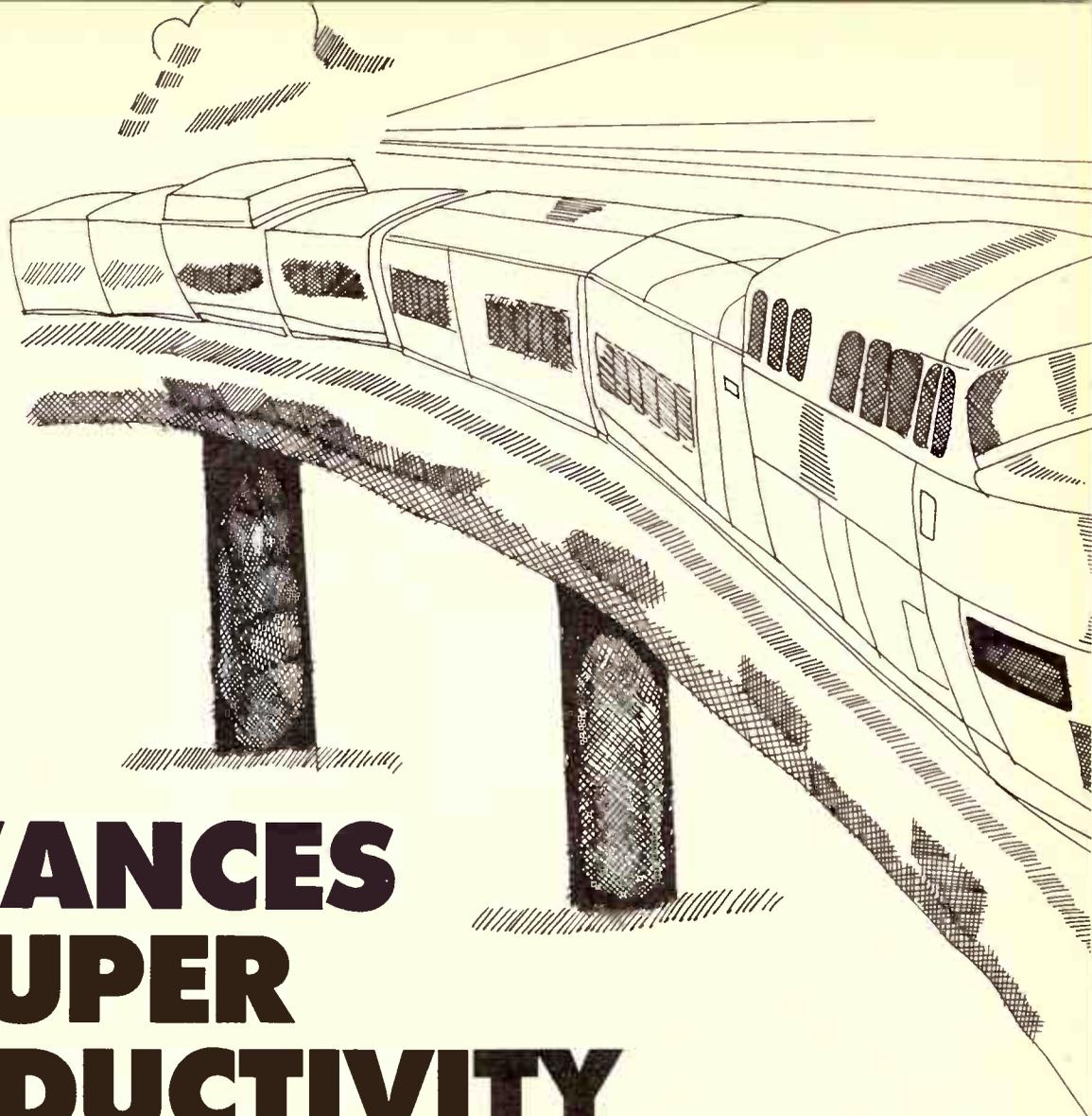
DU, Class A, Advanced, all bands, all modes 2000 Watts

DV, Class B, General, all bands minus a few segments, all modes, 1000 Watts

DW, Class C, Novice, 40 metres, CW and SSB, 50 Watts and 2 metres, FM and SSB, 25 Watts

Many of the applicants for the latter grade of licence are students. Unfortunately, many students, however, do not have facilities for group study; they have to go it alone. One outstanding exception is of the Amateur Radio Club of Manila's Don Bosco Technical College. Licensed as DU1DBT, the radio club is believed to be the only active school station in the country. And active it is with a 2 element quad (one of only a handful in the country) and some 60 members who operate the HF and UHF equipment on a six day a week basis.

For the past quarter century technically-minded youth at Don Bosco have been introduced to the world of amateur radio. Many of them after years of formal training in engineering have gone on to contribute to the technological advancement of a nation that's still more often in the news because of its politics rather than its achievements.



# ADVANCES IN SUPER CONDUCTIVITY

*For about a year now the scientific world has been shaken by rapid advances in the development of super conductors. Does this foreshadow a year of technological revolution?*

**Bob Beale \***

**A** year ago, superconductivity was little more than an interesting phenomenon, a quirk of nature put to work in just a few specialised scientific and medical instruments. Today, it is the basis of one of the most extraordinary spurts of interest and intrigue the scientific world has seen for some decades.

Universities, big companies and public utilities have shown almost indecent haste in their efforts to get in on the ground floor of what promises to be a revolution in the way electrical currents, and magnetic fields, are harnessed and employed.

In Australia alone, for example, at least five teams of physicists, chemists and material scientists have been hastily assembled in the past few months to investigate

the implications of the discovery behind all the excitement: a new class of copper-oxide ceramics which become superconductors at temperatures far higher than had been known before.

In general, those implications have already been widely canvassed: extremely fast computers, levitating trains, extremely small electronic components, highly efficient electricity transmission lines, and so on. To understand why and how such applications may now be possible, it is simplest to follow the research trail back to 1911.

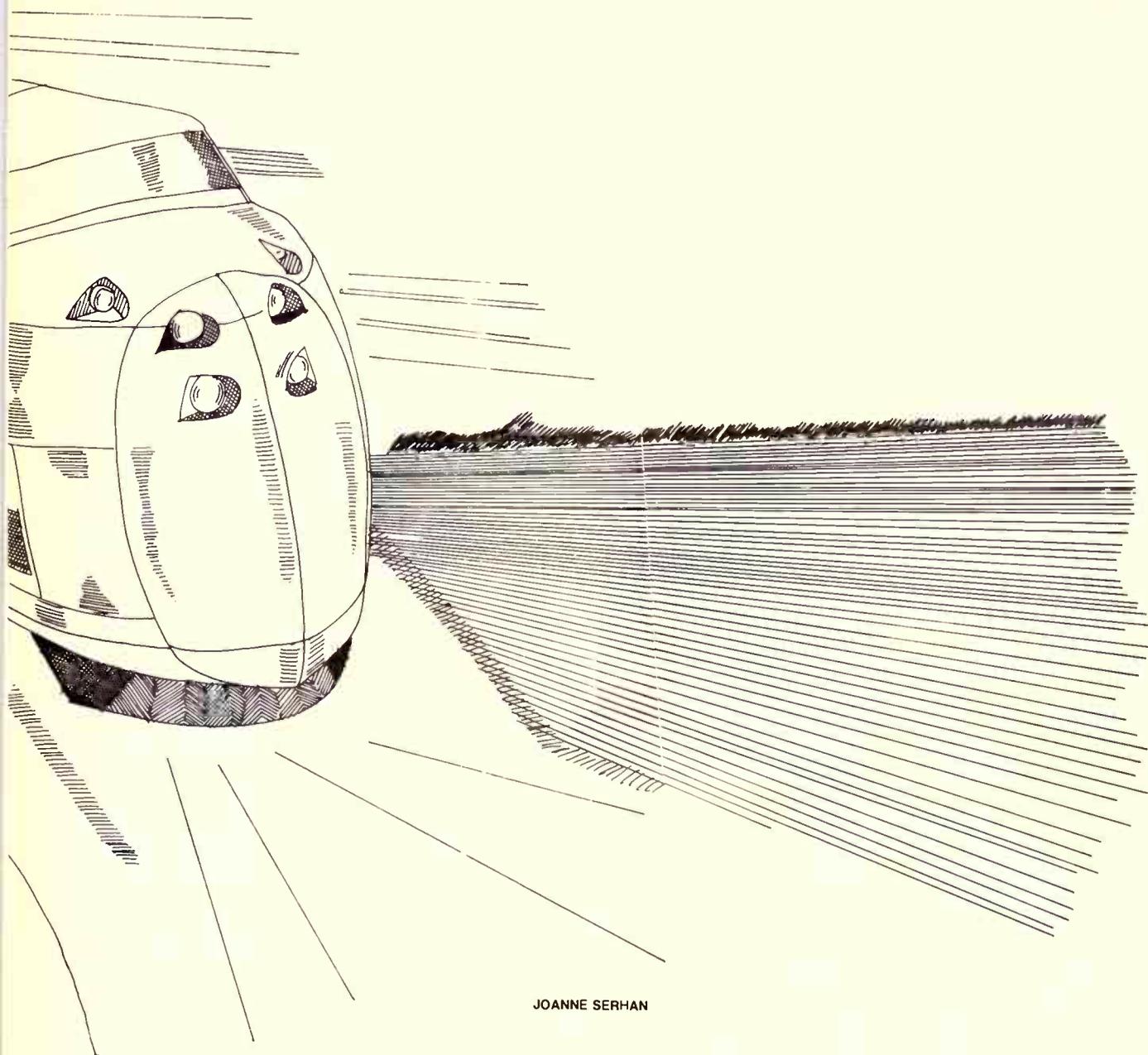
## **Kammerlingh Onnes**

In that year, a Dutch scientist, Kammerlingh Onnes, discovered superconductivity

when he found that mercury loses its electrical resistance when cooled to 4.3 degrees Kelvin, barely above absolute zero (one degree Kelvin equals one degree Celsius — absolute zero is 0 K, or minus 273 C).

Over the following decades, other researchers devised various new superconducting materials which lifted the transition temperature below which superconductivity begins.

But by 1973, the best result was a transition temperature of 23.3 K, in an alloy of germanium and niobium, and there the limit stayed until early last year. Naturally enough, applied physicists had long since speculated about what it might be possible to do with materials that were



JOANNE SERHAN

superconductive at much higher temperatures.

But while the transition point remained so low, very little in the way of practical technology could be developed. The main problem was not with the material itself, but the need to maintain such intense cold. The only feasible cooling agents, such as liquid hydrogen or liquid helium, were either too dangerous, too costly or too impractical to permit widespread use of the material.

### Muller and Bednorz

Enter Alex Muller and Georg Bednorz, at IBM's research centre in Zurich, Switzerland, and a new mixture of barium, lanthanum, copper and oxygen. The two

scientists tested the mixture early last year and found it became superconductive at 35 K, still very cold but a dramatic improvement on the old record.

When the news was made public last September, what followed was like a dam-burst. Not only had Muller and Bednorz demonstrated that the material achieved zero resistance at that temperature, but that it had the second distinguishing mark of superconductors — a phenomenon known as the Meissner effect. When exposed to an external magnetic field, superconductors 'echo' the field with a precisely balancing one of their own.

Research laboratories around the world raced to duplicate the IBM team's recipe and search out new ones that might lift

the record yet again. In February this year a team led by Dr Paul Chu, at the University of Houston, revealed a startling breakthrough: a new compound of yttrium, barium, copper and oxygen with a transition temperature of 90 K.

### Cocktails

Since then many other researchers have been able to cook up the same cocktail, lifting the record still further to 98 K. This alone has been seen as good enough reason to rejoice, because at temperatures above 77 K liquid nitrogen can be used as the coolant.

Liquid nitrogen is not only more practical for that purpose but is between 10 and 30 times cheaper than liquid helium, de-

## SUPER CONDUCTIVITY

pending on how much is bought. So, even as things stand now, the prospect of superconductors becoming more widely available is far ahead of what it was at this time last year.

One reason why so many teams have been able to enter the race is the relative ease with which these new materials can be made. As one scientific magazine recently pointed out, you don't need millions of dollars or fancy high-tech equipment to cook up a batch.

A well-equipped school could do so very easily: you need a mortar and pestle, a furnace or kiln, 5 grams each of yttrium oxide and barium carbonate, and a plastic cup full of liquid nitrogen. The dry ingredients are mixed and heated for about nine hours at between 900 and 1,100 C, at which temperature the chemical reactions that produce ceramic superconductors take place.

Cooled slowly, the cooked powder is superconductive: compressed into a pellet and annealed for a further eight hours, it's even more so. Dip the pellet into the liquid nitrogen, and it will behave like a magnet of opposite polarity when brought near a conventional magnet.

Some neat demonstrations have been rigged up to show how it works. One of

them produced a remarkable photograph of a magnet hovering in mid-air above a disc of superconductor material. As the material warms up to room temperature, the magnet drops down onto it. Little wonder, then, that people who have seen such demonstrations dream of levitating trains and new non-chemical methods of lifting and moving heavy loads.

The practical problem with the ceramics, however, is their brittleness. To be put into use for a wide variety of purposes, the researchers are looking at ways to fashion the material into rings and wires, or to apply it as a thin film on the surface of a conventional conductor.

### The Toshiba Wire

The Toshiba company, for example, announced recently that it had found a way to use its prowess in processing fine ceramics to make superconducting wires. This was done by packing the ceramic powder into hollow rods of 20 mm diameter. The rod is repeatedly drawn out until its ceramic core is a mere 0.6 mm in diameter, and highly compacted by heat treatment. The wire is wound into coils before the heat treatment: such coils could provide the large fields needed, for example, in magnetic resonance imaging equip-

ment, for medical diagnosis.

The big problem with Toshiba's wire, though, was its very low current-carrying capacity, measured at just six amperes per square centimetre. Most applications, those requiring strong magnetic fields, would call for current densities of 10,000 to 100,000 amperes per square centimetre.

Enter IBM again, this time the company's research laboratories at Yorktown Heights, New York. Early in May, IBM announced that it had cracked an important current barrier.

Instead of using the tried and tested method of making the new material, they grew a large, thin-film single crystal of it, about 2.5 cm in diameter. Cooled 68 K, the crystal carried a current of 100,000 amperes per square centimetre — 100 times greater than anyone else had achieved. At that temperature, liquid nitrogen can be used, under pressure, as the coolant. Cooled to near absolute zero, it conducted a current of 5 million amperes per square centimetre, equal to the best metallic superconductors.

### Electronic Revolution

The hopes for an electronic revolution look as though they are going to continue bounding ahead for some time, especially

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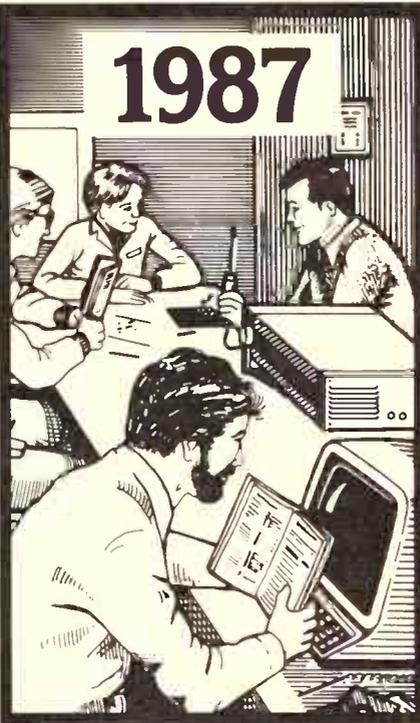
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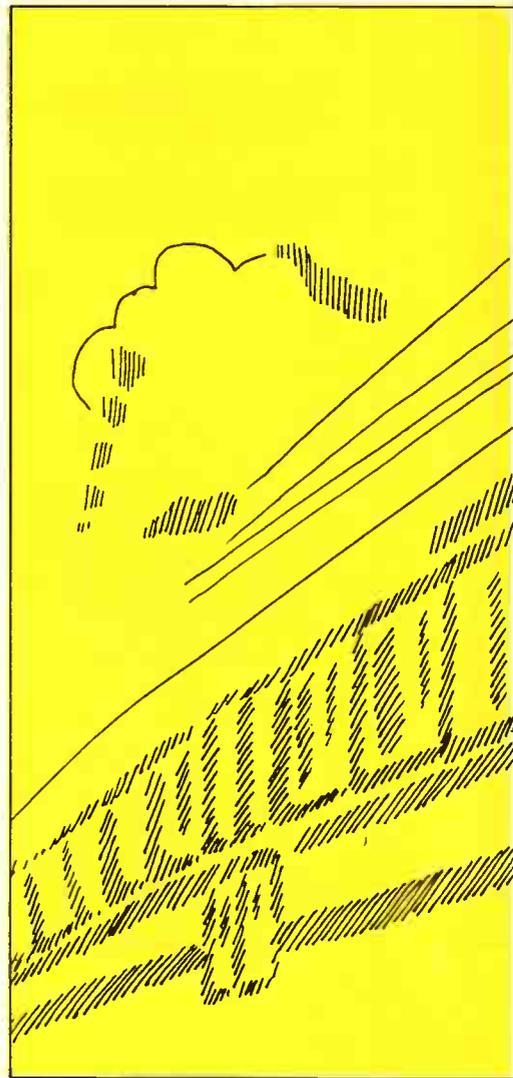
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### SUPER CONDUCTIVITY



given the size of the research contingent working on the question world-wide. Nevertheless, the revolution is not here yet, and some major barriers remain to be overcome before the dreamers can turn their attention elsewhere.

The great hope is to find superconductors that function at room temperature; that is, needing no cooling. If such materials can be found, and be fashioned into the many forms manufacturers would like to see available, the full consequences would indeed be revolutionary.

For starters, wires that carried electricity without generating heat (or loss of energy) would mean substantial savings in electricity transmission costs. The usual estimate is that about 15% of the power generated by a modern power station is lost due to resistance. Similarly, just about every conceivable electric motor and generator could be made more efficient.

The computer industry could be profoundly affected as well. Designers of



JOANNE SERHAN

micro-electronic components could, in theory, miniaturise as far as physical limits allowed, with no worries about heat damage. Superfast switches, known as Josephson junctions, might also become feasible. The sum effect of those two advances could be computers even more compact and hundreds, perhaps thousands, of times faster than those of today.

Aside from cost savings through the use of superconducting wires and cables in transmission grids, power generation might also be improved through the use of superconducting electromagnets in power-station generators, perhaps doubling their output. There has even been talk of using superconducting loops as a means of storing energy: a current introduced into such a loop would circle endlessly around and around, until a user needed to tap into it.

### Ifs and Might

That, of course, is a lot of ifs and mights, and will be only speculation until further

breakthroughs are made. And that's where the intrigue comes into the picture. Since late March, the leapfrogging temperature increases appear to have stopped — or at least, the announcements have. No-one seems to be sure whether some physical limit of the new materials has been reached, or whether the lure of possible commercial opportunities has sent the researchers hurrying towards patent attorneys instead of the scientific journals.

Rumours abound, not least among them that some groups have already found materials that are superconductive at temperatures no colder than a winter's night in North America. If so, the revolution may be closer than we think. Here's hoping.

*Bob Beale is science correspondent with the Sydney Morning Herald.*

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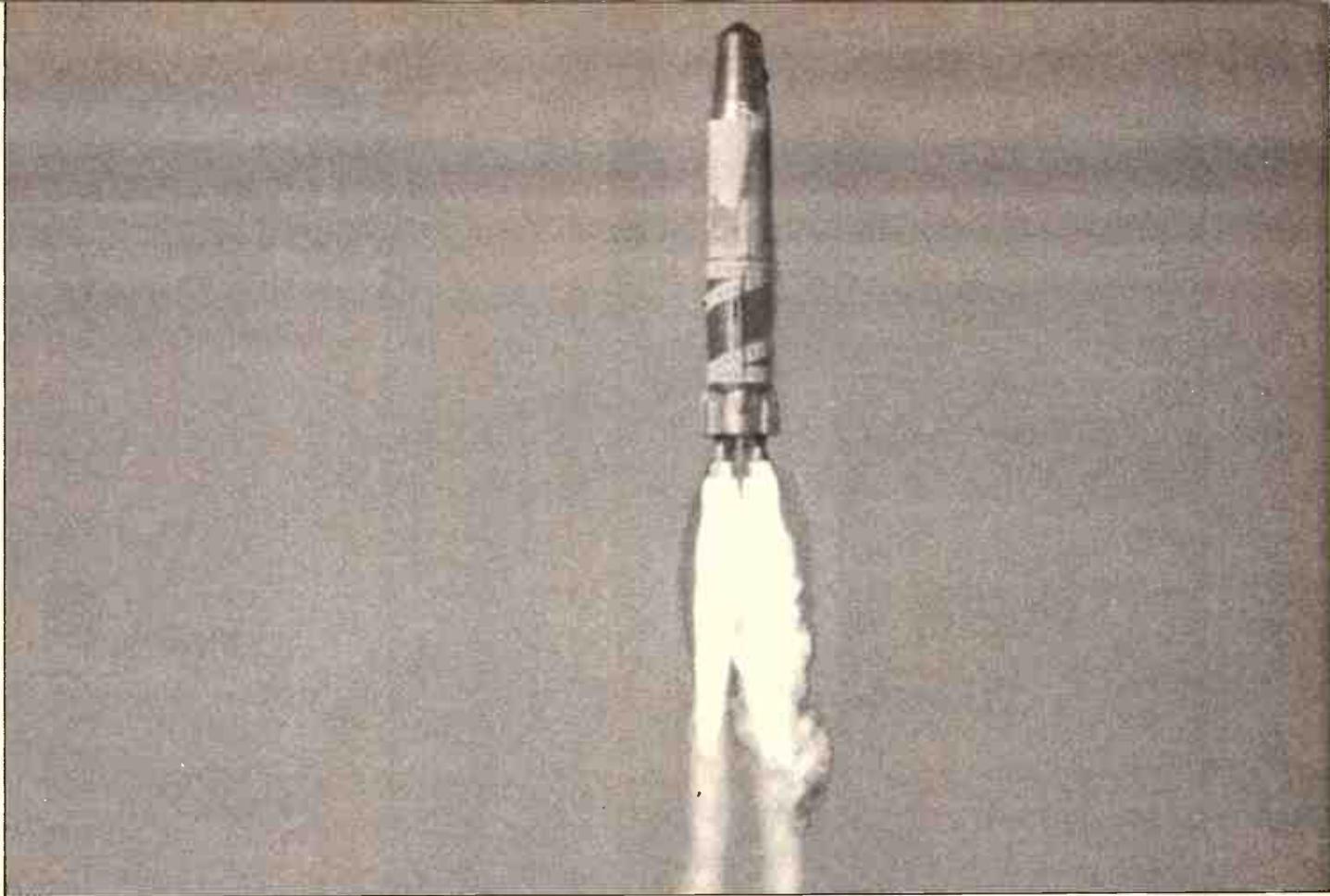
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ETI July 1987 — 25



*The government has funded a feasibility study into a locally produced spacecraft.*

# AUSTRALIA IN SPACE — A NEW START

**Stan Schaetzel\***

**S**ome of the biggest names in the electronics, computer and aviation industries have joined forces to look into the practicality of an all Australian space craft. They include Hawker de Havilland, AWA, CSA, Aussat, the University of New South Wales and the CSIRO.

The objectives of the study are to provide a comprehensive and unbiased review of the possibilities of developing an Australian Science and Application Spacecraft (ASAS), its possible missions, the cost and schedule implications of the programme, its market opportunities and the resulting direct and indirect benefits. The brief is also to minimise the costs of the programme whilst utilising all the latest capability which exists in many Australian

universities, research establishments and industry.

## **History**

Almost 20 years ago, in October 1967, the first Australian satellite, WRESAT, was launched at Woomera. The launch was successful and the satellite performed flawlessly.

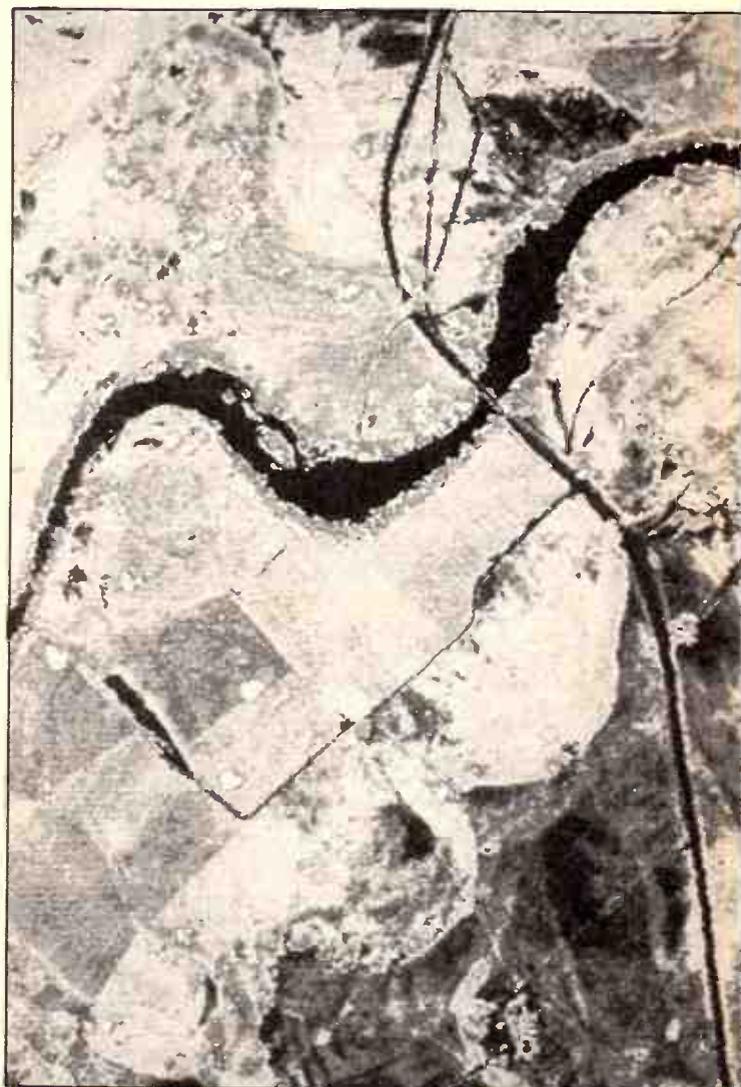
Twenty years ago Australian academia, research laboratories and the aerospace industries were state-of-the-art in space studies and were able, with limited resources, to design, manufacture, integrate, test and launch a competent scientific spacecraft. Woomera was at that stage the second largest western 'Spaceport' and all European ELDO launch activities were taking place there.

Unfortunately, the importance of space activities, our competence at them, and the economic benefits to be gained, were not understood by successive governments.

In the intervening 20 years, the aerospace industries in countries such as the USA, USSR, Canada, Japan, Brazil, India, and the European Community boomed on government contracts.

In fact, space is now so big that since 1983, in the USA the sales of space hardware exceeded in value the sales of all civil aircraft. Meanwhile, the Australian electronics and aviation industries have had to watch money and work vanish overseas. The best that Australian industry could get out of Aussat's space-oriented workload for Aussat 1 was to pro-

One likely use of the new satellite would be in the remote sensing area. Current technology can provide amazing amounts of information about events on the ground, and by the time of the satellite's launch will provide even more. Bottom left shows the Flinders Range. Vegetation shows up as red. Right: Water leakage from the Mitta-Mitta river is shown in this colour encoded temperature image. Red is warm, blue is cold. Below is an image of a bushfire. The image was made at 10 $\mu$ m. At that wavelength the scanner can see right through the smoke to map the fire fronts.



vide some simple wiring harnesses.

Industry constantly receives requests for tenders from Intelsat, but over 95 percent of them cannot be executed due to lack of experience in space.

But the news is not all bleak. Since 1980 there has been a resurgence of scientific space work in Australia. A few projects like Lyman, and its precursor Starlab, Endeavour and ERSI have been funded by the government. However, these projects could never provide the basis for a full blown industry. None of them involves the manufacture of the spacecraft structure.

#### Offsets

However, they have provided some basis for a demand of better treatment next time around. The second generation Aus-

sat will have four percent built in Australia and possibly up to 15 percent of other space areas as a result of offsets — the placing of local orders by foreign companies in return for a slice of government purchasing. Still, there are dangers in excessive reliance on offsets.

Offset work does not include design and final integration and test activities, and therefore will not enable Australian industry to become potential prime contractors for major space projects.

The only way this can occur is by conducting a complete programme of a local application spacecraft, including the development of its payload — and consisting of design, development, manufacture, integration, tests, launch and, finally, mission control and evaluation.

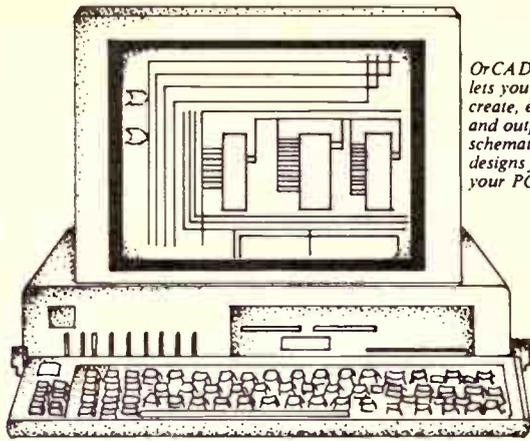
This is an ambitious programme, but it

is realizable. There are several centres in Australia that have world class competence in guided weapons and radio controlled vehicles. In fact, Australia exports in this area to Sweden, the UK and the USA.

#### What should the spacecraft look like?

The initial parameters were chosen as a compromise between what appears to be achievable given the expected funds and what would provide worthwhile operational results. The launchers, of course, loomed large as a design constraint. All potential sources of launch vehicles have been contacted and their inputs will be included in the study.

The major parameters affecting the payload were:



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## AUSTRALIA IN SPACE



Payload Mass: 80 kg maximum.  
Orbital Height: 400 to 800 km.  
Power Available: 100 W.

Life in Orbit: 1 year (-1/2, +1).

The possible timing of ASAS activities appear to be as follows:

Feasibility study: now to September 87.

Phase A (System Definition): November to July 88.

Phase B (Detail Design): August to February 90.

Phases C & D (Manufacture, Integration & Test): February '90 to December '92.

Operations: 1993.

The study will also consider all existing 'cheap' buses for the Australian payloads viz: Spartan, Janus, Mesa, Eureka and Spas. The 'cheapest' of them still costs some \$15m for the bus alone, plus integration and launch costs, and all of them are tied either to the Shuttle or to Ariane and this has significant timing and trajectory limitations.

### Why?

It creates a significant grouping of purely Australian organisations, creating a centre of excellence in Sydney. In the fullness of time this grouping could develop into a significant space consortium. Between them, they cover all the major sectors of space activities such as:

- structures, thermal analysis, tests, integration
- electronics and communications
- aerial design
- remote sensing (visible, I/R, microwave)
- solar cells
- software
- international contracting and marketing
- operations in orbit.

The organisations involved have decided that space activities form part of their long term strategic plan. They have sufficient management resources, manpower and capital resources to bring this plan to fruition. We are dealing here with major Australian companies with a total manpower of some 12,000 people and with a turnover of over \$1 billion per annum. The technical manpower of the participating companies exceeds 1100 engineers, scientists and academics.

There will be an immediate spin-off from space activities into the operations of the participating organisations. This spin-off will increase as, during the progress of the programme, smaller companies are brought in as sub-contractors.

*\* Stanley S. Schaezel DIC, BSc, DLC, C Eng, FRAeS, FIE (Aust), FTS, is technical director at Hawker de Havilland. He is also study leader of the feasibility study.*

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Paul Budde discusses the implication of a new survey into the videotex market.

# Videotex News

There are now close to 30,000 pc's connected to Viatel, one of the world's fastest growing electronic information services. Some 70,000 people use this equipment.

These findings have been revealed in an electronic survey held recently on Australia's public videotex system. The survey also showed that 78% of the clients are happy with the pc and communications equipment they are using to access Viatel. The survey found that of all terminals connected to the Viatel service 89 per cent were pc's and 11 per cent dedicated Videotex terminals.

## Viatel users are happy pc users

*PC's and Terminals in use to Access Viatel*

Commodore	37%
IBM &	13%
Apple	7%
Microtex	6%
Tandata	6%
Sony	5%
Austrad	4%
Sega & BBC each	3%
23 other brands	18%

The major differences with a similar survey held exactly two years ago are:

- Commodore's market share has dropped from 44 per cent to 37 per cent.
- IBM (and clones) share increased from 8 per cent to 13 per cent.
- Dedicated videotex terminals went up from 4 per cent to 11 per cent.
- Apple dropped from 10 per cent to 7 per cent.
- Computerphone disappeared from the market with less than 0.5 per cent share.
- Amstrad improved from 1 per cent to 4 per cent.

## Changes expected in the electronic information markets

The fact that Viatel users are happy with their equipment obscures the fact that PC's are often user unfriendly. It is not easy, most of the time, for an ordinary user to connect and install all the bits and pieces. The high degree of satisfaction therefore, is partly due to the fact that it is still the computer buffs who

are leading the user force. The good thing of course is that they are the early adaptors in the marketing cycle and therefore the sellers of these new products and services to the next level of users. A happy user does a much better job than an unhappy one, and this will greatly stimulate further growth.

But there is a gap between these early adaptors and the next level, which will cause a stagnation in the growth of the market. This in turn will lead to price decreases in modems, software and dedicated videotex terminals.

This stagnation will also lead to a decline in the number of suppliers. A lot of them were attracted by Viatel's early success, but surveys show that there are clearly too many of them. The trend towards a reduction in their numbers has already started among vendors of dedicated videotex terminals. They were the first to enter the market, and are the first to leave.

A similar trend can be seen on Viatel itself. Overseas trends are all showing a decrease in the number of suppliers. Those suppliers who market their services properly will grow bigger, while badly marketed services fail.

At the same time, the very large service providers will have to become more efficient because of revenue/cost performance. The cost of using electronic services is high when there are only a limited number of users, so system and service users have to be very flexible, and remain alert to new trends in the marketplace. Unfortunately, large organisations tend to become more bureaucratic after the initial pioneer phase. Viatel's swift

start could suddenly turn into a downwards trend if their performance declines. With a much higher growth than expected, everybody, even in bureaucratic organisations like Telecom, has been left alone to use their own creativity to set up Viatel with as much flexibility as possible.

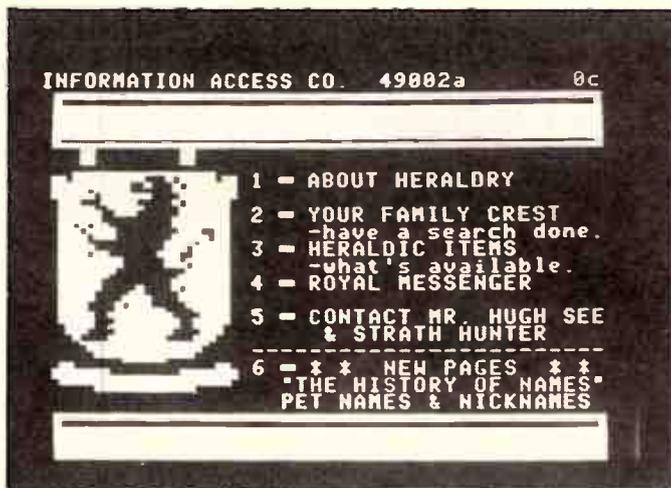
It looks as if this flexibility is slowly disappearing. The Viatel product has reached a difficult stage, and if it is not carefully managed, Viatel could lose its attraction and the product could end up like most other Videotex products in other countries as rather unattractive, with very limited appeal. Both system and service operators should therefore pay the maximum attention to their on-line marketing activities in order to keep the users happy. Only this will guarantee further growth.

## The top tens

Since the start of on-line services for commercial purposes the question always has been: what sort of services could generate enough revenue to make them viable. Until now nobody has been able to come up with the right answer.

On the one hand, financial services attract business users who are prepared to pay for these services. On the other side the number of users that are attracted by these services together with the high ongoing costs and maintenance of these services has not generated one really profitable service anywhere in the world. Nearly all electronic services are costing the operator money.

The secret of running profitable on-line services lies in the right formula, the right package and even more importantly in running them at minimum costs. In compari-





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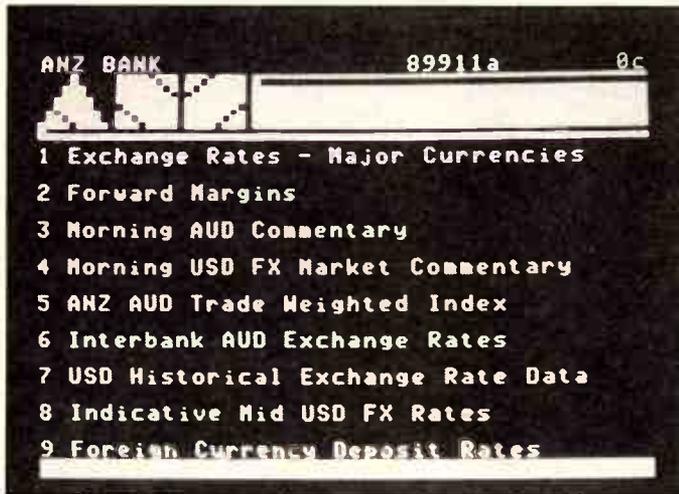
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son to other on-line services Viatel's top tend to be in favour of PC related services.

Viatel's Top 10 of Services

- 1 Bulletin boards and classifieds
2 News and Weather
3 Entertainment
4 PC News and Services
5 Sport
6 Teleshopping
7 Travel
8 Finance
9 Polls
10 Gateway Applications

Creating top 10's is always a risky business as services (especially on Viatel) are rapidly changing.

Viatel's top ten of service providers

- 1 Microtex 666
2 Cable Shop
3 Viatel Mailbox and Telex
4 Money Watch
5 Commonwealth - Telebank
6 Goldlink
7 A. C. Goode
8 Viatel's What is New
9 Australian Bureau of Statistics
10 Game Masters

Viatel generates sales leads

Less than a quarter of the users are interested in teleshopping. Those who use teleshopping are mainly using it for electronic products (71 per cent), 29 per cent are using it for other products. Dick Smith Electronics was by far the largest used for teleshopping. The survey did not record travel bookings or any other services bought electronically.

Electronic services however do lead themselves for generating sales leads. Two thirds of all respondents stated that they do use Viatel to order brochures. In the survey they were asked to list their last ordered brochure.

Brochures Ordered on Viatel Products

Table with 2 columns: Product Category and Percentage. Includes Electronics (PC related) 35%, Finance and Banking services 22%, Travel 21%, Educational Services 9%, Agriculture 6%, Other products and services 7%.

The electronic survey was conducted over a period of 1 1/2 months on Viatel by Paul Budde Communication.

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ETI JULY '87

# THE NEW SUPERNOVA

*David Allen\* examines the new supernova and finds that it poses as many questions as it answers.*



*These delicate wreaths of nebulosity in the constellation Vela are the remains of a star that erupted as a supernova about 25,000 years ago.*

**E**very clear evening I step out of my front door and turn my binoculars to the southern sky. The object I seek is clearly visible to the naked eye, even from suburban Sydney, but the binoculars allow me to make a more precise estimate of its brightness. Through them it appears as an orange star which, three months ago, wasn't there. The object in questions is, of course, supernova 1987a. 1987a is the first supernova seen by the unaided eye for nearly four centuries, and the first time in recorded history that a star in a galaxy other than our own has been so visible.

Why do I keep this vigil? Quite simply because its behaviour is contrary to what all the text books tell you about supernovae. Since its discovery in late February it has brightened steadily, by a factor of about four to date (mid May), and though the rise has slowed over the last week or so, there is no sign that it is about to disappear from view. SN 1987a is an oddball indeed. Over the two months we have studied it, more beliefs have been shattered, more predictions proved false, than in most of the history of supernova study.

## Two Types

Supernovae come in two recognisable types, although further subdivisions are made by the cognoscenti. Type I supernovae are the brighter variety, and are believed to originate when an ultra-dense white dwarf star explodes. The white dwarf itself is the burnt-out core of a star like the sun, in which hydrogen and helium have been transformed to heavier elements such as carbon and oxygen. Under the extreme pressures within stars, these elements are crushed to a density around one million grams per cubic centimetre, a state which can be achieved only because the electrons have been stripped of individual atomic nuclei so that the spacing imposed by chemical bonds no longer applies.

If a white dwarf continues to be fed gas, for example from a companion star which is shedding material, it will ultimately become unstable. The entire star then partakes in nuclear fusion, and over a period of a few months the energy that escapes is equivalent to that of a  $10^{28}$  megatonne bomb. Meanwhile its material is transformed into heavier elements, such as iron, lead, gold, platinum and uranium. In supernovae alone is the process, so long sought by mediaeval alchemists, which transforms base metals to gold. Every bit of precious metal on our planet, and most of the baser metals too, were produced in supernovae that erupted in the youth of our Galaxy, before the Earth and Sun formed from gas enriched by their debris.

In type 2 supernovae a rather similar explosion occurs, but it is triggered by a different mechanism. Type 2's are big stars whose cores became hot enough during the star's lifetimes for nuclear fusion to proceed beyond the oxygen phases, up to iron. The core then ceases to have an energy source, and since the outflow of energy provides the pressure to balance the enormous weight of the star's outer layers, the core collapses. The collapse usually goes beyond the white dwarf stage. Protons and electrons are forced together to make neutrons. With no protons to repel one another, these neutrons crowd together to give a density many millions of times greater than that of a white dwarf.

### Eruptions and Shocks

Following the collapse, a shock wave surges out through the star, creating similar conditions to the exploding white dwarf. This time, however, the explosion is muffled by the outer hydrogen layers of the star, so does not become as bright as a type 1 supernova. Instead, the outer layers are blown off, expanding as they go.

When type 2 supernovae erupt, we first see the expanding hydrogen cloud. Later this becomes more diffuse, and hence transparent. The cloud may glow for many thousands of years, however, for the stellar ejecta continue to be heated by friction as they collide with ambient gas. These so-called supernova remnants become very large, filamentary structures emitting not only visible light, but radio and X-radiation too.

Radio astronomers also find regular pulses of radiation at frequencies of a few Hertz in association with some remnants.

The pulses come from a spinning neutron star left behind after the explosion. Although a neutron star is several kilometres in diameter, its extreme density allows it to spin as many as 1000 revolutions per second without fragmenting. Because they have intense magnetic fields, neutron stars can direct streams of radiation like beams of a lighthouse, and we see a flash each time the beam swings across the Earth. Other than by their pulsed radiation, neutron stars cannot be seen.

### Every Few Centuries

Supernovae occur in the average galaxy once every few centuries. With a handful of exceptions, galaxies are so distant from us that supernovae appear faint, even though their total output can be as great



***The importance of SN1987a to professional astronomers cannot be over emphasised.***



as that of the entire galaxy of  $10^{11}$  stars. Many supernovae are not recognised until they are well past maximum brightness, and because they occur quiet unannounced it is usually difficult to reschedule large telescopes for their study.

If a supernova is to be readily visible to the naked eye it must lie either within our own Galaxy or in one of the two satellite galaxies, the Magellanic Clouds. No supernova has been seen in our Galaxy since 1604, and none had been recorded (except perhaps in oral traditions amongst the Polynesians) in the Magellanic Clouds until this year, even though we can identify several remnants less than one thousand years old.

The first news of SN 1987a was brought, so to speak, by a shower of neutrinos. These tiny elementary particles are extremely difficult to study, since they do not readily interact with anything. On the evening of 23rd Feb about  $10^{13}$  neutrinos

passed through every inhabitant of this planet, as a result of the collapse of the core of SN 1987a. Special neutrino detectors in the U.S.A. and Japan, did record just a few of the particles as they emerged having passed unscathed through the Earth.

The neutrino detections were only recognised some days after the event, and it was the appearance of a new star in the Large Magellanic Cloud that brought the affair to our notice. That discovery was made nearly 24 hours after the core collapsed, independently by a professional astronomer in Nelson, New Zealand.

### The Importance of SN 1987a

The importance of SN 1987a to professional astronomers cannot be overemphasised. It is probably the most significant event in the lifetime of any of the present telescopes in the southern hemisphere. Since it is not visible from most northern observatories, we have a responsibility to gather as much information as possible. The observations we make now can be expected to remain the definitive study of supernovae until the next nearby example, and that may be several centuries hence. For this reason the major optical and radio observatories in Australia immediately swung into action. Particularly during the fast-moving first few days, observations of as many different kinds as possible had to be made, and that entailed taking over the telescopes from observers who had competed successfully for their precious few nights to work on their own particular projects.

Modern astronomy is not the old-fashioned activity that many still imagine. No more the long, cold nights in the dome, eye glued to the eyepiece. Rarely, even, the long exposures on photographic plates. Telescopes today feed their light to sophisticated electronic equipment, computer controlled, which use state-of-the-art technology. Pictures, for instance, are often taken by charge-coupled devices, cooled to temperatures around  $-140^{\circ}\text{C}$ , which convert 70 per cent of the photons that hit them to electrons (contrast one to two per cent conversion efficiency to silver grains in the best photographic emulsions). Each point in the image is read out by amplifiers which measure to an accuracy of two or three electrons. Infrared radiation is sensed by detectors cooled as low as  $1^{\circ}\text{K}$ , or  $-272^{\circ}\text{C}$ , and some radio as-

## THE NEW SUPERNOVA

tronomy receivers also require similar handling. Similar technological expertise is concealed in the optical design of the spectrographs.

This technical sophistication allows us to probe the supernova in detail undreamt of before. Had it occurred one or two decades earlier, we should have learnt a great deal less because the electronic revolution in astronomy has taken place over the last fifteen years. As it is, we are so flooded with information that the interpretation is lagging behind.

Take the radio emission: the major radio telescopes in Australia recorded a brief outburst which has now almost faded away. Although some ideas have been floated, nobody is really certain what cause it. Take the supernova's polarization: when it first erupted, the light from SN 1987a was slightly polarized. Subsequently the polarization has disappeared, except for small wavelength regions where the expanding gas has its major effect. Again, no satisfactory explanation is available. Take the infrared observations: at wavelengths beyond  $3\mu\text{m}$  some unknown mechanism adds to the expected emission from the supernova.

### Remaining Questions

Some of the most fundamental facts remain to be explained. Why is the supernova still brightening? We believe that the explosion produced a vast amount of radioactive  $^{60}\text{Ni}$ , which quickly decayed to  $^{60}\text{Co}$ . The cobalt is itself radioactive and presently is changing more slowly to iron. The energy liberated in the radioactive decays is thought just sufficient to keep the light level constant: something else must be adding to it. Is it, as some argue, the energy output by the neutron star that is presumed buried within? Or was energy stored up in hot, ionised plasma that is now being released?

This is the first time that anyone has been able to identify the star that turned into a supernova. Nonetheless, detailed computational models, tailored to explain the supernovae seen in much more distant galaxies, had led us to be quiet confident of the type of star that is the immediate precursor. Those models showed that a massive star puffs up its outer layers to become a cool, red supergiant before its core collapses to form a type 2 supernova. But the progenitor to SN 1987a was a hot, blue star. Why? It is because the Magellanic Clouds have a different chemical composition from most galaxies, being purer hydrogen, less contaminated by heavier elements such as carbon, oxygen, calcium or iron? A star with a different chemical mix may indeed evolve differently. But much remains to be explored and

explained.

The gas that was blown off this hot, blue star should become transparent quite quickly as it diffuses into space. The effect of clearing the clouds away would be to reveal a hotter interior, and the supernova would then brighten quite suddenly for a few days or weeks. It is in anticipation of such a change that I keep my binocular vigil. But this simple prediction also is failing, and many now doubt that the stellar material will become transparent until the supernova has faded considerably.

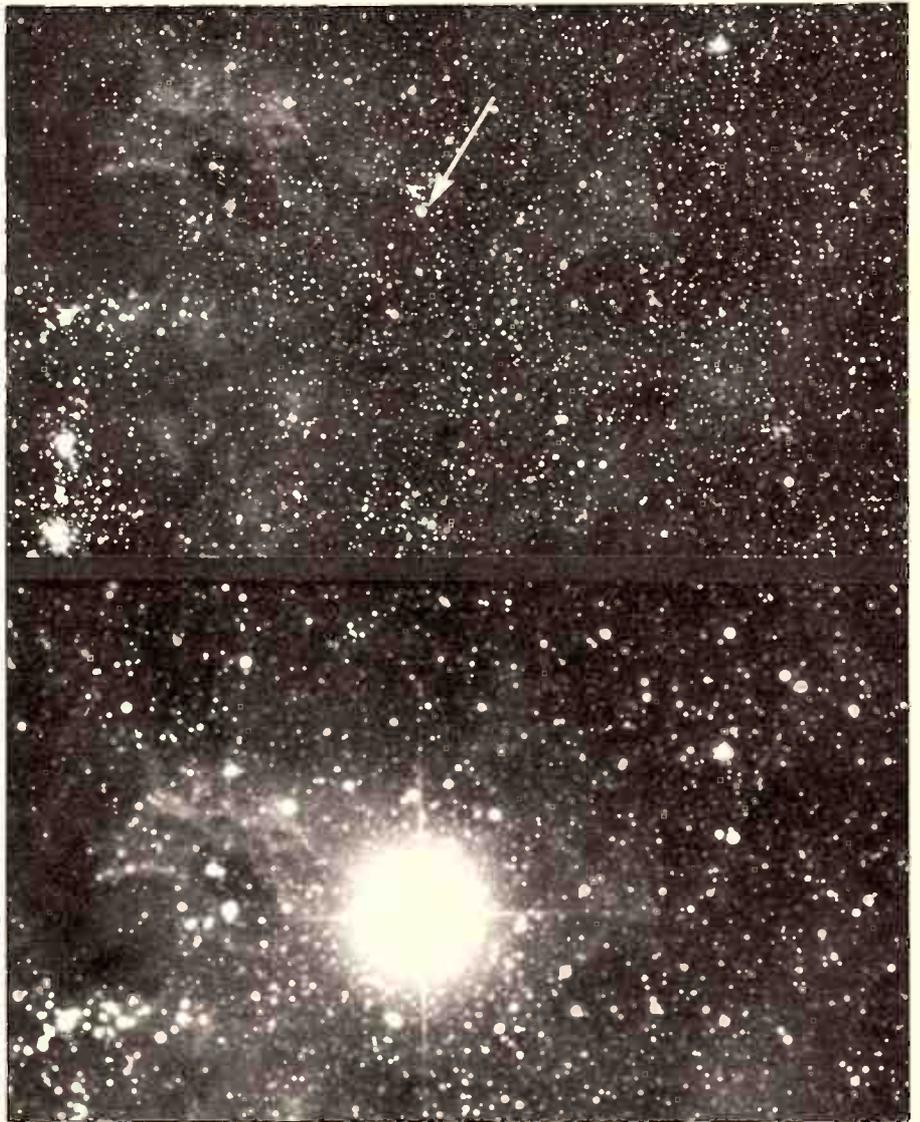
SN 1987a has dared to disobey all the rules. For that reason it has kept us all on the edges of our seats, watching its peregrinations and wondering what it will do next. The Australian astronomical community, and indeed astronomers from all three southern continents, have grappled

with the thorny problem of what observations will eventually prove most valuable in understanding this celestial enigma. At the Anglo-Australian Telescope we have put together from assorted spare parts a major new instrument specifically to observe the supernova, using it as a convenient light source to illuminate dark gas clouds in both our own Galaxy and the Large Magellanic cloud.

This is an exhausting but intoxicating time to be an astronomer. All of us involved in the field count ourselves so, so lucky.

---

\* *David Allen is an astronomer at the Anglo Australian Observatory.*



Now you see it, now you don't. Once an insignificant dot of light in the rich starfields of the Large Magellanic Cloud, supernova 1987a, now more than one thousand times brighter, utterly dominates the region.

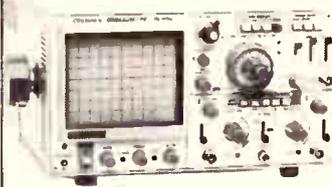
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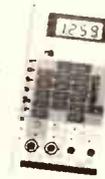
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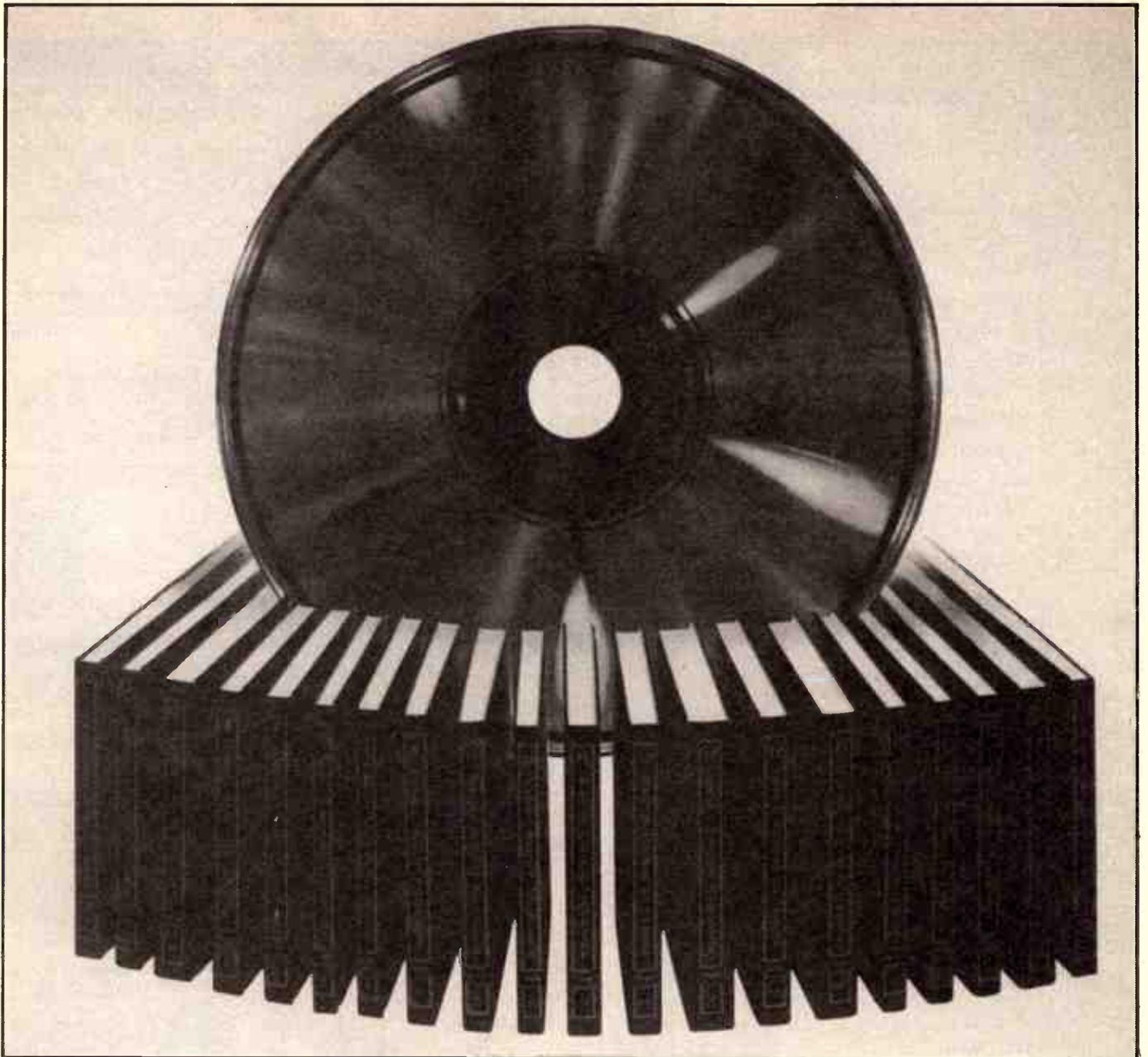
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READER INFO No 11

ETI July 1987 — 37



*Stewart becomes addicted to the new "Electronic Encyclopaedias".*

# SONY CD-ROM REVIEW

**Stewart Fist**

**M**y enthusiasm about the potential of CD-ROM has become a bit of a joke among friends and work-mates — mainly, I believe, because most of them haven't yet had a chance to play around with a system with decent software. All that has recently changed.

Sony lent me their CDU-100 CD-ROM player to review and with it came a copy of Grolier's encyclopaedia and a PC-SIGs

disk of IBM public-domain software from the States.

Sony's player came with a CDB-200B SCSI (Small Computer Standard Interface — pronounced "scuzzy") card which can be plugged into an expansion slot in any IBM PC/AT/XT or compatible. In case you haven't come across SCSI before, it is a new personal computer interface standard which allows you to daisy-chain up to

eight devices (at least one of which must be the computer), and it overcomes most of the problems we've found in the past with incompatibilities and slow transfer speeds of external hard-disk drives, printers, etc.

Installing the SCSI card is simple. I just plugged it in — which was lucky because the manual came in the most exotic form imaginable. It seems to be a Japanese lan-

guge manual with only the keywords translated into English; so you get alternation in each paragraph between Japanese ideographs and English keywords. Weird!

### Controls and Panels

The CD-ROM unit itself only has one settable control. It's a small dip-switch panel at the back of the machine which tells the SCSI system which number (0 to 7) in the daisy chain sequence this machine is. Since there was only one in this particular chain, I left it alone. The back panel also has the power switch and two large 40-pin sockets — one for the main linking cable, and the other which can be used to daisy-chain to the next machine.

The front panel has only two LEDs (one for power and the other to tell you the disk is spinning) and an eject button for the disk tray. So the whole unit is about as complicated to connect and operate as a standard floppy disk drive.

My machine came with a transformer — it was a 110 volt unit. Sony bought these into the country to satisfy early demand, but all current Sony stocks in Australia are now 240 volt units.

### File Structures

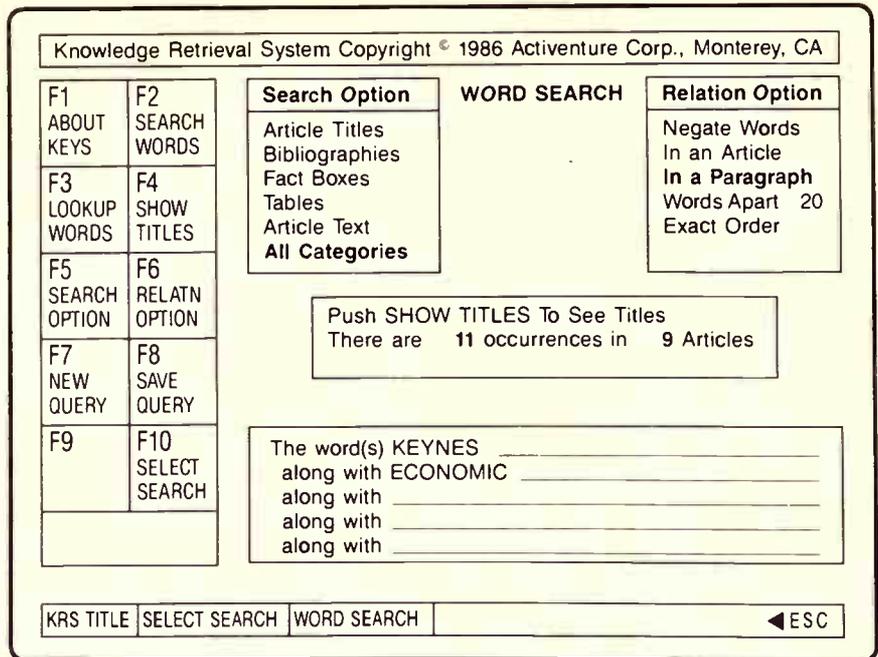
There has been a shake-down period in the CD-ROM world over the last 12 months. Most of the major US and Japanese companies got together to devise the High Sierra Group format. The standards originally set by Sony and Philips for CD-ROM only dealt with the physical and logical levels, and left the file structures open-ended.

This doesn't matter to the purchaser as long as you use a search and retrieval program that has been specially designed for each particular CD-ROM disk, but who wants a separate customised retrieval program with each disk?

The High Sierra Group standardised the logical file level so now any standard retrieval program will know where to look for the indexes, etc, on any disk. I mention this because the two disks I had to review did not conform to the High Sierra format, whereas most of the disks you will see in the future will.

I can understand the frustration that lead to the formation of the High Sierra Group. I have four of my own demonstration CD-ROM disks that were picked up at the Seattle CD-ROM conference a few months ago, but I don't have the retrieval software or the device drivers, so I haven't managed to look at them yet. And to my annoyance, I couldn't get any of these to work with the retrieval software supplied with Groliers and the PC-SIGs disk.

So at the present moment you need a special retrieval program for each CD-ROM disk, but in future most retrieval programs should be capable of accessing any disk — as long as both conform to the



A search page from Grolier's Encyclopedia

High Sierra standard. In fact you'll tend to find the retrieval program as part of the CD-ROM disk itself in future, rather than as a separate floppy.

### The Package

When you first get a CD-ROM package at the present time it will generally consist of a CD disk, a 5.25-inch floppy and a manual. You have to install the floppy so that the retrieval software can be loaded from DOS. This process tells the disk whether you have the Sony, Hitachi or Philips CD-ROM drive — there are subtle differences apparently.

To boot up the Grolier encyclopaedia, you slip in the retrieval software on floppy disk, hit Control/Alt and the software loads and then goes looking for the CD-ROM disk — which appears to it as a normal drive in line after the PC's hard disk (drive D:). Grolier's uses Actventure Corporation's Knowledge Retrieval System software, which is excellent for their purposes; so good in fact that they probably won't change over to the compromise High Sierra standard.

The KRS screen reserves the left hand quarter of the screen for a panel of 10 function-key displays. These are constantly changing as you go deeper and deeper through the retrieval 'layers'. Across the bottom of the screen you will find a reserve status band which tells you how many layers you are below the entry menu.

Unless you've been involved in on-line database searching, there is no good explanatory analogy for these layers in an information retrieval system. But it is the only way to deal with such massive amounts of data.

### Capacity

CD-ROM is a unique form of information storage which holds up to 600,000,000 characters of information — about 120 million words — so the system faces problems of enormous complexity in pulling out the paragraphs of information that you want to access from the millions of other paragraphs that you don't.

The solution is to index the material completely, and provide access through cross referencing. Groliers, for instance, contains the full-text of their 20-volume encyclopaedia set (9 million words and 30,000 entries), but this only occupies 60 megabytes (or 9%) of one disk. Another 50 megabytes are used to index all important words (except a, the, but, etc). This is the reason why you find so many layers, and within the layers there are side-paths that allow you to copy the information to disk or to print it out, etc.

### Browsing

You can search Groliers by either of two methods. The first is the 'Browse' mode where you type in a keyword (or part of the keyword) that interests you, and then initiate the mode by hitting the F2 ("Browse Title") key. The function display on the left-hand side of the screen always tells you which key to select.

Browse drops you into an index of keywords and phrases from article titles, set in alphabetic order. You can use the computer's narrow keys to zip up and down this list until you find something of interest, and then select this by hitting the F2 key again (this time the F2 display is 'Show Text').

At this stage you will drop straight into the text/reference you want, and at this

## Sony C. D. ROM

stage you can use the F3, F4, F5, and F6 keys to move backwards and forwards through the article a paragraph or a page at a time.

In this layer the F8 key takes you instantly to the article next on the alphabetic list which is a sign of intelligent programming, since this is one of the more likely moves you will probably want to make. F7 allows you to copy the text on the screen a paragraph at a time, and F10 consistently drops you back to a previous menu (as does the ESC key).

### Highlighting Defaults

Knowledge Retrieval's approach to finding information is particularly well thought out, and at least half the success of the Grolier's encyclopaedia must be due to them. Each time you drop down a layer towards the information you need, the KRS program selects the most likely of the function keys and high-lights this as a default.

For instance, when you are reading a page of text at the "Show Text" layer, the F4 ("Next Page") key is high-lighted, and you only need to hit the Return key to advance to the next page. It is intuitive to work this way, and so you can learn to use Groliers and handle the necessary complexity, in about half an hour.

With long articles you can get a brief outline of the information structure through the F2 key which takes you to a screen with only major headings and indented sub-heads. This outline layer lets you scan through the major sections of the article without having to read them page by page, and at any stage you can select a section and jump immediately to the full text.

### Boolean

The usual way to search Groliers or any large informational database however is not through the browse function but by "Word Search" which assumes some knowledge of the Boolean operators (AND, OR, NOT AND, etc). Booleans always seem to frighten people, and many of us confuse the AND and the OR functions because these words are casually interchanged in everyday English.

KRS has overcome this problem superbly. It presents a number of entry lines into which you can type words, parts of words (truncated words), or phrases. It asks for "The word(s) . . . along with . . . along with . . ." which is a very clear way of introducing the concept of the Boolean AND.

For instance I can type KEYNES on the first line "along with" ECONOM on the second. The program will search the encyclopaedia for all references to Keynes (or the extension Keynesian, since the as-

terisk stands for any number of extra characters). It will then look for Economy, Economical, Economics, etc, and perform a Boolean AND — which only sets aside those articles with both the KEYNES reference and the ECONOM\*. Upper and lower case are interchangeable.

This search would turn up all references to the economist Keynes, but ignore references to his musician cousin or dilettante grandfather. It resulted in the discovery of 57 occurrences of the two words together in 17 different articles, which is a fair indication of how much information exists on this disk.

These results are also an indication of the value of computerised searching over indexes in the book form. With the paper-based version of Groliers Encyclopaedia, you would be unlikely to find more than a couple of these references because it is impossible to cross index on every important word. Of course you can still make mistakes. I looked up SYDNEY and



**Since each disk has between 20 and 30 programs, this means that you've got roughly 15,000 MS-DOS programs on one disk.**



BRIDGE, and one of the references was to a card-player/Bridge master named Sydney Levy.

The Boolean OR is achieved simply by typing both words on the same entry line with only a comma separating them. This is the most sensible approach I have seen since these words are essentially synonyms and the single line with only the comma separation makes this quite clear.

### Changing the Booleans

You can change the way the Booleans operate through the "Relation Option" menu. You can negate words (NOT AND) — which you sometimes need to exclude a specific item. You can also widen the relational search from the default of having the words "In a Paragraph" to encompass the full article; or, if you wish, limit it to retrieve the item only when the keywords are in exact order; or when the words are only x words apart. You don't normally need these functions, but on occasions they are very handy.

### A Distracting Fault

There is only one major fault I can find with Groliers Electronic Eycyclopaedia; it wastes too much of my time. Whenever I use it to look up a reference, I can't help wandering off and looking at other items that strike my interest. A two minute search for a specific item often becomes a two hour wander through esoteric academic subjects that normally wouldn't come to my notice.

The PC-SIGs disk however had the opposite effect. This is just a single-source collection of the 705 disks of public domain software from the PC-SIGs library in California. Since each disk has between 20 and 30 programs, this means that you've got roughly 15,000 MS-DOS programs on one disk.

Even this doesn't fill the CD-ROM disk entirely, so they've added the full-text of the Bible just in case you need to look heavenward for inspiration, or do a bit of heavy praying when you hard-disk crashes.

Most of these programs are the old CP/M public domain software revamped in MS-DOS, and many of them have bugs — but still, when you've got 16,000 to select from, you must be able to find something useful.

There are educational programs to teach your kids to spell, games like Tic Tac Toe and Blackjack, disk utilities, statistical calculation programs, mind probers, random pattern generators, printer drivers . . . you name it — you've got it! At least 50% of the programs I looked through, I couldn't see how I could ever use — but there were a few that seemed interesting.

The PC-SIGs disk, even more than Groliers, gives you some comprehension of the capacity of a CD-ROM disk. If I were to play with one of these programs a night, this one CD disk would keep me amused for the next forth-odd years. But it also points out the dangers of over-kill, because the disk had so much rubbish that I only spent a couple of hours glancing casually through it, then quickly jumped back to Groliers.

### PRICE LIST

Sony CDU-100 standalone CD-ROM drive ..... \$1548 inc tax  
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## COMING EVENTS

### June/July

**The Australian Hi-fi Shows '87** will be held Sydney 19-21 June at the Airport Hilton; Brisbane 3-5 July at the Gold Coast International Hotel; Melbourne 17-19 July at the Dallas Brooks Hall; Adelaide 24-26 July at the Adelaide Hilton.

### July

**Videotex '87** to be held 30 June to 2 July at the Sheraton Hotel, Auckland. Contact the Secretariat on (649) 68-6955.

**The Third National Space Engineering Symposium** will be held 30 June to 2 July at the Australian Defence Academy in Canberra. Contact The Conference Manager on (062) 73-3633.

**The What's New Products Show** featuring Test and Measuring Equipment at the Homebush State Sports Centre in Sydney on the 8-9 July. It will then move to Melbourne for 29-30 July. Ring G. Maugham at Westwick-Farrow (02) 487-2700.

**Automach '87**, an exposition on automated manufacturing and sponsored by the SME, is scheduled for 7 to 10 July in Sydney. Contact Adolph Greco on (02) 875-2377.

**The 1987 Perth Electronics Show** is on again at the Claremont Showgrounds, Perth, from 29 July to 2 August. Contact address: 94 Hay St, Subiaco, WA 6008. (09) 382-3122.

### August

A **symposium on signal processing** and its applications will be held at the University of Qld 24 to 28 August. Those interested in participating contact the Conference Secretariat, ISSPA '87, Uniquist Ltd, University of Qld, St Lucia, Qld, (07) 377-2733.

**ANZAAS Townsville Conference** 24-28 August. Examination of Databases, communications and networks, videotext, etc. Contact G. Gupta, Department of Computer Science, James Cook University, Townsville, Qld 4811.

**Nelcon '87** national electronics conference will be held 24 to 28 August at Auckland University, New Zealand. Contact B. S. Furby on (02) 957-3017.

### September

**LABEX '87** will be held in Melbourne from September 7 to 10. This exhibition is geared to displaying 'every aspect of laboratory activity'. For more information ring BPI Exhibitions Ltd, Sydney, (02) 266-9799 or Melbourne (03) 699-9266.

**Australian Computer Exhibition and Conference** will be held in the Royal Exhibition building in Melbourne. Phone Riddell House Promotions (03) 429-6088.

**IRECON '87** will feature digital technology when it is held 14 to 18 September. Contact Heather Harriman on (02) 327-4822.

**The 4th Australian Remote Sensing Conference** will be held 14-18 September at the Adelaide Convention Centre. Contact John Douglas, south Australian Centre for Remote Sensing on (08) 260-0134.

**Communications USA** (telecommunications, radio and satellite equipment) in Sydney 21-25 September. Contact Ken Mackenzie on (02) 261-9200.

### October

**Computer Indonesia** will be held in Jakarta 20-24 October. Contact Australian Exhibition Services on (03) 267-4500.

**The 38th International Astronautical Congress** will be held in Brighton, England, 10-17 October. The theme '30 years of progress in space' will be developed through in series of symposia. Contact the Astronautical Society of WA, COSSA, (09) 397-5642.

### November

**The International Robot Show** is scheduled from the 7th to 10th of November at Sydney Centrepoint. Sponsored by the Australian Robot Association the show will display and explain the many functions of modern robots. Australian Exhibition Services Pty Ltd, Illoura Plaza, 424 St Kilda Rd, Melbourne, Vic 3004.

**CommuniTech and Computer '87** is on in Kuala Lumpur 11-14 November. Contact Australian Exhibition Services on (03) 267-4500.

**COSSA et al** are sponsoring a national tour by Gerry Perry between 18-27 November. Mr Perry is an expert on satellites and will speak on a variety of subjects. Phone Lyndal Thorburn, (062) 48-4554, or Geoff Davies, (09) 397-5642.

### December

**Intelligent Autonomous Systems Conference** will be held over December 8-11 Amsterdam. Contact: Secretariat, Conference IAS c/o Congressbureau "Van Neutegen", PO Box 27783, 3003 MB Rotterdam; tel (010) 433-3179.



### Mr Herz's experiment

Wireless communication first began one hundred years ago in the May of 1887. In that year one Heinrich Herz caused a spark to leap across a very small gap placed between two ends of a large resonant loop of wire placed near a transmitter.

By this experiment Herz proved that electrical waves could travel through space which bore out the theories of the Scottish physicist James Clerk Maxwell. Unfortunately Herz did not have long to bask in the fame of his achievement for he died in Berlin on January 1, 1894. His long and fulsome obituary inspired G. Marconi to attempt to make some practical use of Herz's work.

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READER INFO No. 12

# THE RIGHT RECEIVER

*Arthur Cushen tells us some of the basic things you ought to look for in purchasing a new radio.*

## Arthur Cushen

**T**he variety of radio receivers on the market today means that the new radio listener is often in a quandary what to buy and what difference there is between one set at \$100 and another at \$1000.

The receiver you purchase should have the equipment which will accommodate the changing pattern of transmission on shortwave as broadcasters are looking at the possibilities of using single side band transmission. On medium-wave, ordinary AM transmissions prevail although quality AM stereo is available throughout Australia. Most new listeners start their listening on a portable receiver as compared to a higher priced communication receiver, but in either case there are basic requirements which are needed to facilitate better reception.

### **Radio Moscow**

If you wish to listen only to the Voice of America, Radio Australia and Radio Moscow then these signals are audible on most transistor receivers, and you will be listening to these stations mainly for their program content. If you wish to listen in other areas of the shortwave spectrum, including utilities and other modes of transmission, then your receiver would require a BFO (Beat Frequency Oscillator) or product detector to enable the reception of single side band transmission, or morse code or radio teletype. These are essential parts of any new receiver.

The frequency range and the models of reception are certainly very important considerations. The frequency range should cover medium wave 520-1600, and continue through other bands up to 2600 kHz.

### **Tuning control**

When you explore the shortwave spectrum, the receiver should provide you with fine tuning and stability once it has been tuned in. There should be no dial movement when the receiver is tuned and if the dial knob is touched the frequency should not alter. Along with the tuning capacity comes the stability of the receiver, that is the receiver should remain on frequency over a long period of listening and not drift away from the tuned signal. Mechan-



cal drift would mean that the construction of the receiver is at fault. Thermal drift occurs when the receiver is warming up, this could happen because of the outside

BB  
***If you wish to listen only to the Voice of America, Radio Australia, Radio Moscow then these signals are audible on most transistors receivers.***

99  
temperature or the components changing temperature after being switched on. The Oscillator, which regulates the frequency to which you are tuned, gradually changes

its frequencies to which it is tuned.

To avoid mechanical drift the receiver should be of good solid construction. Thermal drift can be overcome by selecting a receiver with good electronic engineering behind it.

### **Dial Accuracy**

Radio receivers are available with either analogue or digital frequency display. The analogue is the traditional dial scale with its pointer which moves up and down across the printed scale. The digital read-out scale is a more modern way of frequency reference and this appears generally as a fluorescent display which tells listeners exactly the frequency to which the receiver is tuned. This type of receiver can be tuned in two ways — with the traditional large knob, or the more modern key-pad design, in which the frequencies are selected by punching up the



bers, similar to a pocket calculator. Memories are available on this type of communication receiver to store your favourite station, so that a press of a memory button not only brings in a pre-determined signal, but also its mode of transmission. Accuracy of read-out is an important consideration. In the early days dial calibration was poor and finding the exact frequency was difficult, but the modern read-out receiver instantaneously tells you what frequency to which you are tuned. Some receivers show read-out information down to 1 kHz which gives very accurate frequency information.

#### Dynamic Range

The new radio should be capable of tuning into very weak signals as well as strong ones and it therefore must be properly designed to accommodate the enormous changes from the weakest to the strongest

signals. It also should reject images, inter-modulation and spurious signals which appears on the radio dial. Most portables which appear on the market are poor in the rejection of unwanted signals. When you touch an aerial the local AM station appears in various spots on the radio dial apart from its true operating frequency. The poorly designed portable receiver is unable to cope with the strong local signals and therefore they appear at various points, in particular powerful shortwave stations often appear on the medium-wave band.

#### Connections

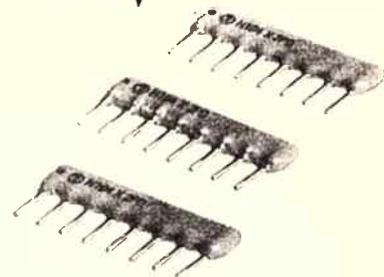
When you look at your new receiver you find that there is provision for an aerial and aerial connection at the back. Most portables have a telescopic aerial which generally improves the signals to the extent that you receive a strong signal and less noise. The earth connection should be fitted to dampen down noise and as provision against lightning.

#### Ease of Operation

Finally the receiver you purchase should be easy to operate. The controls should be placed in a position of easy access and you should feel at home when tuning your new receiver. There should be no complicated switching required to change frequency, alter the modes of the transmission and to generally improve reception. Some modern receivers have some of these functions at the back of the receiver and this spoils the ease of operation when changing modes of transmission. As signals change in strength the levels and other controls should be within easy reach. There should not be many controls on the receiver unless you feel these are especially required.

Additional facilities are a selling point with the receiver, but some of these extras may never be used in your listening. Many new listeners often find it difficult to operate a new receiver, because of complicated controls and operating procedure. Simplicity of design will enable the new listener to get the maximum enjoyment with the least possible effort. When you sit down in front of your new receiver you have or should have the world at your fingertips.

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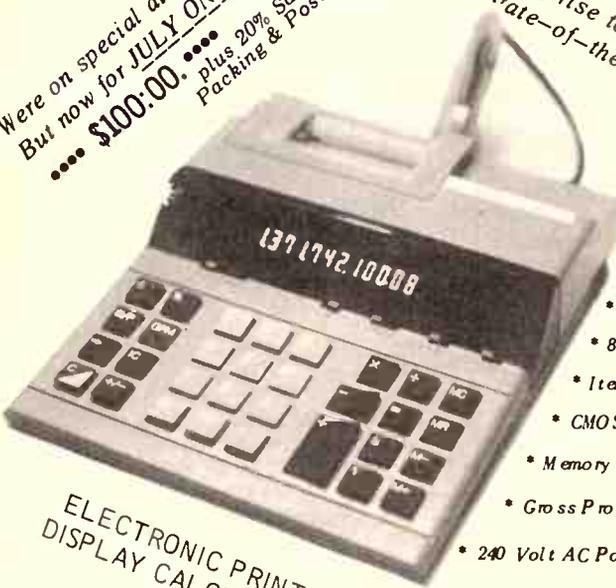
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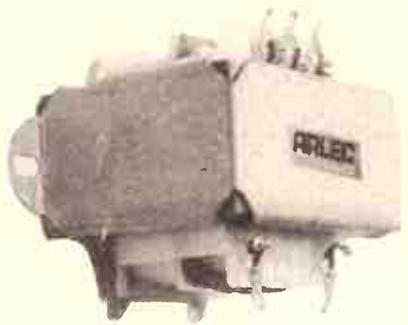
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# Sight and Sound News

## Dali 40s

Scan Audio is about to release a new speaker design from Denmark — the Dali 40. They are unusual in consisting of two base drivers, one at the top and one at the bottom, two midrange drivers between them and a single high-end tweeter in the middle. According to Dali, the arrangement gives unparalleled bass performance.

The design started when Dali engineers were intrigued with the idea of a new bass system which theoretically combined the best aspects of both sealed and bass reflex designs. It is well known that the closed box system, by virtue of its softer roll off, is superior to the bass reflex system in terms of transient reproductions.

However, the bass reflex system, in an equal cabinet size, is capable of producing both a lower cut off frequency and lower distortion, this being made possible by the port's effect of controlling cone excursion.

A closed cabinet constitutes a 2nd order high pass filter that can range somewhere between a 1st order roll off, a 2nd order Butterworth to a 3rd order Chebyshev. On the other hand, bass reflex systems are 4th order devices. They are named after their analogue equivalents and range from sub-Chebyshev 2 to Quasi Butterworth 3 to 4th order Butterworth and 4th order Chebyshev.

The best systems for transient response are those having Q's between 1 and 1.3. For lower limit frequencies, however, this system is also the worst. Dali's new system called 'Bandpass', tries to combine the best qualities of each — very low cut off frequency with excellent transient response.

In 1979 Laurie Fincham showed the possibility of obtaining a 2nd order response from a bass reflex system, by mounting a closed box in front of the woofer cone and using only the port radiation. The problem with this lies in its inherent roll off above about 100 Hz. A major design objective was to extend the response up to 100 Hz so that application with normal speakers would be possible.

Dali decided to try a system containing two drivers. The first one beams in the open air, limited at the back by a bass reflex system. The second unit operates both into the back of the same cabinet and into the front of a closed cabinet. The speaker mounted in front is operating into a cabinet that is actually too large. This results in a dip in the response and a peak at resonance. The speaker farthest in is harmonised in such a way that it fills in the dip below resonance then "phases out" the resonant peak, so they stay in phase up to the natural roll off of the system.

The bandpass system has another important side benefit. If the two drivers are mounted behind each other, we get an equalisation of the vibrations caused by Newton's 3rd law. It works like this: Preventing a force, a second force of equal size will occur, directed against the first. When the cone moves, it will carry out a movement proportional to the mass of the chassis and the mass of the cone. This modulation will make the cabinet move with the result that the tweeter's signal, which consists of small wavelengths, is phase modulated. This output is measurable and is one reason for a poor stereo image. But this phenomenon does not affect the Dali system because the two magnet systems are rigidly connected

and the two forces are offset instantly. Not only is this a more elegant solution than concrete, but the "surging" and the slow energy flow in the time domain of concrete are avoided. So here we have an excellent basis for a loudspeaker. It gives us a low and precise bass response whilst eliminating the vibrations which will affect the rest of the system's performance.

In spite of all the emphasis on bass, Dali recognise that midrange response is the most crucial element in a loudspeaker. If this area is not optimised, the speaker will not sound musical. In light of the outstanding extended bass response, the mid-range was deemed to be of the utmost importance.

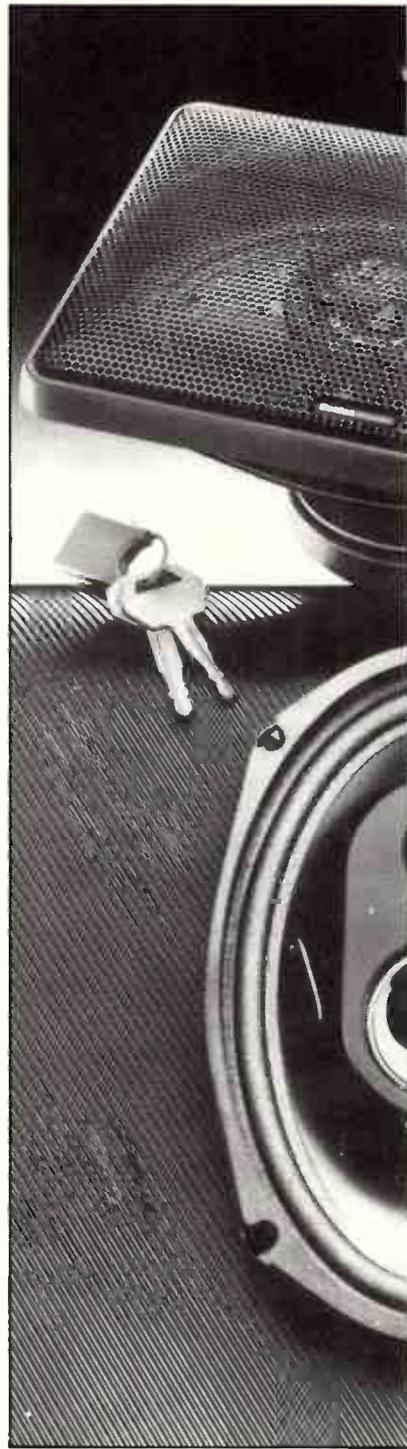
The company have gone to a material called TPX for the cone material in distinction to the bass driver which uses polypropylene. The TPX dome is suspended from a ring of Norsorex, blended from a mixture of foam rubber and oil.

The function of the suspension is to damp out oscillation in the speaker. Norsorex does this supremely well. According to some reports, it is so absorbent that if one constructs a ball of the stuff, and then drops it onto the floor, it will land completely flat, neither breaking or bouncing. As a result Dali is extremely bullish about the performance of their midrange driver, arguing it is the best in the world.

The tweeter is made by Audax. It is the only part of the system not designed specifically by Dali for this application. In fact Audax tweeters are found in many up market designs.

The Dali's will be available through Scan Audio in Melbourne. Watch for an ETI review in the near future.

R.I. No. 117



Boston Acoustics 797

## News from Boston

Boston Acoustics which is based in Peabody Massachusetts tells us that they have developed a new three-way Automotive Speaker. They have called this unit the 797 and proudly declare that it was designed for those 'who require the sound quality of a fine home loud-speaker system in their car or van'.

The 797 features a 150 x 230mm woofer, a 50mm mid-range and a 20mm wide dispersion tweeter. The frequency response extends from 36 — 20,000 Hz at 4 dB. Power handling is 40 watts nominal, 80 watts peak. To purchase this audio wonder you will require 399 Australian dollars.

R.I. No. 118

## NAD's Cassette Deck

NAD claim to have developed the world's first stereo cassette deck to use both Dolby HX Pro DYNEQ circuitry to improve high frequency response at high recording levels. It's called the model 6300 and it seems that NAD expects that it will astonish the world.

The new 'performance optimizing circuits' allegedly counter high frequency saturation in recording and high frequency losses that produce a dull sound in playback. Like the Soundstream products the NAD model 6300 uses a play trim circuit to correct high frequency losses in tapes recorded on other machines of inferior quality.

The 6300 also contains a CAR processor that 'optimises recordings for playback in a car or portable tape player'. Apparently it does this by compressing the dynamic range of the input signal boosting low level sounds by approximately 20 dB so that they will be clearly heard in noisy environments.

R.I. No. 119

## Falk and Soundstream

The Falk electronics firm of Sydney has just been appointed distributor for Soundstream car products of the USA. Soundstream apparently was one of the most prominent pioneers of Digital Audio Recording.

Like Acoustic Research,

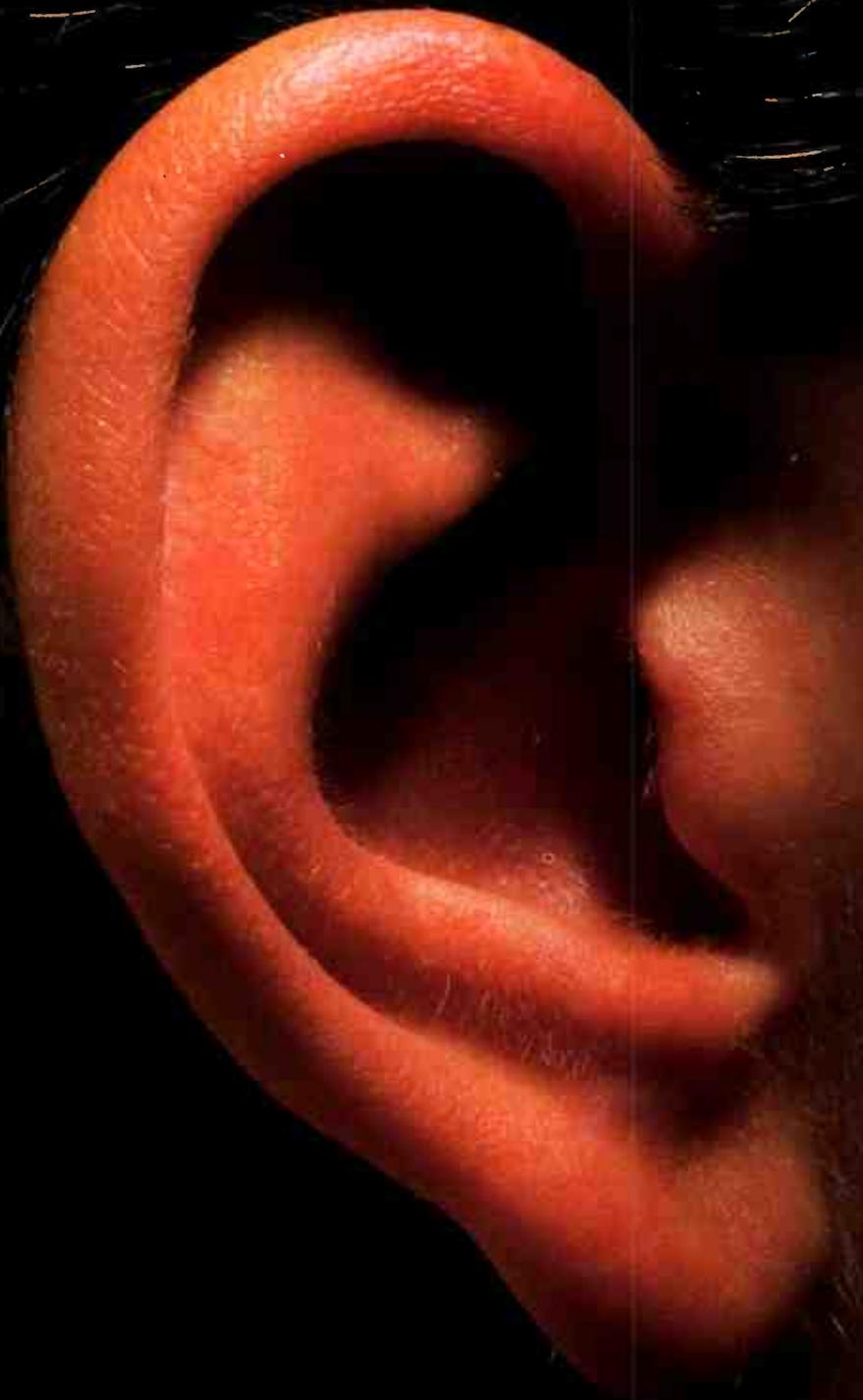
Soundstream hopes to make an impression in the Antipodes by releasing a whole range of car audio equipment. Prominent among these is the D200 Dual-Monoaural Amplifier which features a Power output on Dual channel of 100 watts per channel driven through 4 ohms and 120 watts per channel driven through 2 ohms. The signal to noise ratio of this unit is 100 dB. Another prominent piece of Soundstream machinery is the SF90 Staggered Four-Channel Power Amplifier.

Soundstream also seem to take particular pride in the Playtrim unit which they incorporate in their tuners and cassette decks. This device, which was developed by NAD and Dolby, compensates for high frequency inaccuracies in cassettes.

R.I. No. 120



One of the Soundstream range



## It'll change the way you watch videos forever.

With Yamaha's new AVC-30 Video Integrated Amplifier, you'll be watching videos with your ears. As much as you do with your eyes. Now that may sound strange. But with the AVC-30, that's the only thing that will sound strange. Because once you plug your video cassette recorder and speakers into the AVC-30, the room will be filled with incredibly lifelike sound. (Like sitting at the movies, holding a remote control). When you plug in your graphic equaliser, compact disc player, stereo tuner and turntable, the AVC-30 becomes the control console of your own surround sound video centre. When you hear your next video you'll see exactly what we mean. The AVC-30 Video Integrated Amplifier. For just \$899\* From Yamaha.



## EDTV Timetable

The Japanese electronics industry plans to start selling enhanced-definition television EDTV early in 1989. The Japanese have already developed high-definition television (HDTV), which uses twice the number of horizontal lines for each picture shown. But HDTV is not compatible with existing receivers. The new enhanced system is.

The quality of Japanese TV, like its North American counterpart, is poor because each picture is made up from 525 scanning lines (compared with 625 in Australia and New Zealand). In both systems, however, one full picture is built up from two interlaced half pictures or "fields".

According to the EDTV standard, the broadcaster will transmit a conventional signal which is received by

existing television sets in a conventional manner. But an extra picture signal is transmitted at a frequency slightly above the normal one. This extra signal contains fine picture detail. An EDTV receiver will use this signal to crisp the picture. At the same time, a digital memory will store the incoming fields and reproduces them twice over on the screen to create a succession of full non interlaced pictures.

To do justice to EDTV, JVC, which invented the VHS video cassette recording system, has said it will sell a new system called Super-VHS. It squeezes higher definition from a VHS recorder and cassette by raising the frequency of the carrier signal on which the black-and-white or luminance signal is recorded on tape. Raising the frequency spaces it further from the colour signal. This wider spacing makes it possible to extend the band width of the luminance signal without interfering with the

colour signal, allowing it to convey sharper detail.

The catch is that will the new recorders play the old tapes, recordings made on new machines will not play back on today's ones.

## New Film Format

A Swedish Film Director, Rune Ericson, has demonstrated a new film format to the British Kinematograph Sound and Television Society in London. His system is called "3 perf pulldown".

Conventional 35-millimetre film has four perforations at each side of each picture frame. Toothed sprockets in the camera and projector engage these holes to move the film. When this "4 perf" standard was set, the ratio of the width to the height of the film was 4:3.

New wider screens that

change the ratio of width to height while keeping the same number of perforations at the side of each picture frame as well as the same motor speed have resulted in a mismatch between the film and screen made in the new ratio. The mismatch means that there has to be a strip of blank film between each picture frame if the film and screen are to match each other.

Ericson's elegant solution is to change the number of perforations at the side of each picture frame and change the number of sprockets on the projector, while keeping the speed of the motors the same. The result is that the film moves more slowly, and the picture frame area exactly matches the screen size. Because the motor does not have to be changed, the modifications to the system are not expensive. In fact, the film industry would save many millions of dollars a year because 25 per cent less film is required.

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## QEDA

The electronics exhibition of the Queensland Electronic Distributors Association attracted some 3323 people in March. Organisers were more than happy with the result, and said that the new facilities at the Boondall entertainment centre and the increasing number of visitors had contributed to the success.

Bob Arthur, who managed the Philips Elcoma stand, said that the results of the show had exceeded his expectations, especially in view of the small market.

Plans are already under way for the next exhibition, and any exhibitors who may be interested in participating should contact Bob Hunt or Bob Heelan on (07) 277 4311.

R.I. No. 121

## New VCR Factory

N. V. Philips' Gloeilampenfabriek, of the Netherlands, Tesla Spotrebna Electrotechnika Konzern Bratislava, Czechoslovakia, and Transakta PZO, in Prague, Czechoslovakia, have agreed to set up a joint manufacturing facility capable of providing 0.5 million VCR's a year. It will be called AVEX.

70% of the new company, which will be based in Bratislava, will be owned by Tesla, 20% by Philips and 10% by Transakta. Philips will contribute manufacturing facilities and production know-how. Tesla will be responsible for the industrial infrastructure and Transakta will look after commercial activities.

Output from the new factory will be sold on the Czechoslovakian market and will be exported to countries inside and, via Philips, also outside COMECON.

In addition, the factory will produce VCR mechanisms that will be delivered to other video recorder manufacturers in COMECON.

The supply of components, which will initially take place via Ostimpex, a subsidiary of the Austrian Philips organisa-

tion, will largely be achieved from within COMECON countries by about 1991. The building up of its own network suppliers and the export of video recorders and parts to the West will enable AVEX to achieve a balanced foreign currency situation.



Ted Fawle

## Ted Fawle Leaves Marantz

Ted Fawle, a 20 year veteran of the hi-fi industry, credited with bringing many prestige hi fi brands to Australia, including the world famous Marantz brand that he introduced in 1972, has resigned his position as managing director of Marantz Australia to form a new company specialising in management training by computer simulation.

Contact Ted Fawle at Abbott Training Systems at their Chatswood office on 411 3877, 411 3909.

## CD video

Philips unveiled CD video in March, a new kind of compact disc. The disc which is 12 centimetres across stores 5 minutes of moving colour video with accompanying sound, and a further 20 minutes of sound without video. Philips has agreed the

technical standard with Sony, National and Yamaha in Japan and plans to start selling the new discs, together with the hardware needed to play them, before the end of this year.

Philips will set the price of CD Video low enough for the home consumer. Although the first players will be mains-powered for use with an ordinary TV set, portables with a built-in screen and headphones will soon follow. Travellers will be able to watch pop videos as well as listen to personal stereo on the move.

Philips also sees CD Video as a way of relaunching the technically acclaimed but commercially unsuccessful Laservision videodisc system. Laservision, with discs 30 centimetres wide, has been on sale for nearly 10 years notably by Pioneer.

The old name Laservision will be dropped and the new name and logo used for a series of videodiscs, measuring 12, 20 and 30 centimetres across. They will offer video playing times ranging from 5 minutes to 2 hours.

There is considerable hidden cost for Philips. The technical standard for CD Video in Europe is not quite the same as the technical standard for European Laservision. So Philips and Pioneer will have to compensate up to 15,000 people in Europe whose existing Laservision players will not play the new CDV discs.

A conventional compact disc records the sounds's 16-bit digital code. The player spins the disc between 200 and 500 times a minute so that a fixed laser beam in the player scans a spiral track of information pits on the disc at a constant speed of 1.25 metres/second. This is nowhere near fast enough for moving video pictures in digital code, unless complex and expensive circuitry is built into the player to compress the digital data. So the CDV system compromises by recording moving TV pictures as an analogue waveform.

The disc also spins faster while the video pictures are playing, around 2000 times a minute. The laser then tracks

the disc surface at a linear velocity of around 10 metres/second. The high speed is a cheap way of providing clear pictures, but it limits video playing time to around 5 minutes, meanwhile, RCA in the State's has stolen a march on Philips by squeezing 70 minutes full-screen moving video into the optical compact disc format that Philips and Sony originally developed for sound.

The company announced its Digital Video Interactive system early this month at a conference in Seattle. The system manages to pack all the required information onto a disc by compressing video signals by up to 100-to-1.

The key innovations are a pair of special-purpose integrated circuits developed by RCA's laboratory. One is a picture-element or "pixel" manipulator which decompresses the video signal. The other is an analogue display generator. These are combined with a digital buffer memory built from off-the-shelf chips to decode signals read from the optical disc.

The pixel manipulator chip takes data directly from the optical disc. It is programmable, so data on the disc can tell it how to decompress the video signals. The decoded signals are fed to a buffer memory, made of commercial memory chips. The analogue display generator chip uses these signals to generate video signals in various heights and resolutions. The system also includes a programmable audio circuit board, made from commercial chips, to generate sound to accompany the pictures.

The design had to overcome some stringent limitations inherent in the CD format. The rate at which data are transferred is limited to 150,000 bytes per second or 5000 bytes for each video frame lasting 1/30th second. This may be fine for digital audio or computer data, but it is much too slow for ordinary video, where the signals must be decompressed in real time. The RCA approach can handle general video as well as high-quality computer graphics.

R.I. No. 122



Gavin Ward

## Akai Appoints National Sales Manager

Gavin Ward has been appointed national sales manager for Akai.

He was previously the New South Wales Sales Manager and has been with Akai for five years. He will be taking over the sales responsibility from John Karbowski, Akai's

recently appointed National Marketing Manager. John Karbowski will be devoting much of his time to developing Akai's overseas operations, as well as the challenge of expanding Akai's product range.

## A New Face

W.C. Wedderspoon are the current distributors of AR (Acoustic Research) projects in Australia. AR claim that their equipment is 'bold and unfussy'. Apparently they have achieved this by hiding all the less used controls under front flaps.

One of the highlights of the AR range is the AR P-10 preamp which can drive 400 watts through 8 ohms, 800 watts into 4 ohms and 1,200 watts through two ohms. Another eminent unit is the AR X-10 which claims to be 'everything you could want in a output, into 8 ohms, 90 watts per channel into 4 ohms, 2 dB of dynamic headroom for music peaks and a 40 amp current capability for 'difficult' loudspeaker loads.

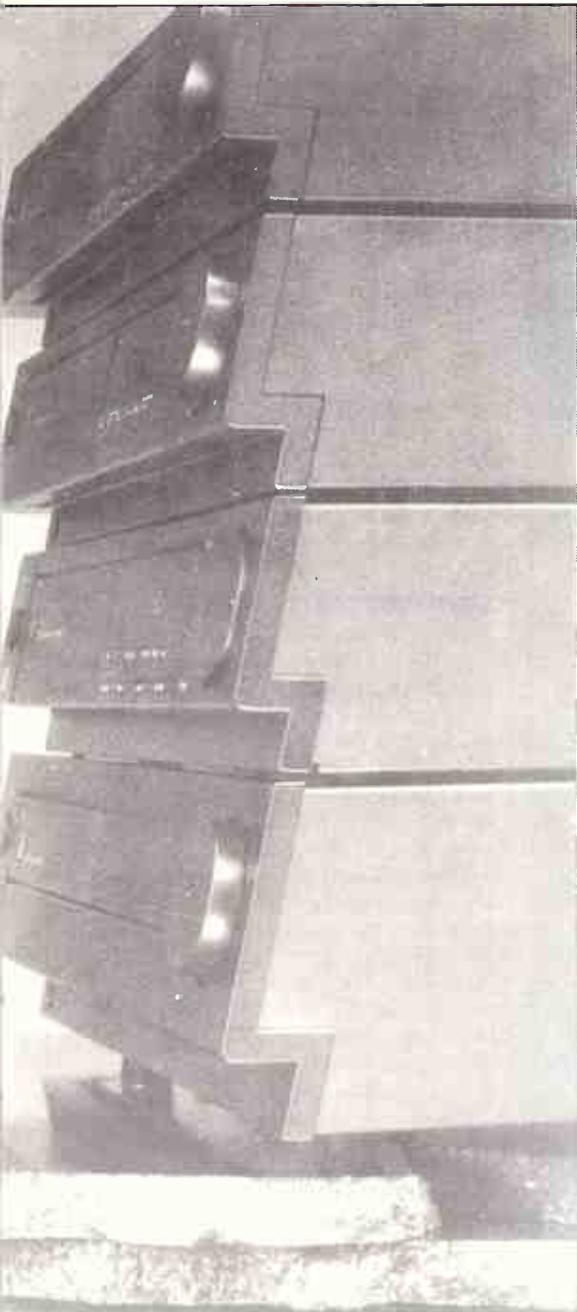
R.I. No. 123

## Alpine Audios

The Alpine company of Japan has decided, after six long years, to open a branch in Melbourne to coordinate its Australian operations. To herald their new status the company has released a new compact disc player, model number 5950.

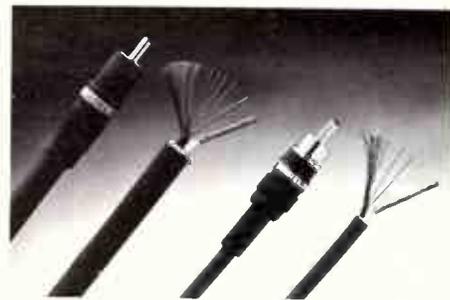
The 5950 holds twelve compact discs in a changer unit mounted in the boot and is fully programmable via a small unit which is dash mounted. To enhance the pure sound dynamics which compact discs are supposed to reproduce the company has developed a system of optical data transmission between the control and boot unit. This ensures that since the signal is pulse coded light there are no mechanical connections as such.

R.I. No. 124



Acoustic Research

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# Automotive Audio

## The Principles of Purchase

**C**ar stereo ain't what it used to be — and not because of any hi-tech developments (there haven't been too many, anyway). No, it's not the gear that's changed. It's the buyers.

The days of the young 'P' platters rock-

ing into the local supermarket come hi-fi shop, in desperate need of a bolt-in ghetto blaster, are, almost, behind us. Today's buyers may still be young, but they're much more discerning. Now, as never before, sound quality is playing a big part in

car stereo purchases. And, not surprisingly, manufacturers are responding with the appropriate gear and marketing.

### Volume

You'll still see ads for units with thousands of watts (including a bonus set of ear plugs) but these marketing marvels are increasingly confined to the classifieds section of local newspapers. The advertising of today is looking for (or creating) a sophisticated buyer, one who recognises good sound from high power distortion.

The volume is still there in today's gear, of course, but the emphasis has shifted, perhaps as a result of the 'yuppy' explosion. Whatever the reason, there are some great sounds to be heard, at very reasonable prices.

While many parts of the economy have experienced a downturn, the car stereo market continues to blossom. It's not uncommon to find half a dozen retailers within one kilometre of each other. Competition is stiff, but the market is large enough to support this concentration.

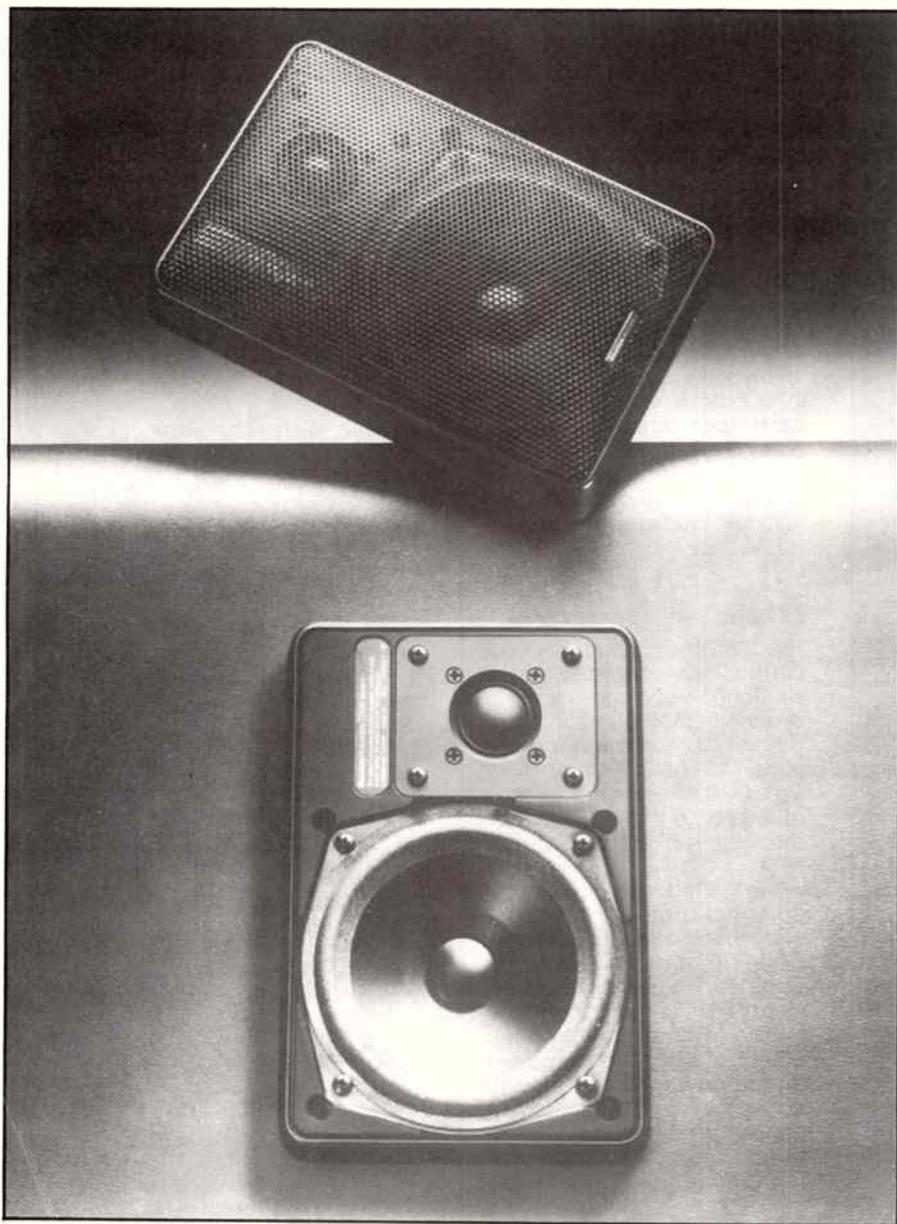
### Contradictory Advice

You might think that with this many outlets, you'll be able to pick up a unit at less than cost with some judicious haggling. Sure enough, you can strike some good deals if you shop around, but don't expect to walk out of the shop with a top of the range Nakamichi for the price of a second-hand Walkman. There are simply too many buyers for that to happen.

What you will get if you shop around, however, is a wealth of advice, much of it contradictory and only about half of it worthwhile.

Step number one when considering the purchase of car stereo is to find a salesperson that really knows the field. That in itself is not too difficult if you're selective in who you deal with.

Places to avoid, unless you know exactly what you're after, are department stores and backyard operators. The former is rarely fully informed of all the units in their department, simply because they are usually also responsible for home hi-fi, alarms, spare parts, kitchen utensils and anything else that happens to be on their floor.



Boston Acoustics L 700 series 2

Conversely, the backyard operator may know a couple of brands well, but is often poorly informed of alternatives. Manufacturers also tend to forget about dealers of this level, leaving them unaware of any impending developments.

### Narrowing the Field

The right places to check for car stereo are, no surprises, car stereo specialists. Some also stock car alarms, others car air conditioning, but the majority remain essentially stereo specialists.

Having done this, the field can be narrowed further. If you find the salesperson is interested in promoting just one particular brand, be sceptical. The brand they're recommending may be the best for you, but it could also be the one with the highest profit margin for them, or a brand that



Pioneer K.P. 3120

they happen to overstocked with. Look for the salesperson that is prepared to seriously consider your needs and provide several acceptable alternatives.

The phrase **acceptable alternatives** is most important. If you've asked to see a few models in the \$300-350 price range, and the salesperson shows you just one in

this range and four worth around \$450, it's obvious which one he or she wants to buy. The expensive models sound great, but you've only got \$350 to spend, so you buy the only 'acceptable' model you looked at. Definitely a bad move. There are so many units around in this price bracket.

Salespeople that are prepared to offer

IF IT'S NOT THERE,  
THEY CAN'T STEAL IT.

No matter how you fit your car stereo, if a thief wants it, he'll get it. Even if he has to use an axe.

That's why Kenwood developed the theft-prevention chassis. Because a Kenwood car hi-fi doesn't come cheap (the best rarely does), we feel you should only ever have to buy one - not buy a new hi-fi every time a thief decides he deserves the luxury of a Kenwood more than you do.

With the Kenwood chassis, if you have to leave your car somewhere where there is a chance it will be broken into, you simply take the hi-fi with you (or perhaps lock it in the car's boot). Just press the release button and the hi-fi slides out - no screws to undo, no wires to detach. It's that easy.

The Kenwood car hi-fi with theft-prevention chassis. Because if it's not there, they can't steal it.



Illustrated: cassette/receiver model KRC-434.

**KENWOOD**  
CAR HI-FI EQUIPMENT

READER INFO No. 18



SONY XRA37R

And if it should break down, service and parts are rarely a problem. Of all the top name brands only National is developing a reputation for poor service.

Ease of maintenance is one of those future considerations, such as compatibility with add-on gear, that is often overlooked. Ensure you buy a brand that can be serviced quickly, and has readily available replacement parts.

Around the \$500 mark, noise reduction facilities become the dominant feature. Dolby is naturally the most popular, and the most useful. Other noise reduction systems are available, but ensure they work effectively with the tapes you intend playing. Even Dolby may be a waste of money if the majority of your tapes are non-Dolby.

In addition to noise reduction, units in this price area often include AM stereo. This relatively recent innovation, despite a good deal of promotion, hasn't exactly set the car stereo market on fire. Put simply, the AM band doesn't offer the quality of sound obtainable on the FM band. Certainly AM stereo sounds better than standard AM, but the difference won't leave you speechless.

There are a number of other facilities peculiar to individual brands, but like noise reduction and AM stereo, whether they are of any use depends on your own needs. Look at them critically; will you use the extra facilities enough to justify spending another \$150-200.

**Power Output**

One area in which there is usually a significant difference between the \$300 and \$500 models is power output. Six to twelve watts is typical of the former, while the latter produces anywhere between 20 and 40 watts.

As a general rule, the greater the out-

good advice do exist. In fact they're probably in the majority. Unfortunately the misleading or ill-informed salesperson sounds very similar, unless you read between the lines of their sales spiel.

Once you've found the right salesperson, a few questions will be fired in your direction, questions you can ask yourself now.

**Mechanics**

The first thing to consider is the mechanics of fitting the unit. Is it to go in or under the dashboard of the car? Do you want the speakers cut into the door panels, or mounted on the rear parcel shelf? Do you want front or rear speakers, or both. Are you going to fit the unit yourself, or do you want the retailer to do this? (Some dealers can arrange free fitting, so be sure to ask about this.)

These are fairly basic questions, but the salesperson is bound to ask them. They should also ask what type of car the unit is going into. In some cars it's impossible or undesirable, to fit the unit into the dash or cut holes in the panels for the speakers.

The next question, probably the most pertinent, is price. Car stereos start at around \$100 and rise to a top price of

\$6,000. As with most things in life, you get what you pay for. One hundred dollars will get you a very basic system with sound that best compares to a 1930s crystal set. On the other hand, \$6000 can buy a slice of audio heaven.

Unless you're either very broke or very rich, you won't be looking for a unit at either extreme of the price range. The majority of buyers today plan on spending between \$300 and \$500.

For \$300 you should be able to buy a basic, high quality unit with push button operation, automatic reverse and AM/FM radio. Additional features are usually kept to a minimum, but loudness and simple noise reduction facilities are common.

When you compare the above facilities with those available in \$100 units, you might at first think the latter is a good buy. However, there is one major difference — quality. You'll get the same features in a \$100 car stereo, but those features won't operate as effectively, and nor will the unit last as long.

**Basic Units**

A basic \$300 unit from a well known brand will serve you well for many years.



Sony XR520R



# The NAD Power Envelope has been delivered.

The NAD Power Envelope amplifiers and receivers have been so successful in Europe and America, it took an age for them to be available in Australia.

Which was frustrating when the specialist magazines had been so very glowing about their performance.

But probably even more frustrating is the fact that they're selling just as fast here, as they do in other parts of the world.

And as they start at only \$399, why wait for the next post?



put, the clearer the sound at high levels, provided the speakers can handle what the amp is churning out. A high wattage rating, however, doesn't mean that the unit will perform effectively only at high levels. Quite often it will give better performance at even the lowest volume setting. But you don't need to go watt-crazy. Think carefully about your needs. In most situations, 12-20 watts is more than enough. If your happy with a six watt unit, remember to consider later compatibility. You may need to add a booster, so ensure one is available for your model.

### Car CD

Once you start looking at models above \$500, you're really moving away from the

mainstream car stereo. At this point it's time to consider the limitations of your vehicle. A car's acoustics are by no means ideal. True sound reproduction is simply not possible when the sound has to contend with seats, oddly-shaped panels, dashboards and occupants. Sure enough, a \$1000 unit will sound better than a \$500 unit, but it won't, as the price difference might suggest, sound twice as good.

Above \$1000 and car CD is within your grasp. This audio marvel of the '80s has as yet failed to make a big impact in car stereo. And at \$1000 plus for a unit, it's little wonder. Those that are around tend to be found in Jaguars, BMWs and the like.

Home CD has dropped dramatically in

price over the last few months, with models starting at around \$200, but no such drop is likely in car CD in the foreseeable future. It generally takes several years for home hi-fi technology to make the move to car hi-fi, then a few more years for the price to fall to a realistic level.

For those that can afford it, car CD is a logical step towards listening excellence. And CD software copes far better with the rigours of storage in a vehicle than do cassettes. But don't expect it to sound as good as quality home CD. Once again, the car's acoustics and road noise will take the edge off clarity.

### Unwanted Removals

The choice of units, no matter what price you are looking for, is rather overwhelming, so be prepared to spend at least several hours comparing them. Look at their ratings, examine their features, and consider how attractive each unit will look in your car (the aesthetics are easily forgotten). And when you've settled on a unit, ask yourself one final question: How is it going to remain your property, and not disappear the first time you park your car?

If you're considering units between \$400 and \$600, you'll come across various theft deterrent features. Some have a coding system that inhibits use after the power source has been temporarily disconnected. Others emit a high pitched noise if switched on without the car's ignition key in place.

Probably the most useful feature though is a concealing fascia. If a would-be thief can't see your stereo, it's hardly likely to attempt to steal it will be made. These facias can blend attractively with the car's dash, and fold down easily during stereo operation.

Another alternative is the removable/portable car stereo. A great idea if you are visiting friends, but not too practical when you've gone out to dinner at an intimate restaurant. Still, any advance in theft deterrents is welcome, even if it is a little unwieldy.

The best idea, of course, is to have an alarm fitted to your car. If you shop around, you may be able to strike a good bargain for the installation of both stereo and alarm. But here, remember not to compromise just for the sake of a bargain. Your bank account can tell the difference and so can your ears!

With a little patience you should be able to end up with a car stereo almost equal to your home unit. Don't expect miracles, but do look for quality gear. It not only sounds better, it lasts longer too.



One of the latest anti-theft strategies is to provide a quick release cabinet so that the radio can be removed from the car. Here Kenwood and Jaguar make a nice up-market combination.

# Create a sonic masterpiece in your own home.

The names VIFA, SCAN-SPEAK and DYNAUDIO are recognised internationally as the finest speaker drivers available today. If you were to open the cabinets of many world-acclaimed loudspeakers you would find that they contain these drivers as their reproduction source.

Now you have the opportunity to construct loudspeakers offering virtually identical performance using complete kits supplied by Scan Audio - for a fraction of the price. By doing your own assembly you will save literally hundreds, even thousands, of dollars in expensive freight, duty, handling and of course, labour charges. If you would rather invest money in your own pleasure than in other people's pockets, you must investigate the potential of assembling your own kit speakers from

the wide range we offer. Currently there are ten kits available ranging from under \$500 to \$4000 per pair including cabinets.

For free brochures, performance data, reviews, price lists and more information about drivers and kit speakers please, contact the Australian distributors Scan Audio.



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S&T 4624



READER INFO No. 20

Profile of New  
Faces in a  
new industry

# At Last — DAT



LAST MARCH all the major Japanese manufacturing giants formally released DAT (Digital Audio Tape) tapes and players.

All the models have adopted mode 1, 5 and 6 of the R-DAT format providing for record/replay of digital audio at 48 kHz sampling frequency and 44.1 kHz reproduction capability. The models also use a copyguard system that detects an anti-copy flag in software based on the standard agreed upon by the DAT Technical Conference in addition to non-recording capability from 44.1 kHz of CD.

Although direct-digital dubbing is not possible from a CD player, the record software industry has objected strongly against marketing DAT without copyguard because the deterioration of sound quality in present systems is not audible to the human ear. Indeed, copies are the next thing to direct-digital, frequency response is 2-22,000 Hz, S/N ratio is 92 dB or higher, dynamic range is 90 dB or better, THD is 0.005 percent or less. As the recording itself is digital, it is completely free of the hiss and wow/flutter deficiencies of analogue recordings. Some models such as Sony's and JVC's have also adopted 32 kHz sampling frequency for reproduction in response to the possibilities of receiving PCM broadcasting and long play-ing mode.

Although the price range has been set at above \$1800 (approx) the specifications and functionality of the new DATs are truly comparable to that of existing high-end digital audio disk players.

The new models are designed to meet the high-end market and for buyers who have been using open-reel tape decks. National's SV-D1000 uses an amorphous fer-

rite composite head which at 2-20-micron width is far more precise than that of conventional systems such as VCR. It places extra emphasis on audio characteristics and attains 1-22,000 Hz frequency response.

The players integrate many more transistors than CD players. Sony's DTC-1000ES, for example, contains approximately 600,000 transistors, three times as many as an average CD player. DAT needs circuits mainly for digital recording and complex servo control including ATF (auto track finding).

The models from National and Sony weigh in the vicinity of 12 kg, and consume more than 30 W largely because of the increase of mounted parts and parts for high-grade audio equipment such as separate large power supplies.

## Portable DATs

How long it will actually take DAT to be incorporated in portable audio equipment is a serious concern. Although Sharp achieved a 5.9 kg minicomponent DAT with 27 W power consumption, Tatsuhiro Yasunaga, general manager of the Digital Audio Equipment Division, says, "It will take another one or two years to realize a DAT boombox that has power consumption below 10W."

## Features

DAT recorders feature a search function that is about 200 times normal record and playback speed, or 10 times faster than a conventional tape deck. An entire 2-hour tape can rewind in 40 seconds. This capability enables a DAT recorder to function like CD players having random access playback, direct music selection, skip

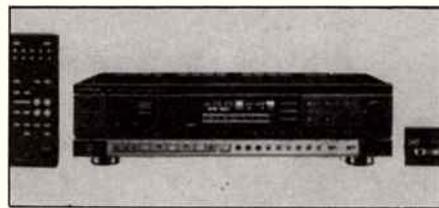
search and multiple repeat mode for single music track, entire tape or between two randomly selected positions.

Unlike conventional tape recorders, DATs can be operated with recorded sub-codes for various controls. For instance, 'absolute time' is recorded on the tape. This allows users to find a position on the tapes with great precision, unlike the counter of a conventional taperecorder. These capabilities allow users to edit tape easily. DATs also adopt new systems devised originally for CD players such as separate power supply and separate A/D and D/A conversion units for eliminating phase distortion of right and left channels.

## Optical Fibre

National, JVC and Sharp have adopted optical fibre data links for digital signal transmission in addition to the conventional coaxial cables. The merit of an optical data link is to simplify equipment connection by using signal multiplexing, enabling the exchange of multiple signals simultaneously. In other words, it can reduce the number of terminals. At present, there is no standard for optical data links and manufacturers are using incompatible plugs for their own equipment.

The Aiwa Company made the first move. Its Excelia XD-001 deck will only be sold in Japan, at least for now and production is set at 2000 units per month. The XD-001 has a 10-key module for direct track selection, FF/REW at 200 times normal speed and auto rewind (the cassette does not have to be flipped in the record-



Aiwa XD-001

er). Suggested retail price will be \$1880. It has all the dubbing capabilities mentioned above.

National has also begun production of its model, SV-D1000. The SV-D1000 adopts Class AA circuitry for analogue signal processing as well as dual A/D, D/A converters and top-end digital filter. It is

equipped with optical digital input/output terminal. It provides a dynamic range of 90 dB (96 dB in playback) and attains better than 93 dB S/N ratio.

In terms of functions, it has 99-step programmable random memory, direct-memory, direct music selection, skip search and



**National SV-1000**

four-way repeat for selection, entire tape between selected two positions, and programmed order. It registers music number automatically by searching a two-second non-recorded section of the tape and detects the end of the song. It measures 430 x 352 x 109 mm, weighs 11.5 kg and is priced at \$1980 (approx.).

The company estimates this year's DAT market to be 50,000 units. Next year, 220,000 DAT recorders will likely be sold. Penetration will be well on its way at 1.1 million units by 1990, says National.

### Sharp DATs

The Sharp Corporation has introduced two models — the RX-X100 and RX-X5. The RX-X100 will be sold for \$1990 and mini-component RX-X5 will have a \$1950 suggested retail.

Sharp has adopted an original front-loading cassette mechanism that uses aluminium diecast chassis with direct-drive motor for stable tape running. The company has also incorporated six new LSIs for signal processing and servo control that improve circuit density and permit a compact appearance. Both models will be produced at a monthly rate of 1000 units each.

They incorporate 16-bit linear 4-times oversampling digital filter for wider dynamic range, and separate A/D, D/A con-



**Sharp RX-X5 and RX-X100**

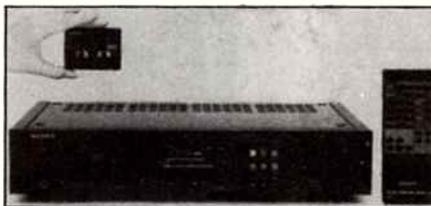
verters for right and left channel, enhancing channel separation. They have optical digital input-output terminals that multiplex signals.

Functions include 30 step random access memory, 200 times normal speed search, monitor search, repeat for entire tape and programmed songs, and auto rewind. Automatic music numbering is achieved by sensing non-recording areas. A companion 26-key wireless remote control uses solar battery. The RX-X100 measures 430 x 95 x 300 mm.

### Sony DATs

The Sony Corporation released the DTC-1000ES DAT deck with its linear skating front loading system on March 23 for \$2000 (approx.)

The unit uses five new LSIs and five new microprocessors. Four time oversampling digital filter and dual A/D, D/A converters used in Sony's high-end CD players are incorporated in the DAT recorder as well. Separation of analogue and digital circuitry maintains high sound quality and four direct-drive motors provide smooth tape transport. Double-encoded Reed-



**Sony DTC-1000ES**

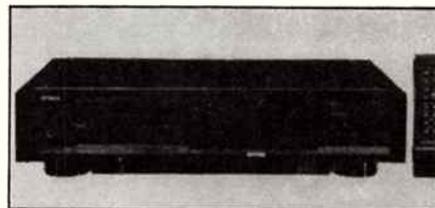
Solomon error correction plus wow and flutter below measurable limits are added features.

The model measures 470 x 110 x 420 mm, weighs 12 kg and includes stereo connection cord and remote control accessories.

### JVC's First

JVC's XD-Z1100 will be the first DAT recorder to be equipped with a long playing mode when enables continuous four-hour recording/playback. The company explains that long playing is especially useful for fm air-check. In response to the requirement for double the accuracy for long playing mode in which tape speed becomes half that of the standard mode, the company has adopted a dual mechanism chassis, sendust/ferrite combination head and high-precision direct-drive motor, it also uses a large flywheel to minimize jitter, and suspension structure to protect the mechanism from other pressure. Frequency response in long playing mode is 45 Hz 14,500 Hz with 32 kHz sampling frequency and non-linear 12-bit quantization, while it has 5-22,000 Hz frequency response in standard 48 kHz.

XD-Z1100 features an after-sampling-



**JVC XD-Z1100**

monitor to confirm the performance of the A/D and D/A conversion. It also has a VU/peak/peak hold meter with bit rate indication, and digital peak level indicator to show margins to full bit level. Other features include random access program, introduction scan, blank search, repeat between selected points, and synchro terminal to enable linked play with a CD player. The model is equipped with optical digital I/O terminals in addition to coaxial digital terminals. According to for \$1980. It measures 435 x 112 x 320 mm, and weighs 9 kg. Power consumption is 30 W.

Turning to tape, National, TDK, Sony, JVC and Hitachi Maxell have already released a number of products and many other manufacturers are waiting in the wings.

*Easy on the pocket,  
not cheap on  
the ears.*

# Richter Oracle Loudspeakers



**T**he downward slide of the Australian dollar has once more created the opportunity for Australian manufacturers to produce 'home grown' equipment that can compete on a more equitable footing with their imported adversaries. One obvious area where such competition has been sorely needed, is in the field of loudspeakers, where the better or best imported products have just about reached the point of becoming financially inaccessible for most of the Australian consumers.

There are a number of well-known and internationally respected Australian designers for loudspeakers. Some of the best of these have ventured overseas. There are others who, like Ralph Waters, who have drawn heavily on the theoretical work of their peer group to produce cost effective Australian designed and manufactured speakers which are currently making a significant impact on this market.

The Richter 'Oracle' is a relatively small two way enclosure with a 160 mm diameter woofer with a polypropylene diaphragm, a long throw voice coil and a flexible roll edge surround which provides low distortion above 150 Hz and modest distortion at lower frequencies. The manufacturer of the woofer is not disclosed, and I suspect it has been selected both for its electrical parameters as much as for its attractive appearance. The tweeter is a Philips 25 mm diameter soft textile dome extended range unit for which the grille protection incorporates an unusual "acoustical spoiler" to reduce the high frequency frontal directivity and thereby achieve a more uniform polar sound dispersion.

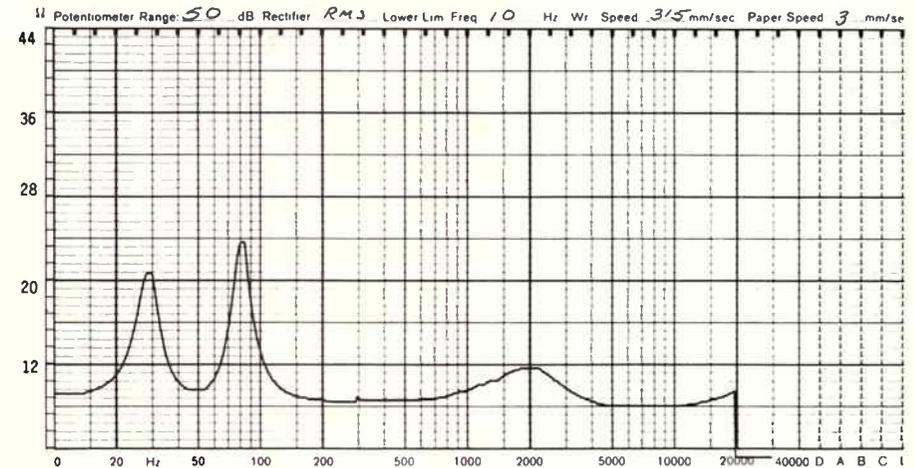
The tweeter and woofer are mounted vertically on the front panel of the unusually shaped speaker cabinet which has a narrow front panel and relatively deep side wall panels which are internally braced to reduce the magnitude of speaker cabinet resonance. The tweeter is provided with a foam plastic surround to reduce front panel Fresnel effects and reduce the magnitude of reflection from the clip-on front panel framing. The front panel frame with its carefully selected acoustically transparent black cloth cover has four plastic clips which mate with the matching inserts on the face of the speaker cabinet. The selected cloth provides almost total visual obstruction for

the speakers mounted immediately behind and as our testing showed, they result in no significant acoustical impedance or modification of the sound emission.

The rear panel of the loud speakers have a pair of good colour coded 4 mm universal terminals for connecting bared speaker wires or plug connections. The rear of the cabinet also incorporates a 50 mm diameter loading port with a length of 75 mm immediately behind the tweeter. This approach to the venting of loudspeakers has once more become a vogue after an almost total absence in the marketplace since the early 50's.

**Rear Venting**

Rear vented speakers have a number of attributes and almost as many liabilities. One could readily liken their characteristics to being similar to a 'double bladed sword'. They can extend the low frequency response of a small speaker cabinet, but because of their proximity to a rear reflective wall and most particularly when used in a corner/wall situation, they can significantly modify the low frequency response as a result of reflections from the floor, the rear wall and most particularly the side walls. The rear venting port's low frequency sound enhancement characteris-



Input impedance of Richter Loud speakers

tic do not display all of their 'real world' characteristics during anechoic testing procedures and consequently one has to either re-assess the speakers with pink noise testing in a conventional listening room or test them in a reverberation chamber to assess the real performance of the low frequency response.

Inside the speaker cabinet the cross over network has its air cored inductors glued to a motherboard with the metalised

polyester capacitors and wire wound resistors. Alternatively, they are mounted on a tag strip which is connected between the speaker terminals. The choice of air cored inductors is thought to be better than the ferrite cored inductors utilised in so many cheap or inexpensive loudspeakers and this ensures far more stable performance at high signal levels. The cross over network has been selected to utilise a first order Butterworth cross-over for the woofer with a second order Butterworth cross-over for the tweeter.

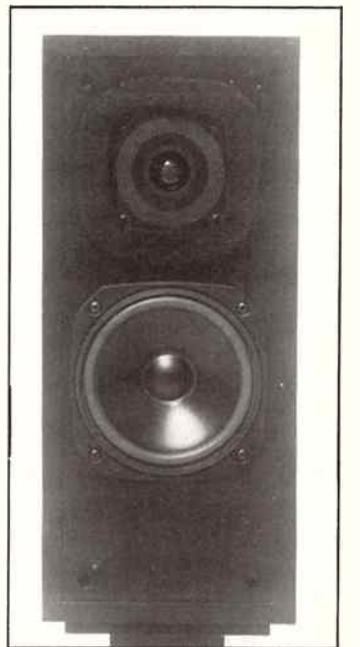
The cabinet is solidly constructed from 15 mm high density particleboard with a single lateral brace element sensibly interposed between the two side walls to provide enhanced stiffness and significant reduction in unwanted cabinet resonances. The inside of the cabinet has been modestly dampened by a 50 mm layer of bonded acetate lining which is stapled into position. A layer of fibreglass would offer a more effective absorption for a similar cost.

**Objective Testing**

The objective testing of the Richter 'Oracles' presents few surprises. The measured 'flat' portion of the frequency response extends from 170 Hz to 20 kHz at 2 metres

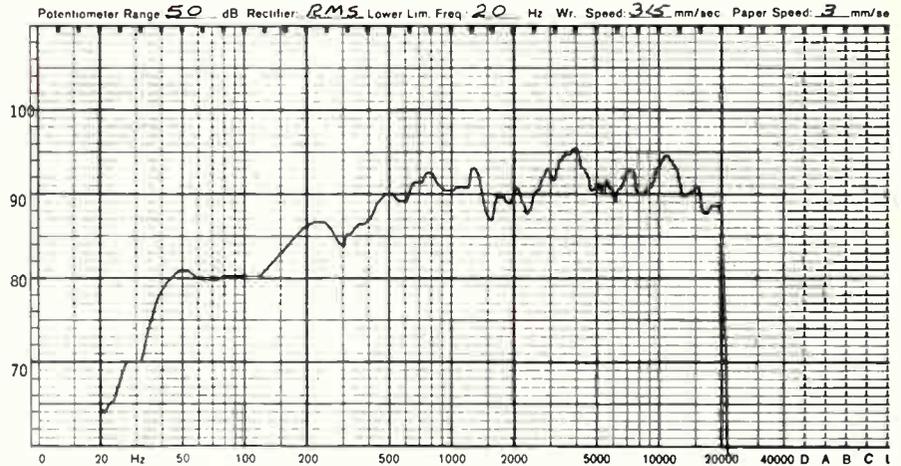
MEASURED PERFORMANCE OF RICHTER LOUDSPEAKERS

SERIAL NO:	NIL				
CROSSOVER FREQUENCIES:	2.3kHz				
SENSITIVITY:	(for 96dB average at 1m) 16.7 V r.m.s. - 14.3 watts (nominal into 8 Ohms)				
HARMONIC DISTORTION: (1) 1m. Level as Indicated)	100 Hz	1 kHz	6.3 kHz		
	(90dB)	(90dB)	(90dB)		
	2nd	28.3	39.8	-	dB
	3rd	29.6	50.8	51.5	dB
	4th	42.2	-	-	dB
5th	43.2	-	-	dB	
THD	5.2%	1.66%	6.27%		
INPUT IMPEDANCE	150Hz	1.28	ohms		
	1kHz	9.6	ohms		
	6.3kHz	5.6	ohms		
	20kHz	5.2	ohms		

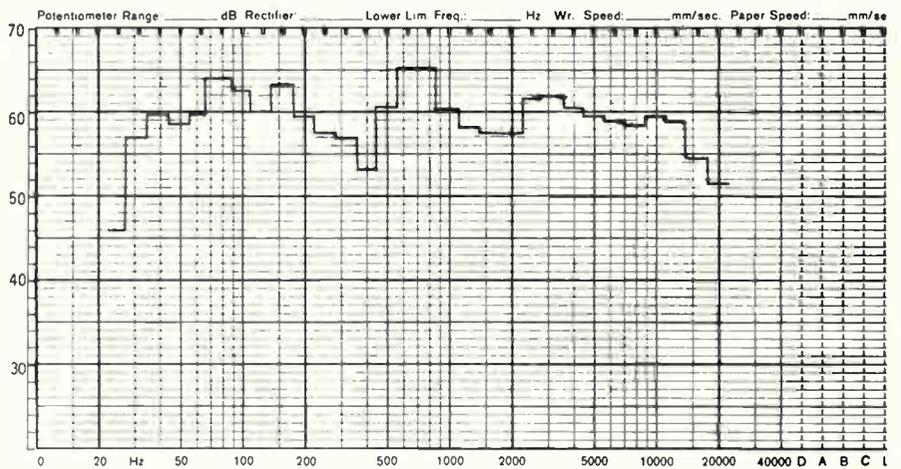


Dimensions: 480mm high x 216 wide x 412 deep  
 Weight: 7 kilograms each  
 Options: Matching stands (supplied for review)  
 R.R.P.: \$449.00

Date: 4th April 1997



Above: Response in an anechoic chamber on axis. Compare the base droop with a pink noise test in a "real" environment (below), and the effect of the rear facing port becomes apparent.



on axis and is within  $\pm 5$ dB under anechoic conditions. The low frequency droop in the 40 to 150 Hz region is primarily the result of the anechoic test conditions being incapable of interacting with the rear mounted venting port which is intended to provide almost 6 dB of boost when correctly positioned in a real room. At 1 metre on axis, the low frequency anechoic chamber test response looks somewhat better than it does at 2m but this is because of the changed emphasis of the rear venting port. A markedly superior low frequency response was then measured in our listening room with the loudspeaker 400 mm above the floor and 400 mm from the rear wall and 1.2 m from the side wall. Under these conditions, the rear venting port's correct interaction with both the rear wall, floor and side wall results in a very satisfactory linearising of the frequency response between 30 Hz and

150 Hz.

### **Pleasing Aspects**

One of the most pleasing aspects of the anechoic chambers frequency response evaluations was the response measured at 30° off axis. Under these conditions the measured tweeter response is remarkably flat all the way up to 12 kHz and still provides an acceptable performance all the way up to 16 kHz. The separate assessments of the tweeter and woofer responses at 5 cm from their diaphragms shows that the woofer response is relatively smooth from 75 Hz to 2 kHz, with the effective cross over of the two drivers taking place at approximately 2.5 kHz. The close proximity measurements on the axis of the tweeter highlights the axial 'spoiling' characteristics of the protective grille which exerts such a strong influence on the achievement of the 'off axis' linearity.

MUSIC SOUND  
RECORDING STAGE LIGHTING

# SONICS

MAGAZINE

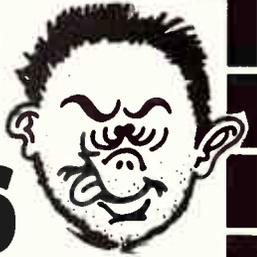
## THE ALL AUSTRALIAN MUSIC MAKERS' MAGAZINE

For: Musicians, Road Crews, Recording Engineers, Lighting People, Managers, Promoters and anybody interested in what goes into today's music-making.

HAVE YOU GOT YOURS YET?

OUT NOW

# CRAZY FACE CELEBRATION NEW STORE OPEN IN FAWKNER (VIC) SALE CONTINUES



### SCANNERS

**\$229**

Top quality brand digital model with all wanted features.

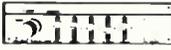


**FERRIS AUTO STOP AM/FM**  
**\$81<sup>98</sup> EA**



**HATADI AM/FM RADIO/CASSETTE**  
**\$59<sup>98</sup>**

### GRAPHICS



**SOUND 4 VALUE AT**  
**\$39<sup>98</sup>**

**NEW 40 CHANNEL 6/E BOOMER CB**



Top quality set by Gardner Electronics  
**\$129<sup>98</sup>**

- Built tough for Australian conditions
- Full 2 year G/tee.

### SPEAKERS



**\$39<sup>98</sup> PR**  
FANCY BOX TYPES

### CB BASES

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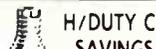


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READER INFO No. 21

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ST 31/5/1987

CUT OUT AND KEEP

## Loudspeakers

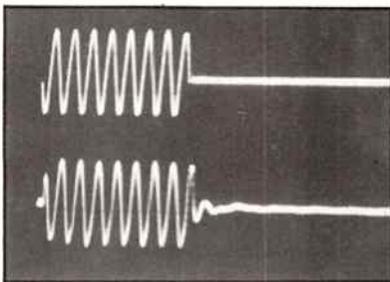
The output impedance has been carefully selected so that the speaker is a true 8 ohm unit with two sharp but otherwise acceptable resonances at 29 Hz and 82 Hz and a modest rise of 11.5 ohms at 2 kHz. This impedance characteristic should cause no problems for even the most cantankerous of amplifiers. The measured phase response of the Oracles is exceptionally smooth showing one deep down to almost  $-180^\circ$  and then a slow rise again back to  $+90^\circ$  at 20 kHz.

The polar responses are particularly good and very much to the credit of the system's designer. The response at 1 kHz is typically 3 dB down at  $\pm 40^\circ$  to the main axis, the 3 kHz response is only 3 dB down at  $\pm 27^\circ$  to the main axis, whilst the 6.3 kHz response is 3 dB down  $\pm 30^\circ$  to the main axis. Even the 10 kHz response is 3 dB down at only  $\pm 20^\circ$  to the main axis and considering that these are such inexpensive speakers, their performance is particularly good.

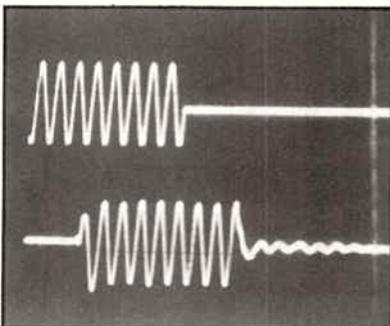
By contrast the distortion characteristics proved to be moderately high at low frequencies, being generally unacceptable at the normal 96 dB test level at 1 metre and consequently a lower signal level had to be used for the testing at 100 Hz. With a 90 dB test signal at 1 metre the resulting distortion was still particularly high at 5.3%, with a 1 kHz test signal level at 96 dB resulted in 1.06% distortion, whilst at 6.3 kHz we had to reduce the signal level to 90 dB in the interests of protecting the tweeter from damage, as these enclosures do not incorporate a speaker protection circuit.

The tone burst decay response at 100 Hz and at 1 kHz are relatively innocuous whilst the 6.3 kHz tone burst decay response exhibits a noticeable degree of ringing which one would reasonably expect on the basis of the distortion figures. The decay response spectra are, by and large, one of the smoothest sets of curves I have yet seen from a loudspeaker in this price range. Only two noticeable resonances show up, with the most pronounced being at 4 kHz (from the tweeter) with a slightly less pronounced resonance also be observed at 11 kHz. The 4 kHz resonance is readily audible on some programme material including the human voice, and to a lesser extent on some musical instruments including piano, violin, guitar and harpsicord. One of the most interesting features of the decay response spectrum is the relativity between low level resonances and the primary response. Natural speaker cabinet resonances are at a much lower level in the 'oracle' system than most other comparable speakers systems in the under \$1000

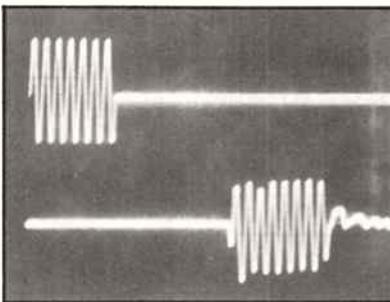
Input Impedance



100Hz (20 ms/div)



1000Hz (2 ms/div)



6.3 kHz (0.5 ms/div)

*Tone burst response for 90 dB SPL. Upper trace is the electrical input and the lower trace the loudspeaker output.*

bracket and this is apparently the result of the choice of speaker cabinet dimensions. The small front panel area and relatively large side panels, which are internally and effectively braced at mid point, obviously exert a significant influence on this characteristic.

During the reviewing of the 'Oracles' I was involved in a simultaneous review of an array of high powered amplifiers in the 100 to 500 watt range. I utilised this opportunity to assess the performance of the 'Oracles' when driven by amplifiers with ratings higher than the Manufacturer's recommendations, as well as with smaller amplifiers in the 40 to 80 watt range.

The most notable feature of the 'Oracles' is that when correctly mounted in relation to the side wall, rear wall and floor they definitely produce a relatively uniform frequency response over the 30 Hz to 16 kHz range.

### Subjective Testing

The 'Oracles' provide extremely good

stereo source localisation with a clear stereo image which is sharp and very well defined. The base response however, is a trifle woolly and particularly under high drive conditions (signal outputs above 96 dB) where they have a tendency to display some break-up or generate frequency doubling under hard drive conditions in the 40 to 80 Hz region. By contrast their response in the 100 to 2 kHz region is clean, responsive and with most programme material very flattering.

This was particularly evident when reviewing one of the new Canadian Broadcasting System Discs "A Fifth of Broadway" SMCD50922 from CBC Enterprises, in which excerpts of the "Sound of Music, My Fair Lady, Fiddler on the Roof, Funny Girl, and Annie" are featured.

By contrast the 2 to 5 kHz region is not well served. The pronounced tweeter resonances noticeably degraded the mid range performance with selective test material. This is particularly evident on a lovely new disc from Virgin Records where "John Ogdon Plays Chopin" revealed new sounds which were never contained on the original recording. Once the frequency content gets beyond the 5 kHz region the speakers' performance is excellent all the way up to 16 kHz, and slightly beyond, if you happen to be sitting close to the main axis of the speakers.

The sensitivity of the 'Oracles' are relatively low and they require typically 14 watts of power to achieve 90 dB sound pressure level on axis at 2 metres. This means that to achieve 100 dB under normal listening conditions you would need to purchase at least a 60 watt amplifier.

The Richter 'Oracles' are a neatly designed, cost effective speaker system which offer a level of performance which can easily match any current speaker system that I have reviewed or assessed in the under \$500 bracket. The Richter 'Oracles' have of course some very worthy adversaries in the \$500 to \$1000 bracket, the majority of which appear to be at least one and a half times the recommended retail price of these speakers.

In terms of dollars per decibel, dollars for space (or appearance) and even dollars for performance, the 'Oracles' are well worth auditioning, particularly in your own home, where their positioning and the characteristics of the room will exert a considerable impact on the quality of the sound that they will produce. These are modestly priced speakers designed to offer a performance beyond that price. For once the designers appear to have been successful and the 'Oracles' currently appear to offer the most cost effective performance in their price range.

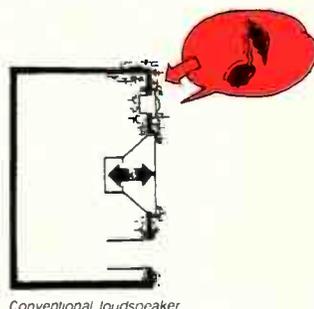
# EUROPE'S FINEST



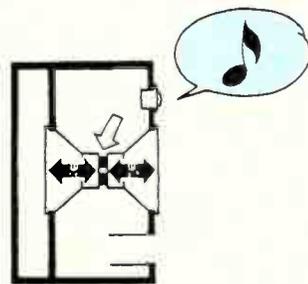
The new DALI-40 loudspeakers are the finest we have ever created. They incorporate technology and design features which make them technically and musically superior to virtually anything else available today.

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Conventional loudspeaker



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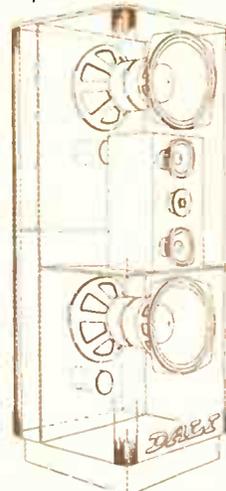


DALI-40 contains four PP-woofers with 25mm linear excursion

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# DALI

# Reviews



Alison Moyet — *Big and Breezy*.

**Artist — Alison Moyet**  
**Title — Raindancing**  
**Label — CBS**  
**Cat # — 450152 2**  
**Format — Not listed**

Alison Moyet is one of a new generation of British female pop singers who have been a delight to listen to over the last couple of years. She is also one of the better known ones, with regular releases of strong singles to guarantee her airplay.

This is her second solo album and although never really breaking new ground it is nonetheless a strong commercial offering. She delivers big production numbers easily, along with tight, bouncy rocky ones. The lyric themes are predominantly concerned with the many facets of love. That is, love going strange: "You Got Me Wrong" love escaping; "Stay"; and bittersweet love: "Glorious Love". Whilst on the surface this may appear turgid the lyrics are, in fact, cleverly constructed with Moyet herself being the largest contributor.

The better tracks are "Blow Wind Blow", which is sensual and haunting,

"You Got Me Wrong" with a terrific Bass and Drum feel, and "Is That Love", where Moyet effectively displays her considerable vocal dexterity.

There are ten tracks in all on this CD with the main production credits going to Jimmy Lovine. If you are already a fan then this release is a must. If not, it is a great introduction to a very talented vocalist.



China Crisis — *The Band (not the fire)*

**Artist — China Crisis**  
**Title — What Price Paradise**  
**Label — Virgin**  
**Cat# — CDV 2410**  
**Format — ADD**

China Crisis are a five piece British band of accomplished musicians. This CD is their fourth release and what a good effort it is. With styles as diverse as pop, orchestral, funk and jazz one gets the feeling these guys are having a ball. China Crisis offer great harmonies, clever use of synthesisers, strong rhythms and intelligently crafted songs. It should only be a matter of time before they become one of Britain's better known musical exports.

Best songs are "Worlds Apart", a funky

tapestry of understated keyboards, weaving rhythms and a brassy solo; "Hampton Beach", a slower, moody, orchestral/synthesiser piece; "We Do The Same", an upbeat tune with interesting studio effects, and "June Bride", a fun pop song with a great melody and tongue in cheek orchestration.

There are eleven tracks on this well produced CD (including one not contained on the album or cassette) and production is credited to Clive Langer and Alan Winstanley.

China Crisis deserves a listen.

— Mark Lewis

**Artist — Chicago Symphony Orchestra with Sir Georg Solti**

**Label — Decca**  
**Cat # 417400-2**  
**Format — DDD**

### 1812 OVERTURE

An overture that celebrates a 'pyrrhic military victory' in which 60,000 soldiers died from hunger and cold seems equally unlikely to reach the 'classical top 40'. In spite of such a difficult initiation, Tchaikovsky's 1812 is one of the most expansive, 'explosive' and yet poignant pieces of music in Tchaikovsky's repertoire and has been enjoyed by millions of music lovers.

This latest version of the 1812 from Decca is as dramatic and exciting an example as any I have yet heard and must be counted as one of the best versions currently available on CD.

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READER INFO No 23

The opening is considerably warmer, and I believe richer, than most other recent digital recordings of the 1812 with the violins and cellos being particularly well recorded and well balanced through almost optimum microphone placement.

The pace of the recording seems ever so slightly quicker than on any of the other discs and recordings of the 1812 that I own, and the trim, tight sound from the brass and drums ensnares you into the spirit of Napoleon's battles of 175 years ago.

As an example of modern digital 'DDD' recordings and of second generation CD disc recordings, this particular disc is one of the best that Decca has yet produced.

Orchestral Hall in Chicago is not one of the world's 'great halls' but Solti and the orchestra obviously warmed to the task with crescendos that are tight and expansive and which create an expectancy which is rewarded by the passionate re-statement of the melodic folk tunes and childrens' folk songs which Tchaikovsky so cleverly interwove into his musical plot.

Whilst the cannon on this particular recording are not quite as loud nor as explosive as they are on some discs (and

notably the Telarc 1812 which is at least six decibels louder) this is unlikely to disturb you if your loudspeakers haven't been selected to cope with 120 decibels of sound pressure level. In any event this disc is most probably the best 1812 that you can currently buy. (14.54)

Music quality ★ ★ ★ ★ ★  
 Realism ★ ★ ★ ★  
 Recording technique ★ ★ ★ ★ ★  
**ROMEO AND JULIET — FANTASY OVERTURE**

Tchaikovsky's sad love affairs led to his producing a poignant yet dramatic piece in which the violins cellos, and violas are exciting and yet still able to conjure up images of 'loves labour lost'.

Solti has produced one of the better or possibly even the best fully digital recording of the Romeo and Juliet — Fantasy Overture.

Although billed second on the disc, this particular excerpt is superb with tighter orchestration than in the 1812 and a sound which 'magically envelopes you'.

The recording technique used is extremely clinical, with the shuffling of musicians' feet being clearly audible in

quieter passages. I guess that if you want good recordings you really have to accept the result "wrinkles, warts and all". (20.15)  
 Music quality. ★ ★ ★ ★ ★  
 Realism ★ ★ ★ ★  
 Recording technique ★ ★ ★ ★ ★

**THE NUTCRACKER SUITE**

The recording technique used in this section of the disc appears to have deteriorated a trifle below the high standards of the first two pieces. The first three tracks of music sounds a little less clear and clinical than I would like, not unlike sitting a little further back in the hall where multiple reflections tend to compete with primary sound for our attention.

The cellist and the clarinet still have the magical characteristic, but the rest of the orchestra doesn't quite project as well. The last five tracks are somewhat richer and clearer but the orchestra never seems to quite reach the heights that they achieve in the 1812 and Romeo and Juliet.

Music quality ★ ★ ★ ★ ★  
 Realism ★ ★ ★ ★  
 Recording technique ★ ★ ★ ★  
 — Louis Challis

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**DENON** 

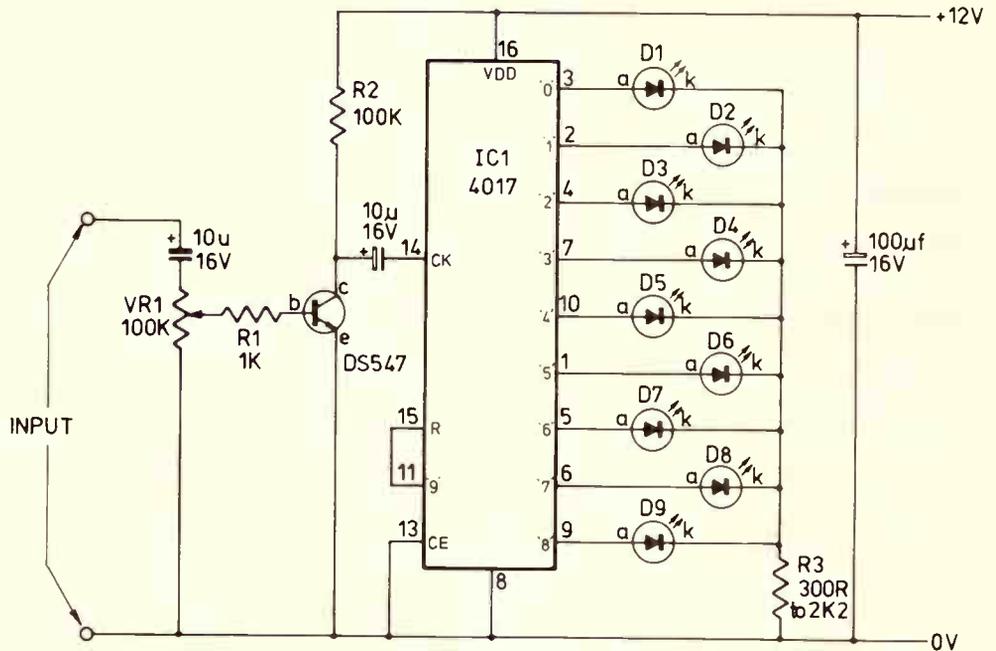
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T. Ho,  
Cremorne, NSW  
2090



Feed Forward needs your minds. If you have ideas for circuits that you would like to enter in our idea of the month contest, programs for the computing columns or just want a word with the editor, send your thoughts to:

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

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

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

## 'Idea of the month' contest

Scope Laboratories, which manufactures and distributes soldering irons and accessory tools, is sponsoring this contest with a prize given away every month for the best item submitted for publication in the 'Ideas for Experimenters' column — one of the most consistently popular features in ETI Magazine. Each month, we will be giving away a Scope Soldering Station (model ETC60L) worth approximately \$191.

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



## RULES

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

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

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

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

## COUPON

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

"I agree to the 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."  
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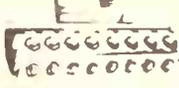
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## FEED FORWARD

```

00100 REM *** INTEREST CALCULATION PROGRAM ***
00110 REM written GARY HEGEDUS 1986.
00120 CLS
00130 INPUT"THE PRINCIPAL .....";P0
00140 INPUT"THE INTEREST RATE % . . .";I0
00150 INPUT"MONTHLY PAYMENTS .....";T0
00160 PRINT"IS INTEREST CALCULATED;"
00170 PRINT"MONTHLY?          enter M"
00180 PRINT"QUARTERLY?       enter Q"
00190 PRINT"HALF HEARLY?    enter Y"
00200 INPUT A1$
00210 IF A1$="M"OR A1$="m" THEN LET L=1
00220 IF A1$="Q"OR A1$="q" THEN LET L=3
00230 IF A1$="Y"OR A1$="y" THEN LET L=6
00240 REM B=B+1:REM MONTHLY COUNTER
00250 X0=X0+((I0*P0)/100)/365)*30 :REM =MONTHLY TOTAL INT.
00260 PRINT" MONTH No. "C;
00270 PRINT TAB(19)"(PRINCIPAL $"INT(P0)");";
00280 PRINT TAB(42)"INTRST. =""$"INT(X0)
00290 B=B+1:REM MONTHLY PAYMENT COUNTER
00300 C=C+1:REM MONTH NUMBER COUNTER
00310 P0=P0-T0:REM SUBTRACT INTRST FROM PRINCIPAL
00320 IF L=B THEN 330 ELSE 240
00330 P0=P0+X0:X0=0:REM ADD INT. & RESET INT. COUNTER
00340 B=0:REM RESET MONTH COUNT
00350 IF P0>0 THEN 240
00360 END

```

### Interest calculation

Taking on a new mortgage or just trying to cope with the old one can be quite a task, but trying to calculate repayments can be even more difficult.

Money lending societies and banks have different methods of calculating interest payments, so be sure that this program suits your needs before diving into debt!

This program calculates

daily balance interest, and accumulates that interest, and adds it to your principal monthly, quarterly or half yearly (depending on your selection). The program runs until the principal reaches zero, and gives the month number and interest accumulation.

G. Hegeous,  
Greensborough,  
Vic

## Minimart

**FOR SALE: SIEMEN TELEPRINTER.** Hooked up to use a computer printer. Reliable with a guarantee. \$85 Frank Rees, 27 King St, Boort 3537, Vic.

**FOR SALE: IBM PC type printer cables.** Two metres long. \$15 plus \$3 P&P. Don McKenzie, 29 Ellesmere Cres., Tullamarine 3043.

**FOR SALE: COMMUNICATIONS receiver.** Kenwood QR666 0.17-30 MHz AM/SSB/FMBC in very good condition. \$90. CHINON F301 3" disk drive unused with disk and specifications, \$80. Phone John (002) 23-2329.

**FOR SALE: CURRENT COLLECTION** of ETI magazines from September 1980. Offers Jim Berry, (08) 356 5786. 619 Burbridge Rd, West Beach, SA 5024.

**FOR SALE: REMOTE CONTROL** Futaba Yacht, hand made lwl 120 cm, beam 15 cm. Ideal for the enthusiast. Offers Simon O'Brien, (02) 693 9706.

**FOR SALE VIC-20 PROGRAMME LIBRARY.** Many interesting games, utilities, educational and miscellaneous programmes available. Send an SAE to Chris Groehout, 25 Kerferd St, Watson, ACT 2602 for a list.



```

00001 REM12345678901234567890123456789012345678901
00100 FORA=2309T0234B
00110 READB:POKEA,B:NEXTA
00120 DATA 22,128,33,0,248,6,16,62,255,150,245,35,5,120,194,12,9,1,16,0,237,66,6
,16
00130 DATA 241,119,35,5,120,194,29,9,21,122,254,0,194,10,9,201
00135 CLS
00140 FORA=0T0255:POKE61440+A,A:NEXTA
00150 S=USR(2309):REM .....CALLS THE ROUTINE.....

```

### ... Topsy turvy ...

This programme appeared in the October 1985 issue of ETI in BASIC. I have now converted it to machine code so instead of the two or three minutes it took to run, now it takes about a second.

The routine turns all the MICROBEE's character set upside down, which can then

be used however you like.

The machine code is poked into the REM statement in line one so make sure that this line is typed just as it appears.

**G. Heathcote,  
Ingleburn,  
NSW**

```

GETKEY EQU 8006H ;Wait for key
PRINT EQU 800CH ;Print to screen
LPRINT EQU 8045H ;Print to printer
LOUTBD EQU 00E3H ;List Output device byte
HANSHK EQU 0109H ;Zero if printer useable

OUTL#1 LD A,2 ;Set output to parallel
LD (LOUTBD),A ;port
LD A,0
LD (HANSHK),A
LD A,15
OUT (1),A
LD A,128
OUT (1),A
LD HL,F000H ;Clear the screen
LD DE,F001H
LD BC,03FFH
LD (HL),20H
LDIR

KEY$ CALL GETKEY ;Get the key
CP 13 ;if <CR> then
JR Z,LFCR ;jump to LFCR
CALL LPRINT ;Print to printer
LD B,A
CALL PRINT ;Print to screen
JR KEY$ ;Repeat

LFCR LD A,10 ;LF
CALL LPRINT ;Print to printer
LD B,A
CALL PRINT ;Print to screen
LD A,13 ;CR
CALL LPRINT ;Print to printer
LD B,A
CALL PRINT ;Print to screen
JR KEY$ ;Repeat

```

### Type-riter

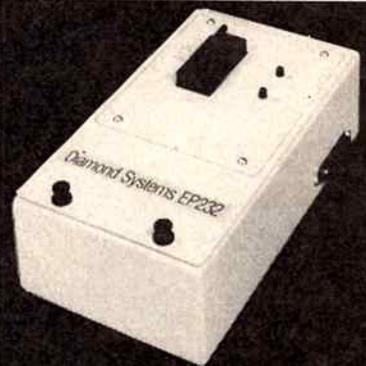
Used with any parallel port printer this program simulates a typewriter. The difference is that you correct each line before pressing (CR).

The equivalent in basic is:  
100 OUTL#1: REM Output to parallel port  
110 K1\$=KEY\$: REM Get key  
120 IF K1\$="THEN110: Check if

nothing  
130 LPRINTK1\$: REM Output to printer  
140 PRINTK1\$: REM Print to screen  
150 GOTO10: REM Repeat

**R. Morgans,  
Flagstaff Hill,  
SA**

# Programmiers



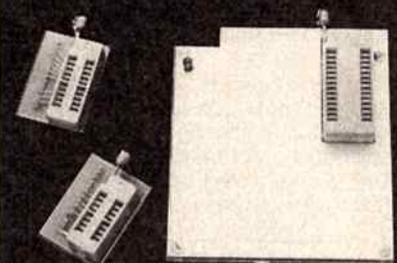
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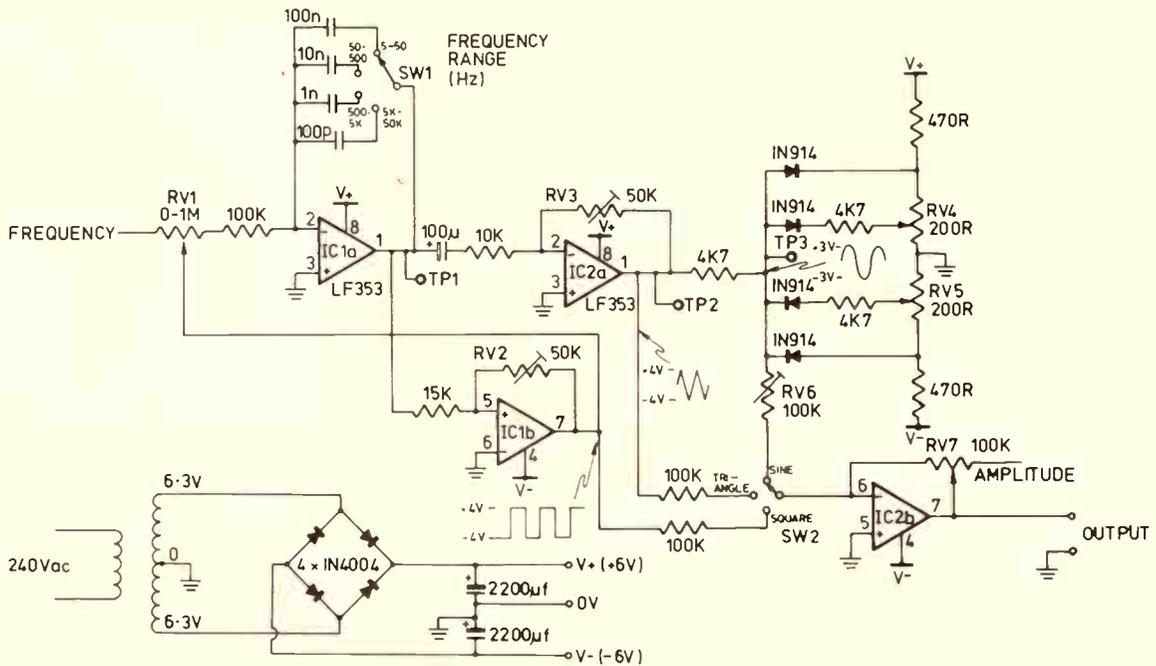
### ALL AUSTRALIAN

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READER INFO No. 27



## Simple Function Generator

In many cases of circuit design and test, a variable frequency and/or variable waveform signal source is required. However the cost of a commercial unit may not be justified. I designed the unit presented here using components "on hand" when a unit was required quickly and cheaply. It generates square, triangle and sine waveforms with a frequency range of 5 Hz to 50 Hz in four decade ranges.

The unit consists of four stages: a ramp generator, a comparator, a diode wave shaper and an amplifier.

IC1a is configured as an integrator which, when fed with

a dc voltage, generates a ramp, the rate of which is determined by the input voltage and the feedback capacitor and the input resistor. The feedback capacitor is switch selectable by SW1 to allow a number of frequency ranges to be selected. The input resistor, RV1, is variable to allow fine adjustment of frequency.

The ramp output is fed to IC1b which is configured as a comparator. Note that POSITIVE feedback is employed to provide hysteresis. The output of the comparator (which is either hard positive or hard negative) is fed back to the ramp generator. Thus the combination forms a triangle wave oscillator of variable frequency and con-

stant amplitude. The output of the comparator is a square wave of the same frequency as the triangle wave.

The sine waveform is synthesized from the triangle waveform using a diode wave shaping circuit. This generates an approximation of a sine wave using six linear segments. Because of the smooth nature of the diode characteristic, the waveform is a good approximation of the sine wave.

A switch, SW2, allows selection of waveform to be fed to the output stage, which also provides amplitude control.

Calibration is a relatively simple matter.

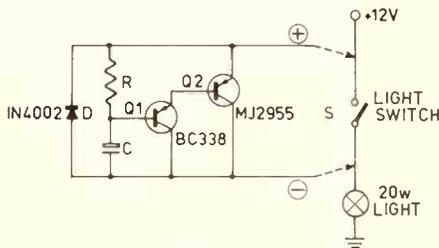
Firstly, frequency is calibrated for ONE range by adjustment of the 50k trimmer

RV2. With RV1 at maximum resistance and switch S1 at position 3 adjust RV2 to get a triangle wave of frequency 500 Hz at test point TP1. With ordinary capacitors, all other ranges will be within 10% of the stated range.

Adjust the 50k trimmer RV3 for a triangle wave of maximum amplitude but without distortion at TP2. Then adjust the two 200 ohm trimmers RV4 and RV5 to get a good sine wave at TP3.

Finally, adjust the 100k trimmer RV6 so that the sine wave amplitude seen at the output is the same as that of the triangle and square waves.

I. A. Curtis  
Vale Park, SA 5081



## Light delay

It would be desirable to have a few seconds more light after leaving a room and turning off the light switch; especially when

going up a staircase.

This circuit is designed for 12 volt dc-systems. It can be wired simply across an existing light switch, watching out for proper polarity. The advantage is that residual current is in fractions of  $\mu\text{A}$ , just enough to keep the capacitor charged up.

When S is closed the capacitor discharges through R, taking about two minutes. When S is opened after that minimum period, C starts immediately to charge via the

base/emitter path of both transistors. Charging current gets amplified through them and runs through the light. With  $C = 330 \mu\text{F}$  and  $R = 47 \text{ ohm}$  a 20 Watt light fades after 20 sec. The 2 transistors may be substituted by a BD 266 or similar. Heating will occur for about 1 minute. This is protection against spikes in the system, such as when using motors, relays or solenoids.

R. Sommerhalder,  
Mudgee, NSW 2850



```

1 REM THE SOUND MACHINE
5 REM Made By Steve Brown 1986
10 KEY OFF:SCREEN 2
20 LINE (0,0)-(639,0)
30 LINE - (639,200)
40 LINE - (0,200)
50 LINE - (0,0)
60 LOCATE 3,30:PRINT "THE SOUND MACHINE"
70 LOCATE 5,5:PRINT "1: Police Siren"
80 LOCATE 6,5:PRINT "2: Ships Siren"
90 LOCATE 7,5:PRINT "3: Water Drops"
100 LOCATE 8,5:PRINT "4: Laser"
110 LOCATE 5,30:PRINT "5: Telephone"
120 LOCATE 6,30:PRINT "6: Screeches"
130 LOCATE 7,30:PRINT "7: Flying Saucer"
140 LOCATE 8,30:PRINT "8: Random Sounds"
150 LOCATE 10,5:INPUT "ENTER NUMBER";N$
160 IF N$="1" THEN GOTO 300
170 IF N$="2" THEN GOTO 350
180 IF N$="3" THEN GOTO 400
190 IF N$="4" THEN GOTO 450
200 IF N$="5" THEN GOTO 500
210 IF N$="6" THEN GOTO 550
220 IF N$="7" THEN GOTO 600
230 IF N$="8" THEN GOTO 650
240 IF N$="" THEN END
300 REM Police Siren
310 FOR I=1000 TO 540 STEP -10:SOUND I,.5
320 NEXT I:FOR I=540 TO 1000 STEP 10:SOUND I,.5
330 NEXT I
340 GOTO 150
350 REM Ships Siren
360 FOR I=900 TO 1000:SOUND I,.089999999#:NEXT I
370 E$=INKEY$:IF E$="" THEN 380 ELSE 150
380 GOTO 360
400 REM Water Drops
405 FOR J=1 TO 5
410 I=100:I=I+1^1.01
420 SOUND I,40/I:IF I)1000 THEN 430 ELSE 440
430 SOUND 32767,30
435 NEXT J
440 GOTO 150
450 REM Laser
460 FOR J=1 TO 3:FOR I=2500 TO 2480 STEP -5
470 SOUND I,.5
480 NEXT I
490 NEXT J:GOTO 150
500 REM Telephone
510 FOR X=1 TO 30:SOUND 523.25,.5
520 SOUND 659.26,.5:NEXT X:FOR Y=1 TO 1500:NEXT Y
530 I$=INKEY$:IF I$="" THEN 510 ELSE 150
550 REM Screeches
560 FOR X=12000 TO 1400 STEP -100
570 SOUND X,.11:NEXT
580 I$=INKEY$:IF I$="" THEN 560 ELSE 150
600 REM Flying Saucer
610 FOR A=500 TO 1500 STEP 200:SOUND A,.5
620 NEXT A
630 I$=INKEY$:IF I$="" THEN 610 ELSE 150
650 REM Rnd Sounds
660 SOUND (2000*RND)+37,.5
670 I$=INKEY$:IF I$="" THEN 660 ELSE 150

```

**Sound Machine**  
 This program is written for the IBM PC and it uses the sound capabilities to the best of its ability.

S. Brown,  
 Salisbury Hts,  
 SA

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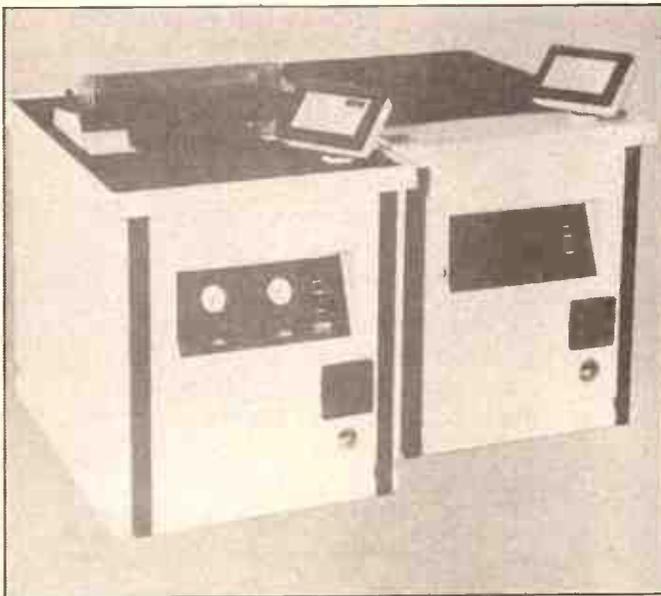
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READER INFO No. 28



## The Quest System

Quest Electronic Developments (QED) claims to have just received delivery of our country's first Computer Aided Printed Circuit Board Prototyping System. Apparently this device hails from Colorado Springs in the US and is being installed in QED's facility at Technology Park, Adelaide.

The new machine known as the CM 3000 will be distributed by QED which will also be offering a bureau facility for rapid turnaround on prototype boards. From re-

ceipt of a file from a user QED claims that it will guarantee a three day turnaround for a board as standard and a 24 hour premium service will also be made available.

The maximum board size that can be handled by Australia's first computer aided printed circuit board prototyping system is 254 x 420 mm with a minimum trace width of 0.010 inch and a minimum trace clearance of 0.10 inch.

R.I. No. 100

## Printer with an impact

Printers seem all the rage at the moment and Storage Technology of Australia has just released the 5000 Series model 21 Impact printer, which is said to provide "exceptionally high print quality and a maximum print speed of 2100 lines per minute. Printers using the technology provide better speed than dot matrix printers and quality as good as daisywheels.

The new printer, the Model 21, consists of a single hammerbank with its own dedicated electronics and the flexibility of 132 or 150 print positions. An additional option of 168 print positions is available. It is equipped with

a replaceable stainless steel print band containing 576 characters that are etched onto the band to provide high definition and long life. The 5000-021 band speed ensures superior print quality.

The model 21 is a freestanding unit containing a power supply, cooling and vacuum systems, print mechanism, control logic and powered stacker. It is also apparently compatible with a wide variety of IBM systems including the 370, 3000, 4300, 9300 series (4248 mode) and compatible processors. It retails for about \$82,000.

R.I. No. 101

## Labtam Graphics

The Labscope Color Graphics Terminal has just been released by Melbourne based Labtam. According to Labtam the Labscope "is a high performance, high resolution, state-of-the-art colour graphics display".

When this is connected into Labtam's range of 32 bit System V unix based system the Labscope becomes a powerful CAD/CAM and engineering workstation. Anyone who purchases this display will find that it has 23 graphic drawing commands, eight double buffered colour planes (256 from a palette of 24 million or 4096 colours, optional) and three extra planes for text, background and cursor at a density of 1024 x 800 pixels.

Labscope is said to cater to a range of applications, notable those in the CAD/CAM, publishing and research environments. It forms the basis of the Labstam CAD/CAM workstations which runs Labcad software and the University of NSW/RMIT developed VLSI design software.

R.I. No. 102

## The Compas Card

PAS has just announced its Compas card which is claimed to be a major breakthrough in providing low-cost access to x.25 communications.

The Compas card is said to provide a viable method for companies wishing to establish continuous branch-to-head office communications without incurring the high costs of lease lines and capital outlay for 3274 controllers and network interface adaptors at each respective location. Compas is supposed to carry all of these functions 'on board' as well as the appropriate terminal emulations.

It features an on-board CPU which controls all functions and the interface to the PC and the network is direct

memory access (DMA) supported, enabling the PC to interface in stand-alone operation with the network.

PAS claims that they have tested and proved the card in 240 different PC brands and models, including the Australian built MICA system.

R.I. No. 103

## New Xerox

The new version of Xerox's Ventura Publisher is said to incorporate no less than 80 new features into the design. Among the 80 are included; text files imported from the most popular word processing packages, graphic files from more than 500 graphics packages based on a dozen different file formats, etc.

Xerox claims that the number of graphics packages supported by Xerox Ventura publisher is more than five times greater than any other desktop publishing software. The earlier version of this device can be upgraded from July 1 at a one off cost of \$199.

R.I. No. 104

## New One Meg Chips

The American Intel corporation has developed military versions of two of its one megabit EPROMS (eraseable, programmable Read only memories) namely the 28-pin M27011 and the 40 pin M27210 which each capable of storing more than one million bits of data. Intel claims that these virtues offer military systems designers alternatives for applications, performance, and upgrade paths as they move into one-megabit memory densities.

The EPROMS are offered in windowed, ceramic dual in line packaging (CERDIP). They are organised as eight pages of 16 k x 8 bit words. Programming support is available from Intel's IUP 200/201 programmers with the addition of the new generic universal programmer interface (GUIPI) personality module. The one megabit EPROMS are available in volume, as they would need to be, and are priced at no less than \$US8.70 each. R.I. No. 105

## Philips Industrial Automaton

It seems no product news would be complete without some new announcement from Philips. Recently the company has announced the production of an all-new Industrial controller, the KS4580.

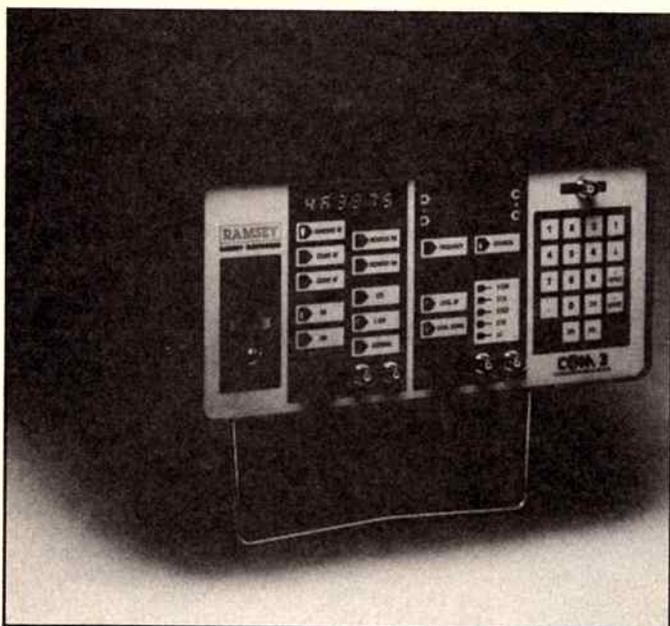
According to Philips this controller contains several features such as microprocessor-control, liquid crystal display and three-level operation from the splash protected, 96 mm square controller front; all of which are said to contribute to ease of use and accuracy.

Interestingly enough the operation of this machine is entirely transparent to the operator. All the control actions are displayed in stand-

ard symbols on a large, back-lit multifunction LCD which includes a bargraph for indicating the trend of any control deviation.

The KS4580 uses a three level operation by means of six tactile push buttons. The first level is composed of everyday operator functions which provide immediate access to set-value, process value and correcting variable. The second level permits the setting of the control parameters for tuning and controller to the loop and the third level is password-protected. It deals with configuration and allows the controller to be matched to its measurement and control tasks.

R.I. No. 106



## New Service Monitor

Associated Calibration Laboratories have been appointed distributors for Ramsey Electronics of the US. In this capacity they have released a new service monitor.

The new unit is designed for the communications service technician. Known as the COM 3 the monitor covers a frequency range

from 100 kHz to 1GHz and, apparently offers some unique features such as programmable offset keys and the ability of the units, encoder to generate all standard EIA subaudible sounds in the 50-300 Hz.

The machine weighs less than 6kg including the rechargeable battery pack. It sells for less than \$5000.

R.I. No. 107

## BRIEFS

Mosig and Bennet of Ballina have developed a car light Controller. The new controller will switch on the vehicle headlights automatically and will distinguish between parking and head lights. For more information ring (066) 86-6679.

**A new family of transient voltage suppressors designed to protect 4-20mA and 10-50m analog control loops has been released by General Semiconductor Industries. Delivery will take from 2 to 4 weeks. Price per hundred for the 4200LB versions start at \$45 while the 420LE plastic enclosure versions start at \$60. For further information ring Dave Huchins 0011 (602) 968-3101.**

The Queensland Railways has chosen TRW Fibre Optic Splice kits for use by communication maintenance engineers. TRW Optasplice Splice Modules use the Optaguide fibre alignment patented by TRW. For further information ring TRW (03) 288-4044.

**The Queensland Government has been given permission to buy a further 50 data earth stations as part of its Q-Net communications programme. It is estimated that the cost of purchasing the stations will come to \$986,400.**

ICOM Australia is set to release a new marine transceiver the M-700. The M-700, a 48 channel HF (High Frequency) SSB/AM marine transceiver, can transmit and receive on any authorised marine channel from 2 to 3 MHz with up to 150 watts output. For more about this transceiver ring (03) 51-2284 or (03) 529-7582.

**The JRC Cellular Tester NJZ-900 has just been released by Associated Calibration Laboratories. The new tester features a number of special features such as speech testing and general purpose tester capability in the Manual Test mode. Ring (03) 842-8822.**

Two new CAD/CAM terminals have been produced by Data-matic. The 2220 and 2320 are said to set new standards in price/performance. The two terminals are successors to the 3220. For further information contact Peter Wilson (02) 888-1788.

The Standards Association of Australia is looking for comment on a proposed new standard for colour television receivers which gives limits and methods of measurement of those parameters concerned with planning Australia's allocation of frequencies to various users. The Department of Communications intends to legislate enforcement of the finished document. Contact Jack Moncrieff, (02) 963-4111.

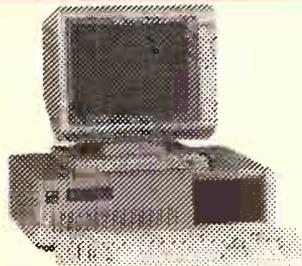
**A Kiwi Fruit logger has been released by Tech-Rentals. In essence the new device is a miniature temperature recorder which was developed to monitor the condition of perishable foods during transport. For more information contact the Tech-Rentals office in your nearest state capital.**

Scope Laboratories have released their model SR27 desolderor. This unit is claimed to have 2 1/2 times the suction capacity of the standard model. It sells for \$25. Further information can be obtained by ringing (03) 338-1566.

**An intelligent printer controller has been developed by Diamond Systems. The unit is designed specifically for the office and similar environments and allows four or five computers to be connected to two or three printers giving all users access to shared resources. For further information ring Diamond Systems, (03) 714-8269.**

The British have developed an automatic multistandard colour decoder unit which is claimed to be comparatively priced and is suitable for a range of applications where colour television signals are received in more than one coding standard. For further information ring Britain ISDE 635-68830 or Canberra 70-6666.

The British company Ultratnet Ltd is looking for an Australian partner to help it sell its range of data communication products including a packet switched system. For more information contact the British Consulates General in either Sydney (02) 27-7521 or Melbourne (03) 67-5879.



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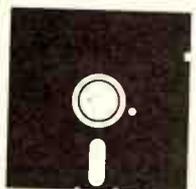
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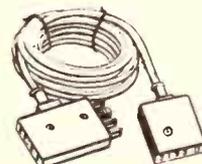
	1-9	10+	100+
2716	\$9.95	\$9.50	\$8.95
2732	\$8.95	\$8.50	\$7.95
2764	\$7.95	\$7.50	\$6.95
27128	\$6.95	\$6.50	\$6.25
27256	\$11.50	\$10.50	\$10.00
27512	\$19.50	\$18.50	\$17.50
4116	\$3.95	\$3.50	\$2.95
4164	\$2.25	\$1.95	\$1.75
41256	\$6.95	\$6.50	\$5.95
5558pin	\$0.50	\$0.40	\$0.35
6116	\$3.95	\$3.75	\$3.50
6264	\$6.50	\$6.00	\$5.75
6802	\$5.00	\$4.00	\$3.75
6821	\$2.00	\$1.80	\$1.70
6845	\$5.00	\$4.00	\$3.75
7406	\$0.40	\$0.30	\$0.25
INS8250	\$29.95	\$27.95	

### MEL9501

Have you blown up your Apple drive by plugging it in backwards or not turning off the power while changing boards? We have the MEL9501 chip! SPECIAL, ONLY \$29.95

### 8087

Genuine Intel chips with manual and data sheets packed in boxes!  
 8087-3 (4.7MHz) \$269  
 8087-2 (8MHz) \$385  
 8087-1 (10MHz) \$585  
 80287-6 (6MHz) \$475  
 80287-7 (8MHz) \$679



**TELECOMMUNICATIONS AUSTRALIAN STYLE ADAPTOR CABLE**  
 • Australian socket to plug socket  
 • Length 10 metres  
 Cat. Y16015 \$14.95



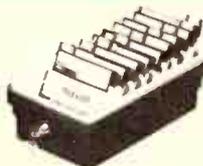
**TELEPHONE CURL CORD**  
 • U.S. plug to U.S. plug  
 • Replacement hand set cord  
 • Length 4.5 metres  
 Cat. Y16023 \$6.95



**TELEPHONE ADAPTOR**  
 • Australian plug to U.S. socket  
 • Length 10cm  
 Cat. Y16026 \$5.95



**TELEPHONE EXTENSION CABLE UNIT**  
 Allows 15 metres of telephone extension cable to be neatly wound into a portable storage container. The reel sits on a flat base and has a handle to wind cable back on to it after use. No tangles - no mess! Ideal for the workshop, around the house, office, pool etc  
 Cat. Y16013 \$22.95



**JUMBO 5 1/4" DISK STORAGE**  
 If you've got lots of disks, you'll appreciate the extra capacity of this disk storage unit when it comes to locating "that" disk!  
**Features...**  
 • 100 disk capacity  
 • Smoked plastic cover  
 • Lockable (2 keys supplied)  
 • 9 Dividers/spacers  
 C16020 only \$24.95  
 C16027 (Hinged Lid) \$26.95



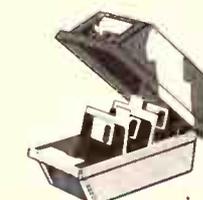
**5 1/4" DISK STORAGE**  
 Efficient and practical. Protect your disks from being damaged or lost!  
**Features...**  
 • 70 disk capacity  
 • Smoked plastic cover  
 • Lockable (2 keys supplied)  
 • Dividers/spacers  
 Cat. C16025 only \$19.95



**5 1/4" DISK STORAGE**  
 Efficient and practical. Protect your disks from being damaged or lost!  
**Features...**  
 • 50 disk capacity  
 • Smoked plastic cover  
 • Lockable (2 keys supplied)  
 • Dividers/spacers  
 Cat. C16030 only \$19.95



**3 1/2" DISK STORAGE UNIT**  
 • Holds up to 40 x 3 1/2" diskettes  
 • Lockable (2 keys supplied)  
 • High impact plastic lid and base  
 • Anti-static  
 Cat. C16040 only \$19.95



**3 1/2" DISK STORAGE UNIT**  
 • Holds up to 40 x 3 1/2" diskettes  
 • Lockable (2 keys supplied)  
 • High impact plastic lid and base  
 Cat. C16035 only \$19.95



**RS232 GENDER CHANGERS**  
 • Saves modifying or replacing non-mating RS232 cables  
 • All 25 pins wired straight through  
 Cat. X15650 Male to Male  
 Cat. X15651 Male to Female  
 Cat. X15652 Female to Female  
 Normally \$19.95 each  
**Only \$14.95**



**RS232C NULL MODEM ADAPTOR**  
 • Male to female connections  
 • Pins 2 and 3 reversed  
 • All 25 pins connected  
 Cat. X15657 Male to Male  
 Cat. X15658 Male to Female  
 Cat. X15659 Female to Female  
 Normally \$22.95  
**Only \$14.95**



**RS232 WIRING ADAPTOR BOX**  
 • Male to female  
 • 25 Detachable plug on leads  
 • 2 mini jumpers  
 • Ideal for experimenting or temporary connections  
 Cat. X15665 Normally \$39.95  
**Only \$29.95**



**RS232 MINI JUMPER PATCH BOXES**  
 • Interface RS232 devices  
 • 25 pin inputs  
 • 25 leads with tinned end supplied  
 • Complete with instructions  
 Cat. X15653 Male to Male  
 Cat. X15654 Female to Male  
 Cat. X15655 Female to Female  
 Normally \$25.95  
**Only \$19.95**



**RS232 MINI TESTER**  
 • Male to female connections  
 • All pin wired straight through  
 • Dual colour LED indicates activity and direction on 7 lines  
 • No batteries or power required  
 T D Transmit Data  
 D S R Data Set Ready  
 R D Receive Data  
 C D Carrier Detect  
 R T S Request to Send  
 D T R Data Terminal Ready  
 C T S Clear to Send  
 Cat. X15656 Normally \$39.95  
**Only \$29.95**



**PRINTER LEAD FOR IBM\***  
 • Suits IBM\* PC, XT and compatibles  
 • 25 pin "D" plug (computer end)  
 • Centronics 36 pin plug  
 Cat. X19029 1.8 metres \$18.95  
 Cat. X19030 3 metres \$29.95

**UV EPROM ERASER**  
 Erase your EPROMs quickly and safely. This unit is the most effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips)  
**Features include**  
 • Chip drawer has conductive foam padding  
 • Mains powered  
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 • Engineered to prevent UV exposure  
 • Dimensions 217 x 80 x 68mm  
**WITHOUT TIMER**  
 Cat. X14950 Normally \$119  
**Special, \$89**

**WITH BUILT-IN TIMER**  
 Cat. X14955 \$139  
**Special, \$119**



**"IBM\* AT COMPATIBLE" KEYBOARD**  
 • 100% IBM\* PC, XT compatible  
 • Low profile keyboard design  
 • Proper placement of shift keys with large key tops to suit professional typists  
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 • Cherry brand TS-M00001 19mm low profile switches, meet 30mm ergonomic requirement and provides high performance and maximum reliability  
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 • 3 Status displays  
**Just like the "Real McCoy" only at a fraction of the price!**  
 Cat. X12020 only \$129



**IBM\* XT & AT COMPATIBLE EXTENDED KEYBOARD (105 KEYS)**  
 These new keyboards are both XT and AT compatible!  
 • 20 Dedicated function keys  
 • Enlarged "Return" and "Shift" key  
 • Positive feel keys  
 • Low Profile Design, DIN standard  
 • Separate Numeric and Cursor control keypads  
 • Additional Functions  
 Key-in-lock, Audio Beep, Previous Word, Next Work, Fast Repeat, Line Feed, Pause, Clear Screen, Reset  
 Cat. X12022 ~~WAS \$299~~  
**SPECIAL, ONLY \$199**



**APPLE\* II SERIES COMPATIBLE JOYSTICK**  
 These joysticks have adaptor connectors to suit the Apple II, IIC, IIE and II+ computers. Features include selectable "spring centring" or "free floating" Electrical trim adjustments on both axis, 360° cursor control and dual fire buttons  
 Cat. C14201 \$49.95



**JOYSTICK FOR IBM**  
 Features Selectable "Spring centring" or "free floating" Electrical trim adjustments on both axis, 360 degree cursor control  
 Cat. C14205 \$49.95



### IBM XT COMPATIBLE CARDS

NEW! NEW! NEW! NEW!

**20M/BYTE HARD DISK CARD**  
XT compatible, simply plugs straight in to your computer!  
Cat. X18002 ..... \$1,195

**Colour Graphics Card**  
Cat. X18002 ..... \$129

**Graphics Card (Hercules compatible)**  
Cat. X18003 ..... \$145

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Cat. X18005 ..... \$59

**Floppy Disk Drive Controller Card (4 Drives, 16 Bit)**  
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**High Resolution Mono Card**  
Cat. X18007 ..... \$199

**Colour Graphics & Printer Card**  
Cat. X18010 ..... \$149

**768KB RAM Card (without memory)**  
Cat. X18012 ..... \$89

**Printer Card**  
Cat. X18017 ..... \$34.95

**Game I/O Card**  
Cat. X18019 ..... \$37.95

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Cat. X18020 ..... \$225

**Clock Card**  
Cat. X18024 ..... \$57.50

**RS232 Card (without cable)**  
Cat. X18026 ..... \$52.50

**RS232 & Clock Card**  
Cat. X18028 ..... \$95

**XT Turbo Motherboard (without memory)**  
Cat. X18030 ..... \$275

**Multi I/O & Disk Controller Card**  
Cat. X18040 ..... \$169

**I/O Plus Card**  
Cat. X18045 ..... \$129

**768K Multifunction I/O Card (includes cable but not 41256 RAM)**  
Cat. X18050 ..... \$199

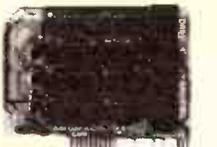
**Hard Disk Controller Card**  
Cat. X18060 ..... \$195

**Enhanced Graphics Adaptor Card (256K RAM on board)**  
Cat. X18070 ..... \$295

**64K Printer Buffer Card**  
Cat. X18077 ..... \$139

### (AT COMPATIBLE)

**Enhanced Graphics Adaptor Card (Award Bios)**  
Cat. X ..... \$495



### APPLE COMPATIBLE CARDS

**PRINTER CARD**  
Cat. X17029 ..... \$89

**DRIVE CARD**  
Cat. X17019 ..... \$79

**80 COLUMN CARD**  
Cat. X17025 ..... \$85

**SUPER SERIAL CARD**  
Cat. X17035 ..... \$119

**RGB CARD**  
Cat. X17039 ..... \$79

**PAL COLOUR CARD**  
Cat. X17027 ..... \$95

**280 C/M CARD**  
Cat. X17041 ..... \$59

### APPLE IIe COMPATIBLE CARDS

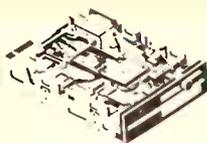
**80 COLUMN/64K CARD**  
Cat. X ..... \$69

**64K/128K CARD**  
Cat. X ..... \$69



### ANTI GLARE SCREEN

Half the price of other brands! Relieve eye strain and headaches and increase productivity with these Anti Glare Screens. Suitable for 12" monochrome and colour monitors.  
Cat. X99995 ..... \$24.95



### NEC DISK DRIVES

**3 1/2" DISK DRIVE**  
● 1 M/Byte unformatted, (640K formatted).  
● Double sided, double density.  
● Access Time 3m-sec  
Cat ..... \$265

**5 1/4" SLIMLINE**  
● Switchable 1.6 M/Byte to 1 M/Byte unformatted  
● 1.2 M/Byte to 720K formatted  
● Double sided, double density.  
● AT compatible  
Cat. C11906 ..... \$295

**8" SLIMLINE**  
● Double sided, double density.  
● 1.6 M/Byte unformatted  
Cat. C11908 ..... \$795



### SAMSUNG TTL MONITOR

A quality 12" TTL monitor, with a high contrast, non-glare screen at a very reasonable price!  
**SPECIFICATIONS:**  
CRT: 12" diagonal 90° deflection, non-glare screen  
Active Display Area: 216(H) x 160(V)mm  
Display Characters: 2,000 (80 characters x 25 lines)  
Scanning Frequency: Horizontal: 18.432 - 0.1KHz  
Vertical: 50 Hz ± 0.5%  
Description Cat.No. 1-9 10+ Green X14517 ..... \$189 \$179  
Amber X14518 ..... \$189 \$179



### SAKATA 13" RGB COLOUR MONITOR

High quality IBM compatible monitors, great with VCR's too!  
**SPECIFICATIONS:**  
CRT: 13", 90° deflection colour  
Input Signal: Video Signal: Separate video signal  
Video Positive  
Sync: Positive  
Input Level: TTL Level  
Scanning Frequency: Horizontal: 15.7KHz  
Vertical: 60Hz  
Display Size: 245(H) x 182(V)mm  
Resolution: Horizontal: 640 dots  
Vertical: 200 lines  
Cat. X14530 ..... \$695



### INTRIA 14" RGB HIGH RESOLUTION COLOUR MONITOR

Compatible with IBM and compatibles, and EGA Cards. Why pay more?  
Resolution: 640 x 350 dots  
Dot pitch: 31mm  
Display Format: 80 x 25 characters  
Cat. X14514 ..... Normally \$1,295  
Special, only \$795

### INTRIA 14" RGB COLOUR MONITOR

Resolution: 640 x 200 dots  
Display Format: 80 x 25 characters  
Display Colours: 16  
Dot pitch: 39mm  
Sync Horiz. Scan Freq: 15.75 KHz  
Sync Vert. Scan Freq: 50Hz  
Band Width: 18MHz  
Cat. X14520 ..... \$695



### RITRON 2 MONITORS

Stylish 20MHz, non-glare 12 inch monitors available in green or amber displays and featuring swivel base that lifts forward and back and swivels right to left!  
Green Cat. X14506. Normally \$235  
Amber Cat. X14508. Normally \$239  
SPECIAL, ONLY \$199

# ROD IRVING ELECTRONICS FOR ONE STOP BARGAIN SHOPPING!



**IBM COMPATIBLE DISK DRIVES**  
Tired of paying out more for Japanese Disk Drives? These "direct import" Hong Kong disk drives are the solution! They feature Japanese mechanical components, yet cost only a fraction of the price!  
Cat.No. Description Price  
X18011 500K ..... Normally \$199  
SPECIAL, ONLY \$179  
C11805 1.6 M Byte ..... \$259



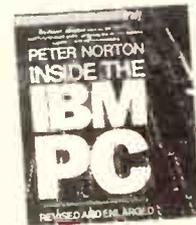
### PAPER TAMER

Restores order to the top of your desk or work area  
● Made of white plastic coated steel  
● Stores up to 900 continuous sheets  
● Allows perforated paper feed  
● Allows easy examination of print out  
C21050 (10") ..... only \$49.95  
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(Printer and paper not included)



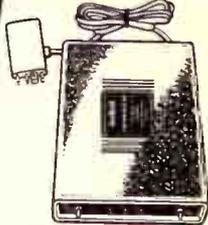
### CANON A-40 PRINTER

● Serial Impact Dot Matrix  
● 140 C P/S  
● Near Letter Quality Mode  
● 1.4K Buffer  
Cat. C20040 ..... \$595



### INSIDE THE IBM PC

(Revised and expanded edition)  
Peter Norton  
The widely acclaimed guide to the IBM PC's inner workings. The latest edition now covers every model of the IBM micro PC, XT and AT, and every version of DOS from 1.1 to 3.0 B20080 ..... \$44.95



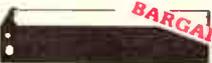
### SENDATA DIRECT CONNECT MODEM

● CCITT V21 300 baud full duplex  
● CCITT V23 1200/75  
● Bell 103 300 Full duplex  
● Bell 202 1200 Half duplex  
● Auto answer, auto disconnect  
● LED display for Power, TX, RX, CD  
● AC power adaptor included  
● DB25 pin connector  
● Telecom Approval No C8337/1045  
Cat. X19120 ..... \$295  
(SDFTWAVE FOR VIATEL \$95)



### 20 M/BYTE HARD DISK DRIVE FOR IBM AND COMPATIBLES

NEC drive with DTC controller card  
Cat. X20010 ..... WAS \$995  
SPECIAL, ONLY \$850  
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### PRINTER RIBBONS

CP80, BX80, DP80, BX100, MB100  
ALL A CRAZY LOW \$9.95



### PRINTER LEAD FOR IBM

● Suits IBM PC XT and compatibles  
● 25 pin "D" plug (computer end)  
● Centronics 36 pin plug  
Cat. P19029 1.8 metres ..... \$17.95  
Cat. P19030 3 metres ..... \$22.95



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### SUPER 5 EP-1201 DOT MATRIX PRINTER

● 120 C P/S  
● Price of Elite character set  
● Print Modes: NLO, Dot Graphics, Proportional Font, Draft  
● Proportional Printing  
● Reliable and Compact  
● Proportional Printing  
● Logic Seeking  
● 1K Printer Buffer  
Cat. C20035 ..... only \$595



### IBM PC TROUBLESHOOTING & REPAIR GUIDE

Robert C. Brenner  
Keep your IBM PC in top operating condition with this handy reference book. Inside you will find pages of schematics, photos and block diagrams to help you identify problems. Simple instructions tell you what's wrong and how to fix it fast.  
● Make most repairs with few or no tools  
● Quickly zero-in on a malfunctioning component  
● Reduces downtime  
● Pays for itself many times over in repair savings  
● Easy to understand circuit diagrams  
The IBM PC Trouble Shooting & Repair Guide will make even the computer novice feel comfortable with the complex world of electronic trouble shooting. This fully illustrated book is recommended for anyone who uses an IBM PC  
Cat. B ..... \$44.95



### APPLE COMPATIBLE SLIMLINE DISK DRIVE

Japanese Chinon mechanism, compatible with Apple 2+  
Cat. X19901 ..... Normally \$225  
SPECIAL \$199  
(Apple is a registered trade mark)



### PASCAL PRIMER

Michelle Waite, David Fox  
If you are learning programming or have dabbled in the popular language BASIC and wish to learn the capabilities of Pascal, this book is definitely written for you. Written and illustrated with a touch of humour, the informative text describes Pascal program structure Pascal variables, Pascal procedures and many other features. There are chapters on decision making statements, numeric functions, string functions, arrays and sets, and much more. The eight appendices present facts about the advantages and disadvantages of Pascal components of a Pascal system, interfacing assembly language routines, and other useful information  
Cat. B ..... \$24.95

### DB25 CONNECTOR SPECIALS!

We have just imported 50,000. So you get to save a small fortune!  
DB25 MALE (P10900)  
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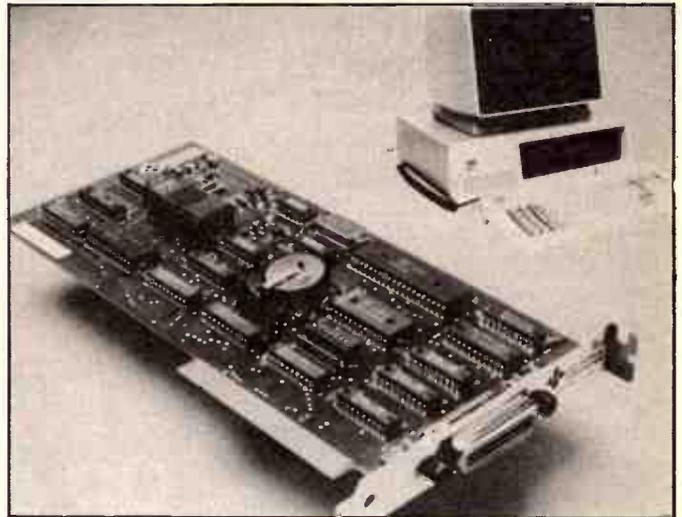


## Smart Card

The American company ICS electronics has developed a plug-in card for the IBM PC, PC/XT, PC/AT and compatibles which turns these personal computers into GPIB (IEEE 488 bus) controllers able to operate up to 14 independent test and measurement instruments or other devices. It is being released in Australia through Scientific Devices Australia. ICS claims that its card is about three times faster than industry standards. On individual commands the ICS card is "significantly faster".

What does it support? Ac-

ording to ICS the standard 488-PC1 card supports IBM Basic, BasicA and compiled Basic; other card versions are available to support a variety of languages including C and Turbo Pascal. It transfers data at speeds of 67 Kbytes/second using program I/O and to 300 Kbytes/second using DMA. The bus drivers meet all IEEE 488 specifications, and the driver routines are stored in an 8K x EPROM; The card accepts standard IEEE 488 cabling; It is powered from its host computer's power supply and draws 600 mA at +5 Vdc. **R.I. No. 114**



## Blowing Air

A newly designed and manufactured ionised air blower has been produced by 3M and Torin. The new machine, known as the 3M Model 909A Ionised Air Blower was designed in Sydney by 3M Static Control systems division and air movement specialist Torin.

The Blower is designed to eliminate the build up of static electricity on non-conductors, a continuous source of quality control problems in the electronics industry. Previous to this development the only ionised air blowers available in Australia have been imported from America. Normally this would be the end of the story however

3M and Torin were encouraged in their endeavours to develop an Australian product by two things. First of all the American machines required alteration to cope with Australia's 240 volts and secondly the downward spin of the Australian dollar made the American units vulnerable to local competition.

3M claims that unlike models previously available the 3M model 909A can be opened by the user for easy replacement of the ion source when it is depleted. Torin has also made provision in the unit for a heating element to be added when necessary.

**R.I. No. 116**

## Pulsar's Motherboards

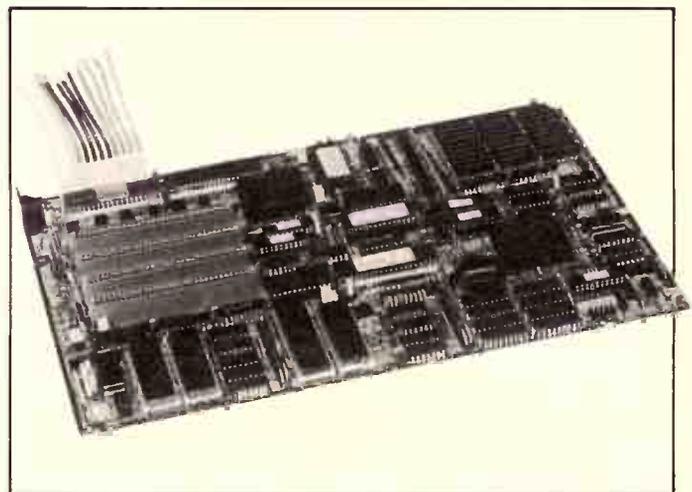
Yet another Australian company seems to have entered the lists of technological enterprise. Pulsar Electronics of Tullamarine Vic, has just released two PC compatible motherboards, the PC/XT and PC/AT, both of which have been designed for low power consumption, high speed operation, and to eliminate the need for additional function cards.

Pulsar informs the motherboard buying community that the new boards have been totally designed, developed and manufactured in Australia with a total Australian content in excess of

40 per cent. According to the manufacturers Systems built upon them can achieve Australian contents in excess of 70 per cent.

Pulsar claims that each of the new motherboards has EGA Monochrome text and graphics, Hercules, CGA, EGA and Plantronics video standards etc. Pulsar claims that both systems "are seen to be ideal as the heart of low-power industrial controllers, commercial stand-alone PCs, or as diskless workstations. Each has an on board audio driver and battery backed calendar-day-date real time clock.

**R.I. No. 115**



## CHMOS 128-kilobit EPROM

Intel has introduced a CHMOS 128-k EPROM (erasable, programmable, read-only memory).

Intel's 27C128, organised 16K by 8 is pin compatible with earlier HMOS 128-kilobit EPROMS, such as the 27128A and 110-nanosecond 27128B. The new 27C128, provides a maximum access time as fast as 150 nanoseconds and consumes 100  $\mu$ A during standby, 30 milliamperes when active.

The 27C128 is available in three different options, a 28 pin ceramic DIP; a plastic one time programmable package and a 32 lead plastic leaded chip carrier for surface mounting. In addition, Intel's Quick-Pulse Programming algorithm allows

the 27C128 to be programmed in less than two seconds which apparently is nearly a 100 fold improvement over programming times of previous algorithms.

R.I. No. 108

## Memory in a bubble

A Bubble Memory Driver has been imported by Macro Dynamics from RTC. It allows the use of Intel's IPCB-75 Bubble Memory card with RTC's PC/RTC, AT/RTX and RTX286 real time operating systems for IBM PC/XT/At computers. The device driver can be configured to provide 4Mb or 8Mb of random access bubble memory.

RTC real time, multitasking operating systems with bubble memory capability are said to be ideally suited to severe environment; diskless applications.

R.I. No. 109



## Simulating Interference

The name of the Schaffner Elektronik company may not be on everybody's lips but Westinghouse Systems is just about to be distribution of the German companies new ESD (Electro Static Discharge) simulator on to the Australian market.

The new unit will simulate electrostatic discharges in a range from 2 to 25kV. According to the company, it has been designed to meet all relevant national and international standards, and has capacity for expansion to meet future legislation.

R.I. No. 110



## Low Cost Signal Generator

The Fluke 6062A Synthesised Frequency Generator has just been released onto the Australian market by Elmeasco. It apparently has signal generation capabilities from 0.1MHz to 2.1GHz. The unit also includes a high-performance pulse modulator.

The pulse modulator uses gallium arsenide switch technology for rise/fall times of 15ns and on/off ratios of 80dB. The 6062A is appar-

ently designed for L-band applications in avionics, communication and navigation.

The output level of the 6062A is adjustable over the range of +16 to 137dBm (to 1050MHz), and +13 to -137dBm to 2100MHz. Absolute accuracy is apparently  $\pm 1$ dB. Amplitude can be displayed in volts, dBm, dB  $\mu$ V, or dB mV.

R.I. No. 111

## IBM's new RT PC

IBM have told us that their new RT personal computer system is "one of the industry's most powerful workstation systems". The new unit offers a one megabit memory chip, the densest microprocessor ever announced in a RISC (Reduced Instruction Set Computer) architecture machine. Like every new product these days the RT PC is claimed to be state-of-the-art.

The one megabit chip increases the memory of the RT up to 16 megabytes which is four times the capacity available on earlier models of the system. The improvements do not end there, a newly developed 32-bit microprocessor has doubled the RT's processing power. The new chip is apparently being made using Complementary Metal-Oxide Semiconductor (CMOS) technology. IBM say that this is a high performance, cool running chip that

is as thin as one micron.

IBM also claim that the RT PC offers a unique optimizing program compiler which generates extremely efficient machine code. This apparently produces performance gains of 10 to 20 percent over standard compilers.

R.I. No. 112

## Tektronix's CAE Software

The Tektronix company has released new CAE software called Designer's Database Schematic Capture (DDSC) and HILO-3 Logic Simulation System software on Digital Equipment Corporation's new VAXstation 2000 Desktop Workstation.

This software is designed to provide tools for use in computer-aided engineering (CAE) applications. The software may also, apparently, be used with any of Digital's VAXstation group of high performance workstations. It is also supported by Digital's Local Area VAXcluster Systems.

R.I. No. 113

# STEREO CHORUS ENSEMBLE

Fatten up your keyboard or guitar sounds with this multiple image chorus unit. Its in stereo too!

**Terry Kee**



The chorus effect is probably familiar to most musicians. It produces an effect of sound being emitted in harmony from a multiple source, hence the word 'choral'. It can be used with synthesizers notably of the digital sort, which have string voices that sound very 'unstring'. In this application the chorus unit really does enhance the effect, making it sound much smoother and realistic. Guitar sounds also sound creamier and richer. The stereo effect enhances the chorus effect further and adds an extra dimension to the sound image.

## Description

The unit converts a mono signal source to stereo. It is a true stereo device in that 2 completely separate delay channels are used. The delay times are modulated in anti-phase so that when one delay line is

at maximum delay the other is at minimum and vice versa. The unit is also unusual in that it has a modulation facility to enhance the choral effect. The chorus effect is obtained by varying the delay time of the delay line, around 10 mS, and adding it to the original signal. The result is a signal with notches in its response that are swept up and down in frequency. Bucket Brigade Devices (BBD's) are used to delay the signal.

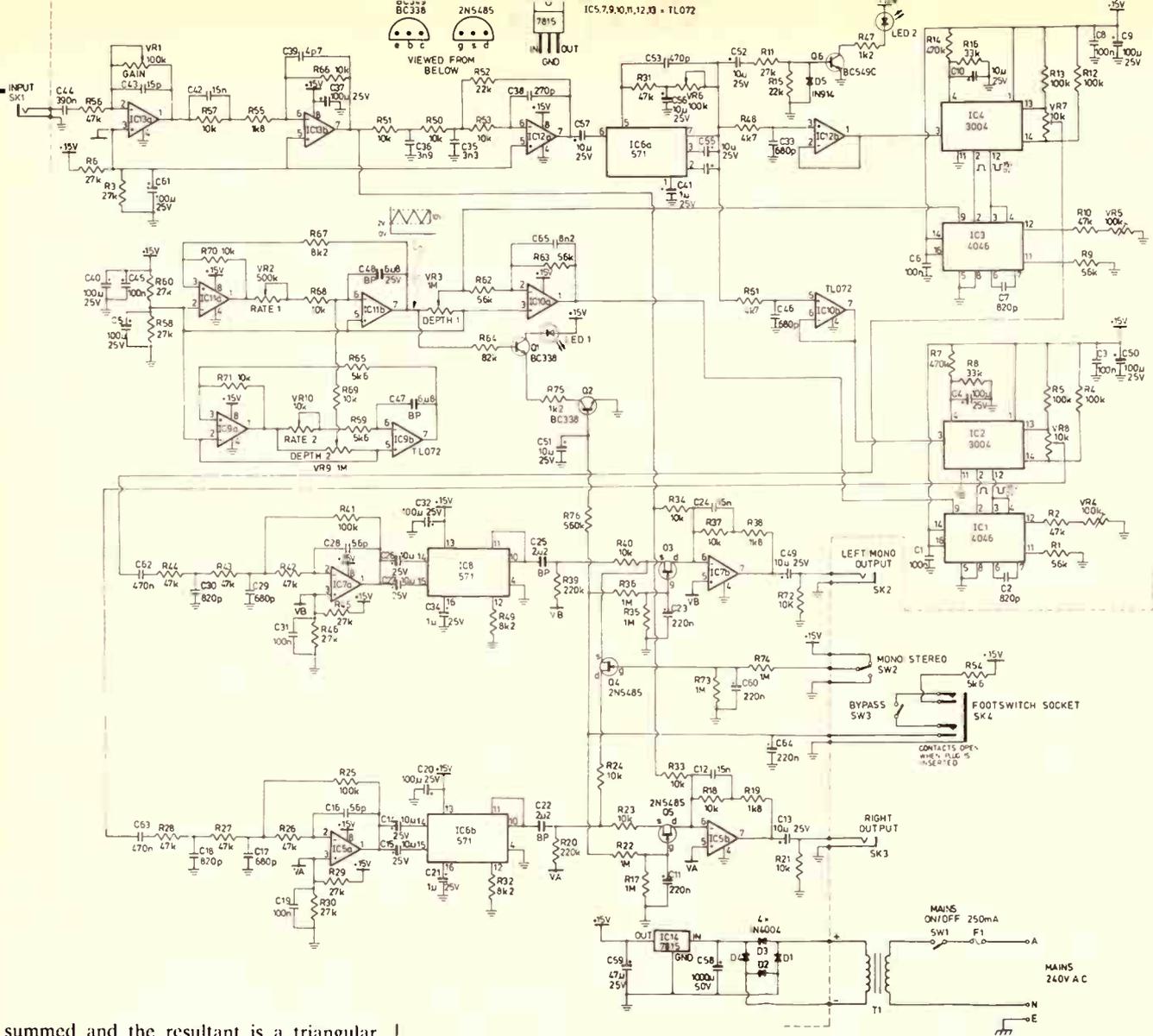
For musical applications the major problem with BBD's is that they are inherently noisy devices. In this unit the problem is attacked by incorporating companding to boost input low level signals out of the noise floor of the delay line and perform the complimentary actions at the output to restore the original levels. Pre-emphasis and de-emphasis reduces the noise even further. The block diagram shows the gen-

eral outline of the unit.

The signal in the BBD is sampled at a rate determined by the clock generator. To prevent aliasing from occurring the sampling frequency has to be at least twice the maximum bandwidth of the input signal. There is a further consideration in that for minimum distortion through the MN3004 the bandwidth of the input has to be about a third of the sampling frequency. The input low pass filter limits the bandwidth to about 9 kHz so the minimum frequency is limited to about 24 kHz. This corresponds to a maximum delay of 10 mS. The signal is buffered to ensure that the 2 channels are separated to keep clock intermodulation whine and whistles to an absolute minimum. The buffered signals are then fed to the BBD's in the left and right channels.

Because of the limited signal voltage swing of 1.8 Vrms through the MN3004 care must be taken not to overload the device. To help the user set up the correct levels for maximum performance, a level LED is designed to start turning on at about 0 dB, leaving a further 5 dB headroom before clipping commences. Extraordinary care was also taken to keep the power supply rails squeaky clean, hence the use of all the decoupling capacitors. HF circuitry was physically separated from the audio path as far as possible.

The voltage control clock generators for both channels are set to approximately the same range of frequencies however they are modulated in anti-phase. This means that when one is at maximum frequency the other is at minimum frequency, producing minimum and maximum delay times respectively. The clock frequency range is roughly between 24 kHz and 100 kHz. The modulation range can be set internally. The VCO clock generators are modulated by 2 low frequency triangular oscillators of which both the frequency and amplitude can be varied by controls on the front panel. The outputs are



summed and the resultant is a triangular waveform with a high frequency superimposed on it. The effect of such a waveform is that the stereo image pan rate is determined by the lower frequency waveform and the apparent multiple imagery by the faster one. An inverter inverts the output to drive the clock generators in anti-phase. The depth 1 control varies the overall modulation level.

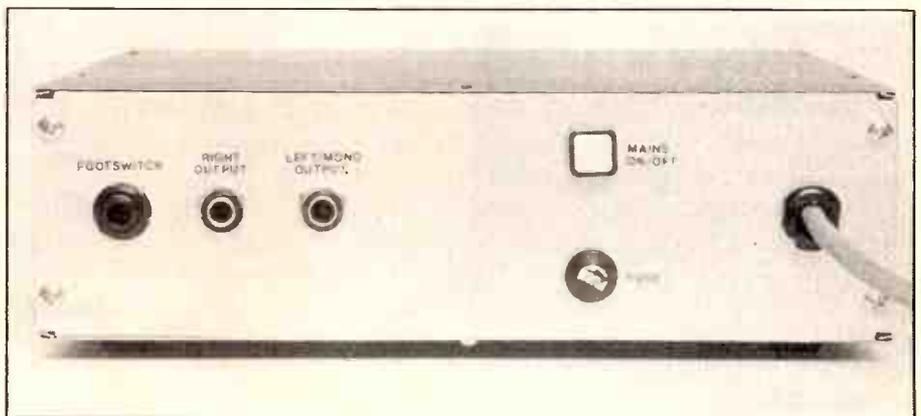
The delay line outputs are then fed to their respective low pass filters which smoothes out the sampled signal and filters out the clock components. After expansion the audio is passed through a FET switching network, which allows the chorus effect to be switched in or out. As an option a remote footswitch can be plugged in to bypass the switch on the front panel. DC switching voltages are used throughout to minimise hum and noise pick-up. A mono/stereo switch allows the output of the delay lines to be added together to give a similar chorus effect without the stereo imagery. The mono output is made accessible at the left output.

### Construction

The project is built on a single-sided pc board. Start by inspecting the pc board for any broken or bridged tracks. Once you are satisfied that the pc board is perfect the links, resistors, capacitors and presets can be mounted and soldered in. Take care with the correct orientation of the

electrolytics. The use of a finely tipped soldering iron is recommended as some of the pads are quite close to tracks.

The ic sockets comes next. Note that all the ic's face the same direction. Leave the ic's out for the moment. Next insert the transistors, regulators, FET's and diodes making sure of their correct orientation.



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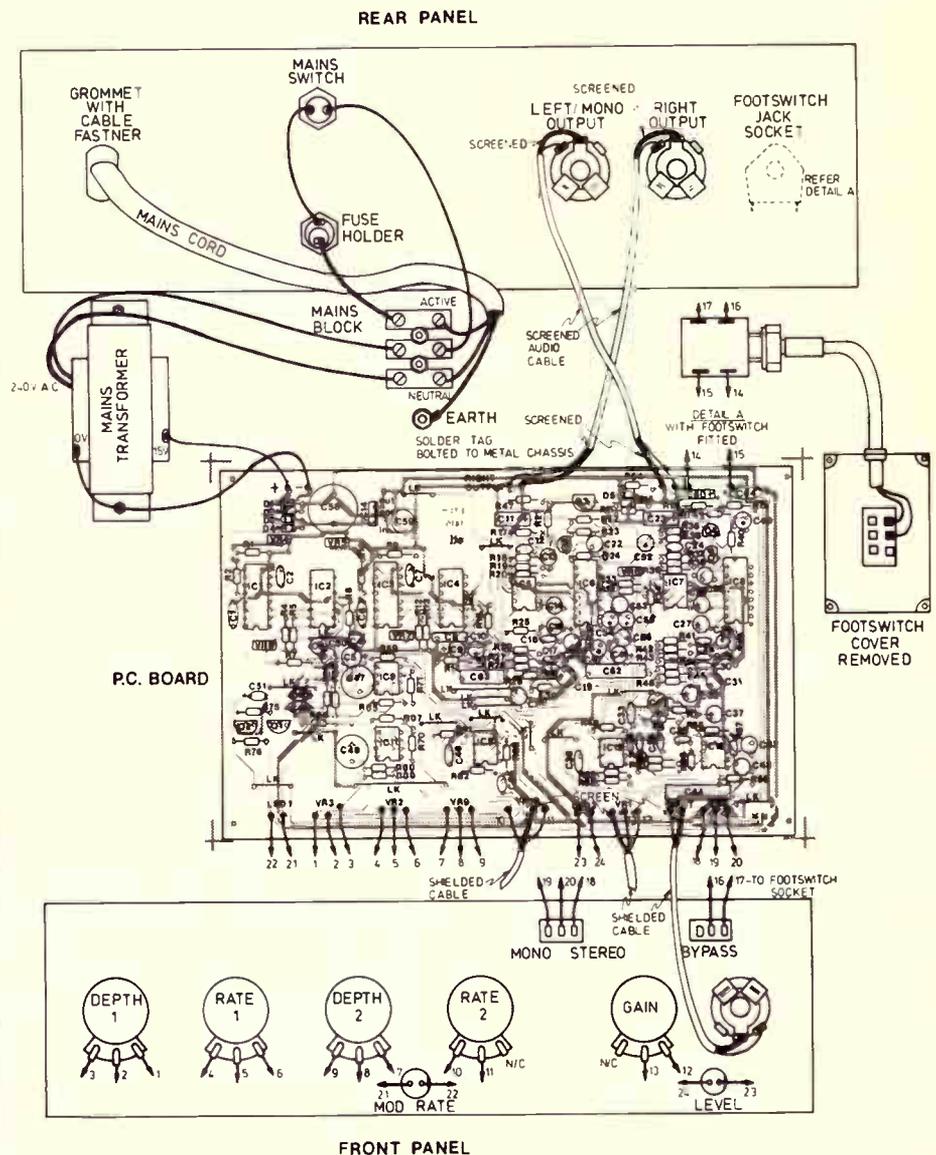
82 — ETI July 1987

Use the scotchcal as a template and align it so that the corners square up. Mark the centres of the holes with something sharp like a drill bit, then take the template off and drill the holes. Do the same for both the front and back. Use a reamer to open the holes to the correct diameter. Drill the holes for the pc board, mains block, earth tag and transformer. Mount the transformer as far away from the audio inputs as possible to minimise hum pick-up. Note that the earth tag has to be bolted down onto the metal chassis of the box.

Clean the front and back panel before sticking down the scotchcal panels. Cut

the holes out with a sharp knife or scalpel. Next cut the pot shafts to a length to fit your knobs and mount them along with all the sockets, switches, mainsblock, fuse-holder and transformer.

The mains cord should enter the box via a rubber or plastic grommet with an anchor clamp. The Active and Neutral connections should be terminated into a mainsblock. Refer to the wiring diagram. Solder the Earth wire directly to the earth tag on the chassis. It's a good idea to tin the mains wire with solder to ensure a good solid contact. Next wire in the fuse-holder, mains switch and transformer.



## Parts List

**Resistors**.....  
All 1/4 W Metal film, 1% unless stated otherwise

R1, 9	56k, 5%
R2, 10, 56	47k, 5%
R4, 5, 12, 13	100k, 5%
R7	470k, 5%
R8	33k, 5%
R20, 39	220k, 5%
R21, 31, 34, 68, 69, 70, 71, 72	10k, 5%
R32, 49, 67	8k2, 5%
R47, 75	1k2, 5%
R54, 59, 65	5k6, 5%
R64	82k, 5%
R76	560k, 5%
R3, 6, 11, 29, 30, 45, 46, 58, 60	27k
R14	470k
R15, 52	22k
R16	33k
R17, 22, 35, 36, 73, 74	1M
R18, 23, 24, 33, 37, 40, 50, 51, 53, 57, 66	10k
R19, 38, 55	1R8
R25, 41	100k
R26, 27, 28, 42, 43, 44	47k
R48, 61	4k7
R62, 63	56k
VR4, 5, 6	100k 5mm vertical miniature trimpot
VR7, 8	10k 5mm vertical miniature trimpot
VR1	100k log pot
VR2	500k linear pot
VR3, 9	1M log pot
VR10	10k linear pot

**Capacitors**

C1, 6, 19, 31, 45	100n greencap
C2, 7, 18, 30	820p ceramic, 10%
C4, 5, 9, 20, 32, 37, 40, 50, 61	100µ/25V pc mount electro
C8, C3	100n miniature ceramic
C11, 23, 60, 64	220n/35V tantalum
C12, 24, 42	15n greencap
C10, 13, 14, 15, 26, 27, 49, 51, 52, 54, 55, 56, 57	10µ/25V pc mount electro
C16, 28	56p ceramic 10%
C17, 29, 33, 46	680p ceramic 10%
C21, 34, 41	1µ/25V pc mount electro
C22, 25	2µ/25V Bipolar electro
C35	3n3 greencap
C65	8n2 greencap
C36	3n9 greencap
C38	270p ceramic 10%
C39	4p7 ceramic 10%
C43	15p ceramic 10%
C44	390n greencap
C59	47µ/25V pc mount electro
C62, 63	470n greencap
C47, 48	6µ8 25V Bipolar electro
C53	470p ceramic 10%
C58	1000m/50V pc mount electro

**Semiconductors**

IC1, 3	4046 Phase lock loop
IC2, 4	MN3004 512-Stage BBD
IC5, 7, 9, 10, 11, 12, 13	TL072 Dual Op-Amp

IC6, 8	571 Companding IC
IC14	7815 Regulator
DI to 4	1N4004 Rectifier Diodes
D5	In914
Q1, 2	BC338
Q6	BC549C
Q4, 5, 3	2N5485 N-Channel FET

**Miscellaneous**

T1	0-15V transformer at 1A
F1	M205 Panel Mount Fuse holder and a 250mA fuse
SW1	Push button on/off switch rated at 240VAC
SW2, 3	Miniature toggle switch SPDT
SK1, 2, 3, 4	6.5mm Mono Insulated Jack Socket (contacts closed when plug is not inserted) IC sockets, mains cord, heavy duty footswitch suitable diecast box for foot switch, metal cabinet (Horwood cabinet 203 x 102 x 254mm) or similar.

Price estimate \$158 (includes cost of power supply and cabinet but excludes the optional footswitch). The MN3004 BBD's are available from Radio Spares, 6c Durdans Avenue, Rosebery, 2018, NSW.

Only use suitable 240 Vac cable for all mains connections. Cover all exposed wiring with suitable heatshrink sleeving. Be extra careful with mains wiring, recheck your work. LIVE WIRES CAN KILL.

Use audio screened cable for the input and output connections. Keep the input wire as short as possible to avoid pick-up. Use a short length of twin screened cable to connect in the Rate 2 pot. Cut off the screened wire at the pot end. The rest of the wiring can be done with hook-up wire. Refer to the wiring diagram.

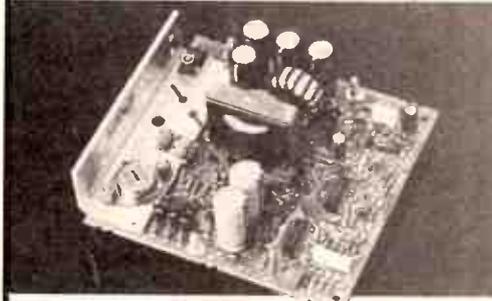
Any suitable rugged box can be used to house the footswitch. I used a small diecast box (110 x 60 x 30mm) with a 5m length mains cable terminated in a mono jack plug.

### Testing

Start by checking the pc board for dry joints and especially for solder splashes across adjoining tracks. Before the unit can be fired up properly the voltages rails need to be tested. Without any of the ic's inserted check that the dc voltage is within 500mV of 15 volts. Do not forget to put in a 250mA fuse into the fuse holder.

Once the correct voltages has been established switch off the power and wait until C58 has discharged before inserting the ic's. Take the usual precautions with handling all the MOS devices. The BBD's are particularly electrostatic sensitive devices. Before switching on again check the

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3T 5AN6030	+20 to +60V	-4.5 to -30V	5A

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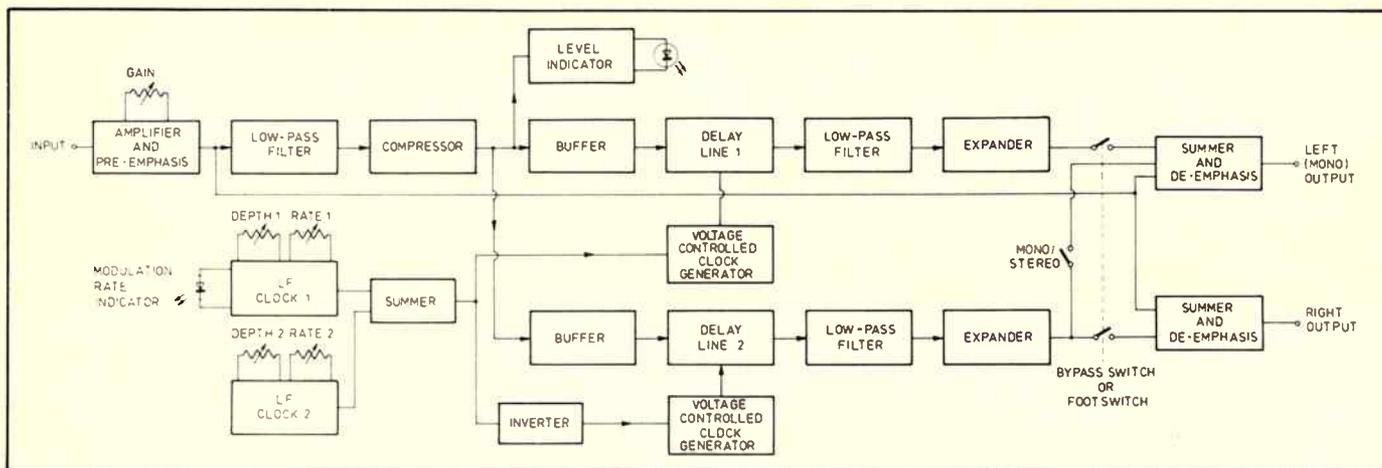
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orientation of all the ic's. If everything is okay you should see the modulation LED flashing when the switch on the front panel is switched to the chorus mode.

Set your multimeter to measure dc voltage and with the gain control turned down to the minimum, put the probe at pin 1 of IC12b, adjust VR6 for a reading of 7 volts. This sets up the input dc bias of the MN3004's. Next apply a 500 Hz sine wave and adjust the gain control until the level LED just starts to light up. Put a scope probe at the wiper of VR7 and VR8. You should see a 500 Hz sine wave with a clock signal superimposed on it. Adjust VR76 and VR8 for the minimum clock amplitude. If you do not have access to a

CRO then set the 2 presets midway, this adjustment only affects the distortion marginally.

The final adjustment is a personal one. The setting for the deepest chorus effect depends on the type of instrument you intend to use, obviously the harmonic content of a synthesizer voice will be vastly different to a guitar. Plug in the instrument, adjust the gain for a reasonable level and listen to the output. With the unit set to chorus, turn the Depth 1 control to maximum and the Rate 1 control to a fairly slow rate. Turn the Depth 2 control to the minimum and set to the stereo mode while you are doing this test.

A synthesised string voice is a good

sound source if you intend to use the unit mainly for keyboards. Play a chord, listen to the left output and adjust VR5 for the smoothest and deepest sweep. Repeat with the right channel except you adjust VR4. Listen to the output in stereo and you should hear the sound swirl from left to right and back again. Good eh! Turning up the Depth 2 control should bring in a slight warble effect. Note that overmodulation will cause a distinct pitch bend particularly when the Rate 1 control is set to the fastest rate. Reducing the overall modulation level via the Depth 1 control will eliminate the pitch bending. It's now up to you to experiment with all the controls.

## ETI-1416 HOW IT WORKS

IC13a is configured as an inverting amplifier with an input impedance of 47 k so is capable of accepting keyboards, guitar and line inputs. The gain is variable from full attenuation to a maximum of 6 dB using VR1. The pre-emphasis circuit built around IC13b and associated R's and C's boosts signals above about 1 kHz with a maximum gain of about 14 dB.

The signal is then fed to a 3-pole low pass filter configured around IC12a. It limits the bandwidth to about 9 kHz with an 18 dB per octave slope. Using 1 per cent tolerance resistors helps keep the cut-off frequency within the tolerance of the capacitors, around 10 per cent.

As the circuit is powered from a 0 to 15V supply the op-amps are biased to around 7.5V using resistor potential dividers. One half of IC8 (571) is connected as a compressor with a 2 to 1 compression ratio that is set internally to the device. The resistors R31 and VR6 sets the dc level and is made variable to set the dc bias of the BBD's (IC2 and IC4) to 7V which is the optimum value for the MN3004. The signal is ac coupled via C52 and sent to the level indicator configured around Q6. A resistor pair R11 and R15 divide the signal level to turn Q6 on at about 0dBm. The diode D5 protects the base-emitter junction of Q3 against excessive reverse biased voltages.

The signal is then split to drive the left and right channels. To simplify the circuit description only one channel will be discussed. The audio path is buffered by IC12b and along with a low pass filter R48 and C33 prevents hf clock components from getting back into the audio path and causing clock intermodulation noise. The Panasonic BBD (MN3004) re-

quires a 1V dc voltage at pin 4 with a 15V supply and this is supplied via R14 and R16 and decoupled by C10. The output of the MN3004 has a clock null facility provided by VR7, and is used to adjust the clock amplitude to a minimum. IC3 is actually a phase-lock loop (4046) however, only the VCO part is used. As the MN3004 requires an anti-phase signal to clock it, an exclusive or gate internal to the 4046 is used as an inverter. The result is an inverted clock signal at pin 2 of the 4046. With the modulation waveform generated by IC9 and 11, the minimum clock frequency is set to around 24 kHz.

The frequency range can be adjusted by VR5, turning it fully anti-clockwise will give an approximate 24 kHz to 62.5 kHz range and with it fully clockwise will give a 66 kHz to 100 kHz range.

IC10a and b are connected as a simple triangular oscillator. IC10a is configured as a schmitt trigger that drives an integrator IC10b. VR2, R68 and C48 determine the frequency of oscillation and the range is approximately between 0.14 Hz to 7 Hz. The output level can be varied via VR3. The output is inverted by IC10a to produce the anti-phase modulation signal to drive IC1. The second triangular oscillator consisting of IC9a and b is identical to the first one except the frequency range is set between 4.7 Hz to 13 Hz. Again the frequency and amplitude can be varied using VR10 and VR9 respectively. The outputs are summed in IC11b so the Depth 1 control will determine the overall modulation level. Pin 7 of IC11b is also fed to a transistor LED driver Q1 which turns LED 2 gradually on and off at the modulation rate. Q2 is turned on when the chorus effect is selected to be modulated by the oscillator and thus give a visual indication when the effect is

switched in.

The output of the MN3004 (IC4) is ac coupled via C62 to a third order low pass filter constructed around IC7a, in order to filter out the clock components of the sampled waveform. The biasing arrangements for the op-amps of the two channels are intentionally separated to minimise clock intermodulation between the two channels.

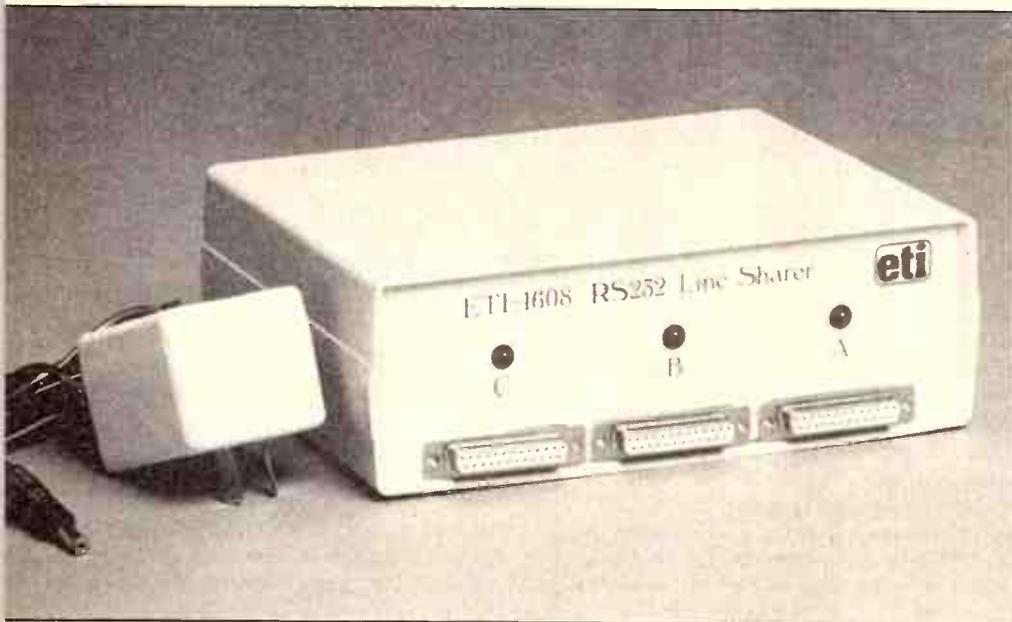
IC8 is the expander that performs the 2 to 1 complimentary expansion. The signal is ac coupled into pin 14 and 15 of IC8 to improve low level signal tracking. R49 is used to bias the output to 7.5V to maximise the dynamic range. The expander output is then fed to the de-emphasise circuit built around IC7b. It attenuates the signal above about 1 kHz to compliment the pre-emphasis at the input. IC7b also acts as an adder, adding the original pre-emphasised signal from pin 7 of IC13b to the delayed signal. Furthermore the virtual earth junction of IC3b is used for FET switching of the chorus/bypass and mono/stereo mode. The small signal levels across the FETs allows low distortion operation. Switching voltages are 0 to 15V. When the chorus mode is selected Q5 and Q3 are switched on and the delayed outputs are summed in IC7b and IC5b with the original. In the mono mode the outputs of IC8 and IC6b are added together with the original. Both outputs are ac coupled by C49 and C13. The footswitch jack socket SK4 is wired so that when the jackplug is inserted the normally closed contacts are opened and the bypass switch (SW3) on the front panel is bypassed. The circuit draws a dc current of about 45mA.

See page 108 for dia.

# RS232 LINE SHARER

Make three RS232 ports out of one with this cheap, easy to build project.

S. K. Hui



IN OUR OFFICE, we have DB25 sockets in the wall to provide connection to the local mainframe. The problem is we don't have enough, so that a single socket must be shared by the IBM-PC, the plotter for our CAD system and the line printer. To add to the problem, we need the IBM to act as host for either the plotter or the printer, and for other terminals in the network to be able to drive the printer. At the moment we solve the problem of connecting all this together by plugging and unplugging cables as required. It's messy, frustrating, and what's more, wears out the plugs in a surprisingly short period of time.

What we need is a switch. It needs to be able to switch a few ports, and be bidirectional as well so that it doesn't matter whether one is dealing with inputs or outputs. It would also help if it had the additional flexibility of being able to be config-

Artwork available from ETI reader service ph. (02) 693-6666. Completed circuit boards and panels may be obtained from RCS Radio (02) 587 3491.

ured to fit the wiring pattern of individual units.

This is the motivation behind the ETI-1608 RS232 Line Sharer. Although the application of this project seems to be limited to the professional market, the design is flexible enough to cater for individuals. Its features could be reduced (along with the cost) during the construction process to suit hobbyists. No extra work is required to achieve this economical version except putting less components on board.

The fully configured version can switch one input port to any one of the three output ports (8 lines per port) at a flick of a switch. But that is not the end of the story. The unit can also be used in a reverse sense, allowing three computers to share one peripheral such as a line printer. Each port can be configured individually to save the pain of having another RS232 break-out box external to the unit.

## Design approach

After a glance of the circuit, I can hear a lot of you say: "What, no ICs??" The answer is that this is a SIMPLE, but NOT a stupid design. No LSTTL multiplexers, no CMOS analogue switches and no RS232C transceiver chips are used at all. The ma-

ajority of the components on board are just relays, relays and relays again. Don't run away with the idea that I earn commission from a relay company. There are practical reasons behind it.

To be honest, my initial thoughts led me naturally to think in terms of LSTTL multiplexers, decoders or CMOS analogue switches. In fact, my first attempt was based on the good old analogue multiplexer 4052B. The device has eight analogue switches inbuilt, requiring four ICs only to switch up to four ports. Unfortunately though, it can only switch analogue voltages up to  $\pm 9V$ . The RS232 standard permits transmission of voltages up to  $\pm 25V$ . Although a lot of equipment in the market uses  $\pm 12V$ , it is still a little too high for the 4052B switches.

So why not transpose the RS232 voltages down to TTL logic levels and do all the switching there before reconverting back to RS232 level?? I did exactly just that in my second attempt. It turns out that there are problems with this approach too. To allow total flexibility, each port has to be configurable, so each pin has an equal probability of being either an input or output pin. In other words, an RS232 driver and a receiver gate will have to be reserved for each pin on the connector. Additionally, each line to be multiplexed in logic level will have to have a directional control. Even if you consider switching eight lines (instead of 25) per port, the number of gates required will be horrendous. In fact, the cost of gates is similar to the cost of relays used in my final design. Furthermore a circuit that uses this many gates will be more complex and expensive than necessary. After long contemplation, I finally decided on the relay approach. It's simple and economical to build, and most important of all, simple to use.

One of the great advantages of using relays is that they pass signals in any direction, thus eliminating the problem of having directional control on each line. Secondly, relays can switch the RS232 voltages ( $\pm 25V$ ) quite comfortably without breaking down. Furthermore, the finite mechanical life usually associated with relays does not seem to be a problem here since its nearly infinite when switching

25V signals continuously. Even on the assumption that the work load in the office requires the lines to be switched 100 times a day, it will be years before any of the relays bust.

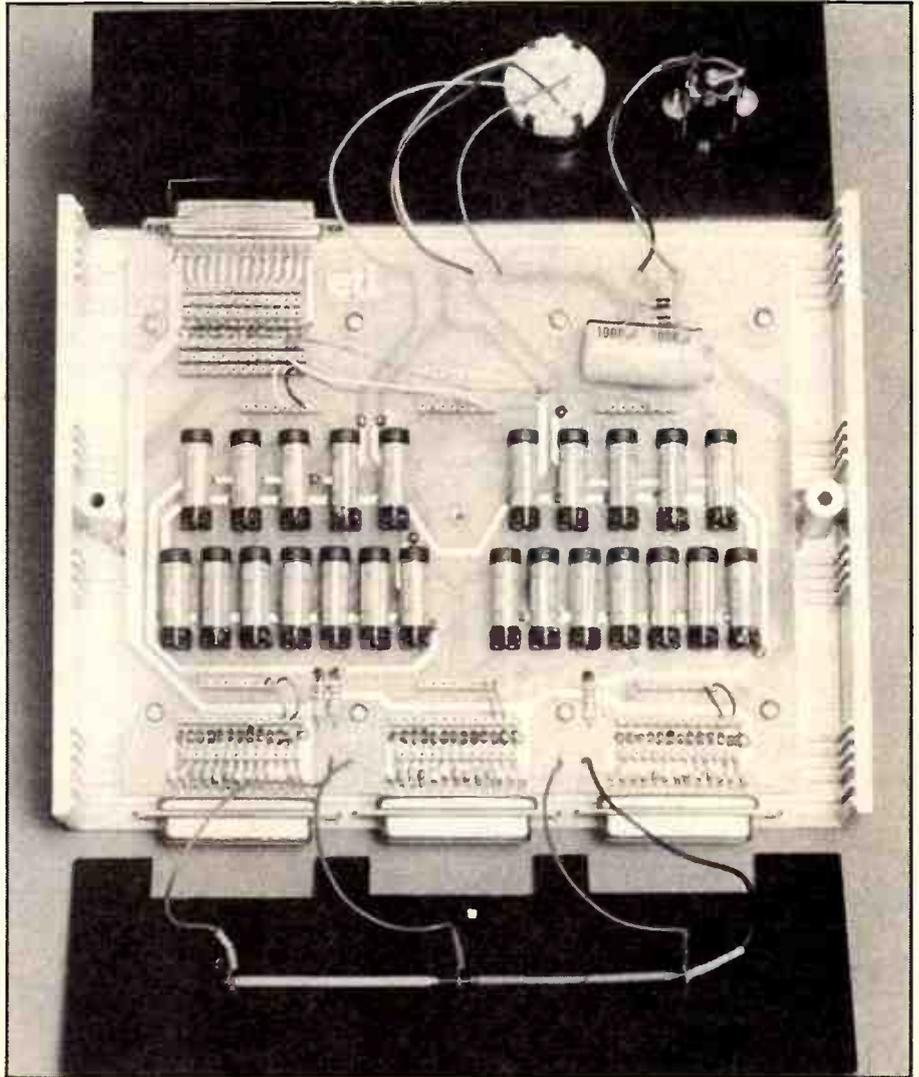
The functional block diagram of the circuit is shown in figure 1. Port D can be made to connect to any one of Ports A, B or C by the selector. There is no restriction on which is the input or the output port so long as the two ports connected have a matched configuration. The output of the selector controls the relays which are arranged in three banks. Each bank can accommodate up to eight individual relays and will be energized (on) or de-energized (off) together.

There is no reason why you should not put in less relays if the number of lines that need to be switched is less than eight. Note that the input and output of the relays goes to nowhere except to the single-in-line sockets. This feature allows maximum flexibility in configuring individual ports independently. Pushing the idea further, you could even multiplex general purpose analogue signals (either in current or voltage) from port D to either A, B or C.

According to the RS232 standard, no matter what the configuration, pin 1 and pin 7 of the DB25 connector are always the same. Pin 1 is the chassis and pin 7 is the signal ground. It is a waste of relays to switch these lines. In this design, pin 1 on each port is joined together by tracks on the pc board. There is a similar arrangement for pin 7 as well, so the eight switching relays are only reserved for switching signals only.

## Construction

The only semiconductors on board are the two diodes. It is almost impossible to go wrong electrically when you build this circuit up. The only thing worth discussing is the mechanical side of the construction. Even then, to be sure everything fits nicely into the box first time without too much bending or twisting, only a few sec-



General internal layout of the unit.



Accessories of the unit. The plug with the matching chassis mount socket (SK1) the selector and the sight in line socket (SIL).

## ETI 1608 — PARTS LIST

### Resistors

R1, R2, R3..... 150R (0.25W, 5% tol.)

### Capacitors

C1..... 1000 $\mu$ F, 16V (elec.)

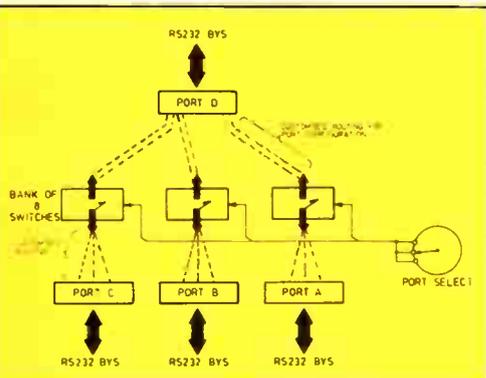
### Semiconductors

LED1, LED2, LED3 5mm. dia. red LED

D1, D2..... 1N4004

### Miscellaneous

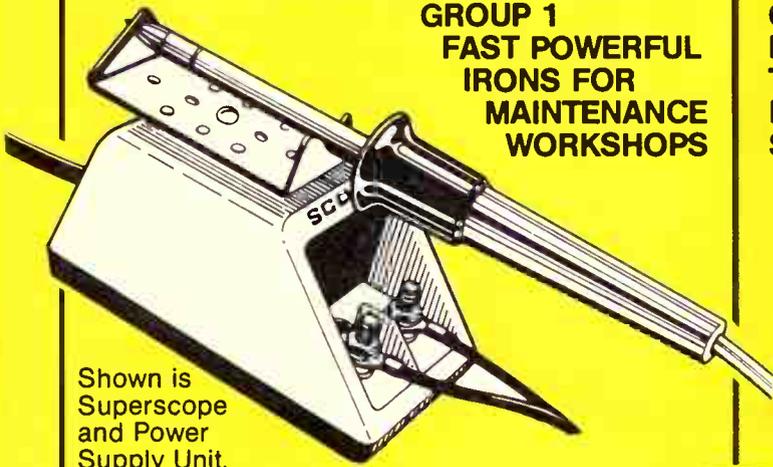
Four female, soldering type DB25 connectors and a 2.1mm chassis mount socket for the plug pack (Jaycar Cat. PS-0516). Two strips of single-in-line ic sockets with 20 holes per strip. Twenty four 5V reed relays, they can be obtained from Hi-Com Unitronics or Tandy Electronics. A double-sided pc board and three LED holders. A plastic box (has to be exactly the same as the one shown in the picture) with nine self-tapping screws and some different colour hook up wires. Two scotchcal panels, one for the rear and one for the front panel of the box. The last thing you need is a 3-pole, 4-way selector switch and a 180mA (min.) 6V dc plug pack.



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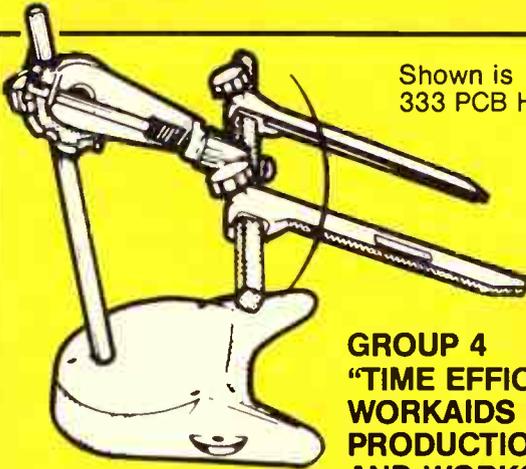
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panels already on without at the same time, twisting, or wrinkling it.

There is no need to mount the DB25 connectors onto the flimsy plastic panels. They will simply crack when you plug in or unplug something onto the connector. The strength to hold them in place comes entirely from the 25 pins, which are soldered firmly onto the board. The board itself is secured to the plastic studs sitting on the floor of the box by nine self-tapping screws as shown in the picture.

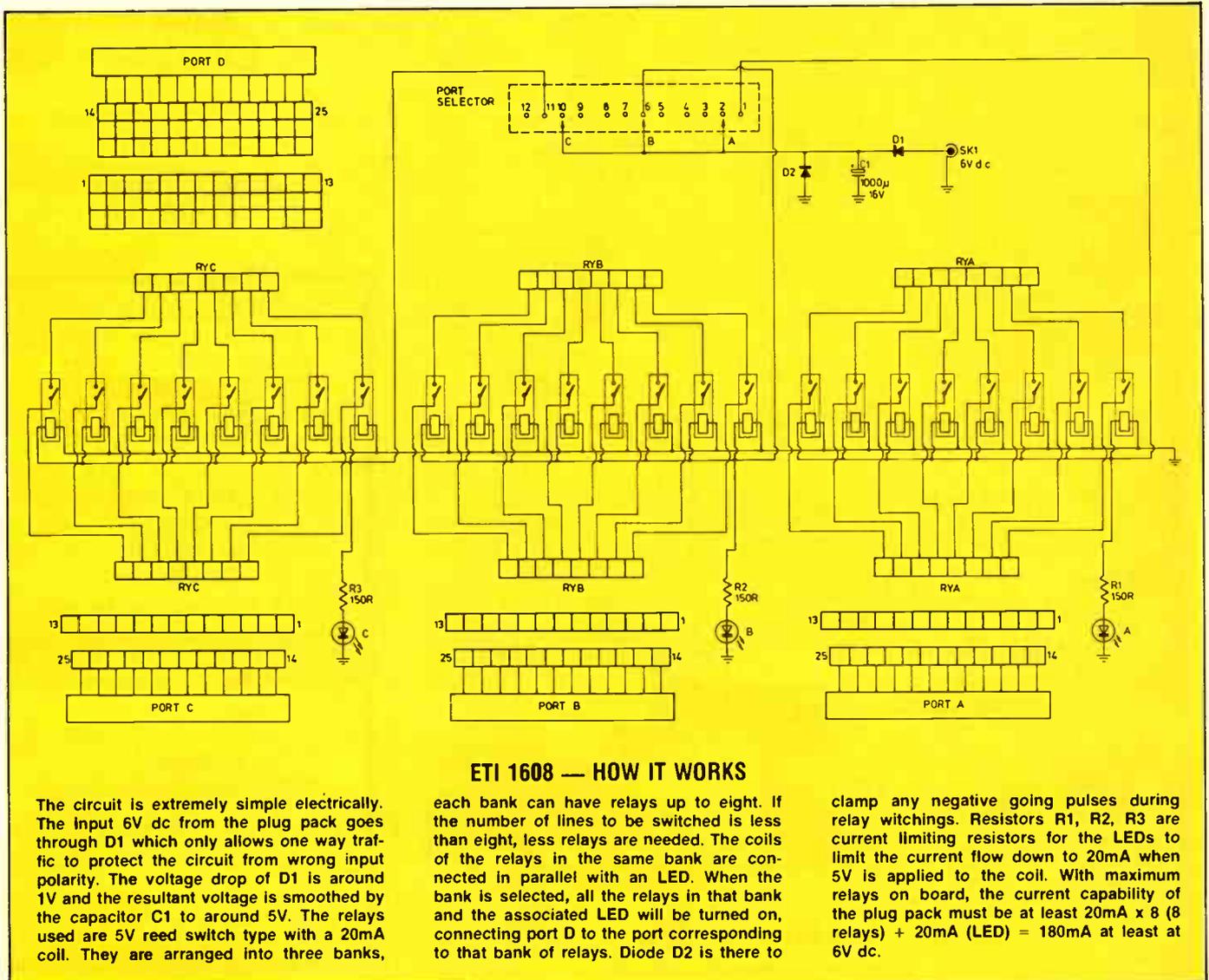
Before you put anything on the plastic panels such as the LEDs or the port selector, make sure you can slide the pre-cut plastic panels down the slots on the box comfortably. When everything seems to fit properly, remove the panels and stick down the scotchcal panels. The holes on the scotchcal are then cut nicely by using a sharp scalpel and tracing the outline of the holes and the slots already cut on the plastic panels. The accessories are then put on

the rear and front panels. The wiring diagram is shown in figure 2.

**Testing and Setting Up**

Although the circuit is protected against wrong power polarity input being applied to SK1, it is always a good move to check the polarity of the plug matches that of the socket before plugging it in. Turn the selector until any one of the three LEDs light up. The selector is a 3-pole, 4-way (selections) type allowing one off position if port D is to be isolated from the rest. In that case, all LEDs will be off. Check that the light up LEDs do correspond to the overlay diagram, for instance, if LED A is on, a continuity test on a pin to pin basis should be carried out to see if the two single-in-line sockets RYA are connected (by the bank A relays from RYA1 to RYA8). An identical test should be run on port B and C as well.

Provided the tests are positive, you are ready to configure the ports. First make up your mind what peripheral is going into port A etc. and write down the port configurations you need. Port A has two rows of single-in-line (SIL) sockets carrying 25 pins of the DB25 connectors. Each of these pins can be routed onto its corresponding relays input socket RYA. The output of the relay also go to an identical socket RYA which could then be routed onto port D's SIL sockets. A similar procedure can be carried out on port B and C. Since port D has to accept routings from RYA, RYB and RYC, each pin on port D will have three holes reserved to allow one hole per wire. That's why there are six rows (each two rows for 25 pins) of SIL sockets for port D. Wires used for the routing will be a single core type and the diameter of it should match with the size of the holes on the SIL socket for secure connections.



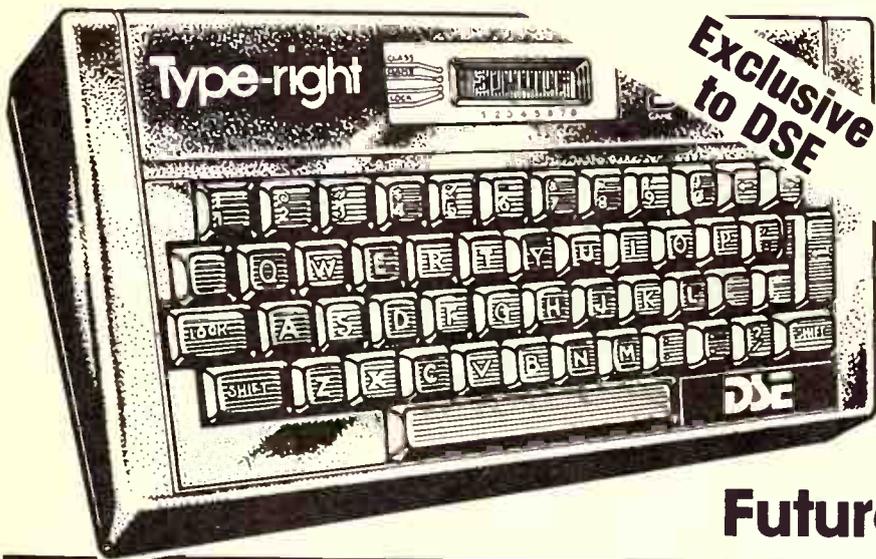
**ETI 1608 — HOW IT WORKS**

The circuit is extremely simple electrically. The input 6V dc from the plug pack goes through D1 which only allows one way traffic to protect the circuit from wrong input polarity. The voltage drop of D1 is around 1V and the resultant voltage is smoothed by the capacitor C1 to around 5V. The relays used are 5V reed switch type with a 20mA coil. They are arranged into three banks,

each bank can have relays up to eight. If the number of lines to be switched is less than eight, less relays are needed. The coils of the relays in the same bank are connected in parallel with an LED. When the bank is selected, all the relays in that bank and the associated LED will be turned on, connecting port D to the port corresponding to that bank of relays. Diode D2 is there to

clamp any negative going pulses during relay witchings. Resistors R1, R2, R3 are current limiting resistors for the LEDs to limit the current flow down to 20mA when 5V is applied to the coil. With maximum relays on board, the current capability of the plug pack must be at least 20mA x 8 (8 relays) + 20mA (LED) = 180mA at least at 6V dc.

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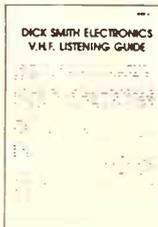
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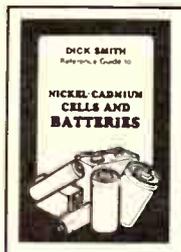
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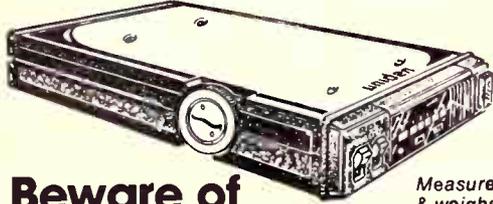
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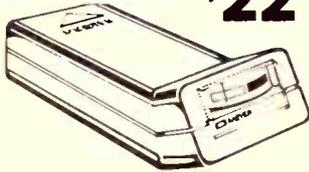
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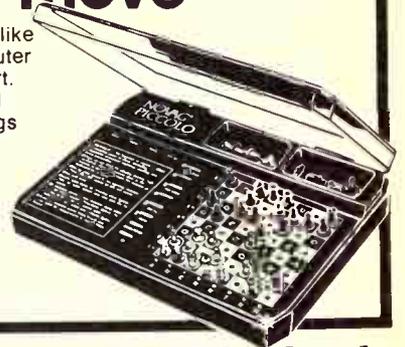
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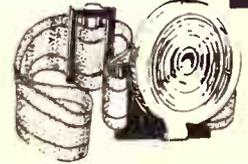


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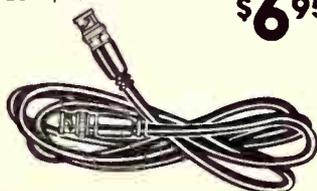
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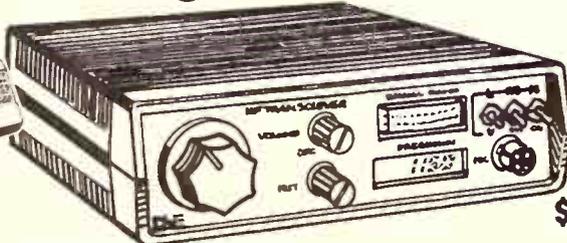
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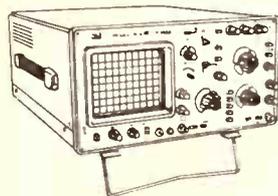
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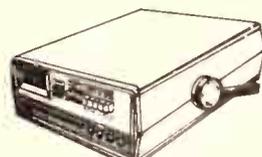


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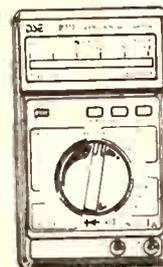
**\$159**



### Push-Button Selection

It's so easy to use! Push-button range selection makes this LCD Multimeter a joy to use. With large 13mm LCD display and inbuilt bench stand. It's a quality unit at a great price! Features diode checking, 16 ranges, high input impedance, 10A DC range and overload protection. Cat Q-1444

**\$49**



### Best of Both Worlds

The DSE Bargraph Multimeter has all the ease of an analogue meter PLUS the speed and accuracy of digital meters! Ideal for the professional or hobbyist. With diode test, audible continuity tester, maximum display value freeze and more! Look at the features: • Data hold • Sample Rate; 10 sec • 5M ohms input impedance • Complete with probes • And much more! Cat Q-1777

JUST **\$149<sup>95</sup>**

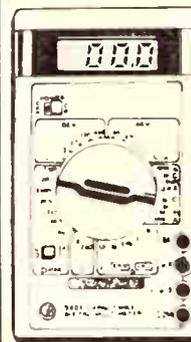
JUST

## Windspeed Meter

### \$30 Off!

Fits in the palm of your hand and measures true windspeed — quickly and accurately! Imagine the applications; boating, scientific, aviation, sporting, etc. Knots miles per hour or metres/second... it measures the lot! With 3 digit LED display and sapphire jewel bearings for minimum resistance and long life. Cat Q-1405

Was \$159  
ONLY **\$129** SAVE \$30!!



### MM with 5 range Cap. Checker

It's the Digital Multimeter with it all! All the usual features including 10A AC/DC PLUS 5 ranges of capacitance checking two ranges of conductance AND a diode check. And it's accurate (<0.25% on DCV). Good enough for design and inexpensive enough for the hobbyist! Cat Q-1460

FANTASTIC!

**\$99**

### E-Z Cable Checker

Every roadie, every band in the world needs one of these. Even the amateur sound recordist, club or church PA operator — anyone involved in audio cables will find the E-Z Check invaluable. Simply plug your cable in — Cannon, 6.5mm mono or stereo, RCA or BNC — and a series of LEDs tell you if it is okay. Imagine the time savings when searching for that elusive cable fault. Works equally well with patch cables having different connectors on each end. Requires only single 9V battery (not included). Rugged, heavy-weight steel case will handle the knocks. Cat Q-1532



WAS \$79.95  
NOW  
**\$59<sup>95</sup>**

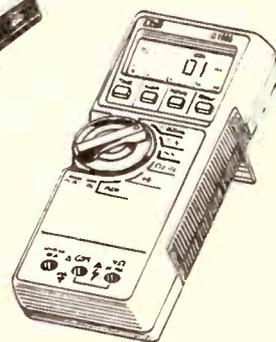
SAVE \$20!!



ONLY  
**\$9<sup>95</sup>**

### Cable Voltage Tester

Ideal for automotive use. This piercing type lead tester gives you an LED readout to indicate if the lead is alive. Can save heaps of time! Cat Q-2000

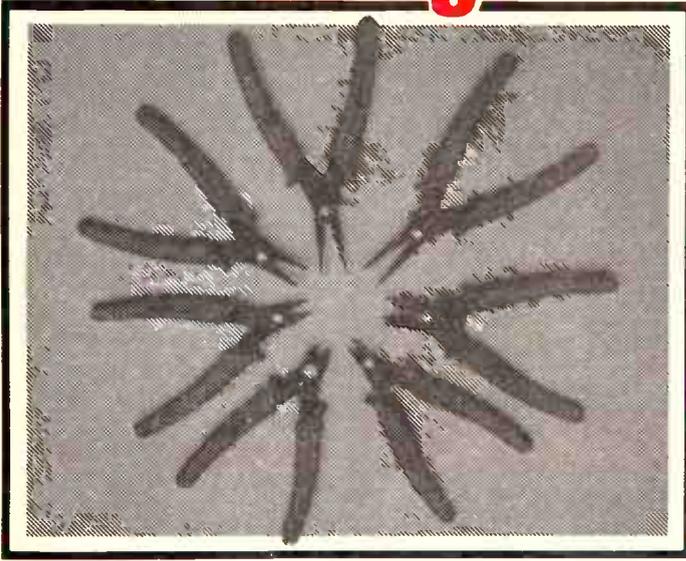


### 4000 Counts Multimeter

Now the multimeter which has it all! Digital and bargraph display, resistance, audible continuity checks, diode test, 10A AC/DC range, memory, auto power down, 40M ohm resistance range... the list goes on! Full scale display of 4000 counts provides high accuracy and resolution. If your work depends on the best — then you won't get better value! Cat Q-1666

Amazing! **\$249<sup>95</sup>**

# Quality tools save time and money — Piergiacomini now at DSE!



Around the world, Piergiacomini tools are known for their outstanding quality and reliability. They're the choice of professionals — and now DSE has available this superb range.

## Cutting Nipper with back-angled cut

Designed especially for pcb soldering work. Blade opening 7mm, handles up to 1.3mm copper wire. Cat T-3261



\$16<sup>95</sup>

## Cutting Nipper with standard cut

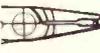
Ultra-precision cutter with standard angled blades allowing completely flush cutting. Cat T-3262



\$16<sup>95</sup>

## Inclined Frontal Cut Nippers

Very easy to handle, allowing leads to be cut 1.5mm from plane — perfect for soldering or to clear soldered joint. Cat T-3263



\$19<sup>95</sup>

## Inclined Cutter and Bender

Not only cuts the pigtail, but bends it away from pcb so the component won't fall out. Fantastic! Cat T-3264



\$18<sup>95</sup>

## Shears

For larger cutting jobs — like mini scissors but with the extra strength needed to get through metal, plastics, etc. Cat T-3265



\$22<sup>95</sup>

## Needle Nose Pliers

Tweezer-like ends for reaching into almost inaccessible places — and flat blades so delicate components won't be damaged. Cat T-3266



\$17<sup>95</sup>

## Flat Nose Serrated Pliers

Fine (2.5mm) ends with serrations along blade mean extra grip when you really need it. Cat T-3267

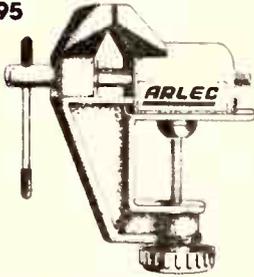


\$16<sup>95</sup>

## Arlec Mini Vice

Need a third hand? Here's one that won't let go! The mini vice from Arlec attaches to any table, desk, bench, etc. (up to about 40mm thick). 50mm wide jaws hold tight — opens up to around 60mm for those big jobs. More than strong enough for cutting, filing and other testing applications. Cat T-4748

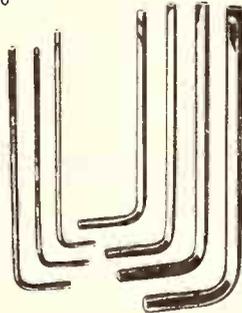
\$12<sup>95</sup>



## Allen Key Set

Here's an ideal set for the workshop. 7 gunmetal finish Allen keys in a plastic wallet. Sizes 1.4mm, 1.5mm, 2mm, 2.4mm, 2.5mm, 3mm, 4mm. They are ideal for most European and Japanese equipment that have Allen screws. Cat T-5080

\$3<sup>95</sup>



## Deluxe Pin Vice

It's a small hand tool that looks a lot like a jeweller's screwdriver — without a blade. Stored away inside the body are two double-ended locking collets that can be used to hold anything from 3mm diam. down to virtually nothing. That could be small drills (fantastic for drilling PCB's!), screwdriver blades (now you don't have to throw broken blades out!) awl points, scribers, reamers, needles and pins, etc etc. Cat T-5115

\$15<sup>95</sup>



## Retractable Blade Neon Tester

Avoid that dangerous habit of carrying around a screwdriver in your pocket! Famous Germain "Boker" quality "driver" has retractable blade for safety PLUS inbuilt mains voltage neon tester (100 to 500V). Screwdriver blade length 25mm, 3mm width. Handle (including pocket clip) 115mm x 15mm diam. Cat T-4007

WAS \$6.55

NOW \$5<sup>95</sup>



## Varitemp Iron

Variable temperature — the right heat for every application! And the temperature adjustment is right there on the handle: that's convenient! Interchangeable tip means total flexibility. Cat T-1350

\$35<sup>95</sup>



Accessories to Suit:

Spare Tip (medium) Cat T-1351 \$4.35

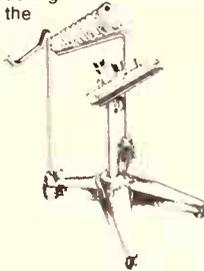
Spare Tip (large) Cat T-1352 \$4.35

Spare Tip (conical) Cat T-1353 \$3.95

## Multi-purpose Stand

Holds boards or components firmly in rubber faced vice. Angle of vice may be varied widely in three dimensions for greater accessibility to board. Convenient soldering iron holder also adjustable. Adjustable spool holder for solder & desoldering wick. Ideal for the hobbyist or professional. Leaves both hands free. Cat T-5700

\$39<sup>95</sup>



## Butane Soldering Iron

Totally portable, 'all-in-one' soldering iron that fits easily in a shirt pocket. Uses refillable 'butane' — the type used in ordinary cigarette lighters provides an amazing 60 minutes continuous use at a full 60 watts. Adjustable temperature control provides an equivalent to 10 to 60 watts. Detachable cap features a built-in ignition system which uses replacement flints. Cat T-1370

\$59<sup>95</sup>



Just the size of a marker pen — ideal for on-the-spot repairs.

## S/S Transistor Nipper

Ideal for pcb work. Very sharp precision cut with long life cutting edge. 95mm body with spring return. 9mm cutting blades. Cat T-3205

\$16<sup>95</sup>



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World Radio History

## Scope Cordless Solder Gun

Powerful enough to handle the same jobs as 60W mains irons, but inbuilt NiCads give you up to 100 solder joints away from power points and extension cords. Includes plugpack for overnight charging; heats in just six seconds and takes standard Miniscope spares. Supplied with charger, two spare elements and two spare bits. Cat T-1600

\$119



## UHF Hand-Held

Go-anywhere action on UHF CB: that's the Sundowner Hand-Held. All 40 channels fitted with very healthy 1.5W output (switchable to 0.15W to save battery). It's supplied complete with 10.8V NiCad battery (recharger also inc) and whip antenna — so you don't need anything else to start talking! Cat D-1807

**ONLY \$599**



## 5W 6 Channel Marine Transceiver

At this low price anyone on the water can have the security of a quality transceiver! With maximum legal power and fitted with 27MHz marine frequencies, it's ideal for the small boat owner and weekend fisherman. Cat D-1126

### Features:

- 27.880MHz crystals
- On/Off/Volume, channel select, PTT, squelch switches
- External power jack
- Huge 5 watt power
- Signal/battery meter
- High/Low power switch
- High/Low mic. gain

**\$149**



## Dual Beam Timing Light

With our fantastic Dual Beam Timing Light your car will be purring like a kitten. Save time and money and do it yourself. Cat A-7470



**FANTASTIC!**

**\$59<sup>95</sup>**

## 10 Function Engine Analyser

Optimise engine performance and maximise fuel economy! The 10 Function Analyser is a professional quality test device for reliable and accurate automotive use. Checks:

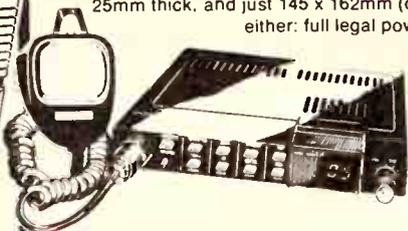
- Idle speed and carburettor adjustment
- Adjusts ignition contact points
- Tests battery condition and electrical systems
- Tests generators/alternators
- Tests high tension leads and coil
- Provides simple method for troubleshooting. Comes with comprehensive instructions and all connecting leads, etc. Cat A-7480



**\$69<sup>95</sup>**

## Royce Slimline

It's the most advanced UHF CB set available. And yet it's also one of the smallest — an amazing 25mm thick, and just 145 x 162mm (d x w)! Nothing has been left out, either: full legal power output, all forty channels, full scanning facilities, instant highway/emergency channel access, repeater access, optional selcall and tone squelch... everything the avid UHF CBer could possibly want! Cat D-1810



**VALUE!**

**\$599**

## Selcall Option

5 tone Selcall (selective calling) pcb which means squelch will only open when it receives the correct tones. Great for clubs etc. Cat D-1808

**\$129**

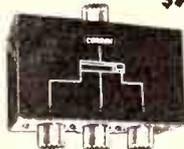
## Make it portable!

What a brilliant idea! The Royce Portable Carry Case lets you take (and use) your CB anywhere. Has battery rack, antenna and shoulder strap for complete portable operation! Cat D-1812

**\$189<sup>95</sup>**

## 3-way Antenna Switch

If you have more than one antenna or use more than one rig then this switch will save you swapping by hand. Handles 150 watts at 30MHz: ideal for base or mobile use. Cat D-5206



**\$16<sup>95</sup>**

## VHF/UHF Universal Antenna Kit: Whip, coax and base

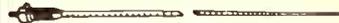
- Quality stainless steel 520mm whip, complete with cutting chart, suitable for mid VHF band (about 120MHz) up
- Deluxe gutter gripper mount, 5/16" 26TPI coaxially fed antenna base (intended for UHF work — even better at VHF!)
- 2 metres UHF quality RG58C/U coaxial cable
- PL-259 UHF converter (as used on most transceivers)

**BEST VALUE! \$32<sup>95</sup>**



## 183cm Whip, Super Heavy Duty

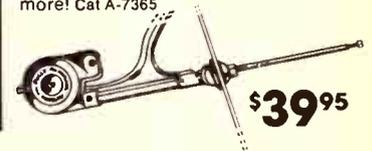
Just right for 4WD's vans etc — or anyone really serious about CB! Heavy duty unbreakable mounting base unit and massive spring, complete with PL-259 coax lead. Requires 13mm mounting hole — in something real solid! Cat D-4078



**\$99**

## Fully Automatic Antenna

The ultimate in ease! Antenna automatically goes up when you turn on your radio. Features 5 section anti corrosion stainless steel mast, FM/MW/LW reception, easy two wire connection, 300mm underhang and more! Cat A-7365



**\$39<sup>95</sup>**

## Your own Radiator Checker

You know how hard it is to remember to check the water level in your car's radiator! Now the DSE Fluid Level Monitor does it for you. Easy to fit it could save you a fortune on repairs. Cat A-8535



**\$19<sup>95</sup>**

## Remote Starter Switch

Fantastic when you're working on the car by yourself! The Remote Starter Switch lets you start the car from under the bonnet. It's much safer when you control it yourself. No workshop should be without one! Cat A-7465



**\$9<sup>95</sup>**

## Ambler Warning Light

Revolving emergency signal light for car, truck or marine use. Magnetic base for easy fixing to any metal surface. 3.6 metre coil cord and cigarette lighter plug. Cat A-8510



**\$39<sup>50</sup>**

## Auto Inspection Lamp

A compact 12 volt DC lamp which is ideal for the car, truck, camper, etc. High intensity lens provides concentrated beam which is ideal for emergency repairs. Comes complete with built-in hook, cigarette lighter adaptor and 6 metres of lead. Cat A-8506



**\$5<sup>50</sup>**

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## Car sound at its best!!!

The Sharp RG-F887G Car Stereo is, without doubt, one of the most sophisticated systems around. With 3 band tuner, 7 band graphic equaliser, LED display, 5 memory station program, auto reverse, blank tape pass, 50 watt power output, built in security alarm... There just isn't the room to list all the fantastic features! Cat A-9020



True Car Hi-Fil

**\$599**

## 3-Way Closed Speaker System



**\$299**

The CP-FA30 closed, rear mount system produces great dynamics. Uses the square-type flat diaphragm woofers for improved bass response. Couple this with 60W input power and you'll never want to get out of the car. Cat A-9060

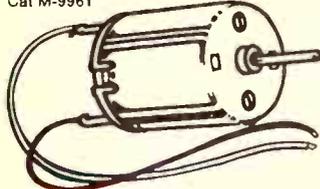
- 60W per channel maximum input power
- Square, flat diaphragm woofer with honeycomb core
- 100cm squared mid-range
- 3.5cm tweeter

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# 2 FOR THE PRICE OF ONE!!

Hey, this is fantastic value! Quality, reliable Mabuchi Electric Motors at half their normal price. Rated at 3 volts these are great for projects, experiments, model building or just playing around. Right now, you get two for the price of one! Cat M-9661



**TWO FOR \$2.75**

## POWER SUPPLY 16V AC 900mA

The biggest problem with most projects is fitting in the transformer! This one obviates the problem — keep the supply components inside, but the plug-pack hangs on the power point! With a very healthy 16V at 900mA, it's perfect for 12 volt DC supplies. Energy authority approved. Cat M-9567



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## TRANSFORMERS

Save heaps on our quality transformers! Hundreds of applications for projects, power supplies, linear amplifiers, etc. Our low prices are always hard to beat — but now they're even better!

### 5-15V Variable 2A Power Supply



**JUST \$99**

### 3-6-9-12V DC @ 1 amp



**\$29.95**

### 3-6-9V DC @ 200mA



The perfect work bench companion! Continuously variable output from 5 to 15V DC at 2A continuous, 4A peak. Ideal for the hobbyist, handyman and technician. Fully metered, showing either voltage or output current (switchable). Low ripple: <20mV at 2A (or <200mV at 4A). Cat M-9549

Invaluable around the home or workshop, it will give a maximum of 1 amp at 3, 6, 9 and 12 volts DC. Simply plugs into 240V AC power socket — DC connections via screw terminals on front of unit. Ideal for use with alarm systems, intercoms, etc. Cat M-9530

This great value Power supply has the three most used voltages for battery powered equipment. 3, 6 & 9V @ 200mA **\$17.50**  
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Hurry, take advantage of our amazing power supply \$\$\$ savers now! Battery eliminators from DSE save you money.



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NOW \$12.95**



**WAS \$10.45  
NOW \$9.95**



**JUST \$7.95**

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Primary: 240V.  
Secondary voltage: 18V. Secondary current: 2.2A.  
Terminations: Flying Leads. Cat M-1990

**DSE 1200**  
Primary: 240V.  
Secondary voltage: 40V @ 10mA, 19V @ 200mA, 11.2V @ 450mA.  
Terminations: Flying Leads. Cat M-1200

**DSE2155**  
Primary: 240V, 50Hz.  
Secondary voltage: 6.3, 7.5, 8.5, 9.5, 12 & 15V.  
Secondary current: 1 amp. Terminations: Flying Leads. Cat M-2155

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Quite often, the products we advertise are so popular they run out within a few days, or unforeseen circumstances might hold up shipments so that advertised lines are not in the stores by the time the advert appears. And very occasionally, an error might slip through our checks and appear in the advert (after all, we're human too!) Please don't blame the store manager or staff; they cannot solve a dock strike on the other side of the world, nor fix an error that's appeared in print. If you're about to drive across town to pick up an advertised line, why not play it safe and give them a call first... just in case! Thanks, Dick Smith Electronics.

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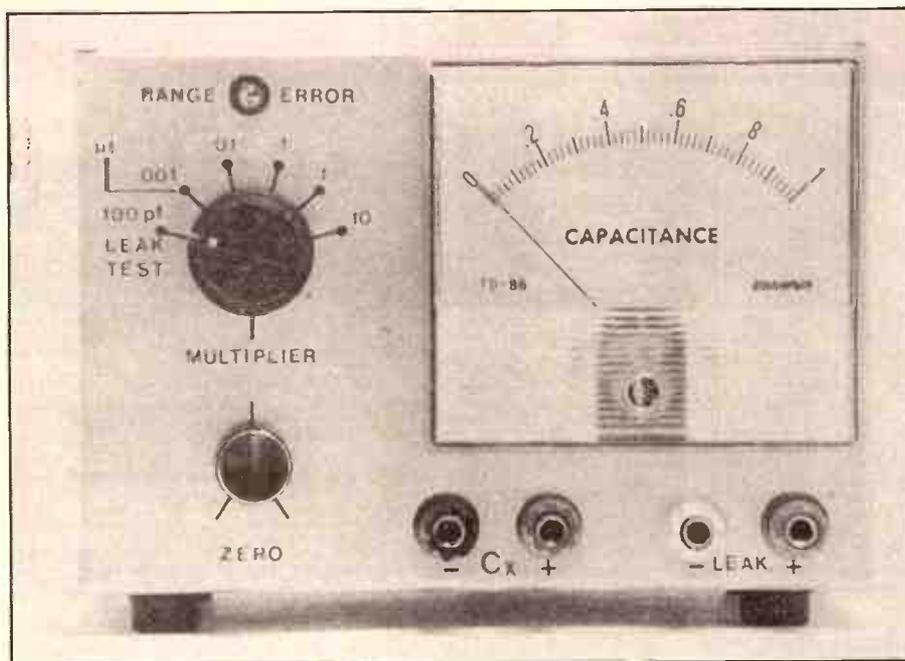
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*No test bench is complete without a means of testing and measuring capacitors. This unit not only reads capacitance value, but has a leakage tester built in. Forget the manufacturers codes: read the actual value quickly and easily.*

Peter Phillips



**D**igital capacitance meters are now commonplace, available as kits or commercial hand held meters. However, sometimes the displayed value can be difficult to interpret. Values such as 150 nanofarads, or 12000 pf need further analysis if a microfarad value is required, moreover, leakage characteristics are rarely tested with digital devices, and often a faulty capacitor will display an apparently useful capacitance reading. The instrument described in this article conforms to the standard established in all the prior projects presented in this series, in that it is analogue based, cheap, and uses the same size case. It is capable of measuring capacitance values from 10 pf to 10  $\mu$ F, over 6 ranges, and has a zeroing

feature to allow on-board testing using a test lead. As well, leakage is tested using a 100 volt dc test voltage and resistance values up to 22 M ohms can give full scale deflection.

Open-circuits can also be found by observing the lack of deflection normally caused during the leakage test by the charge taken by the capacitor. Because 100 volts is used the leakage test facility could be used in determining insulation characteristics in devices such as motors, heating elements, and so on.

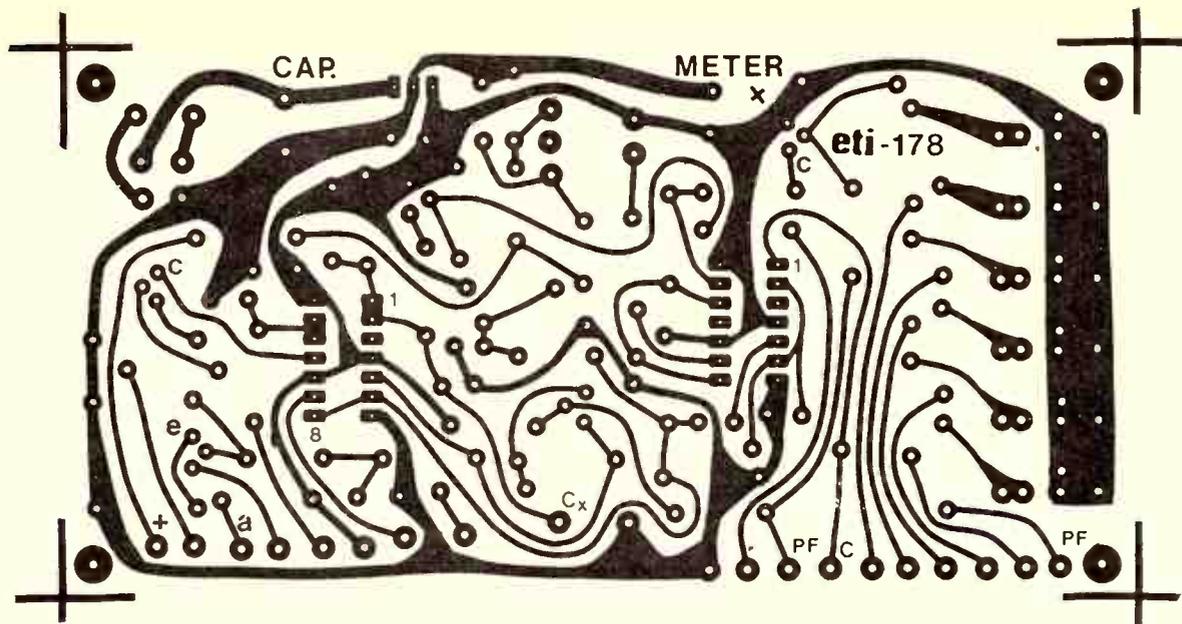
### The Circuit Principles

Figure 1 shows a block diagram of the circuit, drawn as two sections; measurement and leakage testing. Capacitance measure-

ment is achieved in the following way. The range switch establishes the operating frequency as oscillator 1. The capacitor under test is connected as the timing capacitor for monostable 1. The output of this mono will be a series of pulses at a rate determined by the oscillator, and a duration by the test capacitor. A dc meter movement connected to the output of mono 1 and earth would register a deflection proportional to the width of the pulses. As the pulse duration is proportional to the value of the test capacitor, the deflection is a measure of the capacitance value. However, because the internal capacitance of the mono will produce a pulse even when no test capacitor is included, monostable 2 is used to offset this effect.

The meter is therefore connected between the outputs of two monostables, each timed to produce the same output pulse width in the absence of a test capacitor. Because both monos are operating at the same frequency, the potential difference between their outputs is zero at all times. Any variations are adjusted using the zeroing control which trims the pulse width of mono 2. When the pulse width of mono 1 exceeds that of mono 2, the meter will register. This system allows low value capacitance measurement, as well as the cancelling of the capacitance of any test leads used in measurement of in-circuit components.

The leakage tester uses another oscillator, which, in conjunction with a transformer and voltage doubler produces an open-circuit voltage of approximately 100 volts dc. This voltage, via high value protection resistors is connected in series with the item under test to the 'control' pin of mono 2. Any leakage will cause the voltage to vary the pulse width of mono 2, in



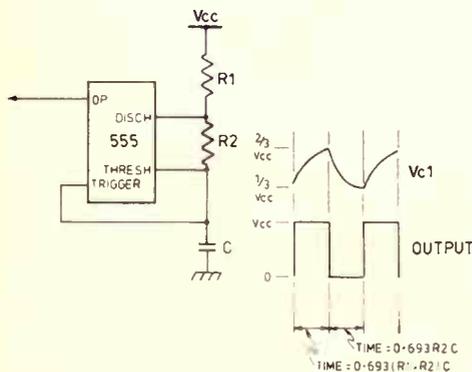
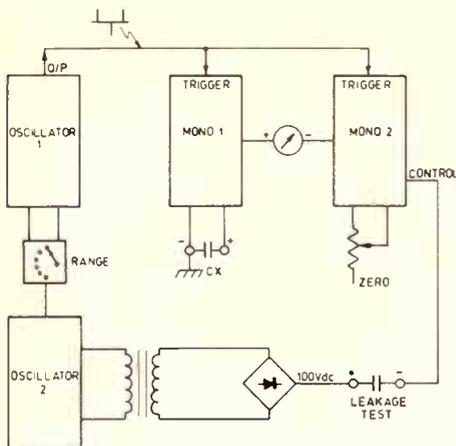
turn causing meter deflection.

### Background theory

This circuit, like the frequency meter of part 7 is basically an analogue switching circuit. As detailed in part 6, (ETI, May 1987), the timing cycle of the 555 is terminated when the charge across the timing capacitor reaches  $2/3 V_{cc}$ . The 'control'

pin allows this voltage to be varied, giving control of the duration of the timing cycle. If a voltage is connected to the control pin, it will over-ride the internally applied voltage, and reduce the timing period for control voltages less than  $2/3 V_{cc}$ . Conversely, longer timing cycles are provided by increasing the control voltage above the internally set value.

Because the internally pre-set voltages to both comparators are determined by a common potential divider network, modifying the voltage at the 'threshold' comparator will affect that at the trigger comparator. This sets a limit on the permissible range of the externally applied voltage, if triggering is to continue. A typical range for a 15 V supply is from 9 to 11



### PARTS LIST — ETI-178

**RESISTORS** ..... all  $1/4$  watt 10% unless otherwise specified. all values in ohms.

- R1, R2, R19..... 220k
- R3, R7, R16, R23, R28, R29..... 1k
- R4, R15, R27, R30..... 4k7
- R5, R6, R9, R14..... 10k
- R8..... 820
- R10..... 100k
- R11..... 1M
- R12..... 390k
- R13..... 4M7
- R17..... 100
- R18..... 18k
- R20..... 3k3
- R21..... 18k-22k (see text)
- R22, R24..... 22k
- R25..... 1k2
- R26..... 1k8
- R31..... 2k2
- R32..... 47

### POTENTIOMETERS

10 turn, or large size vertical mount

- RV1..... 500
- RV2..... 5k
- RV3..... 50k
- RV4..... 500k
- RV5..... 200k
- RV6..... 1M
- RV7..... 10k panel mount

### CAPACITORS

types not specified are 25V electrolytics. all polyesters 100V unless otherwise specified. all values in  $\mu F$ , pcb mount.

- C1..... 1000
- C2, C9..... 1 tant. or mono.
- C3, C4, C7, C11..... 0.1 polyester

- C5..... 0.001 polyester
- C6, C14..... 0.01 polyester
- C8..... 330pF ceramic
- C10, C12..... 100pF ceramic
- C13..... 470

### SEMICONDUCTORS

- Q1, Q4, Q5..... BC557 or similar
- Q2, Q3..... BC547 or similar
- D1-D4..... 1N914 or similar
- ZD1..... 5V6 400mW Zener diode
- IC1.....  $\mu A7812$ , TO220 voltage regulator
- IC2, IC2.....  $\mu A556$
- Bridge..... W05 or equiv.
- LED 1..... to suit

### SWITCHES

- S1..... 6 pole, 2 way wafer

### METER MOVEMENT

1ma dc, 100 or 200 ohm coil, 80mm x 80mm panel mount (or 100mm x 80mm).

### TRANSFORMERS

- T1..... 240:12.6V, 150mA eg, type 2851
- T2..... Dick Smith type M-0216

### MISCELLANEOUS

PCB or vero board; Scotchcal front panel; aluminium case, (W x D x H) 152 x 132 x 103mm (see note below); 4 terminal posts, 2 control knobs; 4 pcb supports, rainbow cable hook-up wire, 240 lead and plug; grommet; terminal block; cable clamp; lugs, mounting hardware for LED.

### NOTE:

The case size was based on the Dick Smith case, catalogue no. H-2330. However, although this unit has the same dimensions, a recent discovery shows they are for D x W x H. The larger aluminium case, no. H-2335 can be used if necessary, but the front panel design will need enlarging to suit.

**APPROXIMATE COST = \$45**

## CREATING WITH ELECTRONICS PART 8

volts, although wider variations can be applied with care.

A common use for this application is *frequency modulation* of the output. If the 555 is connected as an astable multivibrator, another signal applied to the control pin will vary the frequency of the output proportionally to the control signal's amplitude. Thus a crude form of FM is possible. A two-tone siren can also be generated this way, along with a wide range of other possibilities.

The astable multivibrator is a very common application of the 555 timer, (figure 2). At switch on, the timing capacitor C will be discharged, giving 0 volts at the trigger input. This ensures the 555 immediately enters its active state, sending the output high, and turning off the internal discharge transistor. The capacitor then charges through the series connected timing resistors R1 and R2. When the charge on C equals 2/3 Vcc, the threshold comparator will reset the timer to its other state, sending the output low, and turning on the discharge transistor. The charged capacitor now discharges through R2 and the internal transistor. When the capacitor voltage falls to 1/3 Vcc, the trigger comparator switches, setting the timer back to its active state, and the cycle recommences.

The frequency of operation is independent of the supply, and the duty cycle of the output waveform is determined by the resistor values. The relevant equations are:

$$\text{HIGH time (t}_H\text{)} = 0.693 (R1 + R2)C \dots (1)$$

$$\text{LOW time (t}_L\text{)} = 0.693 R2 C \dots (2)$$

$$\text{PERIOD (T)} = 0.693 (R1 + 2R2)C \dots (3)$$

$$\text{Frequency} = \frac{1}{T} = \frac{1.44}{(R1 + 2R2)C} \dots (4)$$

$$\text{Duty Cycle (d)} = \frac{R2}{R1 + 2R2} \dots (5)$$

To obtain a nearly symmetrical square wave, R2 should be much higher than R1. The minimum value for R1 is 1k, and if R2 is 10 times higher than R1, a simplified equation for frequency is:

$$\text{Approx. frequency} = \frac{0.7}{R2C} \dots (6)$$

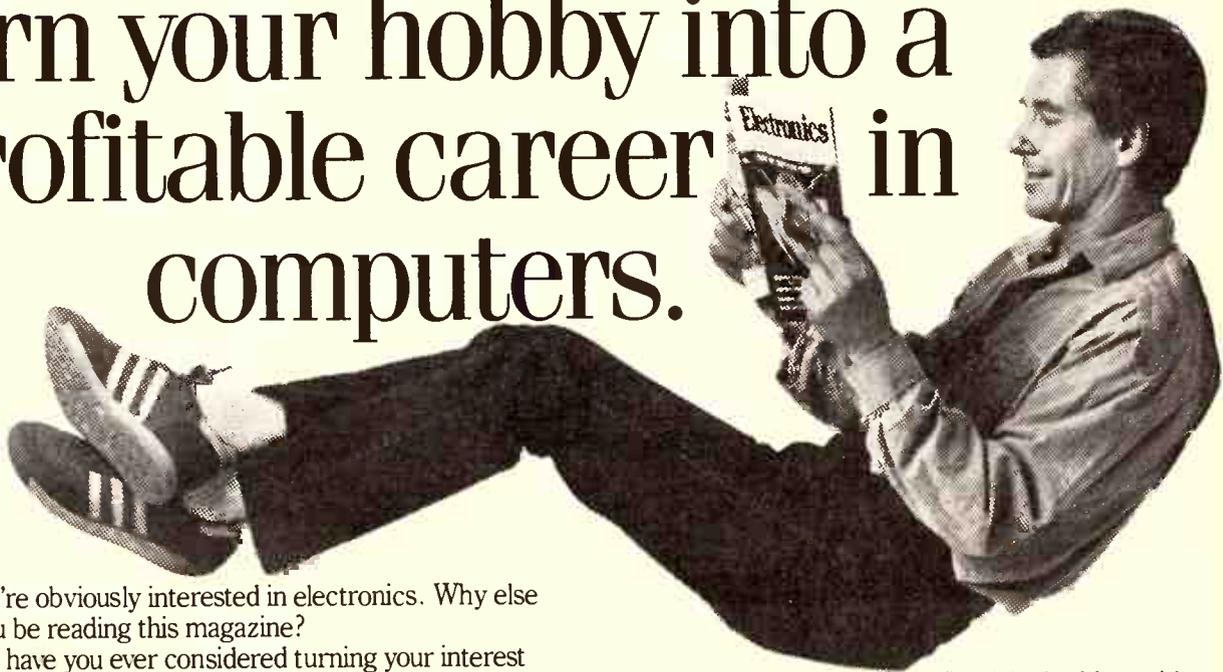
### Construction

Commence construction by preparing the case. Use the template supplied with the meter to drill the case, and a nibbler tool to cut the large hole for the meter body. Mount the transformer on the rear of the case, as shown in the accompanying photos. Use the pcb board as a template to drill its mounting holes in the case, positioned to clear the protruding devices inside the case.

As usual, mount all low profile devices on the pcb first, starting with the resistors, then the diodes, proceeding with the capacitors and semiconductors. Note that C13 mounts across the meter terminals. The six trim pots should be mounted last, and can be either the 10 turn type, or the cheaper, large vertical mount variety, as the layout provides for both. IC sockets are recommended. The wafer switch should be connected with minimum lead lengths, using rainbow cable. To facilitate fault finding connect the meter, range LED, zero control and terminals with leads sufficiently long to allow the pcb to be held away from the case. It is important that the case be connected to the common (negative) supply so connect, the negative terminal post for the capacitance measuring (Cx) terminals directly to the case. After a final check for shorts and incorrectly polarised components, connect the transformer secondary, and apply power.

First confirm that no ICs, etc. are overheating, then select the pF range and observe if the zero control will vary the meter reading. If the range error LED is on, and/or the meter is deflecting more than half scale, IC3 is probably the cause, due to its manufacturing source. This can be ascertained by observing that other

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ranges give appropriate deflection when a suitable value capacitor is connected for measurement. The only cure is to use another brand of 556. Once this problem is fixed, see if the meter can be zeroed when the zeroing control is midscale. If not, modify the value of R21 to give the required results. If no adjustment is available, try the leakage test. This can be done by placing a high value resistor (10M ohms) across the leakage test terminals, and if all is well, the meter should read full scale. If not, confirm that the dc voltage across the leakage test terminals is around 100 V, using a DVM (or any high impedance voltmeter). If so, examine the circuitry associated with the meter, including IC3. If not, check around IC2. If the leakage test is operating correctly, and the zero control is still ineffective, try another brand for IC3. Otherwise check the circuit around IC3.

#### Calibration

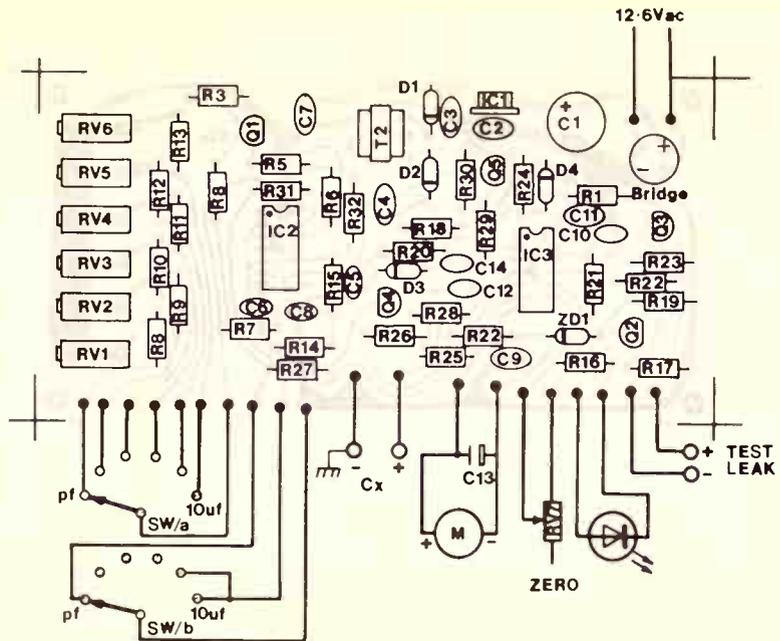
A rough calibration can be achieved by using capacitors whose value is assumed to be that marked, but final calibration can only be done with accurately measured capacitors. The controls do not interact, and calibration is simply a matter of applying the appropriate size capacitance value for each range, and adjusting the preset pots to give the required deflection.

Because the meter may not be perfectly linear, do not attempt to get extreme accuracy. The prototype was adjusted to give a full scale deflection that was correct for the applied capacitance value. Obviously, accuracy is both a function of initial calibration and linearity of the meter movement. Extreme accuracy is only available with a more sophisticated, digitally

based device. The values shown on the circuit diagram for R8 to R13 may need to be varied if the pots run out of range. The value of C6 would be a possible cause if considerable variation is required.

#### Using the Meter

This instrument can virtually test for all capacitor faults. Measurement range is re-



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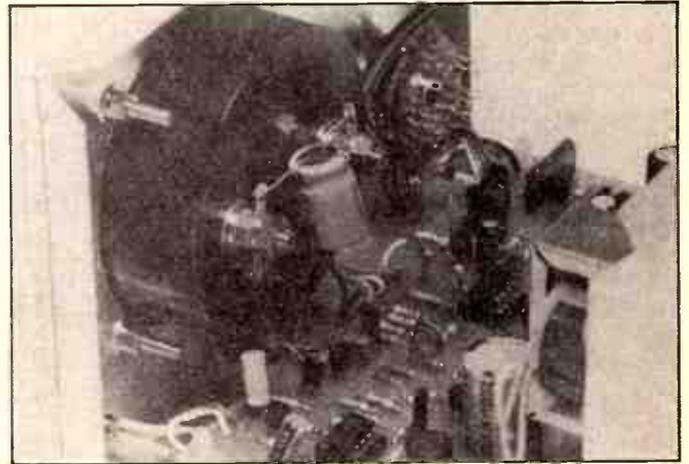
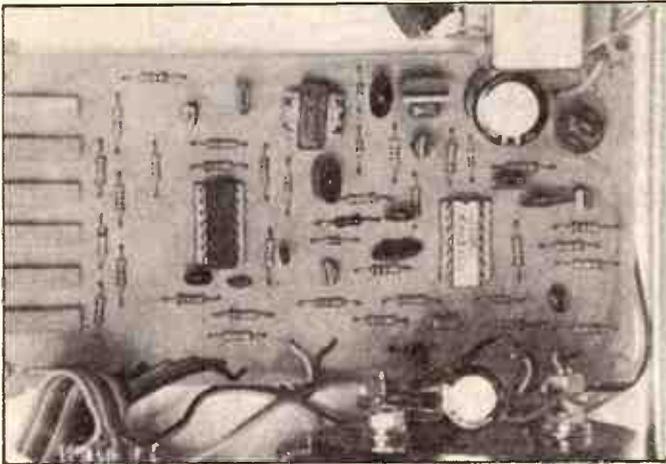
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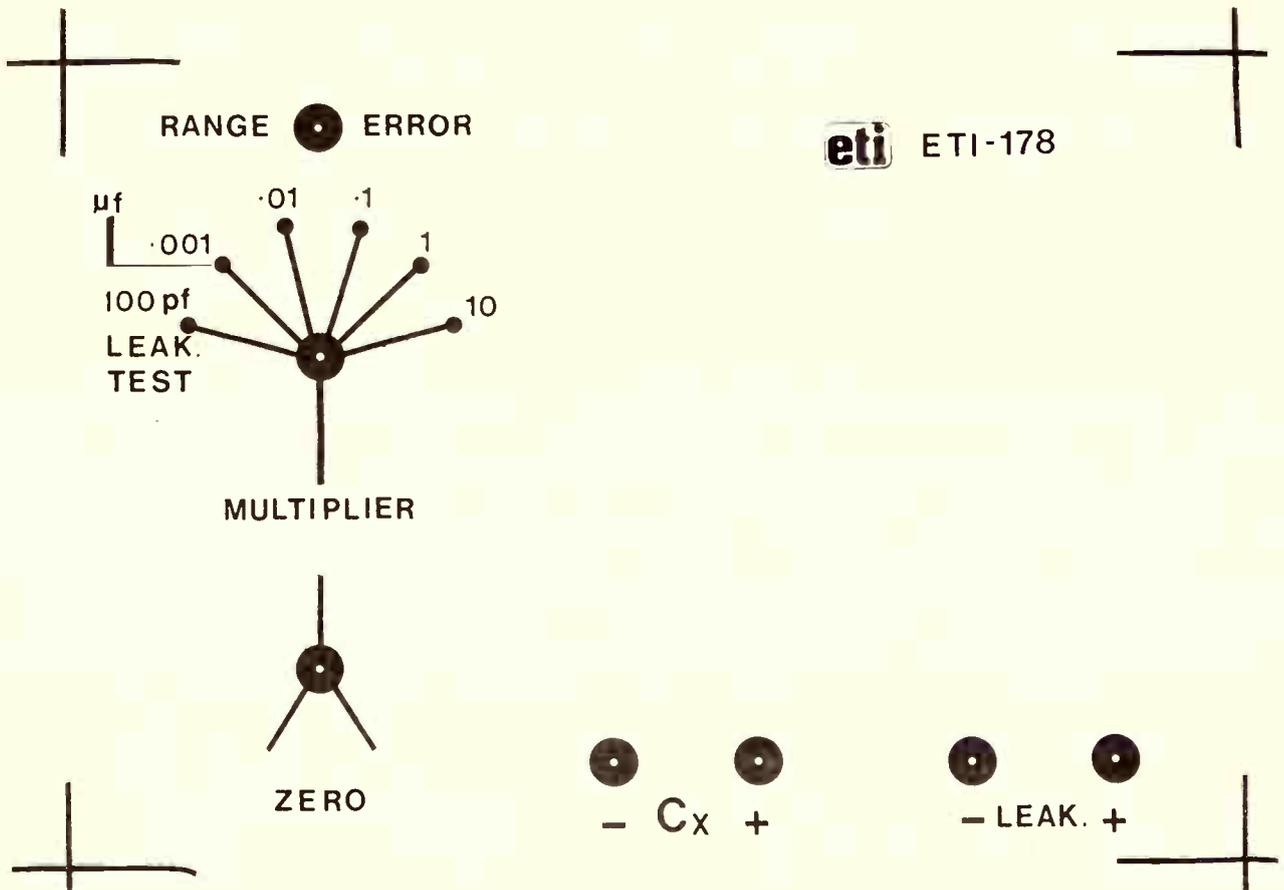


stricted to a maximum of 10  $\mu\text{F}$ , but values greater than this are rarely required anyway. As the test terminals are polarised, electrolytic type capacitors can be tested. Note that the negative test terminal connects to ground. A feature of the meter is that all readings are in  $\mu\text{F}$ , except the lowest range, which is in pF. A meter scale calibrated 0 to 1 means that the displayed reading must simply be multiplied by the selected decade value. The zero control will allow, depending on the value of R21, test lead capacitance values of up

to 30 to 40 pF to be cancelled if in-situ measurement is used for low value capacitors. The range error LED should start to operate once the capacitor is 50% higher than the maximum allowed value for that range.

Leakage testing is a useful test of any capacitor, as the low voltage used to measure the capacitance value may not demonstrate leakage that occurs only upon application of a sufficiently high voltage. Obviously, capacitors rated at less than 100 volts should not be subjected to the

leakage test, particularly polarised varieties that may well be distressed into breakdown if tested on this unit. Ideally, a zero deflection should be obtained, but surface leakage may produce a small deflection on some devices. Touching the test terminals will not induce an electric shock, but will produce full scale deflection. Users may like to establish the resistance values required for various degrees of deflection. The prototype gave full scale for 22 M ohms, and half scale for 100 M ohms. Leakage resistance for any



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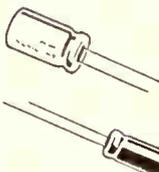


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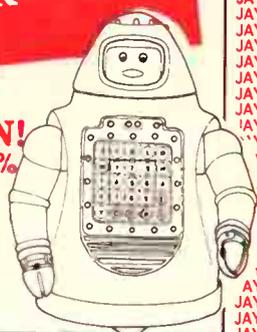
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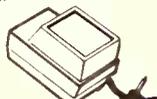
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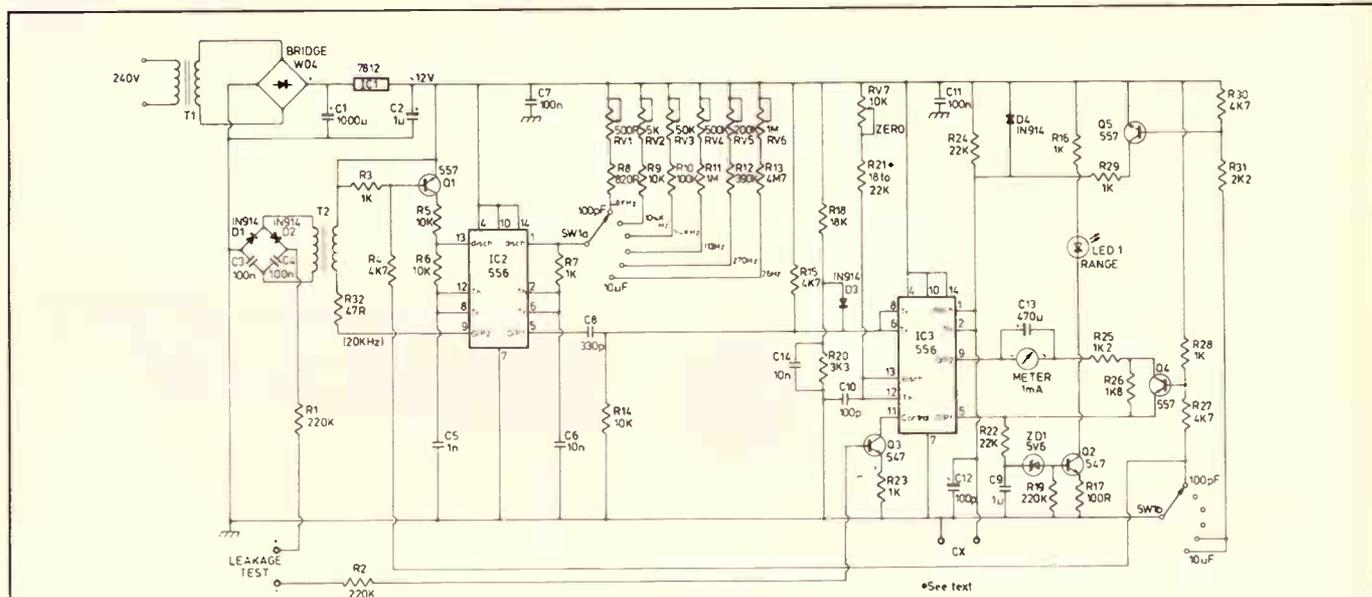
## CREATING WITH ELECTRONICS PART 8

appliance can be determined, although 240 volt rated devices should ideally be tested at voltages up to 500 volts. Certainly, if leakage is exhibited at 100 volts, applying 240 volts is asking for trouble.

Open circuit faults in capacitors are common, and can be confirmed by noting that no initial deflection occurs during the

leakage test. Very small value capacitors will not produce much deflection, but values above 100 pF should exhibit the effect sufficiently to confirm no open circuit exists. Values above 0.1  $\mu\text{F}$  will cause an initial deflection to, or above full scale, and, as a charge is taken, an eventual return to zero should occur taking a time

depending on the capacitor value. As an example, a 1  $\mu\text{F}$  capacitor could take up to 20 seconds or more to be fully charged. An important point to note is that the capacitor will be left holding a 100 volt charge, and should be discharged before measuring its capacitance value, or anything else for that matter!



### HOW IT WORKS — ETI-178

The circuit is in two separate, but integrated sections; the capacitance measuring part, and the leakage tester. For both sections, IC2 provides the function of two separate oscillators, one fixed at around 20 kHz for the leakage tester, the other operating at selected frequencies for each capacitance range. The 20 kHz oscillator functions when Q1 is turned on by selecting the pF/leak test position on switch S1B. The output waveform for this oscillator is low for only 20% of the total period, ensuring a sufficiently narrow current pulse through the primary of the transformer to minimise power dissipation in IC2. R31 also assists by limiting the value of each current pulse. The secondary of the transformer is connected to a voltage doubler which produces approximately 100-Vdc when unloaded. The timing components for this oscillator are R5, R6 and C5. R3 holds Q1 off, unless a current path to ground is provided through R4 and SW1B.

The oscillator frequency for the capacitance measuring section is selected by switching in one of the 6 trim pots and its associated series resistor. The frequencies obtained on the prototype are included on the circuit diagram, but will differ with each instrument by as much as 10%. The timing capacitor for this oscillator is C6. The output of the oscillator is fed to the differentiating circuit comprising C8, R14 and R15, which then delivers trigger pulses to the two monostables provided by IC3. The trigger pulse clipping circuit of D3, R18, R20 and C14 is used to eliminate the trigger comparator saturation problems discussed previously, (Part 6). For some brands of 556, eg, Fairchild, these components are unnecessary. Note that some other brands of 556 will not work properly in this circuit, due to the small value of the timing capaci-

tors C10 and C12. RCA types work, providing the clipping circuit is included, but Signetics brand do not.

As described in the text, the meter movement is connected between the outputs of both monos, to allow a zero reading when the pF scale is selected. Nulling of the pointer is provided by RV7, which adjusts the high time of mono 2. The series resistor R21 may need to be varied from that shown to ensure no pointer deflection when the zero control is centred. The timing capacitor for mono 2 is C10. The unknown capacitor  $C_x$  is placed in parallel with C12, which together form the timing capacitor for mono 1, causing the high time of this mono to extend beyond that of mono 2. The meter deflection is directly proportional to the amount the pulse width of mono 1 exceeds that of mono 2, and represents the value of  $C_x$ . The circuit values are arranged so that full scale deflection occurs for a duty cycle of around 30% for the output waveform of mono 1. By varying the pulse repetition rate, determined by the oscillator, up to 6 decades of capacitance value can be applied without exceeding the 30% duty cycle.

However, some complications arise. If a direct relationship between oscillator frequency to capacitance decade were used, the range of frequencies would exceed the capabilities of the circuit. To permit measurement over the six decades, two switching transistors, Q4 and Q5 are used to change the meter sensitivity and the timing resistor value of mono 1. When pF measurement is selected, Q4 is turned on, which then short circuits R26, a resistor otherwise in series with the meter movement. This leaves R25 as the only resistor in series with the meter movement, increasing the sensitivity of the meter circuit by around

50%. The oscillator frequency can then halve that otherwise required. The next three decades then use a direct relationship of dividing the oscillator frequency by ten as higher decade values are selected. The final two decades, if this relationship was to continue would then have frequencies of approximately 10 Hz and 1 Hz respectively. Because these frequencies are too low to be practical, the timing resistor for mono 1 is lowered, by causing Q5 to switch a parallel resistor, R29 across the previously used timing resistor R24. This permits higher frequencies to be used for the last two decades.

The range error LED is driven by Q2, which is turned on when the voltage across C9 rises sufficiently to forward bias ZD1. This occurs when the output of mono 1 has a duty cycle greater than 50%. The leakage test circuit applies approximately 100 volts across the test terminals, supplied from the voltage doubler in series with R1. The current that flows through the device under test will forward bias Q3, which has its base connected to the other test terminal through R2. When conducting, Q3 will cause the control voltage to mono 2 to drop, decreasing its pulse width. This causes the meter to deflect proportionally to the current flowing through the capacitor under test. Because the pF range and the leakage test share the same switch position, the meter circuit is at its highest sensitivity, and leakage currents of 10  $\mu\text{A}$  or less will produce full scale deflection. To protect IC3 against the possibility of a charged capacitor being placed across the capacitance measuring terminals, D4 is connected to the positive test terminal and  $V_{CC}$  clamping this point to around 12 volts, and providing a discharge path for the capacitor.

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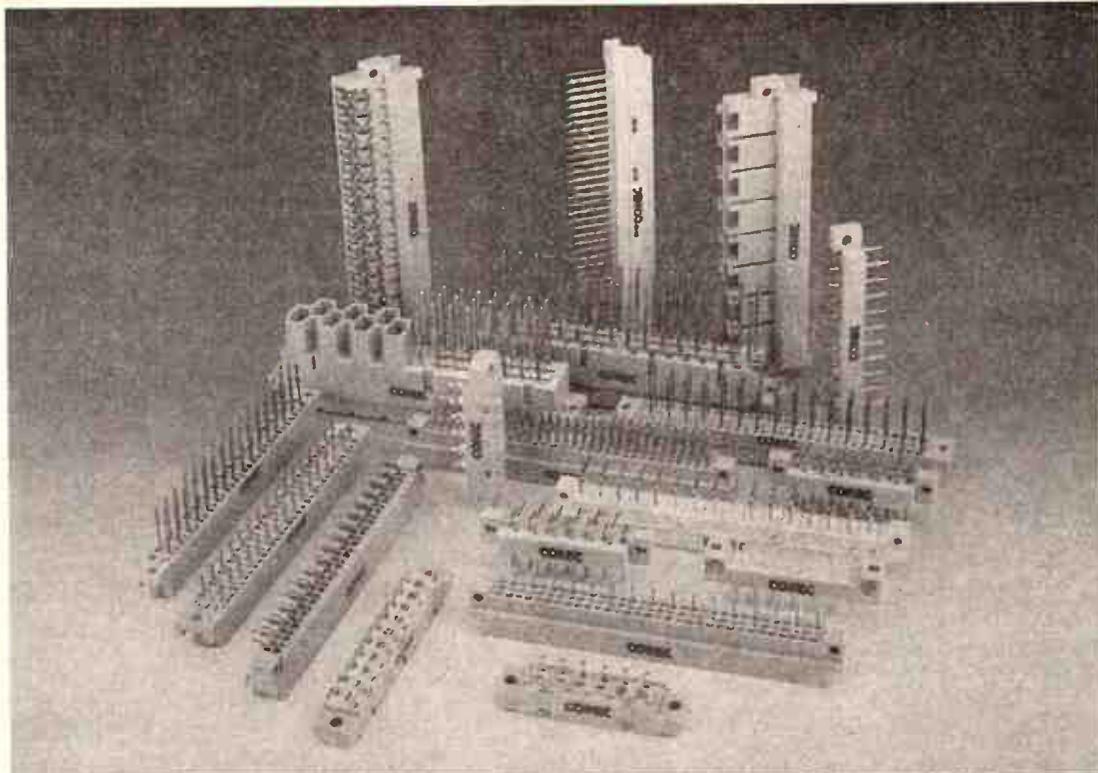
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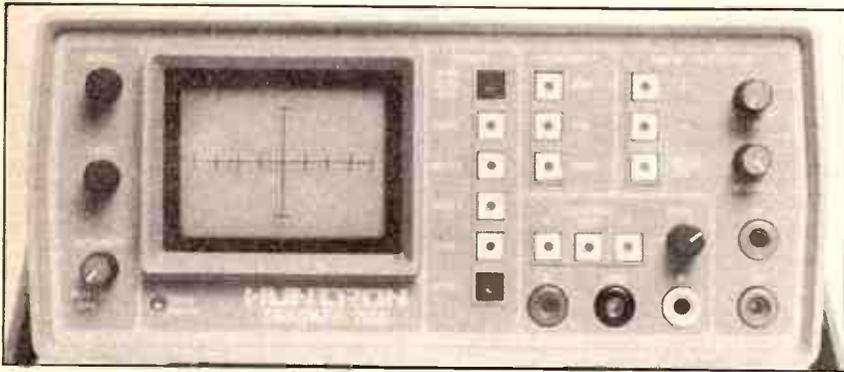
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A new device for finding faults

# The Huntron Tracker 2000

Jon Fairall



Both versions of the Huntron Tracker can be seen at the Whats New Products show at Homebush State Sports Centre, Sydney between 8-9 July and in Melbourne 29-30 July.

A few months ago we reviewed a device called a Polar T1200, which could find faulty components by displaying a voltage versus current plot of the component. It was, I thought, an interesting device, one of those good ideas that make you ask: "why was it never thought of before?"

The idea is to put a variable voltage between the probes, and then monitor the resulting current. Different types of components reveal themselves by characteristic traces. For instance, a resistor is just a straight line, ramping up in accordance with Ohm's law. A capacitor is an oval, the amount of capacitance determining the ellipticity of the oval.

Semiconductors also have their characteristic shapes. A diode, for instance, has a knee with a horizontal and then a vertical section. Transistors show their typical characteristic curves.

The beauty of such a device is that in-circuit testing, with all that implies in terms of time saving at the work bench, becomes possible. For instance, using a multimeter, it's impossible to detect an open capacitor in parallel with a resistor, since the meter will only register the resistance. If the capacitor is short, a multimeter will not tell you which component is at fault. A V versus A display will. A resistor and capacitor in parallel, for instance, will display a little bit of resistance and a little bit of capacitance, and give you a diagonal oval. Alter the amount of

capacitance present, and the shape of the oval changes.

The worst thing about such a device is that measurement is extremely difficult. At best it is imprecise, at worst, impossible. Therefore, one must concentrate on the shape of the trace, rather than its size if the unit is to have any value. For this reason, the best troubleshooting strategy in a practical situation is by comparison. The board under test and a known good board are laid, side by side, and the two are compared.

## The Huntron Trackers

I was rather taken with the T1200 because I'd never seen anything like it before. However, it turns out that there is more than one such device out in them thar hills. The Tracker 2000 has been produced by Huntron instruments of the US, and is being distributed by ECO Electronics in Brisbane. Its worth \$3257 ex tax. A model 1000, without the pulse generator, less impedance ranges and less oscillators, is worth \$1754 ex tax. According to Wayne George the managing director of ECO, the model 2000 has received an enthusiastic response from local technicians. Over 200 Trackers of both types have been sold Australia wide.

It comes in a grey case with a small display to the left of the screen and a series of knobs to the right. Each knob has a small light in the middle which lights up when the function is activated. It's a nice

touch that reveals the state of the instrument at a glance. You don't have to check to see whether a particular function is active.

Immediately to the right of the screen is the range selection panel. This allows the operator to change the impedance of the instrument through four ranges. Impedance is important because the test signal is applied between the probes as a specific voltage level and input resistance. The current that flows when the circuit is completed through the device under test is used to drive the vertical deflection of the trace. The voltage on the terminals causes the horizontal deflection. Thus the behaviour of the trace depends quite critically on the amount of input resistance in series with the voltage source, the idea is to increase the impedance if you want more horizontal discrimination, and reduce it for vertical discrimination. There is an auto function on this as well so the instrument will spool through the various settings.

Next to the ranging buttons is a set of three to select the sine wave frequency. It will apply a sine wave to a component at 50, 400 and 2000 Hz. It can also supply pulses of variable level and shape for dynamic testing. For instance, it is possible to put the probes across the collector emitter of a transistor and then confirm its operation by turning the base on and off with the pulser. The level of the pulse is variable between plus and minus five volts. It's also possible to vary the width of the pulses.

Finally, at the bottom of the panel is a selector for the two channels. This allows the user to apply signals to two boards, switching between the two. A variable pot allows the selection of the rate at which the instrument swops between the two channels. It also sets the rate at which the impedance level changes when in the audio ranging mode.

In use, the 2000 works well. Not that the comparison method of problem solving is the answer to a technician's prayers. Trouble shooting still requires the application of common sense, since boards are rarely identical, and quite frankly, it's a pain to have to connect two leads every time you want to make a test. It seemed to me that the most efficient way to use the machine is to make an educated guess at the expected shape of the trace at a given point and then to probe. The manual helps here. Apart from a comprehensive instruction and servicing section, it also contains pages of useful diagrams of what various devices should look like.

I liked the tracker. I doubt it will replace the multimeter on too many workbenches, but it could well stand along side it.

## Electrical Death

Few of the articles and projects published in ETI have ever made much mention of the safety risks inherent in their operation and construction. In order to redress this balance we publish the following salutary tales and graveside warnings as a guide to the unwary. The source of much of this material comes from 'What a way to Go' by Peter Bowler and Jonathon Green published by Pan.

## Pussy's Revenge

Many people hate cats but none more so than Mr Frederick Power of Newcastle. As a consequence he decided to build a trap consisting of a small sardine can, filled with meat, which was attached by an electrical cable to his garage power point. Shortly afterwards Mr Power was discovered in his backyard, dead, lying face down, holding the electrified sardine can.

The resulting coronial inquiry was unable to discover why Mr Power was clutching the fatal can. Some have pointed out however, that in laboratory experiments cats have been taught to manipulate switches very successfully.

## The Electrifying Pastor

Pastor Kaarlo Toivo was a 62-year-old Swedish clergyman. Like many modern evangelical sects the Pastor's church believed in adult baptism. As this was Sweden the Pastor performed his religious duties in a heated pool. During one such ceremony this excellent churchman called for his microphone, forgetting he was still in the pond. The resulting effects of this unwise move saw a change in sacrament from baptism to burial.

## Mr Anonymous

A sadly disturbed young man decided to commit suicide. Determined to make an impression as well as reflect his sexual predilections, he proceeded to dress himself in panties and a brassiere filled with foam balls. He stripped the ends of an extension cord and taped them to his nipples with sticking plaster. Then he fixed another cord to the switch in such a way that he could turn on the switch by tugging the cord. He threw this cord over a handy beam, and suspended himself from the same beam by the wrists. One of the worlds great innovators died when he tugged the cord.

## Walking the Line

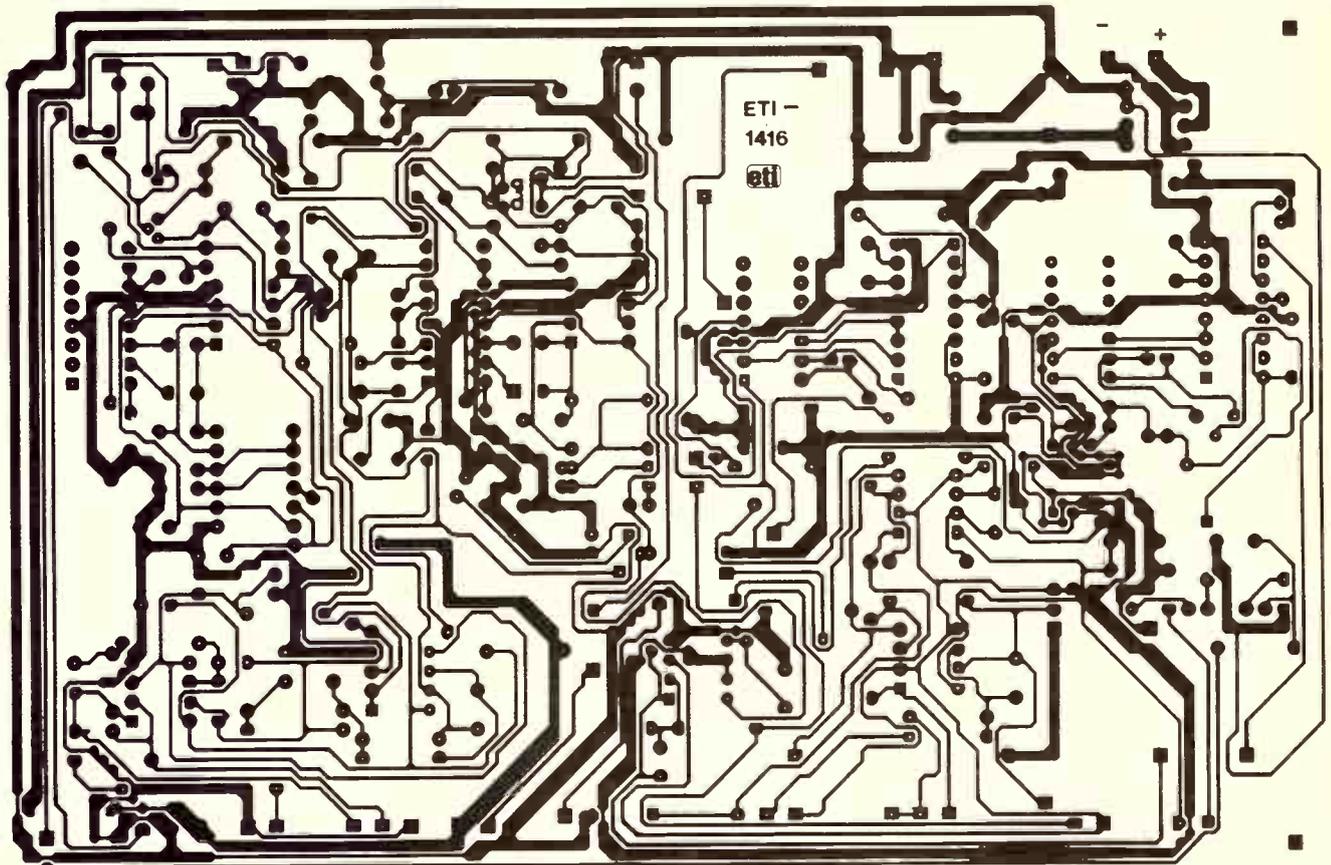
Joseph Patrick O'Malley met his end when he went walking beside the track of a New York Subway railway line whilst drunk. It seems that O'Malley stopped to urinate and when the noxious stream hit the electrified third rail it acted as a path for 600 volts to enter his body. Apparently the only clues to the cause of his death were certain electrical burns found on the tip of his penis and on his thumb and forefinger.

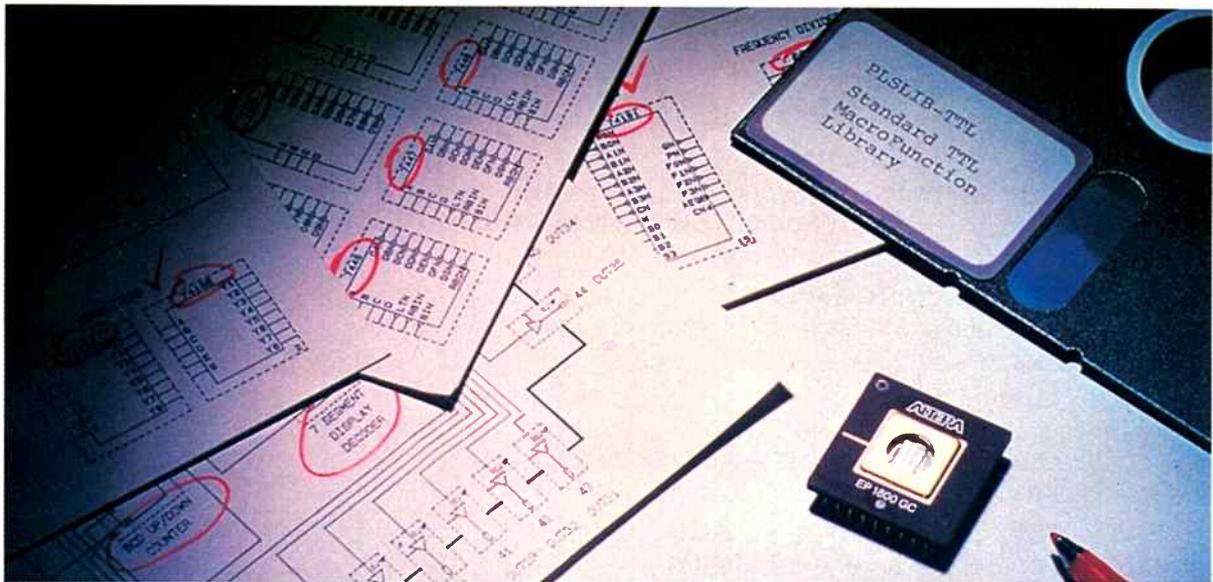
## Bavarian Surprise

At some time in the twentieth century a Bavarian man was discovered by the local police sitting on the lavatory, stark naked with a potato masher attached to his genitals. Apparently this individual had discovered (one wonders how) that power from the mains, applied through a potato masher (which he shaped to fit his organs) gave him great stimulation. He was in the habit of using the masher in this way constantly.

He met his death when, having finished his pleasure he stood up and attempted to pull the chain. The metal chain provided a perfect earth and he was electrocuted.

ETI — 1416





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### CONDITIONS OF ENTRY

1. The competition is open only to Australian Residents authorising a new/renewal subscription before last mail September 30, 1987. Entries received after closing date will not be included. Employees of The Federal Publishing Company, Thai Airways International Limited and their families are not eligible to enter. To be valid for drawing, subscription must be signed against a nominated valid credit card, or, if paid by cheque, cleared for payment.
2. South Australian residents need not purchase a subscription to enter, but may enter once only by submitting their name, address and hand-drawn facsimile of the subscription coupon to The Federal Publishing Company, PO Box 227, Waterloo, NSW 2017.
3. Prizes are not transferable or exchangeable and may not be converted into cash.
4. The judges decision is final and no correspondence will be entered into.
5. Description of the competition and instructions on how to enter, form a part of the competition conditions.
6. The Competition commences on July 1, 1987 and closes on August 31, 1987. The draw will take place in Sydney on September 3, 1987 and the winner will be notified by telephone and letter. The winner will also be announced in The Australian on September 7, 1987, and a later issue of this magazine.
7. The prize is: A return trip for two people flying Thai Airlines economy class Bangkok with 8 days and 6 nights accommodation. Breakfast, one set of transfers to and from the International Airport in Bangkok and your hotel are included.
8. Passports, visas, insurance, departure taxes, transportation between any other destination, immigration formalities, transfers to the nearest Thai Airlines International departure Airport, are the responsibility of the winner. The promoter accepts no responsibility for any delay, cancellation, accident, personal or property damage arising from and/or in connection with the travel prize.
9. Entrants under the age of 18 years will be required to nominate a guardian to accompany them on the journey should they win.
10. The winner and their companion agree to abide by the booking conditions as laid out in the Royal Orchid Holiday Brochure. All travel must be completed by September 3, 1988.
11. The promoter is The Federal Publishing Company, 180 Bourke Road, Alexandria, NSW, 2015. Permit No. TC 87/1119 issued under the Lotteries and Art Unions Act 1901; Raffles and Bingo Permits Board Permit No. 87 635 issued on 28/4 87; ACT Permit No. TP87317 issued under the Lotteries Ordinance 1964.

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