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INTERNATIONAL



OCTOBER 1987  
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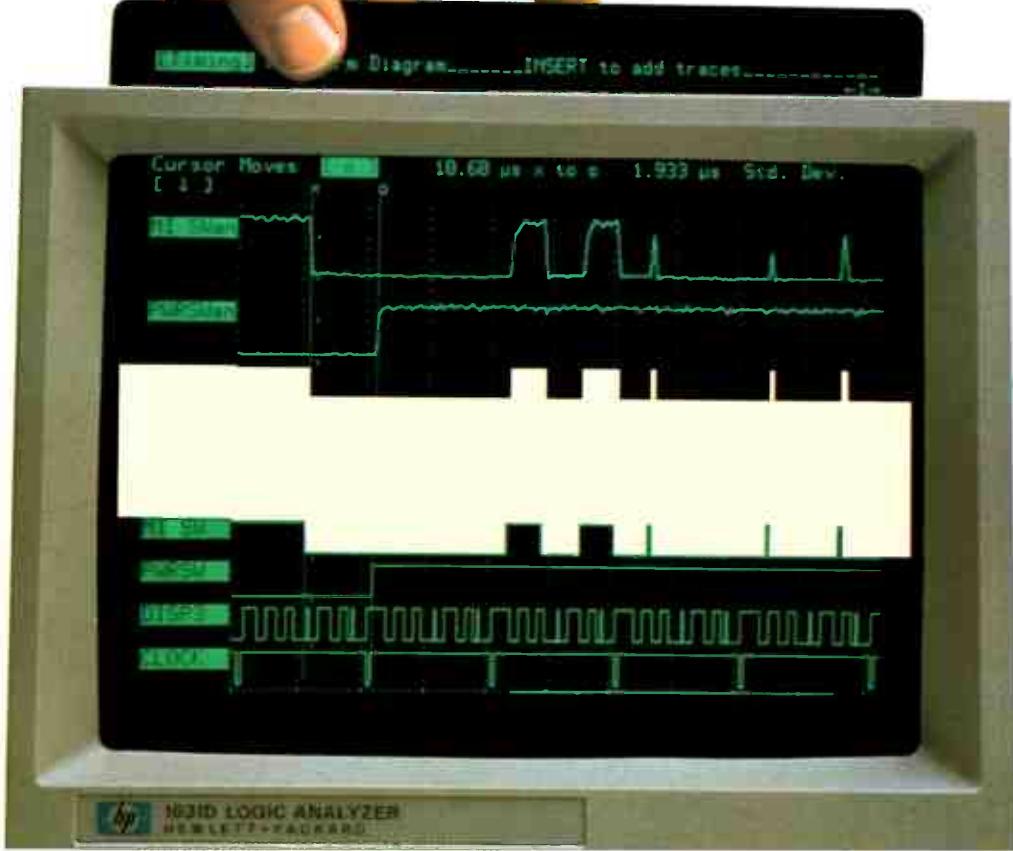
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stop  
asking*

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# Electronics Today

INTERNATIONAL

OCTOBER  
1987

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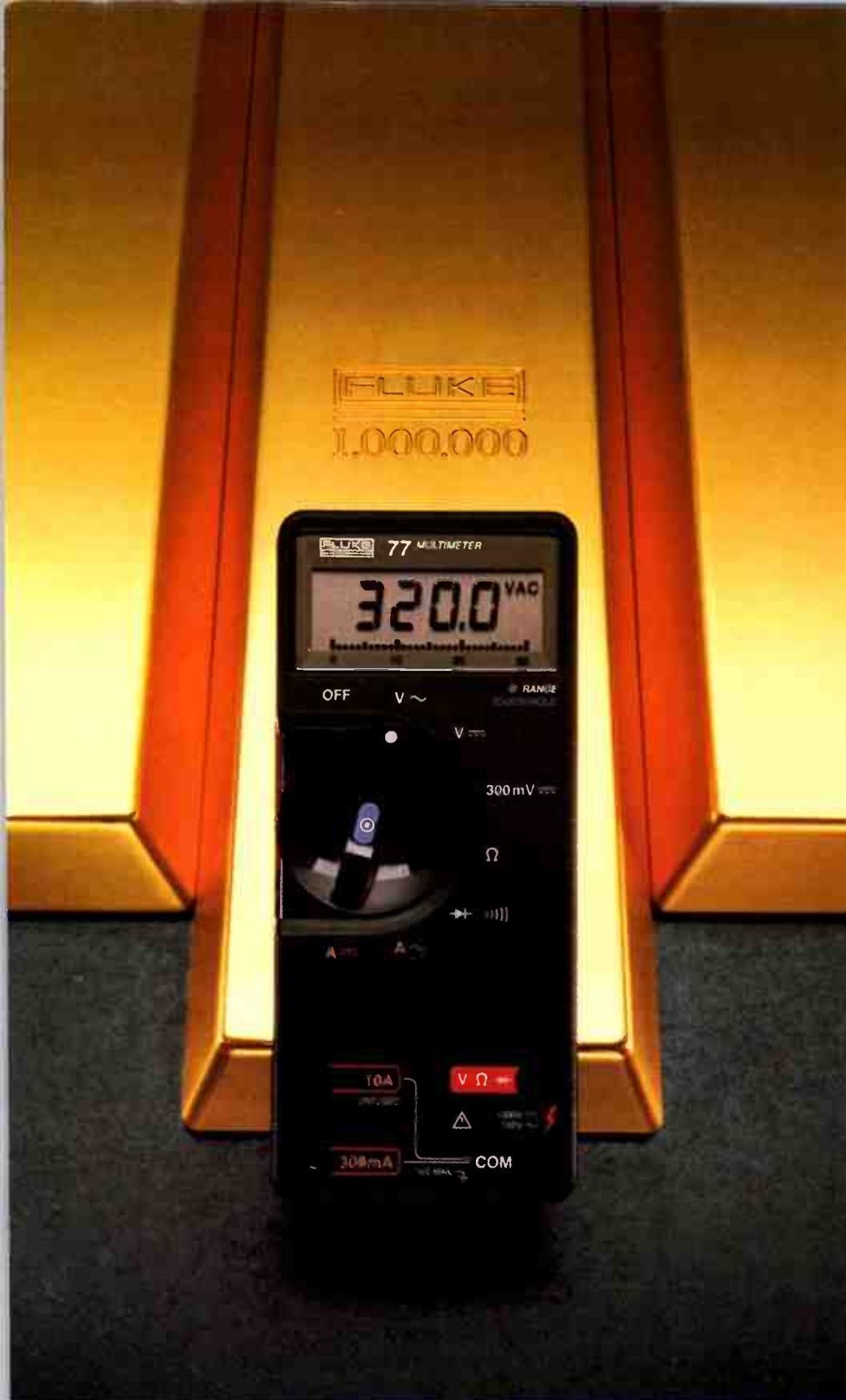


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COVER: Halley's Comet. Photo courtesy of Educational Media Australia.

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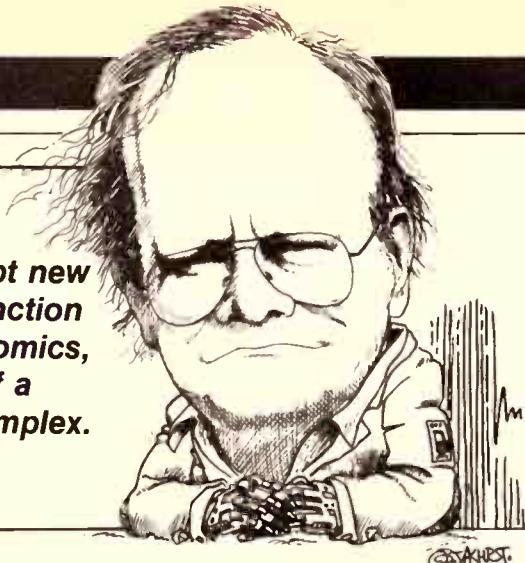
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## Frequency

**Our slowness to adopt new technology was a function not so much of economics, as it was a part of a national inferiority complex.**



There was a time when we in Australia were always behind the rest of the world. It took us years to get radio, years to get TV, years to get FM, not to say years to get decent rock and roll, or mini-skirts. Our slowness to adopt new technology was a function not so much of economics, as it was a part of a national inferiority complex.

Like many who grew up in the sixties and seventies, I have come to accept that this is no longer part of Australian life. We have a radio and TV system better than most in the world. Sydney and Melbourne offer more diversity in listening or viewing than almost any city in the world, with the possible exception of New York or Los Angeles.

In broadcasting at least, this situation looks all set to erode again, because of the government's continued refusal to make proper use of AUSSAT. This comes about just as the rest of the world is starting to get Direct Broadcasting from Satellites (DBS) properly organised.

There has been fortuous DBS in the US and Europe for years. TV originators have been reticulating unscrambled signals to distant terrestrial stations for re-broadcasting, and ordinary citizens have been mounting dishes on their roofs or backyards to eavesdrop on the signal. However, because the transponders in the satellites have typically had only 10 or 20 Watts output, the dishes have been large and the receiving equipment expensive. The latest generation of satellites features 100 Watt transponders. These will enable desk top antenna, dishes only 45 cm across, and electronics cheap enough to be considered alongside the VCR.

At the same time, encryption techniques have reached the stage where it is possible for the broadcaster to control who receives his signal. Thus the stage is set for a complete re-organisation of broadcasting. Instead of using advertising or taxes to pay for the production of TV, we can now implement a user pays service, in which only the watcher pays for the signal. At the same time, the possible market place is increased. In theory, one satellite can service an entire hemisphere. Certainly, there is no problem blanketing an area like Europe or Australia.

As a result, around the world, we are seeing the beginning of the end of the traditional broadcasting empire, and the creation in its stead of "narrowcasting" of TV. Narrowcasting has been going on in radio markets like Sydney for years. With so many stations, it is possible for a station to specialise, so there are stations that specialise in sport, or current affairs, or different types of music. The same thing is happening in TV. Arrangements are well in hand in the UK for a Children's channel, a specialist movie channel, one dedicated to Sport, one to the Arts, and so on.

The problem in Australia is primarily to be found in the media barons — those gentlemen who fork out millions, occasionally billions, for the right to make and broadcast TV signals. Since these are, to a man, shrewd businessmen, one must assume that these colossal prices are a reflection of their profits. As one would expect, they are using, and will continue to use, their considerable muscle to protect their enterprise. As long as they have their sway, Australian TV will continue to be a scarce commodity, and it will continue to be expensive.

Jon Fairall

**EDITOR**  
Jon Fairall B.A.

**ASSISTANT EDITOR**  
Simon O'Brien B.A. (Hons), M.A.

**EDITORIAL STAFF**  
S. K. Hui B.Sc. (Hons), M.Eng.Sc. MIEEE, MIREE  
Terry Kee B.Sc. (Hons), M. Phil.

**DRAUGHTING**  
Karen Rowlands

**DESIGNER**  
Clive Davis

**ART STAFF**  
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Mal Burgess

**ADVERTISING MANAGER**  
Peter Hayes B.Sc.

**ADVERTISING PRODUCTION**  
Brett Baker

**SECRETARY**  
Nina Stevens

**ACOUSTICAL CONSULTANTS**  
Louis Challis and Associates

**PUBLISHER**  
Michael Hannan

**MANAGING EDITOR**  
Brad Boxall

**HEAD OFFICE**  
180 Bourke Road,  
(PO Box 227, Waterloo, NSW 2017  
Alexandria, NSW 2015.  
Phone: (02) 693-6666.  
Telex: AA74488, FEDPUB.  
Federal Facsimile: (02) 693-2842.

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**New South Wales & Queensland:** Peter Hayes, Mark Lewis, The Federal Publishing Company, 180 Bourke Road, Alexandria, NSW 2015. Phone (02) 693-6666. Telex: AA74488 FEDPUB.  
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**South Australia and Northern Territory:** Michael Mullins, C/- John Fairfax & Sons, 101-105 Waymouth Street, Adelaide, 5000. Phone (08) 212-1212. Telex: AA82930. Facsimile: (08) 212-1210.

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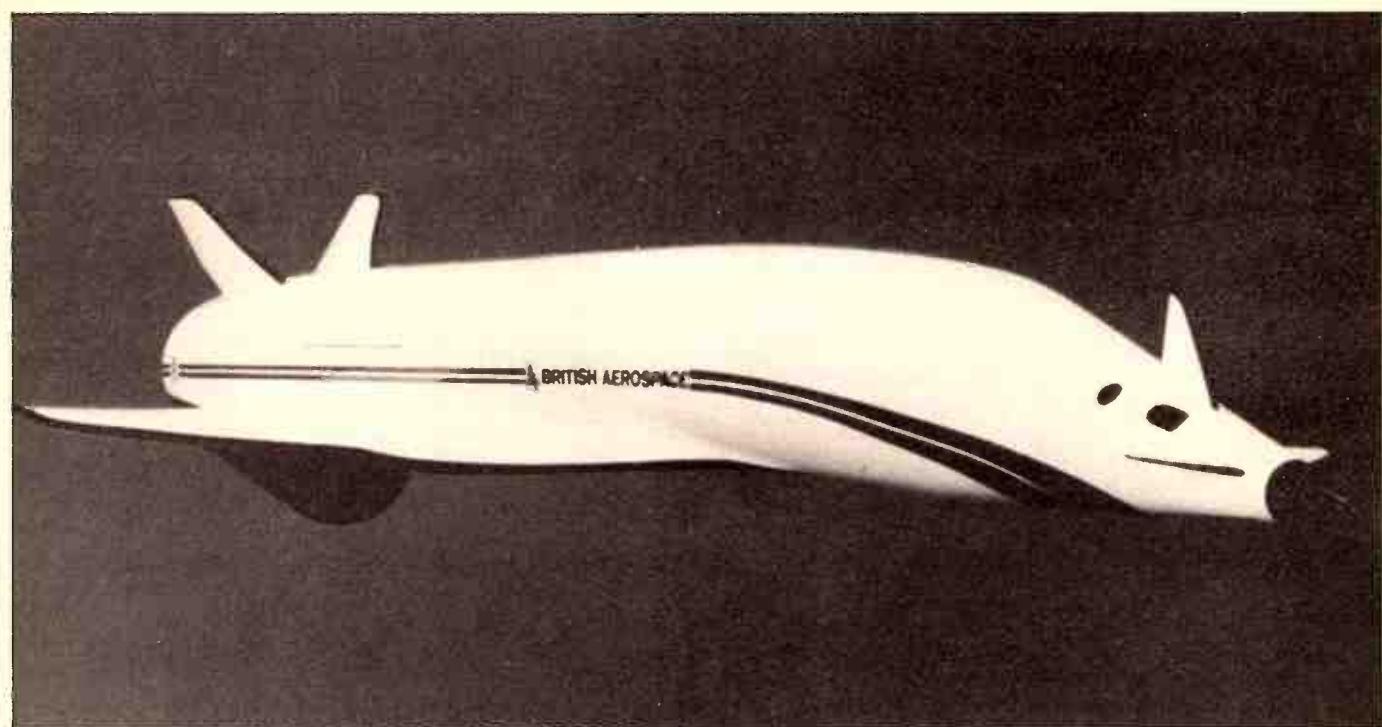
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A model of the proposed British spaceplane HOTOL. It could fly as early as 2005 if funding is forthcoming from the European Space Association.

### More Hotol Work

More research on the British spaceplane Hotol (see News Digest, August 1987) may be contracted out to the Australian National University by British Aerospace.

The ANU runs a facility called the Hypersonic Test Tube which is one of the few places in the world where

really high air speeds can be simulated. BAe space systems manager, Gordon Briggs, said that the tests would concentrate primarily on the nose and air intake region of the aircraft, as well as some other critical flight surfaces. The ANU shock tube can simulate wind speeds of

up to 30,000 km per hour.

The new work comes hot on the heels of a contract awarded to Queensland University to develop a Re-entry Air Data System. The work is coming to Australia because, according to Prof Ray Stalker, there are only two facilities capable of producing

the speed required, and both of them are here.

Writing in the *Bulletin* magazine, Stalker says, 'if we are able to take advantage of the present fortunate technical position generated by our research, then it is feasible we may also play a part in space plane manufacture.'

### New Battery Technology

What appears to be the first real revolution in batteries since the development of the secondary cell has taken place at the University of New South Wales. Dr Maria Skyllas-Kazacos has released details of a battery in which the charge is held in a fluid that can be pumped into the battery to charge it up.

The technology, based on Vanadium, is ideal for use in electric cars and other mobile applications, because the fluid can be treated like a fuel and pumped just like petrol. However, it is likely its first usage will be as a peak demand leveller in small power stations in the out-



Maria Skyllas-Kazacos of the University of New South Wales

back. The development of an electric car will be a secondary priority, but even so, we may well see one on the

streets within two years.

The battery works by extracting the electrical potential between two oxidation states of a Vanadium solution. The negative fluid has a 2+ charge on it, the positive a 5+ charge. The plates are some inert material, although in the prototypes carbon is being used. When a connection is made between the plates current flows as the higher charge discharges into the lower one. To recharge the battery the fluids need to be recharged to their correct potential externally, and then the fluid pumped back in again.

A usable cell based on Vanadium develops 1.5 volts,

much like a lead acid cell, but its energy density is about twice as high, which means that a battery to replace current generation lead acid batteries would be about half the size.

Commercial exploitation of the battery is being undertaken by Perth based Agnew Clough. The company is Australia's only existing Vanadium miner, and initially plans to develop the battery to supply energy to its remote mining operation. This will involve a 125 kW/hr installation. According to a company spokesman, the next step will be the development of a prototype electric car. Skyllas-Kazacos has been

# France to Create New Technology

The French government is worried that France is falling behind in the race for new technologies. Last year there were 60,000 patents in the US, 30,000 in West Germany, 20,000 in the UK but only 12,000 in France.

The French Prime Minister, Jacque Chirac has announced new measures to redress the problem. They range from tax incentives for R and D in the private sector, to financial rewards to scientists who leave the government research bodies to work in industry.

The problem, according to the government, is that the large state supported research bodies cream off the best scientists and then show little interest in turning out marketable products. Chirac has ordered that this barrier between public and private industry must be broken down. He has set up a "New Materials" programme to link defence, industry, communications, the Atomic Energy Commission and Research Organisations. The Programme has a budget of FF 200m.

working on the development of the battery for four years. It is based on a design originated by NASA called the redox flow cell, which used substantially the same methods, but with two dissimilar metals. According to Skyllas-Kazacos, she originally formulated the idea of using Vanadium after observing that the big problem with the NASA cell was caused by the fact that they were using two dissimilar metals. She applied for a grant from the National Energy Council's Development and Demonstrations fund and was able to employ a couple of researchers to develop her ideas from a simple test cell.



A mobitex terminal located on a car dashboard.

## Mobitex

Sweden, Norway and Finland have agreed to go ahead with a common system for mobile data communication. The system, called Mobitex, has been in operation in Sweden since October 1986, and is the first public radio

telecommunication network for text, voice and data.

The situation at 25th June was that Finland had definitely decided to introduce the Mobitex concept, and Norway planned to follow suit. Denmark was not com-

## Wynn's Safari

Telecom is donating an ITERRA satellite ground station to the organisers of the Wynn's Safari car rally again this year.

After last year's success, Automation Australia, who run the rally relying on satellite communication extensively during the 6500 km, nine-day event between Sydney and Darwin. The Iterra Network Services Earth Station (TINES) is Telecom's larger mobile earth station and is mounted on a Volvo turbocharged N10 truck. The four tonne unit is packed with electronics and a 4.6 metre fold down antenna dish. The ITERRA unit is specially modified for use in the outback and is capable of operating in temperatures up to 50 degrees Celsius and in 95% relative humidity.

TINES will provide STD, ISD, text and voice lines — providing facilities for extensive media coverage from the lonely overnight stops in the bush — from locations that have no communications at all.

These facilities will allow use of facsimile for newspaper reports, and the transfer of photographs to newspapers by the use of a Nikon NT 1000 picture transmitter — the machine that was the basis for the scoop photographs out of Fiji during that country's recent crisis.

Another important facility is the ability to make voice re-

ports to radio stations, as well as maintain contact with the event Sydney Headquarters for search and rescue.

For the competitors it means the luxury of telephoning home from 'Back O Bourke'. The Telecom facilities include gold phones, normal handsets, and even new card phones which accept credit cards such as Bankcard or American Express!

The TINES unit will be manned by a Telecom crew who will travel up to 600 kilometres a day, and then set up their facilities within 45 minutes of reaching the Wynn's Safari night time base. The unit can provide 14 telephone lines, but only 10

mitted, but would undertake a quick market research exercise to determine the concept's potential.

The Scandinavian telecommunication authorities have co-operated for many years in developing mobile telecommunications. The aim is to create a range of services which meet the demand and also build up a common telecommunications market within the area.

The Scandinavian mobile data market is still in its infancy. Forecasts indicate that there will be 40,000 mobile data terminals in the region by 1990, increasing to 160,000 by 1995.

are needed for the Wynn's Safari.

As a result of the successful application of the larger TINES unit in events such as the Wynn's Safari, coupled with a greater requirement for communications on the move in the outback, a compact version of the truck mounted Iterra TINES has been developed.

The smaller version features a trailer-mounted three metre dish, which can be towed by a 4WD vehicle over the most rugged terrain. The unit is simple to operate with the minimum of training and means anyone can have access to six phone lines, anywhere in the outback, within 30 minutes of arrival at base.



Competitors ringing home via the Iterra satellite system located in the outback.

### Canadian Radar Satellite

Canada plans to go ahead with its most ambitious remote sensing project — a radar sensor in an 800 km polar orbit planned for 1994. Canadian science minister Frank Oberle announced that C\$725m had been earmarked for the project. Part of the cost will also be met by Britain and the US.

Canada was among the first countries in the world to embrace space technology; they were first with a domestic broadcast TV system and the first non-US user of Landsat images.

Today, the industry spawned by early government involvement amounts to C\$60m in exports alone.

The choice of radar wavelengths accords with the current wisdom in remote sensing science. Radar can see through clouds and works just as well at night. Also, many exciting formations on the earth's surface are reflective to radar wavelengths in unique and interesting ways. Different types of soil and rocks reflect differently, as do different types of plants.

The importance of new wavelengths for remote sensing has been underlined recently by critical assessments of the information being returned at visual wavelengths. For instance, crop monitoring has been one of the many justifications for the use of remote sensing satellites like Landsat. How-

ever, new evidence has come to light of just how inadequate present methods are of using data gathered from space to predict the size of the rice crop in South East Asia.

Stewart Fraser and Ken Bandsley of the Dept of Geography, Flinders University, and Bruce Currey of the Human Resource Development Division of the Winrock International Institute in Dhaka, Bangla Desh, have collated all the data received from the Landsat 1 satellite between July 1972, when the satellite was launched, and the end of 1980. Their paper was published during the month in the science journal *Nature* (6131, 13 August, 1987). Their conclusion: the data was essentially useless as a tool for predicting famine.

Apparently, the problem is that the best indication of the final size of the crop is to be had during the growing phase. Since the amount of time between planting, flowering and harvesting is known with a fair degree of accuracy, it is possible to extrapolate from one stage to the next. However, the growing phase of the rice corresponds with times when south east Asia is covered in cloud as a result of the monsoon. The problem is so bad that in some years no useful images at all are available and even in the best months



*The earth at visual wavelengths. Cloud cover can render such images useless for ground surveys.*

Landsat can only provide seven.

The problem is worse, predictably, in some locations than others. A test site in Honiara in the Solomon Islands was the worst, with not one single good image. Some sites in Bangla Desh and West Bengal provide good images in the Northern winter, but few during the summer.

There are two ways around the problem. One is to use satellites in orbits that give more images; Landsat is in a polar orbit, so it sees all the Earth's surface sooner or later, but its orbit twists slowly so that it only covers the same place once every eighteen days. Newer satellites like NOAA 8 and 9 can photograph the same spot four times daily and so can provide more bites at the cherry but at much lower resolution.

The second technique is to use wavelengths that are not so responsive to cloud, but still give good indications of growth patterns. Radar fits well on the first, and adequately on the second account, which is why the Canadians are so keen to go ahead.

Canada is taking the lead in the venture, but Britain and France will contribute some 40% of the total cost in return for data sharing. British Aerospace, who are prime subcontractors for the European Radar Satellite, will build the spacecraft structure and the US will provide launch services. The Canadians will build the radar and manage data collection.

The data will be marketed on a commercial basis, and is expected to return some C\$34m to the government in royalties.

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## Superconductors support

The Industry Research and Development Board (IRDB) has declared high-temperature superconductivity and superconducting materials a priority area of research and development.

The board has approved their listing as a priority area within the generic technology category of new materials technology under the Grants for Industry Research

and Development (GIRD) Scheme.

IRDB chairman Bill Kricker said that worthwhile projects in priority areas are given preference in allocation of generic technology grants.

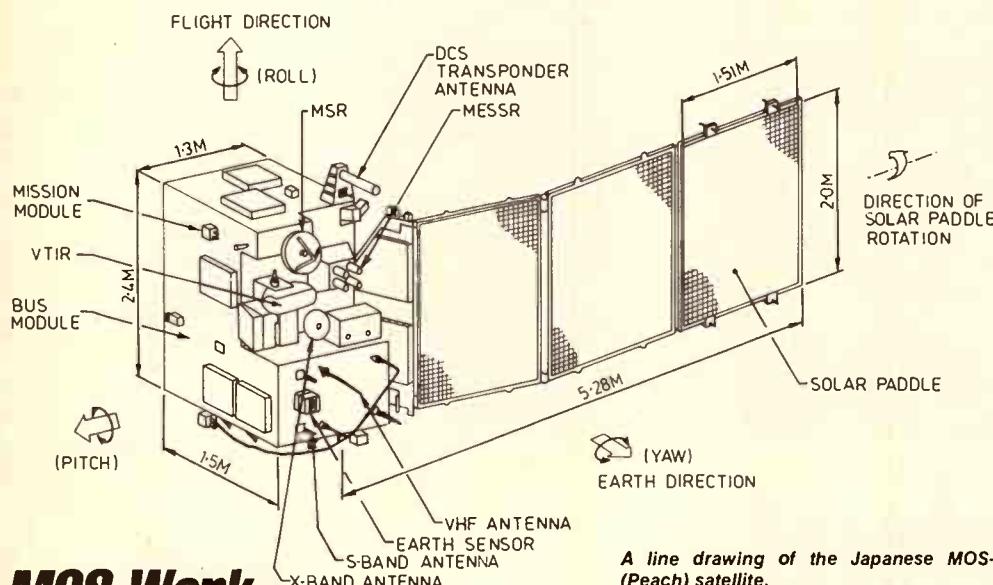
Under the generic technology component of the GIRD scheme, support is provided to technologies considered to be of fundamental significance to Australian in-

dustry's future international competitiveness.

The Minister for Industry, Technology and Commerce, Senator John Button, has declared three technologies, — biotechnology, new materials technology and information technology — generic technologies, and superconductors are one of ten priority areas under the new

materials category, according to Kricker.

Meanwhile, Metal Manufacturers, a major cable maker, has joined forces with the University of New South Wales to search for practical applications of high temperature superconductors. Super conducting power cable could reduce  $I^2R$  losses by 20%.



A line drawing of the Japanese MOS-1 (Peach) satellite.

## MOS Work

Work is now underway on the construction of receiving stations for signals from the new Japanese remote sensing satellite MOS-1 (Peach). Data from Peach will be received by the Division of National Mapping of the Department of Resources and Energy at Alice Springs (see News Digest, September 1987). The work is being carried out by private subcontractors and the CSIRO.

Reception of information from the satellite will begin in the second half of 1988. The satellite, launched on 19 February, 1987, is Japan's first remote sensing spacecraft. Further Japanese earth-observation satellites are planned, including an identical MOS-1b, an earth resources satellite (JERS-1) carrying an advanced radar sensing system, and the Advanced Earth Observation Satellite, ADEOS.

MOS-1 is intended to establish fundamental technologies for earth-observing satellites, primarily by observing marine phenomena such as ocean colour and temperature. In addition to oceanographic studies, the satellite's observations are expected to be of value to agriculture, forestry, fisheries, and environmental studies.

On its mission module, MOS-1 carries a Data Collection System (DCS) and three radiometric sensors: a Multispectral Electronic Self-Scanning Radiometer (MESSR); a Visible and Thermal Infrared Radiometer (VTIR); and a Microwave Scanning Radiometer (MSR). The craft as a whole weighs about 740 kg.

The MESSR is an electronic scan type radiometer which detects solar radiation reflected from the earth's surface in two visible bands

and two near-infrared bands. This bandwidth approximates that of the Landsat Thematic Mapper. MESSR is equipped with two camera systems that are parallel with the direction of the flight of the spacecraft. Each camera system is made up of two units — one for the visible range and one for the near-infrared range — scanning a width of 100 km of the earth's surface at right angles to the direction of flight. Normally, only one unit operates at any given time of the day. Each camera has 2048 charge-coupled devices for detection purposes, giving a resolution of 50 m at the surface.

The VTIR covers one visible band and three thermal infrared bands to detect thermal radiation from the earth's surface. VTIR's swath width is 1500 km and it has a surface resolution of 900 m in the vis-

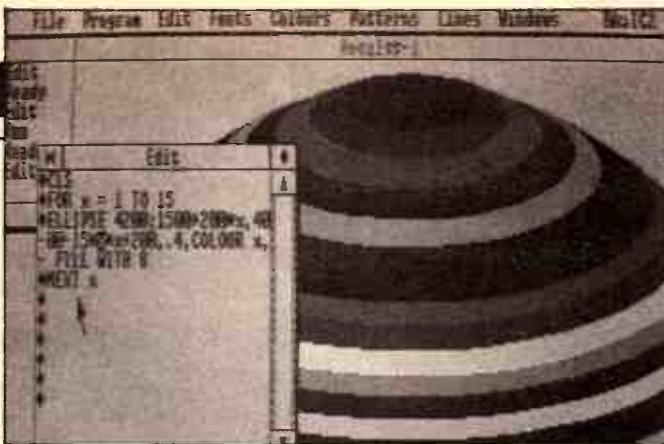
ible and 2700 m in the thermal infrared bands. The instrument functions by day or night.

The microwave scanning radiometer (MSR) senses water in the atmosphere and at the surface by detection of radio waves in the 23.8 and 31.4 GHz frequency bands. The resolution of the instrument is 32 km at the lower frequency and 23 km at the higher. MSR can also operate at all times of the day.

The MOS-1 operating system has two basic parts: satellite tracking and control; and mission management. The satellite is being tracked and controlled primarily by the Tracking and Control Centre at NASDA's Tsukuba Space Centre, and also by tracking and data acquisition stations at Katsura, Masuda, and Okinawa.

However, Peach has no recording facilities on board, so information must be retrieved from the satellite in real time. As it moves in a polar orbit, Peach data will be available sequentially to the Japanese, a station in Thailand, one in Europe, in Antarctica and then Alice Springs.

The agreement with the Japanese, one of Barry Jones last actions as Minister for Science before the restructuring of ministries after the general election, will give Australian remote sensing scientists even more opportunity to experiment in fisheries and oceanographic research, geological exploration, atmospheric science and mapping and surveying.



The graphics screen of Amstrad's PC1512 using windows and BASIC during an ETI review.

## Amstrad Leads in Europe

Amstrad, the popular range of home and business computers distributed in Australia by Mitsubishi Electric AWA, is leading the European market with a 51 per cent share of total home computer sales.

Figures published recently by International Data Corporation, a leading research firm, show that Amstrad's CPC home computer, the baby of its range, combined with the newly-acquired Sinclair products, boosted total 1986 sales to 1.75 million units, the highest in Europe.

This puts the UK-based company way ahead of its nearest rival, Commodore, which claims a 36 per cent market share. Commodore is reported to make about 70% of all Australian domestic computer sales.

Other supposedly household names, such as Atari and Acom account for only seven per cent of total UK

and European sales between them.

While home and hobby computer sales fell six per cent overall throughout Europe, Amstrad products, which include two CPC models, the PCW word processor, the top of the range PC1512 and the Sinclair stock, enjoyed a roll into schools, the business and professional sectors and even the scientific and technical market.

The company also beat Apple, Atari and Epson to win a five per cent share of the scientific and technical market, and posed a major threat to IBM with its 50 per cent shipping increase to Europe.

According to figures released by another market research company, Romtec, the Amstrad PC1512 is now claiming 40 per cent of the UK PC market, compared with IBM's 20 per cent share.

## New Plotter

HST, the Tasmanian company that sprang to prominence with the highly successful Protel CAD package, has shown a Gerber photoplotter based on technology developed in the Physics Department of the University of Tasmania. HST released news of the plotter at the IRECON show held in Sydney last month.

According to John Powell of HST, the photoplotter is not just a pen plotter with a light on it, but a genuine photoplotter that will compete with machines worth \$50,000. He is hoping to put it on the market for about \$25,000. It measures less than one metre by

one metre, and weighs in at 60 Kg. It features auto hold down, and can be driven directly by Protel or any other compatible package.

If this price eventuates, HST is sure to corner a section of the market. The company used the same technique to break into the highly competitive CAD market, when it released Protel PCB at almost half the price of competitive products. The company is also shipping copies of Protel schematic, a schematic drawing package that interfaces to PCB. An auto-routing package is also under development.

## Soviet Smash

A Soviet satellite came down unexpectedly in the middle of the Pacific Ocean on 10 August. It had been in a polar orbit for nine days. Cosmos 1971 splashed down about 4800 km north of New Zealand.

According to Tass, the Soviet news agency, the satellite carried a scientific

package for earth observation and a radio system for highly accurate orbital determination.

According to the US Space Command, who tracked the last few hours of the satellite, it skipped off the atmosphere once before its final re-entry at an estimated 27,000 km per hour.

B series satellite system planned for launch in 1991/92.

TCNZ will use up to four high powered transponders on each of the two planned B series satellites.

Each satellite will feature a specially designed National Beam that will cover all of New Zealand.

The agreement follows current New Zealand contracts (30 watt) transponder and part of a standard powered (12 watt) transponder on AUSSAT 3 which, when launched in September, will provide a spot beam over the South West Pacific, including New Zealand.

The B Series satellites will greatly extend this limited capability enabling enhanced domestic telecommunications, broadcasting and data services within New Zealand in the early 1990s.



Graham Gosewinkel

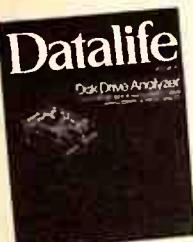
## ANZ Space Agreement

Mr Graham Gosewinkel, Managing Director of AUSSAT recently announced the signing of a Memorandum of Understanding with Telecom Corporation of New Zealand (TCNZ) covering the involvement of the Corporation in AUSSAT's second generation



Laurie Wiggins of Mascot collecting his airline ticket from John Arnold of Air New Zealand. Wiggins won the ticket in a subscriptions competition run in ETI earlier in the year.

# SAVE ON PERIPHERALS AT



## VERBATIM DATALIFE DISK DRIVE ANALYZER

Automatically tests 4 critical areas of drive performance

Disk drives are delicate instruments. And when they get out of adjustment, the integrity of your data is jeopardized.

With the Datalife Disk Drive Analyzer, you will know the exact condition and accuracy of your drives and avoid losing or damaging your data.

### Tests 4 critical areas...

In just minutes, the Datalife Disk Analyzer tests your drives' radial alignment, speed, write/read ability and clamping accuracy. And for each of these areas, it analyzes whether your disk drive is in good condition, fair condition or might need service.

If service is required, you can also use the Disk Drive Analyzer afterwards to ensure that the work was done properly.

### No technical knowledge or special tools needed...

Everything you need is in this package. All you do is place the preprogrammed Disk Drive Analyzer in the drive to be tested, and select from the display screen menu the test or tests you want. And you can perform each test separately or have them run automatically in just minutes.

Your data is worth protecting... Your flexible disks represent a valuable investment of time and money. The data they carry may be difficult or time consuming to replace. That's why it's vital to know the exact condition of your drives.

With the Datalife Disk Analyzer, that's a quick and easy task. If you value your data, you can't afford to be without it.

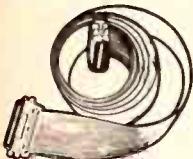
C12525 IBM® PC/XT \$59.95  
C12530 Apple® \$59.95



## IBM® FLOPPY DISK DRIVE EXTENSION CABLE

- DB37 Male to 34 way edge connector
- Length 0.5 metres

P19045 ..... \$95



## 36 WAY CENTRONICS CABLES

- Male to male connections
- All 36 pins wired straight through

P19042 2 metre \$19.95

P19040 6 metre \$29.95

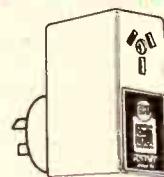


## 2 & 4 WAY RS232 DATA TRANSFER SWITCHES

If you need to share a third or fifth, then these inexpensive data transfer switches will save you the time and hassle of constantly changing cables and leads around.

- No power required
- Speed and code transparent
- Two/Four position rotary switch on front panel
- Three/Five interface connections on rear panel
- Switch comes standard with female connector

2 WAY Cat.X19120 only \$59  
4 WAY Cat.X19125 only \$79



## CPF CONTINUOUS POWER FILTER SPIKE ARRESTOR

The Fortron CPF Filtered Electronic Spike Protector provides a protective electronic barrier for microcomputers, printers, telephone systems and modems, electronic typewriters, audio and stereo systems and other sensitive electronic equipment.

The CPF provides protection from dangerous electrical spikes that can cause anything from obvious damage (like immediate equipment failure) to less obvious harm that can drastically shorten a system's life.

CPF's superior circuitry design and semiconductor technology responds instantly to any potentially damaging over-voltage, ensuring safe trouble free operation.

Additionally, CPF's filtering capability helps eliminate troublesome and annoying interference, general hash created by small motors, fluorescent lamps, and the like that threaten the performance and shorten the life of unprotected electronic components.

### SPECIFICATIONS:

Electrical rating: 220-260 volts (AC) 50/60 Hz 10 Amp

Spike/RFI Protection: 4,500 amps for 20m/second pulses

Maximum clamping voltage: 275V differential mode

Cat.X10088 ..... \$69.95

## 2 & 4 WAY CENTRONICS DATA TRANSFER SWITCHES

Solve time and hassles of constantly changing cables and leads around with these inexpensive data transfer switches. These data switches support the 36 pin centronics interface used by Centronics, Printronics, Data Products, Epson, Micronics, Star, and many other printer manufacturers.

- No power required
- Speed and code transparent
- Two/Four position rotary switch on front panel

- Three/Five interface connections on rear panel
- Switch comes standard with female connector
- Bale locks are standard

2 WAY (X19130) only \$59  
4 WAY (X19135) only \$79



## RS232 DATA SWITCH WITH TESTER

- No power required
- Ideal for 1 computer to 2 peripherals or 2 computers to one peripheral
- 25 pin DB232 "D" connectors
- Six dual coloured LED indicators showing certain flow status

T.D. Transmit Data  
R.D. Receive Data  
R.T.S. Request To Send  
C.T.S. Steal To Send  
D.R. Data Ready  
D.T.R. Data Terminal Ready  
Size: 200(W) x 68(H) x 150(D)mm  
Cat.X19110 R.R.P. \$169

Our Price \$149



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## IBM® AT & AT COMPATIBLE EXTENDED KEYBOARD (105 KEYS)

These new keyboards are both XT and AT compatible!

- 20 Decapad function keys
- Enlarged "Print" 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 Word, Fast Repeat, Line Feed, Pause, Clear Screen, Reset

Cat.X12022 WAS \$299  
SPECIAL, ONLY \$199



## "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.

• 3 step height/angle adjustment

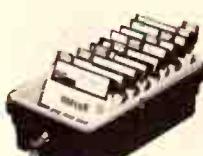
• Cherry brand TS-M00001 19mm low profile switches, meet 30mm drop impact requirement and provides high performance and maximum reliability.

• Cur/lead plugs straight into PC/XT

• 3 Status displays

Just like the "Real McCoy" only at a fraction of the price!

Cat.X12020 ..... only \$129



## JUMBO 5 1/4" DISK STORAGE

If you've got lots 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 \$19.95

C16027 (Hinged Lid) ..... \$19.95



## RS232 BREAK OUT BOX

A simple way of monitoring RS232 interface lead activity. Interface powered, pocket size for circuit testing, monitoring and patching. 10 signal powered LED's for TD, RD, RTS,CTS,DSR,CD,TC, RC, DTR, EITC.

Juniper Wires: 20 tinned end pieces.

Power: Interface power.

Enclosure: Black, high impact plastic.

Dimensions: 85 x 95 x 30mm

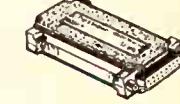
X15700 ..... \$94.95



## DB9 GENDER CHANGERS

- Saves modifying or replacing non mating DB9 connections
- All 9 pins wired straight through
- X15640: Male to male
- X15641: Male to Female
- X15642: Female to Female

..... only \$14.95



## DB15 GENDER CHANGERS

- Saves modifying or replacing non mating DB15 connections
- All 15 pins wired straight through
- X15645: Male to male
- X15646: Male to Female
- X15647: Female to Female

..... only \$14.95



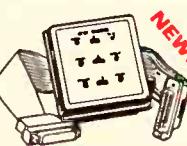
## 5 1/4" DISK STORAGE

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 \$17.95



## RS232 FAST CABLER

Makes RS232 interface configuration fast and simple. 3 slide switches enable line swapping functions, positive and negative voltages are displayed on 6 colour LED's.

### SPECIFICATIONS:

Connector: DB25 plug on 100mm cable and DB25 socket on 100mm cable

Indicators: Tricolour LED's for pins 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DSR), 20(DTR)

Switches: 3 Slide switches to swap leads

Power: Interface power.

Enclosure: Black, high impact plastic

Dimensions: 85 x 95 x 30mm

X15710 ..... \$145



## RS232 INLINE SWITCHING BOX

- 25 pin D™ plug to 25 pin "D" socket
- DIP switches allow easy switching of internal wiring

Cat.X15662 ..... \$32.95



## 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 \$17.95



## 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 \$17.95



## NE5534N SEMICONDUCTORS!

Always check our prices before you buy!

1-9 10+ 100+

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27256 ..... \$11.50 \$10.50 \$10.00

27512 ..... \$19.50 \$18.50 \$17.50

4116 ..... \$3.95 \$3.50 \$2.95

4164 ..... \$3.95 \$2.95 \$2.75

41256 ..... \$7.95 \$6.95 \$5.95

555 8Pin ..... \$0.50 \$0.40 \$0.35

6116 ..... \$3.95 \$3.75 \$3.50

6264 ..... \$7.95 \$6.95 \$5.80

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

NE5534AN ..... \$32.95

1-9 10+ 100+

\$1.95 \$1.85 \$1.75

AMF7910 WORLD MODEM CHIP

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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!

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## RS232 WIRING ADAPTOR BOX

- Male to female

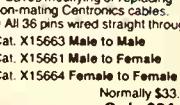
• 25 Detachable plug on leads

• 2 mini jumpers

• Ideal for experimenting or temporary connections

Cat.X15665 ..... Normally \$49.95

Only \$44.95



## CENTRONICS GENDER CHANGERS

- Female to Female
- Saves modifying or replacing non mating Centronics cables

• All 36 pins wired straight through

Cat.X15663 Male to Male

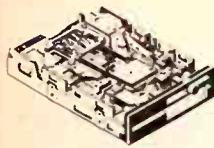
Cat.X15661 Male to Female

Cat.X15664 Female to Female

Normally \$33.95

Only \$24.95

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### 3 1/2" DISK DRIVE

• 1 M/Byte unformatted.  
• (640K formatted).  
• Double sided, double density.  
• Access Time 3ms/sec  
Cat. X2002 ..... \$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



## 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!  
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C11801 500K Normally \$199  
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C11805 1.6 M/Byte \$259



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

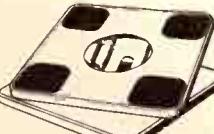
Drive with DTC controller card  
Cat. X2001 WAS \$850  
**SPECIAL, ONLY \$750**  
\*IBM is a registered trade mark



Compatible with Apple 2+  
Cat. X19901 Normally \$225  
**SPECIAL \$179**



(including cable) **Only \$199**  
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Make life easier with these quality, swivel and tilt bases, complete with rubber fittings!  
Cat. D11100 \$24.95



## IBM\* XT COMPATIBLE CARDS

NEW! NEW! NEW! NEW!

20M/BYTE HARD DISK CARD  
XT compatible, simply plugs straight in to your computer!  
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Colour Graphics Card  
Cat. X18002 ..... \$109  
Mono Graphics/Printer Card  
(Hercules compatible)  
Cat. X18003 ..... \$119

Floppy Disk Drive Controller Card  
(2 Drives, 16 Bit)  
Cat. X18005 ..... \$52

Floppy Disk Drive Controller Card  
(4 Drives, 16 Bit)  
Cat. X18006 ..... \$57

High Resolution Mono Card  
Cat. X18007 ..... \$199  
Colour Graphics & Printer Card  
Cat. X18010 ..... \$119

768kB RAM Card (without memory)  
Cat. X18012 ..... \$79

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Cat. X18017 ..... \$34.95

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Cat. X18020 (without memory) \$189

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Cat. X18030 (without memory) \$199

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

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

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

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. ..... \$139

## (AT COMPATIBLE)

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



## SAMSUNG 12" 20MHz COMPOSITE MONITOR ONLY \$149

### FEATURES...

- High contrast, non-glare screen
- Excellent value for money!

### SPECIFICATIONS:

Picture tube: 12" diagonal 90° deflection

### Modem:

### TTL Input signal:

Polarity: TTL Positive

Level: 4V p-p + -0.1V

Impedance: 75ohm

Video bandwidth: 16MHz (-3dB)

Scanning frequency:

Horizontal: 18.432 + -0.1KHz

Vertical: 50Hz + -0.5%

Active display area:

216(H) x 160(V)mm

Display character:

80 characters x 25 rows

Input terminal: RCA Phono Jack

### Controls:

Outside: Power ON/OFF, Contrast,

Brightness, H-Shift, V-Size,

Inside: H-Width, HV hold,

H/V linearity, Focus

Power supply: 110/120V 60Hz,

220/240V 50Hz

Dimensions:

308(W) x 307(H) x 307(L)mm

Weight: 7.3Kg

Shipping weight: 8.3Kg

Cat. No. Description Price

X14500 (GREEN) \$189

X14502 (AMBER) \$189



## SAMSUNG TTL 12" MONITOR

### 100% contrast, non-glare screen

### Excellent value for money!

### SPECIFICATIONS:

Picture tube: 12" diagonal 90° deflection

### Modem:

### TTL Input signal:

Polarity: TTL Positive

Level: 4V p-p + -0.1V

Impedance: 75ohm

Video bandwidth: 16MHz (-3dB)

Scanning frequency:

Horizontal: 18.432 + -0.1KHz

Vertical: 50Hz + -0.5%

Active display area:

216(H) x 160(V)mm

Display characters:

80 characters x 25 lines

Input connector: 9 pin connector

### Controls:

Front: Power ON/OFF, Contrast

Rear: V-Hold, V-Size, Brightness

Internal: Vertical Linearity,

Horizontal Linearity, Horizontal

Power supply: 110/120V 60Hz,

220/240V 50Hz

Dimensions:

308(W) x 307(H) x 307(L)mm

Weight: 7.3Kg

Shipping weight: 8.3Kg

Cat. No. Description Price

X14500 (GREEN) \$189

X14502 (AMBER) \$189



## SAMSUNG 12" TTL/COMPOSITE MONITOR

### 100% contrast, non-glare screen

### Excellent value for money!

### SPECIFICATIONS:

Picture tube: 12" diagonal 90° deflection

### Modem:

### TTL Input signal:

Polarity: TTL Positive

Level: 4V p-p + -0.1V

Impedance: 75ohm

Video bandwidth: 16MHz (-3dB)

Scanning frequency:

Horizontal: 18.432 + -0.1KHz

Vertical: 50Hz + -0.5%

Active display area:

216(H) x 160(V)mm

Display characters:

80 characters x 24 rows

Input terminal: RCA Phono Jack

### Controls:

Outside: Power Switch, Contrast,

Brightness, H-Shift, V-Size,

Inside: H-Width, HV hold,

H/V linearity, Focus

Power supply: 110/120V 60Hz,

220/240V 50Hz

Dimensions:

310(W) x 307(H) x 300(L)mm

Weight: 8.1Kg

Shipping weight: 9.6 Kg

Cat. No. Description Price

X14510 (GREEN) \$249

X14512 (AMBER) \$249



## SAMSUNG 12" FLAT SCREEN COMPOSITE MONITOR

### 100% contrast, non-glare screen

### Excellent value for money!

### SPECIFICATIONS:

Picture tube: 12" diagonal 90° deflection

### Modem:

### TTL Input signal:

Polarity: TTL Positive

Level: 4V p-p + -0.1V

Impedance: 75ohm

Video bandwidth: 20MHz

Scanning frequency:

Horizontal: 15.734 + -0.1KHz

Vertical: 50-60Hz

Active display area:

216(H) x 160(V)mm

Display characters:

80 characters x 24 rows

Input terminal: RCA Phono Jack

### Controls:

Outside: Power Switch, Contrast,

Brightness, H-Shift, V-Size,

Inside: H-Width, HV hold,

H/V linearity, Focus

Power supply: 110/120V 60Hz,

220/240V 50Hz

Dimensions:

310(W) x 307(H) x 300(L)mm

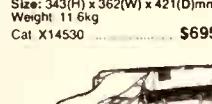
Weight: 8.1Kg

Shipping weight: 9.6 Kg

Cat. No. Description Price

X14509 (GREEN) \$239

X14512 (AMBER) \$249



## PRINTER RIBBONS TO SUIT EPSON MODELS...

CP80, BX80, DP80, BX100, MB100

ALL A CRAZY LOW \$9.95

PRINTERS TO SUIT EPSON MODELS...

MX100, FX100, RX100

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MX70/80, FX70/80, RX70/80

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PRINTERS TO SUIT EPSON MODELS...

PX100, LQ1010

\$17.95

PRINTERS TO SUIT EPSON MODELS...

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Restores order to the top of your desk or work area

Made of white plastic coated steel

Stores up to 900 continuous sheets

Allows perfect paper feed

Allows easy examination of print out

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C21050 (15") only \$79.95

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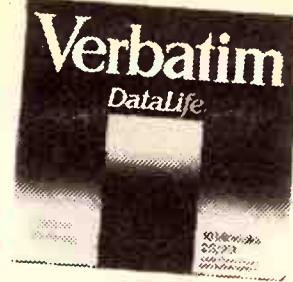
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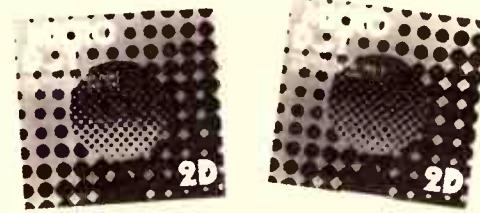
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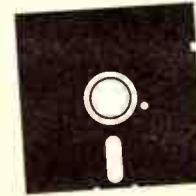


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### CSIRO Changes

One of Neville Wran's first moves as head of CSIRO has been to undertake a major shake of the government researcher. Wran, whose career as Labor premier of New South Wales was dogged by controversy over allegations of corruption has preceded over the biggest rethink of the organization's role since it was set up over 60 years ago.

The reorganisation is designed to make the CSIRO more responsive to pressure from industry for product

development as opposed to pure research. CSIRO has an impressive reputation as a researcher of international status. However, its efforts to develop product have to date been woeful, with the possible exception of the agricultural sector, where many of its advances have enabled Australian farmers to stay one step ahead of the pack.

Under the reorganisation:

- the existing CSIRO structure of 41 divisions grouped into five Institutes will be changed to 32 divisions grouped into six institutes;
- there will be tighter moni-



CSIRO head Neville Wran QC

toring of research to maximise its economic or social value to the Australian community;

- the divisions and institutes will perform much more of their own administrative work, reducing the number of tasks performed at the CSIRO corporate centre in Canberra, in an effort to cut red tape;
- line management will be strengthened by giving chiefs of divisions and direc-

tors of institutes greater authority while at the same time being made more accountable for their decisions and efficient use of resources;

- a vigorous program of management training will be introduced;
- and the corporate centre will be streamlined.

Mr Wran said that the Board has decided to advertise widely the positions of directors of all six Institutes and has decided upon a selection mechanism, by which process it is hoped to appoint all senior officers to the newly formed Institutes by December this year.

### COMING EVENTS

#### SEPTEMBER

**APCON**, the annual convention of the Sydney PC Users Group takes place over September 22-23. Wayne Ratcliffe, the author of dBASE will speak at the convention. Contact the coordinator Geoff May on (02) 699 3518 or the Group's president Ron Pollak (02) 290 3655.

#### OCTOBER

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

An important conference on technology transfer known as Techmart will be held in Birmingham's National Exhibition Centre from October 13-15. It is being sponsored by the British Technology Group which has 40 years' experience in Technology transfer. To learn more about Techmart '87 ring Richard Bull, the press officer on 021 780 4171 Ext 710.

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

**8th Asian Conference on Remote Sensing** will be held October 22-7. Professor Shunji Murai, General Secretary, Asian Association on Remote Sensing, Institute of Industrial Science University of Tokyo, 7-22 Roppongi, Minatoku Tokyo. Telex 02427317 Kosmusr J.

**Industrial Vision by Computer** is the name given to a seminar organised by the French-Singapore Institute. It will take place over October 26-30 in Singapore. The seminar is designed to examine most factors concerning Factory automation. For more information contact the French-Singapore Institute, 12 Science Centre Road, Jurong, Singapore 2260, tel 561140.

#### NOVEMBER

**Small Business Trade Fair** will take place over November 5-8 at Centrepoint in Sydney. For more details ring (02) 699 2411.

**The International Robot Show** is scheduled from November 7-10 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** are on in Kuala Lumpur, November 11-14. Contact Australian Exhibition Services on (03) 267 4500.

**The Gold Coast Amateur Radio and Hobbies Festival** will be held on November 14 at the Albert Waterways Complex, Hooker Boulevard, Broadbeach, Surfers Paradise. For further details phone (075) 582293.

**Globecom 87** — Global Communications Conference will be held in Tokyo, Japan, November 15-18. For more information contact H. Miyakawa, Dept of Electrical Engineering, Faculty of Engineering, University of Tokyo, 7-3-1 Hongp, Bunkyo-ku, Tokyo 113, Japan. Telephone 812 211, ext 6654.

**FinnTech 87**. The Helsinki International Technical Fair will be held in the Helsinki Fair Centre over November 17-21. For more information ring the Finnish Fair Corporation, PB 21, 00521 Helsinki, tel (9) 0-150091.

**Australian Joint Artificial Intelligence Conference**. This will be held in the Masonic Centre in Sydney. Contact Professor John Gero, University of Sydney, NSW 2006. Telephone (02) 439 0033.

**The First International Pacific Air and Space Technology Conference** will be held in Melbourne over November 12-17. The conference is being sponsored by the North American and Australasian Societies of Automotive Engineers with the theme "The Global Challenge in Air and Space". Please contact Mrs Jill Atkinson, Melbourne (03) 654 7533.

**CALITE 87**, the fifth annual conference on Computer-aided learning in Tertiary Education will be held at Sydney University from November 30 to December 2. Contact the Continuing Education Support Unit, University of NSW, PO Box 1, Kensington, NSW 2033. Tel (02) 697 3175.

#### 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.

**The eighth Australasian Conference on Coastal and Ocean Engineering** is scheduled for November 30. It will be held at the AMC in Launceston and over 200 people are expected to attend. Delegates are expected to come from as far afield as Canada, England and Europe.

#### JANUARY

**4th International Colloquium on Spectral Signatures of Objects in Remote sensing** will be held January 18-22. Contact Department des Affaires Universitaire, 18 Ave, Eduoars-Belin, 30155 Toulouse Cedex.

*A review of what's available and some of the issues involved educating the next generation of Australian engineers.*

# AN EDUCATION IN ELECTRONICS

**Jonathan Powers**

**A**ustralia faces an uncertain future. On the one hand lurks the fate of Argentina, a once rich country slowly sinking into the third world. On the other, first world status as one of the lucky countries on the Pacific Rim, the powerhouse of the twenty first century. The difference? The accepted wisdom, from Prime Minister Bob Hawke down, is technology.

The trouble is that technology needs various inputs to work. Capital is one of them, and its lack has been touted in the general media for many years. Not so often in the public eye, but even more fundamental, and certainly more obvious, is the idea that technology needs technologists. Over the years, Australia has made a horrible mess of training technologists, and that, as much as anything, is why we have little homegrown technology to speak of.

Until very recently, the majority of Australian did not complete twelve years of schooling. This has changed under the pressures of unemployment and the accumulating evidence that education means employment, and lack of education a life on the dole queue. As a result, this is putting greater pressure on university places, nowhere more so than in engineering faculties.

First, how is electronic education organised? Education for electronics can be achieved by a number of different paths. At the top: Universities and Institutes of Technology. Below them: Colleges of Advanced Education (CAEs) and finally Colleges of Technical and Further Education (TAFEs). This neat three tiered system is all government run, and qualifications are generally transportable across the country. Also available are private schools offering a wide variety of courses that vary from the exceptional to the downright fraudulent.

## **Universities**

There are a number of different types of university courses. The mainstay, of course, is electrical engineering, which is a global course aiming to teach you how to

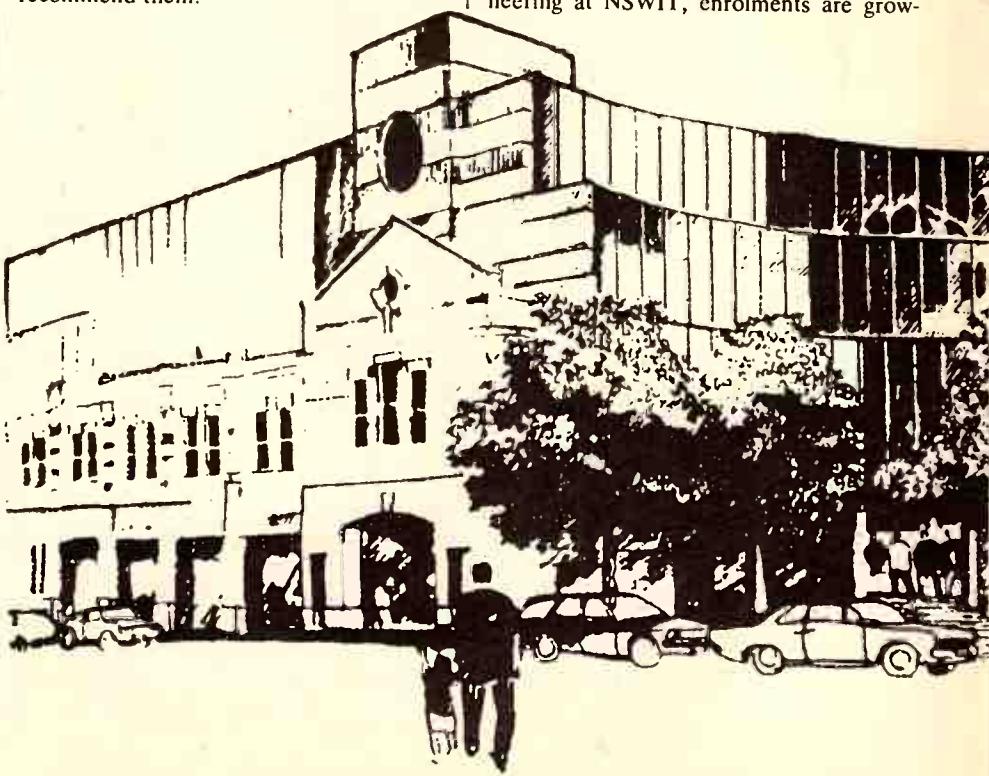
make yourself proficient in any of the electrical arts, whether it be microelectronics or power reticulation. Usually students do a core of subjects during the first year, and then progressively more elective subjects in later years. It's not all open slather, however. Most universities constrain the mix of subjects so as to achieve a sufficiently broad education.

Some universities offer more selective courses. Communications is a favourite, so is electronics. Many universities also offer courses in computers or computer systems, which can entail both hardware and software design. Newcastle University offers a Bachelor of Engineering (B.Eng) in computers. The University of Tasmania offers a B.Eng. called Computer Systems. The Royal Melbourne Institute of Technology offers one called Digital Systems and Computer Engineering. These are usually less comprehensive than electrical engineering, but if you really know what you want to do, they have a great deal to recommend them.

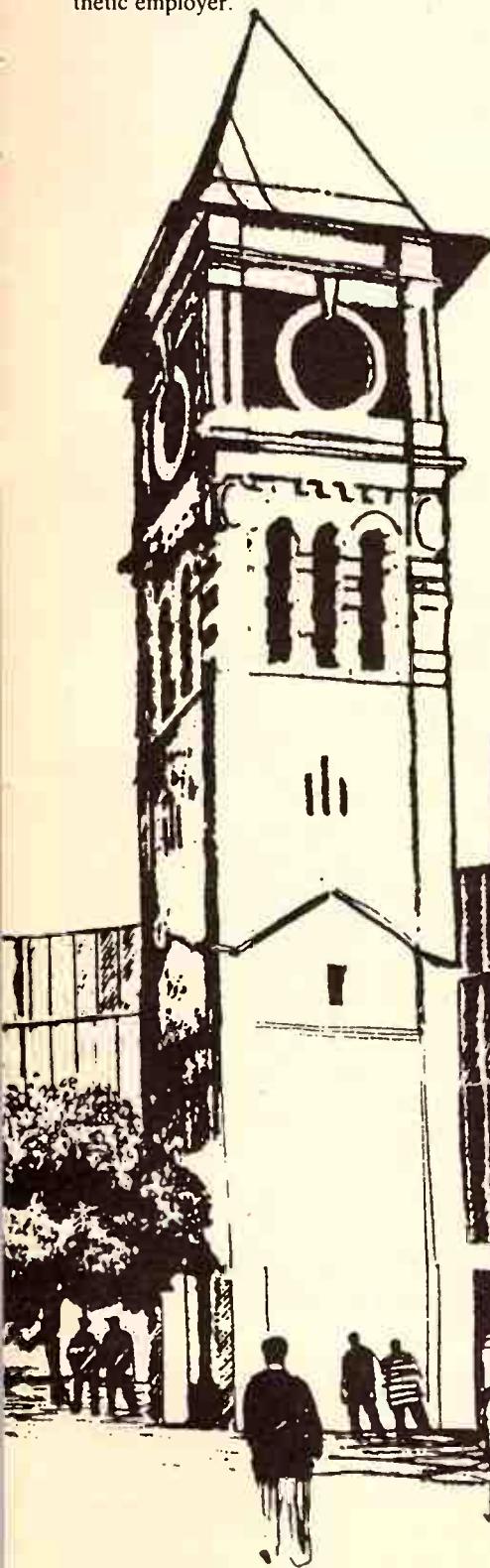
Over the last few years there have been substantial changes in the courses on offer and in the content of existing courses. Changing technology has been the driving force behind this. As new procedures become available it is necessary to redesign courses to keep them relevant.

The universities are also responding to the current demand for a technology led recovery from our present economic woes, by listening more to the demands of industry. This trend is especially true of the various Institutes of Technology. Typically these offer a University level education, but on a part time rather than a full time basis, and with close interaction with industry. Thus the New South Wales Institute of Technology insists that its students have a relevant engineering job for six months of the year. (Students study for the other six months.)

This type of course is proving very popular. According to Dr Chris Peterson, senior lecturer in Computer Systems Engineering at NSWIT, enrolments are growing.



ing at a rate of 20% per annum. In fact, it is proving so popular with students that the Universities are being forced to consider the question of part time courses. Some universities have run part-time evening courses, but their attendance requirements often require an unusually sympathetic employer.



Not all university courses are the same. Some schools have reputations in specific areas, others have more general reputations as 'theoretical' or 'practical'. In Sydney, for instance, the Institute of Technology is considered practical while Sydney University considers itself theoretical. In Melbourne these roles are taken by RMIT and Melbourne University. On the

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***University courses  
anywhere should, at an  
absolute minimum, teach  
you how to think for  
yourself.***

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other hand, if you want to study computer graphics you might like to try Newcastle University. Microelectronics is very strong at the University of New South Wales.

If a university has a reputation in a specific area, it is probably because of the research interests of its staff. It's in this area that some academics are expressing con-

cern at the trend towards "relevance". As universities become more vocational (and thus more the same) the requirements of industry to develop products comes to dominate education. The continuing need for research, which underpins all of technology, gets second place. In the best of all possible worlds, Research would get as much of the cake as Development, but in this imperfect one, it appears that the need to make money, and to be seen to be making money, now dominates thinking at all levels of the educational establishment. The problem is that research does not lead to money making products. Indeed, as the Japanese have shown time and time again, the question of who researched a particular subject is almost totally irrelevant when it comes to the question of who develops a product from the research, and thus who makes the money. Thus the government is putting pressure on the universities to abandon research in favour of product development and the training of graduates who can do the same.

Whether or not any of this makes much difference to the education you get or your employability at the end is difficult to say. Employers will have their own prejudices, especially if they have been through a university somewhere. On the other hand, university courses anywhere should, at an absolute minimum, teach you how to think for yourself, so perhaps the difference can be over-emphasised, especially when you have a couple of years' experience in the real world.

**CAE's**

The Colleges or Institutes of Advanced

## Electronic Education

Education started life as poor men's universities. Essentially they were designed to offer cut price training to people who couldn't quite make it into University. Funds were proportionally small. During the last few years, however, the CAEs have been defining a unique role for themselves in many disciplines. In electronics they have, like the Institutes, been quick to exploit the desire of employers for more "relevance" in their courses.

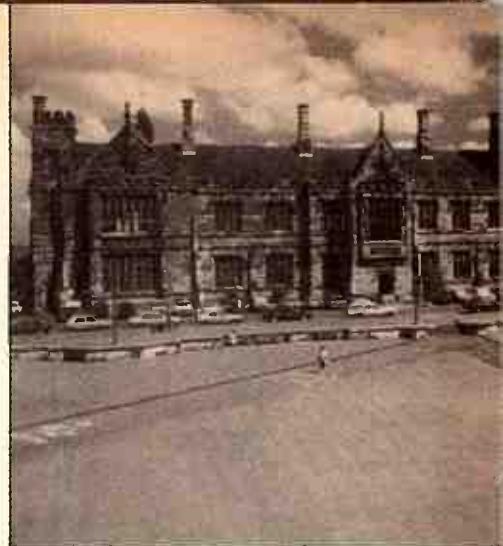
Today they offer the widest range of courses available. Some offer four year engineering degrees and diplomas intended for full time workers in electronics. Canberra CAE, for instance, offers BE degrees in both Electronic Engineering and Computer Engineering. A rather attractive alternative is the shorter speciality courses: telecommunications or microelectronics or computer studies. These don't give you the full picture, but have a lot to recommend them if you want to get through school in a hurry. Other courses are designed for people with a subsidiary interest; doctors, for instance, who find a knowledge of electronics indispensable to an understanding of how medical instruments work.

### **TAFE**

The least difficult, and some of the most

useful, courses, are those offered by the various state TAFEs. For many years TAFE has been the poor cousin of the educational world, short on funds and facilities. A symptom has been crowds turned away each year from colleges. According to Bob Green, head of the Electrical Engineering School at North Sydney College of TAFE, there have been places available to satisfy part time students, and the requirements of the large government departments like Telecom and OTC who use TAFE for their training requirements. However, the problem has been with full time students.

According to Green, this may well be a thing of the past, with new places being made available by the 1988 academic year as a result of building programmes now underway. Just as importantly, the structure of study has been changed. Under new proposals the old certificate courses will be replaced by three new courses: a Certificate, Advanced Certificate and an Associate Diploma of Engineering (Electrical). The names of these courses will be the same nationally, ending years of confusion in which Diplomas, Certificates, Post-Certificates and Advanced-Certificates all changed meaning at each state boundary.



In addition, TAFE proposes to link the new courses firmly into other academic courses and the requirements of industry. For instance, Associate Diplomas will entitle holders to a certain number of exemptions from some of the early elements of a part-time degree. Certificates will be firmly linked to other TAFE post trades courses. At the same time, the content of these courses will be set by a School Advisory Committee that will operate in close consultation with industry.

### **Private schools**

Of course, government bodies aren't the only ones who offer education. Private

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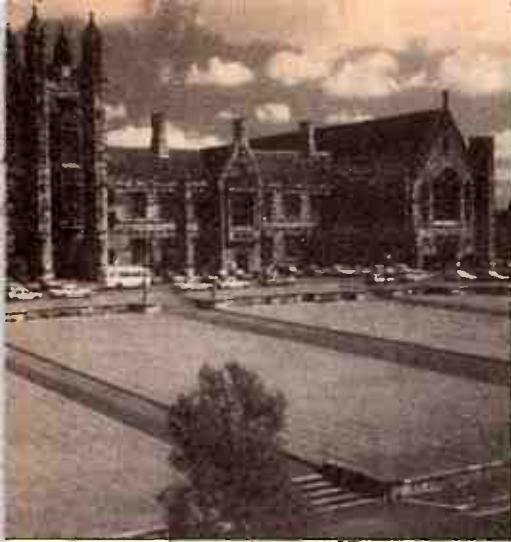
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schools do so as well, and are definitely worth a second look if you are looking for anything less than a full university degree.

The Control Data Institute is fairly typical of private schools. Students study any of three courses in computer maintenance, programming or operations. Another school is the 'Australian School of Electronics', which offers two six month courses in 'Applied Electronic Fundamentals' or in 'Applied-Microprocessor Fundamentals'. Rather more esoteric is the Australian Maritime College down in Launceston, which aims to fit young people up for a job in electronics at sea

Since the reputation of the school stands or falls by the jobs its students get at the end of the course, the school orients its course strongly towards market requirements. In fact, one of the quickest ways to sort the wheat from the chaff with any educational establishment is to approach prospective employers and ask them what courses they recommend.

Private schools face an inherent problem. The service they offer is available elsewhere for free, so why should anyone want to pay for their version? The answer has to be that the school provides a better use of your time; so the cost of tuition plus salary foregone over a short period, is less than the cost of just salary foregone over a longer period.

Whether this is so or not depends on a number of imponderables that can really only be solved by each individual. It depends on the course, the time saving, the likely salary and so on.

Course costs are not cheap, generally in the order of several thousand dollars, but school owners do try to make them as time efficient as possible. This is unlike the technical colleges, which frequently appear to mark time for months on end.

It really comes down to attitude. Private schools, like universities, expect students

to work; in fact, to work extremely hard. Twelve hour days are not unusual by the time you sit in class and do homework. Technical colleges, on the other hand, are more like high schools in their attitudes to things.

## Correspondence

If none of this appeals to you, a further option is the correspondence course. It has the advantage of being something to do in your spare time. However, electronics is a difficult thing to study by mail, so courses are few and far between and generally involve a few weeks per year of practical demonstrations. Gippsland IAE offers an external Electrical Engineering Degree, the only one in the country. Other institutions, like Capricornia and Darling Downs as well as Gippsland IAE offer diplomas on the same basis. Murdoch University has a Graduate Diploma in Computing Studies. It's also possible to do courses at home from New South Wales, Victoria and Queensland TAFEs.

Then, of course, there is also the traditional correspondence school like Stotts and ICS. The latter especially has been around for the best part of 100 years, so it's a fair assumption that they must be doing something that people want. ●

### \* CANBERRA COLLEGE OF ADVANCED EDUCATION

The School of Information Sciences and Engineering at the Canberra College of Advanced Education offers the following courses in electronics related fields:

**Bachelor of Engineering**  
(Communications Engineering)

**Bachelor of Engineering**  
(Computer Engineering)

**Bachelor of Engineering**  
(Electronics Engineering)

**Bachelor of Applied Science in Electronics**

**Bachelor of Applied Science in Applied Physics**

### Graduate Diploma in Electronics

Applications for admission to courses in 1988 are being considered.

The Canberra CAE has a large attractively landscaped campus located in the suburb of Bruce which is about eight kilometres from the Civic Centre of Canberra. Public bus services run between the city and the College and other suburbs. The College has an enrolment of approximately 6,300 students. Residential accommodation is available on campus for 665 students.

For more information and application forms write to:

The Registrar  
Canberra College of Advanced Education  
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# MAGNETIC REVERSALS

***Evidence is accumulating that the Earth's magnetic field is changing. In fact, it might be reversing on itself. Soon North might be South, and South, North.***

**Bob Beale**

**T**here are some things in life that we take as being constant and unchanging, as inevitable as death and taxes. Gravity is one: what goes up must come down, right? At least, that's the way it works until you go into space and there is no gravity, no up or down.

Direction is another; east is east and west is west, right? Wrong. Our compass points depend entirely on the state of the Earth's magnetic field, and even though that may seem constant and unchanging to we short-lived humans, geological studies suggest it has been anything but stable over the ages. And it seems that the magnetic field may be heading for yet another one of its many flipovers, rendering human compasses increasingly useless as it draws nearer.

## **A Diminishing Field**

The intensity of the field has diminished

by about 10 per cent over the past 140 years, according to the latest findings of a working group of the International Association of Geomagnetism and Aeronomy (IAGA). Simple arithmetic suggests that if it keeps dwindling at that rate, it would diminish to zero in about 1400 years. At the moment, however, IAGA cannot say whether the trend is just a minor fluctuation in the field and of no consequence, or whether the field is heading towards a total reversal in polarity.

Surprisingly, scientists involved in this area of study see few problems emerging if the field did reverse. In fact, most living things on Earth wouldn't even notice anything had changed, according to Associate Professor Denis Winch, of Sydney University's department of applied mathematics.

Professor Winch is a member of the IAGA working group, and has been

studying the variability of the field since 1969. His lack of concern about the implications of a field reversal is based partly on the geological evidence that it has been a regular occurrence throughout time.

Those field reversals can be traced and timed in the rocks on the sea floor. Magnetometer surveys at sea reveal a distinctive pattern of positive and negative magnetic anomalies on the sea floor — a bit like the stripes on a computer bar code (See Figure 1). The explanation for the stripes lies in the fact that as new sea floor is being formed at mid-ocean ridges (permanent cracks in the crust where molten rock is extruded) it becomes magnetized in the prevailing direction of the field at the time. As more lava presses up from below, pushing the sea floor aside, it too records the direction of the field at the time it cools and solidifies.

By examining the pattern of polarity reversals over the past 160 million years, geologists have built up a fair prehistoric clock, by which to date other events. It seems that field reversals occur on average once every 50,000 years or so. There can be big variations around that average, though: the last field reversal seems to have been about 700,000 years ago, so we are well overdue for another.

So, why does the Earth's magnetic field flip in direction so much, and why does a magnetic field exist at all? The answer to the first part of the question is that nobody is sure. The answer to the second part is that it is generally agreed now that the field is generated by an electric current, but because the mathematics involved in understanding how that current is generated are so complex, nobody is sure about that either.

Put simply, some sort of dynamo mechanism is at work in the molten part of the Earth's core. The magnetic field is linked to the current generated by fluid motions within the core, not to any peculiar magnetic properties of the Earth itself. However it works, the net result is that at the centre of the Earth is a current that generates a field something like you'd expect from a bar magnet.

Like any other bar magnet, it has a north and south pole, to which our compasses point when we're trying to find our way. But some peculiar effects are likely to happen as the field weakens.

Two smaller foci have already appeared on contour maps of the field, in addition to the main foci near the north and south geographic poles (see figure 2). The new foci are sited over Siberia and South America, and correspond to what are called the quadrupole components of the field. Their appearance indicates the complex form the field will take as it weakens even further.

"It seems very likely that if the reduction continues, the northern and southern hemisphere will each have a north and South magnetic pole," Professor Winch says.

So, what would that mean in practice? Well, if you held out your compass in Sydney, it would indicate north as being in quite a different direction from that you would get in Perth. If the field went into reverse, your compass would indicate east as being what is now west, and vice-versa. All in all, it would be very confusing, and compasses would not be much use.

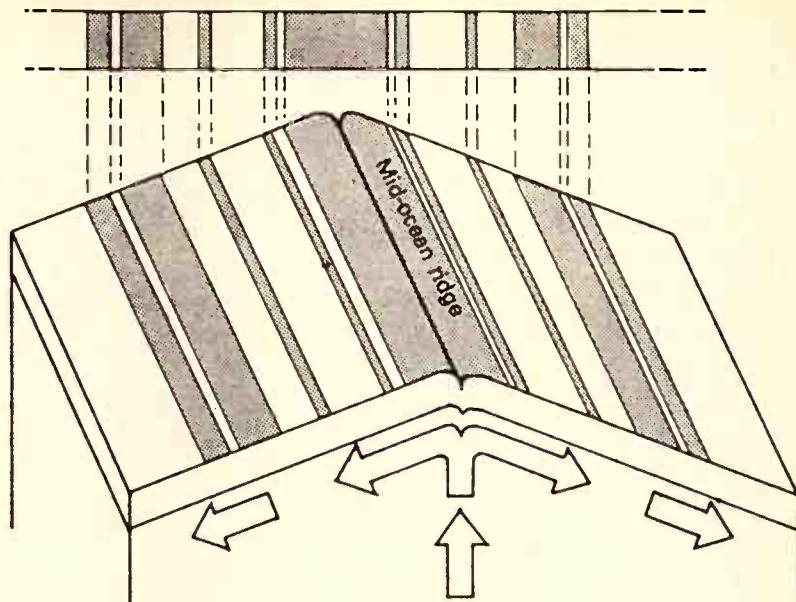


Figure 1: Spreading of the mid ocean ridges leaves a record of prehistoric magnetism.

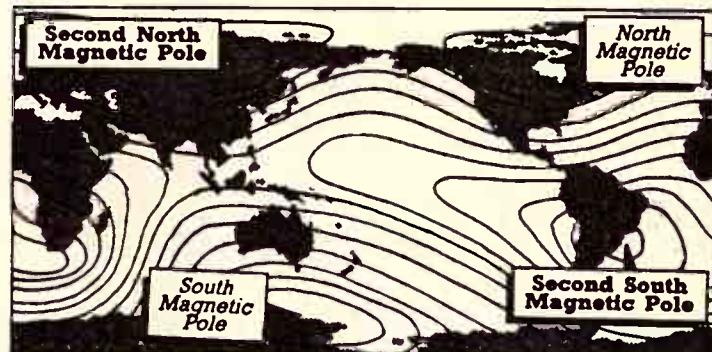


Figure 2: The Earth's magnetic field is growing more complex.

### Suffering Birds

One of the few forms of life that might suffer would be the migratory birds: according to one current theory, such birds are able to find their way between northern and southern breeding and feeding grounds each season by virtue of small bits of the mineral magnetite linked to their brains. If the field went into reverse, there could be some extraordinary scenes for bird-watchers to observe, some of them potentially disastrous for the birds themselves. At the moment, however, that is in the realm of speculation: it is just as possible that birds could learn to adapt, just as we would have to do with our navigation systems.

Studies of the Earth's magnetic field are, however, more than just scientifically interesting.

By mapping the contour lines of the field

accurately, geologists are able to search for anomalies in the field. Using electronic detection equipment, they can narrow down the search for some valuable minerals which have localised magnetic effects. The area around the famous Broken Hill mines, for example, shows up as a mighty blip in the field lines.

The field also extends its influence well beyond the surface of the Earth, and can affect conditions where some important satellites operate. The region surrounding the Earth where the field's influence extends is known as the magnetosphere (figure 3). It extends for some 60,000 kilometres on the sunward side of the planet, and streams out like a comet's tail on the opposite side.

### The Magnetopause

The boundary of the magnetosphere,

## MAGNETIC REVERSALS

known as the magnetopause, is where the field first meets the stream of ionized particles flowing out from the sun — the solar wind. Within the magnetosphere, it is the Earth's magnetic field which controls the particles in the solar wind, rather than the sun's magnetic field.

As the particles become trapped in the field in polar regions, their presence can be seen in the spectacular aurorae that have long dazzled human observers. The rapidly moving particles of the solar wind interact with atoms and molecules in the upper atmosphere, causing them to emit light — often in the form of constantly shifting swirls of streamers or curtains coloured red and green.

The magnetosphere and the interactions with solar particles are not fully understood, although the era of space exploration is beginning to shed more light on the subject. The Active Magnetosphere Particle Explorer (AMPTE) program, consisting of three satellites built by Germany, Britain and the United States, began in late 1984. In mid-1985, AMPTE-2 released a cloud of barium ions at an altitude of 110,000 kilometres above the Pacific Ocean. The ions formed an artificial comet as the solar wind drove them away from the sun.

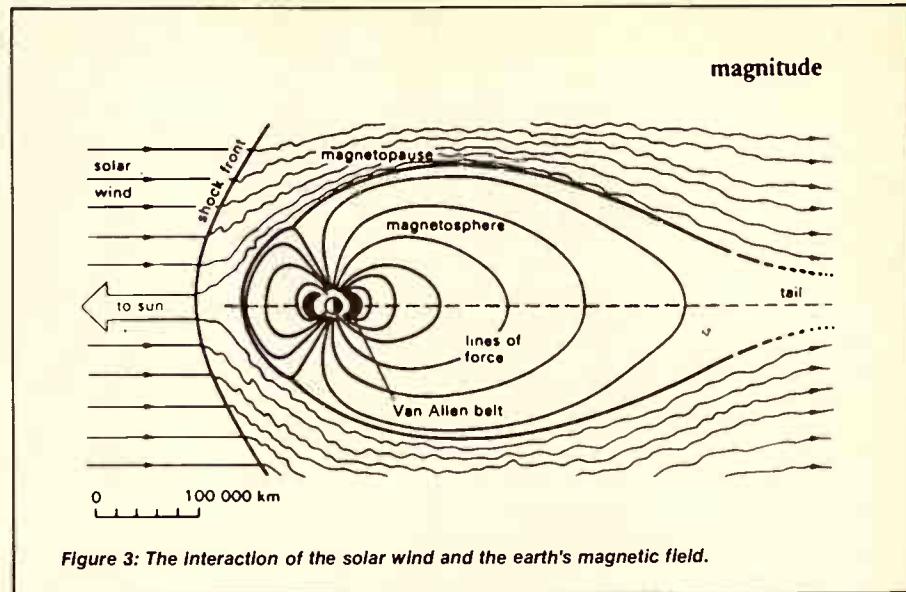


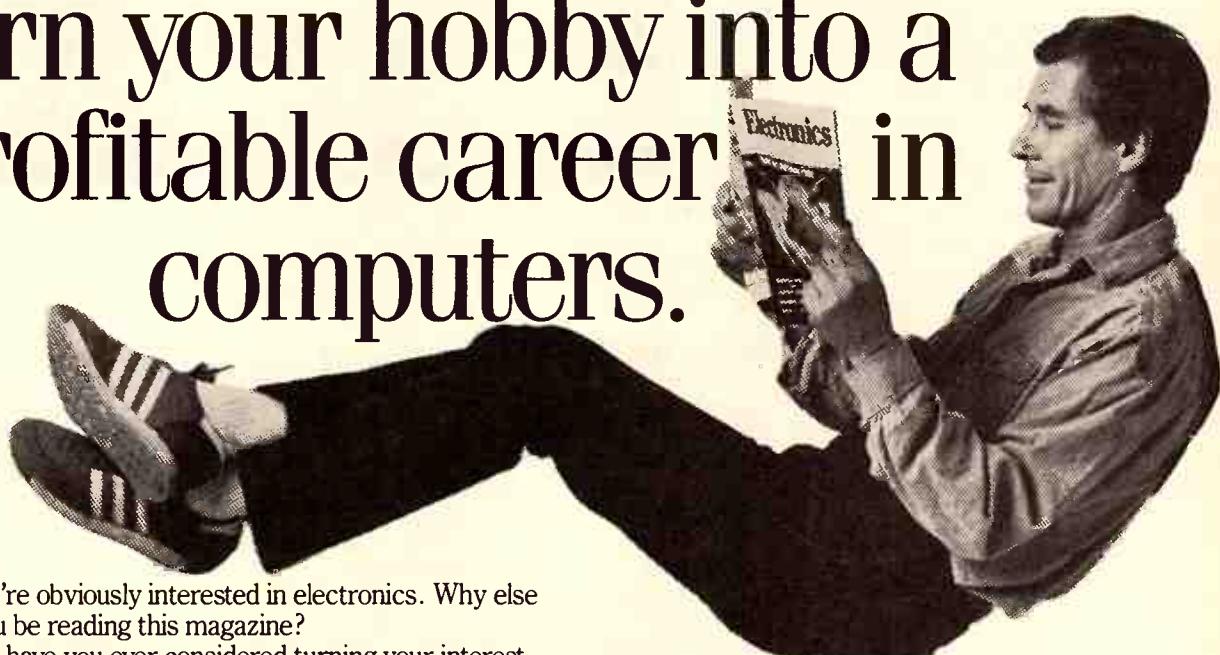
Figure 3: The Interaction of the solar wind and the earth's magnetic field.

Such experiments help to unravel more fully how the Earth's magnetic field influences the planet's environment far beyond ground level. How a reversal might affect the magnetosphere is uncertain. But, if our compasses go crazy over the next millennium or so, perhaps we can hold out hope that those two new extra magnetic

poles will produce an aurora or two at latitudes where many more people can marvel at an otherwise invisible and elusive phenomenon. ●

*Bob Beale is a Science Journalist with the Sydney Morning Herald.*

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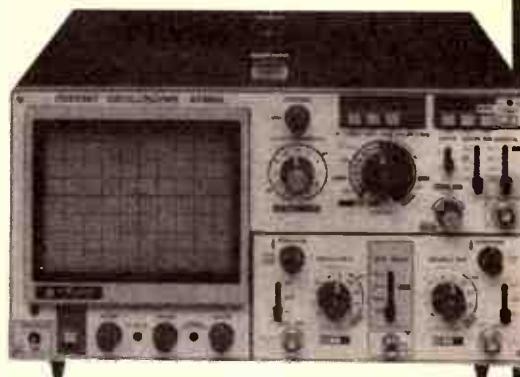
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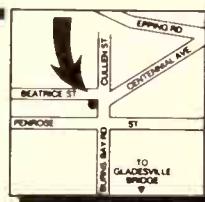


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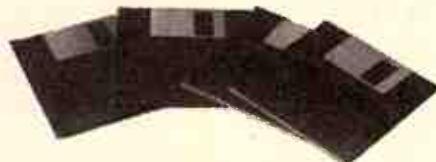
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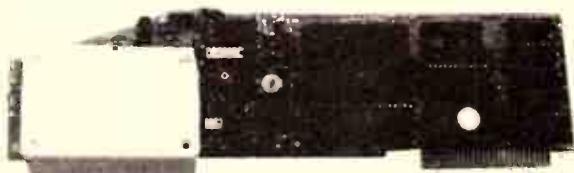
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**Was life brought to planet Earth  
by a comet from deep space?**

# COSMIC BIOLOGY

**By Giuseppe Stramandinoli\***

**P**rofessor Chandra Wickramasinghe, a lean and softly-spoken astronomer from University College, Cardiff, does not seem like the sort of person who could, or would want to, create a raging controversy.

Yet this is what he and his colleague, prominent British astronomer Sir Fred Hoyle, have done with their theory of cosmic biology. The theory, which claims that life on earth originated in outer space and that comets are responsible for the appearance of life, has ruffled more than the odd scientific establishment feather, and has placed the two scientists in direct confrontation with the writings and theories of Charles Darwin.

## **Science In Danger**

Not surprisingly, given the revolutionary nature of their claims, Hoyle and Wickramasinghe have received considerable attention. At the recent ANZAAS conference in New Zealand, three New Zealand scientists dismissed the theory out of hand, arguing it to be so mathematically improbable as to make it almost impossible, and adding for good measure that such theories would put 'science in danger' if they won general public acceptance.

Cosmic biology is the concept of biology which involves the entire universe. "The usual point of view," says Professor Wickramasinghe, "is that life must have originated and had to originate on this little planet. There is no logic that demands this (view) — it's just a preconception that has stayed with scientists for a century or so, mainly following the writings and the impact of Darwin. It is a very crippling assumption to make in terms of understanding biology."

Professor Wickramasinghe can't easily digest the 'primordial soup' theory. This theory, which has gained great acceptance in the scientific community, goes something like this: the earth condensed out of

interstellar gas and dust about 4.6 billion years ago. We know from the fossil records that the origins of life happened soon after, perhaps around 4 billion years ago, in the ponds and oceans of the primitive earth.

The first living things were not anything so complex as a one-celled organism. In those early days, lightning and ultraviolet light from the sun were breaking apart the simple hydrogen-rich molecules of the primitive atmosphere, the fragments spontaneously reconstructing into more and more complex molecules. The products of the early chemistry were dissolved in the oceans, forming a kind of organic soup of gradually increasing complexity, until one day a molecule arose that was able to make crude copies of itself, using other molecules in the soup as building blocks.

## **Problems With Soup**

The problem with the soup theory, says Professor Wickramasinghe, is that it doesn't get anywhere towards explaining how life originated.

"It tries to make arguments for constructing biological building blocks from inorganic material — but the building blocks themselves are not cells of any kind of life or any form. Therefore, there is a further important gap that has to be bridged, namely the gap from the building blocks of life to life itself."

Professor Wickramasinghe sees no use at all for the primordial soup theory. "We have unequivocal evidence of organic material coming into the earth at a steady rate — we think from present studies it measures on the order of hundreds of tons a day of organic material from comets."

"On the basis of very hard empirical evidence, one could make the assertion that there is no need for invoking the primordial soup. The organics, which are the basic blocks of biology, are coming in at the present time and have come in from



the time the earth existed as a solid object."

There is no evidence, argues Professor Wickramasinghe that supports the statement that life was created from non-living matter 3800 million years ago — no more than it is created from non-living matter now. Life, as Louis Pasteur proved when he debunked the theory of spontaneous generation, is derived from life that existed before.

"One has to consider the possibility that life on earth was derived from life that existed in the vast cosmos at 3800 million years ago, and that's the departure from standard thinking that we have pursued over about a decade or so — to explore the possibility that life is everywhere in the universe, that living cells are everywhere and that they were added to the earth at this time in its history."

## **Cosmic Dust**

It was the perceived flaws in the standard theory which saw cosmic dust as being similar to household dust which led Wickramasinghe, Hoyle and others to veer down a much less orthodox path to trace the origins of life.



Their theory offers a reason for the irregular patterns of evolutionary history. The great surges in evolution scattered through the geological record, they say, are fully consistent with the injections of large numbers of comets, a surge which occurs once every 100 million years.

Professor Wickramasinghe believes that the earth is being continually showered with organic debris from passing comets, and it is this belief which leads to another startling claim: that the debris is responsible for epidemics such as flu and smallpox.

The patterns of diseases that are recorded throughout history support this claim fairly clearly, according to Professor Wickramasinghe, because diseases "always seem to arise very suddenly — new epidemic strains are dumped on to the earth and they have their run for a few months or a few years or decades and then they disappear, only to make further incursions later on."

He cites the behaviour of smallpox as a good example. "Smallpox was there at the time of the Egyptian mummies; it wasn't around in the times of classical Greece because we know that people like Hippocrates recorded diseases that were present at the time with great accuracy and attention to detail. So there were great absences of smallpox lasting for centuries. On the whole, it seems that the data supports the viewpoint that smallpox has a period of absence of about 500 to 600 years."

But it is the extensive analysis of data on the behaviour patterns of influenza which has taken up a large part of Professor Wickramasinghe's time. He has studied the incidence of the various strains of influenza over the last 30 years in London and in Melbourne, coming up with some very interesting observations and conclusions.

For example, his findings on the spread of influenza fly in the face of the common assumption that it occurs by person-to-person contagion. He points out that when a new strain of flu hits London, it takes six months for it to appear in Melbourne, a long period of time if one considers the extensive air travel that takes place between the English capital and the Australian cities.

"One would have thought that the new brand of flu would have ripped across the world, reaching Australia with the next plane load of people which had even one infected person. But it never happens like that."

The new strain will appear in Europe, will do its leisurely spread across the northern latitudes, and it takes until the next winter in the southern hemisphere until it trickles into Sydney and Melbourne. If the disease is being transmitted from person to person, then it's mindbog-

bling to understand how there could be regional/geographic separations that are maintained in the present day world."

According to Professor Wickramasinghe, the spread of influenza must be connected with the global circulations of the atmosphere. Every epidemic of influenza, he asserts, has to be driven from outside — "there's no way in which one could understand it otherwise".

Nor have extensive studies revealed any evidence that influenza is spread from person to person. When one looks at the data in great detail an infective hypothesis is not drawn out at all, he says.

#### AIDS

Perhaps not surprisingly, Professor Wickramasinghe has applied his theory to the recent appearance of AIDS on the planet, arguing that the standard theories cannot account for the virus's silent and sudden entry. He wonders why it took hundreds of thousands of years for a virus that could potentially lead to the extinction of the whole species to arrive at the earth at this particular time.

"The AIDS virus has to be of extraterrestrial origin," he states emphatically. "A handful of viruses came in with cometary debris and were dumped in various parts of the world. It turned out that in Haiti the conditions were superbly ideal for the virus to take root, mostly because of the nature of Haitian society."

It is fair to say that the theory of cosmic biology has been dismissed as lunatic fringe stuff by the scientific establishment. In turn Professor Wickramasinghe and his colleagues remain firm in their conviction that the theory is correct.

They have been spurred on by the fact that all their predictions about the nature of Halley's Comet were proven correct, and by the research of Dr Wickramasinghe's brother Dr Dayal Wickramasinghe of ANU, and Dr David Allen of the Anglo-Australia Telescope. The Australian research looked at the infrared emission properties of the dust that came out of Halley, and found that there was a 'fingerprint' in the spectrum that agreed very closely with the bacterial hypothesis.

Professor Wickramasinghe accuses his orthodox colleagues of scientific myopia, criticising the biological establishment of working with a "pre-Copernican mode of thought".

"After the lessons of Copernicus, it would be a very risky business to defend the theory that biology is Earth-centred," he said. "The universe is vast, the Earth is small — and it is not a closed system. The organic material that led to the start of life has been derived from space without any doubt."

\*Giuseppe Stramandinoli is a journalist in the Public Information section of the Department of Science.

Professor Wickramasinghe points out that he and his colleagues were the pioneers of all the models which tried to explain the nature of cosmic dust in terms of inorganic interactions; trying to fit the available astronomical data with models akin to household dust, akin to the particles of ice in cumulus clouds, and to the particles of carbon in the atmosphere, among others.

"It was after about two decades of frustration and failure," explains the Professor, "that we suddenly came upon the hypothesis that life might be cosmic, and if that were true then all the particles that filled the galaxy were actually freeze-dried bacteria. The observational link-up was fantastic. So as soon as we made the apparently outrageous postulate that the cosmic dust was bacterial a whole plethora of astronomical data fell into place almost like magic."

The theory of cosmic biology tries to explain not only the origins of life, but also its evolution. Cosmic biologists argue that life's origins and evolution have to be connected with the steady continuing influence of primary biological material from comets.

# THE CAPE YORK SPACEPORT

**Bold vision or ludicrous fantasy? Simon O'Brien looks at the plans for Queensland's Space Centre.**

Over the years the Premier of Queensland has endorsed some very strange ideas from water powered cars to Milton Byrch's cancer cures. Consequently when he announced his government's plans to build a commercially-funded spaceport in Cape York the idea was greeted with derision by all and sundry. Nothing daunted Sir Joh commissioned a feasibility study into the project which was led by Stan Schaetzal of Hawker de Haviland. This study shows that the concept of a Queensland spaceport may not be as far fetched as it first appeared.

## Equatorial Advantages

Queensland, in particular Cape York, has a number of advantages over other areas when it comes to building launch sites. Most important is its location close to the equator. The closer a launch site is to the equator the better, especially for geostationary low earth orbiting satellites.

This is so for several reasons. Firstly, unless a satellite is launched from the equator into a equatorial orbit it's orbital inclination must be changed. Such changes in orbit require large amounts of fuel which means that a satellite launched from a non-equatorial site cannot carry as big as payload as one that is.

Furthermore, any craft launched from a non-equatorial zone loses the advantage to be gained from the Earth's east-west rotation. This advantage is quite significant since an equatorial launch can add 465 m/s to a satellite's orbital velocity. One nation especially effected by all this is the Soviet Union which has no launch sites south of 45 degrees.

It is these factors which Schaetzal and

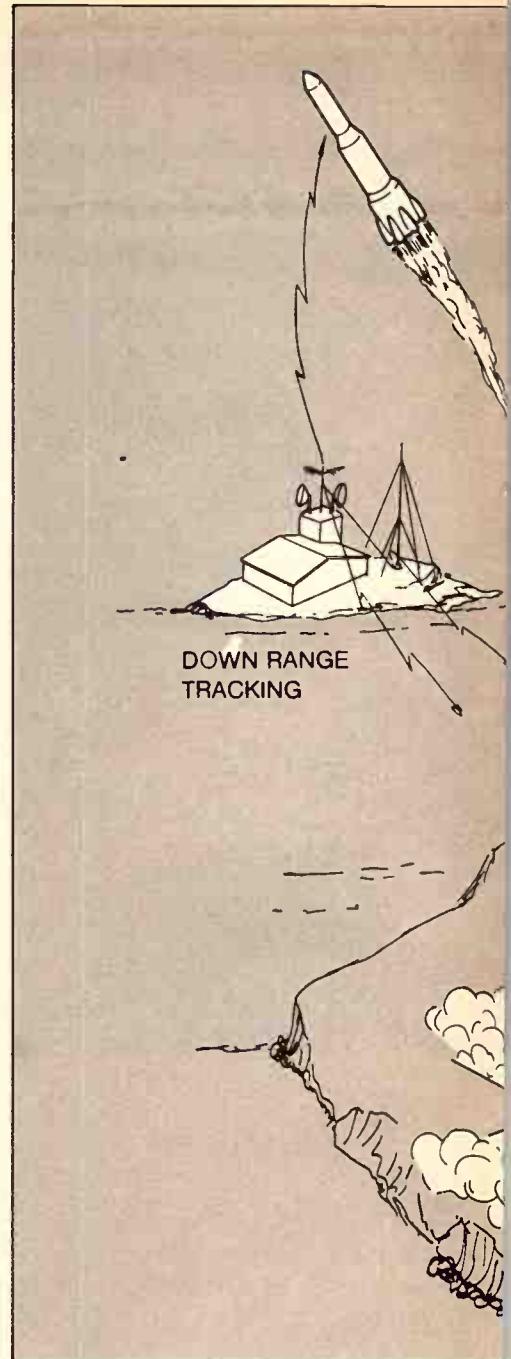
his team saw as ruling out any major recommissioning of the Woomera Rocket range in South Australia.

## Cape York

So in order to secure optimum use for a space port it is necessary to locate as near to the equator as possible. Cape York, however, has several unique advantages of its own. Firstly the Cape area is sparsely populated. This means that few people will be inconvenienced by operations at the port and fewer would be likely to suffer if any spacecraft were to blow up. This disturbance factor should not be underated. The Japanese launch site at Tanegashima Island, for example, can only be used for two months each year (February, August) on account of the vocal and physical opposition of the local fishing community. Fortunately, apart from Weipa, the only significant fishing community in Cape York is Thursday Island and the Queensland government is not known for its tender concern towards the native peoples in its charge.

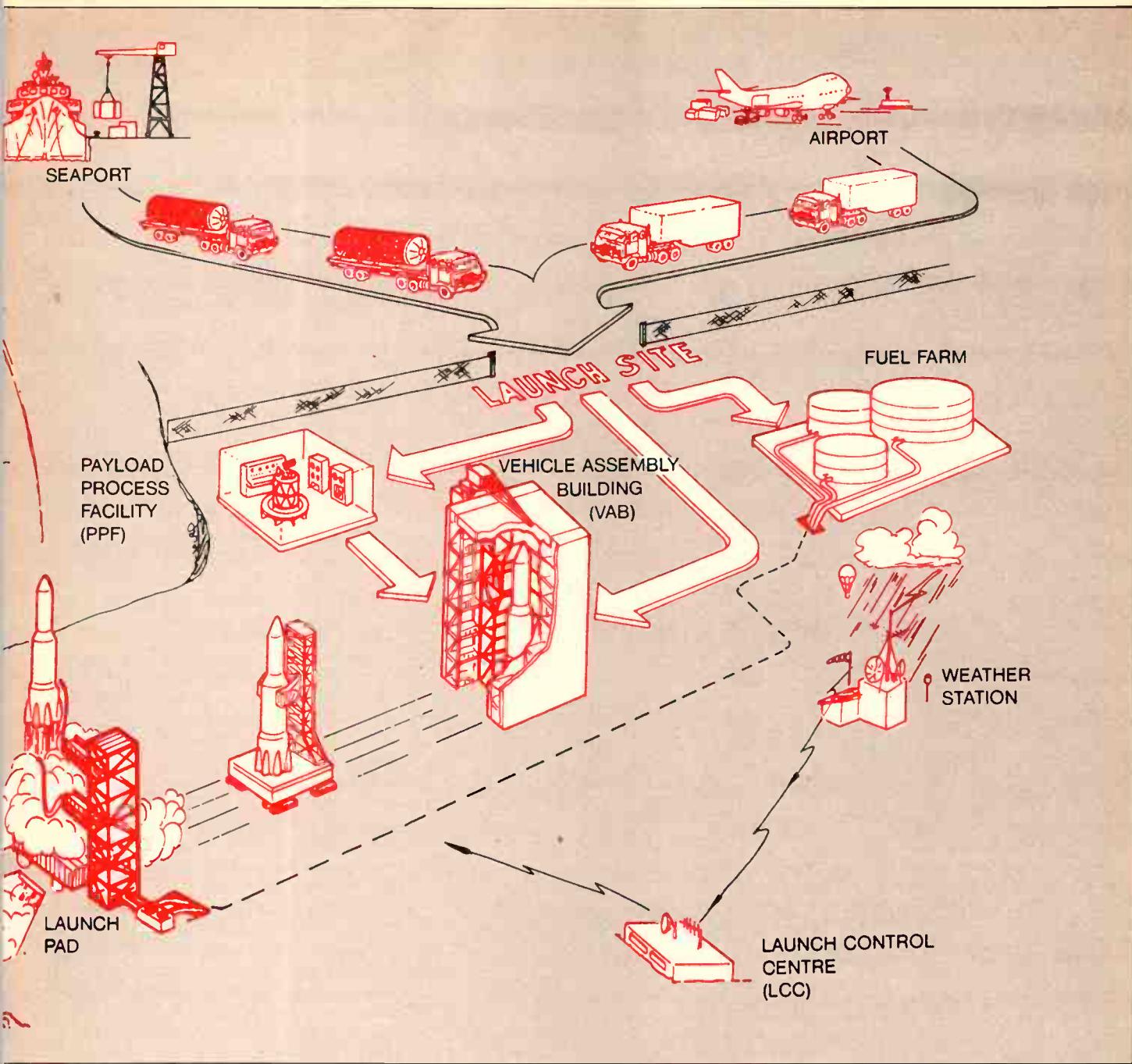
Not only does the northern part of Cape York have few people but it also has an abundance of launch sites especially on the West Coast. The area required is estimated to be not less than 2000 square kilometres (ie: a square with 45 km sides). Few places in the world, especially the more developed areas, have this abundance of space. Fewer still can provide such areas close to the equator without significant mountain ranges of adverse climatic conditions. True the Cape does suffer from the odd cyclone or two but the research team did not consider these to be a very significant hazard.

Apart from geography there is also the



question of a highly developed infrastructure. Any spaceport requires to be near to port and air facilities if it is to function successfully. In the Cape York region both of these facilities are provided by the mining town of Weipa. As a result of this the Dulcie River area, just north of Weipa is one of the most favoured sites for the spaceport. The other main contender comprises the tip of the peninsula including Thursday Island.

A good launch site should also be free of any significant instability either seismic or political. Disastrous earthquakes are relatively unknown in Cape York as is political change. In fact the Queensland



government constantly boasts of its 'stability'.

Finally the authors of the study see the Pacific Ocean as the future 'sea of Technology' which will replace the North Atlantic (the 'Sea of Industry') in importance. They apparently believe that the building of a Spaceport in Cape York will serve to enhance the technological future of the whole region.

### **Money**

It is clear from the feasibility study that a launching site could actually be built in Queensland. What is not so clear is whether such a venture is economically vi-

able. One of the things which tempted the Premier to commission this study was the belief that there were vast profits to be made out of space technology. Since the study was published, however, a good deal of controversy has arisen over this very matter.

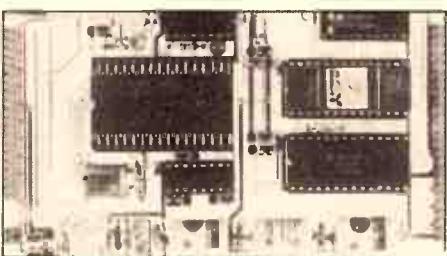
On the face of it there *do* appear to be great financial rewards for the country that can build, run and hire an efficient space centre. Since the launch of Sputnik in 1957 the western nations have launched 1245 payloads. 89% of these launches have been American and the vast majority have had a military purpose. Lately, however, the picture has begun to change. I

The input of Western Europe, China and Japan has increased as has the number of civilian payloads.

The Batelle study (commissioned by NASA) sees the number of US commercial pay loads increasing from 2 per annum in 1986 to 81 (the lowest estimate) by 2001. Other governments, Batelle claims, will increase their payloads from 8 to 146 (lowest estimate). The Queensland government's study team cautioned the Premier and his staff from relying too heavily on these projected figures but there is no gainsaying the impression that the commercial use of satellites will increase markedly over the next fifteen

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READER INFO No. 13

## Cape York Spaceport

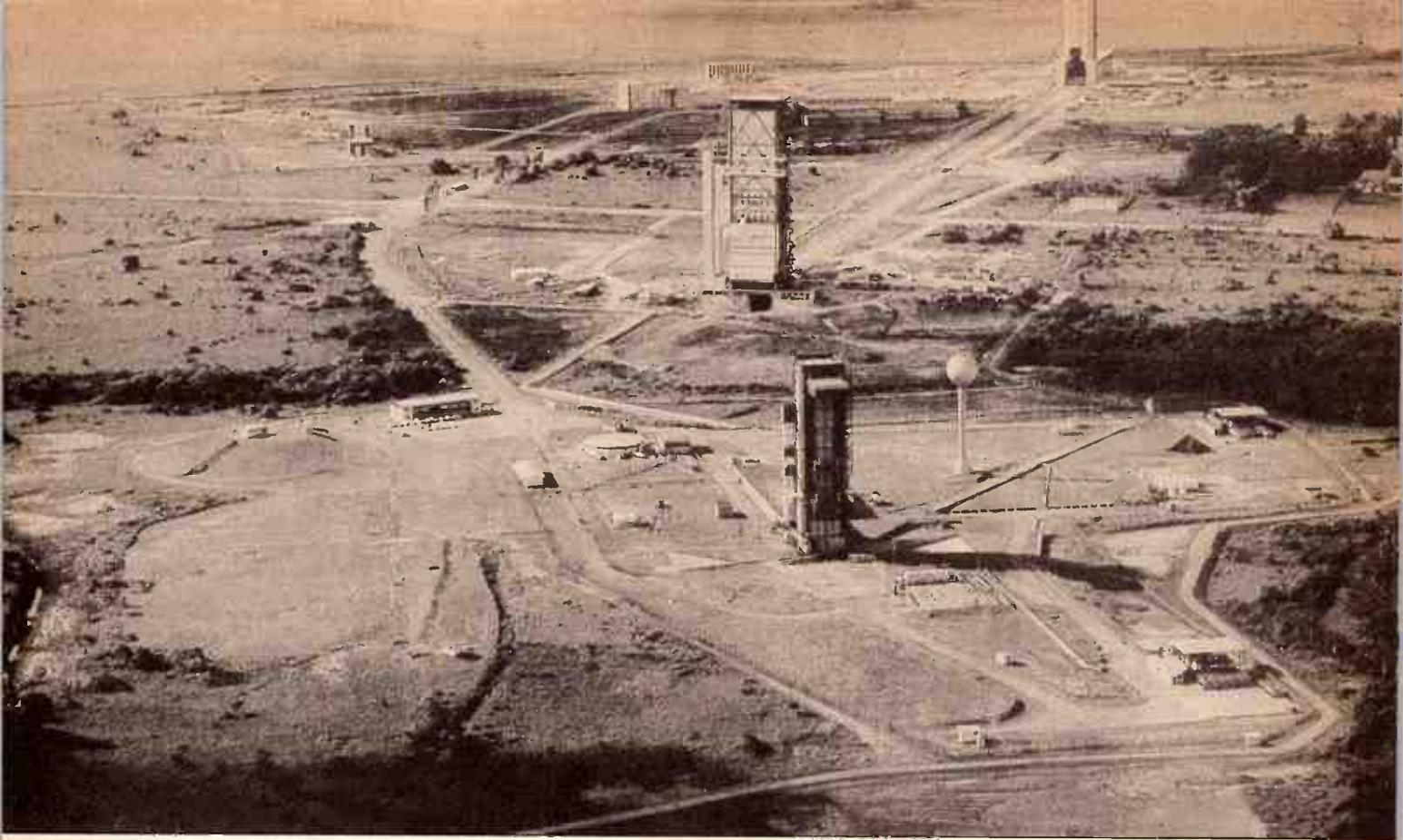
years. Furthermore it is estimated that the vast majority of satellites launched between 1986 and 2001 will be either the geostationary or equatorial type.

As regards revenue forecasts it is believed that the projected 190 (low estimate) geostationary launches in the period 1995-2010 will yield US\$7,600 million in revenue. Added to this is the US\$3,810 million to be obtained from other types of launches such as the low earth orbit equatorial. This comes to a total of US\$11,410 million. The Schaetzal group say that the Queensland spaceport, on account of its location, could expect to capture 1/3 of this trade which equals approximately US\$3,836 million dollars. It should be stressed that all the figures quoted here are on the conservative side. The highest estimate predicts twice as much revenue as the figure quoted here. Furthermore these figures take no account of other nations entering the space trade. The feasibility study mentions that if more nations do want their own satellites then the revenue predictions for Queensland's space port would have to increase accordingly.

### The Negative Side

So much for the plus side but, of course, there is another aspect of the question. Quite simply the costs of building this facility are enormous. This is largely because of the extensive nature of the facilities required. Just to quote some of the more essential requirements there will need to be: "purpose built barge, rail and road transport to handle large and heavy loads, "specialised fuel transport purpose-built barge, rail and road tankers to handle volatile, toxic and cryogenic liquids and gases", "a large transporter to convey the assembled launch vehicle to the pad", "chemical analysis laboratory for testing fuels and lubricants", launch site radar, telemetry equipment, an on-site weather station. The list goes on and on. The final figure comes to well over \$600m.

Which brings us back to the Queensland Premier. Soon after the report was commissioned he seemed to believe that the spaceport would be built by his government alone and that it would provide a much needed boost for the Queensland economy. In a recent report published in "Computing Australia" however, Stan Schaetzal claims that he and his group "played a bit of a swifty" on Sir Joh and that a spaceport could never be commercially viable and could certainly not be built without the Federal Government's help and cooperation. In fact the Federal Government would be the major shareholder. In a more recent interview Schaetzal stated that it was Sir Joh who got things wrong and in fact his report had never said that great sums would definitely



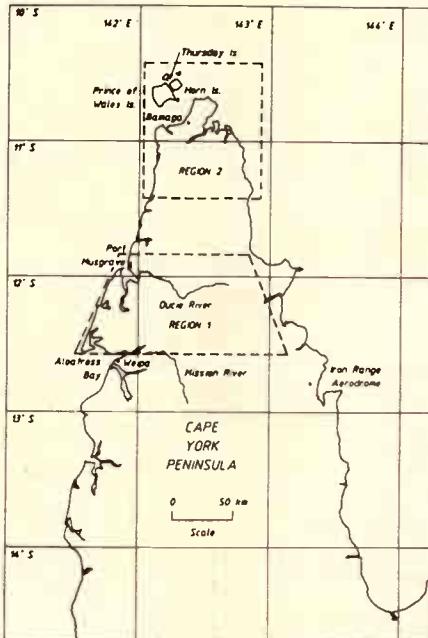
The French launch site at Kourou in French Guiana

be made from the spaceport. He did, however, emphasise the role the Federal government would have to play in the project.

The Federal government body which is supposed to oversee Australian developments in Space is the Australian Space Board.

The administrator for the Board's Light and Service Industries division, Dr Hayman, is at pains to point out that as yet the Federal Government has not received any formal submission from the Queensland government over this matter. He did, however, say that the Federal government would probably have to become involved at some stage if only in regard to such matters as international treaties and trade. Dr Hayman also drew attention to the fact that, as yet, there are no commercial spaceports operating from anywhere in the world.

Finally there is Sir Joh. Does he still feel the need to build a spaceport or has Mr Schaetzal's "swifty" discouraged him? On the face of it apparently not. He has been assiduous in his cultivation of different firms. No less than 400 organisations have been asked to express interest in the proposal by October. One non-commercial group very interested in the whole project is the Soviet Union. The Soviet government has asked Stan Schaetzal, on two separate occasions, to come to the USSR



Cape York, the projected launch sites

to discuss the various ways of launching rockets. He has declined to go on the grounds that he could not make any firm "commitments". The idea that Premier Joh should build his spaceport with Soviet assistance is strong proof that anything is possible in the name of science and self interest.



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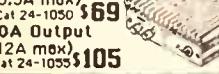
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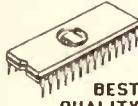
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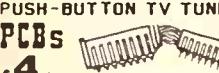
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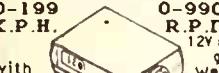
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# MEMORY MAPS AND PORTS

**Getting down to the nitty gritty of the processor, Phil Cohen explains memory maps and ports.**

In the last couple of months' articles, I introduced you to machine code and assembly language, and to the way in which the processor copies information to and from memory. Most of the time, the processor is working with either RAM or ROM. Remember: RAM is memory whose contents can be altered by the processor, while ROM is memory that holds information (usually programs) that is built into the machine during manufacture.

However, there are a number of other things that the processor has to work with, and these are generally bundled under the name 'I/O' (short for Input/Output). I/O generally refers to anything other than RAM and ROM that the processor can work with.

## Address Buses

For example, in a previous article I set out the instruction set of a processor with a 'print' instruction. At the time I mentioned that no processor actually had a print instruction — so how is printing done?

Remember that the processor has two sets of wires attached to it. The first is called the 'address bus' and carries the particular number ('address') of the memory location that the processor wants to work with. The other is called the 'data bus', and carries the information that the processor wants to write to, or is reading from, memory. A single wire from the processor tells the memory whether it wants to 'read' the contents of a memory location, or alter ('write') it.

When it comes to sending information to devices other than memory, such as disk drives and printers, this scheme is extended.

## Extending the Scheme

What happens is this: when the processor wants to send a character to the printer, it puts an address on the address bus that corresponds to the 'port number' of the printer. Then it sets the data bus to the

value that it wants to send to the printer. Then instead of signalling the memory, the processor uses another wire to signal that it wants to work with the I/O part of the computer.

The I/O section of the machine then looks at the address on the address bus, takes the information from the data bus and sends it to the socket at the back of the machine which is connected to the printer.

To the machine code programmer, the instruction to send a character to the printer might look like this:

```
MOV A, 65  
OUT 13
```

The first instruction sets the value in the accumulator to 65 (the value for 'A'), and the OUT instruction sends the current value in the accumulator to port number 13, which is the printer. The printer prints the letter 'A'.

## Ports

'Ports' are so called because they are like the ports of a city — they allow things to move in and out. The I/O section of a computer may be set up to recognise several different port numbers (sometimes also called port addresses), and send information to various parts of the machine depending on which port is being addressed.

The address of the port is signalled from the processor in much the same way that the address of a memory location is indicated — be setting the address bus. But while there may be several tens of thousands of memory locations, there are usually only a couple of hundred ports.

Which port is assigned to which device is not a function of the processor, it's a function of the computer. So while port 13 on one computer might be the printer, it might be the disk drive on another computer, even though they both use, say, an 8088 processor.

The instruction set of the processor not only allows it to 'write' to particular ports, it lets it 'read' the ports too. The I/O sec-

tion of the computer usually stores incoming information (from the keyboard, say) until the processor is ready to read it. This is called 'latching', and involves a small amount of RAM called a latch associated with each port, and capable of being read by the processor — the latch is not part of the main bank of RAM memory.

In order to keep track of which port numbers are associated with which devices, computer manufacturers often supply a 'port map' with the machine, which simply lists each port number and the function associated with it. For example, Table 1 shows part of the port map for the Microbee computer.

Port (hex)	Function
06	Clock chip write
07	Clock chip read
08	Colour circuitry control
0D	Video circuitry control
48	Disk drive controller
50	Memory block switching

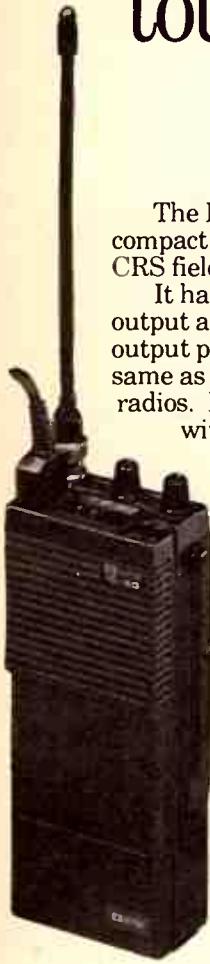
Table 1: Part of the port map for the Microbee computer.

As well as maps of the ports, a programmer will often need a map of how the RAM is used. This is called a memory map — the memory map for the Microbee is shown in Table 2. Don't worry about all

Address Range (hex)	Function
0000 to 00FF	CP/M scratch area
0100 to C7FF	TPA
C800 to D5FF	BDOS
D600 to DF0F	Boot ROM scratch
DF10 to DFFF	Boot ROM
F000 to F7FF	VDU memory
F800 to FFFF	PCG RAM

Table 2: Memory map for the Microbee (simplified). Don't worry about the details — the important thing at this stage is to understand what this 'map' represents.

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## Inside Your Computer Part 15

of the details of the memory map at this stage — not all of them have been explained in this series. The left-hand column gives the addresses of various parts of memory (RAM and ROM) in hex. Look up previous parts of this series if you can't remember how hex works.

The first section of memory is from address 0000 (0 in decimal) to address 00FF (255 in decimal). The second is from location 0100 (256) to C7FF. Notice that the two sections of memory do not overlap — 0100 is 1 greater than 00FF. This is true of all of the rest of the sections of memory.

From DF10 is the ROM area, while the rest of the memory map is made of RAM. Notice that the processor makes no distinction between ROM and RAM, except in the particular area of memory set aside for them. Notice also that within the full range of memory (0000 to FFFF), the space taken up by ROM is not available for RAM\*.

This range of addresses, from 0000 to FFFF is a limit imposed by the processor. It represents 64 K addresses, and is a limit imposed by the fact that the address bus has 16 wires, which can only represent a total of 64 K possibilities. Notice that in a

four-digit hex number (such as 0000 or FFFF), each digit represents the value carried on four address wires, and four digits times four wires gives 16 wires.

This limit of 64 K is called the 'address space' of the particular processor being used, and is in some cases a severe limit on the power of the computer. Microbee's newer models use different processors which have a much larger address space, by the way.

The address space of a processor is also tied to the size of its program counter (see last month's article), which is in turn tied to the number of bits the other registers in the processor can handle. So in an 8-bit processor such as the Z-80 used in the Microbee, it is usual to have a 16-bit address bus, giving a limit of 64 K, while in a 16-bit processor such as the 8086, the address bus has 20 bits, and is capable of handling up to 1024 K (= 1 M).

A recently-released processor, the 80386, has a 32-bit address bus, giving an address space of a terrifying 4 million K!

\*There are ways to get round this, which the Microbee uses, but for simplicity I have ignored them here. ●

### Glossary

**Address bus:** a collection of wires that carry information from the processor about which memory location it wants to access.

**Address space:** the total number of different memory locations that the processor can access — depends on how many wires are in the address line.

**Assembly language:** a way of representing machine code in a readable form.

**Byte:** 8 bits.

**Data bus:** a collection of wires that carry data to and from the processor.

**Hex:** hexadecimal — a system for representing easily a long string of binary digits.

**I/O:** input/output — the function of a computer that deals with communication between the processor and things other than memory.

**Instruction Pointer:** a register which contains the number of the location which contains the next step in a program.

**Instruction set:** a list of all possible instructions for a particular processor.

**K:** roughly one thousand memory locations.

**Latch:** a small device that stores information temporarily.

**Location:** a small area of memory capable

of holding one byte of information.

**M:** roughly one thousand K.

**Machine code:** a series of instructions stored in memory, that a processor can execute directly.

**Memory map:** a table or diagram showing how the address space of a computer is allocated.

**Port:** a means by which information gets into and out of the processor to places other than memory.

**Port address:** a number assigned to a particular port.

**Port map:** a table showing which port address is associated with which device.

**Port number:** same as port address.

**Program counter:** same as instruction pointer.

**RAM:** read and write memory — memory whose contents can be altered by the processor.

**ROM:** read-only memory — memory whose contents fixed when the computer is manufactured.

**Read:** to get information from memory, or from an I/O device.

**Register:** a memory location actually held inside a processor.

**Write:** to send information to memory, or to an I/O device.

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LEADER INFO NO. 16

# A PRACTICAL INTRODUCTION TO RADAR, Part 3

**John Bell discusses some of the differing requirements of civil and military radars. He examines target acquisition and the need to select appropriate pulse repetition frequencies to meet operational requirements.**

In the previous two articles some of the elementary concepts of both pulse and Doppler radar were explained. Here we introduce more concepts which relate to the rather special features and applications of radar systems. In such a large and complex subject there are often no distinct boundaries and, in the interests of simplicity, some generalisations and omissions will be made. For instance, it is convenient to regard radar systems as utilising either short high power bursts of carrier wave (pulse radar) or continuous wave lower power transmissions (Doppler or FM-CW radar); in practice more complex installations may combine several methods of transmission, modulation and signal processing.

## Civil and Military Applications

Radar was originally developed as an aid to certain types of military operations and was later adopted for use by civil and scientific authorities.

There are, of course, many types of civil and military radar installations. Broadly speaking one can say that civil installations deal primarily with high-density cooperating air traffic in clearly defined situations whereas military installations must be able to deal with both cooperating (friendly) and non-cooperating (potentially hostile) targets at any point of the compass or height. Military installations therefore tend to be more sophisticated than their civilian counterparts especially as they need in-built immunity from various forms of radar countermeasures.

## Acquisition

In the previous article the principles of ground-based air traffic control surveil-

lance radar was outlined: it will be recalled that a rotating antenna is used to transmit signals to, and receive signals from, all aircraft in the vicinity of the installation. Aircraft positions and other data are thus displayed on a plan position indicator (PPI); in general no attempt is made to track a selected aircraft at the expense of others.

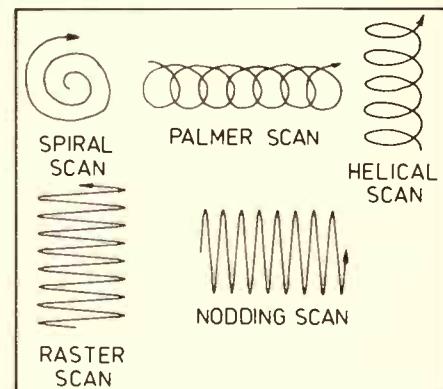
In some applications, mainly military, there is a need to select and then track a specified target: indeed, one can envisage a requirement to select individual targets in a hostile formation.

But in order to select and track an individual target a thin pencil type beam is ideally required. The thinner the beam the better in some respects but this very thinness makes it more difficult to locate the target in the first place; indeed trying to locate an individual aircraft would be like trying to find the proverbial needle in the haystack unless some assistance is given.

In general, tracking radars direct their principal axis of search to a point at which the presence of an aircraft is suspected. Then a search pattern is initiated. Specialised beam forming techniques are frequently used in large fixed installations but the angles through which the beams may be rotated are limited to about sixty degrees. (It was this type of system which was used by the British in their Chain Home Stations during World War 2).

A generally more practical solution for small radars is to use a small dish-type antenna which is able, using electro-mechanical means, to sweep its beam over the selected volume of interest. More recently, advances in antenna theory, construction and signal processing have led to beam-forming being accomplished with smaller

antennae operating at much higher frequencies than the older systems. Some typical search patterns are presented in Figure 1.



**Figure 1.**  
A scanning system is selected to suit the particular operational condition and, in small installations, is often based on the electro-mechanical control of the antenna or beam-forming components. The patterns indicated above are typical of those used to locate a target: once that target has been located it would be most likely that an alternative tracking system would be implemented based on the determination of angular errors and, perhaps, range.

The scan patterns shown in Figure 1 are suitable for locating an aircraft. One can envisage that the nodding scan would be ideal for searching a volume near to, or just above, the horizon. The other patterns suit other operational scenarios. However, none of these scans are really appropriate for the tracking of targets once located; for instance, the pilot of a fighter aircraft (or the homing system of a missile) attacking a target is generally interested in angular error and range. To achieve these objectives tracking radars

employ antenna beam lob switching, conical scans, phased arrays and monopulse systems along with the appropriate signal processing. It is a complex subject and it is of special interest to those interested in the development and application of radars in the military environment.

Modern technology, including the signal processing gain due to the development of advanced computer systems, and led to significant advances in the design, realisation and operation of phased-array antennae. More precisely, modern phased-array antennae are capable of forming multiple beams which thus allow a single antenna to track, and handle, multiple targets.

Probably the easiest tracking system to understand is that employing simple beam lobing. Here, a single beam is switched sequentially in both the vertical and horizontal directions about the forward looking boresight of the tracking radar. Error signals, obtained by comparing the returns from the four beam positions, then indicate the angular direction of the target with respect to the boresight axis.

### Pulse Repetition Frequency

In high-power pulse radar a stream of rectangular pulses are used to modulate a high frequency sine wave carrier. Typically, for surveillance radars, bursts of carrier waves are transmitted about 250 times per second; we then speak of a Pulse Repetition Frequency (PRF) of 250. For tracking radars PRF's up to 5000 may be used.

Once a pulse has been transmitted sufficient time must be allowed for the pulsed carrier wave to reach the target and return before the next pulse is transmitted otherwise misleading range information could be generated. The range to a given target may be calculated using:

$$R = \frac{C \times \text{delay}}{2} \text{ metres} \quad (1)$$

where the delay in seconds is the time between the transmitted and received pulse pair and c is the speed of light.

Note that if the target is at such a distance that the echo pulse is received after another pulse is transmitted the receiver system will be unable to distinguish easily whether the received pulse has been reflected from a target much nearer to the transmitter or from one beyond what is called the unambiguous range. Using equation (1) we can deduce the maximum unambiguous range as being:

$$\text{Runambiguous} = \frac{C}{2 \times \text{PRF}} \text{ metres} \quad (2)$$

The echoes received from targets be-

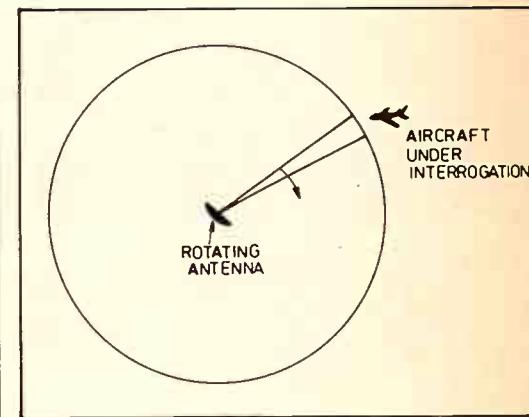
yond the ambiguous range are known as second-time-around echoes; of course, they could equally be third, fourth and so on. In the case of a PRF of 250 pps the unambiguous range is 600 km. Thus, if a second-time-around echo was received from a target at 900 km it would appear to be at  $900 - 600 = 300$  km.

If the target were at precisely 600 km the received pulse would arrive just at the period when the receiver circuits are deactivated for the next transmitted pulse. Under these conditions no echo pulse would be processed and so no target would be detected: there is therefore a "hole" in the system, which in our case, would be at multiples of 600 km.

Now, of course, these twin problems of range ambiguity and "holes" have been known to the designers and operators of radar systems for five decades. In our particular example, an unambiguous range of 600 km is unlikely to be a major problem because the radio horizon of ground-based air traffic control radars are of a comparable figure. Furthermore, operational staff normally have some *a priori* knowledge of aircraft position. However, where range holes and ambiguities cause problems the choice of PRF rate in conjunction with appropriate signal processing will do much to overcome the problem.

Where radars are used over short ranges, for instance in some weapons or aircraft navigation systems, the PRF would normally be much above the value 250 cited earlier. This increased PRF implies that number of range holes and ambiguities within normal radar horizons can increase dramatically: this in turn poses challenges for designers and operational staff.

The choice of PRF is also important in that it determines the number of time a target is "painted" during a sweep of the antenna beam. Consider Figure 2 where a ground-based air traffic control antenna is rotating at 6 rpm (10 seconds per revolution). An aircraft would be intercepted (ie painted) by about 10 pulses at a PRF of 250 pps. It should therefore be clear that the choice of PRF is an important compromise because, not only does it define range hole and ambiguities, but it defines how many hits per target are available to signal processing circuits. Clearly, too, comparatively low PRF rates are reasonable for tracking the average commercial aircraft whilst higher PRF rates are needed to allow processing circuits to deal with high speeds, manoeuvrability and small target size encountered in military type situations.



**Figure 2**  
Transmitted pulses will only "paint" the aircraft whilst it remains in the main beam of the air traffic control radar. With a beam width of 1.5°, a rotational speed of 6 rpm and a PRF of 250 pps an aircraft would be intercepted by about 10 pulses. In practice, the choice of PRF is nearly always a compromise which is dictated by operational requirements and limitations of technology.

### Pulse Compression

Broadly speaking the PRF is set by the minimum acceptable range ambiguity under specified operational conditions — this is not the sole criteria of course. By-and-large long range radars have low PRF's and short range radars high PRF's.

In practice, pulse lengths of 0.5 to 5 μS are common. As electromagnetic waves travel 300 metres in 1 μS a single pulse of length 1 μS corresponds to a range accuracy of 150 metres because the pulse travels out from, and back to the radar antenna. From this it follows that the time during which pulses are actually transmitted is quite low — perhaps well below 1%.

Overall, narrow pulses are thus needed for accurate range measurement; on the other hand the use of narrow pulses restricts radar range as the transmitted (and hence received) power will be reduced compared with a wider pulse. A solution to these contradictory requirements is to adopt what is known as pulse compression.

In pulse compression the technique is to transmit a longer pulse, say of 10 μS duration, and then make it look like a shorter one, of 1 μS say, to the receiver range measuring circuits. Thus, in the simple case quoted, the received power would be increased ten fold whilst range accuracy would approach that due to that associated with a 1 μS pulse. Various techniques are used to achieve pulse compression.

One method is to frequency modulate

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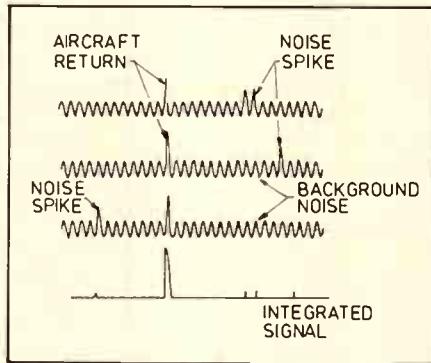
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## Radar

the short burst of high frequency carrier which constitutes the pulse. Upon receipt of the echo signal the carrier is passed through a pulse-compression filter whose action is to compress the received signals into a much narrower pulse: that is, the energy from our 10  $\mu\text{s}$  signal (say) may be concentrated into a 1  $\mu\text{s}$  period so giving both range improvement and accuracy. A pulse-compressor is a frequency dependent device, often referred to as a dispersive



**Figure 3.**  
The above diagram illustrates the concept of integration to assist in positively identifying targets against a background of noise whilst reducing the false alarm rate at the same time. Essentially the signals are summed by superposition, noise on the other hand is random. Three successive returns are shown against a thermal noise background and transient spikes. If all three are added together using special circuits the superposition of the target returns will enhance their value whilst the general noise level will be reduced. It may be simply shown that the improvement is  $\sqrt{n}$  where  $n$  is the number of return pulses integrated. Such processing also assists human operators, who are frequently subject to fatigue, to interpret the data presented.

delay line or matched filter. The pulse-compression filter is thus able to separate the various transmitted frequencies due to the frequency modulation of the carrier and delay them by appropriate amounts before adding them together.

### Integration and Noise

In the simplest sense "integration" concerns itself with finding the area under a curve described by a function and specified between two end points by a summing process of narrow elemental strips. In radar and signal processing the term "integration" is normally used in the context that successive signals are summed in order that their characteristics may better be identified especially when there is a noisy background which could be expected if the radar was operating against a small or distant target or both.

If one is endeavouring to detect a target one must do so against a background of electrical and electronic noise generated from both within and without the receiver. Noise generated from within the receiver

may be due to natural phenomena (such as the sun, lightning, etc) or from man-made sources such as electrical machinery and switching transients. The most troublesome noise is that generated in the input circuits to the receiver itself due to the random motion of electrons in many components forming the initial preamplifier stages. This is called Johnson noise and it is the limiting factor in determining the sensitivity of the receiver. In simple terms, when the signal level at the input to the receiving circuits is equivalent to the equivalent noise level we say that the threshold of detection has been reached. Johnson noise is often called thermal noise and the available thermal noise power can readily be deduced using the expression:

$$N_p = kTB \quad \dots \dots \dots \quad (3)$$

where  $k$  = Boltzmann's constant = 1.38  $\times 10^{-23}$  Joules/degree

$T$  = temperature in degrees Kelvin  
(Standard temperature = 290°K)

$B$  = bandwidth of receiver

However, providing the signal strength received is above the threshold level of the receiver input circuits in a continuous CW radar system there is normally little problem in identifying a target because, like standard radio programmes, the operator or listener can normally make some sense out of the data or information presented. The quality may be poor but unless the interfering signals become comparable with the received signal power the skilled operator is generally able to extract essential data.

With a pulse type radar, however, extraneous electrical pulses and variations in the level of Johnson noise may well present themselves as genuine returns. Such returns are known as false alarms. In many cases selectable false alarm thresholds may be set in addition to the threshold associated with the minimum detectable signal. To assist in avoiding this problem which could confuse operational staff, and radar systems too, if large numbers of unwanted pulses were received the concept of integration may be used. Simply put, successive returns are added together and, as any consistent return will predominate, the unwanted signals can effectively be removed. A simple example is outlined in Figure 3. It will be noted that the PRF and the time the antenna beam dwells on the target (see Figure 2) are the most important factors, as enough "paints" (ie echoes) must be received to make integration possible.

### Errata

In the first article in this series we inadvertently referred to a magnetron running at 36 Hz. This should read 3 GHz.



**Paul Budde reviews  
the international  
position of  
videotex services**

# Videotex News

## VIATEL GROWTH STAGNATES

Late last year, Viatel, the Australian public videotex service overtook the Dutch public videotex service (Viditel). At that stage they both had 22,000 users. Half a year later, Viatel has some 27,000 users and Viditel 30,000.

Viatel's growth of 1,000 users per month has stopped while the Dutch service is still growing with that monthly amount of users.

### Reaction from Viatel:

Viatel's manager, David King, reacted to this by saying:

"We are not chasing increased subscriptions at the moment. Viatel's policy is to seek active users and not aim for high subscription numbers purely because they 'look good'.

It is true that Viatel has remained at about 28,000 users now for some time but this is partly as a result of tougher action being taken with users not paying their bills."

## ELDERLINK SHAREMASTER

For the investor who wants to make money there is now the innovative Elders Sharemaster on Elder's videotex service Farmlink. It offers the following applications:

- ★ Automatic transfer of share prices to personal computer;
- ★ Set target and stop loss limits;
- ★ Lock profits in;
- ★ An indispensable investment tool for building share portfolio.

## JOB WATCH

Money Watch, John Fairfax's stockmarket information service on Viatel, has joined forces with a new division of

Neville Jeffress Advertising to launch a computerised Job Watch service. About 105 positions will be advertised per week nationally on N.J. Job Watch. They will be executive positions principally in the finance, financial services and banking areas including many senior management positions.

## NZ STATS

Vapnet is the videotex access network operated by Telecom New Zealand which provides nationwide access to the various videotex host systems operating in New Zealand and overseas.

Since commencing commercial service in May last year, Vapnet has been experiencing spectacular growth. The average monthly growth rate of 8.5% has meant total traffic has more than doubled in the last twelve months. Current projections show the network carrying 200,000 calls per month by December this year.

It is estimated that over 60% of the total traffic falls into financial money market applications and it is this market segment that is largely responsible for the growth rates being experienced.

Breaking the March 87 figures down, of the 4800 registered users (that is, the number of Telecom Videotex User IDs allocated), 1800 were active for that month. The average active March user made a total of 61 calls with an average duration of 7.3 minutes, giving a total of 445 minutes of usage.

## NZ PLAYS VIDEOTEX

The New Zealand Government Computer Service is determined to become a

player in videotex.

In an unexpected flurry of activity earlier this year the Government Computer Service shouldered all the videotex responsibilities of International Computers Ltd.

The New Zealand Government Computing Service is now positioning itself to offer a turnkey service to its customers including design, consulting and implementation.

Indications are that the GCS will work in partnership or joint venture agreements with Information Providers.

The Government Computer Service now hosts the entire TAARIS database for travel agents, previously hosted by ICL. GCS now looks after all elements of this database except for the information provision which is looked after by BPI.

At the same time GCS has taken over the Development Finance Corporation videotex system, a comprehensive database of financial services including home banking-style transactional applications.

## 'CENTRE POMPIDOU'

A new generation of public access videotex was inaugu-

rated in Paris, France, with the installation of the first Minitel booths at the Centre National Georges Pompidou. Since its opening a decade ago, the popular Parisian cultural centre has attracted an average of 7.5 million visitors a year. The Minitel booths would also be installed in other busy gathering places in France, such as museums, airports and shopping centres.

The Minitel booths include a colour Minitel, a touch screen, a printer and a coin slot.

## FIRST INTERNATIONAL VIDEOTEX FORUM

This "down to earth" symposium is sponsored by the International Videotex Industry Association (IVIA) and will last two days (3-4 November in Paris). Participants will be invited by each country, they, however, must be deeply involved actors!

All presentations will be held in English:

- ★ Videotex trends in the world;
- ★ National policies;
- ★ International videotex services;
- ★ International connections;
- ★ Successful applications.

The objectives of the forum

COUNTRY	PUBLIC SYSTEM	1986 (x1000)	1990 (x1000)
Belgium	Videotex	2	10
Denmark	Teledata	1	30
Finland	Telset	2	10
France	Teleset	1200	3000
UK	Prestel	65	250
West Germany	Bildschirmtext	50	150
Italy	Videotel	2	15
The Netherlands	Viditel	20	25
Norway	Teledata	1	10
Sweden	Datavision	7	30
Switzerland	Videotex	2	20

## EUROPEAN GROWTH

Apart from France, most public videotex services in Eu-

rope have now concentrated on the business users.

## Videotex News

will be to facilitate exchange of information and to announce the set-up of common recommendations for both private and public videotex information providers.

The forum will be free of charge for a limited number of guests per country. The participants will only be charged for personal expenses including meals.

★ A final cocktail party will be offered by IVIA to all participants.

AFTEL (French videotex association) and INTELMATIQUE will organise one-day or two-day visits to approach major French information/service providers, host computers, as well as main companies and organisations involved in videotex development in France (French Telecom, manufacturers, software companies...).

Australia and New Zealand companies who would like to be invited or who want to be represented on this forum should contact Paul Budde on (02) 411 4666.

### EDUTEL

A new service on the French national videotex network which is designed to keep the country's 125,000 school employees informed about educational plans and give them an opportunity to contribute their ideas.

Known as "Edutel" (also the name for the education ser-

vice on Viatel in Australia), it provides three types of service: dialogue, magazine and news.

It will enable the Ministry to talk about school to teachers, parents, pupils and all interested bodies.

### VIDEOTEX — ELECTRONIC MAIL

An important new link has been developed between Prestel and Telecom Gold, British Telecom's electronic mail system. The new X.29 based gateway is a step towards establishing full interconnection between the two networks.

The link incorporates new software to provide a better display of information sent from a scrolling ASCII-type system to a Prestel terminal. The standard 80 column computer display of information is reformatted in a Prestel page style — 24 lines with 40 characters to a line — and the last two or three lines of the message can be carried forward to the top of the next page for easier reading.

Customers will be able to dial the same number for all customer service enquiries, whether on Prestel or Gold.

Charges for the Gold mailbox and Prestel charges will be collated onto the same bill.

### ELECTRONIC YELLOW PAGES

UK Yellow Pages now comes

beautifully bound in an ultra-modern glass and plastic cover. For just the price of a connecting phone call, it can be called up on a PC or videotex terminal. The keyword search facility, using location and classification name, allows access to a comprehensive database without any subscription or time charges. Already, Electronic Yellow Pages covers all of London, Reading, Watford and Guildford and will eventually grow to encompass the entire country. Direct dial access can be gained by both PCs and videotex terminals. EYP is available on the British videotex service in Prestel through a gateway.

### KEYWORD SEARCH

The most important service development on the UK's public videotex service Prestel is clearly Keyword, introduced a few weeks ago. Access information by a plain English word rather than a page number. Set up your own word to define a particular page you want to access frequently. Reasonably advanced keyword search, with features like acceptance of some mis-spellings and synonyms are included.

### REORGANISATION OF PRESTEL

British Telecom's Prestel service has been reorganised into four divisions.

★ The lightly used consumer services segment of Prestel is now grouped with Micronet 800, the PC-oriented on-line service;

★ Messaging and electronic services have been incorporated into the Telecom Gold division;

★ Electronic publishing is being expanded to include a new hotline database;

★ A fourth division will manage the computer centers and network services involved with Telecom Gold, Prestel and a message handling service.

### TELESHOPPING BOOMS IN US

Not videotex but Cable TV has proven to be the key to success in teleshopping. Teleshopping turnover in the US grew from US\$20 million in 1985 to US\$400 million in 1986. The largest service, Home Shopping Network (HSN), booked for US\$3 million a day last December.

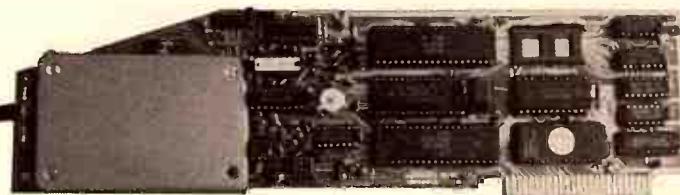
HSN is available to 10 million viewers in 26 states in the US. Recently, HSN got competition from a new company called Cable Volume Network, in which 18 cable operators and NuMedia joined forces.

### US VIDEOTEL TO IMPORT 30,000 MINITELS

US Videotel (USV) will import up to 30,000 M1B Minitel ter-

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# CLEARANCE continues

## The Home of Gardner Electronics

minals for a Texas residential videotex service that may include home banking, tele-shopping, financial services, communications and private business networks.

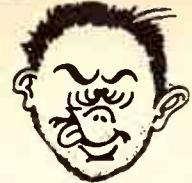
Southwestern Bell Telephone found a back-door approach to the venture by offering to handle market research for USV, thus skirting restrictions on direct telecommunication involvement in information services. Before the commercial launch of the venture late this year, USV, a subsidiary of software developer Encode Information, will run a three-month, 300-site trial in Houston this summer using Minitel terminals. Customers will be equipped with M1B Minitels that USV calls "Videotels" to access the service. USV won't disclose the unit price of the Minitels, which it is importing from French maker Telic-Alcatel, but experts believe the devices may cost under US\$200 each.

### PUSH FOR VIDEOTEX IN US

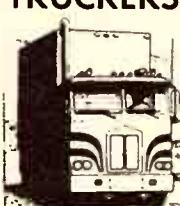
Regional Bell Operating Companies (RBOC's) are accelerating their efforts to establish beachheads in online information services. In separate proposals for information gateway systems Ameritech and BellSouth stress their commitments to systems that will encourage and assist independent information and service provider's participation.

Videotex veterans from the American Newspaper Publishers Association, after a junket to France, suggest that a telecommunication entity may play a key online services role, but US publishers still want to limit RBOC's roles in developing a full-scale Minitel model in the US.

US Congress will issue new rulings on changes in the Modified Final Judgement restrictions by Autumn, probably giving RBOC's only a small dollop of the freedom they seek. Coming up during the 1987-88 Washington political season, are further congressional inquiries into RBOC's role in competitive services plus the eagerly awaited examination of Open Network Architecture which is intended to assure equal access for everyone in information services.



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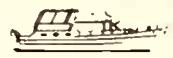
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the latest in amateur radio  
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# Kilohertz Comment

## WCSN Plans Expansion

WCSN operated by the Christian Science Monitor in Boston is becoming a familiar sound on shortwave as the station moves into more extensive programming. WCSN has one transmitter of 500,000 watts located at Scotts Corner, Maine, and has announced plans to build two 500 kW transmitters in the southern US to cover east and west Canada, Central and Latin America and the Caribbean.

The Christian Science Monitor has also purchased KYOI operating 100 kW on Saipan which is carrying Super Rock programmes to Japan and South Korea. It is planned to expand the service of this station to cover audiences in China, India, Indonesia and the Philippines, Australia and New Zealand.

WCSN is assigned its frequencies by the Federal Communications Commission in Washington and for the period September 7 November 1 the schedule will be 2000-2200 on 9465; 2200-0200 on 7365; 0200-0600 on 9465 kHz. The broadcasts can be heard from 1600-1100 UTC and are beamed to Europe and Africa. All programmes are in English. The address for reception reports is World Service, Christian Science Monitor, PO Box 860, Boston, MA 02123, USA. The station commenced broadcasting on 30 March, 1987 at 1600 UTC.

## Increasing Mail to Stations

The recent expansion of Radio Japan, brought about by the leasing of relay bases at Gabon in West Africa and at Sackville in Canada, has meant that it is now reaching audiences in Africa, Europe

and the Americas with a much stronger signal. Radio Japan is providing programme services to these areas with a satellite link and as they are located closer to the audience being served, there is a much more reliable signal than direct transmission from Japan.

According to a report from Tokyo the mail last year totalled more than 80,000 letters comprising 57% from Asia, 13% from Europe, 8% from Africa, 6% from North America, 4% from Central and South America and 2% from Oceania. India topped the list of countries with 18,300 and there were 12,200 from Indonesia with 9,200 from Bangladesh. Listeners in Australia wrote 1,000 and New Zealand 424 letters. Radio Japan has announced further plans for expansion in the use of overseas broadcasting facilities, either by leasing time or a programme exchange. It plans to build a transmitter in Panama to cover Central and South America.

The Voice of Germany, Deutsche Welle, have also announced a major increase in their mail for the last year. They had a total count of some 390,775 letters from listeners. The mail from Africa was almost 85,000, Middle East 26,000, 23,00 from Latin America and 15,000 from listeners in North America. Most of the letters in English from Asia continue to come from India. The majority of listeners' letters from North America were received from the United States and 6,000 of them were written in German and 3,000 in English.

Deutsche Welle transmits to Australia in German and English, and the latest schedule is for broadcasts in English between 0900-0950 on 9715, 11945, 15185, 15205, 15410, 17780, 21650 and 21680 kHz;

2100-2150 on 6185, 7130, 9650 and 9765 kHz. Broadcasts in German are from 0600-0800 on 6160, 9545, 9690, 9735 and 11795 kHz.

## Shortwaves

ALASKA: Station KNLS Anchor Point, Alaska is operating to a new frequency schedule and the broadcasts are September 27, 1987 through to March 2, 1988 on 6095 at 0800-1100 in English; 1100-1230 on 6095 in Mandarin; 1230-1400 on 7355 in Mandarin; 1400-1500 on 7355 in Japanese; 1500-1730 on 7355 in Russian; 1730-2030 on 7355 English and 2030-2300 on 7355 in Russian.

CZECHOSLOVAKIA: Radio Prague in English to Australia is using the schedule of 0730-0800, 0830-0900 on 11685, 17840 and 21705 kHz; 0100-0157, 0300-0357 on 5930, 6055, 7345, 9530, 9740 and 11990 kHz.

FRANCE: Radio France International has decided not to construct a relay station in Sri Lanka but instead seek agreement with the Thai Government for a relay base in Thailand. By 1992 RFI hopes to have recruited 300 extra staff in order to put out 700 hours of programme a day in 36 languages. RFI is comparing itself with the BBC and Deutsche Welle to persuade the French Government to increase its investment in international radio. Twelve of the present 25 transmitters are over 25 years old and as well as upgrading this equipment they plan to increase their numbers of transmitters to 40 for future broadcasts.

INDIA: All India Radio has two transmissions to Australia; 1000-1100 UTC is carried on 11860, 15335, 17875, while the transmission 2045-2230 is on 9550, 9910 and 11715 kHz. All India Radio is at present building a new high power



Broadcasting House  
New Delhi

transmitting centre near Bangalore for external broadcasting and this will consist of two 500 kW transmitters which are nearing completion.

NEW ZEALAND: Radio New Zealand schedule from September 5: 1745-2115 on 11780, 15150; 2345-0145 on 15150, 17705; 0345-0730 on 11780, 15150; 1030-1215 on 6100, 9600 and on Saturdays the programme is continuous 0145-0345. This schedule is effective only to October 25 and after that date when New Zealand moves to daylight time the broadcasts in Australia will be heard one hour earlier.

NORWAY: Radio Norway, Oslo broadcasts only in English on Sundays, and the transmission at 1000 UTC on Sunday includes 30 minutes of English with news and short features from the Norwegian scene. The frequencies of 15180, 15230 and 21730 are used, with 15180 kHz having the power of 500 kW. For morning reception in Australia the transmission at 2200 UTC includes English on 9585, 9610 with both transmitters rated at 500 kW.

This item was contributed by Arthur Cushen, 212 Earn St, Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times quoted are UTC (GMT) which is 10 hours behind Australian Eastern Standard Time.

No. 4

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# SOUND eti INSIGHTS

WHOSE  
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## BOSE AM-5 ACOUSTIMASS SPEAKERS

AUSSIE  
HI-FI  
MAKERS

A new audio project from Bose, a new TV from National and a turntable from the shaky isles reflect the international flavour of this month's

# Sight and Sound News

## Bose AM-5

### cover shot

Sound Insight's front cover for October is the Bose AM-5 Acoustimass speaker system.

Basically, the system consists of a relatively compact cabinet or module containing a dual six-inch woofer array positioned to simultaneously load two internal ported chambers, together with four small tweeters in separate boxes.

The woofers are equipped with one-inch voice coils made up of six layers of conductor, assuring maximum efficiency and high thermal power handling. They are completely enclosed inside the module. Their only access to the listening environ-

ment is through the ports of each internal chamber. One chamber has a resonant frequency of 45 Hz and the other is resonant at 90 Hz.

Since a woofer operating at one resonance undergoes relatively little excursion to move a tremendous amount of air, each system produces a great deal of sound at these resonant frequencies with little cone motion and low distortion. Since the two discreet bass systems are relatively close together in proximity and share common woofers, they operate in a complimentary push/pull or tandem manner. In this way, each of the two ports augments the other, while also acting as a harmonic distortion filter. This is due to the fact that in this particular enclosure design, sound does not radiate directly from the vibrating cone. Rather, it is launched into the listening room through an acoustic

mass (the air in each port), which effectively filters any distortion components which may result from overdriving the system.

Perhaps as important, the system provides for a very sharp roll off above 100 Hz, 24 db per octave. This narrows low-frequency bandwidth which maintains nonlocalization.

Another flexibility feature falls out of this component approach to low-frequency reproduction. Since low-frequency reproduction is handled by the module, it may be moved in a room to produce the most desirable bass response. This, of course, can be achieved without any effect on stereo image since the cube speaker arrays operate independent of the module.

Because the lowest octaves are effectively covered by the Acoustimass module, it is possible to use wide-

range drivers in the localizing speakers instead of conventional woofers and tweeters. The AM-5 systems utilizes four separate 6.3cm wide-range drivers to reproduce the middle and high frequencies not covered by the Acoustimass module.

Each driver is mounted in a cube. Two cubes are interconnected through the use of a center jack and make up each left and right cube speaker array. The arrays allow each cue to swivel a full 360 degrees enabling the finished system to send sound into the room in a controlled manner.

In the standard configuration, the bottom cube in each array faces into the main listening area for accurate imaging, while the top cube reflects off the surrounding walls to provide the critical reflected sound cues necessary for lifelike sound reproduction.

R.I. No. 116

**EDITOR**  
Jon Fairall B.A.

**ASSISTANT EDITOR**  
Simon O'Brien B.A. (Hons), M.A.

**DESIGNER**  
Clive Davis

**ART STAFF**  
Ray Eirth

**PRODUCTION**  
Mal Burgess

**ADVERTISING MANAGER**  
Peter Hayes B.Sc.

**ADVERTISING PRODUCTION**  
Brett Baker

**SECRETARY**  
Nina Stevens

**ACOUSTICAL CONSULTANTS**  
Louis Challinor and Associates

**PUBLISHER**  
Michael Hannan

**MANAGING EDITOR**  
Brad Boxall

**HEAD OFFICE**  
180 Bourke Road,  
(PO Box 227, Waterloo, NSW 2017  
Alexandria, NSW 2015.  
Phone: (02) 693-6666.  
Telex: AA74488, FEDPUB.  
Federal Facsimile: (02) 693-2842.

**ADVERTISING**  
New South Wales &  
Queensland: Peter Hayes. Mark  
Lewis. The Federal Publishing  
Company, 180 Bourke Road,  
Alexandria, NSW 2015. Phone  
(02) 693-6666. Telex: AA74488  
FEDPUB.

**Victoria and Tasmania:** Valerie  
Newton. The Federal Publishing  
Company, 221a Bay Street, Port  
Melbourne, Vic. 3207. Phone  
(03) 646-3111. Facsimile: (03)  
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## New Sony CD Player



The Sony Corporation have just released the CM M70. The M70 is the replacement for the CDP-65 which was one of Sony's success stories in 1986. The CDP-65 captured

a major slice of the mid ranged feature product sales.

Major features of the new player are: a 16 bit digital filter with 4 times over sam-

pling, resulting in improved phase characteristics; an unilinear converter system which prevents the generation of jitter and reduces the digital's signals influence on the analog signal; plus a dual D/A converter system which eliminates time lag between left and right channels.

The M70 also has random music search (RMS) enabling up to 20 tracks to be programmed for playback in order of preference, shuffle play, where the player selects the track playing order at random. There is the five-way repeat mode and a wireless infra-red remote commander, operating to a distance of seven metres.

The CDP-M70 is available through the Sony dealer network at a suggested retail price of \$899.00. R.I. No. 117

## **Radio 2SM Upgrades Studio Facilities**

Sydney's Radio 2SM has recently upgraded its studio with the installation of new equipment featuring a Sound Workshop Series 34 console.

The new console is to be used to produce commercials as well as skits and special entertainment programs with such requirements as musical backing and sound effects.

Distributed by Amber Technology, the Sound Workshop Series 34 is a modular 24 bus audio record/mix console

that is said to be simple to operate, but complete in its functional abilities.

Extensive switching and patching facilities permit modification of the signal flow to the requirements of any specific session. These facilities also allow the console to excel in all areas of audio production, including music recording, sound reinforcement, broadcast, and video and film post-production.

R.I. No. 118

## **Akai in New Zealand**

Akai Australia, a 100% owned subsidiary of Akai Electric Japan will handle the sales and marketing of Akai products in New Zealand. Direct representation by Akai in New Zealand terminates the agency agreement for Akai products with Fountain Marketing Group (New Zealand) and is effective from July 1, 1987.

The direct presence of Akai in New Zealand is part of a world wide rationalisation and reorganisation of the Company's affairs. In streamlining its operations, Akai is trying to improve its ability to respond to varying market conditions.

This restructuring has resulted in de-centralisation of power in the Akai operations which allow a flexible marketing approach which is tailor made for each market but retains the backing and support of Akai Japan. Akai New Zealand will receive back up from Akai Australia and Japan but it will essentially be a New Zealand operation. It will have its own freedom to respond to local market conditions and will be in direct control of its own

affairs.

Akai will hold a unique and valued position in New Zealand being the only company in the field with direct representation. This hopefully will bring stability, confidence and accountability to the Akai brand name.

Recent changes in tariffs and import licensing have led to confusion in pricing, product range and availability in the New Zealand market. To maintain continuity of supply and to reach specific price points, the larger retailers have been opting to import product from Korea, Taiwan etc. As a result the bulk of the product available from larger outlets is aimed at the low end of the market. The medium to upper price range product is largely overlooked and what has resulted is a classic gap in the market. Akai believe that the New Zealand situation will mirror the Australian experience. That is to say that whilst there is a demand for low end product it would not be at the expense of respected names such as Akai which are backed with a solid reputation and image.

R.I. No. 119



## **The Aura Turntable**

The Aura turntable is claimed to extract the most information possible from the grooves of a record, without adding unwanted colouration or noise. It can best be described as a stabilised uni-pivot having high rotational inertia. The AURA is hand-built in New Zealand to stringent standards and tight tolerances. Each turntable is assembled, tested, run in and then listened to ensure that it meets the required standard.

The Aura platter mat is made of polymethylmethacrylate, which has properties very close to vinyl itself; this rests on a light aluminium platter which is lined with lead, so that energy is deflected quickly through this platter and absorbed by the lead. The platter is attached to a boss which is decoupled from the "sub-platter", which is a 20mm thick steel plate. The Assembly is damped with lead in order

to suppress vibrations by converting them to heat. To this plate are attached cylindrical steel weights to add further mass. This sub-platter acts as a flywheel to provide the necessary speed and mechanical stability.

The usual construction of a turntable consists of a platter positioned on top of a bearing shaft which in turn is stabilised by two bearing sleeves, the complete rotating assembly sitting on a thrust pad. The Aura uses a self-centering carbide bearing and pivot situated immediately below the platter, the high mass sub-platter being several inches below. Thus the centre of gravity is well below the pivot, so the rotating mass is inherently stable, only a small Teflon sleeve near the bottom of the outer shaft being needed to steady the assembly. The result is a worthwhile reduction in noise.

R.I. No. 120

## **Soundcraft Chosen For Sheraton**

JBL Australia will supply Soundcraft mixing consoles for the new Sheraton Main Beach Resort, on Queensland's Gold Coast. This New International Hotel is situated in the heart of the Gold Coast, and includes a major Convention Centre.

The consoles chosen are a Soundcraft Series 500 24 channel, a Soundcraft Series 200SR 16 channel and a Soundcraft Series 200SR 8 channel rack mount.

The Series 500 console features include as standard, 8 subgroups, 6 auxiliary sends, 4 band EQ with semi parametric mid bands, balanced inputs and outputs, and VU meters for the groups and main mix. The Series 200SR consoles feature 4 subgroups, 4 auxiliary sends, 4 band EQ, and 4 VU Meters.

The consoles are being supplied through the audio contractor for the project, Jands Contracting.

R.I. No. 121

## Tandberg Receiver



Tandberg has recently released the 3080 programmable receiver onto the market.

The tuner section features a 16 preset FM tuner with digital control and readout. Selectivity is determined by a computer designed filter giving the necessary bandwidth to permit undistorted reception.

The digital readout is in

50 kHz steps (100 kHz in USA). Up/down search is by manual or automatic operation.

The phono pre-amp has separate MM and MC inputs, automatically switched. Separate program-select and record-select switches allows the users to record one source and listen to another at the same time.

R.I. No. 122

## NAD 5300 Compact Disc Player

The 5300 begins with a three-beam tracking system, four-times oversampling, digital filtering, programmable playback, audible scan, infrared remote control, and a graphics subcode output. But NAD claims that its similarity to other CD players ends there.

The NAD 5300 employs D/A decoder chips selected for the lowest distortion at high levels and best linearity at low levels. It has a fixed-level output and a second output whose volume is governed by the remote control. A digital code output is included for use with future digital signal processors. The NAD 5300 also includes three new features:

The Disc Condition Analyser identifies CDs that are excessively dirty, scratched, or defective. The blinking of an amber LED shows how

many data-reading errors are being fully corrected, and a red LED flashes when disc flaws or reading errors exceed the capacity of the error-correction circuits.

The Dynamic processor provides an unobtrusive 20% reduction in recorded dynamic range, gently reducing the contrast between loud and soft passages. Use it for late-night listening, to reduce the demands on a power amplifier, or to make cassette tapes for car or portable playback.

The Ambience processor provides an excellent playback environment for digital recordings that are too bright or dry. This unique NAD circuit is claimed to enhance the warmth, depth, and ambience of the recorded sound, "providing a remarkably satisfying degree of musical realism".

R.I. No. 123

## Mordaunt Loudspeakers

Concept Audio have recently introduced the Mordaunt Short System 442, which is claimed to embody radical new ideas in loudspeaker design and manufacture. Mordaunt claims that their system offers a level of performance which is achievable only through the elimination at source of many of the fundamental performance constraints suffered by conventional loudspeakers.

The first common constraint — the potential of a cabinet to store energy (and then to radiate it to the listener as unwanted distortion and 'colouration') — is eliminated in System 442 through the integration of its drive units into a rigid stand assembly, around which the cabinet is then 'floated' on energy absorbing seals. This floating enclosure technique, unique in contemporary loudspeaker design, enables isolation to be achieved between the source of mechanical energy (the drive units) and the major energy storage 'mechanism' (the enclosure).

The second common con-

straint — the potential of a drive unit to transmit low frequency mechanical energy to its stand, to its enclosure, and to its listening environment — is eliminated through the use of a 'mechanically opposed, secondary bass unit', driven in reverse phase, and facing forward to reduce distortion.

A third common constraint — the potential for a filter network to store electrical energy — is substantially reduced in System 442 through its use of a self-bandwidth limiting primary drive unit, permitting accurate integration with the titanium dome high-frequency drive unit through the simplest of passive filter networks, at a crossover frequency of 5 kHz, safely above most fundamental program information.

Australian readers can judge for themselves whether the Mordaunt designers have done a good job. The product will arrive in Australia in September and the anticipated retail price is around \$6000.

For further information contact Concept Audio, telephone (02)938-3700.

R.I. No. 124

## Australia's Largest Microphone Order

Pacific Sound & Vision, which was established as part of the Bilsom Australia Group to market the Milab range of microphones and communication products in Australia, has received an order for the broadcast microphones to be used in the new Parliament House in Canberra.

The microphones have been specially developed by Milab International E.B. of Sweden to meet the stringent specifications of the building architect and the Engineering & Services Consultancy Group of the Australian Broadcasting Corporation.

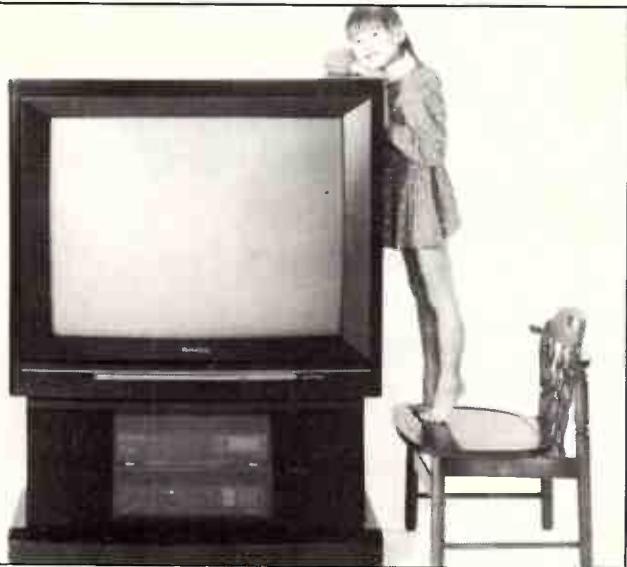
By using an innovative modular mounting system, the same condenser micro-

phone can be used for all locations in the new Parliament requiring broadcasting and speech reinforcing — principally in the two chambers and 19 committee rooms.

The microphone itself, a development from the standard Milab cardioid range, is 28 mm long and 18 mm in diameter.

Milab International A.B., a subsidiary of Bilsom A.B. — probably the world's largest company devoted to the supply of products and training aids for industrial hearing conservation programmes — began making microphones for the Swedish armed forces during World War II.

R.I. No. 125



## National TV

National Panasonic has introduced an extremely large CRT colour television featuring a 43-inch type direct view screen.

National say that the new television combines a jumbo-size screen with the sharp picture resolution of CRT TV. These unique values make the 43-inch (109 cm) type colour TV ideal for home use or for play in public establishments.

National claims that it broke through the design barriers preventing the commercial development of ultra-large size colour CRTs using several technological innovations. An improved overlapping field lens, an aberration reducing triode,

and a specially impregnated cathode give the new colour CRT the capability needed to handle higher current for extra brightness while providing sharper focusing with smaller dot size.

The company will start marketing the new TV together with an exclusive TV stand having built-in stereo speakers this September but no immediate plans have been made to introduce into Australia. The 43-inch type colour CRT TV, TH-43K1D, and stand, TY-G43K1D, sells for \$A18,868. Sold separately, the new TV costs A\$17,924, and the stand for A\$943.40 (all prices are approx.)

R.I. No. 126

## Philips' Camcord



Philips has just released the VC6830 Camcorder. It boasts hand operation with a built-in VHS-C recorder, all weighing less than one and a half kilos. Philips believe it is the only Camcorder that comes with its own soft carry-bag.

Philips chose the VHS-C system because it allows such portability, yet the cassette can still be played back on any VHS recorder using the motorised adaptor supplied. Recording time is up to 60 minutes on one cassette. With optional RF converter, audio and video can be played back direct from the Camcorder on to any TV receiver without the need of a normal video recorder.

A further reason for the VC6830 compactness is the use of CCD (charge-coupled device) image sensor which replaces the old style camera tube. The CCD is claimed to give high picture quality sensitivity and great durability.

This Camcorder, with its six

to one power zoom lens and built-in microphone, is easy to use, even for a novice. It has an automatic focus device which scans the image and still operates perfectly for scenes with little light. Control can be switched over to manual at any time. The lens aperture is also controlled automatically for the best illumination in all conditions. As the camera can operate in normal lighting down to 15 lux, spot lights are not necessary.

The electronic viewfinder is a miniature built in TV monitor which can also be used to check back your recordings. Fast forward, reverse picture search and still frame picture controls let you see quickly just what you want. With the quick review option, you can watch the previous two seconds before recommending recording.

For further information, please contact: Marc Bonney, (02) 742 8471; George Sprague, (02) 925 3333.

R.I. No. 127

## Pioneer CD players



Pioneer Electronics has just released a new range of CD players — the PD4050, PD6050, PDM40 and PD-M60.

All new players in the

range have a honeycomb chassis which increases the rigidity of the frame and protects the pick up and disc drive system from vibration

generated by speakers and other external influences. The PD-4050 provides 16 track random program play whilst the PD-6050 has a 24 track random program. Both PD-M40 and PD-M60 take a 6 disc magazine offering either endless random selection or 32 track random program play.

Pioneer was the first to introduce the CD Multi-play concept which gives unlimited hours of music enjoyment. So successfully received was this breakthrough that the company was awarded the prestigious CESA grand prix award for

the CD of the year! This sought after feature has now been introduced into the PD-M40 at a more affordable price, as well as the improved PD-M60.

All models have digital filter for clean sound, styled in a slim line design. Each has 2 speed manual search and remote control. The recommended retail price of the PD-4050 is \$439, PD6050 is \$599, PD-M40 is \$699 and PD-M60 is \$999.

For further information, please contact: Keith Millar WMCC Consultants. Tel: (03) 699 3000

R.I. No. 128

Peter Hayes examines part of a recent survey of 29,375 people by the Roy Morgan Research Centre and comes up with some surprising results.

# Megasurvey Under The Microscope

## **Hi-Fi and CD**

268,000 adults (people aged 14 or over) bought a CD player in the last 12 months, according to a survey conducted by The Roy Morgan Research Centre between April 1986 and March 1987. The leading brand was National/Technics with 36,000 sales, followed by Sony with 33,000 Yamaha and TEAC with 21,000, Philips with 19,000 and the other 138,000 not statistically significant.

Roy Morgan interviewers also asked people of their intention to buy CD players. They estimated that 558,000 adults intend to buy one in the next 12 months. Market share is indicated as National/Technics 47,000, Philips 46,000, Marantz 38,000, Sony 34,000, Akai 33,000, Pioneer 23,000 and the others don't get a mention. These estimates indicate that Philips, Marantz and Akai will improve their market share and that Yamaha and TEAC are likely to slip.

The survey also attempts to shed light on recent buying and intention to buy "Hi-Fi". People were asked "Do you or anyone else in your household intend to buy a Hi-Fi?" If you intended to buy a cassette deck you would probably say "No" to this question.

According to the results 667,000 adults bought a Hi-Fi (whatever that is) in the last 12 months. Market share was led by Philips/Pye with 94,000, followed by National/Technics 60,000, Sharp 51,000, AWA/Thorn 50,000, Pioneer 36,000 and the other 376,000 ranked as not statistically significant.

Intention to buy "Hi-Fi" by brand was not asked but 679,000 adults intend to buy a "Hi-Fi" compared with 988,000 who intend to buy a VCR, 839,000 a colour TV, 924,000 a microwave oven and 758,000 a refrigerator.

## **Who Buys Audio?**

The survey indicates that:

- ★ Young adults are by far the biggest audio consumers and intending consum-

ers. For example, 14-24 year olds are 24% of the adult population but bought 41% of the CD players sold in the last 12 months.

★ Men are more likely to buy audio than

women. For example, 68% of CD players will be bought by men when only 49.4% of the adult population are men.

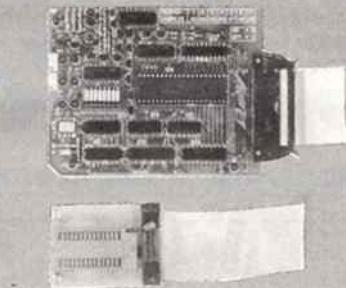
★ Full-time and part-time workers are

## **Interview Results**

	Interviews:	Intend to buy in next 12 months		Obtained in last 12 months	
		Hi-Fi	CD	Hi-Fi	CD
Interviews:	29,375	1483	1229	1466	592
Population (in thousands):	12,302	679	558	667	268
Aged 14-24	2960	373	238	317	110
Aged 25-34	2602	155	156	154	67
Aged 35-49	2934	108	119	129	58
Aged 50 +	3807	43	45	66	33
Men	6087	414	380	397	154
Women	6215	265	178	269	114
Professionals or Managers	717	46	76	43	31
Farm Owners	264	3	4	7	1
Clerks or White collar workers	2284	166	151	162	72
Skilled workers	1023	72	55	69	23
Unskilled workers	1176	87	64	91	29
Total Full-Time workers	5463	375	350	372	157
Part-Time workers	1343	84	64	77	33
Total Don't Work	5496	220	143	217	79
Looking for full time work	414	51	28	27	11
Looking for Part-time work	161	14	9	15	6
Not looking for work					
Home duties	2269	50	33	59	22
Don't work	216	8	7	13	2
Retired	1465	7	6	20	9
Student	972	90	60	83	30

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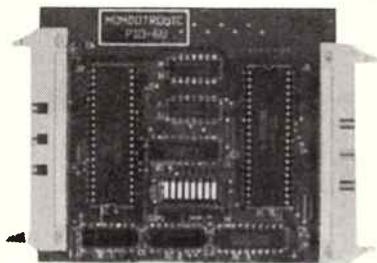
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READER INFO No. 20

SOUND INSIGHTS, OCTOBER '87 — 7

more likely to buy audio people than people doing home duties or retired.

- ★ Professionals or managers are the most convinced of the merits of the CD player with 14% of CD players to be bought by 6% of the population.
- ★ There is no particular income group buying audio products.
- ★ N.S.W. is the biggest market for audio products, mostly from having the biggest population.

What started as an exercise in describing the results of a large and relevant survey has revealed some shortcomings. First of all one cannot help noting the high number of unrecorded "others" in both the case of CD players and HiFi purchases.

The statistic that 558,000 adults intend to buy a CD player is based on the fact that 1,229 of the 29,375 people interviewed answered "Yes" to the question "Do you or anyone else in your household intend to buy a CD player in the next 12 months?" The results are then "weighted" to account for differences in desired numbers of interviews secured. They are then projected to a population, in this case the number of adults in Australia being 12,302,000. These figures should have been projected to the number of households.

According to the Australian Bureau of Statistics there were 5,254,000 households in Australia. Thus all figures I have quoted may be over-estimated by a factor of two. To overcome this problem, I have suggested that in future people are only asked about their own buying history and intention. It also seems a bit much to expect people to know accurately what all their fellow householders intend to buy.

Some other interesting sidelights to emerge were:

- ★ Full-time workers are a minority of adults with 5,468,000 or 44.6% of adults in this category.
- ★ 414,000 people are looking for full-time work which seems remarkably low compared with Department of Social Se-

curity and Australian Bureau of Statistics estimates of the same.

- ★ We know you are interested in audio. The same survey estimated that 13% of Electronics Today International readers intend to buy a CD player in the last 12 months and 7% of you have bought one in the last 12 months.

### **How reliable is this survey?**

As a guide, the results are compiled from the same Morgan Gallup survey used to accurately predict election results and the popularity of our political leaders. These predictions come from approximately 1800 interviews.

Objectively, Morgan's claim that the estimated variance can be calculated thus: To be 95% certain than an estimated statistic is correct  $\pm E\%$ . Where E is calculated:

$$E = 2 \times (\sqrt{P(100-P)/N})^*$$

For example: The estimate of the number of people in full-time work is 44.4%. The estimated variance is calculated:

$$E = 2 \sqrt{\frac{44.4 \times 55.6}{29,375}} = .6\%$$

Thus we can say that we are 95% certain that the number of full-time workers is  $44.4\% \pm 0.6\%$ . Or at least we could if the question was perfect.

A significant problem is that this probability sampling equation assumes an unweighted random survey. This survey however is weighted and cluster sampled using 10 households. The real confidence limits are an exercise for professors of statistics who tend to be more interested in light bulb defects than real world sampling.

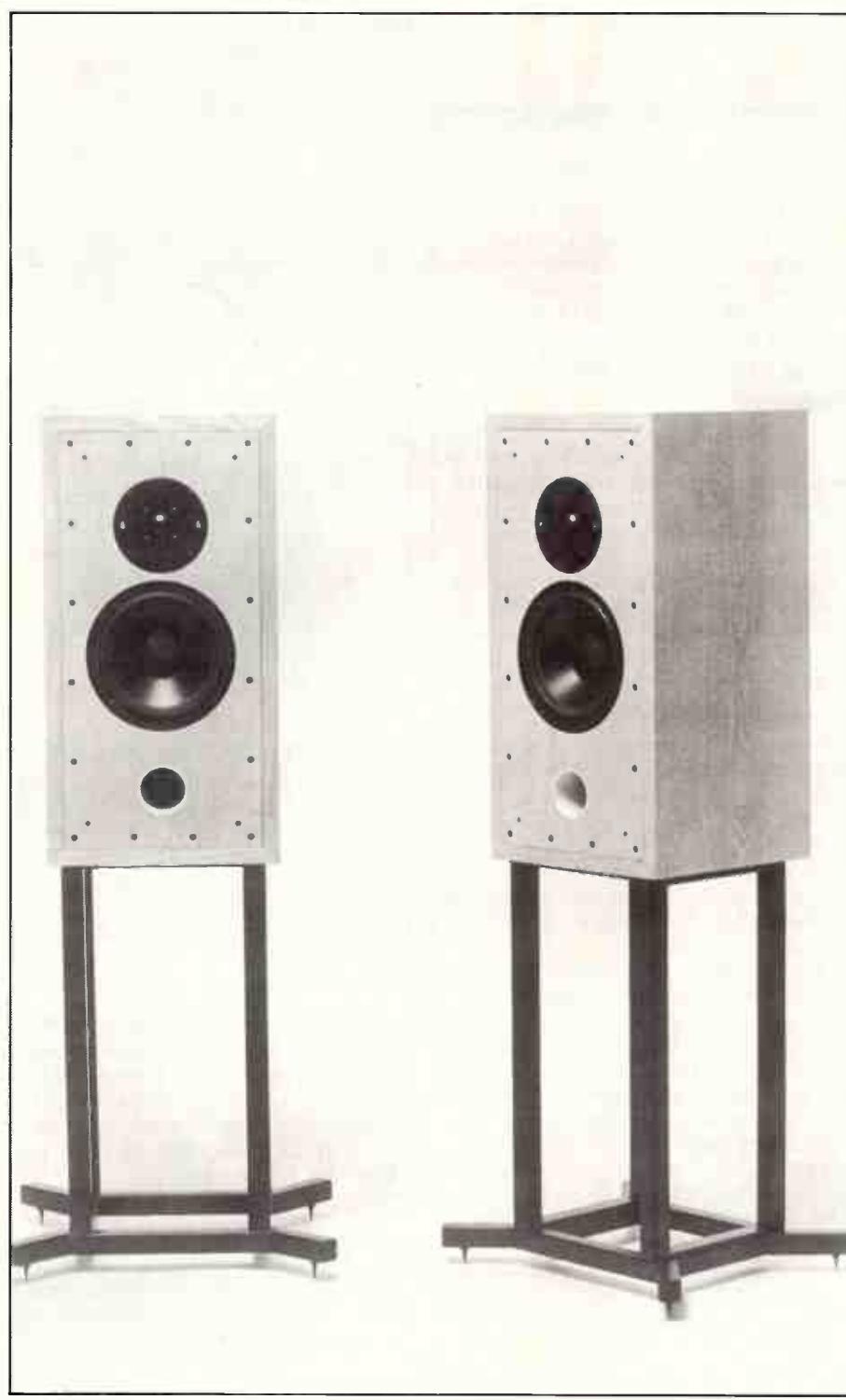
ETI has secured rights for publication of some Roy Morgan Research Centre data. We will be pleased to include some more in the future if you flood us with requests through the free "Comments to the Editor" card.

\*E = Estimated Variance

P = Survey Estimate

N = Size Of Sample

# Orpheus Apollo Speakers



CHOOSING THE name 'Orpheus' for a loudspeaker manufacturer is undoubtedly an appropriate name for a young and enthusiastic firm striving to produce a better product. The first of their products to reach this office is called the 'Apollo'.

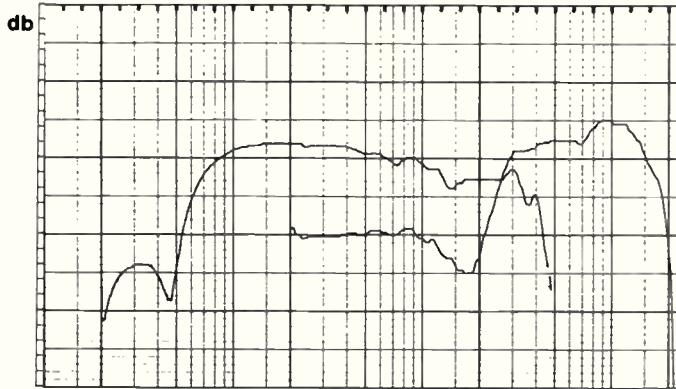
## **Appearance**

Apollos are one of the most well made small speakers I've seen in the last few years and they display a standard of finish which is well above that which I have grown to expect from either imported or locally made consumer products. The soft honey coloured Ash veneer is applied on all six faces of each enclosure and is as near to perfect as one could reasonably hope. The front panel with the 2 drivers and venting port is recessed into the front of the cabinet with exposed fixing screws. The drivers are covered by a translucent cloth covered speaker grill whose inner edges have been carefully chamfered to reduce diffraction effects. The light timber with black speakers is however an inappropriate combination, and either the speaker grill cloth should be made darker or the front panel veneered with a darker hued timber.

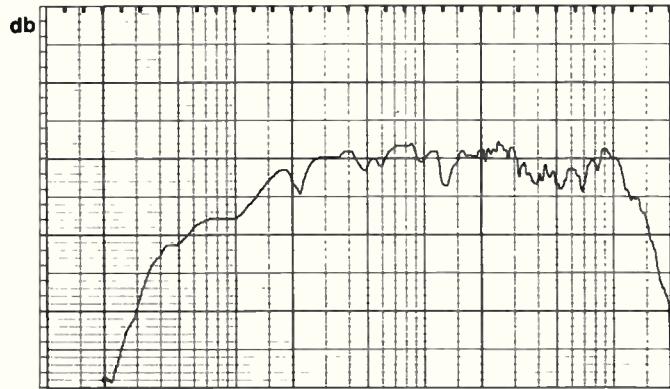
The speaker line up is an SEAS Model H107 25 mm soft dome tweeter at the top, with a 150 mm Peerless WF165 Series 'woofer' located centrally on the front panel. A 37 mm diameter loading port is located near the bottom of the front panel as part of the conventional venting system to extend the low frequency capabilities of the system. The 150 mm driver is correctly sized for the cabinet volume and the designers have followed good practice in their basic selection.

The rear of the cabinet has a single pair of large colour coded universal terminals for connecting the speaker to the amplifier, with no other technical data, manufacturer's label or serial number applied.

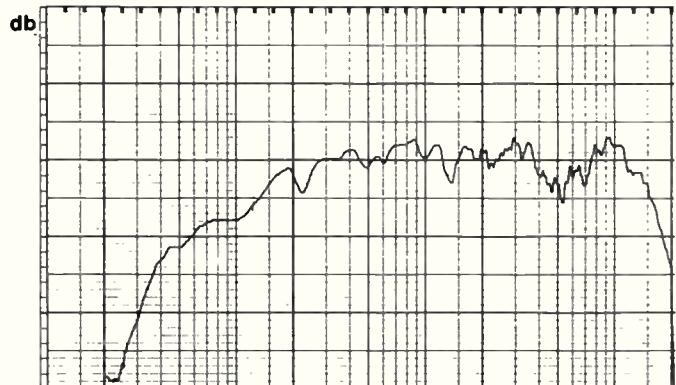
The cabinet has a net internal volume of 18.5 litres and is very solidly constructed from high density chipboard. This has a carefully selected bituminous damping layer glued and stapled to the inner surfaces to reduce cabinet resonances. The cabinet is supplemented by a bonded acetate internal damping media and the crossover network incorporates high quality air cored inductors and high voltage metalised capacitors.



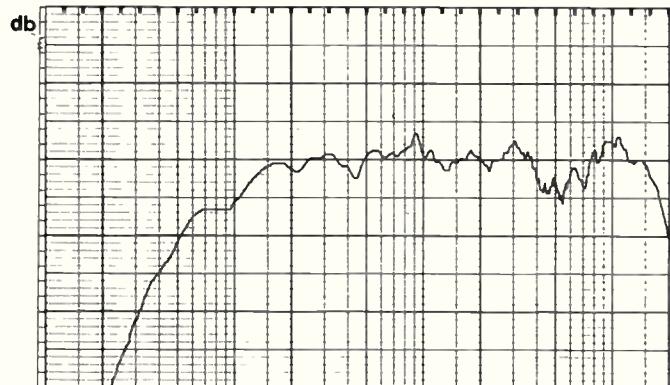
5 cm from woofer and tweeter



2m 30 off tweeter axis



2m on tweeter axis



1 m on tweeter axis

The Apollo speakers were not accompanied by technical literature as this series was only recently developed and the marketing literature had not apparently caught up with the development program.

The development program for these speakers placed major emphasis on subjective evaluations, especially for the choice of cross-over networks which involved extensive subjective testing (in preference to objective testing). This approach has some advantages as well as pitfalls, as our evaluation soon revealed.

### Objective Tests

The on-axis anechoic frequency response of the Apollos exhibits a reasonably good frequency response between 130 Hz and 15 kHz with a number of intriguing peaks and dips. The most significant peaks occur at 800 Hz, 3 kHz and 10 kHz, whilst the most interesting of the dips appear in the 4 to 6 kHz region. When examining the on axis, as well as the off axis, performance below 150 Hz, I initially had some misgivings.

The steepness of the high frequency droop above 12 kHz caused me even greater concern, particularly with the off axis measurements.

The near field measurements performed at 5 centimetres from the woofer and

tweeter revealed a rather unusual relationship for the woofer's output vis a vis the tweeter's output. These characteristics indicated that the chosen cross-over utilises a sharp cut-off for the tweeter input, but a shallow slope with less demanding slope attenuation for the woofer's electrical input.

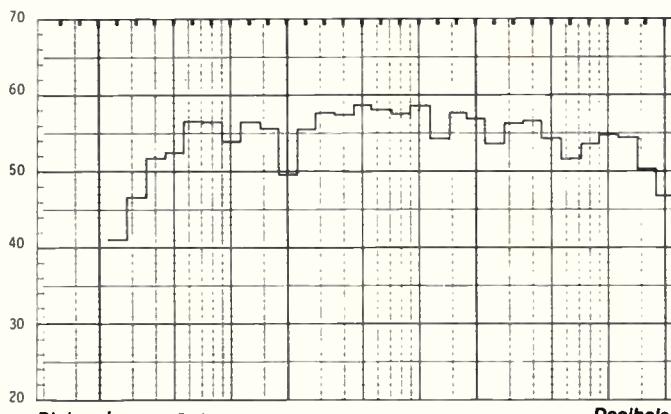
This is a rather unusual combination which results in both the woofer and tweeter providing parallel inputs over the frequency region 1500 Hz to 4.5 kHz. This parallel feed shows up as a significant interaction between the parallel driver outputs in the frequency response.

I conducted a reassessment of the speaker's output with a broad band pink noise input conducted in my listening room. For this test both of the speakers were optimally mounted 400 mm above the floor to assess the one-third octave band room response. This test revealed a far more acceptable set of characteristics.

When tested under these conditions, the

MEASURED PERFORMANCE OF ORPHEUS APOLLO SPEAKERS			
Serial No. Nill			
CROSSOVER FREQUENCIES 4 kHz			
SENSITIVITY (for 90 dB average at 2m)			
7.3 VRMS = 6.7 Watts (Nominal into 8 ohms)			
HARMONIC DISTORTION (level as indicated)			
100 Hz	1 kHz	6.3 kHz	
90 dB	96 dB	90 dB	
2nd	-38.7	-49.4	-55.3 dB
3rd	-44.8	-39.9	-62.1 dB
4th	-	-	-
5th	-59.2	-68.8	-
THD	1.3%	1.07%	0.19%
INPUT IMPEDANCE			
100 Hz	9.0 ohms		
1 kHz	9.0 ohms		
6.3 kHz	6.0 ohms		
Minimum at 300 Hz and 4.5 kHz	5.6 ohms		

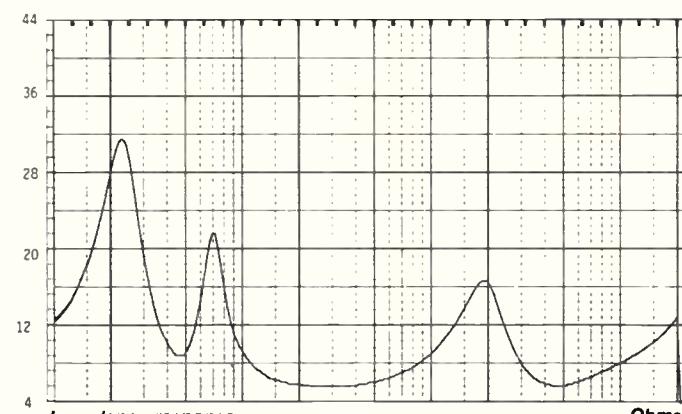
## Orpheus Apollo Speakers



Pink noise response

Apollos revealed a reasonably good performance all the way down to 50 Hz and acceptable performance up to the middle of the 16 kHz band. An examination of the one-third octave band filtered pink noise signal still displays a significant rise in mid band response at 800 Hz as well as some unusual peaks and bumps in the 2 to 4 kHz region. Once again this appears to be the result of destructive interaction between the two drivers.

The speaker's directivity characteristics were evaluated in the anechoic room at



Decibels

1 kHz, 3 kHz and 6.3 kHz at which frequencies the Apollo reveals exceptionally good performance. At 10 kHz however, the polar plot starts to become somewhat narrower, although it is still acceptable. With the speaker grill installed on the front of the cabinet there is a measurable and significant narrowing of the polar band width at frequencies above 8 kHz.

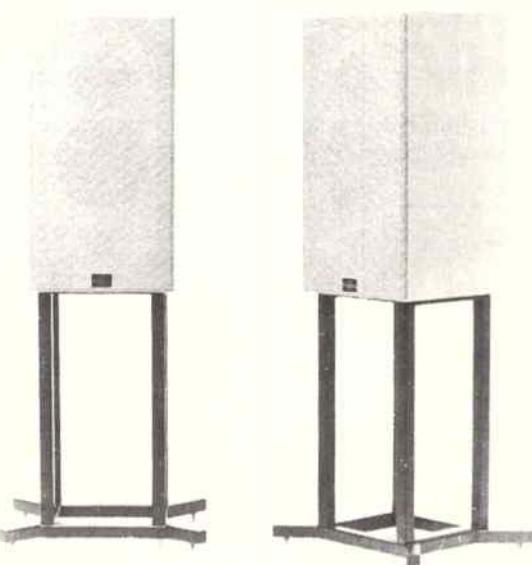
The impedance characteristics of the Apollos reveal classical rises in the graphed response at 23 Hz and 70 Hz, where the impedance rises to peaks of 29

and 22 ohms. The base level impedance is reasonably smooth at 5.6 ohms between 200 Hz and 400 Hz and again at the 5 kHz region. The Apollos should be classified at a 6 ohm speaker system and as such will extract very useful power from most amplifiers.

The tone burst testing revealed significant resonances and ringing in the 8 kHz region and significant traces of ringing in the 3 to 4 kHz region. These results correlated extremely well with the decay response spectra evaluation. This clearly

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**O**rpheus Loudspeakers utilise the very latest polypropylene bass drivers and ferrofluid tweeters. All crossover components are high quality low loss (air cored inductors and metallized polyester capacitors).

**O**rpheus Loudspeaker's cabinets are rigidly constructed, braced and use bitumous panel damping to reduce cabinet colouration.

**T**his culminates in a sound quality that offers audiophiles and music enthusiasts all the attributes (accuracy, dynamics and imaging) of the well known imported products without the inherent price penalty.

**A**ll Orpheus Loudspeakers are handsomely finished in your choice of real timber veneers. Queensland or American walnut, teak, English ash and cedar are but a few of the veneers available.

**O**rpheus Loudspeakers can be auditioned at these quality Audio dealers:

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2 Beattie St, Balmain  
Sydney. Ph: (02) 818 5054

**Music By Design**  
65 Oxford St, Bondi Junction. Ph: (02) 387 7106

**Orpheus**

shows the ringing in the 800 Hz region, as well as in the 3 to 4 kHz region. The peak level characteristics of the decay response spectra clearly show the speaker's lack of uniformity of transient response as the 800 Hz peak stands out above the rest of the response, whilst the tweeter response, although generally peaky in the 4 to 8 kHz region fails to maintain its output characteristics beyond the 12 kHz region. Beyond 12 kHz the output sadly droops down all the way to 25 kHz. The rolling peaks radiating laterally out at 800 Hz and also in the 5 to 8 kHz region indicate a number of significant mid range and high frequency resonances. These indicate fundamental design problems in both of the drivers.

The decay response spectra indicates possible cabinet resonance problems, the most significant of these appearing in the 200 to 400 Hz region, as well as in the 700 Hz to 1 kHz region. As a check on the validity of these interpretations, I mounted a sub-miniature accelerometer at the centre of the side and rear of one of the speaker cabinets to measure the vibration level when the speakers are fed with swept sinewave signal between 20 Hz and

5 kHz. The vibration response output reveal virtually no trace of resonance until 200 Hz. The graph reveals two dominant modes at 220 and 350 Hz which appear to correspond to the fundamental resonance mode for the panel dimensions chosen for the cabinet. A quick check of the internal construction revealed that the cabinet does not incorporate any internal bracing elements (which would be worthwhile additions), although the damping system that has been provided is otherwise excellent.

The distortion characteristics of the Apollo are relatively high at 100 Hz and 1 kHz but reasonably low at 6.3 kHz. With sufficient power to produce 96 dB at 1 metre the low frequency distortion is readily audible at 100 Hz, just detectable at 1 kHz and clearly heard at 800 Hz and

in 3 to 5 kHz region. The phase linearity of the Apollos' is very good. After the mixed bag of objective tests I was unsure of what I would find in the subjective testing.

### **Subjective Assessment**

The subjective assessment of the Apollos was generally rewarding for although not internally protected, I soon found the speakers can easily handle high level inputs with a general aplomb that belies their size.

One of the first things I did was use a pink noise signal to compare the Apollos' colouration with two sets of reference speakers. These both have neutral characteristics and do not display any perceptible signal from any part of the spectrum. As predicted the colouration in the 800 Hz region is most evident, whilst that at the higher frequencies, although not as clearly evident with the pink noise testing, is so under other listening conditions. This is particularly true on voice as well as with tympany and violins. I evaluated the voice characteristics with the latest re-release of "Sgt Pepper's Lonely Hearts Club Band" (EMI CDP7 464422) and with a much

#### **Specifications**

**Dimensions:** 500mm High x 262mm wide x 265mm deep  
**Weight:** 13 kilograms each  
**Options:** Matching stands (supplied for review)  
**R.R.P.:** \$950.00.

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**NEW!**



KSN 1005A  
Flush  
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400hz-  
20Khz  
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Harsh Environment

READER INFO No. 93



2 x 5 Inch Wide Dispersion  
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READER INFO No. 94

3Khz-40Khz

Model KSN 1090A 4" Broad  
Range Speaker

READER INFO No. 95

400hz-20Khz



3.75 Inch Exponential Horn  
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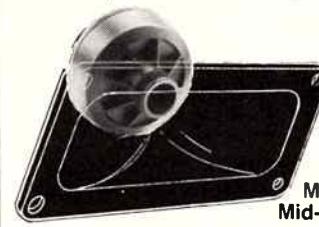
READER INFO No. 96

3.5-2Khz

2 x 6 Inch Wide Dispersion  
Horn Model KSN 1025A

READER INFO No. 97

1.9Khz-40Khz



800hz-15Khz  
Driver

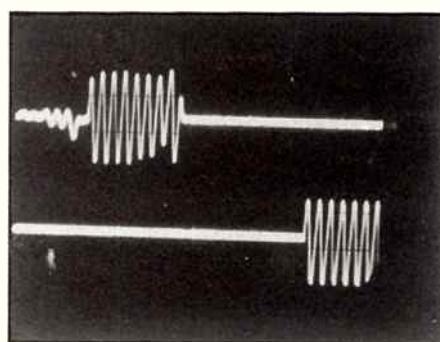
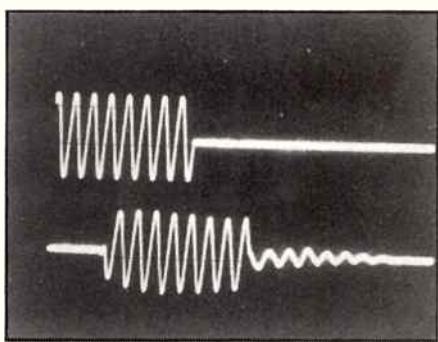
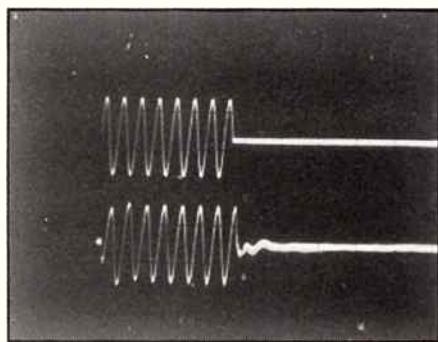
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# Orpheus Apollo Speakers

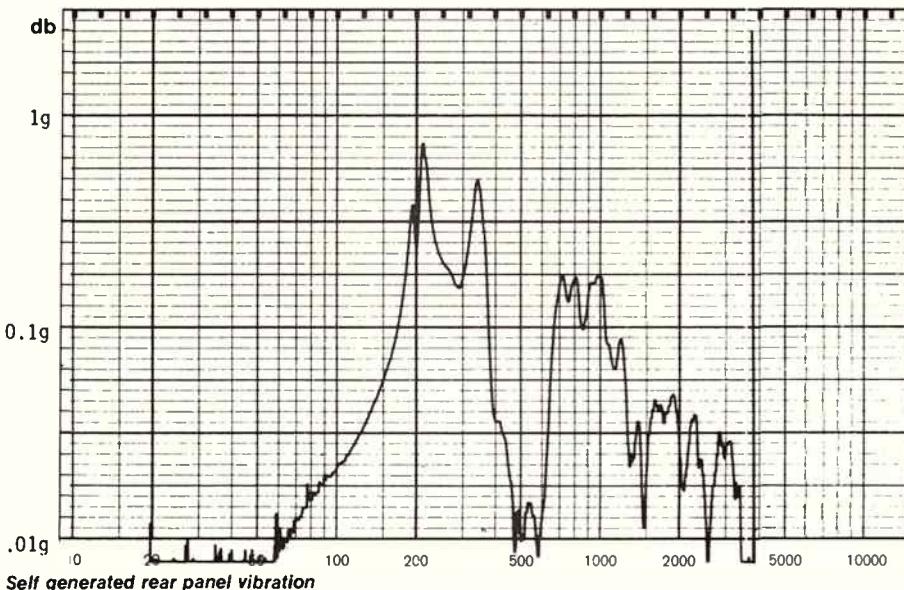


Upper traces are input, lower traces are acoustic output.  
Left 100 Hz; centre 1 kHz; right 6.3 kHz

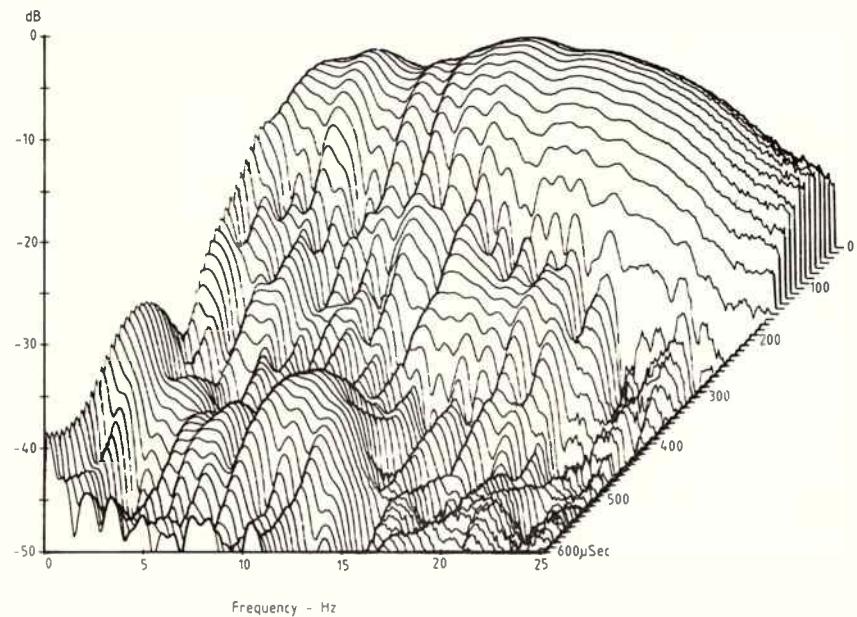
newer disk "Portrait of Kiri Te Kanawa" (Decca 417645-2) which is an absolute gem.

Whilst Sgt. Peppers provides reasonable direction and some obvious clues to the colouration in the 800 Hz region (but not at frequencies above), Kiri Te Kanawa with her 'musical instrument' voice provides positive information which is there for all to hear. With orchestral material like "Schubert's Symphonies Nos. 3 and 6" with Otmar Suitner and the Staatskapelle of Berlin (Denon 33CO-1253) the Apollos were very much more in their element and they provided exciting listening (where I was not really aware of the speakers but only of the music). With a more strident and dynamic classical music as typified by Lorin Maazel with the Pittsburgh Symphony Orchestra in "Tchaikovsky's Symphony No. 2 and Rimsky-Korsakov's Symphony No 2" (Telarc CD 80131) I was particularly impressed with the Apollos' ability to produce peak levels of up to 105 dB without too much complaining although I was readily able to detect the low frequency distortion on drum rolls as well as from the base and violas.

The Apollos are a positive attempt by a relatively new Australian speaker manufacturer to achieve above average acoustical performance matched by a quality of construction which has not really been attempted in quite the same way before. The attempt has been reasonably successful as these speakers have plenty of presence and handle high power levels with a degree of panache which has to be admired. With more carefully chosen drivers which do not exhibit quite as much colouration, these speakers will easily be able to challenge the more expensive and strongly entrenched imported speakers from England, America and Scandinavia. ●



Self generated rear panel vibration



Spectograph — dB vs frequency vs time

R.I. No. 115

**Australian hi-fi manufacturers gallantly heed their nation's call to build, sell and export.**

**David Frith**

# Aussie Music Makers

- ★ A LOUDSPEAKER system made in Adelaide takes the American audio-phile market by storm, earning its maker millions of dollars a month. It's billed as the most accurate in the world and a lot of US reviewers agree . . .
- ★ An electrostatic speaker from Tasmania is a hit attraction at the Chicago Consumer Electronics show . . .
- ★ Audiophiles from the US, Japan and Western Europe clamour to buy phono cartridges made in Sydney . . .
- ★ What do Aaron Loudspeakers, Audio Sound Laboratories, Advance Australia turntables, Absolute reference, Murray Amplifiers, Orpheus Loudspeakers, Amber Amps, and Eidetic have in common? Answer: they are some of the many home grown firms which now manufacture Hi-Fi products.

These are just some of the straws in a new electronic wind. Almost incredibly, in the spring of 1987, a viable — if fragile — Australian hi-fi manufacturing industry is emerging, making top class products for a world market.

Paul Keating's celebrated J-curve — the trend that was supposed to turn the dive of the Australian dollar to Australia's advantage by making its manufacturing industries competitive — actually seems to be working. Scores of small makers round the nation are suddenly visiting their financial advisers, setting up mini production lines and making overseas market research tips. Hi-fi visionaries are predicting an export market worth scores — perhaps hundreds — of millions of dollars by the 1990s. They look to growing markets in Europe and Asia — especially Japan — as well as the US.

## Domestic Prejudice

It's taken Australia long enough to realise the possibilities. Across the Tasman, New Zealand, with its Perreux amps among others, has been pulling in big dollars for first-class audio gear for some years. Australian hi-fi makers by comparison have been slow on the uptake, and many are new to the business world. They are hampered by a financial sector that doesn't wish to know them, governments that provide almost no assistance and a home market that still distrusts Australian-made high-tech products.

Though the future seems so promising,

they may have some painful lessons ahead. Not all will survive.

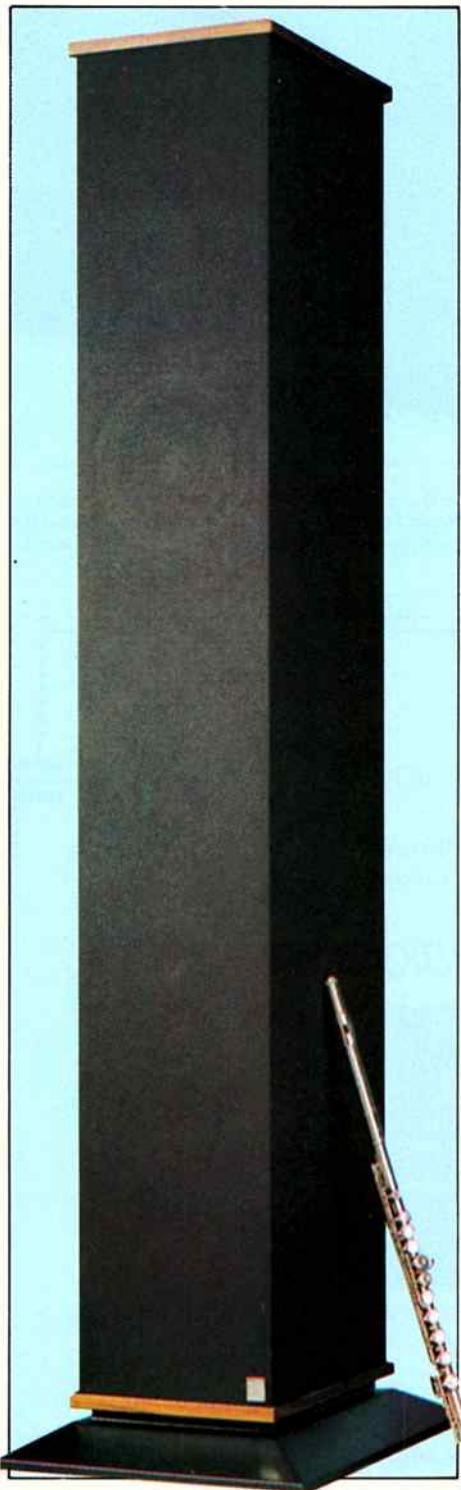
## Duntech's Experience

"Everyone thinks the American audio market is a tough one to crack — in fact it's the easiest market in the world. If we can do it, others can follow," says John Dunlavy of Adelaide-based Duntech International Pty Ltd. "But," he adds, "it helps to have friends." Dunlavy, who is short of neither friends nor dollars, is easily the biggest success story so far of the emerging Australian hi-fi industry — and, to the chagrin of some, the story has a strong American flavour.

In 1981, upset by the growing violence of American society, this brilliant engineer, physicist and businessman left his native US, seeking a more stable framework to develop his theories and dreams for Duntech. After touring the world he chose Adelaide's Technology Park and — despite a few hiccups — is sure he made the right choice. Duntech sales last year were around \$7 million. They are now flowing at more than \$1 million a month, and John Dunlavy expects them to reach \$40 million a year by 1995.

The plant will then employ 200 people; it currently employs 20, producing five different speakers: the PCL-3 and PCL-5 wall-mounted models; the giant Sovereign 2001 and Crown Prince tower models, selling in this country for \$13,000 and \$7,000 a pair respectively; and the latest addition, the little \$1,000 Duchess. It is the Sovereigns and Crown Princes which have really made the Duntech name. Bert Whyte, highly respected associated editor of US Audio magazine has called the Sovereigns an engineering tour de force and "incontestably the best" in the world. Digital Audio named them as part of its dream system; and American hi-fi editors at the last Chicago consumer Electronics Show voted them the No 1 speaker.

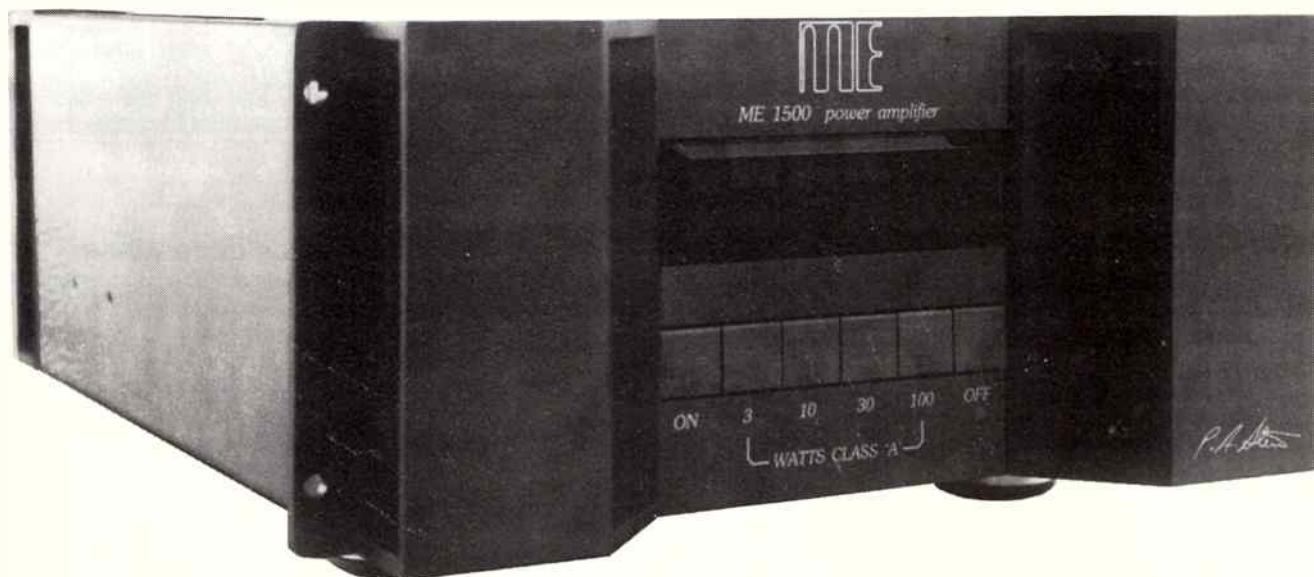
But it's the bookshelf-sized Duchess that is currently embarrassing John Dunlavy. It has taken the US market by storm, and Duntech's American agents are asking him to gear up for an incredible 5,000 pairs a month — a market worth more than a million dollars a week. "That's one helluva problem, believe me," drawls Dunlavy. He would need a much bigger factory to do it, and there isn't one



The Duntech Crown Prince

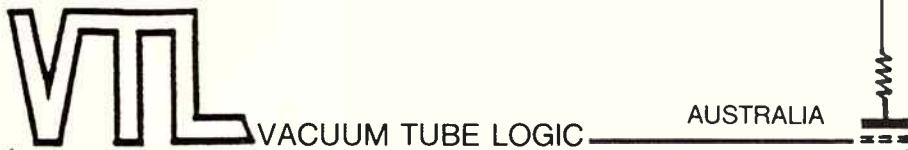
R.I. No. 133

## Aussie Music Makers —



R.I. No. 134

**Quality from the bush.** The ME 1500 power amplifier is the brainchild of Peter Stein who designed and built this unit at his factory at Dyers Crossing on the mid-north coast of NSW. Stein has been in business for 13 years and his amplifiers are noted for such features as their large power supply, low level negative feedback circuits and their modular design. Representatives for ME products have recently been appointed in Hong Kong and the UK.



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in sight. Reluctantly he has turned down immediate orders of \$1.6 million.

The Duchess is enjoying considerable success at home, too. Sixty pairs have been ordered for Canberra's new Parliament House and the ABC has also ordered a considerable quantity for its FM studios. For Duntech International this is just the start. Dunlavy has plans for further models to fill the yawning gap between the Duchess and the Crown Prince — expect a mid-sized speaker retailing for between \$3,400 and \$5,000 — and is getting involved with receivers and amplifiers.

### Salutary Warning

John Dunlavy believes other Australian manufacturers could emulate his success — indeed he is helping two small amplifier makers with introductions to the US market — but he sounds some warning notes. "The American market is very large and always looking for something new, but to succeed a product has to be perceived as high quality and unique," he says. "Frankly, many Australian products I have seen are just not good enough: they won't survive."

Some other problems he sees in the Australian industry are the difficulty of raising finance for new high-tech ventures, and misdirected government assistance: "Small amounts are available for inventors with products that don't go anywhere —

but they don't seem to want to back success, or even to listen to advice on who they should be backing." Not that he wants to be subsidised, but he wouldn't mind some help in finding a bigger and better factory than the leaky contraption he has battled at Technology Park. While Dunlavy's success has evolved from American technology (he is, incidentally, now an Australian citizen), no one should doubt that Australia has home-grown talent capable of meeting the challenge of world markets.

### More Examples

Two examples are Alan Wright of Sydney, designer of Vacuum State valve amplifiers, and Alan Moss of Launceston with his Ultrasound electrostatic loudspeakers. Both have received international acclaim, but both have found getting them onto the market fraught with difficulty and delay, mostly to do with money.

After several false starts, in which financial partners have come and gone, Alan Wright's Vacuum State amps have finally gone into production. A small production line has been set up at Balmain, Sydney, to produce two models, the four-valve FVP, selling in Australia for \$1295 and the 16-valve RTP at \$3500.

Among the first buyers of the RTP is A. J. Van den Hul, the cable manufacturer, who ordered it during a recent Australian visit. It was personally delivered and installed in Holland by Wright during a trip which saw Vacuum State distributors appointed in the UK and Germany.

Wright and his new financial partner, insurance man Bruce Bell, believe the German market may prove immense. Enthusiasm for the product among distributors and dealers is very high, they say, even though the amps will sell in Europe for twice their Australian prices. Bell and Wright are moving one cautious step at a time, however. Monthly production rate has been set at 25 FVPs and 10 RTPs, until the water is fairly tested. This rate can be doubled immediately if sales are as predicted, they say — and doubled or quadrupled again with relative ease.

"One surprising fact we have learned," says Bruce Bell, "is that there is no shortage of skilled Australian labour available — skilled enthusiasts who would leap at the chance of joining the line." New models are on the drawing board, at the urging of the European distributors: a valve power amplifier and a valve tuner.

For Alan Moss's equally exciting Ultrasound electrostatic speakers, the future remains a little cloudy. Prototypes were enthusiastically demonstrated and promoted at recent hi-fi shows round Australia — as

well as in the US — but the Melbourne investors who planned to put them into production have since had to withdraw.

Moss, a retired Launceston pest exterminator and audio enthusiast developed the speakers over seven years. They are unusual in having curved electrostatic panels instead of the flat panels found on designs such as the Martin-Logan and Quad: a feature Moss claims produces wide sound dispersion, with exceptional dynamic range and — unlike other electrostatics — can be driven with quite low powered amps. The design is now in the hands of the Seridian investment group of Melbourne, headed by Leo Tsatsaronis. Mr Tsatsaronis told ETI it was hoped to have the speakers in production in a Melbourne factory in September. Investment to that stage would be about \$250,000.

Production would begin at 10 pairs a week, building to 25 a week fairly swiftly, and around 90 per cent of output would be for export to the US and Europe. "This is a specialised product and we would expect to exhaust the local market fairly quickly," he said. Suggested retail price of the Ultrasound is around \$4,000 in Australia. In the US they will be pitched around \$US3,000 in order to compete with the

\$2,500 Martin-Logans.

### The Garrott Diamonds

Success in the world market doesn't have to be on a gargantuan scale. Sometimes the world will come to you. The Garrott Brothers, John and Brian, found international recognition — and a good living — working alone from their former home in Sydney's leafy Avalon.

"We're not technicians, we're micro-surgeons," says John Garrott. And so they are. Working with stereo microscopes, the Garrotts painstakingly graft the best diamonds in the world to clients' phono cartridges. They guarantee to make any cartridge — from a Goldring cheapie to \$4000 esoteric model — sound not just better, but "astonishingly better".

Seen under the microscope, the diamonds that come even with the most expensive cartridges are lumpy dull grey products; a Garrott diamond by contrast is a true gem — sharply multi-faceted, mirror surfaced, glowing with fire — and much better at tracking the grooves of an LP. Laser-cut in Japan to the Garrott's specifications, they are undoubtedly the finest quality in the world, and cartridges arrive by mail daily from North America.

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## Aussie Music Makers —



A quality amp from Metaxas. Metaxas in Melbourne is the name of the company begun by Kostas K. Metaxas in 1981 after returning from his studies in West Germany. The company has been getting good reviews in the German audio press.

R.I. No. 135

Europe and Japan for the Garrott treatment. Average price for treatment: around \$200-300.

The Garrots have also resumed making their own cartridge, the P77 "dynamic coil" — an item which they claim combines the dynamics of a moving coil cartridge with the smooth, easy listening response of a moving magnet. The British audio press — the world's toughest — has raved about the Garrott's products; they are hailed as the world's leading experts on diamonds. Yet they remain relatively unknown in their own country.

Modest and unassuming, they like it that way. "We don't market our products — if we went into advertising and promotion, we would need to raise our prices," says John Garrott. "So our clients have to find us. But once they do, we give them a service and a product they won't find any-

where else in the world."

Finding the Garrots at the moment is more difficult than usual. Dismayed at the increasing intrusion of suburbia into Avalon, they have moved to the Blue Mountains. The new address is Cox's River Road, Little Hartley, NSW 2790. Or if you would like to speak in person to a living national treasure, ring (063) 55 2142 and ask for Brian or John.

### Ralph Waters

Some new Australian manufacturers aren't looking towards the export market at all. Ralph Waters is a young Sydney audio engineer who has found a market niche with his low-priced yet astoundingly good Richter speakers.

He first had to overcome a reluctance by many dealers to stock Australian products: Leisure Sound's Andrew Goldfinch

and Music By Design's Matthew Bond were among the first to hear the light. A press article drawing attention to the value in his tiny \$399 Richter Merlins — which compare favourably with many British brands at twice the price — turned the tables, and many other dealers began stocking these tiny marvels.

For Waters the problem is now keeping up with demand: he is caught in a classic cleft stick of small-scale Australian manufacturing. If he expands production by putting on staff, his costs will rise and prices will have to follow; if he doesn't, dealers face delays in supply — and their clients will order other brands. Ron Cooper of the Sydney-based Audiosound company accuses hi-fi dealers of failure to support Australian product. "They only want well-established brands," he says. Cooper has been turning out high quality audio gear for public and professional use for many years. His current range encompasses two amps, eight speaker systems and three tuners but, despite approaching more than 80 dealers over the years, he says most of his sales are direct to the public or to professional users, including the ABC and commercial TV channels.

Top audio dealers deny the charge. They would happily stock more Australian product, they say, if only the locals adopted a more professional approach. Lane Cove (Sydney) dealer Len Wallis says Australian makers have the technical expertise but all too often lack the professional marketing skills. "The killer has always been product finish and marketing," he says. "The potential for Australian products is fantastic — the only market reluctance is toward anything second-rate. The products have not only to sound good, they have to look good, be properly packaged and supported by well-printed manuals and other literature."

He is echoed by Drummoyne dealer Mike Bartlett. "The Australians too often just can't seem to get their act together," he says. "You need consistency of supply — too many of them try to do everything themselves, without proper financing or a consistent management plan, and find they can't keep it up. "The next thing you know you have four or five orders, with deposits taken, and you're being told you can't be supplied for 10 or 12 weeks. Naturally the buyer switches to something else, and naturally the salesmen lose interest in pushing the Aussie product."

Bartlett believes there is no shortage of finance for Australian manufacturing: just a shortage of business planning. "If you put up a good plan, the banks will listen — we'll even put up money ourselves for a well planned venture," he says.



Amplifiers from Trevor Lee's audio of Melbourne. Trevor and his brother Chris have been in business since 1975 and their products have aroused interest in both Holland and the US.

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16	41	66	91	116	141	166	191	216	241	266	291	316	341
17	42	67	92	117	142	167	192	217	242	267	292	317	342
18	43	68	93	118	143	168	193	218	243	268	293	318	343
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**Most of the amplifiers on the market use some degree of feedback to improve their stability and reduce distortion. But feedback is not the only way to do it.**

# Feedforward Amplifiers

MOST OF YOU will be familiar with feedback, less so with feedforward. Feedforward was invented before feedback, but has not enjoyed the same popularity. This is surprising, because feedforward holds a promise of improved performance over feedback, and is probably simpler to understand.

## Feedback

To start, how does feedback work? The basic principle is that a fraction of the output of an amplifier is fed back to the input so as to reduce the gain of the amplifier by an amount  $1 + AB$  (See Figure 1). In

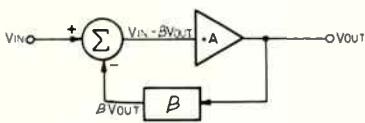


Figure 1

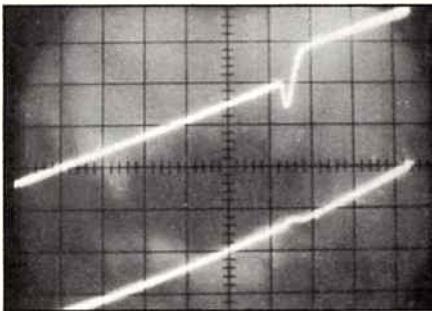
return for sacrificing this gain, a number of advantages are obtained. The gain is now the reciprocal of the fraction of the output fed back to the input ( $1/B$ ). Since this fraction is usually set by two resistors, the amplifier gain is easily controlled and is quite stable. On the other hand, the gain of the amplifier when no feedback is present is dependent on the parameters of the transistors within the amplifier (which can vary up to 500%) and temperature variations.

There are other effects too. For instance, it changes the input and output impedance. Another effect of feedback is that distortion is reduced. The distortion is reduced by the same amount as the gain reduction, i.e.:

$$A \quad (1)$$

$$1 + AB$$

This equation suggests the first limitation of feedback. The distortion can be reduced by a certain amount, but cannot be eliminated altogether. (The equation can only be reduced to zero if A is zero). A feedback amplifier is arranged so that a



Top: Main Amp Output. Bottom: Error Amp Output expanded to see Crossover Region. The kink in the main output is clearly seen, whilst the "anti-kink" is seen to be 10 times larger.

distorted signal will be fed to its input; the amplifier distorts this pre-distorted signal to produce a relatively pure output (via the B network). Thus the output of a feedback amplifier will always contain distortion products, no matter how small.

An analogy will make this clear. A common case of feedback control is driving a car. When you drive your car along a highway, you continually make steering adjustments. You must correct your own steering errors, plus make allowance for random movements in the car, plus alterations in the direction of the road. The current position of the steering wheel is thus determined by a mixture of where you want to be, what's happening now and what just happened in the past. An amplifier output stage, trying to track a moving input signal, has much the same problem.

The most common strategy employed to reduce distortion in a feedback system is to make the gain of the amplifier as large as possible. This is confirmed by formula 1.

Making A big reduces the value of B. To all intents and purposes it is possible to make the gain of A infinity. Typical opamps may amplify ten thousand fold.

However, this brings up another problem; the second limitation in feedback systems. In any real amplifier there are increasing phase shifts as the frequency in-

creases. Once these phase shifts reach 180 degrees the feedback reinforces the input and the amplifier oscillates. The closed loop gain at this point must be less than one, or the oscillation is sustained. (Closed loop gain is gain with feedback; open loop gain is the gain without it). Large loop gains (especially at high frequencies) are not possible, therefore distortion levels cannot be reduced ad infinitum. In practical amplifiers, loop gains of 1000 (60 dB) are possible at low and mid frequencies, but at higher frequencies gains of 10-100 (20-40 dB) are not uncommon. This means that distortion at 10 kHz may only be reduced by ten times. There must be a better way!

## Feedforward

The technique known as feedforward is fundamentally different to feedback. The

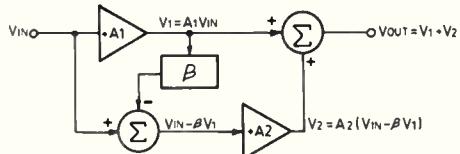


Figure 2

output of the main amplifier (Figure 2) is subtracted from the input, so that the output of the subtractor is distortion only. This error signal is then amplified and subtracted from the main signal. The distortion is therefore completely removed.

To see how the distortion reducing mechanism actually works, it helps to con-

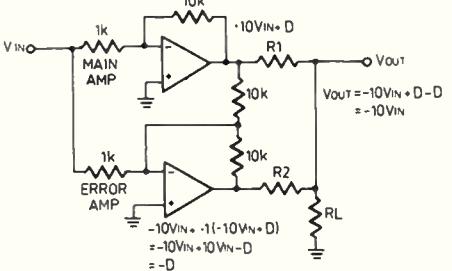
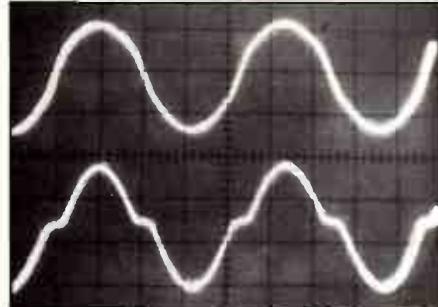


Figure 3

vert the diagram into something a bit more familiar, which we have done in Figure 3. The main amplifier has a gain of -10 (set by using feedback) and its output is -10 Vin, being an inverting amplifier. The output also contains distortion. The error amplifier is a summing amplifier with its output the sum of the input signal Vin (amplified by 10), and the inverted output of the main amplifier. When these two signals combine the main signal is cancelled and only -D remains. The minus sign signifies that this signal is 180 degrees out of phase with the distortion component in the main amplifier. By summing these two outputs via R1 and R2, the main signal is left intact and the distortion completely cancels.

Here is the important difference between the two techniques. Whereas feedback can only reduce distortion, feedforward can completely remove it, leaving zero error. Furthermore, there are absolutely no instability problems (oscillation) since the output is not fed back to the input.

Feedforward can be just as effective at high frequencies as it is at low frequencies. In addition to this, feedforward will correct for any type of distortion you care to mention. Harmonic, intermodulation, transient intermodulation distortion, gain errors, phase errors and any other forms of distortion yet undiscovered. The amplifier itself becomes a distortion analyser,



*Top: Main Amp Output ( $\sqrt{A}$ ). Bottom: Error Amp Output ( $\sqrt{B}$ ) with boot stripping.*

sensing the difference between its input and output, and then cancelling that error.

The only distortion remaining will be that of the error amp, but since this is distortion of the distortion it is a minor consideration. The error amplifier provides little power and can be made high quality.

### A Conventional Power Amplifier

Almost all power amplifiers today use class B output stages, and the main type of distortion encountered is crossover distortion, where one transistor turns on and the other turns off. In an attempt to combat this the output transistors (or MOSFET's) are turned on a little (10-100mA). This reduces the problem considerably, although some distortion remains. The reason is that as one transistor starts to turn on, the other one must turn off by exactly the same amount. Unless the two devices are perfectly matched this complementary action is less than perfect.

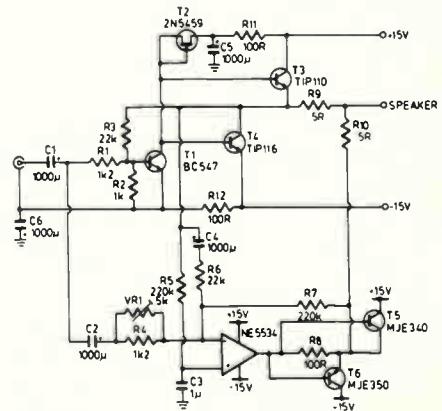
As an added complexity, the base emitter voltage of a transistor is temperature dependant, so a thermally compensated bias network must be used, adding circuit and mechanical complexities. MOSFET's are better in this respect, and generally do not need thermal compensation, however both devices must have some bias to reduce crossover, and minimum crossover requires correct adjustment. The bias network may need re-adjusting as the amplifier ages or if an output transistor is changed.

Feedforward could eliminate this problem. If an amplifier was designed where the output transistors were not biased on, all the bias adjustment and thermal tracking problems would disappear. Of course, there would be excessive crossover distortion. Feedforward could be used to correct this and an adjustment free amplifier would result. As a bonus the amplifier would still be distortion free after years of ageing or if an output device was changed.

In addition, if feedforward is going to straighten out the main amplifier, there is little point in going to great lengths in reducing other forms of distortion. The main amplifier can be considered a work horse delivering lots of power without being too elegant. As long as the error amplifier is not overworked the main amplifier may contain moderate levels of distortion.

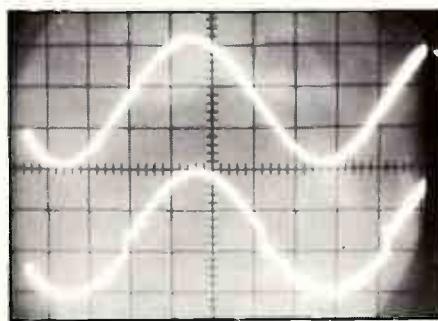
### Prototype Power Amplifier

To test the effectiveness of feedforward, a small power amplifier was designed and built. The circuit is shown in Figure 4. In



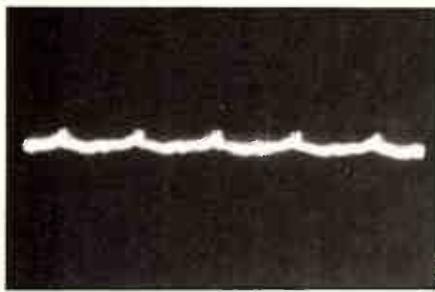
*Figure 4*

sympathy with the design goals the circuit was kept as simple as possible. The main amplifier has only one power stage (T1) with an FET constant current source col-



*Top: Main Amp Output. Bottom: Error Amp Output. Notice that the error Amp signal at crossover is 10 times larger.*

## Feedforward Amplifiers



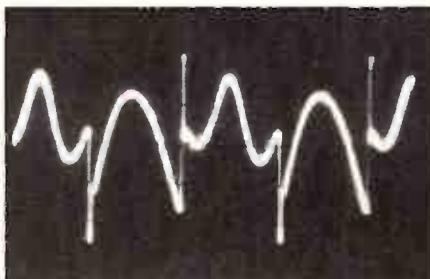
Distortion Waveform with Feed Forward 0.025% (1 kHz) (Output of Distortion Analyser).

lector load (T2). This maximizes the gain of the stage. The output transistors (T3 & T4) are Darlington transistors to give the necessary current gain and have absolutely no bias. Since there are a minimum of stages in the amplifier with the resultant lower open loop gain and minimum phase shift, no frequency compensation is needed. Normally a compensating capacitor would be connected between the base and collector of T1. The amplifier will develop approximately seven watts.

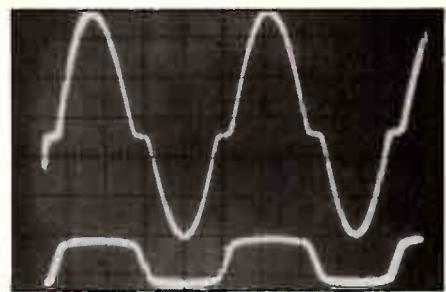
In order to maintain simplicity the error amplifier uses an op-amp with a booster output stage. This type of booster stage does produce some of its own crossover

distortion, but it is very much a secondary effect. The error amplifier is biased from the output of the main amplifier via R5. C3 grounds the positive input for ac signals. This biasing ensures that there is no dc difference between the output of the two amplifiers.

The error amplifier has a gain of ten so its summing resistor R10 is ten times the value of the main amplifiers summing resistor R9. VR1 is used to trim the gain of the bootstrapping signal, and this was adjusted by monitoring the signal across R10 and pulling any main signal component, so that only the distortion signal is being passed through R10.



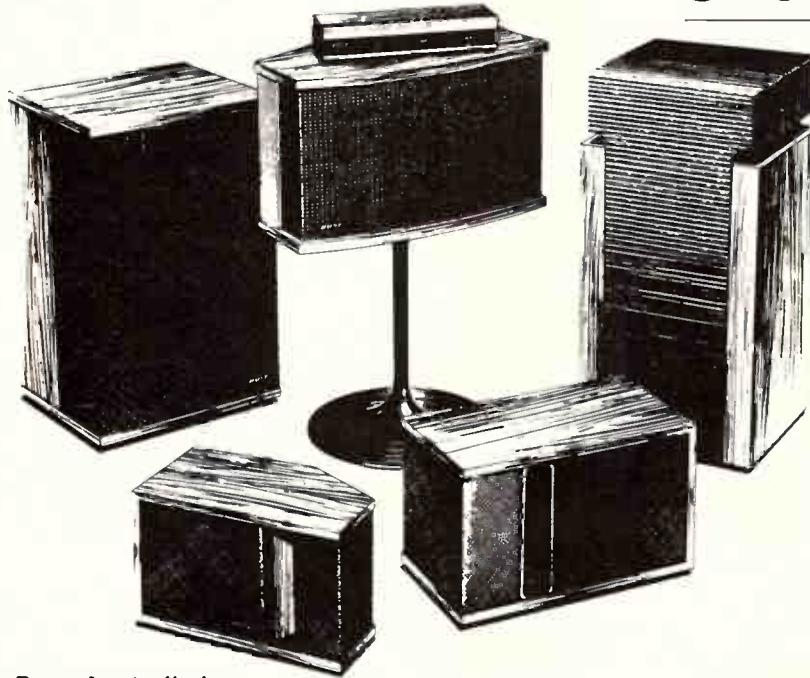
Distortion Waveform with no Feed Forward 0.6% (1kHz) (Output of Distortion Analyser).



Top: Main Amp Output (VA). Bottom: error Amp Output (VB).

Measurements were taken at 20 volts peak to peak (approx six watts). With R10 disconnected, ie: no feedforward signal the distortion was measured at 6% at 1 kHz and 10 kHz. With the error signal fed forward (R10 connected) the distortion dropped to .025% at 1 kHz and .09% at 10 kHz. This is a reduction of 24 times at 1 kHz. At 10 kHz the improvement is less spectacular, but this is mainly due to the slowness (limited bandwidth) of the error amp, and highlights the fact that in a feedforward amplifier the error amplifier must be of high performance. However, .09% THD is not always achieved in conventional amplifiers and is certainly excellent for an amplifier of such simplicity. ●

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# Reviews



**Artist — Suzanne Vega**  
**Title — Solitude Standing**  
**Label — A and M records**  
**Cat No — CD53233**  
**Producers — Steve Addabbo and Lenny Kaye**

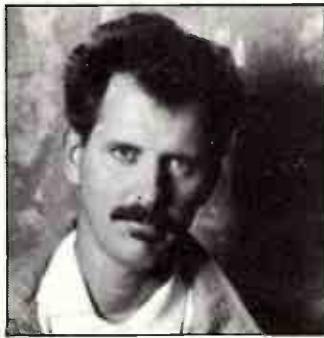
Suzanne Vega first gained the attention of the Rock Media some six years ago when she was considered one of the rising talents on the New York folk circuit. Her early promise as a recording artist was confirmed when she released *Suzanne Vega* in 1985 which sold some 600,000 copies world wide. Anyone who thought this would be an isolated phenomenon should listen to her latest release *Solitude Standing* which maintains and even extends this high standard.

The music is simple, sweet and clear. It is mercifully free of the modern blight of over-production. However, the main part of any Vega album are the lyrics and the lyrics of *Solitude Standing* are purely and simply remarkable. Vega refuses to let herself be bound by either the wistful mysticism of Dylan or the courtly love obsessions of almost every other popular song writer. Instead she sings about loneliness and life in the urban wilderness.

In *Solitude Standing* she personifies Solitude as a woman who has come to set a "twisted

heart straight" whilst in the poignant *My name is Luka* she sings of the modern phenomenon of childbashing. These songs speak of serious and morose subjects. However, Vega handles her subjects with the utmost delicacy so that the listener is more intrigued than discouraged.

Simon O'Brien



**Artist — Michael Franks**  
**Title — The Camera Never Lies**  
**Producer — Rob Mounsey**  
**Label — Warner Bros**  
**Cat No — 925 570 2**

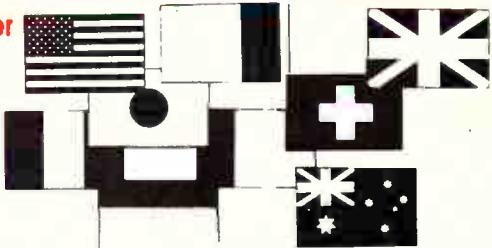
Michael Franks is an artist in possession of that most rare commodity called musical integrity. Although hardly prolific (this release is his sixth in eleven years) his infrequent musical excursions are well worth the wait.

Owing to an increased use of electronic musical and studio effects this offering represents a departure in style from his previous work. It is a departure that succeeds admirably and indicates an artist open to change and a willingness to harness the dramatic technical progress made in musical studio equipment. Nowhere does Franks "drown" in this technology (like many others) and yes we still have those slick jazzy arrangements and that marvelous laid-back vocal style.

Of the nine excellent tracks contained on his CD the stand

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### FRANCE

"It shows...exceptional cleanliness of sounds, total absence of distortion, amazing ease with which the most complex messages are played back...We rediscover numerous records." *La Nouvelle Revue du Son*

### GERMANY

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ME 1500 Poweramp



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READER INFO No. 26

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out ones are *Face To Face (For PY)* a funky chorus line with tight brassy embellishments; *The Camera Never Lies* terrific jazz guitar and harmonies with Art Garfunkel; *Doctor Sax* a more percussive tune with an upbeat middle-eight and stunning saxophone provided by Michael Brecker; *Innuendo* a softer slower piece with exquisite acoustic guitar played by Earl Klugh.

If you like music that is accomplished, tasteful and original, go directly to Michael Franks and you will collect more than two hundred. Recommended.

Mark Lewis

**Artist — The Alan Parsons Project**  
**Title — Gaudi**  
**Producer — Alan Parsons**  
**Label — Arista**  
**Cat No ARCD 8448**

*Gaudi* continues the Alan Parsons Project's tradition of thematic albums. It consists of a series of songs inspired by the work of the Catalan architect Antonio Gaudi (1852-1926)

whose Sagrada Familia cathedral in Barcelona is considered one of the greatest modern buildings in the world.

The songs on this album vary from virtual hymns to the more conventional pop rock style. Particular highlights are *Closer to Heaven*, *Inside Looking Out* which are both sung with particular sensitivity by Eric Woolfson and the more up tempo *Standing on Higher Ground*. One minor criticism of *Gaudi* might be that remarkably little Spanish influenced music is featured on an album inspired by a Spanish architect and Spanish Cathedral.

But why quibble. If you like your music exquisitely melodic, well produced and brilliantly executed you will like *Gaudi*. It is one of the discs of this year.

Simon O'Brien



### Artist — Crowded House

### Title — Crowded House

**Producer — Mitchell Froom**

**Label — EMI**

**Cat No — CDP**

**746317 2**

An extraordinary amount of hype has surrounded this Australasian outfit and their debut offering. Let's set the record straight (pun intended). They are not the new Beatles as touted by an avaricious music media and gold plated record executives from Sydney to San Francisco. They are, in fact, a talented original trio (and if they manage to survive the extreme G-Forces imposed by this aforesaid media) will, hopefully, go onto greater more deserved acclaim.

This is not a great album as such, it's more like a greatest hits collection. There are nifty, even classic pop songs but the themes or song cohesion has all but been abandoned.

Intrinsic to many debut albums is an amalgam of musical and emotional styles emanating from the dominant creative



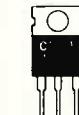
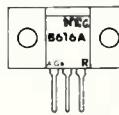
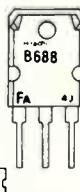
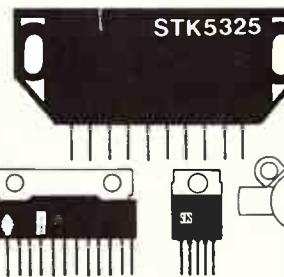
forces within the band. Crowded House are dominated by the inscrutable Neil Finn who has elected to use an alarming number of styles with the possible view that something's bound to catch on. Indeed, the success of this release is testimony to this theory.

Best songs? By now you probably know them well enough and have found yourself humming *Don't Dream It's Over* or *World Where You Live* in the shower. You may have even felt quietly saddened by the lyrical content of *Hole In The River*. In fact all 10 tracks have particular merit.

I enthusiastically look forward to their follow up release which should feel less hurried, be more cohesive and whereby Crowded House may, to quote Mr Finn, have their "blind date with destiny".

Mark Lewis

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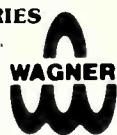
### RETAIL ENQUIRIES

Wagner Electronics,

305 Liverpool Rd.

Ashfield 2131.

PH: 798 9233



READER INFO No. 29

SOUND INSIGHTS, OCTOBER '87 — 23



# 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?

**NAD**



Peter Robinson (left) of Dynasound Melbourne awards Peter Walters (right) his prize from the ETI-Bose Competition.

```

10 REM SIMPLE HARMONIC MOTION
15 KEY OFF
20 CLS
30 INPUT "RADIUS";R
40 INPUT "SPEED (w);W
50 INPUT "NUMBER OF CYCLES";C
60 INPUT "X-CYCLES";CX
70 INPUT "Y-CYCLES";CY
73 INPUT "MASS";M
78 D1=(M*(W*CX^2*R))/35 : D2=(M*(W*CY)^2*R)/40
80 SCREEN 2
90 FOR T=0 to (2*3.1416/W)*C STEP .01
100 X=1.3^(R^2*SIN(W*CX*T))+360
110 Y=(R*COS(W*CY*T))+180
120 PSET(X,Y)
130 CIRCLE (X,Y),20,,,75
140 X=X-360 : Y=Y-180
150 FX=M*(W*CX).2*X
160 FY=M*(W*CY).2*Y
190 FX=FX-D1 : FY=-FY/D2
200 LINE (640,80)-(640+FX,80+FY)
220 NEXT T

```

## Lissaus Figures for the IBM (with hercules graphics card)

This program simulates simple harmonic motion (SHM) by plotting on the screen the desired pattern.

Once the program is run it will prompt you with "RADIUS"; (or the size of the shape), then "SPEED (w)"; (or the resolution), then "NUMBER OF CYCLES"; (or the numbers of times it repeats the pattern), then "X-CYCLES"; (or the number of oscillations the x-coordinate does in one cycle), followed by "Y-CYCLES"; (the same as X-cycles), and lastly the "MASS"; (the weight of the object).

Try one and there should be a Lissajous figure in the

centre of the screen, and a force diagram in the top right hand corner.

Try this one — 150 (cr, 1  
(cr, 1 (cr), 1 (cr), 3 (cr), 1 (cr).  
Once you have typed these  
values in, go for a walk  
around the yard, come back,  
and have a wild guess of  
what the symbol on the  
screen is.

If you get bored watching it drawing circles, make it draw lines! All you have to do is change line 130 to read  
— 130 LINE (X,Y)-(X+20,Y)  
Have fun.

J. Young  
Townsville  
Qld

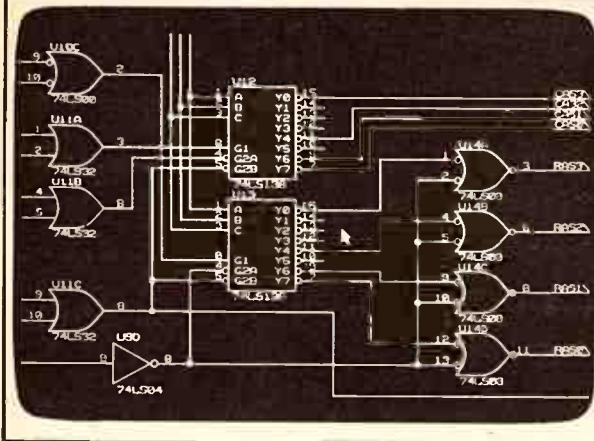
## **Calendar/Date Planner**

This program will produce a pattern of symbols and numbers corresponding to the dates on a calendar. It requires a daisywheel printer or at least any ASCII printer that will respond to margin set commands. The variable 'D' must be set to equal the n'th day after the Sunday on which the current year begins. A short initial delay is

incurred while the dimensional arrays are being filled. Try putting individual sheets of tractor through sideways and stapling in the margin to make a detachable binding. Even try adding a centrefold from your favourite magazine.

**P. Sullivan,  
Plympton,  
SA.**

## FEED FORWARD



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191 Riversdale Road Hawthorn Vic. 3122.  
Telephone: 819 6088 Fax: 819 6085

READER INFO No. 31

```

00100 REM ***** DISTANCE CALCULATOR *****
00110 REM BY DAVID W. GALEA 27-09-1986
00120 REM FOR THE MICROBEPC COMPUTER
00130 CLS:UNDERLINE
00140 PRINT"THIS PROGRAM CALCULATES THE EXACT DISTANCE BETWEEN ANY TWO"
00150 PRINT"POSITIONS IN THE WORLD. ALL YOU DO IS ENTER THE CO-ORDINATES."
00160 PRINT"PRINT" POSITION E1"
00170 PRINT"(N) - NORTH OR (S) - SOUTH."
00180 INPUT Y1$:
00190 IF Y1$="N" OR Y1$="n" THEN LET Y6$="North":GOTO 220 ELSE GOTO 200
00200 IF Y1$="S" OR Y1$="s" THEN LET Y6$="South":GOTO 220 ELSE GOTO 210
00210 IF Y1$<>"N" OR Y1$<>"n" OR Y1$<>"S" OR Y1$<>"s" : GOTO 170 ELSE GOTO 220
00220 PRINT"ENTER Y6$":CO-ORDINATES.:
00230 INPUT Y1:
00240 PRINT
00250 PRINT"(E) - EAST OR (W) - WEST.":
00260 INPUT X1$:
00270 IF X1$="E" OR X1$="e" THEN LET X6$="East":GOTO 290 ELSE GOTO 280
00280 IF X1$="W" OR X1$="w" THEN LET X6$="West":GOTO 290 ELSE GOTO 250
00290 PRINT"ENTER X6$":CO-ORDINATES.:
00300 INPUT X1:
00310 CLS
00320 CLS:UNDERLINE
00330 PRINT"PRINT" POSITION B2"
00340 PRINT"(N) - NORTH OR (S) - SOUTH.":
00350 INPUT Y2$:
00360 IF Y2$="N" OR Y2$="n" THEN LET Y7$="North":GOTO 390 ELSE GOTO 370
00370 IF Y2$="S" OR Y2$="s" THEN LET Y7$="South":GOTO 390 ELSE GOTO 380
00380 IF Y2$<>"N" OR Y2$<>"n" OR Y2$<>"S" OR Y2$<>"s" : GOTO 340 ELSE GOTO 390
00390 PRINT"ENTER Y7$":CO-ORDINATES.:
00400 INPUT Y2:
00410 PRINT
00420 PRINT"(E) - EAST OR (W) - WEST.":
00430 INPUT X2$:
00440 IF X2$="E" OR X2$="e" THEN LET X7$="East":GOTO 460 ELSE GOTO 450
00450 IF X2$="W" OR X2$="w" THEN LET X7$="West":GOTO 460 ELSE GOTO 420
00460 PRINT"ENTER X7$":CO-ORDINATES.:
00470 INPUT X2:
00480 CLS
00490 IF Y6$<>Y7$ THEN GOTO 520
00500 IF X6$<>X7$ THEN GOTO 530
00510 GOTO 540
00520 Y2=Y2+180:GOTO 500
00530 X2=X2+180:GOTO 510
00540 IF X1>X2 THEN LET X3=X1-X2
00550 IF X2>X1 THEN LET X3=X2-X1
00560 IF Y1>Y2 THEN LET Y3=Y1-Y2
00570 IF Y2>Y1 THEN LET Y3=Y2-Y1
00580 Z1=50R((X3*X3)+(Y3*Y3))
00590 Z2=(3.1415927*6371*Z1)/180
00600 PRINT"\:\:\:\PRINT" THE DIFFERENCE IS 1221KM.

```

### Distance Calculator

This program calculates the exact distance between any two positions in the world. All

you do is enter the co-ordinates.

D. Galea,  
North Altona,  
Victoria

### Letters to the Editor

I fully agree with your "Bright Kids are being turned away from engineering" article. Almost everything we buy today is manufactured overseas. Where are the Australian Hi-Tec exports? Knuckleheads in Canberra should start again from the drawing board.

Mark Johnson  
Rozelle  
Sydney NSW

Top effort to date, but how about publishing the odd data sheet for specialists now and then. As a student and hobbyist this sort of thing often comes in handy. But enough of my whining, keep up the good work.

S. Jay  
Launceston  
TAS.

I would like to take this opportunity to applaud the way your new science and technology section was put together. I especially enjoyed your articles on superconductivity and the Supernova too.

R. J. Spencer  
Duncraig WA

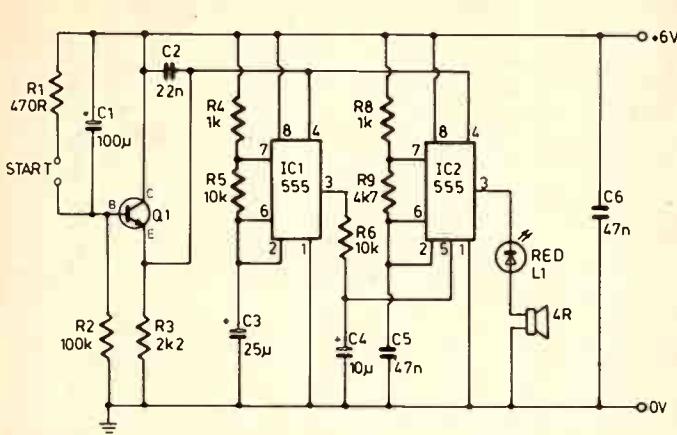
You should publish a column called 'kid's experiments' or 'children's projects'. This would give children a chance to show their ability to design and build circuits.

Nathan Parker  
Hurstville, Sydney NSW

As a reader since ETI started I am disappointed to see an ever increasing reduction in constructional projects. I find the magazine is becoming too commercialised. Congratulations on keeping the price down. Other publications are twice the price and half the content.

R. J. Elliot  
Springwood Qld

# UNIX-based 32-bit PC add-in boards

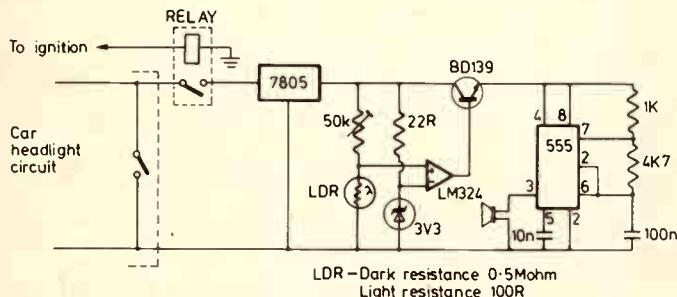


## Alarm Sound Generator (with time out)

This circuit adds a more forceful variation to an alarm generator built around a 555. Both timers IC1 and IC2 are operated in the astable mode and IC1 has a lower frequency than IC2. Pin 5 of IC2 is the modulation input

and is controlled by the low frequency output of IC1. Transistor Q1 in conjunction with the 100 uF capacitor C1 determines the time-out period of the circuit. Notice that Q1 controls the reset (pin 4) of both IC1 and IC2.

A. Uz,  
Auburn,  
NSW.



## Car Headlamp Reminder

This circuit is ideal for people like myself, who when driving at night forget to turn their car headlights on. The circuit has two basic blocks, one is a comparator and the other is a simple oscillator. The comparator is built around an LM324 op-amp. While this is a quad circuit only one op-amp is used. I used this device as it happened to be the cheapest one I could buy in my area, any other op-amp should be suitable.

The 3.3V zener is used as a reference, holding the output of the LM324 low and preventing the output of the BD139 from conducting dur-

ing daylight. When insufficient light falls on the LDR, the voltage on the non-inverting input of the op-amp rises above 3.3V and the output of the op-amp swings to Vcc. In this condition the BD139 is saturated and Vcc is applied to the 555 oscillator circuit. This produces an irritating 1 kHz tone which warns the driver of the car that the vehicle headlights should be turned on. The relay prevents the circuit from being operated whilst the vehicle is not in use. A 50 k trimpot is used to give some sensitivity adjustment.

A. Lord,  
Bently,  
W.A.

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With National Semiconductor's SYS32/20 Add-In Development Package from NSD you can turn your existing IBM PC/XT/AT or compatible, into a high performance, 10MHz, no-wait state, 32-bit PC, processing in the UNIX environment. And, it can have either 2 Mbytes or 4 Mbytes of on-board memory.

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## NEW PRODUCTS

### Micro-Soft "Windows" Assist Debugger

Microsoft Windows lets the end user invoke several programs at once. It also provides memory allocation, memory management, and user interface services for multiple applications. Developing software for this type of operating system poses many more problems than developing for MS DOS. Programs and data are moved dynamically at run time by Microsoft Windows when memory allocation is required.

This means you are debugging a program which is moving in memory while it is being debugged. You may even want to trap program events which are not yet resident in memory but reside on disk. With many programs operating simultaneously, program bugs have a far greater chance of corrupting other programs as well as themselves. Atron's Windows Probe is designed to support the Windows development environment. Windows Probe is a software debugging package which runs on the Atron hardware assisted software debugger — the AT Probe.

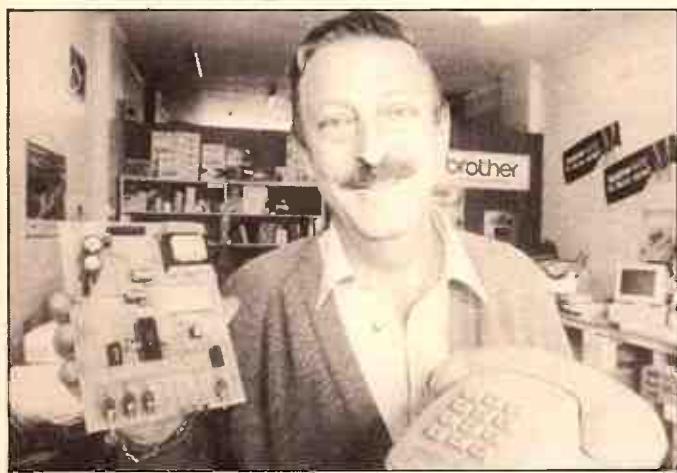
Windows Probe dynamically tracks the Windows memory manager and adjusts symbolic and source

level debugging information. For example, if a real time trap is set on overwriting a variable, and the variable is allocated to a new memory location by Windows, Windows Probe knows to reset the breakpoint automatically at the new location.

Since Microsoft Windows takes up additional memory space, source level debugging of large programs with many symbols may be impossible with software only debuggers. This is because MS DOS, Microsoft Windows, the applications program and its symbol table cannot be resident in memory all at the same time. Atron's AT Probe contains 1 megabyte of hidden and write protected memory which stores the Windows Probe debugger software and the programs symbolic and source level debugging information without using the lower 1 megabyte of system memory. This also keeps the debugger from being corrupted by the program.

For further information contact the master distributor: Macro Dynamics, 80 Lewis Road, Wantima South, P.O. Box 336, Bayswater 3153, Australia. Ph: (03) 220 7260.

R.I. No. 100



Abe Computers have just released a modem kit for \$95. The modem will do 300 board full duplex 1200/75 or 75/1200. You can buy it for \$238 built and tested and \$330 complete.



### Fujitsu's New Printer

Fujitsu Australia has just announced the release of its top of the range 24-wire dot matrix printer. The DL5600 is an extension of the successful Fujitsu 24-pin range of printers already released in Australia, and is said to be one of the fastest 24-pin printers available in the Australian marketplace.

The DL5600 prints 486 cps in draft mode at 12 pitch, 405 cps in draft mode at 10 pitch, with letter quality printing at 135 cps, well above industry standard. It has a low noise level of 55dBA with an MTBF of 8000 hours. Printhead life is rated at over 400 million strikes per wire.

A user friendly operator

panel enables programs to be selected and a printout provides hard copy for easy reference. Frequently used settings can be stored in memory. As a standard feature, this printer also offers a massive 32k buffer — equivalent to 16 screens of data.

The DL5600 is designed especially for heavy duty use, capable of printing an original plus five copies. Fujitsu have also incorporated a feature which offers automatic platen adjustment, eliminating the need for the operator to manually correct platen adjustment every time there is a change of stationery. The CL5600 will be available from October 1987.

The DL5600 is available from Fujitsu's Distributors who will also provide pricing details. Phone (02) 959 6544 for more details.

R.I. No. 101

### Datamatic Ergonomics

Datamatic has replaced the monitor in the Spectragraphics DesignSet 1080 family of high-performance graphics workstations with a new 19-inch colour monitor. The new monitor features nearly twice the contrast of previous monitors plus a smaller footprint, more easily serviced electronics and a flatter screen.

The high contrast ratio of the new DS 1080 monitor eliminates the need for special positioning of the equipment in areas with high ambient light. Even in bright rooms the monitor will produce a sharp image with enough contrast for good legibility — without glare. A redesigned neutral-density screen includes special anti-glare filter additives in the glass to provide comfortable

viewing in nearly any light and the new screen eliminates distortions at screen edge. Redesigned electronics in the monitor provide a smaller footprint preserving more of the user's scarce workspace, and makes the monitor easier and faster to service.

DS 1080 workstations use a raster-scan graphics system that provides 1024 x 1024 pixel resolution in up to 256 colours with local 3-dimensional transforms and area fill.

For further information please contact: Mr Peter Wilson, Datamatic Pty Ltd, 9 Byfield Street, North Ryde, NSW 2113. Phone: (02) 888-1788.

R.I. No. 102

## 10MHz TURBO PLUS MOTHERBOARD

This 10MHz, no-wait-state board is a drop-in replacement for the sluggish 4.7MHz PC motherboard.

- 8088-3 running at 10MHz/no wait states
- Turbo/normal selectable
- 4 channel DMA      ■ 8 expansion slots
- Keyboard port      ■ 640K RAM fitted



**\$495**

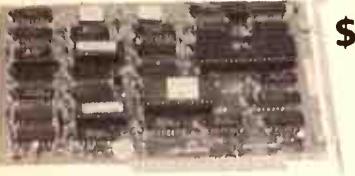
READER INFO No. 51  
8MHz Turbo Motherboard still available at new low price. Was \$450.00.

**NOW ONLY \$425**

## 1.2MB/360KB FLOPPY CONTROLLER

The perfect answer for backing up hard disks, archiving etc.

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READER INFO No. 52

## 150W SWITCHING POWER SUPPLY

Drop-in replacement for IBM PC's puny 63W supply.

- Boosts PC to PC/XT specs. Essential to run hard discs and other ad-ons on PC.
- Outputs +5V/15A, -5V/1A, +12V/5A, -12V/1A.
- All cables to disk drives, mother-board etc.



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READER INFO No. 53

## AUSTRALIA'S BEST SPEEDUP CARD

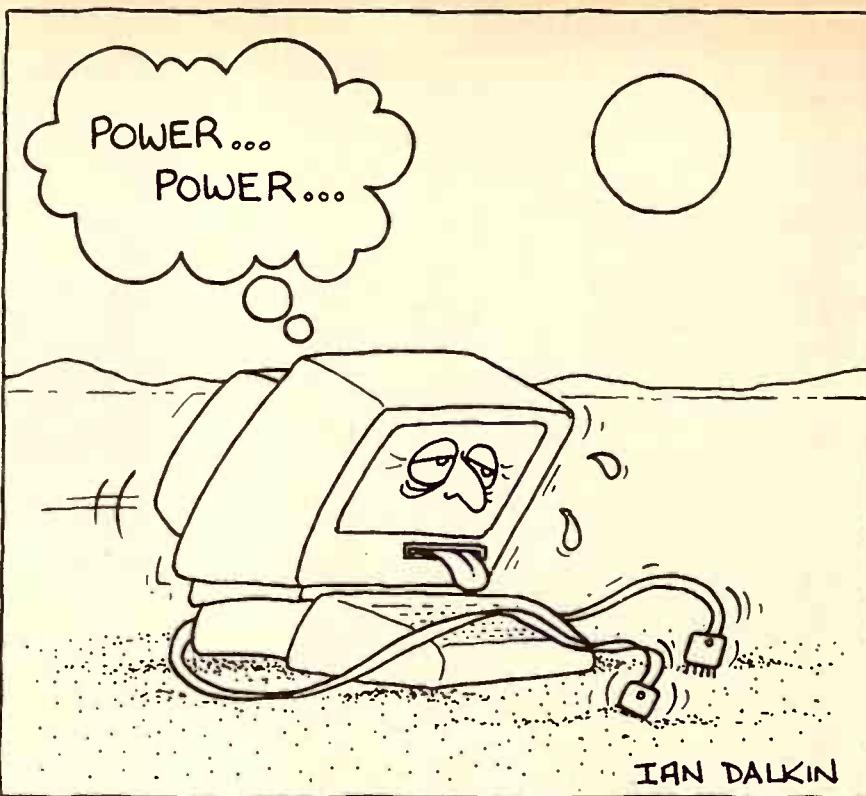
Speed up your PC over 7 times with our superb new speed-up card.

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- DMA support
- Socket for 80287 co-processor



**\$595**

READER INFO No. 54



## FLOPPY DISK CONTROLLER

Controls up to 4 DS/DD 360K drives.



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## PEGA EGA card – unmatched resolution

Get all the standards with this superb short slot EGA card.

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- Flicker free scrolling in all modes

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## DISK DRIVES

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Very fast track-to-track. 360KB DSDD. Lowest price in Australia. **\$245**

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Super high density. Superb construction and reliability. Works with 1.2MB floppy controller.

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**\$895**

READER INFO No. 57

## XT Style Case with Hinged Lid

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## MEMORY

### 512K Ram Card – Short Slot

- 512K RAM installed (41256 chips)
- DIP switches to start address

**\$195**



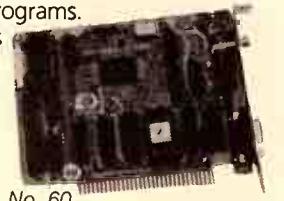
## 640K Ram Card – Short Slot

- 640K memory installed
- User selectable from 64K to 640K
- DIP switches to start address

**\$225**

## Colour Graphics/Mono – Short Slot

This amazing new card drives RGB colour, composite colour or a TTL monochrome monitor. And it fits in a short slot. Full CGA support. Can be used as a colour graphics card with a monochrome display and still run all the colour programs.



The card even cures

the dread colour  
graphics "flicker  
and snow".

**\$195**

READER INFO No. 60

## Colour Graphics Video Card

- Suits RGB and composite colour monitors
  - Light pen interface
  - Fully CGA compatible
  - 40 x 25 & 80 x 25 (text), 640 x 200 (mono) and 320 x 200 (colour)
- READER INFO No. 61 **\$115**

## Colour Graphics/Printer Adaptor

Attaches to IBM-compatible RGB monitor; provides complete compatibility with IBM Colour Graphics Adaptor. Equivalent to the IBM colour/graphics adaptor with additional printer port to replace the video port originally supplied by IBM.

**\$145** READER INFO No. 62



## 2.5MB Multifunction card for PC/AT

READER INFO No. 63



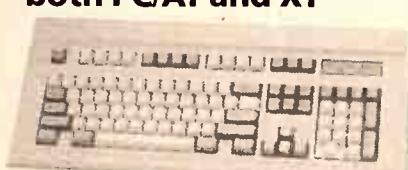
## 180W AT Power Supply



**\$170.00**

- Cooling fan stops when voltage output falls to zero
  - Top quality components used throughout
- READER INFO No. 64

## Enhanced Keyboard suit both PC/AT and XT



The finest keyboard on the market.

- Suits both IBM PC/XT and AT (switchable)
- Full 101 keys with separate cursor and numeric pad
- Superb key action
- Lights for caps, num and scroll lock

**\$195.00** READER INFO No. 65

## Parallel Printer Card

- Standard TTL level
  - Centronics printer port, full IBM, EPSON compatible
- READER INFO No. 66 **\$44**

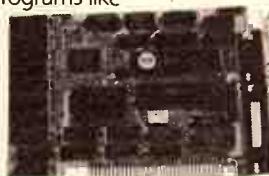
## Turbo Mono Graphics/Printer – Short Slot

If you want fast, flicker free scrolling and full Hercules compatibility, this is it!

Perfect enhancement for slow scrolling programs like Microsoft Word etc.

The ultimate monochrome graphics card.

**\$175**



READER INFO No. 74

## Serial RS-232 Card

- Independent receive clock input
- 2nd serial port option
- Full buffering eliminates need for precise synchronisation

**\$55**

## 2MB EMS Memory Card for PC/XT or AT

An affordable "Above Board" memory card. Fit up to 2MB of high speed RAM (OK fitted). At a low introductory price: **\$495**



READER INFO No. 70

## Multi I/O Card

- Floppy disk adaptor, 2 drives DS/DD
  - 1 serial port, 1 parallel port, 1 joystick port
- Clock/calendar with battery backup

**\$175**

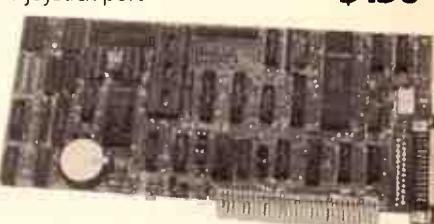


READER INFO No. 71

## I/O Plus Card

- Clock calendar with battery backup
- 1 serial port, 1 parallel port, 1 joystick port

**\$136**



READER INFO No. 72

## SUPER SPECIALS

V20 chips .....	\$29.00
V30 chips .....	\$49.00
NEC Multisync monitor .....	\$1350.00
TTL Amber Monitor .....	\$299.00
TTL Green Monitor .....	\$289.00
256K RAM chips .....	\$7.00

READER INFO No. 73

## ELECTRONIC SOLUTIONS

### Electronic Solutions

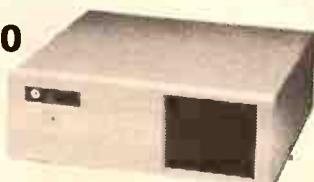
PO Box 426 Gladesville 2111

Phone (02) 427 4422.

We accept Bankcard, Mastercard and VISA. Mail order our specialty. All prices include sales tax.

- All products carry a 14 day money back guarantee
- All products carry a full 3 months warranty
- All cards come with full documentation
- Ring for quantity discounts and tax free prices.
- Freight \$7.50 for first item, then \$2.50 for each extra item.

TULDIN



Suits "Baby AT" motherboard or 10MHz PC/XT motherboard.

- Hinged cover for easy access
- Keyswitch, reset/turbo buttons, indicators

READER INFO No. 69

## NEW PRODUCTS



### Sanyo's Concurrent Multiple Operating System

Sanyo Office Machines has announced the release in Australia of what they claim is the first computer capable of operating concurrent multiple systems.

The Sanyo Icon was developed by Dennis Fairclough of Brigham Young University in Utah, USA, who worked on three concepts for a single computer — the "Disk Cache", Concurrency and Parallel Processing.

The Sanyo-Icon 32-bit series computer became reality as the result of a multi-million dollar joint research and development program between Icon International and Sanyo Electric Company. Sanyo currently holds 66 per cent of Icon.

The dominant feature of the MPS020-2 is its capacity to run different operating systems concurrently, while sharing a common data base. It is the only computer at this time that offers this facility as far as we know.

Based on multiple 32-bit Motorola MC68020 microprocessors, it can be used immediately with all major operating systems — without modification or emulation techniques. It is totally compatible with all existing installations using UNIX, PICK or MS-DOS.

Separate processors handle terminals, programme execution, operating system functions, files, disk cache management and associated operating system functions. An Intel 80288 processor board provides IBM AT compatibility.

A spokesperson for Sanyo Office Machines said the advent of a highly advanced and totally proven 32 bit parallel processor architecture with patented caching facilities is seen as an important extension of Sanyo Office Machines' marketing activities in the 16-256 user systems area.

R.I. No. 111

### 'Super-Ex from Alfatron'



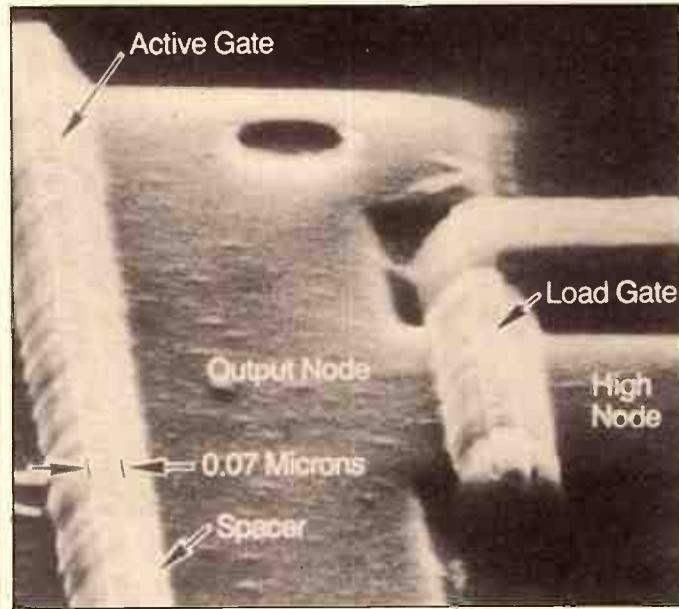
The SE4944 is a new advanced programmer that uses modules to allow it to cover a large range of programmable devices. Like its predecessor the SE943, it has excellent functionality with only a few keystrokes required to carry out operations such as erase-check, verify and programming.

Whilst the unit is designed for stand-alone operation it can operate fully remotely

via an RS232 interface. Menu driven software is available for this function. It also has a parallel interface which allows simple downloading of data. An optional ROM emulator may be attached to the parallel port also. Transfer formats for up/downloading cover most commonly used types.

A broad range of EPROMs and EEPROMs (up to 1Mbit types) is supported as standard and various modules extend this to cover other devices such as single chip microprocessors and flatpack type devices. Extensive checking is carried out on the devices to be programmed to ensure that the operation has gone correctly. Various programming methods may be selected by the operator to provide the most efficient programming.

R.I. No. 112



**GATEWAY TO THE FUTURE:** Two of the world's smallest transistors, pictured here, work together in an experiment at the IBM Thomas J. Watson Research Center, Yorktown Heights, N.Y. For the above photo, top layers of transistor material have been removed to reveal two very thin vertical lines, about two hundred atoms wide (less than one-tenth of a micron) which form "gates" that switch the transistors on and off. Such transistors have the potential to make future computers many times more powerful than was previously thought possible.

## Pascal Compiler

A Melbourne company has developed a single board Pascal compiler. The MXPascal Cross-Compiler System released by Interrupt Systems provides a highly portable means of developing applications for microprocessors. Running on MS/PC DOS the system allows for the quick generation of assembler source code for a range of processors including the 6800/8/10/20, 8088/86/186/286/386 and Z80/NSC800/64180 whilst still providing for low-level control.

The MXPascal Compiler utilises a subset of the Pascal language as defined by Jensen and Wirth and will run in Turbo Pascal. As the code produced by the compiler must pass through a conventional assembler the assembler source code is always available for inspection. An in-line directive allows for the inclusion of assembler source code at any point in the MXPascal code. Hand optimisation is therefore possible and may be mixed in with the MXPascal source file to give total control over the

target processor. Also as variables and code are not mixed together the compiler produces totally ROMable code.

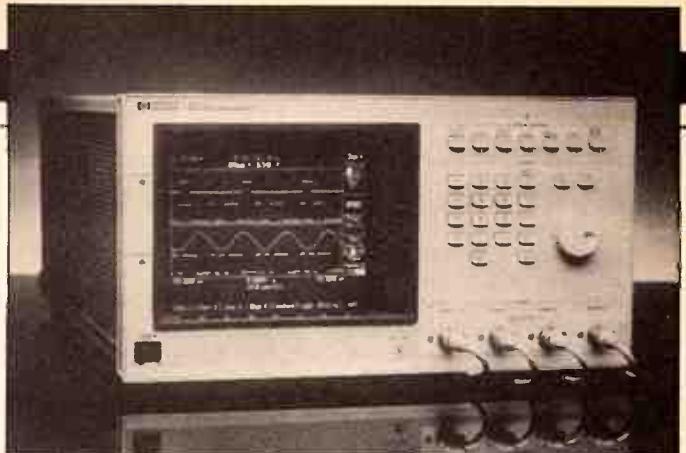
R.I. No. 113

## HP Digitizing Oscilloscope

Hewlett-Packard Australia has introduced the new HP 54112D digitizing oscilloscope with four channels and 64 K datapoints deep of waveform memory.

The new scope has a bandwidth of 100 MHz for both single-shot and repetitive applications. Its 64 K-deep waveform memory allows records that range from 160 microseconds at the fastest sweep speed to 21 minutes at the slowest. In addition, the HP 54112D provides triggering on edge, pattern, state, delay by events and delay by time.

The feature set of the HP 54112D is similar to those of the HP 5411D, introduced in October 1985, and the HP 54111D, which was announced in November 1986. All three instruments have a completely digital architecture, providing a fully programmable digitizing oscillo-



The new HP 54112D digitizing oscilloscope from Hewlett-Packard.

scope. HP believes that the HP 54112D's combination of four channels, fast sampling rate, high single-shot bandwidth and deep memory will round out the the HP 54100 family of digitizing oscilloscopes.

Like its predecessors, the HP 54112D provides:

- Color display with 4,096 user-definable colors in seven-color segments;
- digital storage;
- true multi-channel simultaneous capture;
- variable to infinite persistence displays for worst-case analysis;
- pre-trigger viewing to display events that lead to the trigger condition;
- instant hardcopy output to HP printers and plotters;
- a clutter-free, easy-to-use

front panel; and

- a variety of setup aids that simplify time-domain measurements.

The HP 54112D automatically measures frequency, period, pulse width, transition times, peak-to-peak amplitude, top- and base-voltage levels, preshoot and overshoot with the touch of a front-panel button.

This variety of built-in analysis features, combined with the deep waveform memory, enables the HP 54112D to compress, expand and measure the waveform. It also can position the window in positive or negative time with respect to the trigger, allowing the designer to trace a glitch back to its cause.

R.I. No. 114

## REVIEW

# NetComm Radio Modem

NetComm, one of the leading Australian companies specializing in modem manufacturing recently announced its first general purpose radio modem, which they have called the Radio SMart modem. It is designed to plug directly into the audio input of any standard two way CB radio, and has a standard RS 232 link for connecting to a computer. The operational characteristics are solely dependent on the CB radio characteristics and geographical factors. In general, these are the same sort of factors one would worry about when trying to get bet-

ter reception on TV. Operating ranges as far as 650 km have been achieved successfully, according to the marketing manager of NetComm.

The radio modem could find itself indispensable in numerous applications. It opens up a whole new world in wireless data communication. For instance, a traffic control system could be built around them in which traffic information is fed directly into a computer in the control centre from helicopters and patrol cars.

There are many other possible applications. Surveyors

might use them from the field for direct access to a computer. Civil Engineers on a construction site can find out the floor plan or certain detailed information from the headquarter's computer. Stocktaking could be much more efficient if the forklift driver checking the stock in the warehouse could directly update the computer with remote communications made possible with this modem.

As an advertising gimmick, but one that really illustrates the potential of the system, NetComm has sponsored a computer monitored racing car. It's a 4 cylinder fuel in-

jected turbo Nissan Skyline equipped with a state-of-art computerised engine management system. Sensors will be put on the car systems for monitoring the engine, temperature, fuel etc and data sent back to a central computer to achieve the best performance. The driver can just concentrate on his driving without even having to worry about watching the gauges.

There were considerable problems to overcome in designing the SMart modem. Due to heavily congested radio frequency bands, a half-duplex system is stand-

ard in radio communication, so that communications can go in only one direction at any one time. However, this conflicts with the traditional full duplex communication between modems and computers. The main problem is that characters typed on the terminal will take too long to be echoed on the screen.

A second problem is that a radio link can only accommodate one user at a time (when using one frequency carrier), so a multi-user system is impossible unless there is some kind of protocol established in the modem for multi user conditions.

A different sort of problem concerns the nature of the communications channel. The reliability of modem communication is subjected to the radio link. But this depends heavily on the weather conditions, the rf signal power and the physical environment in the vicinity of the modems.

This is probably sufficient to show that while the theory of radio modems is easy to understand, its practical implementation is very difficult. They rejected the idea of using a great piece of hardware to overcome their problems. Instead they developed a unique software protocol to kill many birds with one stone. The Block Exchange Compelled Sequence Protocol (BECS) allows a fully error corrected data path over the radio link. Characters presented to the radio modem and stored in the buffer are assembled into BECS block before being transmitted over the radio link. The block consists of an ID number, checksum and a variable length-of-data block. The receiving modem will do the checking and if correct, response to the sending modem with an acknowledgement for further transmission.

Before exchange of data occurs, a data path has to

be established. The master modem automatically sends an initial contact BECS data block every 500ms to the remote slave modem. This sequence continues until the slave decodes the block correctly without error and responds to the master with a response block. Once the link has been set up, both can exchange data as they wish. As far as the computer user is concerned, the operations of the modems is transparent.

Each block being sent has to be acknowledged and every time the modem changes from transmitting mode to receiving mode there is a delay caused by the rf modulator as it locks on to the carrier frequency. For this reason, the data throughput is typically 39% of the rf link baud rate, assuming a perfect radio link and high (9600) baud rate between the modem and its terminal. For inferior radio conditions,

the data throughput could be reduced to zero if blocks transmitted are not received. However, note that with the intelligence built-in to the BECS protocol, an error free path is still being maintained.

When using a pc in terminal mode, any software which supports flow control and local echoing will run the modem happily. The flow control can either be a RS232 hardware handshake or the XON/XOFF software handshake. Most of the common terminal software on the market like YAM, Carbon Copy, Blast, Mirror, Procomm etc will support it. If you want to transfer files, the modem BECS block is almost transparent to most file transfer software in the market.

This little handy machine will surely find its way into a lot of applications which cannot be covered by more 'normal' modems.

— S. K. Hui

## Casio FX 850P

Pocket computers first made their appearance about five years ago. They were sold as the ultimate in programmability, more flexible, it was claimed, than high end calculators. In truth, they were toys; a good scientific calculator was a far more efficient and flexible machine. The difference was rather like the difference between programming in machine code and in a high level language like BASIC. The high level language is easy to use, but not as efficient or as useful.

However, in the past few years this objection has become more and more specious. The best of the pocket computers have become marvels of electronic miniaturisation in their own right. In fact, the similarity in size and appearance between the new and the old is somewhat misleading, as a run around Casio's new 850P shows.

It's quite conventionally laid out, and is the normal size for this type of machine, but consider its features: It

will operate in calculator mode, when it has access to all the usual functions of scientific calculator, including the full range of trig and algebraic operators. It has a fully configured BASIC with 107 command words. It has a formula storage function, which allows you to enter the variables as proper names; a data base, a memo scratch pad for storing things like telephone numbers or hard to remember formulae, and most powerful of all, a library of important formula already stored in ROM.

Then again, consider its Input/Output features. It can connect to a proprietary interface unit to drive a printer, plotter or cassette for mass storage. It also has an RS232 interface for connection to a PC, so you can drive a conventional printer with a parallel input port. It also has facility for connecting RAM expansion paks should you require them.

This is something like a wish list for calculator buyers. The library of often used



functions is truly amazing. It goes from relatively simple problems, like simultaneous equations, quadratics, base conversion, areas of various geometric figures through to operations like integration and differentiation, and a whole range of statistical operations. It will even solve matrices. Then there is a long list of scientific formulae, including 16 electronic type formula, but also covering areas like motion and energy, thermodynamics, metric conversions and even a list of 38 of the most important

trig functions. (I remember sitting exams where I would have given my right arm for a list of trig functions.)

In short, the new Casio is a delight. It's ideal for anyone interested in storing formulae, or phone numbers. It's ideal if you want to learn how to program. It's even ideal if you just need a good scientific calculator. It's worth \$349.95 for the basic unit plus \$169.95 for a 32 k RAM pak. At the price, it's a steal compared with the rest of the market.

Jon Fairall



EDM-2347

R.I. No. 129

# DIGITAL MULTIMETERS BUYERS' GUIDE

*The most basic piece of test gear is the multimeter. We've put together a chart of a representative group of them, together with some of their more important characteristics, and have thrown in precious advice on how to select a meter for yourself.*

If you don't buy a multimeter on the basis of the pretty colours on the case, how do you select one? It turns out there are a few things to look for that can make the difference between a good and a bad buy. Multimeters are definitely not all the same.

The first question is undoubtedly: *how much?* The DMM has come down in price to the extent that sixty dollars will buy you an instrument in which almost every parameter you might care to name is as good as the best of the analogue types. Top of the range for handheld DMMs is \$500-\$800 and bench types go up to \$18,000. There is, as they say, a price to suit every pocket.

## Digital and Analogue

Given that you know how much you are prepared to spend, the next consideration

should be the number of digits. At the low end of the market almost all the available models will be the 3½-digit type, ie: the first digit can only be a 1, so full-scale reading is 1999. If you need 4½-digits, be prepared to pay.

The number of ranges should influence your choice as well. As a general rule the more ranges, the more you will pay, but the better the resolution. Typically, there will be five ranges of ohms, volts and amps, and switching between them can be a major problem. In the analogue meter the standard way of doing it is to have one or two rotary switches which can be turned to select the desired function and range. Some digital meters have the same layout.

## Buttons

Another system involves a row of push

buttons down the side of the meter. Usually this is set out with range selectors at the top and function switches below. A third method, favoured on benchtop units but not very common on handheld DMMs, is a set of pushbuttons.

Choosing between these various options is very much a matter of individual preference, and to a lesser extent, a function of how you use the meter. Buttons down the side clearly favour the person (right handed only) who holds the meter in his hand and wants to be able to change function without changing his grip. It tends to get a bit fiddly if the meter is lying on the bench. The converse holds for the rotary switches. They are great if you habitually use the meter on the bench and want to be able to change ranges with a minimum of fuss.

## Multimeters Buyers' Guide

Another point worth noting is that most of the DMMs have separate input sockets for the positive lead, depending on the function being selected. Obviously this is very fiddly in practice, but it does have the enormous advantage that it is impossi-

ble to inadvertently put the meter into the current mode while trying to measure volts.

While you are looking at the range buttons, have a look at the extent of the ranges themselves. Most of the meters on

the market today will read up to 1000-Vdc, 750 Vac, 20M and 10 A. It's worthwhile thinking for a minute about the likely uses of your meter before deciding which ranges you need to emphasise.

The problem of having lots of ranges is

MANUFACTURER	MODEL	DISTRIBUTOR	PRICE	NUMBER OF DIGITS	VOLTS dc	VOLTS ac	OHMS	AMPS	AUTORANGING	INPUT RESISTANCE	TRUE RMS	TEST MODES
					ranges	maximum value	ranges	maximum value				
B & K PRECISION	2028	PARAMETERS	776.25	4.5	5 1000	5 750	6 25	2 10	YES	10 YES	20	YES NO
	01558	DICK SMITH ELEC	149.95	4.5	5 1000	5 750	6 20	2 10	NO	NO	NO	YES
	01777	DICK SMITH ELEC	149.95	4.5	5 1000	4 750	5 2.5	3 .25	NO	NO	NO	YES NO
	01445	DICK SMITH ELEC	79.95	3.5	5 1000	5 750	7 200	10 10	NO	NO	NO	YES YES
	01465	DICK SMITH ELEC	119.95	3.5	5 1000	5 750	7 200	10 10	NO	NO	NO	YES YES
ESCORT	EDM-2347	EMONA	471.00	4.5	5 1000	5 1000	6 20	2 10	NO	YES	100	YES NO
ESCORT	EDM-2116	EMONA	258.00	3.5	5 1000	5 1000	6 20	2 10	NO	NO	100	YES NO
ESCORT	EDM-1346A	EMONA	276.00	4.5	5 1000	5 750	6 20	5 10	NO	YES	200	YES NO
ESCORT	EDM-1341	EMONA	279.00	4.5	5 1000	5 750	6 20	6 10	NO	YES	200	YES NO
ESCORT	EDM-1110	EMONA	246.00	4.5	5 1000	5 750	6 20	6 10	NO	NO	200	YES YES
ESCORT	EDM-1118	EMONA	139.00	3.5	5 1000	5 750	6 20	5 10	NO	YES	200	YES NO
ESCORT	EDM-1164	EMONA	122.00	3.5	5 1000	5 750	6 20	5 10	NO	NO	200	YES YES
ESCORT	EDM-1111A	EMONA	113.00	3.5	5 1000	5 750	6 20	4 10	NO	NO	200	YES YES
ESCORT	EDM-1105A	EMONA	96.00	3.5	5 1000	5 750	6 20	5 10	NO	NO	200	YES YES
ESCORT	EDM-758	EMONA	82.00	3.5	5 1000	5 750	6 20	5 10	NO	NO	200	YES YES
ESCORT	EDM-728	EMONA	82.00	3.5	5 1000	5 750	5 2	3 2	NO	NO	200	YES NO
ESCORT	EDM-708	EMONA	59.95	3.5	5 1000	2 750	6 2	5 2	NO	NO	200	YES NO
FLUKE	73	ELMEASCO/CLIFF	159.00	3.5	5 1000	4 750	6 32	1 10	YES	10 YES	NO	YES NO
FLUKE	75	ELMEASCO/CLIFF	219.00	3.5	5 1000	4 750	6 32	3 10	YES	10 YES	150	YES NO
FLUKE	77	ELMEASCO/CLIFF	279.00	3.5	5 1000	4 750	6 32	3 10	YES	10 NO	150	YES NO
FLUKE	21	ELMEASCO/CLIFF	205.00	3.5	5 1000	3 750	6 32	2 10	YES	10 NO	150	YES NO
FLUKE	23	ELMEASCO/CLIFF	299.00	3.5	5 1000	3 750	6 32	3 10	YES	10 NO	150	YES NO
FLUKE	25	ELMEASCO/CLIFF	472.00	3.5	5 1000	4 1000	6 32	5 10	YES	10 NO	150	YES NO
FLUKE	27	ELMEASCO/CLIFF	543.00	3.5	5 1000	4 1000	6 32	5 10	YES	10 NO	150	YES NO
FLUKE	8050A	ELMEASCO/CLIFF	885.00	4.5	5 1000	5 750	6 20	5 2	NO	YES	NO	YES NO
FLUKE	37	ELMEASCO/CLIFF	466.00	3.5	5 1000	4 1000	6 32	5 10	YES	10 NO	150	YES NO
FLUKE	8010A	ELMEASCO/CLIFF	645.00	3.5	5 1000	5 750	6 20	6 10	NO	YES	NO	YES NO
FLUKE	8012A	ELMEASCO	825.00	3.5	5 1000	5 750	6 20	5 2	NO	YES	NO	YES NO
FLUKE	8020B	ELMEASCO	465.00	3.5	5 1000	5 750	6 20	4 2	NO	NO	10 NO	YES NO
FLUKE	8826B	ELMEASCO	475.00	3.5	5 1000	5 750	6 20	4 2	NO	NO	10 YES	YES NO
FLUKE	8821B	ELMEASCO	375.00	3.5	5 1000	5 750	6 20	4 2	NO	NO	10 NO	YES NO
FLUKE	8824B	ELMEASCO	585.00	3.5	5 1000	5 750	6 20	4 2	NO	NO	10 NO	YES NO
FLUKE	8060A	ELMEASCO/CLIFF	769.00	4.5	5 1000	5 750	8 300	5 2	NO	10 YES	YES	YES NO
FLUKE	8862A	ELMEASCO	656.00	4.5	5 1000	5 750	8 300	5 2	NO	10 YES	YES	YES NO
FLUKE	8840A	ELMEASCO	2175.00	3.5	5 1000	5 700	6 20	1 2	YES	10 YES	NO	NO NO
FLUKE	8842A	ELMEASCO	2175.00	3.5	5 1000	5 700	7 20	2 2	YES	10 YES	NO	NO NO
FLUKE	8506A	ELMEASCO	18000.0	6.5	5 1200	6 500	8 100	5 1	YES	10 YES	NO	NO NO
GW INSTRUMENTS	GDM-8845	EMONA	336.00	4.5	5 1200	5 1000	6 20	6 20	NO	10 YES	NO	YES NO
GW INSTRUMENTS	GDM-8835T	EMONA	400.00	3.5	5 1200	5 1000	6 20	6 20	NO	10 YES	NO	YES NO
GW INSTRUMENTS	GDM-8835F	EMONA	292.00	3.5	5 1200	5 1000	6 20	6 20	NO	10 NO	NO	YES NO
HEWLETT PACKARD	HP 3468	HEWLETT PACKARD	1440.00	3.5	3 301	4 301	6 30	2 3	YES	100 YES	NO	NO NO
HEWLETT PACKARD	HP 3457A	HEWLETT PACKARD	5567.00	7.5	5 303	5 303	9 3000	5 1	YES	100 YES	NO	NO NO
HEWLETT PACKARD	HP 3466A	HEWLETT PACKARD	2312.00	4.5	6 1200	4 1200	7 20	5 2	YES	2 100	NO	NO NO
HEWLETT PACKARD	HP 3435A	HEWLETT PACKARD	1624.00	3.5	5 1200	5 1200	7 20	5 2	YES	10 NO	NO	NO NO
HEWLETT PACKARD	HP 3437A	HEWLETT PACKARD	6476.00	3.5	3 28				NO	100 NO	NO	NO NO
HUNG CHANG	HC 5810K	DICK SMITH ELEC	119.00	3.5	5 1000	5 750	6 20	6 10	NO	NO	200	YES YES
HUNG CHANG	HC 5810EC	DICK SMITH ELEC	169.00	3.5	5 1000	5 750	6 20	11 10	NO	10 NO	200	YES YES
HUNG CHANG	HC 776	DICK SMITH ELEC	115.00	3.5	5 1000	4 750	5 20	10 10	YES	10 NO	19	NO YES
HUNG CHANG	DM 105	WES/DSE	89.00	3.5	4 1000	2 750	4 2	5 10	NO	NO	NO	NO NO
HUNG CHANG	HC 4310	WES	169.00	4.5	5 1000	5 750	5 10	4 10	NO	NO	YES	YES NO
HUNG CHANG	HC 779	WES	129.00	3.5	5 1000	4 750	5 20	2 10	YES	NO	NO	NO YES
KEITHLEY	197	SCIENTIFIC DEVICES	1440.00	3.5	5 1000	3 750	7 200	6 10	YES	1000 YES	YES	YES
KEITHLEY	175	SCIENTIFIC DEVICES	1083.00	4.5	5 1000	2 750	7 200	6 10	YES	11 YES	YES	YES
KEITHLEY	196	SCIENTIFIC DEVICES	3360.00	4	3 300	4 300	7 300	5 3	YES	1000 YES	YES	YES
LEADER	LDM 853A	AWA	375.00	3.5	5 1000	5 1000	6 20	4 2	NO	10 NO	NO	NO NO
LEADER	LDM 852A	AWA	938.00	4.5	5 1000	5 1000	6 20	4 2	NO	500 NO	2	YES NO
LEADER	LCD 100	AWA	1310.00	3.5	5 1000	4 750	5 32	1 .001	NO	NO	NO	YES NO
LUTRON	DM 6819	WES	69.00	3.5	4 500	3 500	4 2	3 .001	NO	NO	NO	YES NO
LUTRON	DM6822A	WES	139.00	3.5	5 1000	5 750	7 20	5 20	NO	NO	NO	NO YES
METEX	M3568	DICK SMITH ELEC	159.00	3.5	5 1000	5 750	6 20	9 10	NO	10 NO	YES	YES
METEX	M4638	DICK SMITH ELEC	225.00	4.5	5 1000	5 750	6 20	9 10	NO	10 NO	YES	YES
METEX	M3530	DICK SMITH ELEC	129.00	3.5	5 1000	5 750	6 20	9 10	NO	10 NO	YES	YES
PARAMETERS	7835	PARAMETERS	98.00	3.5	5 1000	5 750	8 2000	5 2	NO	10 NO	100	YES YES
PARAMETERS	7866	PARAMETERS	114.00	3.5	5 1000	5 750	8 2000	5 2	NO	10 NO	100	YES YES
PARAMETERS	7808	PARAMETERS	143.75	3.5	5 1000	5 750	8 2000	3 10	NO	10 NO	100	YES YES
PARAMETERS	7825	PARAMETERS	98.00	3.5	5 1000	5 750	5 20	5 10	NO	10 NO	100	YES YES
PHILIPS	PR2534	PHILIPS	6.5	4	300	4 300	6 300	2 3	YES	10 YES	NO	NO NO
PHILIPS	PM2519	PHILIPS	4.5	5	1000	4 600	10 10	4 20	YES	1 YES	0.001	YES NO
SIGMOTEK	CD-1	EMONA	4.75	5	1000	5 1000	5 40	3 2	YES	1 NO	NO	NO NO
SIGMOTEK	CD-2	EMONA	4.75	5	1000	6 1000	5 40	3 2	YES	1000 NO	NO	NO NO
SIGMOTEK	CD-3	EMONA	4.75	5	1000	5 1000	5 40	3 2	YES	1000 NO	NO	NO NO
SOAR	3088	DICK SMITH ELEC	49.95	3.55	1	1	2	1	YES	NO	NO	NO NO
SOAR	4010	EMAIL RELAYS	206.00	3.5	5 1000	4 750	6 40	1 10	YES	11 NO	400	YES NO
SOAR	4020	EMAIL RELAYS	215.00	3.5	5 1000	4 750	6 40	3 10	YES	11 NO	400	YES NO
SOAR	4040	EMAIL RELAYS	253.00	3.5	5 1000	5 750	5 40	3 10	YES	11 NO	400	YES NO
SOAP	3050	EMAIL RELAYS	351.00	3.5	5 1000	5 750	5 40	3 10	YES	11 NO	400	YES NO
SOAP	3100	EMAIL RELAYS	172.00	3.5	5 1000	4 750	6 20	4 10	YES	11 NO	200	YES NO
SOAP	3100	EMAIL RELAYS	199.00	3.5	5 1000	4 750	6 20	6 10	YES	11 NO	200	YES NO
SOAP	ME-530	EMAIL RELAYS	142.00	3.5	5 1000	4 750	5 20	5 10	YES	11 NO	200	YES NO
SOAP	3438	EMAIL RELAYS	248.00	4.5	5 1000	5 750	6 25	2 10	YES	10 YES	250	YES NO
SOAP	3450	EMAIL RELAYS	518.00	4.5	5 1000	5 750	5 25	2 10	YES	11 NO	250	YES NO
SOAP	8050	EMAIL RELAYS	173.00	3.5	5 1000	5 750	5 25	2 10	NO	10 NO	200	NO YES
SOAP	343D	EMAIL RELAYS	1150.00	4.5	5 1000	5 750	6 25	6 10	YES	11 YES	250	YES NO
SOAP	5450	EMAIL RELAYS	978.00	4.5	5 1000	5 750	6 25	2 10	YES	11 YES	250	YES NO
SOAP	302P	EMAIL RELAYS	5.5	4	450	4 450	5 7	2	YES	5 NO	200	NO NO
THURLBY	1504	PARAMETERS	684.00	4.5	5 1000	4 750	6 32	6 10	NO	10 NO	1000 YES	1000 NO YES
YU FONG	YF1060	ARLEC	52.00	3.5	4 1000	2 500	4 50	2 3	NO	1 NO	NO	YES NO
YU FONG	YF3060	ARLEC	108.00	3.5	5 1000	4 750	5 2	6 10	YES	10 NO	19	NO NO
YU FONG	YF1030C	ARLEC	72.00	3.5	5 1000	2 500	5 20	5 10	NO	10 NO	NO NO	NO NO
YU FONG	YF1020	ARLEC	97.92	3.5	5 1000	5 750	6 20	10 10	NO	10 NO	NO NO	NO NO
WAVETEK	52	SCIENTIFIC DEVICES	5400.00	4.5	5 1000	5 750	6 320	4 10	YES	1000 YES	1000 YES	YES



The GDM-8145 (GDM-8045)

R.I. No. 130



The Fluke 77

R.I. No. 131

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READER INFO No. 34

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## Multimeters Buyers' Guide

that you need lots of switches. One way around the problem is to put an autorange function into the meter. With this facility, the meter will select the appropriate range once the operator has selected the function. Such meters represent the ultimate in simplicity of use, but they do suffer from the disadvantage that there can be a considerable delay between the time you put the probe on the test point and the time the meter finally gives you a stable reading. This is a problem inherent to DMMs, and it's made worse by autoranging. One of the best features of the old VOM was that you could 'probe and glance'. It doesn't work with the DMM.

### Special Facilities

Although there doesn't seem to be much variation in the models we tested, it is a worthwhile exercise to check the *input resistance* of a unit before you consider buying it. The industry standard is 10M and most manufacturers in our survey claim to have achieved this. Indeed, some claim to go orders of magnitude beyond it. There are few extra facilities it's worth thinking about before purchasing your meter. By and large they don't seem to add much to the cost, and if you have some special application in mind they can save a fair bit of messing about. For in-



The CD-2 Autorange 4½ Digital Multimeter

R.I. No. 132

stance, models are available with capacitance testers on them. Transistor testers are another facility that can be very useful. By pressing one button you can determine the polarity of an unknown transistor, as well as its beta.

If continuity testing is going to be an important part of the work you do with the meter, an audio indication of continuity can be very useful. It allows you to make the test without taking your eyes off the probe, a handy facility when trouble shooting on crowded boards. But bear in mind that there is usually a minimum

resistance below which the buzzer will sound. Sometimes it's as high as 120 ohms, so you can't reliably check for things like dry joints, or partially open components.

Another trap to watch for with buzzer continuity is that there is sometimes a considerable reaction time while the meter does an A-D conversion. It can be long enough to deceive an inexperienced user.

Closely allied to this sort of 'one eyed' reading are those meters that have an 'auto lock' button. This will freeze the reading on the display even after the

## MICROPROCESSOR SYSTEM FAULTFINDING INSTRUMENTS

The fault finding instrument's personality pod replaces the microprocessor and runs the board under test. No assembler programming knowledge is required, as only the system memory map need

be known to enter test programs. The system memory and peripheral I.C.s can be tested directly, while a "loop program" allows decoding type problems to be traced using a 'scope.

### 16 & 32 BIT SYSTEMS

#### Antron MST 16/32

Specifically designed as a 16 and 32 bit tester, it provides 16 predefined single key tests, plus BASIC and Quick Code assembler. 58k total program memory. Standard dual RS-232 comm's ports.

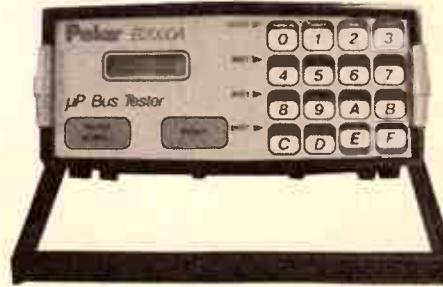
QUOTE AEE J680

### 8 BIT SYSTEMS

#### POLAR B2000A

Low cost production or field service instrument. Provides 12 predefined single key tests. Integral printer records all results. Non-volatile memory stores up to 15 test programs.

QUOTE AEE J681



POLAR B2000A

Also available: POLAR T1200 in-circuit faults locator, and POLAR 700 short circuit locator



## EMONA INSTRUMENTS

DIVISION OF EMONA ENTERPRISES PTY LTD

NATIONAL DISTRIBUTORS

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QLD Baltec Systems Pty Ltd Brisbane Phone 369 5900  
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Phone 34 2233

George Harvey Electronics Launceston Phone 31 6533

SA Int Communication Systems Pty Ltd  
Port Adelaide Phone 47 3688

WA Hinco Engineering Pty Ltd Perth Phone 381 4477

READER INFO No. 35

World Radio History

probe has been lifted from the test point.

In certain applications it's worth thinking about a decibel (dB) reading on the display. Typically, such instruments will either change a voltage reading into its equivalent dBm reading (ie: relative to 1 mW in a 600 ohms load, or else they will give you a dB<sub>r</sub> reading, ie: a decibel level *relative* to some voltage you have already put into the machine). Clearly, this is useful for someone who habitually spends time with analogue equipment.

If you intend spending some time looking at high frequency inputs, say 1 kHz and above, the ac performance of the meter is of some consequence. For a start, make sure the input is ac-coupled. This will allow separate determination of the ac and dc components of the input. A dc-coupled meter allows only a determination of the sum of the two.

### True RMS

You also need to consider the difference between *true RMS* and *averaging* meters. The true RMS meter will usually have some kind of thermocouple arrangement on the input, in which the input is allowed to heat an element and the meter then measures this heating effect.

An averaging meter, on the other hand,

puts the ac into an ac-dc converter and then scales it up to give an RMS reading. This technique is quite legitimate so long as you are looking at a sinewave. There should be no difference between the two types of meter under these circumstances.

As the input deviates more and more from the pure sine function, however, the differences between the two types become more and more apparent. According to Fluke Manufacturing, who produce many meters of both types, you can expect about a 1.4% error when measuring supply line ripple, 20% across a triac switching circuit and 29% from a transformer secondary. Of course, when we go to pulse trains and square waves with small duty cycles, the errors are much greater.

The problem is compounded by the fact that the more distorted the waveform, the more high frequency components will be present. A square wave, for instance, will have several harmonics, at least, of its fundamental frequency. To measure such a waveform properly the meter must respond to these harmonics. As a rule of thumb, you will get reasonable results if the DMM has a bandwidth five times greater than the fundamental frequency.

### Physical Construction

Finally, there is the physical environment

in which the meter will be used. Although it is probably the last thing to be thought about when buying a meter, the physical construction of the unit is probably the area where manufacturers can make their biggest price saving.

There is often a real trade-off between price and the rigidity of the case. It needs to be said, however, that this is not a universal rule. Some of the cheapest units we tested gave us the appearance of great robustness. On the other hand some quite expensive meters looked very flimsy.

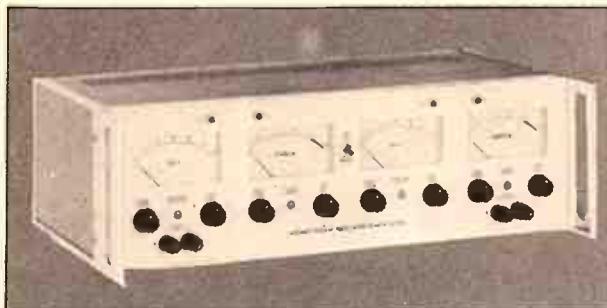
In the normal course of things this doesn't matter much. A laboratory bench is, or ought to be, a fairly 'kind' environment for electronic gear. If you intend using it in a garage, or at sea, or in a construction site, think about the unit's ability to withstand wear and tear. How easy will it be for spray to penetrate to the pc board? Could it withstand a two-storey fall? (Or even a two metre fall).

The final choice is up to you. It's worthwhile to consider carefully though, and not to be overly influenced by 'specials' and the prospect of saving a few dollars. Remember that your meter will probably be around for many years. And bear in mind that the biggest problem with meters is the short circuit between the users' ears. ●

# LABORATORY POWER SUPPLIES

APLAB offer a complete range of regulated DC bench rack power supplies combining high precision and regulation capabilities with continuously adjustable outputs.

Designed with single, dual and multiple outputs, these power supplies can be used in either constant voltage or constant current mode of operation.



#### Standard models include:

##### SINGLE OUTPUT

OUTPUT: Output VOLTAGE: Current  
0-30V 0-1A to 30A  
0-70V 0-2A to 10A

##### DUAL OUTPUT

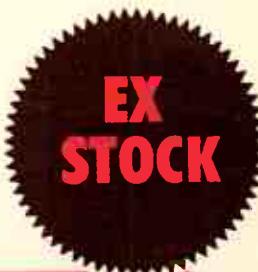
0-30V 0-1A to 2A

##### MULTIPLE OUTPUT

0-30V 0-2A to 5A



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# ETI 287 — LED LIGHT CHASER

THIS PROJECT IS very simple to construct and understand, yet features an immense variety of applications.

When we constructed the prototype it was designed for a two-fold purpose. As well as emulating the "Knightrider" scanner light (a television program featuring a fully computerised state of the art, talking, crime-busting car), it was also used as a bio-medical aid in the learning process of a young, handicapped child.

The usage of this project is limited only by your imagination. In its basic form it is a LED light chaser, but can be used as a normal light chaser by feeding the outputs into transistors, relay's, etc . . . A little experimentation can produce excellent effects, as the well known Melbourne institution "Tikki and John's — Crazyhouse Theatre" have found. They have utilised four of these units to produce an amazing mini light show. A winking, blinking, "computer console" launches an on-stage rocket, the lead astronaut has his own light show on his head, etc. Professional special effects at a fraction of the

cost of commercial units.

To keep the project cost-efficient, yet not lose any of the advantages, we opted to use a single-sided printed circuit board and high intensity red LED's. The use of a single-sided board necessitates wire links of tinned copper wire. These are probably the easiest part of the project. The Telefunken SLH56VC high intensity LED's draw the same current and voltage as normal LED's, but are some 100 times brighter. A standard LED produces some 0.9 millicandella (mcd) of light, whereas the SLH56VR emits some 90.0 mcd — ensuring that your chaser can be seen bright and clear at great distances. Current drain on the power supply is minimal. Our prototype ran continuously for well over 100 hours on a standard 9v transistor radio battery.

We found 5mm red LED's to be the most visible and compact, but variations on colour and size are also possible. Another prototype of ours has a mis-matched jumble of colours and looks quite good. If space is not a problem, the new 10mm

range has a beautiful, soft, bright red — the best colour in any LED we've ever seen.

The rate of the flash can also be varied.

## ETI 287 PARTS LIST

**RESISTORS** — All 1/4 watt unless otherwise specified

R1 330 ohm CR37  
R2 56K CR37

**POTENTIOMETERS**

RV1 1M Vertical Trimpot

**CAPITATORS**

C1 0.15uf (150nf) Greencap

**SEMICONDUCTORS**

IC1 555 Timer

IC2 4029

IC3 4013

IC4 4049

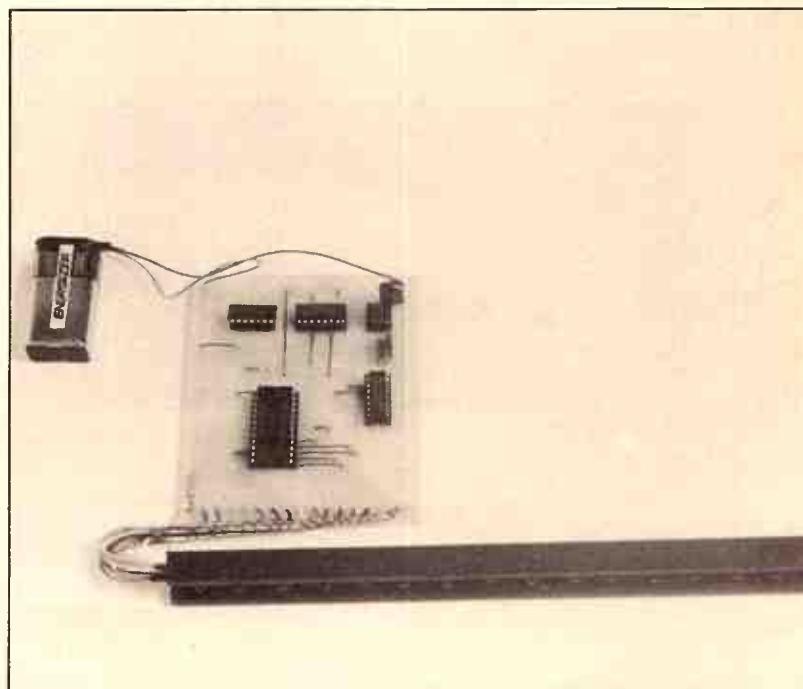
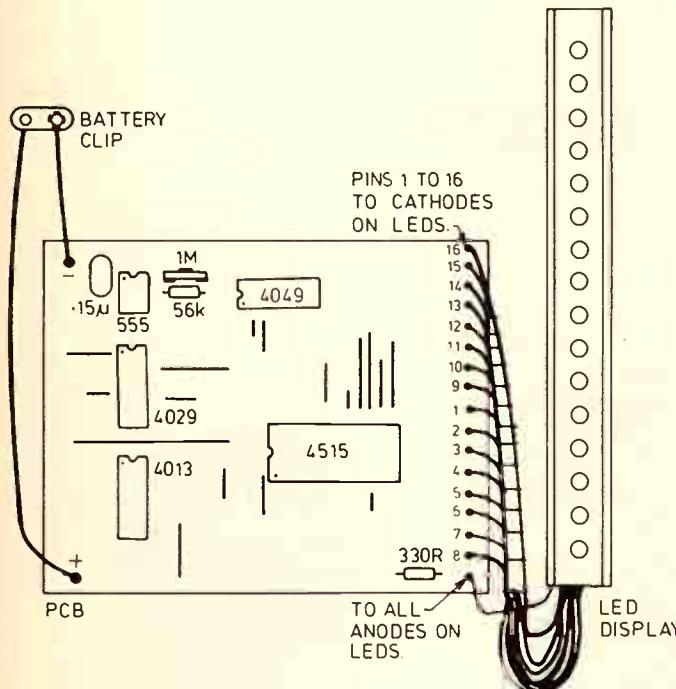
IC5 4515

LED 1-16 SLH56 VC High-Int. Red LEDs

**MISCELLANEOUS**

PCB AEC 86-9-1

Assorted... 1 x 9V battery clip, 1 x 8 pin IC socket, 1 x 14 pin IC socket, 2 x 16 in IC socket, 1 x 24 pin IC socket, Tinned Wire, Hook-up wire, Rainbow Cable, Solder.



# LED LIGHT CHASER

## ASSEMBLY

To begin assembly, check the Printed Circuit Board for bridges, undrilled holes, etc. It is suggested that you use a board for ease and neatness. Cut and shape all wire links, insert, and solder these first. The IC sockets come next, followed by the capacitor, resistors and trimpot.

Solder the output wires to the cathodes of the LED's (or the bases of the transistors if used). Bridge all the LED anodes (or transistor collectors), and solder this bridge to the common rail on the PCB. Insert the IC's, using standard MOS handling procedure.

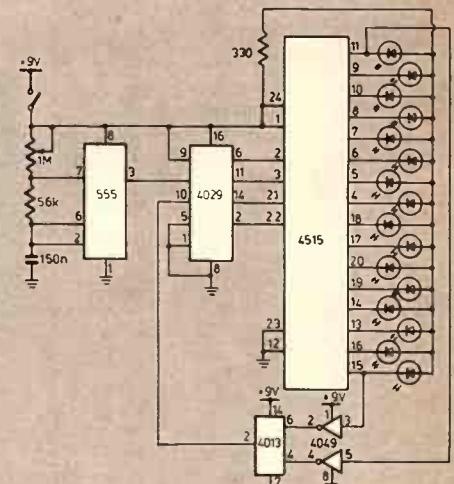
Note that the 330 ohm resistor may need to be substituted for another value, or left out altogether, depending on the supply voltage. For 9-12 Vdc operation, we found 330 ohm to be adequate. If used in a 12 Vdc supply from a car, a 0.1 uf ceramic or greencap capacitor would be placed across the power in, to avoid a possible "locking in" of all LED's. This is caused by the alternator switching in and out, and resetting the unit. The 1M ohm trimpot can be used to adjust the speed, or rate of flash.

The project is simple to construct but

## HOW IT WORKS

A 555 timer IC is used for clock pulses, and the trimpot adjusts the rate of oscillation. The output of the 555 — pin 3 — drives the 4029. The 4029 is a BCD up/down counter — its mode depending upon whether pin 10 is high or low. The output of the 4029 is used to drive the input of the 4515; its output being 16 — stage, active on the negative pulse. The function of the 4029 is to invert the pulse coming from the first and last output of the 4515 to either count up or down. Two outputs of the 4049 are used to set or reset the 4013, sending its output high or low to set pin 10 of the 4029 to either high or low. This forms the stimulus to set the IC to count up or down.

The 330 ohm resistor is used as a voltage drop, and current limiting resistor for the LED's.



should fault-finding be required, it will probably be due to a simple error, such as bridged tracks on an IC, incorrect orientation of an IC, reverse polarity of a LED, etc. The In-Circuit Digital IC Tester published several issues ago will provide ready

check if all IC's — except the 555 timer. ●

*This project was devised by the staff at All Electronic Components.*

MAIL ORDERS !!!

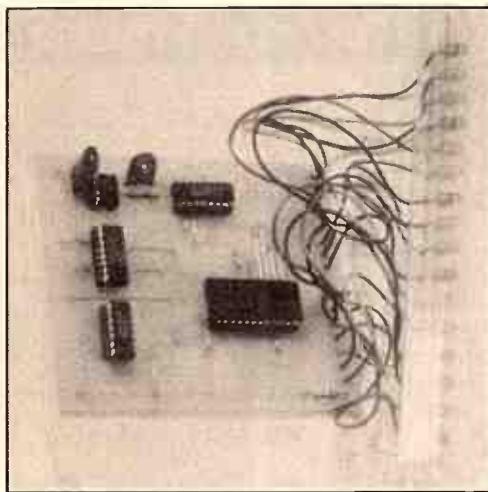
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READER INFO No. 37

# WHICH SWITCH?

## Toggle Switches

### Ultra Miniature DPDT

The contact rating to size ratio is very high with this miniature toggle switch. Ideal for models, miniature portable instruments, or any use where a high quality miniature switch is required. Cat S-1245

**\$3.50**



1.5A 240V

**SPDT**

Body 8mm x 13mm, clearance 17mm. Cat S-1173

**\$1.65**



2A 240V

**DPDT**

Body 13mm x 13mm, clearance 17.5mm. Cat S-1174

**\$1.80**



**4PDT**

Body 13mm x 21.5mm, clearance 20.5mm. Cat S-1175

**\$5.95**

2A 240V

**Heavy Duty DPDT**

Amazing contact capacity!

Although this switch is miniature in size, it offers an enormous contact to size ratio. Ideal for use where high power levels are involved and small size is of prime importance. Cat S-1168

**\$3.75**

10A 125V



### Right Angle PCB Mounting

With extended right angle lugs for soldering direct to pcb. No mounting nuts required (there's no thread anyway!) Cat S-1180

**\$2.50**



### Standard DPDT

Same general features as SPST Cat S-1215. Cat S-1216

**\$2.25**



1.5A 240V

### PCB Mounting Push Button

Has right angle legs for pcb mounting through panel. 120V AC. Cat S-1253

**\$2.95**



### Waterproof Toggle

Fully sealed SPST toggle for low voltage applications. Toggle has rubber boot to ensure complete waterproofing. Ideal for marine use and other hostile environments. Cat S-1195

10A 12VDC **\$7.55**



### Standard DPDT Centre Off

Rugged bakelite case, chrome toggle, red and black On/Off/On indicator plate and heavy duty solder lug terminals. This switch features heavy duty contact rating. Makes ideal motor reversing switch eg electric aerial on cars. Cat S-1217

**\$2.50**

1.5A 240V

### Piano Key DPDT

Ideal for audio and electronic projects. Superbly engineered and has a white toggle. Cat S-1393

**\$3.50**

### Illuminated SPST (12V)

Intended for automotive use. The soft glow from the toggle is not distractible, but means the switch can quickly be located.

12V lamp operates from supply being switched. Cat S-1214

**\$3.95**



16A 12VDC

## 1987 ARRL Handbook

All the updates on basic and advanced information, theory and a fascinating section on satellites. Cat B-2220

**WAS \$49.94  
\$39.95**

## UHF/VHF Manual

This huge hard covered manual deals with the techniques and equipment applicable to frequencies above 30MHz with particular emphasis on microwaves. Cat B-2054

**\$39.95**

## Encyclopedia of Electronic Circuits

This comprehensive reference book is the A-Z of electronic circuits. It will save you valuable time searching for a particular circuit, plus eliminates all guess work in deciding whether 'that' circuit will meet your requirements. Cat B-1760

**\$59.95**

## Basic Electronics Theory

With projects and experiments. Starts with very basic principles and ends with computers — with just about all aspects of electronics in between. Ideal reference work for tech, school students, etc. Cat B-1615

**\$27.45**



### Line Switch

High impact plastic moulded switch for insertion in any cord for remote on/off. Ideal for putting on/off switch in a floor standing lamp. Cat P-5515

**\$5.95**



### Blank Plate

Same size as power point, but blank: ideal for gap-filling when you move points, switches etc. Cat P-5535

**\$1.99**



### Double Power Point 10A Rating

Replace old single outlets with a double: much more convenient. Cat P-5560

**\$1.10**



### Wall Board Clip

Can be mounted from the front. Mount power outlets, switch plates, on any cavity wall (other than brick) without the need for a mounting block. Cat P-5530

**99c**



### Architrave Switch

Standard architrave switch — can be used to replace old, worn out units in your home. Positive action switching. Cat P-5570

**\$4.55**



### Standard Mounting Box

Mount power points, plates, etc. on any surface including brick. Cat P-5531

**\$1.99**



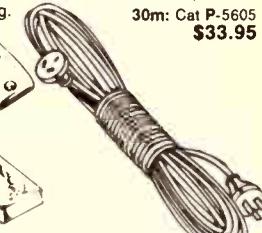
### Extension Cord

3 core cable already fitted with plug and socket. 7.5A rating.

5m: Cat P-5595 **\$6.25**

10m: Cat P-5600 **\$9.45**

30m: Cat P-5605 **\$33.95**



## Em-Bezel Away!

### Miniature LED Bezel

Low current drain (20mA @ 2 volts) but offering high visibility. Smart chrome bezel, needs a 7mm hole. Red Cat S-3528

RG Green Cat S-3529

**\$1.20**



### Dual Colour LED Bezel

Two LEDs in one bezel — ideal for two-state indication (on/off, etc.). Operates on 1.3-1.5V @ 25-30mA. Cat S-3530

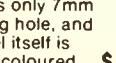
**\$4.60**



### Miniature Neon Bezel

A favourite because of its tiny size. Requires only 7mm mounting hole, and the bezel itself is chrome-coloured. Cat S-3552

**\$1.25**



### 12V Bezel

A very attractive medium size bezel using a 12V LES bulb. The body of the bezel is chrome plated. Requires an 11mm mounting hole, and obviously 12 volts AC or DC. Red Cat S-3510

RG Green Cat S-3512

**\$1.65**



### 240V Neon Bezel

Intended for 240 volt projects, this bezel can be wired direct to the mains. It has a series resistor actually mounted inside the bezel case. Cat S-3550

**\$1.25**



### IC Sockets

PTY LTD

18 Pin DIL Socket **35c**

Cat P-4180 10 up 30c

28 Pin DIL Socket **50c**

Cat P-4245 10 up 45c

14 w/wrap Pin DIL Socket **\$1.70**

Cat P-4260 10 up \$1.60

14 Pin DIL Socket **25c**

Cat P-4140 10 up 20c

16 Pin DIL Socket **30c**

Cat P-4160 10 up 25c

24 Pin w/wrap DIL Socket **\$2.99**

Cat P-4268 10 up \$2.70

20 Pin w/wrap DIL Socket **\$2.49**

Cat P-4264 10 up \$2.25

16A 12VDC **\$1.60**



## You can't refuse

### Fuses

Wide range of fuses in both popular styles: M-205 mini (approx. 20 x 5mm) and the popular 3AG (approx 32 x 6mm). Remember, the lower the current rating of the fuse you use, the greater the protection afforded. All fuses 'fast blow' type for greatest protection.

#### 3AG TYPE

100mA Cat S-4449 1.5A Cat S-4465 15A Cat S-4477  
150mA Cat S-4451 2A Cat S-4467 20A Cat S-4479  
250mA Cat S-4453 3A Cat S-4469 25A Cat S-4481  
350mA Cat S-4455 5A Cat S-4471 30A Cat S-4485  
500mA Cat S-4457 7.5A Cat S-4473 35A Cat S-4487  
1A Cat S-4461 10A Cat S-4475

#### M-205 TYPE

1A Cat S-4421 2.5A Cat S-4423 5A Cat S-4425  
250mA Cat S-4412 2A Cat S-4423 5A Cat S-4425  
500mA Cat S-4415 10 up 32c



### Slo Bio Fuses

#### M-205 TYPE

250mA Cat S-4300 500mA Cat S-4305 1 AMP Cat S-4360  
310mA Cat S-4305 500mA Cat S-4355 2 AMP Cat S-4365  
1 AMP Cat S-4310 500mA Cat S-4350 2 AMP Cat S-4320

#### 3AG TYPE

1 AMP Cat S-4360 5 AMP Cat S-4370 10 up 85c

#### Auto Blade Fuses

5 AMP Cat S-4505 20 AMP Cat S-4520 50c  
7.5 AMP Cat S-4507 25 AMP Cat S-4525  
10 AMP Cat S-4510 30 AMP Cat S-4530 10 up 45c  
15 AMP Cat S-4515

## Australian Radio Frequency Handbook

This is the second edition of this best selling Introduction to Scanning! This edition has been updated and contains hundreds of NEW frequency listings.

B-9600 \$6.95

## Australian Marine Radio Handbook

This book will help boat owners find out just how simple choosing, fitting and using a marine radio can be. Cat B-9604

\$6.95

## Australian CB Radio Handbook

A complete guide to CB Radio including latest marine radio service detail. How to conduct yourself on air. The latest edition includes the new regulations and channel allocations. Cat B-2325

\$6.95

## Electronics Notebook Vol 3

The latest in the series. You've benefited by the information in the first two; now keep right up-to-date. Cat B-3634

\$3.25

Hobbyists...  
experimenters...  
bargain hunters...

Announcing a great new  
"seconds" centre at DSE!

Demo models... stock repairs... samples... etc. — all at discount prices at DSE's new Seconds Centre at our Chullora (Sydney) store. Most items have normal DSE 90 day warranty!

PLUS!!! Hobbyist's Junk Bins — full of economically unrepairable items, broken samples, etc. etc. — so popular for parts, bits'n'pieces — even to try repairing yourself! (Obviously, no warranty or repairs offered on items from junk bins).

Only at DSE Chullora Store!

# Pieces

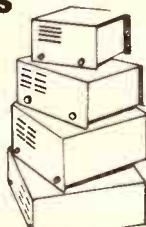


## Metal Cabinets

Beautifully made cabinets to suit a huge variety of projects, especially those with meters, control, etc. which need to be mounted on the front panel. They consist of an aluminium base, slots, and self-tapping screws complete with cup washers. All-in-all a case you'd be proud to put your prestige projects into. They come in an attractive two-tone finish.

102 x 56 x 63mm  
Cat H-2741 \$4.95 each,  
10 up \$4.45  
150 x 61 x 103mm  
Cat H-2742 \$6.25 each,

10 up \$5.50  
150 x 76 x 134mm  
Cat H-2743 \$7.65 each,  
10 up \$6.55  
185 x 70 x 160mm  
Cat H-2744 \$8.90 each,  
10 up \$7.55



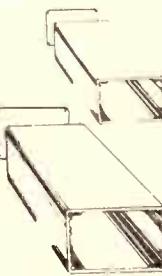
## Semi Savings!

Cat No.	Description	Was	Now
R-7040	Capacitor Pack Polyester	-	12.60
R-7050	Capacitor Pack Ceramic	-	6.25
Z-1604	BF184 NPN Transistor	1.71	.99
Z-2072	2N3460 N-CH Fet	.25	.20
Z-2130	2N3053 Gen Pur Sw	.20	.15
Z-4070	LED 5mm Circ. Red/Green	.80	.70
Z-4912	74LS11 IC Triple 3 input AND Gate	.85	.15
Z-4931	74LS31 IC Delay Line	.35	.30
Z-4992	74LS92 IC Low Schottky	1.65	1.49
Z-5010	7400K Quad 2 input NAND gate	.55	.10
Z-5011	7401K Quad 2 input NAND open cct/coll	.55	.35
Z-5015	7405 IC Hex Inverter Open cct/coll	.70	.35
Z-5018	7408 IC	.35	.25
Z-5020	7410 IC Triple 3 in NAND gate	.50	.35
Z-5023	7413 IC DL4 in NAND Schmitt Trig.	1.05	.10
Z-5024	7414 IC Hex Schmitt Trigger	.81	.70
Z-5030	7420 IC D. 4 input NAND gate	.63	.25
Z-5035	7430 IC 8 input NAND gate	.63	.40
Z-5076	7476 IC TTL	.70	.60
Z-5085	7485 IC 4 Bit Mag Comp	1.00	.85
Z-5086	7486 IC Quad Excl OR gate	.30	.25
Z-5092	7492 IC Div by 12 Cntr	.90	.25
Z-5095	7495 4 Bit L-R Shift Reg	.70	.50
Z-5263	74123 IC DL, Re-Trig. Monostable	.70	.60
Z-5267	74157 IC Quad 2 Input Mpxr	.70	.60
Z-5298	74LS240 Octal Buf/Line Dvr	2.00	.45
Z-5300	74LS95 Oct. Dvr Tristate	3.60	.80
Z-5374	74C157 Data Selector Quad 1 of 2	4.95	1.50
Z-5378	74C221 Monostable D. Schmitt	3.85	.70
Z-5644	4044 Flip Flop R/S Quad	1.65	.70
Z-5945	74HC240 Oct. Buff/Line Dvr	3.85	.25
Z-5965	74HC373 Oct. Transparent Latch	4.95	1.00
Z-6010	CA3100 Op Amp Wideband 36DB	7.95	7.16
Z-6816	MM5865N Timer IC Universal	6.05	4.00
Z-9206	2513 Character Gen.	17.55	8.95

## Aluminium Cases

Superb range of cases based on a specially made 18 gauge aluminium extrusion giving cases which are ultra strong, ultra reliable. The extrusion measures 76 x 102mm — and is available in three different lengths. Internally, there are four slots for insertion of PCB's without use of screws (PCB width 92 or 71mm). End plates fasten into corners of extrusion with PK screws. Includes 2 end plates and 8 screws.

76mm length Cat H-2420 \$10.95  
102mm length Cat H-2425 \$12.95  
153mm length Cat H-2430 \$14.95



## Plastic Instrument Cases

95 x 45 x 145mm 200 x 65 x 160mm

This precision instrument case, exclusive to Dick Smith Electronics has a unique snap together design - no screws required. With front and back panels included this case is ideal for small projects. Cat H-2503

\$12.55  
10 up \$11.55

10 up \$15.25

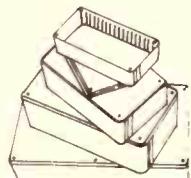
A superb case for all 'instrument' type projects, and many more. Case splits apart for ease of working, comes complete with 4 rubber feet and assembly screws. Cat H-2505

\$16.95  
10 up \$15.25



## Diecast Aluminium Boxes

These are the ones with channelled walls for easy PCB mounting — and they're ideal for RF circuits because the lid forms a very effective screen. They're also great for circuits involving heat — remember diecase aluminium makes a great heatsink. And these boxes will withstand incredibly high temperatures: up to 600°C! Complete with screws.



190 x 60 x 110mm Cat H-2201  
\$17.30 each, 10 up \$15.55  
150 x 50 x 80mm Cat H-2206  
\$11.05 each, 10 up \$10.95  
120 x 40 x 65mm Cat H-2211  
\$8.05 each, 10 up \$7.25  
100 x 25 x 50mm Cat H-2221  
\$6.25 each, 10 up \$5.65

## Aluminium Heatsinks PCB Mounting

Just right for today's projects with everything mounted on the PCB: two heatsinks that also mount on the PCB. Designed to be soldered direct to the tracks, with their fins mounted vertically for even more heat loss. Two handy types to choose from:

**Large:** H pattern, 30 x 30 x 30mm, drilled to take a single flat-pack semiconductor Cat H-3495  
\$2.65

**Small:** U pattern, 17 x 15 x 30mm high. Again, drilled for a single flat-pack, with tapped 4BA hole. Cat H-3490  
\$2.05



**Small:** U pattern, 17 x 15 x 30mm high. Again, drilled for a single flat-pack, with tapped 4BA hole. Cat H-3490  
\$2.05



## Plugs & Sockets

### 3.5mm Miniature

Plug Red Cat P-1132 40¢  
Black Cat P-1134 10 up 35¢



### Stereo Line Socket

Cat P-1238 Stereo Plug Cat P-1140 Stereo Socket  
\$1.50 10 up 70¢ \$1.40 10 up \$1.30

Stereo Line Plug Cat P-1166 Stereo Socket Cat P-1266  
\$1.10 10 up \$1 90¢ 10 up 85¢

### Line Socket

Mono: Cat P-1264 Stereo: Cat P-1286  
90¢ 10 up 85¢

Line Socket Red Cat P-1410 Black Cat P-1412  
45¢ 10 up 40¢

## Battery Holders

### BATTERY SNAP

Suit 216 Cat P-6116

25¢ 10 up 22¢



### BATTERY HOLDER 3V CHASSIS/PCB MOUNT

Cat P-6220

\$3.75 10 up \$3.50

4 x "AA" SIZE HOLDER — SQUARE

Cat P-6124

70¢ 10 up 65¢

### 8 x "AA" SIZE HOLDER — RECTANGULAR

Cat P-6128

\$4.20 10 up \$1.10

6 x "AA" SIZE HOLDER — RECTANGULAR

Cat P-6116

95¢ 10 up 90¢

## Audio Adaptor Plugs

3.5mm Stereo Socket to 6.5mm Stereo Plug

Cat P-6500 \$1.30 (10 up \$1.15)

6.5mm Stereo Socket to 3.5mm Plug

Cat P-6505 \$1.30 (10 up \$1.15)

6.5mm Socket to 3.5mm Plug Cat P-6510

\$1.30 (10 up \$1.15)

3.5mm Socket to 6.5mm Plug Cat P-6520

\$1.30 (10 up \$1.15)

2 x 3.5mm Stereo Plugs to 1 x 3.5mm Stereo Plug

Cat P-6525 \$4.50 (10 up \$4.00)

RCA Socket to 6.5mm Plug Cat P-6530

\$1.30 (10 up \$1.15)

3.5mm Socket to RCA Plug Cat P-6535

\$1.30 (10 up \$1.15)

6.5mm Socket to RCA Plug Cat P-6550

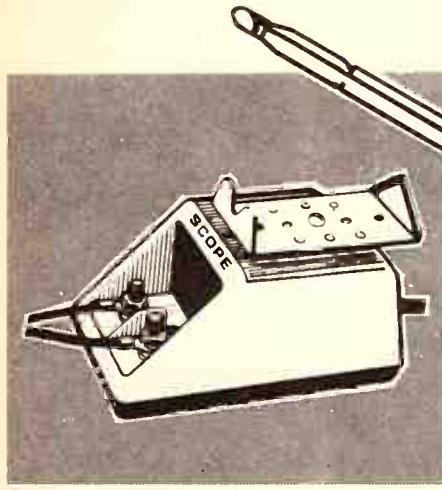
\$1.30 (10 up \$1.15)

RCA Socket to 3.5mm Plug Cat P-6560

\$1.30 (10 up \$1.15)

# Save over 25%\* on Scope irons

## October only



### Perfect Partner Scope Transformer

Quality Australian made just for Scope Irons! Delivers 3.3 volts at 30 amps. Special low voltage is designed to help prevent damage to sensitive components. With electrostatic shield for extra protection! Rugged, reliable and complete with iron rest.

Cat T-1692

Normally \$59.95

\$43.95

### 150 watts - fast!! Superspeed

When the demands are on — there's only one iron that can deliver the goods, quickly and reliably! Delivers a huge 150 watts: in just 6 secs. from cold! You have complete control. With stainless steel barrel and spare tip and element. Use with Scope Transformer (T-1692). Cat T-1603

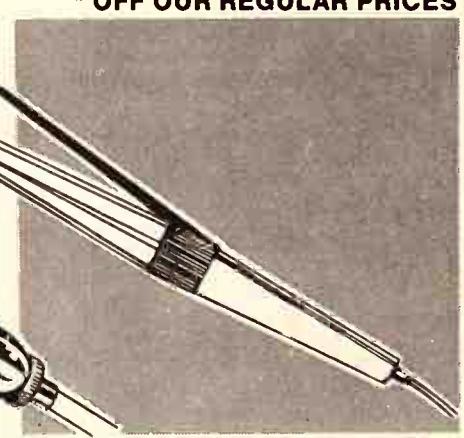
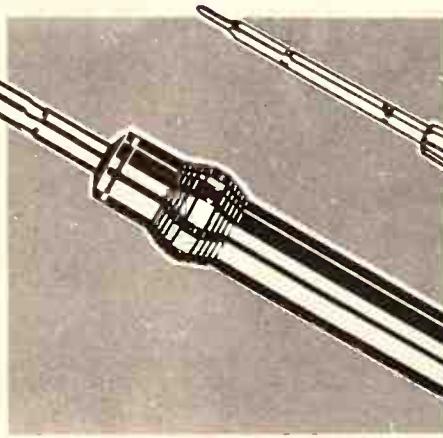
Normally \$52.95

SCOPE ELEMENT AND TIP PACK TO SUIT  
ABOVE Cat T-1603 Was \$8.95 NOW \$5.50!

\$39.50

SCOPE ELEMENT AND TIP PACK TO SUIT  
ABOVE Cat T-1601 Was \$8.95 NOW \$5.50!

\* OFF OUR REGULAR PRICES



### Lever Control Miniscope

The perfect iron for general service work, kit building, etc! Lightweight and incredibly easy to handle. At-hand lever gives precise temperature control equivalent to 10-70 watt range. Use with Scope Transformer (T-1692). Cat T-1660

Normally \$52.95

\$39.50

SCOPE ELEMENT AND TIP PACK TO SUIT  
ABOVE Cat T-1601 Was \$8.95 NOW \$5.50!

# Only at

# DICK SMITH ELECTRONICS

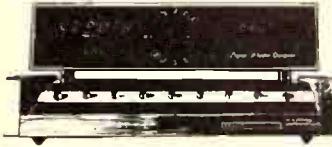


World Radio History

PTY LTD

# Do it yourself

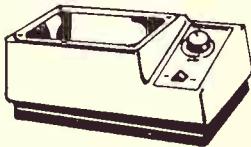
## Computerized Weather Station



From the most respected kit builders in the world, comes the most advanced computer weather station! Features digital clock/4 year calendar, 4 digit accuracy, barometer, thermometer, wind vector, memory and more! Cat G-2000

**ONLY \$999**

## Ultrasonic Cleaning Bath!



Ideal for jewellery, coins, components... almost anything! Cleans ultrasonically — without rubbing or scratching. 150mm x 100mm tray. Uses ordinary soap or softener. Cat G-2010

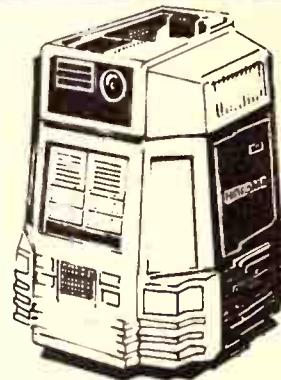
**\$299** Needs external 110V transformer

**\$1395**

## RF Generator

Hobbyist or technician you won't find better quality! Modulated and unmodulated signals from 310kHz to 220MHz. Cat G-4005

**\$199**



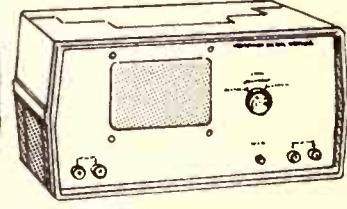
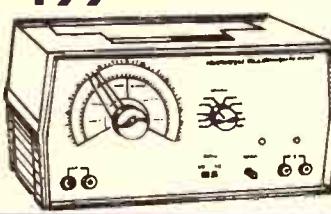
## Robotics Trainer!

Build yourself the most advanced robot kit available! With Hero Jr you'll get first hand experience in the fascinating world of robots. He's used as a trainer in many institutions around the world. Program Hero with his own keypad or with your home computer. He'll remember dates, wake you in the morning, he can even be linked to your security system! Cat G-1005

## Signal Tracer Kit

Save a heap of time on repairs! The signal tracer kit will check RF, IF, even audio circuitry quickly and easily. Ideal for any workbench! Cat G-4015

**\$1895**



## DSE MAKES DOING IT YOURSELF — EASY!



### DSE Metric Clock

Stay one step ahead! Metric time isn't far away so you'd better get used to it now. This brilliant kit gives highly accurate time with a large LED display. That's right!... a metric day is only ten metric hours long. Cat K-3000

**\$59.95**

### 4 Sector Home Security

Where else could you get 4 sector security at this ridiculous price? It's a bare bones controller but it's packed with features. Complete with on-board PCB connectors and instructions! Cat K-3254

#### Value Plus!

**\$29.95**

Short Form Kit  
Case not supplied



### LED Tacho

Build your own LED Tacho. Displays engine speed with a row of LED's. Full instructions included. Watch the revs and get more life from your car! Cat K-3240

**\$26.95**

### RF Attenuator

Any amateur will know how valuable an attenuator is and how expensive they normally are. Build it yourself and save! 0 to 63dB attenuation from 50 to 500MHz. Cat K-6323

**\$37.95**



### Optical Motion Detector

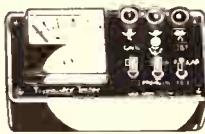
Perfect as part of your alarm system or as a door minder etc. An optical IC detects movement by changes in light level. Self contained and battery operated! Cat K-2721

**\$29.95**

### Fault Finding in a Flash

This low cost Transistor Tester Kit tests bipolar transistors, diodes, F.E.T.'s — even S.C.R.'s and P.U.T.'s. Simple enough to be built by a beginner! Cat K-3052

**\$26.95**



### Accurate LCD Panel Meter

A versatile accurate panel meter with large LCD display. Ideal as a readout device on many projects for amateurs or professionals! PCB design allows for maximum flexibility. Cat K-3450

**\$49.95**



### Zener Diode Tester

Can't make out the markings on those diodes? Well, here's the answer! The Zener Diode Tester gives direct readout of Zener voltage of 400mW and 1W Zeners from 3.3 to 50 volts (2 ranges). Cat K-3051

**\$29.95**



**NEW!**

# DICK SMITH ELECTRONICS

PTY LTD

IT HAD  
TO HAPPEN!

# BUILD-IT-YOURSELF 'AT' COMPUTER!



At last! The perfect opportunity for the hobbyist to build the perfect computer... Perfect because it has in it what YOU want! All the features of the "AT" - blinding speed, high expandability, and so on - but you put it together yourself - and \$ave!

There's more: each board or module comes with a full 12 month warranty PLUS individual, professionally prepared manuals - no Jinglish to decipher!

And best of all, you don't have to buy it in one hit: add what you want, when you want it (and when the pocket allows it!)

#### Look at the features:

##### SUPERB QUALITY HINGED CASE

"Baby AT" case in heavy gauge steel, heavily covered in damage-resistant bone crinkle finish. The lid is hinged and locks up for instant internal access - no more undoing screws! Large enough for expansion - but features a footprint of just 430mm square! Cat X-1005

**ONLY \$175**

##### 200W POWER SUPPLY

Completely pre-assembled - even to the on/off switch and input sockets! Simply slots into place in cutouts provided in case. Heavily plated steel case for minimum RFI with integral whisper-quiet fan. 200W capacity is ready for . . . anything! Cat X-1010

**ONLY \$275**

##### "BABY AT" MOTHERBOARD

Again, completely pre-assembled. No risk of dry joints - you just connect appropriate cables (as described in detailed manual included). On-board capacity for 1Mb RAM and 7 slots for expansion in true "AT" format. Offers 6, 8, 10 & 12MHz speed (switch & software selectable) giving outstanding software compatibility PLUS blinding speed when you need it, and time & date memory with battery back-up. Cat X-1000

**JUST \$995**

##### PLUG-IN CARDS

Cards for the various graphic standards, printer ports, serial ports, etc etc. Choose the one that suits your requirements - and remember, you can always upgrade later!

CGA plus Parallel Printer Card Cat X-2010 \$129

MGA plus Parallel Printer Card Cat X-8141 \$149

EGA Card with Hercules compatibility Cat X-2013 \$399

Serial/Parallel/Game Card Cat X-2012 \$139

##### DISK CONTROLLERS

Your choice of hard/floppy or floppy disk controller card: choose the one that suits your needs best. Both plug in to motherboard.

Floppy Controller (up to 4 1.2Mb or 360Kb) Cat X-2014 \$129

Hard/Floppy Controller (2 of each) Cat X-2008 \$399

##### DISK DRIVES

Also include appropriate cables.

1.2Mb Floppy Disk Drive Cat X-2014 \$269

20Mb Hard Disk Drive Cat X-2201 \$795

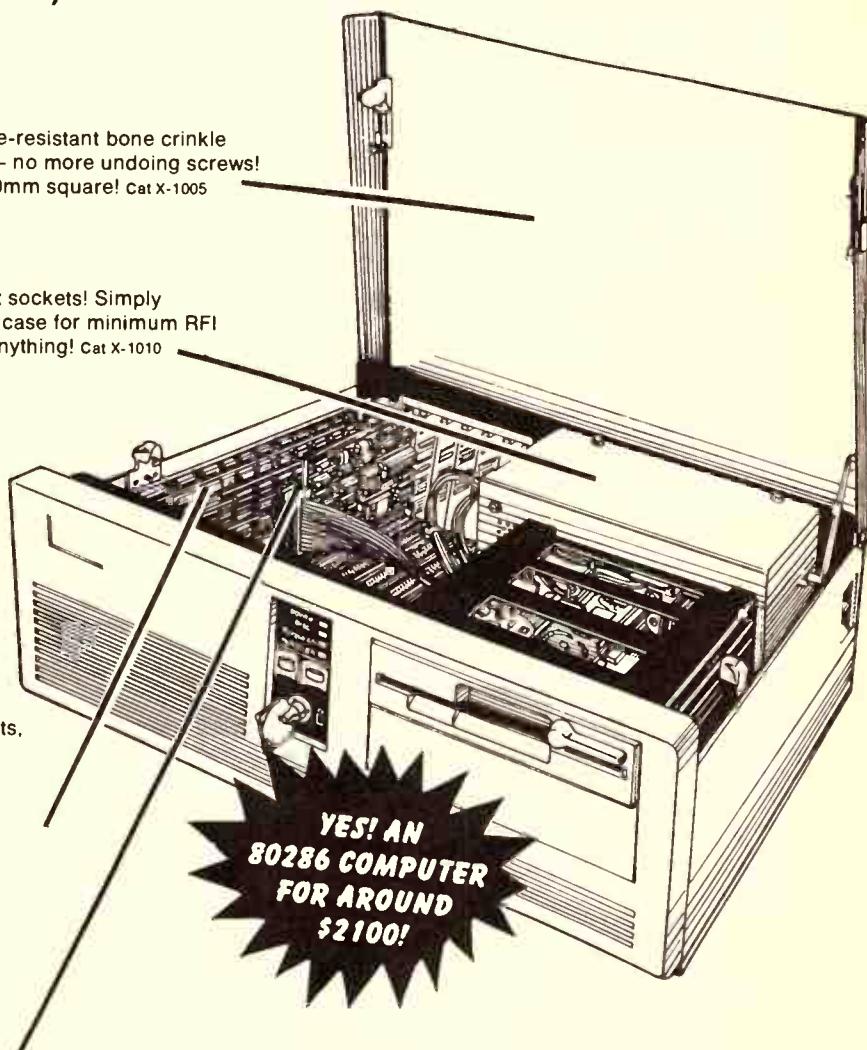
(Other higher capacity Hard Disks available if required)

##### KEYBOARDS

Two types available:

84 Keys with top quality "Alps" keyswitches Cat X-3820 \$129.00

101 Keys - with numeric keypad Cat X-3821 \$149.00



## WHERE ELSE BUT

**DICK SMITH  
ELECTRONICS**

PTY LTD

DSEB450/RT1087

# Get it up!

For the best picture — Quality antennas from DSE.

## Perfect for Fringe Areas

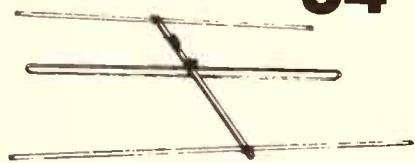
Get The Picture

**\$79.95**

Super Band 5 UHF for a great picture in fringe areas. 16 elements with 15 element reflector for minimum ghosting, maximum gain! Easy to install and great value! Cat L-4045

## 3 Element FM

**\$34.95**



For top performance from your FM tuner! Try to find better value than this for a quality FM antenna — don't waste too much time though. Easy to erect with 300 ohms impedance. The reception will amaze you! Cat L-4064

## Indoor or Out!

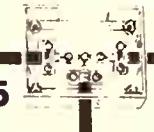


Matches 75 ohm coaxial cable to the 300 ohm ribbon terminals on your TV, tuner or antenna. Weather resistant for either indoor or outdoor use. Comes complete with coaxial plug connector! Cat L-4465

**\$4.35**

## 75 Ohm 2-way Splitter

Need to run two devices off one antenna? Here's the inexpensive way to do it! Designed for indoor use it covers 50-890MHz. Cat L-4472



**\$5.45**

This Is A Hold Up!



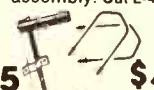
## Barge Board Mount

Quality galvanised construction it's designed to mount any antenna from a vertical surface — barge board, chimney, wall, etc! 139cm long. Cat L-4150

**\$11.95**

## Chimney Mount

No, it's not the sort of thing that Santa is after — unless his antenna's falling down! Double arm with single strap is easy to mount on most chimneys. Complete mast mount assembly. Cat L-4154



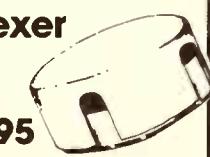
**\$18.95**

## SUPER \$AVER!

## Indoor UHF/VHF Diplexer

Got both UHF and VHF antennas but only one TV antenna input? Now the problem's solved! The indoor UHF/VHF Diplexer accepts lead-ins from both antennas and successfully combines them. Cat L-4470

**\$4.95**



## Ghost Buster!

**\$99**

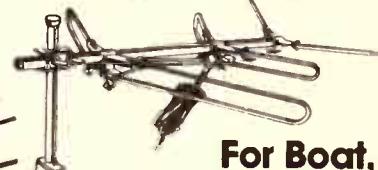
Picture a little fuzzy? Do you live too close to a signal source? The incredible Ghost Buster UHF (Band 4)VHF antenna features a ghost cancelling box which will clean up that picture — once and for all! Cat L-4023

## UHF Band 4 Perfect for SBS 28! With Reflector!

**\$49.95**

Ideal for coupling with your existing VHF antenna — especially if SBS Channel 28 reception is poor. Saves buying an expensive combined model! Lightweight, easy to install and quality construction. Cat L-4040

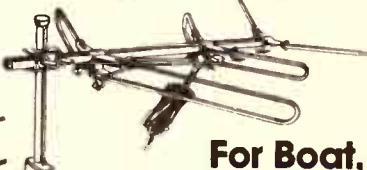
**\$49.95**



## For the Country Estate

The Phase Array VHF Antenna Is ideal for country areas! Receives signal over 100km from transmission source. You can have the full choice of stations! Easy to install... you can do it yourself! Cat L-4025

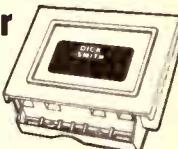
**ONLY \$99**



## For Boat, Camper, Caravan, etc!

**\$49.95**

Here's the go! Superb TV/FM antenna ready for the holiday! Comes with 'gutter gripper' bracket, mini mast and 7 metres of 300 ohm ribbon. Cat L-4026



## The Picture Fixer



Is the signal lousy and your picture about the same? The DSE Mast Head Amplifier could easily put an end to the problem. Won't help clean up the rubbish but it's perfect for a weak signal. Comes with amplifier box and power supply! Cat L-4200

**Great! \$75**



## 4-way 75 Ohm Splitter

Run up to 4 sets (when using 75 ohm cable) from one antenna! Quality plastic box with snap lid and nickel plated screw terminals for easy connection. Cat L-4474

**\$7.75**

Value



## Universal Balun

Can be used for either 300 ohm ribbon cable or 75 ohm coaxial cable! Use it any-which-way. Ideal if you don't know which type to use! Cat L-4456



**\$2.95**

BARGAIN

**\$4.40**

## Super Saver Cables!

### 300 Ohm Flat Ribbon

Low loss 300 ohm ribbon for good reception areas! Cat W-2070

**30¢ pm!**

### 75 Ohm Coaxial Cable

Ultra-low-loss air dielectric 5C-2V. Ideal for long runs where minimum loss is required. Cat W-2082

**50¢ pm**

### 75 Ohm Cable Set

2 metres of quality 75 ohm coax fitted with TV coax plugs. Ideal for units, flats, etc! Cat L-4506

**\$4.40**

**DICK SMITH ELECTRONICS**

PTY LTD

# NZ BARGAINS!

## LCD Panel Meter

Build your own LCD Panel Meter and save! Design allows for maximum flexibility to cater for varied mounting arrangements. Ideal for amateur or professional! Cat K-3450



HUGE SAVING

**\$49.95**

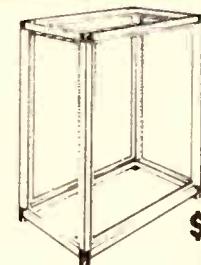


## Bargain Priced Auto-ranger!

Cat Q-1516

**\$129**

Need a quality DMM that you can rely on? This one's it!! 3.5 digit with memory, auto or manual ranging, continuity buzzer, transistor checker, 10A AC/DC range... and more! And you can carry it in your pocket.



## 19" Zip Rack

**\$229**

The secure storage rack for transceivers, hi-fi, etc! Easy to assemble unit measures 19" W x 24" H x 12" D. Cat H-2470



## Data Hold DMM

**\$249**

It's the 4.5 digit DMM which holds the reading till you've finished with it! Plus a huge 20A AC/DC range, buzzer, transistor/diode checker, capacitance... everything! Ideal for test and evaluation procedures. Cat Q-1600

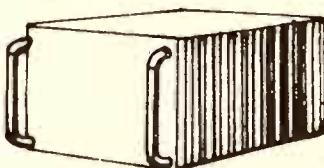


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R-1960	2KR Trimpot Vert 10mm FR108D	\$1.03	.50
R-6836	Pot Carbon 6mm 20K Ohm DG LIN	\$4.55	\$1.55
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# ETI-084 REVISITED

Old car alarms don't fade away, they just keep on making a noise.

IN 1977 ETI published a book called Project Electronics; it was a compendium of simple but useful projects for enthusiasts. Probably the most popular project was the ETI-084 car alarm, which was based around three 555 timers. The circuit diagram is reproduced here. The first 555 (IC1) uses its reference level to detect a voltage drop on the supply rail. The second (IC3) is configured in the traditional manner as a 1 Hz oscillator and drives the LED when the alarm is set, and the relay when it is triggered. The third 555 (IC2), is used to reset the alarm after about 45 seconds. It does this by discharging capacitor C4.

In practise, the circuit appeared to be extremely reliable, with a smaller number of false alarms than most comparable types. It is relatively easy to disable by cutting appropriate wires, but since car thieves are largely ignorant as well as stupid, its deterrent value seemed to work well.

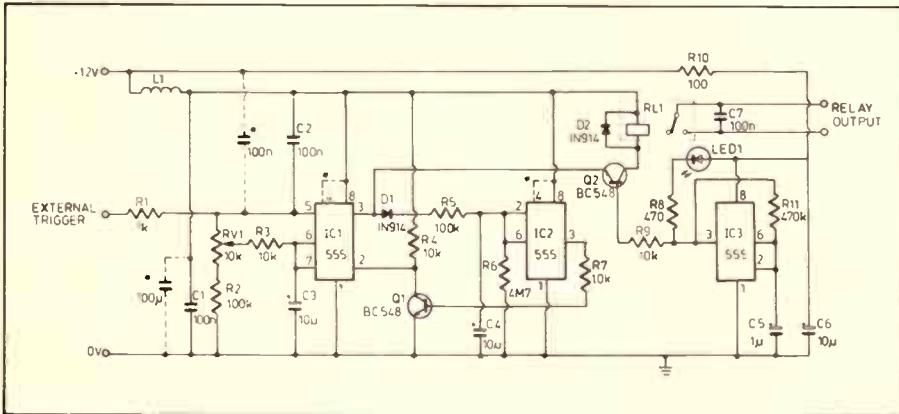
Now, just to prove that you can't keep a good idea down, Dick Smith Electronics has repackaged the circuit as an alarm for a motor bike. Motor bikes pose special problems for alarm circuits. In the nature of the case, the alarm is likely to be more visible than in a car, therefore more vulnerable. Also, it's possible to steal a bike by lifting it onto a ute and disappearing into the night without worrying about trying to start it. Indeed, as steering locks become more effective, this becomes a fa-

voured means of doing things. Obviously, if you don't start the machine, or switch any of the services on, you won't trigger the alarm.

Bearing all this in mind, the new ETI-084 comes in a bland black box which can be bolted onto the machine in some hidden position. Leads come from the box for power, to drive the LED, a mercury switch and the siren. The LED should be mounted on the dashboard, and the wires hidden inside the wiring loom. This is probably a convenient way to handle the horn leads too. If you do not use the bike's horn, a new deterrent horn is supplied with the project. If you use this, the critical factor in deciding how to mount it is to conceal the wiring. The alarm is also supplied with a mercury tilt switch which, when closed, will trigger the alarm in the absence of a voltage drop. It needs to be mounted across the axis of the machine so that it will close if someone tries to move the bike off its stand.

The last consideration is connection to the power supply. Supply should be taken from a point that is active all the time, but not directly from the battery. Bear in mind that the device works by detecting a voltage drop, so the more cable between the input and the battery, the better.

If you take a bit of trouble to mount the device properly, you can make your bike invulnerable to all but the most determined thief. Of course, it helps if you turn it on, so remember to do so! ●

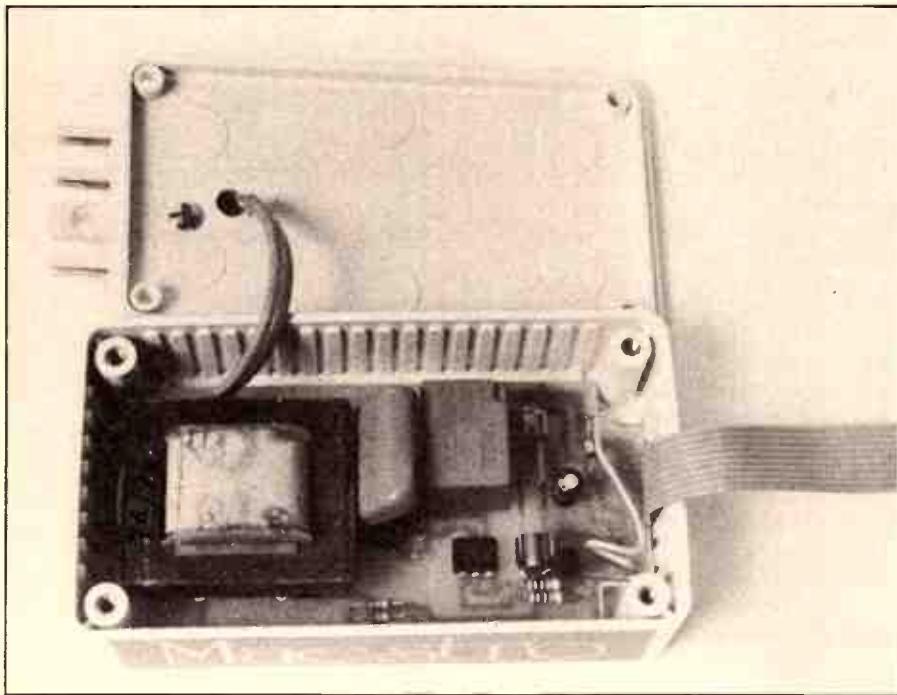


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# APPLE MODEM CARD

**Chris and Dan Darling**



The isolation box. Note the phone plug bolted to the lid.

"NOT ANOTHER MODEM", I hear you say. Fair comment, except that a V21, V22, V23 auto answer, auto dial modem for only \$249 is not a bad buy. In fact, if you run an Apple, and need to communicate, its one that will knock your socks off!

The ETI-1609 was designed to have a number of features. It should be compatible with existing software, be able to communicate at 300/300 or 1200/1200 for bulletin boards and other modems. It should operate essentially under software control, with soft toggles on mode selection and baud rates. It should auto answer and auto dial, and of course, work with any of the card carrying Apples.

Further considerations include using commonly available components to make communications easier and cheaper for Apple users. It should form a neat package which could be installed and forgotten about, and finally it should be safe. A per-

ennial worry for Telecom (and modem designers) is to ensure that the electrical safety of the telephone lines is secured and also that no interference occurs with other users.

#### Architecture

The first thing you may notice after a quick look at the circuit is the use of two separate modem chips. This doubling up is necessary because of the difficulty of getting one chip to handle all of the CCITT standards. The first modem chip is the 7910. This handles the (FSK) V23, 300, and 1200/75 modes. The second chip is the EFG7515. It controls the (DPSK) V22,

#### Selections Using Ascii Express

ASCII EXPRESS	ACTUAL
110	1200/75
300	300/300
110	1200/75
300	1200/1200

1200/1200 mode.

The other large chip in the circuit is the 6850 (IC1), an Asynchronous Communication Interface Adapter (ACIA). It has the task of converting the parallel information on the computers' data bus to serial form, to be used by either the 7910 or the 7515, as well as monitoring the serial data from both modem chips, to be used by the systems data bus.

Most of the other chips are either 14 or 16 pin packages. These provide the necessary logic to determine the mode of operation of the card.

The basic operating mode of the card is determined by the address decoder IC5 74LS138. It uses address lines A0, A1, A2 and the device select signals available on the Apple expansion slots. This chip enables one of the 6850's four registers or enables additional circuitry to test for a ring or begin the dialling sequence.

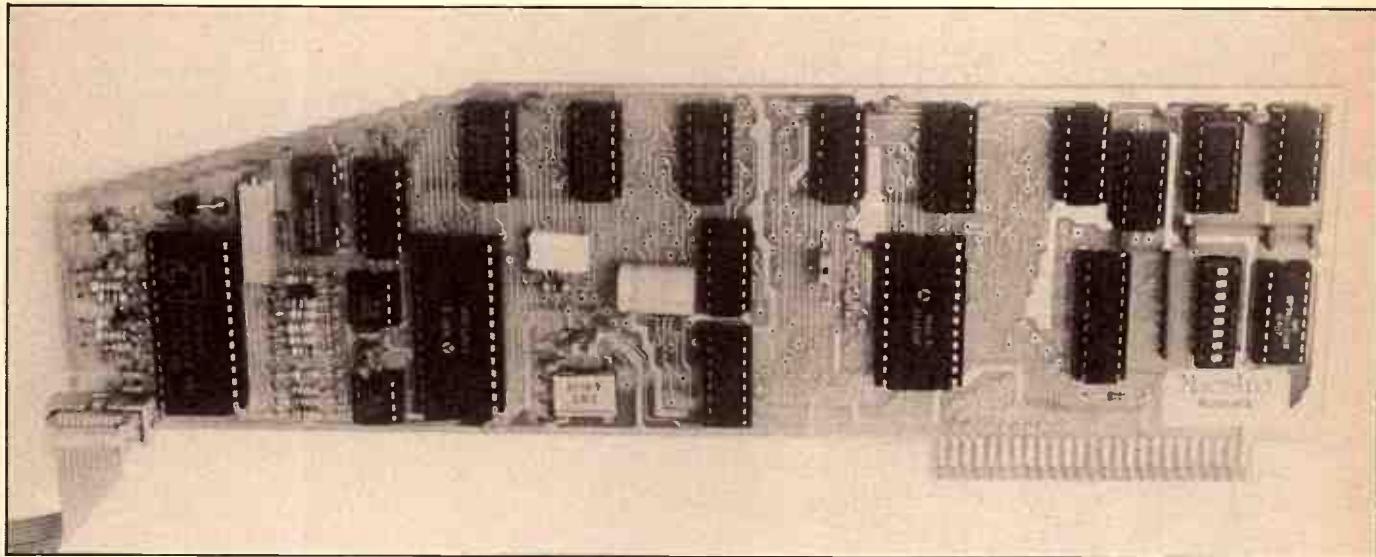
The 74LS153 (IC6) is a dual 4-input multiplexer. Its function is to select the correct clock combination to be supplied to the 6850, ie, 1200/1200, 1200/75, 75/1200 or 300/300. The input is provided by IC16, the 4060 which divides down clock signals derived from the crystal via the 7515.

The 74LS174 (IC7) is a hex D flip-flop. However only 4 bits are required for this circuit. Data bits from the Apple circuit are latched here. The bits used are bit 7 to control the off/on hook and the dialling. Bit 6 helps determine the selection of either the 7910 or 7515. Bit 2 is to control the originate or answer mode. Bit 0 is the baud rate select.

The 74LS244 in combination with the DIP switch provides a signature byte required by some software to determine which type of card is in the slot.

The two-position jumper J2 near the crystal allows a choice of Bell or CCITT standard. The other two-position jumper gives a software selection. In one position it gives 300/300 and 1200/75. In the other it gives 1200/75 and 1200/1200.

Interfacing between the modem chips and the telephone line is accomplished by



The plug-in card. The ribbon cable at left connects to the isolation box.

two parallel amplifiers. The 7910 drives an amplifier based on the TL 081 (IC13), and the 7515 drives IC14. It wasn't possible to build a single satisfactory amplifier to satisfy the requirements of both chips.

#### Software

Auto dial is provided by IC7 when se-

lected by IC5. IC7 drives the relay RLY1 via some buffers. The creation of the pulses is done in software by selecting auto dial mode, then turning pin 14/IC7 on and off at the appropriate frequency.

Auto answer is done by gating the ring line onto the data buss via IC10b, where software can make the appropriate re-

sponses.

The Hayes standard originated in the US with the Hayes Micro Modem some time ago. In those days a typical modem for micro computer work was only expected to be able to do 110 and 300 baud. Consequently many of the packages available on the market only have these selec-

#### HOW IT WORKS — ETI-1609

IC7. By toggling bit 7 of the data bus, pulses are created which drive relay RLY1 via IC19a and 19b.

The output of IC9d is gated with the read/write line to ensure the computer is ready to read the status of the read line. This is achieved by IC10a and IC10b.

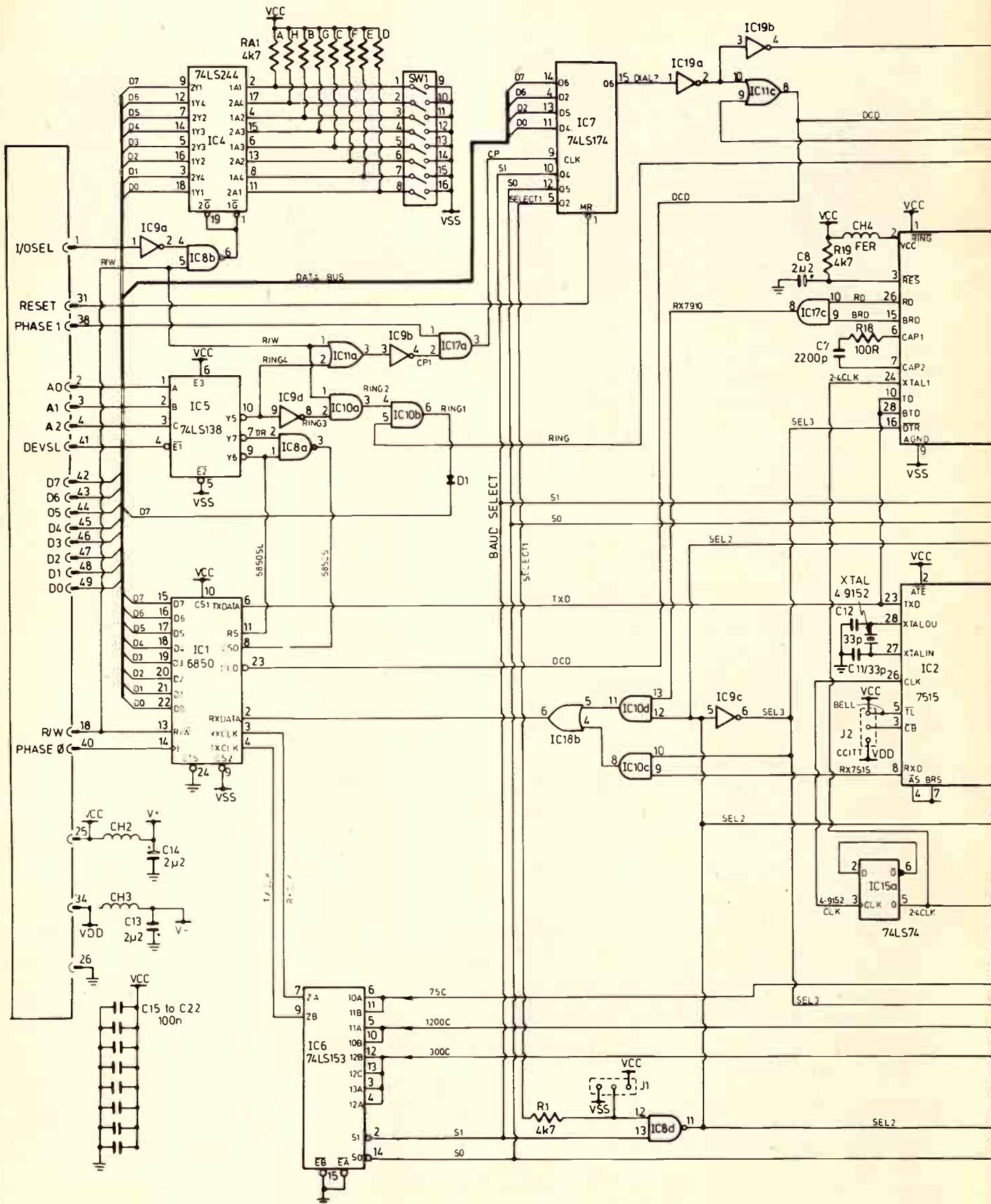
Whenever pin 8 on IC1 goes high this chip is selected. It is capable of transmitting and receiving serial data at the same time. If the baud rate was the same in both directions one clock would be enough for this to happen. However with V23 (1200/75) they are obviously quite different and two separate clocks are needed for its transmit and receive sections (IC6 supplies these clocks). One further problem is that we have two modem chips to communicate with so we need additional logic to gate the serial data to its proper destination. Luckily, this only effects the RxDATA pin so the logic can be carried out by just two AND gates and an OR gate (IC10c, IC10d and IC18b).

The two clocks needed by IC1 are available from IC6. The binary pattern on pins 2 and 14 of IC6 determine which clocks will be transmitted out of pins 7 and 9. Because IC6 acts as a divide by sixteen counter, the clock pulses provided from IC6 are sixteen

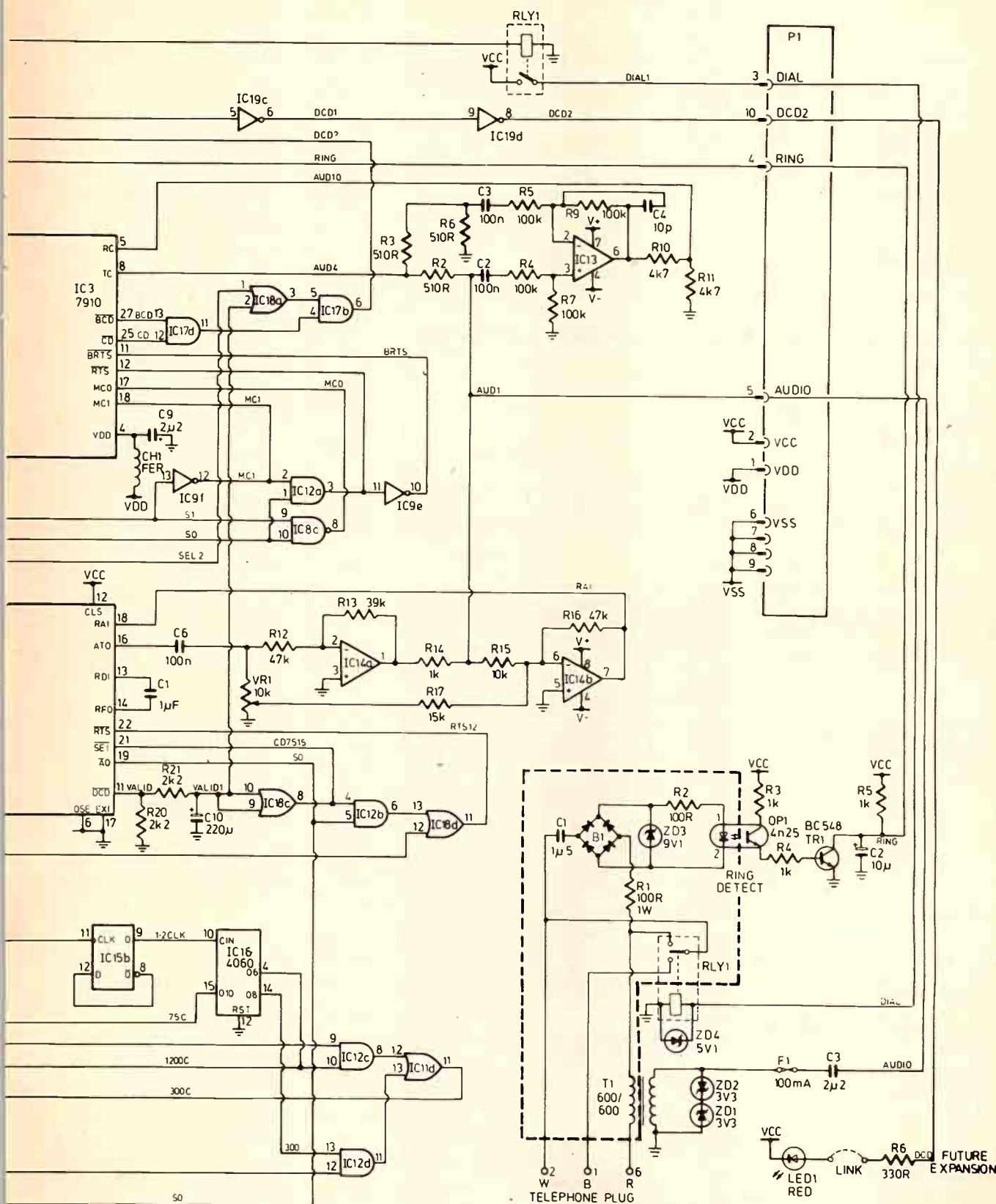
times higher than 75,300 and 1200 Hz. Which one is allowed through depends on the state of S0 and S1, which are derived from IC7. Normally pins 3, 4, 12 and 13 have a 300 clock applied to them. The exception is that when IC2 is selected they are changed to 1200 by IC12c and IC12d.

The 7910 is a single-chip asynchronous frequency shift keying (FSK) voiceband modem. In this project it is designed to supply the CCITT V21 and V23 modes. There are five mode select pins. However only pin 17 (originate/answer) and pin 18 (V21/V23) are needed here. Its output is taken from pin 8 to the audio amplifier IC13 via AUD4.

The 7515 is a single chip DPSK and FSK voiceband modem. It is also the most expensive chip on the card. So be careful with it! For proper interaction with another modem a handshaking protocol must take place. This is done in hardware. Hence the need for a delay circuit between the DCD (pin 11) and RTS (pin 22) composed of IC18c and associated components. This delay is not used in the answer mode so the answer/originate line and the delayed DCD line are AND'ed in IC12b. The resulting signal continues through IC18d to the RTS pin of the 7515.



# APPLE MODEM CARD



tions available.

To cater for people with packages like this, especially the very popular package called Ascii Express, we have made the card respond by selecting 1200/75 whenever the 110 selection is made. When the 300 selection is made the card will either respond by operating on 300/300 or 1200/1200, depending on the position of jumper J1. Connected to power it will select the 7910 and 300/300 and 1200/75. Connected low it will select either the 7910 in 1200/75 or the 7515 in 1200/1200.

#### Construction

*Important!!! Note that the 7515 chip (IC2) is*

*placed on the board back to front with the other chip.*

Because most of the circuit is built on a single plug-in card construction is quite straight-forward and should be completed in a single sitting. Start by examining the board for shorts and open circuits, and if all appears in order, insert the resistors, the ic sockets and finally the capacitors. In order to keep the board profile as low as possible, leave the legs of the big capacitors, C7 and C10 long so they can be bent over and lie flat on the board. Note also the inductors CH1-CH4, formed by threading a wire lead through a ferite bead. Use a bit of araldite or some other

glue to keep the bead in place. The sockets and jumpers are next, and then you can insert all the ICs in their sockets. Notice the injunction above concerning the 7515.

Put the card to one side and start work on the isolation box. The box lid should have two holes in it, one for the phone socket, and one for the lead from the board. It should also have a small slot on one side to accommodate the ribbon cable. If any of these are missing, do the necessary machining now. The lead should have Telecom connectors on it. If it has, slip these onto the pins of the connector. Pull the lead through the appropriate hole and screw the Telecom plug onto the lid. If the leads lack connectors, you can use solder, although you need to apply a bit of heat to the big copper lugs to make any impression on them.

Now get the small isolation board. Once again ensure all the tracks are where they should be. Ensure that the board fits neatly into the box. Note there is one component on the solder side. Begin by soldering all the small components, leaving the relay and the transformer until last. Take particular care with the ribbon cable. The insulation will melt if you apply too much heat so use the iron with care. Finally, turn the board over and solder the diode ZD3 onto the bottom.

At this stage it's probably a good idea to go over your work very carefully, making sure you have got every component in correctly. Pay particular care to the orientation of diodes, capacitors and particularly ICs. Remember that one of them plugs in the wrong way around.

Now solder in the three wires from the phone cable, slide the board down into the box as far as it will go, and screw down the lid. Plug the box into the wall socket, and the ribbon cable into the card. Plug the card into the Apple and switch on.

#### Set up

There is very little to do to set the device up. It should run straight away. It may be necessary to adjust VR1. Put the modem into V22 originate with the line connected. Using either a CRO or an audio voltmeter probe pin 18 of IC1 and adjust for minimum level.

*Chris and Dan Darling are Maestro Ltd, a Gosford NSW company that is busy establishing an impressive track record in the design and sale of modems and other peripherals. Enquiries regarding this project should be directed to them on (043)68-2277.*

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98 — ETI October 1987

# ETI 1617 DISC DRIVE for the 1616

Remember the first article on the 1616? We said that we thought it was best to leave the disk controller to an expansion board and do the job properly. Well this is it! Its a slave processor disguised as a disk controller. Its called the "Applix 1616 disk co-processor card" or SSDCC for short.



GIVEN THE need for a disk interface for the 1616, there are a number of ways in which this could be done:

#### **Direct interface to MC68000:**

Connect the disk controller IC to some form of memory buffer. During disk reading control hardware placed data from the disk controller into the buffer which may then be read out by the MC68000. This avoids the problem of totally occupying the processor time, however it requires a lot of tricky hardware.

#### **DMA control:**

During reading, data is moved from the disk controller IC directly into the 1616's main memory by a Direct Memory Access controller. This is a very common way of interfacing a disk controller and it would be a quite reasonable way of solving the problem.

#### **Slave microprocessor control:**

This is the chosen technique. A stand alone 8 MHz Z80 computer which communicates with the 1616's MC68000 micro-

processor via an 8 bit data port and some handshake and interrupt signals. This is attractive because of its flexibility; with a separate Z80 to manage the disk I/O we can perform buffering of large amounts of data in the Z80's memory, control the SCSI interface as well as the floppy interface and control a couple more serial ports.

The Z80 was chosen because the 8 MHz device is quite a fast microprocessor; it has the power to perform the I/O tasks needed and since all the data is handled in single bytes, a 16 bit CPU is not really an advantage. The cost is low, the Z80 is well known and development tools and software are common. Finally, it is not impossible that the 1616 will one day be seen running the good old CP/M (or ZSYSTEM) operating system within its disk controller!

The SSDCC circuitry's major sections are the Z80 processor and its address decode circuitry, the Z80's memory, the floppy disk interface, the SCSI hard disk interface, the dual serial I/O channels and the 1616 bus interface.

Unlike the 1616's MC68000 microprocessor, the Z80 has separate memory and I/O address spaces, and a separate set of bus signals to control memory and I/O transactions. The Z80 decode PAL (IC8, ZPAL) and the 3 to 8 decoder (IC13) together perform the memory and I/O enabling.

The Z80 may be forced to insert extra clock cycles into a memory or I/O transaction by forcing it into a 'wait state'. This is done when pin13 of the Z80 PAL goes low; the arrangement of the flip-flop IC6 causes the Z80 to insert a single wait state into a memory or I/O access. Thus the programming of the PAL determines which addresses receive wait states and which do not. At present all I/O transac-

#### **SSDCC Hardware Specifications:**

- On board 8MHz Z80H CPU.*
- 8K to 32K of ROM.*
- 8K to 64K of RAM.*
- WD1772 disk controller chip.*
- Expansion includes . . .*
- SCSI hard disk interface.*
- Two additional serial ports.*

**SPECIALS!****COMPUTER DRIVEN RADIO TELETYPE TRANSCIEVER KIT**

Here what you've been asking for, a full transmit-receive system for computer driven radio teletype station. The software provides all the latest "huzz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed specifically with the popular Microbee, tips are available on interfacing the unit to other computers. (ETI Nov. '84) ETI 755)  
Cat. K47550 ..... Normally \$135  
**SPECIAL, \$99**

**LOW OHMS METER**

How many times have you cursed your multimeter when you had to measure a low-value resistance? Well with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms. (ETI Nov. '81) ETI 158  
Cat. K41580 ..... Normally \$44.95  
**SPECIAL, \$39.95**



**SLIDE CROSS-FADER**  
Want to put on really professional slide show? This slide cross-fader can provide smooth dissolve from one projector to another, initiate slide changing automatically from an built-in vanable timer, and synchronise slide changes to pre-recorded commentary or music on a tape recorder. All this at a cost far less than comparable commercial units. (EA Nov. '81) K15511  
Cat. K81110 ..... Normally \$99.00  
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The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both voltage and current metering is provided. (ETI Dec. '83) ETI 1162  
Cat. K41620 ..... Normally \$73.50  
**SPECIAL, \$63.50**



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Protect your home and possessions from burglars with this up to the minute burglar alarm system. It's easy to build, costs less than equivalent commercial units, and features eight separate inputs, individual sector control, battery back up and self-test facility. Specifications:

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- Battery back-up with in-built charger circuit.
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**15V DUAL POWER SUPPLY**

This simple project is suitable for most projects requiring a dual voltage. Includes transformer.  
(ETI 581, June '76)

Cat. K45810 ..... \$34.95

**50 W AMPLIFIER MODULE (ETI 480)**

Cat. K44880 ..... (Heatsink optional extra)

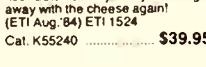
**100 W AMPLIFIER MODULE (ETI 480)**

Cat. K44801 ..... (Heatsink optional extra)

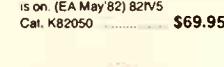
\$34.80

**ELECTRONIC MOUSETRAP**

This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again! (ETI Aug. '84) ETI 1524  
Cat. K55240 ..... \$39.95

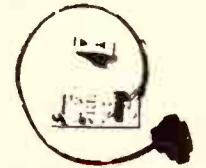
**12/240V 40W INVERTER**

This 12/240V inverter can be used to power up mains appliances rated up to 40W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May '82) 82TT8  
Cat. K82050 ..... \$69.95

**CRYSTAL CONTROLLED TV PATTERN GENERATOR**

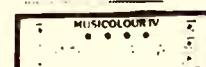
Anyone wishing to obtain the maximum performance from a colour TV receiver needs a good pattern generator. This superb unit which provides five separate patterns: dot, crosshatch, checker board, grey scale and white raster? Note: The RIE kit includes a large ABS type case! (80pgb, EA June '80)

Cat. K8003 ..... \$99.95

**RADIOTELETYPE CONVERTER FOR THE MICROBEE**

Have your computer print the latest news from the International shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to either computers too! (ETI Apr. '83)

Cat. K47330 ..... \$19.95

**MUSICOLOR IV**

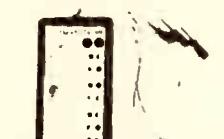
Add excitement to parties, card nights and discos with EA's Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety. (EA Aug. '81) MC8  
Cat. K81080 ..... \$114.95

**MOTORCYCLE INTERCOM**

Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you're on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build! (EA Feb. '84) B4MC2  
Cat. K84020 ..... \$49.95

**MICROBEE SERIAL-TO-PARALLEL INTERFACE**

Most microcomputers worth owning have an RS232 connector, or port, through which serial communications (input/output) is conducted. It's a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel Centronics interface printers. Save money by building this interface. (ETI Jan. '84) ETI 675  
Cat. K46750 ..... \$49.50

**TRANSISTOR TESTER**

Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester, such as the EA Handy Tester. (EA Sept. '83) 83TT8  
Cat. K83080 ..... \$18.95

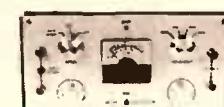
**12/240V 40W INVERTER**

This 12/240V inverter can be used to power up mains appliances rated up to 40W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May '82) 82TT8  
Cat. K82050 ..... \$69.95

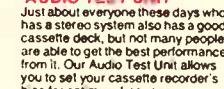
**ELECTRIC FENCE CONTROLLER**

Restore discipline to the farm or allotment with this new electric fence controller. It features higher output power and lower current draw than the previous design for use in rural areas.

(EA Dec. '81) 85e111  
Cat. K85110 ..... \$49.95

**AUDIO TEST UNIT**

Just about everyone these days who has a cassette deck, but not many people are able to get the best performance from it. Our Audio Test Unit allows you to set your cassette recorder's bias for optimum frequency response for a given tape or alternatively, it allows you to find out which tape is best for your recorder. (81AO 10) (EA Oct. '81)  
Cat. K81101 ..... \$59.50

**STEREO ENHANCER**

The best thing about stereo is that it sounds good! The greatest stereo hi-fi system loses its magnificence if the effect is so narrow you can't hear it. This project lets you cheat on being cheap and creates an "enhanced stereo" effect with a small unit which attaches to your amp.

(ETI 1405, ETI, MAR '85)  
Cat. K54050 ..... \$79.50

**VIDEO FADER CIRCUIT**

Add a touch of professionalism to your video movies with this simple Video Fader Circuit. It enables you to fade in/cut to black (and back again) without loss of picture lock (sync) or colour. (EA Jan. '86, 85t10)  
Cat. K86010 ..... Normally \$24.95  
Special, only \$19.95

**LOW BATTERY VOLTAGE INDICATOR**

Knowing your batteries are about to give up you could save many an embarrassing situation. This simple low cost project will give you early warning of power failure, and makes a handy beginner's project. (ETI 260, March '85)

Cat. K42600 ..... \$9.95

**PARALLEL PRINTER SWITCH KIT**

Tired of plug swapping when ever you want to change from one printer to another? This project will do just that. It lets you have two Centronics-type printers connected up permanently, so that you can select one or the other at the flick of a switch. (ETI 666, Feb '85)

Cat. K46660 ..... \$79.95

**CRYSTAL CONTROLLED TV PATTERN GENERATOR**

Anyone wishing to obtain the maximum performance from a colour TV receiver needs a good pattern generator. This superb unit which provides five separate patterns: dot, crosshatch, checker board, grey scale and white raster? Note: The RIE kit includes a large ABS type case! (80pgb, EA June '80)

Cat. K8003 ..... \$99.95

**HUMIDITY METER**

This project can be built to give a readout of relative humidity either on a digital dot-matrix display or a conventional meter. Note: when it can be used with another project as a controller to turn on and off a water mist spray in a hothouse, for example. (ETI May '81) ETI-256 (Includes humidity sensor \$19.50)  
Cat. K42560 ..... \$61.45

**STEREO ENHANCER**

The best thing about stereo is that it sounds good! The greatest stereo hi-fi system loses its magnificence if the effect is so narrow you can't hear it. This project lets you cheat on being cheap and creates an "enhanced stereo" effect with a small unit which attaches to your amp.

(ETI 1405, ETI, MAR '85)  
Cat. K54050 ..... \$79.50

**THE BUSKER PORTABLE AMPLIFIER**

This handy amplifier is completely portable and is capable of operating from either the mains or a 12V battery. Main features include guitar and high-level inputs, an built-in loudspeaker, and bass and treble controls. It's just the thing for busking or for guitar practice. (EA Feb. '85) 85t10  
Cat. K85020 (excluding cabinet) \$99

**SERIES 5000****INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HI-FI SYSTEM!**

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Superb Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,500 sold!

For those who haven't the time and want a quality hi-fi, we also sell the Series 5000 kits assembled and tested.

**POWER AMPLIFIER**

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER

• 1% Metal Film resistors

**SPECIAL, ONLY \$399  
SAVE \$50**

... developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

**SPECIFICATIONS:** 150W RMS into 4 ohms (per channel)

**POWER AMPLIFIER:** 100W RMS into 8 ohms (+ - 55V Supply)

**FREQUENCY RESPONSE:** 8Hz to 20Hz +0 -0.4dB 2.8Hz to 65kHz, +0 -3dB. NOTE: These figures are determined solely by passive filters.

**INPUT SENSITIVITY:** 1V RMS for 100W output

**HUM:** 100 dB below full output (flat, 20kHz bandwidth).

**2nd HARMONIC DISTORTION:** -0.001% at 1 kHz (0.0007% on Prototypes) at 100W output using a + - 55V SUPPLY rated at 4A continues 0.0003% for all frequencies less than 10kHz and all powers below clipping

**TOTAL HARMONIC DISTORTION:** Determined by 2nd Harmonic Distortion (see above)

**INTERMODULATION DISTORTION:** 0.003% at 100W (50Hz and 7kHz mixed 4:1)

**STABILITY:** Unconditional.

Cat. K44771 ..... \$449

**Assembled and tested \$599  
packing and post \$10**

**PREAMPLIFIER**

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER

• 1% Metal Film resistors

**SPECIAL, ONLY \$359  
SAVE \$40**

... believe that dollar for commercial unit available that sounds as

**SPECIFICATIONS:** High Level Input to RIAA equalisation +0 -0.2dB

**DISTORTION:** 1kHz -0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)

**S/N NOISE:** High Level input, master full, with respect to full output (1.2V) -92dB flat -100dB A-weighted, MM input, master full, with respect to full output (1.2V) -71dB flat -75dB A-weighted

**1.2V AND 200mV INPUT SIGNAL:** -71dB flat -75dB A-weighted

Cat. K44791 ..... \$399

**Assembled and tested \$699  
packing and postage \$10**

**THIRD OCTAVE GRAPHIC EQUALIZER**

**SPECIFICATIONS:** 28 Bands

**BANDS:** 28 Bands

**SPECIAL, ONLY \$209  
SAVE \$30**

**SERIES 4000 SPEAKERS**

8 Speakers ..... only \$549

8 Speakers with Crossovers .. \$795

Speaker Cabinet Kit (complete) \$395

(Please specify cabinet to suit 7" or 8" mid range woofer)

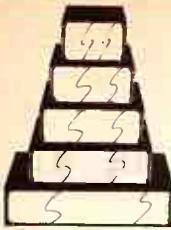
Crossover Kits ..... \$295

Complete kit of parts (speakers, crossovers, screws, innerband boxes) ..... \$1,095

Assembled, tested and ready to hook up to your system ... \$1,295

(Approximately 4 weeks delivery)

Errors and Omissions Excepted



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93/10V	H10466	254 x 76 x 228mm	\$18.95
93/12V	H10468	305 x 76 x 228mm	\$21.50
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Z10152	5mm Yellow	\$0.20



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O10510	MU45 0-5A	\$2.50
O10518	MU45 0-1A	\$2.50
O10520	MU45 0-20V	\$2.50
O10525	MU45 0-20V	\$2.50
O10530	MU52E 0-1A	\$4.50
O10533	MU52E 0-5A	\$4.50
O10535	MU45 VU PMetre	\$4.50
O10538	MU65 0-50μA	\$6.95
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- Easy to remove tip
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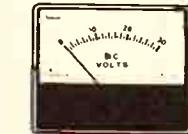
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1.5 metres of specially treated braid for removing solder from PCB's etc Simply place the braid against the solder and apply the soldering iron. The melted solder is drawn up into the braid!

T11320 1.5 metres \$1.95



PANEL METERS GALORE!

We have a great range of panel meters at great prices

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O10504	MU45 0-100μA	\$2.50
O10510	MU45 0-5A	\$2.50
O10518	MU45 0-1A	\$2.50
O10520	MU45 0-20V	\$2.50
O10525	MU45 0-20V	\$2.50
O10530	MU52E 0-1A	\$4.50
O10533	MU52E 0-5A	\$4.50
O10535	MU45 VU PMetre	\$4.50
O10538	MU65 0-50μA	\$6.95
O10540	MU65 0-1mA	\$6.95
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Cat. M16672			

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2860	240V 15V CT 250mA	10+	\$5.50
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# DEFINITELY NOT YOUR AVERAGE COMPUTER

## the Applix 1616 power, price and flexibility

ALL AUSTRALIAN DESIGN, MANUFACTURE AND SUPPORT

"The highest performance computer design ever published"

ETI Magazine December 1986

### MOVE UP TO THE 68000

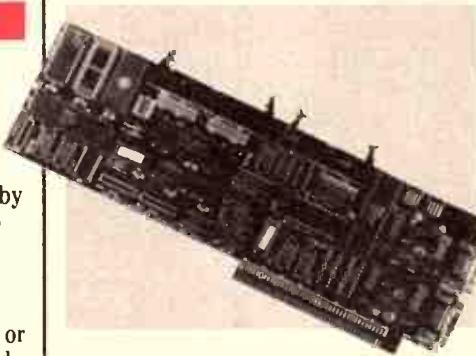
If you take your computing seriously Applix is for you!

The Applix 1616 microcomputer.

The 1616 gives you the power of the Motorola 68000 processor, supported by a hardware design that lends itself to all purposes — industrial control, educational applications or serious programming.

The 1616 is available fully assembled or in "kit" form; the 1616 can be tailored to suit your level of computing needs. Just build up partly for programmable controllers, or all the way for a powerful, flexible personal computer.

After building your system, you have total control using the powerful ROM Resident Operating System, abundant I/O and unlimited expansion capabilities.



### THE OPERATING SYSTEM

1616/OS offers features such as

- I/O redirection.
- File management.
- Text editing.
- 68010 support.
- Over 100 documented internal system calls.
- Monitor functions.
- Installable drivers.
- ROM resident.
- Windows and graphics and more . . .

1616/OS is a very powerful and flexible operating system and takes full advantage of the 1616 hardware.

### ASSEMBLY LANGUAGE

Each 1616 kit is supplied with a copy of SSASM — a 68000 macro assembler. Full documentation and system macro library supplied.

### 32 BIT FORTH

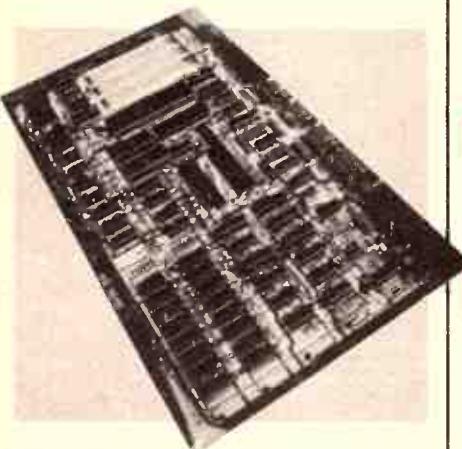
SSFORTH is a complete implementation of the FORTH language. SSFORTH runs under 1616/OS, rather than the normal FORTH screen system. It is fast, has full access to 1616/OS (including EDIT) supports 32 bit integers, float and interrupt driven words. Full source code supplied!

### BASIC INTERPRETER

SSBASIC features 32 bit integer numbers, floating point, variables, multi dimensional arrays and character strings. Access to 1616/OS, graphics and assembler from within BASIC.

### POWER AND FUNCTION

- Motorola 68000 (16/32 bit) processor.
- 512K bytes RAM as standard.
- 64K ROM expandable.
- On-board high speed cassette interface.
- Optional disk/co-processor card.
- Four 80 pin expansion slots.
- Dual serial ports.
- Centronics compatible parallel printer port.
- General purpose digital to analogue I/O port.
- Analogue two-button joystick port.
- Graphics: 320H x 200V 16 colours, 640H x 200V any four of 16 colours.
- Standard RGBI interface or composite video.



### "C" COMPILER/CROSS COMPILER

All Australian. The Hi Tech "C" Compiler running under 1616/OS comes with macro assembler, linker and librarian.

A cross-compiler running under MS-DOS and producing code for the 68000 is also available.

### DISK/CO-PROCESSOR CARD

Truly a computer in its own right, the 1616 Disk Controller Card adds another dimension to the 1616 system.

Using an 8Mhz Z80H as a co-processor, tasks such as getting data to and from the disk can be off-loaded from the 68000, leaving it to do what it does best!

#### SDCC Technical Features:

- On board Z80H CPU (running at 8Mhz).
- 8K to 32K of ROM.
- 8K to 64K of static RAM.
- WD1772 disk controller chip.
- Supports both 3.5" and 5.25" DS 80 track floppy drives.

#### Options:

- SCSI hard disk interface using the NCR5380.
- Two additional serial ports (under Z80 control) using the Z8530 SCC.
- CP/M support coming!



### JOIN THE HUNDREDS OF 1616 USERS

Mini kits start at \$239, basic kits from \$449, keyboard \$139, power supplies from \$69, disk controller kit from \$249.

If you require further information, pricing and updates, user groups information.

### CONTACT APPLIX TODAY

Applix Pty Limited

324 King Georges Road, Beverly Hills  
P.O. Box 103, Beverly Hills  
N.S.W. 2209, Australia  
Telephone: (02) 758 2688

**About 16L8 PALS:**

The PALS which are used on the 1616's main board are 16R8's. The 'R' stands for registered, which means that these PALS have latched outputs, so that changes in the registered PAL's output state can only occur on the rising edge of the PAL's clock pin. A 16L8 PAL, however, is an array of simple logic gates whose output is immediately available.

A registered PAL is used in a situation where its outputs have to be synchronised or where memory about the PAL's previous states is needed. The non-registered PAL (16R8) is used simply to detect certain combinations of its input pins, which make it ideal for address decoding applications.

tions and ROM reads have a wait state. RAM reads and writes proceed at full speed.

The signals 'MAP' and 'BANK' which go into the Z80 PAL are provided for selecting a different memory map and for overlaying memory banks. The Z80's memory map is as follows:

0000H-5FFF H:ROM

6000H-7FFF Common RAM bank

H:

8000H-FFFF Switching RAM bank

H:

So that the Z80 may access all of the possible 64 kbytes of RAM whilst still reading from the ROM the RAM is split into two 32k halves. Only one of these halves may appear in the top 32k of address space at a time. When the 'BANK' signal is low the data in RAM0 (IC1) is accessible in this address range; when 'BANK' is high the data in RAM1 (IC2) is accessible. If 8 kbyte RAM chips are loaded in the board then only the first 8 kbytes of this 32k address space are useful. The first 8 kbytes of RAM is always accessible in the common bank. The 'MAP' signal is not used at present.

**The Z80's I/O port address map**

Address	Name	Function
00H	PORT	Read only input port.
08H	LATCH	Read/write disk select latch
10H	ZINTS	Write: interrupt the 1616.
10H	ZCLRIINT	Read: clear pending Z80 interrupt.
18H	SDATA	Read/write 1616 communications port.
20H	SCSIBASE	SCSI controller base address
40H	FDCBASE	Floppy disk controller base address.
60H	SCCBASE	Serial communications controller base address.

The input port enables a Z80 program to determine the level of the following signals:

Bit 0: The 'SCOMMAND' signal is set when the byte from the 1616 which is currently held in the receive latch is a command, meaning that

the MC68000 put the data there by writing to its 'SCOMMAND' output port.

- Bit 1: The 'ZRXRDY' signal is high if there is a data or command byte from the MC68000 within the receive register.
- Bit 2: The 'ZTXRDY' signal is high if the 1616 has read the previous byte out of the transmit register.
- Bit 3: This signal determines whether the Z80 is to enter its normal operating mode or to execute its diagnostic test mode.

**The floppy disk interface:**

The disk controller uses Western Digital's WD1772 all digital floppy disk controller IC. A floppy disk controller handles the low-level control of the disk drive: synchronisation of new data with that which is already on the disk, checking for errors in read data, searching for the correct disk sector, issuing stepping pulses to move the disk drive's read-write head, etc. This leaves the Z80 with the task of issuing commands to the controller, transferring data to or from it and handling errors which the controller detects.

We have seen many generations of floppy disk controllers over the years; it is only this latest generation which have avoided the need for setting up magic frequencies with variable capacitors, devising ingenious data separators which occasionally worked, etc. The all-digital design of the WD1772 eliminates these problems. The chip still has a few problems which can keep a programmer quiet for a few days, however . . .

The disk select latch (IC16) contains signals which are set up by the Z80 and which are used for selecting between multiple drives (DS0 and DS1), ejecting the disk, selecting the desired side of the disk, etc.

**SCSI hard disk interface**

The SCSI (Small Computer Systems Interface) standard is a specification for communicating data over a high speed 50 wire bus which appears quite frequently in medium performance microcomputer systems. Hard disk drives are available which have an SCSI bus interface; host commands, data and error information are

passed between the controlling computer and the disk drive electronics over this bus.

The NCR 5380 IC is designed for interfacing microprocessors to the SCSI bus. It incorporates line drivers and receivers and so yields a single-chip solution to the 1616's need for a hard disk interface.

The SCSI interface and connection of the SSDCC to hard disks will be covered in full in a future article.

**Serial ports**

The design of the SSDCC allows the implementation of two serial ports. These were made to be identical to those on the 1616's main board: the Z8530, the strapping blocks, the RS-232 drivers and receivers and the connector pinouts all match those on the 1616. For the record, we had serial ports on the SSDCC prototype to help with debugging and to allow downloading of code to the Z80. After some head scratching and shoulder shrugging it was decided that the SSDCC deserved its own dual serial I/O ports.

Think of this. In between the MC68000 and the serial ports on the SSDCC is a Z80H and 64K of RAM. This allows for some pretty powerful serial operations. For starters, what about a transparent (to the MC68000) serial protocol convertor, or an intelligent network server . . .

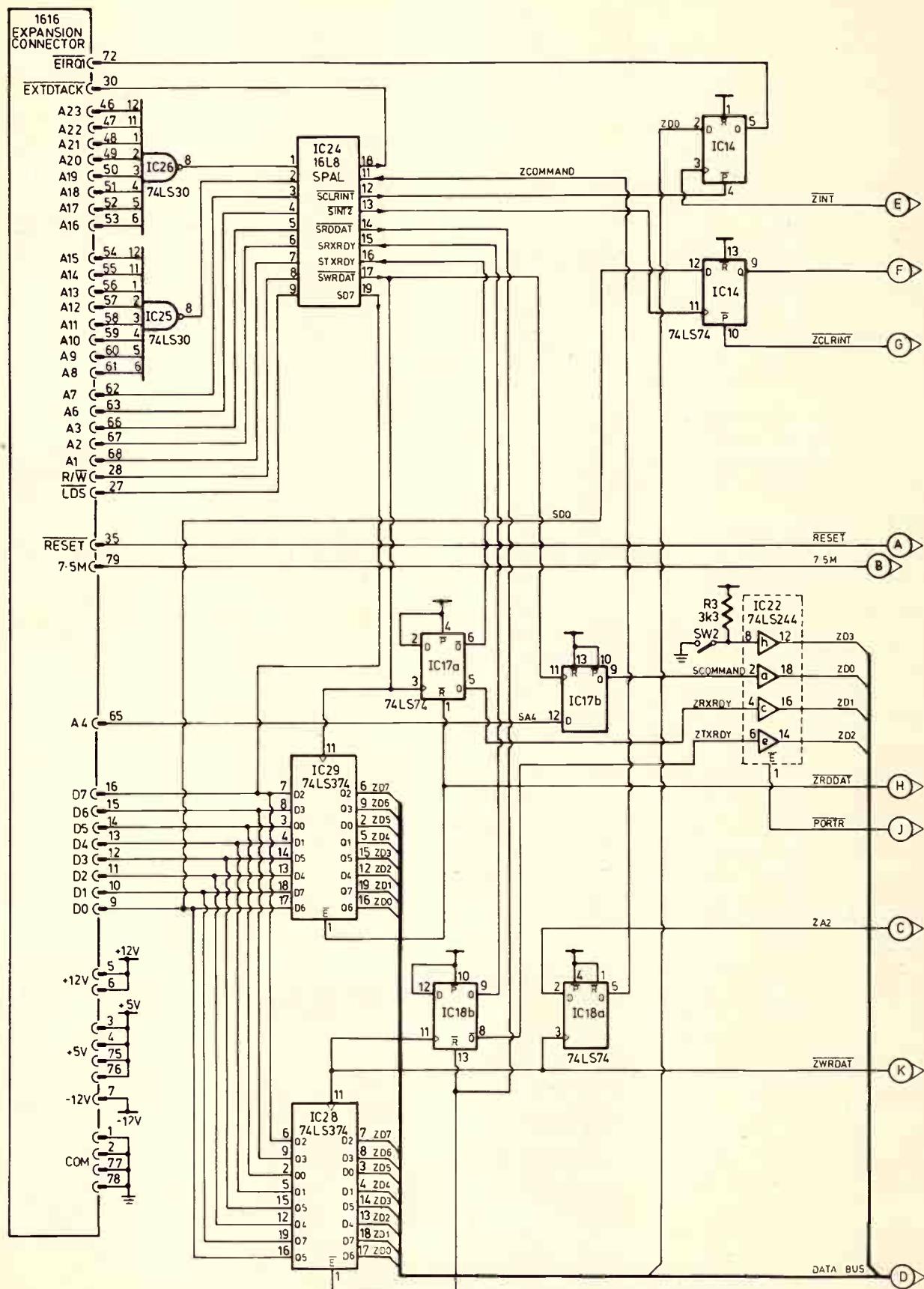
**1616 interface:**

The other 16L8 PAL on the SSDCC is referred to as the 1616 PAL (IC24, SPAL). It handles the 1616 address decoding, /DTACK signal generation, status port multiplexing and handshaking control.

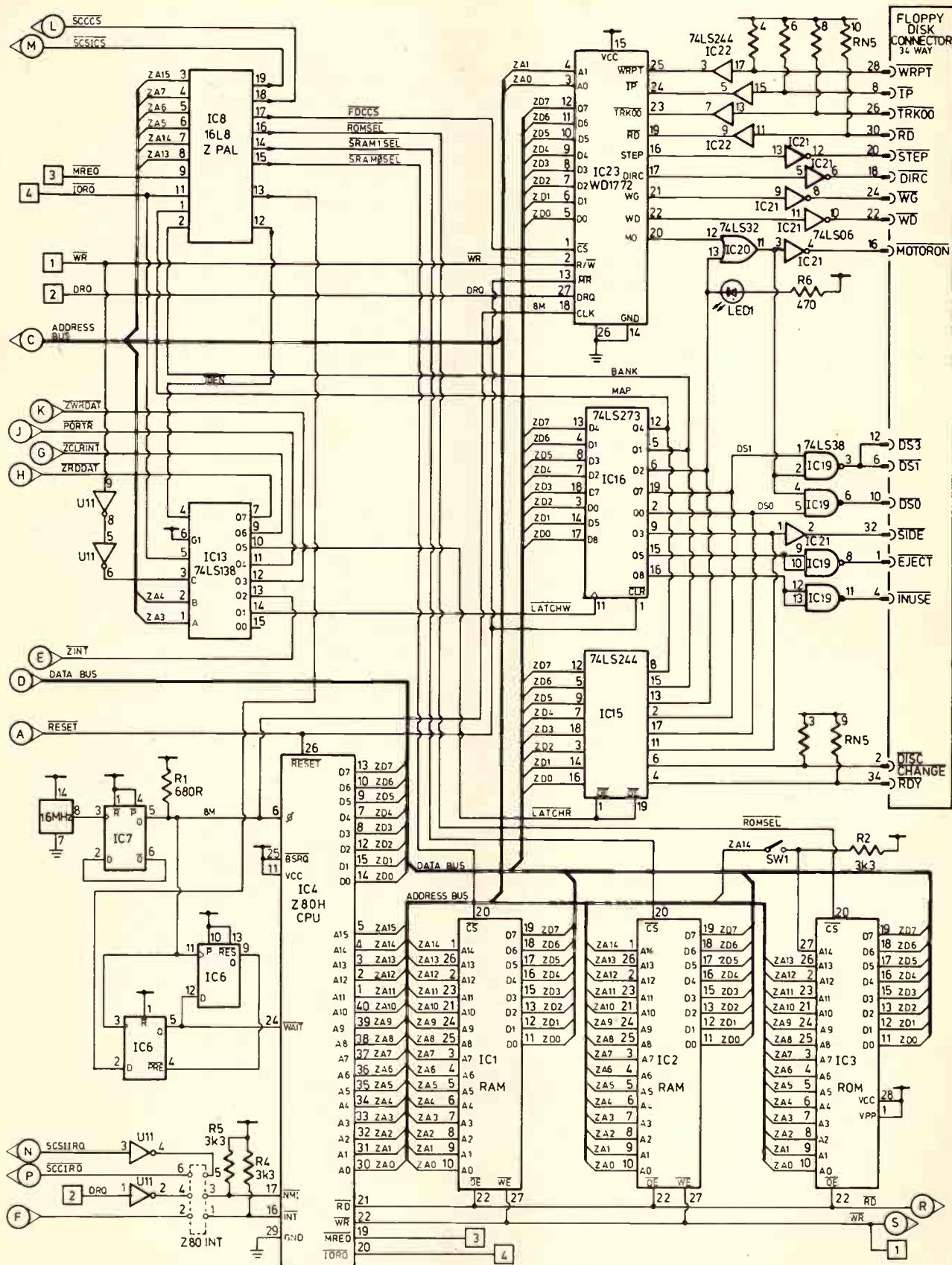
With this PAL we are using the PAL's ability to turn its outputs into a high-impedance (or floating, or tri-state) condition under certain input signal combinations. The /DTACK output pin is normally floating; it is actively driven only during MC68000 accesses. Similarly the D7 output pin directly drives the 1616 data bus and is floated until the MC68000 reads the SRZRDY, STXRDY or ZCOMMAND signals. When this happens the PAL routes the selected signal onto the D7 output and enables this pin to drive the bus.

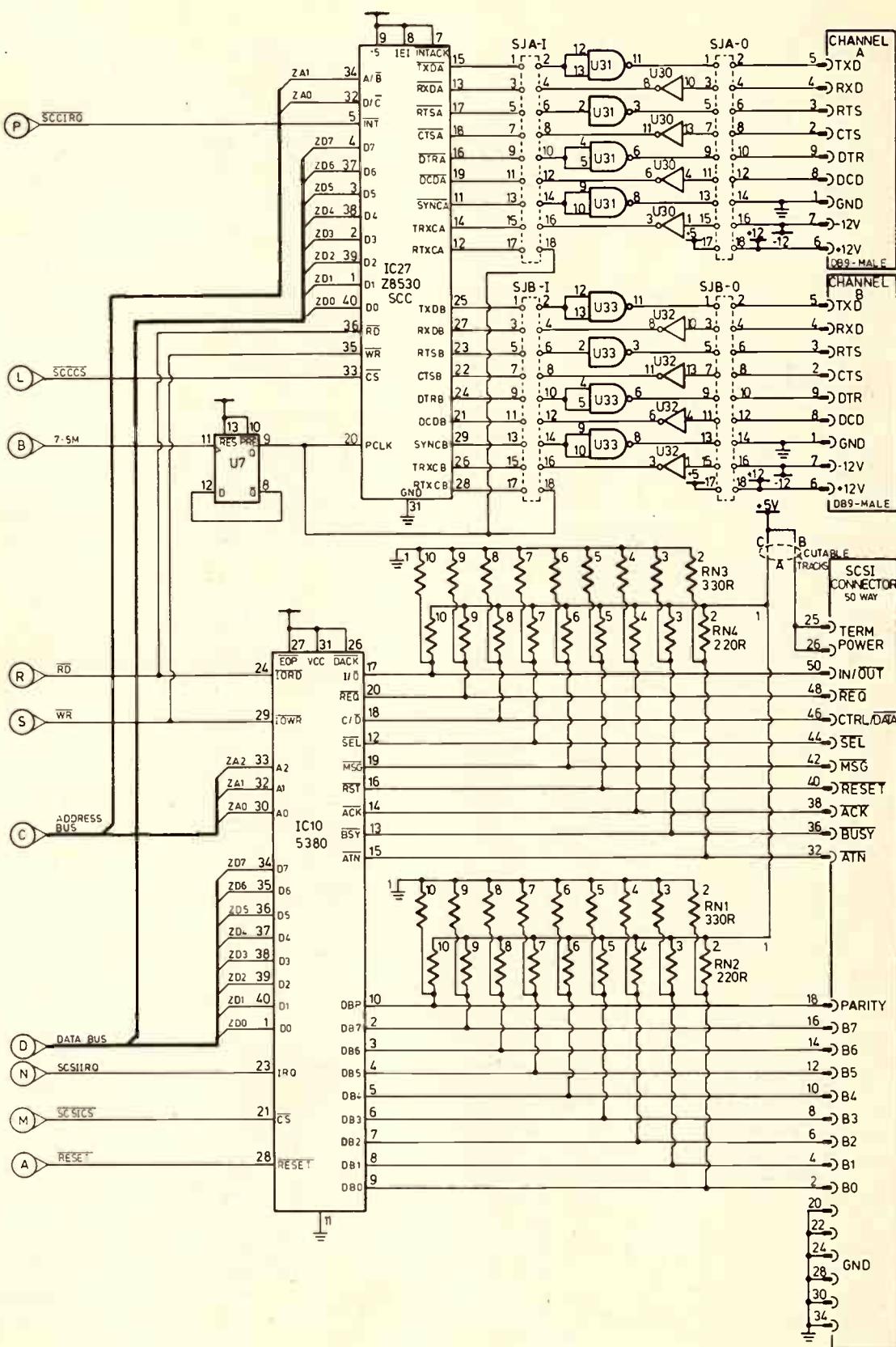
The 1616's MC68000 can read and write various registers within the controller at fixed addresses:

Address	Read/write R/W	Name	Function
\$FFFFC1			Read: Data from Z80. Write: Data to Z80.
\$FFFFC3	Read	SCLRIINT	Clear 1616 interrupt.
\$FFFFC3	Write	SINTZ	Interrupt Z80.
\$FFFFC9	Read	SRXRDY	Bit 7 set if receive latch full.
\$FFFFCB	Read	STXRDY	Bit 7 set if the contents of the receive latch is a command.
\$FFFFD1	Write	SCOMMAND	Write data to the data latch, set SCOMMAND bit.



# Disc Drive





## Power and ground connections

Chip No.	Device Name	+5V	Gnd.	+12V	-12V
IC1	6262/62256	28		14	
IC2	6264/62256	28		14	
IC3	2764/27128/27256	21,1		14	
IC4	280H	11,25		29	
IC5	SPARE				
IC6	74LS74	14,1,10,13		7	
IC7	74LS74	14,1,4,10,13		7	
IC8	ZPAL 16L8	20		10	
IC9	SPARE				
IC10	5380	27,26,31		11	
IC11	74LS04	14		7	
IC12	SPARE				
IC13	74LS138	16,6		8	
IC14	74LS74	14,1,13		7	
IC15	74LS244	20		10	
IC16	74LS273	20		10	
IC17	74LS74	14,2,4,10,13		7	
IC18	74LS74	14,1,4,10,12		7	
IC19	74LS38	14		7	
IC20	74LS32	14		7	
IC21	74LS06	14		7	
IC22	74LS244	20		10,19	
IC23	WD1772	15		14,26	
IC24	SPAL 16L8	20		10	
IC25	74LS30	14		7	
IC26	74LS30	14		7	
IC27	28530	7,8		31	
IC28	74LS374	20		10	
IC29	74LS374	20		10	
IC30	1489	14		7	
IC31	1488		7	14	1
IC32	1489	14		7	
IC33	1488		7	14	1

The communication between the two processors is quite simple. If the 1616 wishes to transmit a byte to the Z80 it waits for STXRDY to go true and then writes the byte to the ZDATA port. The action of writing to ZDATA causes STXRDY to go false until the Z80 has read the new byte.

Similarly when the Z80 wishes to transmit to the 1616 it waits for ZTXRDY to go true, indicating that there is valid data in the receive port latch. When the 1616 reads the data SRXDY goes false and the Z80's handshake signal ZTXRDY goes false. In fact ZTXRDY is the complement of SRXDY and ZRXRDY is the complement of STXRDY.

For software reasons it is desirable that the transmitting processor can add a flag to a transmitted byte to indicate whether it is a data byte or a command byte; a command byte is one which initiates a whole transaction such as reading a disk sector. Being able to flag commands simplifies the problem of synchronising each processor's software.

The command bits are address triggered; when the 1616 writes to the data port latch the MC68000 address line A4 is latched in IC17 as the SCOMMAND signal. When the Z80 sees that data is available (via ZRXRDY) it inspects the SCOMMAND signal. If this is high then the Z80 knows that the 1616's A4 signal was high when the data was written; the 1616's command port is at an address which has A4 high whereas its data port's

address has A4 low, so the Z80 can differentiate between command bytes and data bytes.

### Interrupts:

There is capability for the Z80 and the 1616 to interrupt each other. Interrupts are not used by the software in the SSDCC at present.

The interrupt mechanisms are as follows: Z80 interrupted by 1616: The 1616 writes a byte with a zero in its least significant bit (LSB) to the SINTZ port; this causes pin 9 of U14 to go low. This signal should be connected to the Z80's /INT or /NMI signal on the interrupt strapping block. When the Z80 accepts the interrupt it should clear the interrupt signal by reading from its ZCLINT address.

1616 interrupted by Z80: The Z80 writes a byte with zero in the LSB to the ZINTS port. This sends pin 5 of IC14 low, holding the 1616 bus /EIRQ1 signal low. The /EIRQ1 signal must be connected to one of the 1616's interrupt pins on the 'INT level' strapping block on the 1616 main board. When the 1616 interrupt is taken the 1616 must clear the interrupt signal from within the interrupt service routine by reading from the SCLINT port.

### Buying the 1616 and SSDCC:

The 1616 computer and SSDCC computer is available directly from its designers, Applix. Pricing is as follows:

1616 MINI KIT: The Mini Kit costs \$239 and includes the 1616 printed circuit board, EPROMs, PALs, 30MHz oscillator, MC68000 CPU, SSASM and set of four manuals. This kit would suit people who can source their own components and are familiar with a project of this type.

1616 BASIC KIT: The Basic Kit costs \$449 and includes all the components, connectors plus the contents of the Mini Kit. This kit would appeal to most people and works out significantly cheaper than purchasing a Mini Kit and sourcing the components commercially. It is important to note that this kit does not include the necessary components to implement the serial, centronics and user ports, as most people would regard these as optional. It also does not include IC sockets.

1616 I/O KIT: The I/O Kit costs \$59.95 and includes all the necessary components to implement the serial, centronics and user ports.

1616 IC SOCKET KIT: A complete set of high quality IC sockets for the 1616 motherboard. \$39.95.

KEYBOARD: This high quality, IBM AT style, XT keyboard costs \$139.

POWER SUPPLY: This 'Apple type' switching power supply costs \$69. A heavy duty supply is also available.

## Disc Drive

SSDCC KIT: The SSDCC Kit costs \$249 and includes the SSDCC printed circuit board, connectors, and components. It does not include IC sockets, 1616 motherboard expansion socket(s). SCSI hard disk or serial port options.

SSDCC IC SOCKET KIT: A complete set of high quality IC sockets for the SSDCC. \$19.95.

DISK DRIVE: 3.5" 80 track, double sided disk drive. Includes free cables when purchased the SSDCC. \$239.

SSBASIC: A powerful BASIC interpreter for the 1616 costs \$69. It is available on cassette or disk.

FULLY BUILT: Fully assembled and tested 1616 systems and versions of all 1616 kits are available. Contact Applix direct for more details.

Coming soon: Hi-Tech C compiler and cross compiler, 32 bit FORTH, 1616 box, User groups and more.

*Signals beginning with a '1' (eg /DTACK) are active low. A signal is referred to as being 'asserted' when it is in its active state. For an active low signal this is the low state. A signal in its inactive state is referred to as being 'negated'.*

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How many movies have ever been made solely on the subject of electronics. In fact how many movies concentrate on technology per se at all. Not many and the reason for this may lie in the intelligence of the scriptwriters. The following gems were first published in the "Son of Golden Turkey awards" compiled by Harry and Michael Medved.

### SHE DEMONS (1958)

Our first example provides a fascinating lesson in geology.

**Mad Scientist** (Rudolph Anders): It was during the course of our experimentation that we quite accidentally discovered a potential power of incomparable magnitude. The source of our radiation pointed to hot, volcanic matter.

**Explorer** (Tod Griffin): You mean lava?

**Scientist**: Yes, precisely. The largest natural source on this earth.

**Explorer**: Why, of course! Whereas oil and coal and iron are known to exist only on the extreme crust of the earth, the entire center is a mass of boiling rock. If someone could discover a use for this lava, why, they could have a constant supply of ready made power from now until kingdom come!

**Scientist**: We are electronically extracting the heat from the center of the earth and converting it into useful power.

**Explorer**: Then what you're saying is, you've accomplished perpetual motion!

**Scientist**: That is quite correct. You see, although I have succeeded in completing the most sought after dream of mankind since time immemorial, I have to keep it a close secret between myself and my creatures. I am master of my own Isle!

### PLAN NINE FROM OUTER SPACE (1959)

In our second example of Hollywoodian Science, a heroic Jet Pilot explains American real politic to Eros the alien.

**Colonel Edwards** (Tom Keene): Why is it so important that you want to contact the governments of our earth?

**Eros the Alien** (Dudley Manlove): Because of death. Because all of you of Earth are idiots!

**Heroic Jet Pilot** (Gregory Walcott): Now you just hold on, buster!

**Eros**: No — you hold on! . . . Your scientists stumbled upon the atom bomb — split the atom! Then the hydrogen bomb, where you actually explode the air itself. Now you bring the total destruction of the entire universe, served by our sun. The only explosion left is the solaronite.



Man with Solaronite — notice the effect on his trouser belt.

**Colonel**: Why, there's no such thing!

**Eros**: Perhaps to you, but we've known it for centuries. Your scientists will stumble upon it as they have all the others. But the juvenile minds which you possess will not comprehend its strength until it's too late.

**Colonel**: You're way above our heads!

**Eros**: The solaronite is a way to explode the actual particles of sunlight!

**Colonel**: Why, that's impossible . . . a particle of sunlight can't even be seen or

measured!

**Eros**: Can you see or measure an atom? Yet you can explode one! A ray of sunlight is made up of many atoms.

**Jet Pilot**: So if we do develop this solaronite bomb — we'd be even a stronger nation than now!

**Eros**: Stronger? You see! You're stupid minds! Stupid! Stupid!

**Jet Pilot**: That's all I'm taking from you! (He punches him.)

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- South Australian residents need not purchase a subscription to enter, but may enter once only by submitting their name and address on a 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 to cash

4 The judges decision is final, no correspondence will be entered into

5 Description of the competition and instructions on how to enter and conditions of entry form part of the competition conditions

6 The competition commences on September 1 and closes on last mail December 31st

The draw will take place in Sydney on January 18th, 1988, and the winner will be notified by telephone and letter. The winner will also be announced in the Australian

on January 25th and a later issue of this magazine

7 The prize is A 1987 Daihatsu Rocky Long Wheel Base EX model registered and pre-delivered ex Sydney Head Office of Daihatsu Australia

8 The winner will collect the vehicle from the capital city of the state they live in if they do not wish to travel to Sydney for the prize

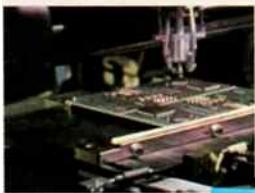
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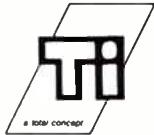


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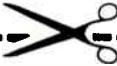
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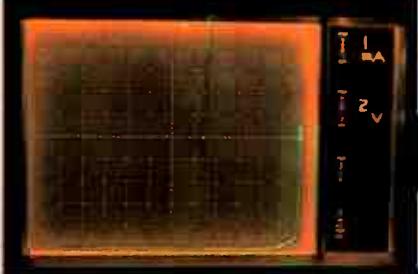
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