

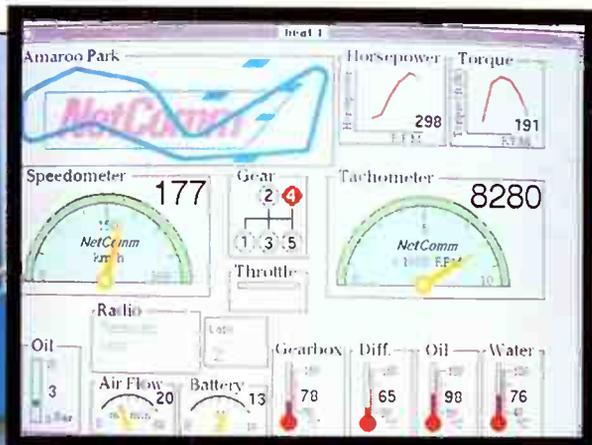


NDD

ETI

ELECTRONICS · TECHNOLOGY INNOVATION

ALL THUMBS IN SPACE: ZERO GRAVITY AND THE HUMAN BODY



DEADLY DATA:

HOW THE VINCENNES GOT IT ALL WRONG

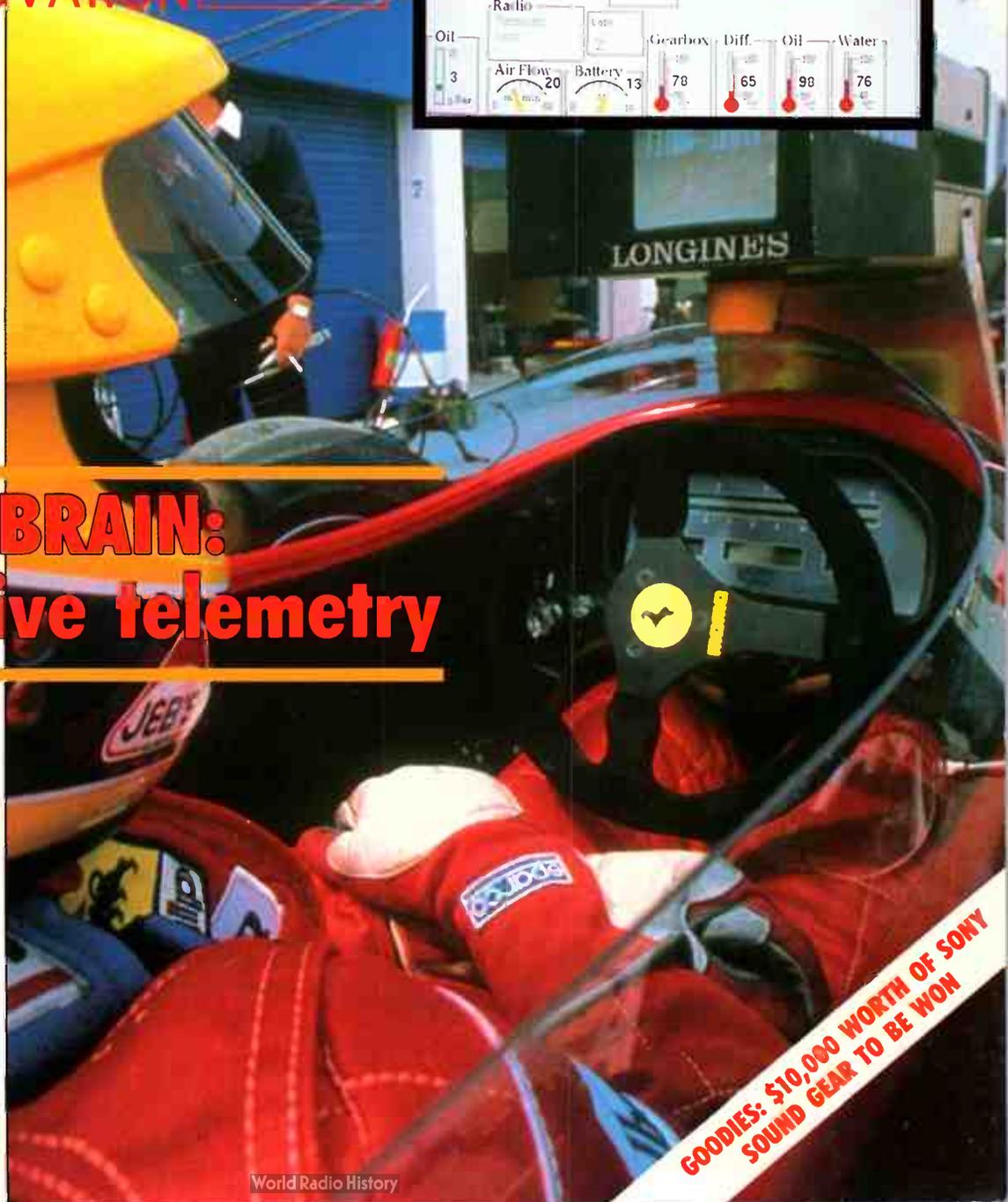
BUDGET BOARD:

THE \$500 PC to AT CONVERSION

PITLANE BRAIN: Automotive telemetry



FLAT'N'FULL: WALL SPEAKER BREAKTHROUGH



**GOODIES: \$10,000 WORTH OF SONY
SOUND GEAR TO BE WON**

Yes Yes Yes Yes Yes

Introducing the "Yes" Service for Passive Components

Yes Yes Yes Yes Yes

Yes Yes Yes Yes Yes

Yes Yes Yes



In today's competitive production world, engineers need to have supply at their finger tips. The "just in time management" philosophy is proving to be a commercial reality. Philips are prepared.

When you call your component supplier you **need** some positive answers.

Philips Components promises to

deliver more yes's to your questions because they are leaders in:

- Quality
- Product Range and Stock availability

Not just platitudes but a strong commercial reality as a result of massive research investment, modern systems for efficient production and stock control and that absolutely vital element... top calibre, friendly people.

Apart from being the largest supplier of electronic components in the world, Philips aim to be the friendliest.

If you have a problem right now call the Philips "Componentline" and hear that magic phrase... "Yes, we can do it".

Sydney 439 3322 Melbourne 235 3677 Adelaide 268 6701 Perth 277 4199 Brisbane 844 0191.

United Nations 817

Philips Components



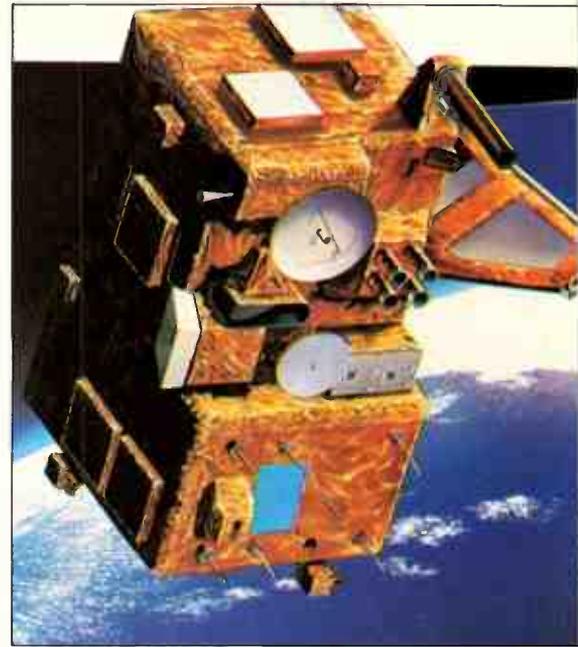
PHILIPS

INNOVATION

The Pitlane Brain Telemetry on wheels	24
Man in Space Dexterity at zero G	34
SMPTE show Video highlights	50

TECHNOLOGY

Gulf Disaster Computers get it wrong	28
First light from MOS-1 Remote sensing	42
Greek Radio Athens calling	47



Page 42

SOUND INSIGHTS

Sound products	2
Amstrad Mixing Desk	8
Melbourne Audio-Video Show	12
Jamo Speakers	16
Reviews	20
Sound industry news	22



Page S1 16

ELECTRONICS

ETI-1423 Stereo Encoder	93
ETI-1613 Baby AT part 3	100
Spectrum Analyser testing	108
ETI-1418 Mixer part 3	112
Feed Forward	124

DEPARTMENTS

Editorial	5
News Digest	6
Texas Instruments Contest	8
Kilohertz Comment	14
Finance	16
Videotex News	20
Politics	22
Communications News	40
Product News	80
Semiconductor watch	88
Dregs	128



Page 50

Page 100



When brief is not the case... keep an Organiser II handy



When you're out scouting for business you've got to be prepared. Everyone wants answers and they want them now! Price lists, schedules, inventory, facts and figures, names and addresses. Carrying hard copy data stuffed into a brief case used to be your only option. A slow, heavy, clumsy option.

Now, there's the PSION ORGANISER II computer, a handheld power of information storage which clearly displays the confidence that you know what you are doing. Packed with up to 320K of memory the ORGANISER II easily carries vital office intelligence into the field. User programs and databases can be copied and stored permanently on plug-in Datapaks, and the Comms-Link, with 32K of communications software built-in, enables connection to modem, printer or desk-bound PC allowing the simple transfer of data to and from the ORGANISER II.

When you need to know...keep the ORGANISER II handy. *Datapak Options: PSION Developer, Finance Pack, Spreadsheet Pack, Concise Oxford™ spelling checker, Maths Pack, 16K, 32K, 64K, 128K Datapaks*

Eastern Micro Electronics, 45-47 Tope Street, South Melbourne, 3205. Fax (03) 690 9562 Phone (03) 699 3088.

READER INFO No. 40



JON FAIRALL

Education — why is it so?

For some strange reason, education seems to be dominating the headlines at the moment. A number of reports on the health or otherwise of the university system have been completed in the past twelve months. Of particular interest to readers of this magazine, a report has just been released on Engineering education. (p 22) At a different level, the newly elected government of Mr Nick Greiner in New South Wales has been busy putting a new broom through the school system in that state. Inevitably, there will be fall out in the rest of Australia.

The motivation for all this seems to be based on a recognition that the most important prerequisite for a modern developed economy is a modern developed individual. As concern mounts that the former is slipping from our grasp, the training of the latter increasingly occupies our thoughts.

This is something of a motherhood sentiment. More contentious is the means by which one actually achieves it. In practice, it seems to mean that education needs to be measured directly in economic terms. So, we are short of technocrats; ergo: stop the film appreciation, give the kids more maths. Japan is an important trading partner: drop the French lessons, teach the kids Japanese.

One needs to tread carefully. There is no doubt that the state of technical literacy in this country is profoundly depressing, and no doubt too, that our dismal economic performance over the past twenty or so years relates directly to our dismal educational achievements. But it's not clear that ramming

'... the state of technical literacy in this country is profoundly depressing.'

"relevant" subjects down our kids' throat is the right way to cure it.

Even if we do insist that there be more maths and physics taught in school, we have still to decide how it should be taught. Educators, particularly in the technical subjects, seem obsessed with the logic of their subject. So, before you can do any interesting chemistry, you have to balance chemical equations; before you can build a filter, you need to understand imaginary numbers. Unfortunately, the best way to teach something involves exactly the inverse process. We learn things because something catches our interest. Show the kids how to make a big bang, then leave them to find out why. Observe the effect of filters, then look at the maths behind them. You start at the end, then work back. Professor Sumner Miller long ago recognised that "Why is it so" is the key to effective education.

Curricula need to be rewritten to recognise these facts. If children stop doing maths and physics at high school it may be that most children find maths largely irrelevant and physics is dead boring. If girls stop doing it before boys, that might be only because the girls have more imagination. If first year engineers drop out at prodigious rates, it might be because a year of maths and physics is not what excites a tyro engineer.

Trying to make these subject more compulsory will not result in more technocrats. It will just convince more of the population that science is boring. The challenge for educators is to explain to children that the 'hard subjects' are also the most interesting. Once the kids accept that, a scientifically literate population will follow automatically.

EDITOR

Jon Fairall B.A.

PRODUCTION EDITOR

Henk H. von Zuilekom

EDITORIAL STAFF

Terry Kee B.Sc. (Hons.), M. Phil.

DRAUGHTING

Kerry Benyon

DESIGNER

Clive Davis

ART STAFF

Roy Eirth

PRODUCTION

Mol Burgess

NATIONAL ADVERTISING MANAGER

Mork Lewis

ADVERTISING PRODUCTION

Brett Baker

SECRETARY

Nino Stevens

ACOUSTICAL CONSULTANTS

Louis Chollis and Associates

PUBLISHER

Michael Hannon

MANAGING EDITOR

Brod 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: Kim Bucknole, 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, 221o Bay Street, Port Melbourne, Vic 3207. Phone: (03) 646-3111. Facsimile: (03) 646-5494. Telex: AA34340 FEDPUB.

Queensland: John Saunders, The Federal Publishing Company, 26 Chermiside Street, Newstead, Qld. Ph: (07) 854-1119. Facsimile: (07) 252-3692.

South Australia and Northern Territory: Michael Mullins, C/- Federal Publishing, 98 Jervois Street, Torrensville, SA 5031. Ph: (08) 352-7937

Western Australia: Des McDonald, 48 Clieveden Street, North Perth 6006 WA. Phone: (09) 444-4426.

New Zealand: Rugby Press, 3rd Floor, Communications House, 12 Heather Street, Parnell, Auckland. Phone: 796-648. Telex: NZ63112, "Spartby".

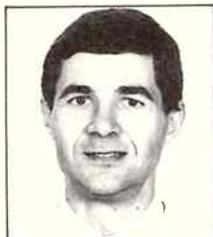
Britain: Peter Holloway, C/- John Fairfax & Sons, 12 Norwich Street, London EC4A 1BH. Phone: 353-9321.

ELECTRONICS TODAY INTERNATIONAL is published and distributed monthly by The Federal Publishing Company Pty Limited, 180 Bourke Road, Alexandria, NSW 2015, under licence from Double Bay Newspapers Pty Limited, General Newspapers Pty Limited and Fairfax Community Newspapers Pty Limited. Printed by Hannonprint, Sydney. Distributed by Newsagents Direct Distribution, Alexandria, NSW 2015.

*Maximum and recommended Australian retail price only. Registered by Australlion Post. Publication No. NBP0407. ISSN No. 0013-5216. COPYRIGHT© 1985, Double Bay Newspapers Pty Limited, General Newspapers Pty Limited and Fairfax Community Newspapers Pty Limited (trading as "Eastern Suburbs Newspapers").



Industry News



Frederic Mortreux

Following the acquisition of the Thomson-LGT and Thomson-GTE agencies, Quantum Pacific Pty Ltd has announced the appointment of Frederic Mortreux as Sales Engineer.

Mr Mortreux's unique area of expertise covers sales, installation and service of microwave links for the broadcast industry, and his background includes tracking radars in the Air Force.

★ ★ ★



John Button

Senator John Button, Minister for Industry, Technology and Commerce, has recently opened the new Canberra offices of Computer Sciences of Australia.

The offices are located at the recently established Fern Hill Technology Park in Bruce, close to the Canberra College of Advanced Education.

FRAM makes it big

Ferro-random access memory (FRAM) has at last come of age. The company that makes the material, announced in June that it had signed a deal with ITT, one of the biggest electronic companies in the US, giving ITT access to the FRAM technology.

FRAM first surfaced in the late sixties as the brainchild of GM researchers interested in the fact that certain substances could be made to hold their electrical state irrespective of the applied voltage. Research languished however, until a Queensland company called Newtech, looking for investment opportunities in the US, happened on it, and bought a 72 per cent share in the technology.

During the early 1980s, Newtech executives made many a foray into the Southern states, where the electronic press largely dismissed their claims as so much vapourware. And indeed, in the early years, many claims were made for FRAM that



Ross Lyndon-James

simply were not born out by experience. Although an experimental chip was in existence at least three years ago, numerous problems were experienced in trying to turn a prototype into a manufacturable item.

Now it appears that these problems have been overcome, and Ramtron shareholders appear to be sitting on a small fortune. According to Dun and Bradstreet, a market research group in the US, estimates of the FRAM market should be worth \$430m by 1992. This appears

conservative given the value of the entire memory market — \$6.6b.

There is reason for the optimism. FRAM can be accessed like RAM, but is totally non-volatile. It operates from a single five volt rail, is impervious to radiation and requires no refresh cycles in operation. It could be used to replace EPROMs, EEPROMS, and will no doubt have significant implications for the Gate Array and Custom chip market place.

Ramtron expects the agreement with ITT to be the first of a series of agreements that will take the company into the centre of the mainstream chip supply market. Much of the advantage of this will flow back into the Australian marketplace, according to Ramtron International chief executive Ross Lyndon-James. A \$10m joint venture with the Victorian government is already in place to enable a company called Ramax to manufacture FRAMs in Australia.

\$2 million Cue-Bic agreement

AWA Computers has entered into an agreement with Apscore International to market Cue-Bic software with its full range of business computer systems estimated to be worth \$2 million over 12 months.

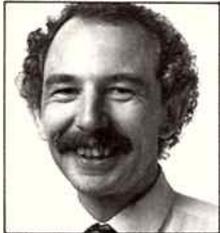
Cue-Bic is an operating environment loaded with advance features that include security, office automation and batch processing.

Further information from: John Winters, Apscore ☎ (02) 953 8411 or Frank Broos, AWA Computers (02) 922 3300.



Mike Piggott from Cue-Bic, Frank Broos from AWA and John Winters from Apscore.

Industry News



David Jacob

Scan Audio announces the following appointments within the company:

David Jacobs, National Sales Manager.

Ian Parnell, NSW Sales Manager.

Ralph Grundl, Vic Sales Representative.

Mr Jacobs has spent the past 9 years with Sony Australia as Major Accounts Supervisor.

Mr Parnell is well-known in the hi-fi industry and has had extensive experience in the hi-fi field and Mr Grundl, 24, has spent the past 2 years with Voca Communications selling facsimile machines.

★ ★ ★



George Wood

Amber Technology has announced the appointment of George Wood as State Manager for South Australia. Mr Wood's career background covers 18 years in the professional electronics servicing industry.

Solar power on the line

Australian National has equipped its vital micro-wave communications link on the Tarcoola to Alice Springs railway with Australian sourced batteries in an effort to reduce costs and maintenance.

BP Solar's PVSTOR batteries offered a 50 per cent reduction in the cost of replacement compared with the batteries previously used. The batteries are used at 23 repeater stations along the link.

Communications Engineer for AN, Dave Keddie, said PVSTOR batteries enabled AN to halve the number of batteries required while retaining the same capacity as the previous units.

"The reduced number achieved a reduction in initial purchase price, while PVSTOR's high electrolyte reserves mean we have been able to reduce maintenance costs by 75 per cent," he said.

The PVSTOR batteries incorporate design advantages such as flexible links between cells said to be more reliable



David Keddie with two of the solar batteries "on line".

than the solid links used on other systems.

Transparent casings allow electrolyte levels to be easily

monitored and nine of the 23 repeater links have already been converted.

Boost in exports to Japan

A study by the Japan External Trade Organisation (JETRO) just released shows that Australia has joined the list of the top ten countries supplying processed and manufactured goods to the Japanese market.

In 1987, the value of Australia's exports of these goods to Japan reached \$2.11 billion, an increase of 40 per cent over the figures for 1986.

Commenting on the Study, the Minister for Industry, Technology and Commerce, Senator Button, said that pro-

cessed and manufactured goods now account for 22.5 per cent of Australia's exports to Japan, compared with only 15 per cent in 1986.

"Australia now out-performs Canada, Singapore and Hong Kong in the Japanese market for value-added goods. A similar growth rate during 1988, which is achievable, would propel our export earnings from the sale of processed and manufactured goods to Japan close to the \$3 billion mark."

Senator Button said he was particularly heartened by the

63 per cent increase in exports of manufactures and 35 per cent increase in exports of elaborately transformed manufactures (ETMs) recorded in 1987 over the figures for 1986.

"These figures demonstrate that it is feasible to think of a new era in Australia-Japan commercial relations which is not dominated so exclusively by the resources trade and Australian imports of Japanese manufactures. In the future, investment flows between the two countries can be expected to strengthen."

TEXAS INSTRUMENTS

TECHNOLOGY AWARD UPDATE

Student: Trevor Jackson.
Supervisor: Mr P. Leskiewicz,
South Australian Institute of
Technology.

During 1987 Texas Instruments sponsored various final year electrical engineering projects in the fields of Digital Signal Processing, Local Area Networks, and Parallel Processing. In Digital Signal Processing (DSP) systems, Analogue signals such as sound waves are converted into digital information by an Analogue to Digital Converter. All processing on the signals is then carried out using digital techniques, which do not suffer many of the disadvantages of analogue processing. Examples of these are the inability of an analogue circuit to be used for more than one task, whereas a single DSP circuit could be designed to do multiple tasks. Another common problem with analogue processing systems is that their performance varies due to temperature changes, whereas DSP systems can be immune to such changes.

In the following work on an acoustical analyser, DSP techniques are used to determine the acoustical characteristics of a room, and thereby allow corrective adjustment of equipment or the room to be made in order to improve sound quality.

Principle of operation

When audio equipment is operated in an enclosed space such as a room or a

hall, the acoustical characteristics of the loudspeaker system and the room itself, combine to give a sound which may be of an unacceptable quality.

Identification of the composite performance of the equipment and the room using an Acoustical Analysis may reveal why the sound quality is unsatisfactory, and thus enable corrective adjustments.

The aim of the analysing functions of the processing system will be to complete sufficient signal processing routines at the rate necessary to define a rapidly varying complex signal, such as a human voice or a complex mechanically induced acoustical signal. The results of the analysis including time, amplitude, and frequency components that are obtained using DSP techniques such as Fast Fourier Transforms, correlation, and digital filtering, can then be delivered to a suitable output system either for further processing, or to a display to allow feedback of the analysis.

In order to develop a test system it was decided to restrict the bandwidth to 2 kHz, while a planned future version will support the full audio bandwidth of 20 kHz. Development of the DSP software was done using a TMS32020 Software Development System.

Overview of room acoustics

Due to the many factors that effect the propagation of sound waves in a room, the transfer function relating the sound pressure level at two different points in a room is highly complex. The most widely used parameter to describe the acoustical properties of a room is the reverberation time. However the reverberation time of a room is practically the same wherever it is measured in a room, and consequently it provides no information as to why the acoustical quality of a room changes markedly with the position of the listener. The reason for the variation in acoustic quality is in fact very dependent on the sequence in time and intensity of the echoes received at any particular point. Because of the reflections that occur when sound waves propagate through a room, the total resultant sound (or pressure) wave at any one point can be found by applying the principle of superposition to the many sound waves arriving at that point (due to echoes) at any instant in time. Identification of the echo sequence arriving at a point reveals much about the quality of the sound received, and it is this identification that is the function of the Acoustical Analyser.



TEXAS INSTRUMENTS AUSTRALIA
SEMICONDUCTOR GROUP
Phone (02) 887-1122

ETI OCTOBER '88

Industry News



John Fitzpatrick

Amber Technology has announced the appointment of John Fitzpatrick as National Sales Manager after 17 years in the industry.

This follows recent appointments intended to boost the company's marketing strength. These include Karl Seglins, appointed General Manager — Professional Audio; and David Hudson, appointed Marketing Manager.

Managing Director, David Hannay said the newly organised team would reinforce Amber's growing position of leadership as a supplier to the professional audio industry.



PC enhancement board builder Hypertec Pty Ltd has made a further move into exports by appointing a large UK distributor, Logitek Plc. Logitek is one of the UK's leading distributors of micro-computer hardware. It is best known as a distributor for Wyse, Altos, 3 Com and Genicom products.

Hypertec managing director David Cunneen said the agreement should mean export sales for Hypertec of some \$1 million to \$2 million in 1988-89 to the UK.



ACME Electronics, a part of the James hardie Technologies group, has appointed Phil Martyn-Jones as State Manager, New South Wales. Mr Martyn-Jones, 48, will be responsible for all of ACME's operations in that State.

Digital darkroom software

A researcher at AT&T Bell Laboratories has developed a programming language that turns a computer into a "digital darkroom".

"Using the new picture editing language, a computer can mimic everything a skilled professional can do with a photographic negative using chemicals and enlargers in a darkroom," said researcher Gerard J. Holzman of the Computing Principles Research Department.

"The language can also do things that a darkroom technician cannot do," he said. "For example, it can smoothly fade a picture from a negative to a positive version, twist a picture into a spiral, even restore focus in a fuzzy picture or remove motion blur."

The picture editing lan-



THREE FACES OF EVE? — Using a new programming language, AT&T Bell Laboratories researcher Gerard Holzman turned a normal portrait into a computerised distortion.

guage is described in a textbook called *Beyond Photography: The Digital Darkroom*, to

be published this month by Prentice Hall (ISBN 0-13-07441-0-7).

Plan your home on 3D screen



Arrow Framing Systems' new computer installation converts building plans into a 3-D image.

New home purchasers will soon be able to see their plans converted into a 3D image on a computer and make changes or rearrange their plans with a much clearer view of the finished project.

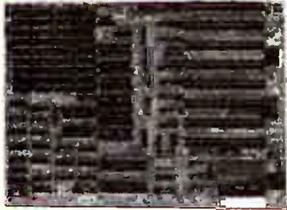
On completion of the de-

sign process, frame component manufacture will be automatic.

The breakthrough has been made by Sydney based steel house frame manufacturer Arrow Framing System who plan to have the computer aided design and manufac-

ture service operating in all States by the end of the year.

According to Mr Fraser Moore, general manager, the company's new computer system will enable home buyers to see their future home in full 3D.



XT* TURBO MOTHERBOARD

- 8MHz
- 8088 Processor
- Expandable to 640K on board.
- Provisions for up to 6 x 2732 EPROMs on board
- Keyboard connector
- 8 Expansion slots

X18030 (excl. RAM) **\$169**
 X18031 (incl. 640K RAM) **\$699**



10 MHz XT* TURBO MOTHERBOARD

Increase the performance of your sluggish XT* approximately four times with this super fast motherboard.

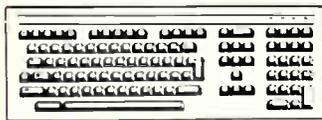
- 8088-2 running at 10 MHz. no wait state
- Turbo Normal selectable
- 640K fitted
- 8 Expansion slots
- 4 Channel DMA
- Keyboard port

Excluding RAM . **\$199**
 Including RAM) . **\$749**

BABY AT* MOTHERBOARD (WITHOUT MEMORY)

- 6/10 MHz system clock with zero wait state.
- 80286-10 Microprocessor
- Hardware and software switchable
- Socket for 80287 numeric data co-processor
- 256K, 512K, 640K, or 1.024K RAM
- 64K ROM
- Phoenix BIOS
- 8 Expansion slots

X18200 (excl RAM) **\$689**
 X18201 (incl. 640K RAM) **\$1,299**

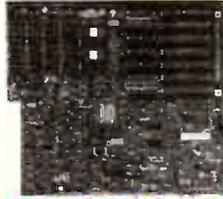


IBM* COMPATIBLE EXTENDED KEYBOARD (101 KEYS)

These new keyboards are both XT* and AT* compatible!

- 20 Dedicated function keys
- Enlarged "Return" and "Shift" key
- Positive feel keys
- Low Profile Design, DIN standard
- Separate Numeric and Cursor control keypads
- Additional Functions: Key-in-Lock, Audio Beep, Previous Word, Next Work, Fast Repeat, Line Feed, Pause, Reset, Clear Screen.

Cat. X12022. **only \$109**



6/10 MHz AT* MAIN BOARD

- 6/10 MHz system clock with zero wait state
- Hardware and software switches for alternative system clock.
- Rechargeable battery backup for CMOS configuration table and real time clock.
- 80286-10 microprocessor
- Socket for 80287 numeric data co-processor
- 256KB, 512KB, 640KB, or 1.024KB RAM
- 64KB ROM, expandable to 128KB
- 8 Input/Output slots
- Hardware reset jumper
- Power and turbo LED connector
- Phoenix BIOS

X18100 (Excl. RAM) **\$689**

386 MAIN BOARD

- Intel 80386 CPU (16MHz)
- Socket for 80387 Math co-processor
- 32 bit BUS system, 1 M/Byte or 640K on board memory
- Built-in speaker attachment
- Battery backup for CMOS configuration table and real time clock.
- Keyboard controller and attachment
- 7 Channel DMA
- 16 Level interrupts
- 3 Programmable timers
- 8 System expansion I/O slots: 5 with a 36 pin and a 62 pin expansion slot 2 with only the 62 pin expansion slots 1 with two 62 pin expansion slots (32 bit BUS)

X18101 without RAM **\$2,489**
 X18103 1 M Byte RAM **\$3,495**
 X18105 2 M Byte RAM **\$4,495**



MULTI I/O & DISK CONTROLLER CARD

This card will control 2 x double sided, double density drives, and features a serial port, a parallel port, and a joystick port or games port. It also has a clock/calendar generator with battery backup.

Cat. X18040 **\$145**

768K MULTIFUNCTION I/O CARD

(Includes cable but not 41256 RAM)

- Serial port
- Parallel port
- Games port
- Clock/Calendar with battery back-up
- provision for second serial port

Cat. X18050 **\$194**

MULTI SERIAL CARD

- 4 RS232C asynchronous communication serial ports. One fitted 3 optional.
- NS16450 Asynchronous communication elements (ACE)
- COM1/COM2 COMPATIBLE
- DTE/DCE Selectable
- Drive support for PC*/AT*, XENIX*
- Interactive installation procedure available.

X18154 **\$139**



16 BIT FLOPPY DISK DRIVE CONTROLLER CARD

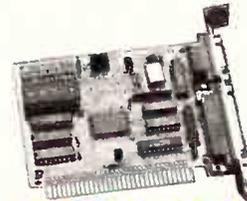
These cards will control up to 2 or 4 double sided 360K IBM* compatible disk drives.

X18005 (2 Drives)...**\$52**
 X18006 (4 Drives)...**\$55**

1-2 M/BYTE/360K FLOPPY CONTROLLER CARD

The ideal solution for backing up hard disk, archiving etc. Suitable for 1-2 M/Byte and 360K drives. XT* and AT* compatible

Cat. X18008 **\$124**



GRAPHICS CARD

- Hercules compatible
- Interface to TTL monochrome monitor
- One Centronics parallel printer port
- 2K-Static RAM, 64K Dynamic RAM
- Display Mode: 720 dots x 348 lines

Cat. X18003 **\$139**

COLOUR GRAPHICS CARD

This card plugs straight into I/O slot and gives RGB or composite video in monochrome to a monitor.

Colour graphics: 320 dots x 200 lines.
 Mono graphics: 640 dots x 200 lines.

Cat. X18002 **\$99**

ENHANCED GRAPHICS ADAPTOR CARD

- 256K display RAM
- Handles monochrome, CGA Hercules and E.G.A.
- Paradise* compatible
- Up to 16 colours
- Standards: 320 x 200, 640 x 200, 640 x 348, and 720 x 348.

X18070 **\$195**

COLOUR GRAPHICS & PRINTER CARD

This combination card features printer and monitor interface. It has 1 parallel printer port, RGB CTTC outputs.

Colour:
 Text Mode: 40 columns x 25 rows.
 Graphics: 320 x 200
 Monochrome:
 Text Mode: 80 columns x 25 rows.
 Graphics: 640 x 200

Cat. X18010 **\$99**

PRINTER CARD

This card features a parallel interface for Centronics printers. Included is printer data port, printer control port, and printer status port.

Cat. X18017 **\$29**

DTC HARD DISK CONTROLLER CARDS

X18060 (XT) **\$190**
 X18140 (AT) **\$290**



RS232 & CLOCK CARD

This RS232 card supports 2 asynchronous communication ports. Programmable baud rate generator allows operation from 50 baud to 9600 baud. Fully buffered. Clock includes battery back-up and software.

Cat. X18028 **\$89**

RS232 (SERIAL) CARD

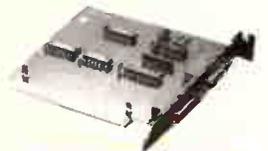
This RS232 card supports 2 asynchronous communication ports. Programmable baud rate generator allows operation from 50 baud to 9600 baud. Fully buffered. Second serial port is optional.

Cat. X18026 **\$49**

CLOCK CARD

Complete clock card including battery back-up and software.

Cat. X18024 **\$55**



GAMES I/O CARD

Features two joystick ports. (DB15).

Cat. X18019 **\$29**

I/O PLUS CARD

Provides a serial port, a parallel port and a joystick port, and even a clock/calendar with battery backup!

Cat. X18045 **\$119**



512K RAM CARD (SHORT SLOT)

- 512K memory
- User selectable from 64K to 512K
- DIP switches to start address

X18013 Without RAM **\$99**
 X18014 With RAM **\$459**

2 M/BYTE RAM CARD

Plugs straight into BUS ports on motherboard. XT* compatible. RAM not included.

X18052 (Excluding RAM)..... **\$194**



MAIL ORDER HOTLINE
 008 335757
 (TOLL FREE)
 LOCAL: 543 7877

If Rod Irving Electronics didn't offer that little extra, we'd be just another retailer.

While most retailers offer a choice of discount prices OR service, Rod Irving Electronics are able to offer both, and without compromising either. In fact, its the little extra we offer to our customers that has seen us grow substantially over the years. Little extras such as **exceptional prices**. Its not often you'll find prices below ours. We achieve this by buying in large quantities, and by importing directly, hence cutting out the middle-man. Our **extensive range** is quite impressive. Not easily matched by our competitors. You'll find every thing from the common every day items such as computers and diskettes, to hard to find items such as gender changers, disk drive power connectors, even mini jumpers. And finally, **Peace of Mind** which means technical support with our own technicians, something not normally associated with retailers offering competitive prices. In addition to this, we'll still be here tomorrow, and next year too. After all, this is our 10th year of doing it right.



IBM* XT* COMPATIBLE COMPUTERS FROM \$875

Check these features and our prices. They're exceptional value for money!

- Final assembling and testing in Australia!
- Fast 8MHz TURBO Motherboard
- AT* style keyboard
- Tested by us for 24 hours prior to delivery!
- 8 Slot motherboard
- 12 months warranty!
- 150W power supply

*\$875 COMPATIBLE COMPUTER

256K RAM Single Drive, Graphics and Disk Controller Card. \$875

256K RAM COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 1 Parallel Port. (Includes Timer Disk) \$1,045

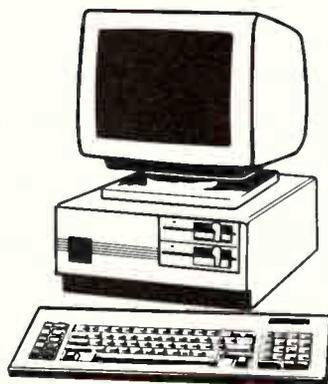
640K RAM TURBO COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 1 Serial, Parallel Port. (Includes Timer Disk). \$1,175

WITH 20 M/BYTE HARD DISK:
& single 360K Floppy Disk Drive...\$1,775
& dual 360K Floppy Disk Drives...\$1,975

WITH 40 M/BYTE HARD DISK:
& single 360K Floppy Disk Drive...\$2,475
& dual 360K Floppy Disk Drives...\$2,675

WITH 80 M/BYTE HARD DISK:
& single 360K Floppy Disk Drive...\$3,895
& dual 360K Floppy Disk Drives...\$4,095



BABY AT* COMPATIBLE COMPUTER! FROM \$2,295

- Final assembling and testing in Australia!
- 1 M/Byte Main Board
- Switchable 8/10/12 MHz
- 1.2 M/Byte Floppy Disk Drive
- 80286 CPU
- Colour Graphics Display Card
- 8 Slots
- Floppy & Hard Disk Controller
- Printer Card and RS232
- Keyboard
- 200W Power Supply
- Manual
- 6 Months Warranty
- Size: 360(W) x 175(H) x 405(D)mm

SHORT BABY AT* 512K RAM... \$2,295

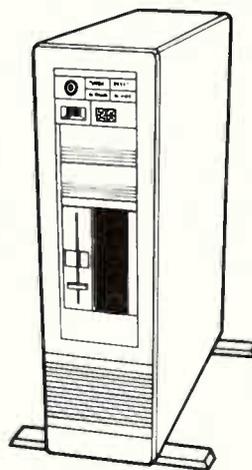
STANDARD BABY AT* 640K RAM, hard disk drive....
WITH 20 M/BYTE HARD DISK . . . \$3,295
WITH 40 M/BYTE HARD DISK . . . \$3,795



VERBATIM HARD DISK CARD

Available 20 or 30 M/Byte! IBM* compatible, plugs straight in to your computers bus connectors!

X20020 20 M/Byte \$695
X20030 30 M/Byte \$895



386 TOWER PC

The 386 Tower PC is a high performance system that is functionally and mechanically compatible with the IBM* AT*. However, the 386 Tower PC contains a 80386 microprocessor, 32-bit memory access, and other features, giving it 2-5 times the performance.

FEATURES:

- Intel 80386-20MHz microprocessor
- Switchable 8/16 20 MHz, 8/16 25 MHz, 0 wait state.
- One 32 bit memory slot with 0 wait state.
- 2 M/Byte fitted. Total memory expandable up to 16 M Bytes.
- Up to 2 M/Byte or 8 M/Byte RAM modules on system board or on RAM card
- Up to 2M/Byte or 8 M/Byte RAM chip on system board or on RAM card
- Option for 80287 & 80387 co-processor socket
- Operates in page mode with interleave memory subsystem
- Shadow RAM supported to allow system BIOS to be executed on system memory instead of slower EPROM
- Real time clock with on board rechargeable battery or external battery
- Four 16-bit I/O slot. Three 8-bit I/O slot, and one 32-bit memory slot.
- 8042 keyboard controller interface for AT* compatible keyboard
- Seven direct memory access (DMA) channels
- 16 interrupts
- Chips and Technology chip set
- AMI 386 BIOS / Phoenix 386 BIOS / AWARD 386 BIOS (AMI fitted)
- 50 M/Byte Miniscribe hard disk. Fast access. Formatted to 42 M/Byte.
- EGA card

\$5,995



MELBOURNE: 48 A Beckett St.
Phone (03) 663 6151
NORTHCOTE: 425 High St.
Phone (03) 489 8866
CLAYTON: 56 Renver Rd.
Phone (03) 543 7877
MAIL ORDER & CORRESPONDENCE:
P.O. Box 620, CLAYTON 3168
Mail Order Hotline: 008 33 5757
(Toll free, strictly orders only)
Inquiries: (03) 543 7877
Telex: AA 151938
Fax: (03) 543 2648



MAIL ORDER HOTLINE
008 335757
(TOLL FREE)
(STRICTLY ORDERS ONLY)

LOCAL ORDERS & INQUIRIES
(03) 543 7877

POSTAGE RATES:
\$1 - \$9.99 \$2.00
\$10 - \$24.99 \$3.00
\$25 - \$49.99 \$4.00
\$50 - \$99.99 \$5.00
\$100 plus \$7.50

The above postage rates are for basic postage only. Road Freight, bulky and fragile items will be charged at different rates.

Errors and omissions excepted. Prices and specifications subject to change. IBM*, PC*, XT*, AT*, are registered trademarks of International Business Machines. *Apple is a registered trademark. *Denotes registered trademarks of their respective owners.



Hamilton Island

GREAT BARRIER REEF • AUSTRALIA 

THE BEST RESORT IN THE WORLD



THE BEST ACTIVITIES

Ride a jet-ski. Hire a catamaran, dinghy, surf ski, canoe or power boat. Water-ski, fish, snorkel or scuba dive. Sailboard, parasail or bushwalk. Try tennis, squash, aerobics or the gym. Or just lie on the beach and soak up the sun.

THE BEST ACCOMMODATION

There are individual "Polynesian-style" Bures, spacious hotel rooms and luxury, self-contained suites with up to three bedrooms. All have king or queen size beds, ceiling fans and spacious balconies and the views are spectacular.



THE BEST FAMILY FACILITIES

As well as their own supervised Kids Club (for those under 12), the children will love meeting the kangaroos, emus, koalas, wallabies, deer and birdlife in our mountain-top Fauna Park. And that's on top of all the other island activities.

For reservations see your Travel Agent or Ansett Airlines. For further information call 02-327-1899 or mail this coupon to FREEPOST 14, Hamilton Island Marketing, Suite 609, Eastpoint, 180 Ocean Street, Edgecliff NSW 2027.

Name _____
 Address _____
 _____ Postcode _____

THE BEST VALUE

Currently prices for a week on Hamilton Island are:

SYDNEY	\$879*	CAIRNS	\$699*
MELBOURNE	\$949*	CANBERRA	\$899*
BRISBANE	\$799*	PERTH	\$1249*
ADELAIDE	\$999*	HOBART	\$1069*

*All prices include return economy airfare and share twin Allamanda or Bure accommodation. Similar savings are available in Bougainvillea hotel rooms and one and two bedroom apartments. These prices are available April 30 to September 18, 1988.

Industry News



David Gradwell

Tektronix announces Mr David Gradwell has been appointed to the position of National Sales Manager — Information Display Group. David, who has an Honours degree in engineering, has an impressive background in computer graphics, sales and marketing.

★ ★ ★



Gough Whitlam

Voca Communications, the Australian company which recently announced former prime minister, Gough Whitlam, as its spokesman in forthcoming advertising, has appointed Atlas Gentech Pty Ltd as its New Zealand distributor for Voca-fax machines.

★ ★ ★

Trace Technology has announced its acquisition of agency distribution rights for LTM Corporation, suppliers and manufacturers of professional lighting for film and television.

Advancenet to tap unused PC power

Most of the computer processing capacity installed in commercial enterprises is not being effectively used because of lack of suitable networking technologies, according to Bernard Guidon, marketing manager of Hewlett Packard's information networks Group.

Guidon said that the processing power in personal computers now exceed that in large systems by a factor of three to two. Yet they were only used, on average, 5 per cent of the time. Improved techniques for networking personal computers into large systems were needed to exploit this greatly untapped resource, Guidon claimed. He said present PC networking systems would be shortlived unless they evolved to integrate better into emerging corporate networking systems.

Guidon outlined HP's products and strategy recently in Sydney, at the launch of the company's Advancenet networking system in Australia. He claimed that HP was now "the best computer networking company in the world, ahead of DEC and IBM".

HP's strategy includes 10 megabit/sec communications capability over twisted pair wiring, the promotion of X.254 as a wide area networking standard for use throughout an organisation, networking in the IBM OS/2 environment, a joint venture with Northern Telecom to integrate computer and voice communications technologies for future office automation products and a network management strategy, Open View, that will provide network management for the HP's entire network product range.

Network management in multivendor environments was now the biggest problem facing corporate communications planners, according to Guidon, The OSI communications

management interface protocol (CMIP) provided a language to link different devices to be managed, but the full OSI specifications, already eight years in the making, would be ready until 1991, he said.

According to Guidon, Open View provided the tools for other organisations to develop network management applications on top of the basic system. Already over 60 requests for this developer's tool kit had been received.

Open View is based on the OSI network management framework and followed all recommendations of the OSI standards committees. The product runs on IBM PC/AT compatibles and embodies a graphical user interface.

Guidon said much progress in network management systems was needed before networks would be fully self healing, but the inclusion of expert systems techniques into network management products was making the network managers job much easier.

Urban rail electrified

Communications and signal equipment, vital to the safety and convenience of passengers aboard Perth's new electric train system, will be supplied by Austral Standard Cables (ASC).

ASC, a division of the Metal Manufactures Group, was chosen to supply cables for general communications and signal control along 90km of track in Perth's Urban Rail Electrification Project.

The \$145 million electrification project, due for completion in 1991, will see Perth's current diesel engines replaced by sleek, modern electric carriages.

The contract, worth close to one million dollars, involves production of about 4700 pair kilometres of cellular polyethylene insulated twin communications (copper) cable, a two MBits PCM carrier sys-



tem and a bearer for voice and data transmission along the network.

The new-look sleek lined carriage to replace the aging stock on Perth's Urban Rail.



ARTHUR CUSHEN

A WORLD OUTSIDE

The immediacy of shortwave listening



Clive Robertson

Many housebound radio listeners are finding that the world outside can bring them all the news and information they require.

While they are well aware of the services on medium-wave from New Zealand and Australian stations, the same group is beginning to realise the value of international shortwave broadcasting and the quality of the transmissions which they can hear in their own homes. Those who are professionally interested in news, or who simply want to keep abreast of world events are finding the immediacy of shortwave radio unbeatable.

The Australian news commentator Clive Robertson is heard on Channel Seven Network across Australia. He claims to find shortwave listening gives him the news before it is received in the television newsroom. He says that shortwave radio has been

a great refuge to him. He listens to a wide variety of stations for their news and rates the BBC and Voice of America as the quickest news service. He said more people should realise the joy of listening to other countries as this far surpasses the parochial view of many Australians. He concluded a Radio Australia interview by saying "I do not know how anyone who is interested in the world cannot have a shortwave set. "Forget about

'... forget about your television receiver, it causes interference anyway.'

**Clive Robertson
Commentator, ATN7**

your television receiver, it causes interference anyway and just sit there and absorb the world news — we are not so stupid we cannot differentiate between propaganda and entertainment."

These sentiments from an Australian national figure are typical of listeners in all walks of life. They are finding that information they hear on the shortwave bands often does not appear on domestic radio or television or in the press and they are able to get a good cross section of international events when and where they happen.

Disabled listeners

The promotion of listening for the disabled is part of the

world wide theme of radio clubs and in New Zealand the Handicapped Aid Programme is sponsored by the New Zealand Radio DX League, who helps the disabled listeners enjoy their hobby. Many disabled will find that the modern key-pad receiver with memories a simple way to find frequencies, while for the visually handicapped the voice chip enables tuning to various stations to be simplified. There is a considerable amount of material on shortwave with special sessions for the radio listener. The Handicapped Aid Programme assists radio listeners in New Zealand and Australia to better enjoy their listening. Information on this assistance is available from the writer of this feature.

Four sessions are providing interesting news for the

shortwave listener — "Communicate" from Radio Australia on Sunday at 0230 on 15240 kHz repeated at 0730 on 9555 kHz; "Media Network" from Radio Nederland Thursdays at 0750 on 9630, 9715 kHz; "Wave guide" from the BBC London, on Sunday 0745 on 15360 kHz and "Swiss Shortwave Merry Go Round" from Berne, Saturday 0845 on 9560 kHz and repeated Sunday 0415 on 9885 kHz. These are only four of many sessions designed for shortwave listeners which are broadcast each week from stations in all countries.

Olympic Games

Though radio and television networks in Australia and New Zealand will be providing a considerable amount of material from Seoul on the Olympic Games, there are al-

AFRTV services close

The Armed Forces Radio & Television Services which has operated for more than 40 years is scheduled to close next month.

There has been decreasing use by overseas relay stations of the shortwave service due to satellite linking with AFRTV stations in various parts of the world. The Armed Forces Radio has been operating 24 hours of the day mainly running news and sports. The news has been presented in five minute segments from the hour to half hour and has featured a news service on UPI and AP, two of the press services and the network ABC, CBS, NBC and MBS as well as programme services from National Public Radio. Listeners in the Pacific will regret the closing as it did provide relays of top sporting events such as National baseball, basketball and at times the leading boxing events held in the United States. The transmitters which have been actually owned by the Voice of America will revert back to the VOA and carry their programmes in the future.

ways those listeners who wish to tune direct to hear broadcasts from the Korean Broadcasting System. The transmission at 0800 on 13670 kHz provides us with a good summary of news from the Asian area, while at 1000 UTC a new service on 11740 kHz has been noted with a 30 minute English broadcast.

The BBC has announced that they plan to operate a two-network service during the Olympic Games. The World Service will be available on many frequencies, but some frequencies will carry continuous coverage from the Olympics similar to the past cricket tests in the UK. Listeners are therefore assured of ample coverage of this important sporting event

and no doubt the stations in the East Asian area such as Radio Japan and Radio Beijing will also provide news from a different angle on the sport event of 1988.

Around the globe . . .

AUSTRIA: Vienna is noted on 9875 kHz with an English broadcast 0400-0430UTC. On Monday Shortwave Panorama is featured which is a programme of information for radio listeners. **CHINA:** Radio Beijing now announces that there are four transmissions to the South Pacific with best reception 0830 on 9700 and 11755 kHz. A broadcast from 1200-1300 is also audible in this area, on 7820 and 11600 kHz, both frequencies outside the normal shortwave bands.

COLUMBIA: After an absence of some six years the Caracol network has returned to shortwave and has been observed on 4755 kHz from around 0600 to past 0900. The transmission is of music, with network announcements each 10 minutes and news on the hour in Spanish, but so far no originating station has been identified.

COSTA RICA: Radio Impacto which operated and is heard on 6155 kHz has now appeared on 5030 kHz and is heard closing at 0600UTC. The last hour is generally of news and information, from Central American countries and the identification announcement when closing makes reference to the two shortwave frequencies.

FRENCH GUYANA: Radio France International transmitters at Montsinnery is to relay broadcasts of Radio Japan 0200-0300 on 15350 in Japanese; 0330-0400 on 15350 Spanish; 0800-0900 5965 in Japanese; 2200-2300 9685. Japanese. In exchange RFI programmes in French will be carried by Radio Japan in Yamata 0930-2300 will be carried by Radio Japan in Yamata 0930-1130 15410, 1000-1100 15325, 2300-0030 on 15300, all programmes beamed to Asia.

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 are quoted in UTC (GMT), which is 10 hours behind Australian Eastern Standard Time.

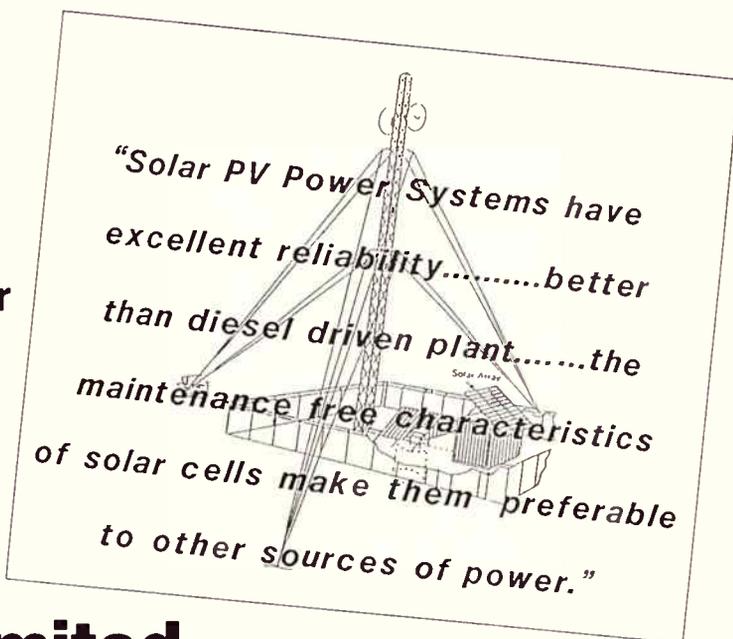


SOLAREX



Solarex is the major supplier of Solar Power equipment to Telecom, the largest commercial user of PV Power Systems in the World.

(Excerpt from the Telecom Australia Solar Power Manual, Network Engineering Department, January 1987.



"Solar PV Power Systems have excellent reliability.....better than diesel driven plant.....the maintenance free characteristics of solar cells make them preferable to other sources of power."

Solarex Pty Limited

78 Biloela Street, Villawood 2163, NSW, Australia, PO Box 204, Chester Hill 2162 Telephone: (02) 727 4455 Telex: AA121975



JOHN COWARD

LAUNCHING A COMPANY

Market potential is where venture capitalists separate the inventors from the entrepreneurs. John Coward describes the setting up of a business plan for a technology start up company.

Your business plan demonstrates the viability and potential of your new technology business — plus your knowledge and understanding of the variables necessary for successfully attaining your objectives. It also provides prospective investors with a basis upon which to evaluate both the business potential and the individuals who will manage the venture. It should also serve as a valuable planning exercise — which should increase the chances of success in your venture. Here is a step-by-step guide.

To make for easier reading of the plan start with a summary of what you are trying to accomplish. This summary should be the first one or two pages after the table of contents inside the front cover of your plan.

Your summary should clearly address the salient reasons why someone should invest in your company and should include a brief discussion of the market potential, the product and technology you expect to capitalise on, the track record and depth of your management team, abbreviated financial forecasts and any desired venture capital investment.

Following that, briefly describe your company, its products and industry, including your company's operating

history, present ownership and future objectives, your product's function and uniqueness, the technology involved and your company's role within your industry and the trends in that industry.

Potential

Many good technologies are never successfully commercialised because their inventors don't stop to analyse the market potential or assemble the management team necessary to capitalise on the opportunity.

This section of your business plan will be scrutinised carefully. Your market analysis should therefore be as specific as possible, focussing on believable, reasonable and obtainable projections, including: the size of the potential market and market niche you are pursuing, the market share you anticipate achieving, the competition — who and what, the marketing channels you expect to use, the potential customers, and the pricing of your product, compared with competitive products.

Where possible, practicable and cost effective, you should use independent studies to verify the potential of various market niches.

Your marketing strategy is just as important as your

product's development. In presenting your marketing strategy, therefore, be sure to include a discussion of:

- The specific marketing techniques you plan to use.
- Your pricing plans — demonstrating the value added to the customer, versus the price paid
- Your planned sales force and selling strategies
- Your customers — how many there are and where they are
- Your customer service — which markets will be covered by direct sales force, which by distributors, representatives or resellers
- Your specific approaches for capitalising on each channel and how they compare with other practices within your industry
- Your advertising and promotional plans.

Then, in broad, fairly non-technical terms, present the status of your technology development. This should allow someone reasonably familiar with the technology

'Venture capitalists invest in people'

to conclude whether you are at the concept, R&D, prototype or product ready for market stage. Points to cover in this section include the extent of development required to successfully complete your projects, the track record of key technical people the proprietary aspects of your technology and the reasons why your product is more advanced than the existing technology.

Operations

Outline your plans for operations within various time

frames, including: development, early manufacture, market development and first product installation — as well as facilities, work force by job category, extent of subcontracting, sources of supply, and warranty and service strategy.

Your work force analysis should represent a headcount by function or department (or both) for a specified time period.

Venture capitalists invest in people — people who have run or who are likely to run successful operations. So potential investors will look closely at the members of your management team. Your team should have experience and talents in the most important management disciplines, such as research and development, marketing and sales, manufacturing and finance. This section of the business plan should therefore introduce the members of your management team, highlighting their track records.

Detailed financial forecasts should also appear in an appendix but within your business plan — condensed to about a page — you should include a financial summary of your company: income statement, cash flow analysis and balance sheet. Be sure this information addresses the extent of investment you'll need and provides the basis for a venture capitalists to conclude on the potential future value of the investment made.

A range of items can be included as attachments, including *curricula vitae*, detailed financial forecasts (including key assumptions), references, independent evaluations / studies / surveys, photos.



Adilam Electronics

COMPONENT SPECIALIST



ADILAM OFFICES

MELBOURNE Suite 7
145 Parker St.
Templestowe VIC 3106
P O BOX P O Box 131
Bulleen VIC 3105
PH (03) 846 2511 (4 lines)
FAX (03) 846 1467
TELEX AA 151369

SYDNEY Suite 1,
Ramsgate Plaza,
191 Ramsgate Rd
Sans Souci NSW
PH (02) 529 2277
FAX (02) 529 5893

ADELAIDE
N S Electronics (S A)
59 Wood Ave
Ridleyton SA 5008
Ph (08) 468 531
Fax (08) 310 1456

BRISBANE
St Lucia Electronics
24 Campbell St
Bowen Hills QLD 4006
Ph (07) 252 7466
Fax (07) 522 862

CANBERRA
Electronic Components Pty Ltd
Unit 10
Fyshwick Plaza
Wollongong St
Fyshwick 2609
Ph (062) 80 4654
Telex 62468

PERTH
Prospec Distributors
Helidon House
31 Adrian St
Wetshpool WA 6106
Ph (09) 362 5011
Fax (09) 361 7592

DISTRIBUTORS

READER INFO No. 38

ANOTHER OFFER FOR **Electronics Today** READERS

The credit card sized organiser that stores all your information in one place . . .

The Calling Card — the latest advance in MicroElectronics costs just

Microchip Technology is advancing all the time. Now there's an electronic personal organiser the size of a credit card that can store over 2,000 characters. That's enough for all your personal information — bank balances, birthdays, appointments, phone numbers, shopping lists, travel information, bills to be paid — the list goes on.

The Calling Card has been designed to play an active part in your personal organisation. It has so many uses around the home, in the office, or on the road you'll wonder how you ever managed without one. And it's as easy to use as an ordinary calculator. The clear LCD display shows 24 characters at a time and can scroll through information quickly. And it is simple to add and delete from files.

Think of things you're always forgetting or the information you never seem to have at hand — the Calling Card will fill those gaps. It will keep you better informed and better organised.

IT'S AN APPOINTMENTS DIARY

DOCTOR
5 JULY 2PM

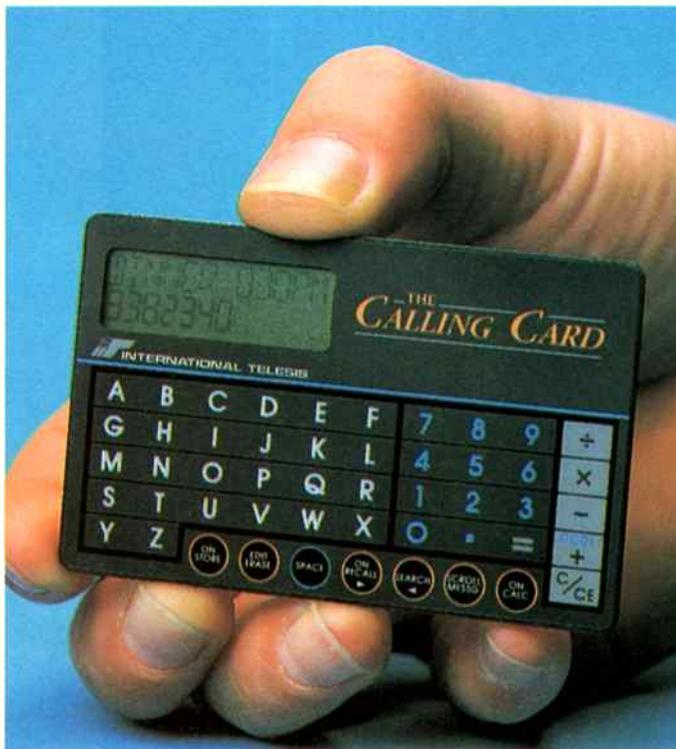
Simply key in your appointments for the coming day, week, month or even year and you'll have a ready list of all your engagements in your pocket at all times.

You need never forget an important appointment again.

IT'S AN ADDRESS AND TELEPHONE BOOK

PETERSONS
593 0431

Key in all your important addresses and phone numbers. The Calling Card automatically stores them in alphabetical order, making them easy to find again. Wherever you are, you'll always have those phone numbers next to you.



IT'S A SECURE HOME FILE

BANKCARD
469 3201480

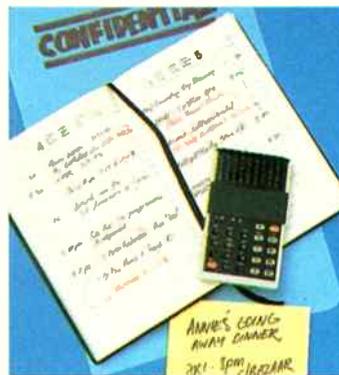
You can use the Calling Card to recall instantly personal information — bank balances, passport and insurance numbers; it can even remind you when a bill falls due. You can safely file your pin code number — the Calling Card has a security lock which stops any unauthorised access to your files. So all your personal information is strictly confidential.

IT'S A CALCULATOR

33 X 4.573
150.909

Not only is the Calling Card a comprehensive personal data bank, it's a full-function calculator too.

YOU MAY NEVER NEED CALCULATORS, DIARYS, MEMO PADS EVER AGAIN.



\$55

IT'S A JOTTER PAD

AM TUESDAY
BUY FLOWERS

Ideas or action points that occur to you can be quickly and simply entered into a file — no growing heaps of jottings and notes, no need to find pen and pad every time you have an idea. It's also ideal for shopping trips and making notes of phone calls.

All this in a unit measuring just 5.5 x 8.5 x 0.3 cm, small enough to slot into your credit card wallet.

UNCONDITIONAL GUARANTEE

If for any reason you are not completely satisfied with the Calling Card, simply return it to us within 30 days and we'll give you a full refund or a replacement.

MAGNAMAIL

Magnamail has been appointed to fulfill these orders. Any enquiries should be directed to Magnamail Pty. Ltd., P.O. Box 453, Brookvale 2100 or by telephone at (02) 938 5277, allow 21 days for delivery.

TO ORDER: Fill in attached coupon, place in the reply-paid envelope and post. Or if missing, send name, address, telephone no. and cheque, money order or credit card details (card type, number, expiry date and signature) to: FREEPOST No. 4, P.O. Box 227, Waterloo NSW 2017. No stamp required.

R160 THE CALLING CARD \$55.

ANOTHER OFFER FOR Electronics Today READERS

How can we sell this Two-Man Boat

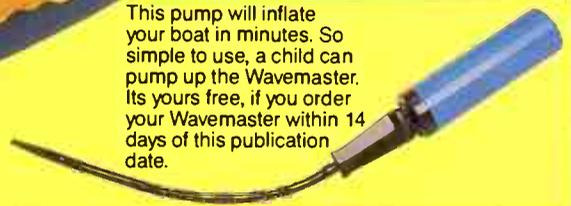
for **\$55**
only

(Complete with oars,
rollicks and
tow rope)



**FREE
BONUS**

This pump will inflate your boat in minutes. So simple to use, a child can pump up the Wavemaster. Its yours free, if you order your Wavemaster within 14 days of this publication date.



Because this low price is part of a nationwide publicity campaign to introduce the unique, all purpose Wavemaster. A best seller in the U.S., the Wavemaster is expected to be rushed at this low price!

Consequently, we must limit sales to only two (2) to each household at this incredible price.

YOU'VE ALWAYS WANTED YOUR OWN BOAT. BUY IT NOW FOR THE HOLIDAYS

This handsome inflatable craft has to be the ultimate in compact convenience. Uninflated it folds to a thickness of only three inches (8cm).

Merely remove the Wavemaster from its handy carrying case and inflate it to its full 6ft size in a matter of minutes including the double safety air chamber floor, (see pump bonus offer).

No more tin dinghies on roof racks, this "go anywhere" boat can be packed neatly into the boot until you need it, or carried on your lap.

Even the oars (yours at no extra cost) fold down to just 18" (45 cm) for easy storage.

STOWED IN YOUR CAR BOOT, THE WAVEMASTER IS ALWAYS THERE WHEN YOU WANT IT.

These spunky little craft are real performers. Tough and trim, they handle like a dream. Perfect for fun on the water.

Ideal as a tender for cruisers, runabouts or sailing boats, because of its minimal folded space. It offers fun transport at all times.

Each Wavemaster also includes specially designed light-weight oars weighing only 11½ oz (365 g) each, which fold away for easy storage.

WAVEMASTER PACKAGE DETAILS

Approximate deflated size Folded in carrying case
78" x 46" (198cm x 117cm) Oars weight 11½ oz each

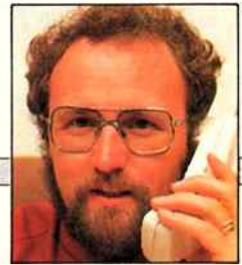
RISK FREE MONEY BACK GUARANTEE

Enjoy the pleasures of the incredible Wavemaster for 30 days and if you are still not absolutely satisfied simply return within 30 days for a full refund of your purchase price.

Magnamail has been appointed to fulfill these orders. Any enquiries should be directed to Magnamail Pty. Ltd., P.O. Box 453, Brookvale 2100 or by telephone at (02) 938 5277, allow 21 days for delivery.

TO ORDER: Fill in attached coupon, place in the reply-paid envelope and post. Or if missing, send name, address, telephone no. and cheque, money order or credit card details (card type, number, expiry date and signature) to: FREEPOST No. 4, P.O. Box 227, Waterloo NSW 2017. No stamp required.

Z047 Two Man Boat \$55



PAUL BUDDÉ

FAX, VIDEOTEX ON THE MOVE

Paul Budde reports on the local and international Videotex scene.

Report analysis

The Yankee Group recently published a report on electronic communication systems in Australia. Videotex and fax are described as the "goers" for Australia, telex is dying, teletex is stillborn, E-Mail too complicated, user unfriendly and too many systems and standards. DVMS (Digital Voice Messaging System) and Teleconferencing are strengthening but there is still some hope for the future.

Some quotes from the report on videotex:—

- ★ Videotex has become very popular in Australia in recent years. There are three basic divisions: Telecom's public Viatel system, public systems operated through the PSTN but independently of Viatel, and private systems. For reasons of length and scope, the report is concerned mainly with the first two.
- ★ Videotex is easy to use, but operates at low speed. As such, it is especially suited to systems involving a limited degree of interaction and a large number of unsophisticated users. Major uses include pricing information, booking systems (entertainment, travel, etc.) and home banking and shopping. It is an ECS in that it is also suitable for low volume electronic mail.
- ★ Videotex has been proven as a highly effective delivery system for financial information and services. This is in stark contrast to



Videotex is one of the most popular forms of electronic communications — but some frames say more than others.

the almost total failure of teletex, for which no industry sector seems to have found a role. The Yankee Group believes videotex is one electronic communication service every financial institution should closely examine, but teletex currently just does not warrant the time or effort.

- ★ Videotex deserves to be used more often and more efficiently. Many organisations that could use it are not, and most that are using it are not using it properly. The Yankee Group believes that virtually all large organisations could cost-effectively use videotex for any application requiring an inexpensive and user friendly front-end to DP systems.

Mac hooks Teletex

Macintosh computer owners can now hook into the international teletext network following the release recently by Telecom of teletext software for the Mac. Teletex is an internationally agreed standard for the exchange of formatted documents over the public telephone network. It represents an advance on the thirty-years-old telex system with the availability of all upper and lower case alphabetic characters as well as arithmetic signs, miscellaneous symbols and fractions.

The system was developed in West Germany which has well over half the world's 20,000 teletex terminals. It has been less successful in other countries and a com-

plete failure in the UK. British Telecom has abandoned it in Australia where teletex has been in operation for about 18 months, there are about 400 terminals installed, according to Peter Home, Telecom's manager text services. Home anticipated that this number would double in the next 12 months. He attributed the demise of teletex in the UK to BT's policy of supplying only dedicated teletex terminals. Telecom Australia does supply these, but it also provides software for a variety of popular office computer systems including, IBM, Wang and DEC.

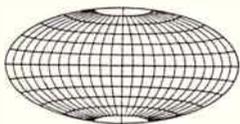
Users have the option of creating a document, using the teletex software, in which case it can be sent to any teletex terminal, or of using proprietary word processing software and sending the document as a binary file, in this case the system at the other end must use the same software.

Teletex operates over a leased line connection to the subscriber at a rate of 2400 bits per second. It will be able to operate over dial up lines in the ISDN network which will come into service from the middle of next year. There would appear to be an element of competition between teletex and the Telecom/OTC Keylink electronic mail service, which is cheaper than teletex. Keylink has recently been enhanced to allow binary file transfer so it could be used to exchange formatted documents between compatible word processing systems. Keylink is, however, a store and forward system — the message will not be delivered until the subscriber dials up and checks his mailbox. Teletex is a real-time system — messages are transmitted through the net-

work with no intermediate storage. Home doubted that the two services would compete. He described teletex as a "professional service". Key-link, he said was for more casual users.

In one respect, telex is still ahead of teletex. A telex message has the status of a legal document. A fact which Telecom has been using to promote telex in recent advertisements. This advantage cannot be acquired except by the establishment of a precedent in a court of law. Until a teletex message is presented as evidence in a court proceedings, there will be no ruling on it as a legal document.

Around the globe . . .



Dialcom extends

The electronic mail service of British Telecom, Dialcom, has extended its service to the advertising world with a special data base called "Communication". The service has also been interlinked with other marketing data bases and is available in Australia and Hong Kong.

Yellow pages on PC

Yellow Pages in the UK now come 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.

Bell helps

US West's three telephone operating companies (Mountain Bell, Northwestern Bell and Pacific Northwest Bell) have introduced "ScanTel", an on-line directory assistance service. The service lets subscribers access information from phone directories

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.

School tool

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

this service. 90,000 only offer business to business services and the other 64,000 are for at least 50 per cent depending on business to business services.

The information will be "published" in three ways:—

- ★ on a videotex system with a gateway to the national service;
- ★ a fully automatic telephone voice response service;
- ★ five regional printed directories.

Publimedia has invested DFL5 million in this new service.

BTX in Germany

German Telecom are experts in marketing forecasts for their Bildschirmtext videotex system. In 1982 they predicted one million BTX sets by 1986. After 5 years 60,000 terminals are now linked to the German service.

Despite all this, new forecasts are made, predicting two million videotex subscribers by 1990. The new optimism is based on contracts from German banks including the Deutsche Bank and a possible low cost terminal à la Minitel.

VAS problems

Serious disagreements have emerged at the latest preparatory meeting for the ITU's forthcoming World Administrative Telegraph and Telephone Conference (PC WATTC), due to be held in late 1988. At previous meetings, proposals that value-added services should fall under the regulatory powers of the ITU have provoked strong reaction from the US and the UK, but now it appears that the split between these countries and the more hard-line PTTs is widening.

'Videotex deserves to be used more often and more efficiently'

(names, addresses, telephone numbers) in the fourteen states served by three telephone companies. The telephone companies do not provide terminals to users, who pay up to US\$100 to set up an account, then pay 22c per listing accessed. Other options include name searches throughout the region or within a single state. Only customers of the Bell companies (but not those of independent telecommunication companies in the area) are in the ScanTel listings, which are updated weekly.

Public access Videotex

A new generation of public access videotex was inaugurated in Paris, France with the installation of the first Minitel booths at the Centre National Georges Pompidou. Since its

service 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.

Dutch treat

Dutch cable TV users with a teletext TV set have an increased access to Electronic Yellow Pages. At the rate of a couple of cities per month, electronic yellow pages is added to the cable TV — teletext service. The latest town is Gouda with 27,000 cable TV subscribers.

Publimedia (Electronic Yellow Pages) in the Netherlands combines old and new media in their new directory service. 154,000 Dutch companies are listed free of charge in



K R Y S W A R E I N G

ENGINEERING A CAREER

Report lacks rapport

Krys Wareing looks at a Government Review which targets women, the educationally disadvantaged and Aboriginals to solve Australia's shortage of engineers.

Women, the educationally disadvantaged, and Aboriginals are the three sub-groups of the population targeted by the Review of the Discipline of Engineering to swell the ranks of employed engineers by the end of this century. The review, of all engineering schools, was commissioned by the Federal Government.

The recently released report by the Commonwealth Tertiary Education Commission seeks to define what Australian institutions should do to keep pace economically with technologically advanced countries. Graduation rates must rise, it said, and first-year student drop-outs should be reduced. And the review suggests institutional courses should place more "empha-

sis" on engineering "in the business context."

So important are engineers, continues the report, in the last few years many countries have appointed committees of enquiry to investigate the quality and the quantity of engineering education.

Although, as much as the report stresses Australia's economic needs, some of its recommendations are contentious.

For starters, the review recommends reducing the flow of student drop-outs through making courses more attractive to potential drop-outs, students told the review committee that a number of first-year drop-outs in engineering probably would not have occurred if engineering

subjects had been taught in the first year, rather than mathematics and science, which were "imposed" on them.

However, first-year teaching at institutions involving mathematics and science is already difficult enough for lecturer and student alike. The HSC aggregate for entry to Chemical Engineering at the University of Sydney is 360. "Below 330, students definitely would have difficulties in the subject," said Professor Prince of Sydney's Chemical Engineering school.

Therefore, high schools are crucial to students' appreciation of "harder" subjects, with school teachers exercising a "critical" influence on students' choice of subject, said Professor Hugo Messerle, the Head of the School of Electrical Engineering at the University of Sydney. Professor Messerle, who said the School had its first woman metallist three years ago, also called for an "intensive attack on the problem of science education at female schools."

Anger

To attract students from the targeted groups, the Review committee suggests a "greater use" of scholarships and cadetships, and a review of physics curricula in senior secondary schools to improve participation levels, particularly of female students. However, things may be going backwards in this area. According to Vicky Webber, Co-ordinator of the Women in Engineering Unit at the University of Technology, the

NSW Government has abandoned the Non-Sexist Unit in Education, which was established particularly to address the aim now suggested by the review.

Although targeted as a pool from which new graduates could be spawned, female enrolment across the engineering groups is not uniform. At the University of Sydney and the University of Technology Sydney, for example, women make up 30% of the quota of chemical engineering. They make only a few percentage points of Electrical Engineering at UNSW. Vicky Webber said female attitudes to engineering are often "misconceived, and gender-based," with en-

'... there is a difference in the quality and quantity of engineering taught'

gineering viewed as purely a man's job, "involving dirty work and solving mathematical problems all day."

Another factor against women choosing engineering as a career is the effect of family pressure, with fathers or mothers actively against their daughters entering what is perceived as a masculine career.

While underscoring a target of active engineers at 1% of the labour force by the year 2000 — the present level is 0.8% to 0.9% — the review ignores the associated cost of expansion "in offices and laboratories" because a tandem industry demand of 3% per year for engineers may not be met, it said. But industry is



Civil engineering — attitudes often "gender-based."



Thirty per cent of Sydney University's chemical engineering students are women.

asked to share the economic burden. Such demand for engineers should be generated from industrial research and development, while industry should raise the levels of technology by adopting or adapting higher levels of technology established by others.

Meanwhile, some academics are resisting the idea that the links between industry and institution should mean more communication skills in engineering courses, as well as more emphasis on management techniques and business practice.

One of the five specific criticisms to emerge from the review suggests that too many graduates seeking employment do not have written and oral communication skills. But extra units on business practice simply would be "superficial" said Professor Prince, who added that one week in the course was "knocked out" to allow for a unit on Industrial Relations. The students complained bitterly but those who carried on to complete it then found they enjoyed it. "The last thing an engineering student wants to do is (anything

other than engineering)," he said.

Employers

In some quarters, industry is not unduly pressuring institutions to provide more business practice, even though some see managerial communication and co-ordinating skills as "necessary."

Richard Berling, director of personnel consultants Wareham and Associates said recently that clients want a lot more now than just formal qualifications. They are after managerial, communication and co-ordinating skills which "sadly" aren't often there. "It's one hell of a problem," he said. "Often you'll find yourself interviewing someone who has all the enthusiasm and expressiveness of a stuffed owl."

But rather than insist that first-degree potential engineers be swamped with business practice, those already holding degrees in engineering may wish to supplement their credentials with say, an MBA. Engineers "serious about management" should have at least one diploma of management, marketing or finance, if not an MBA,"

claimed Matthew Mitchell recently, a UK-trained mechanical engineer at the Slade Consulting Group.

On management studies in first degrees, the review quotes the education committees of NSW and Victorian chapters of the Association of Consulting Engineers who have said the current average of 4% class time devoted to management topics should be raised to at least 15%. But groups such as Telecom Australia told the review they rejected the need for management skills before graduation, on the basis that their engineers achieve advancement as technical specialists, while gaining personnel management skills after initial work experience.

The long view

On a larger scale, the Review of the Discipline of Engineering is useful in revealing the structures behind the teaching of and research in, engineering. But the lower-level comparisons, based as they were on a standard "score-card" revealed "enormous bias," claims Professor Prince, who visited institutions with the review committee, as a "spare part."

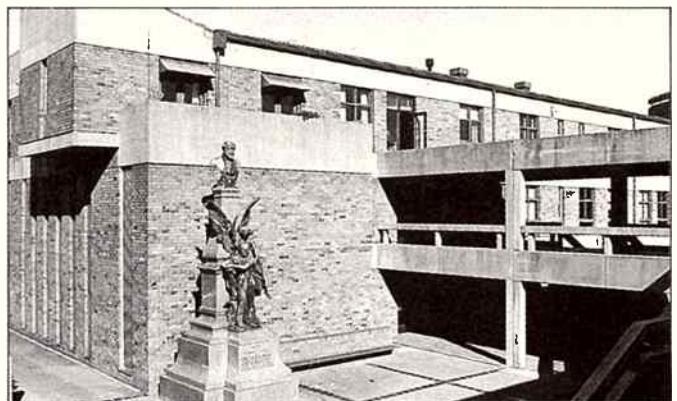
Much of the work done in

comparison is lost within the lower-level comparisons, he claims, with the questions asked of the institutions open to bias because "different interpretations arose out of various people using different approaches" to the issues.

In looking to sub-groups of the total population to attract potential engineering graduates, the government should build up a respectable level of mathematics and science in high schools and, as the review suggests, set up special tutorships to encourage the educationally disadvantaged, and integrate and encourage Aborigines to pursue engineering.

But there is still the disconcerting aspect that most high-school females do not pursue subjects with a high level of mathematics and science.

That a competent level of education is needed in all institutions is hardly worth repeating. The review shows, in its comparison of all institutions, that there is a difference in the quality and quantity of engineering taught. But incomplete as the review's recommendations are, they need much more groundwork before they can be satisfied.



Engineering at university . . . Industrial Relations caused students to "complain bitterly."



PETER BREWER

For Australian motor racing fans, the first weekend in October is like a religious festival.

Tens of thousands of devotees make the annual pilgrimage to the shrine, located just outside of Bathurst in western NSW, while those who can't make the journey undertake a bizarre ritual which involves some seven and a half hours in front of TV set, and drinking copious quantities of beer.

Weird? You bet, but Australia's premier touring car race, formerly known as the James Hardie 1000 until a fallout between the sponsors and the organisers and now sponsored by the Bond brewing giant and renamed the Toohey's 1000, has affected people this way for a number of years.

Yet while the race's stature has blossomed internationally over the past 25 years to the extent where some 630 million people will watch the race, live or via a delayed TV highlights package, there are still vast numbers of local fol-

'Technology . . . offers no substitute for raw human skills and abilities'

lowers who have been befuddled by the rapid changes which technology has brought to the sport.

It was all pretty easy for spectators back in the early sixties — you were either pro-Ford, pro- Holden, or pro-Something Else (rest assured, the latter group

were a very small minority). Allegiances to the various car companies were forged through ownership of the appropriate make of family car.

And the racing was simple wheel-to-wheel stuff.

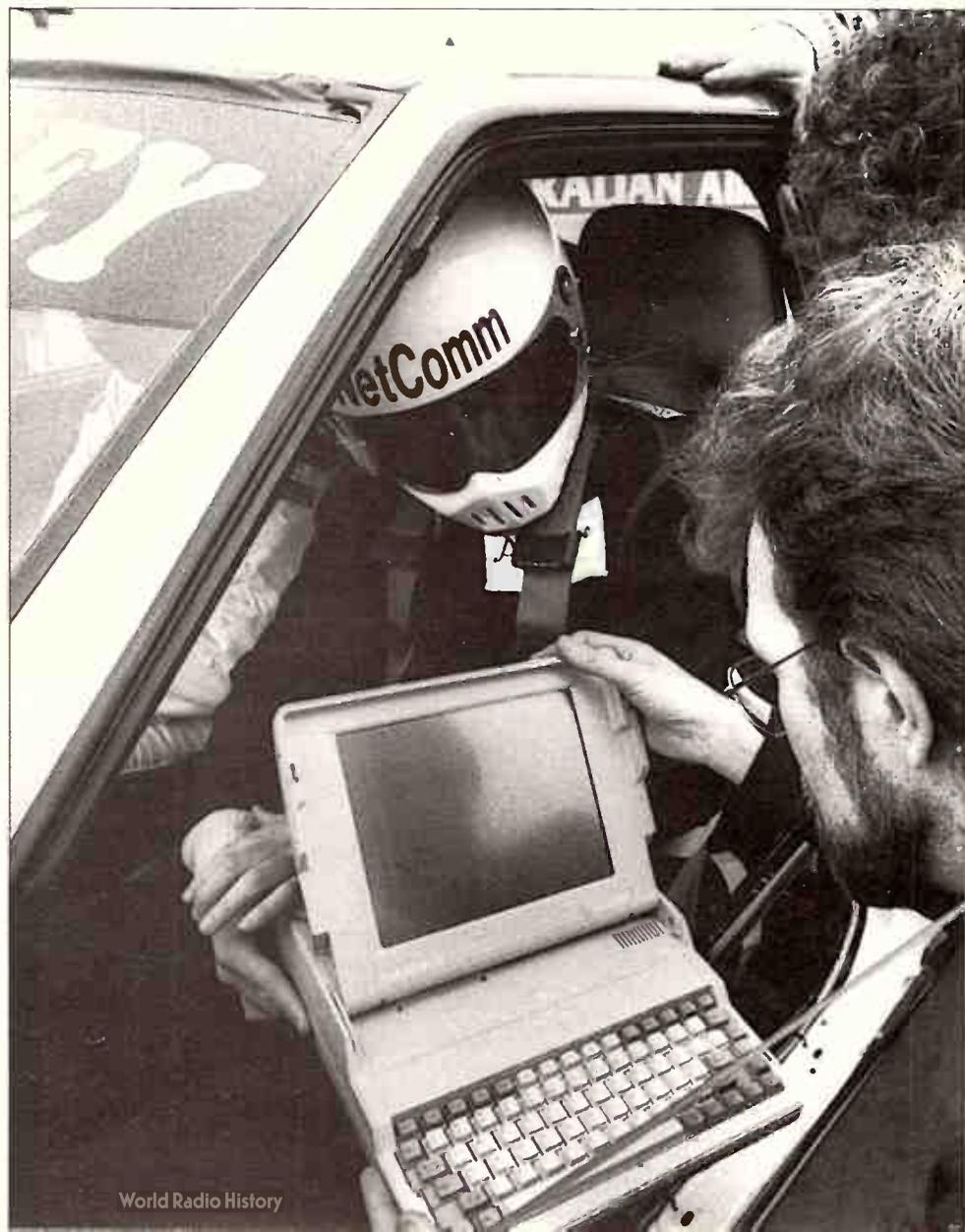
No high-tech mumbo jumbo, just good honest endurance driving: a battle between the best-prepared teams and the most capable, consistent drivers over six long hours of thumping up and down a 6 kilometre stretch of mountain road. These parameters remain for 1988 and, on the face of it, appear to be an unchanging foundation for victory year after year. But are they? Certainly the driving talent of the human behind the wheel is a fundamental constant.

Technology, while it can help a driver

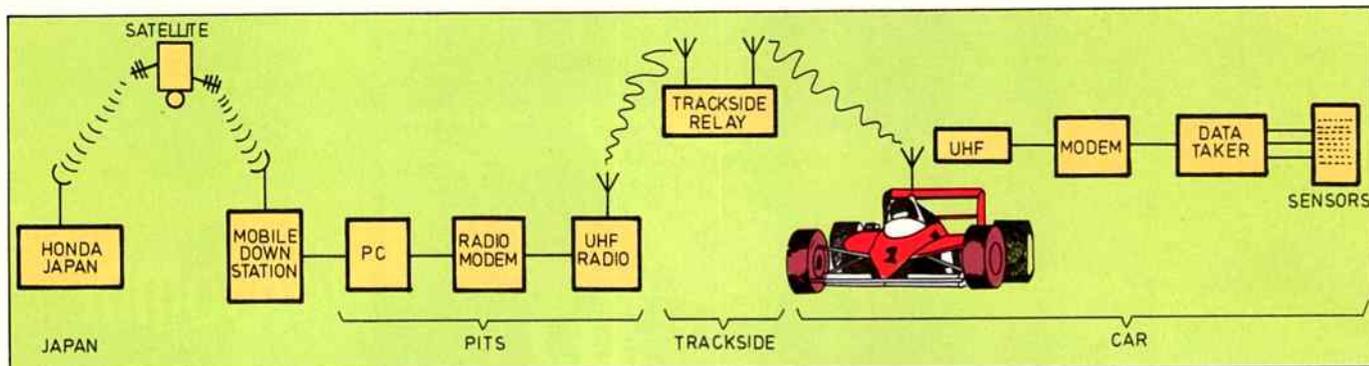
THE PITLANE BRAIN

Modems manage motor racing

The pitlane mechanic of today considers his computer as part of his toolbox. Motoring writer Peter Brewer reports on the technological umbilical between the racing driver and his crew.



The pitlane brain



Honda powered McLaren Formula 1 racing cars have a potent communications link behind them, so that engineers in Japan can study the car's performance in detail, no matter where it is racing.

concentrate better on the task at hand and protect him from damage, offers no substitute for raw human skills and abilities, especially over a long period — in the case of Bathurst, some six and a half hours — of stress and concentration at high speeds.

But the reality for spectators and competitors is that every year, the driver's role is becoming less important to the task of winning a race.

Now it is the machinery which takes centre stage in touring car racing: the turbocharged Ford Cosworth Sierras, the fuel-injected BMW M3s, and the high tech Nissan Skyline Turbos.

Things have come a long way since the 1960s and 70s when the cars you could buy in the showroom could strut their stuff at Mt Panorama with few modifications.

Of the three varieties of touring cars mentioned, none is sold in Australia. They can be bought in European and Japanese showrooms, but only a fool would purchase one expecting the same characteristics as the specialised racing versions.

They'll look the same, of course, as that's part of the rules but the performance will be well adrift of the racetrack version even though the engine specifications will, on paper, appear almost identical.

Underlying differences

The underlying difference between the two isn't weight, tyres, suspension settings and brake performance, although all four of these play their role in extracting the best lap times on the racetrack. No, it's the engine management computer — that ubiquitous black box which controls and monitors all the vital engine functions, balancing a highly-stressed engine on a tightrope between maximum performance and destruction.

Reigning touring car champions, Queenslanders Dick Johnson's Shell

team, take no chances. Chief engineer Neal Lowe takes more than dozen EPROMs for the Ford Sierras' engine management systems in a lined box to each race meeting.

These are the keys to ultimate performance, each specifically programmed to change the characteristics of the engine to suit the layouts of various race circuits and ambient temperatures. The "hand grenade" chips — maximum torque and power but minimum reliability — are reserved for the all-important qualifying sessions to determine grid positions.

But while this might seem the cutting edge of race car technology, the technique of physically changing the engine management EPROMs or even re-programming RAM at a pitstop with different values (as other teams do) is certain

'... it's the machinery which takes centre stage in touring car racing'

to be replaced within the next few years by a more complex system where the technicians standing in the pitlane have an active role in changing the performance of the car — as it speeds around the track.

Netcomm Australia, the modem specialist, has been largely responsible for demonstrating to our homegrown touring car teams how the big boys in Formula One operate when it comes to monitoring their cars' on-track performance.

The company, though its sponsorship of veteran driver Murray Carter first in a Nissan Skyline and now in a Ford Sierra, has used its involvement as an R&D base for developing its equipment — and at the same time getting some good publicity value. Peter Brock's BMW team has also been signed as

participants in the Netcomm plans for '88 and at least one of the outfit's cars — probably that of newcomer and Sydney-based Channel Seven commentator Neil Crompton — will be "wired up" for the Mt Panorama classic this year.

Basically, the Netcomm system involves the transmission of data from a series of sensors on the race car back to an Apple Macintosh Two micro in the pitlane, via a radio link. The information is broken down for transmission by a modem in the car, retranslated at the other and thrown up on the computer screen for instant analysis.

While the engineers are only interested in what's happening inside that vital management computer, there's more offbeat data available too, like driver heartrate, respiration, humidity, G-forces, cabin temperature, tyre temperature, brake lock-up, battery current, and external air pressure.

New outlook

Netcomm can access 67 data inputs simultaneously. Last year, the company joined forces with Channel Seven in order to provide the race's massive TV audience with a whole new outlook on the event — from the driver's perspective.

While a Racecam — a miniature TV camera inside the car next to the driver — provided the view and sounds from the cockpit via an uplink to a Seven helicopter, Netcomm overlaid its data, showing engine revs, speeds, and the gear selection. The effort by both parties lost much of its TV impact because of a breakdown in transmission but Netcomm believes it has the problem licked for this year's Bathurst. A second aerial will be placed on the top of Mt Panorama (some 860 metres above the first pitlane aerial) so the signal comes through loud and clear.

The data transmissions rate has also been stepped up on the racecar's

modem, so instead of transmitting pictures at the rate of one frame per second, the information will be stepped up to three frames per second over a 2400 baud link. This allows a three times faster update of the information received by the computer and relayed to Channel Seven.

It is certain to make for exciting television viewing. Further down the track there's the likelihood of a switch to cellular phone technology to transmit the information, instead of UHF. But what of the future? Can someone standing at a computer change the values of a race car's engine management system on the move? The answer has obvious implications for helping a driver get maximum speed and reliability from the car.

Engineers at Netcomm can do it now, but only in the laboratory. They believe the technology already exists in multi-million dollar business of Formula One motor racing, but isn't fully applied. The Honda-powered McLaren F1 cars which have so dominated grand prix racing this season have two small radio aerials nestled behind the rollcage. One is for the driver's radio link, the other for the engine's data link. The data is relayed back to the pits, stored and analysed. At several races this season, Honda brought its own satellite dish in order to beam the information they were receiving directly back to HQ in Japan.

The greatest benefit for teams receiving this data is to ease the responsibility of watching the instrumentation off the drivers, so they can fully concentrate on the job at hand. In Formula One, fuel consumption is so critical it has to be reviewed two or three times a lap: a job which the driver clearly hasn't time for during the cut and thrust of racing.



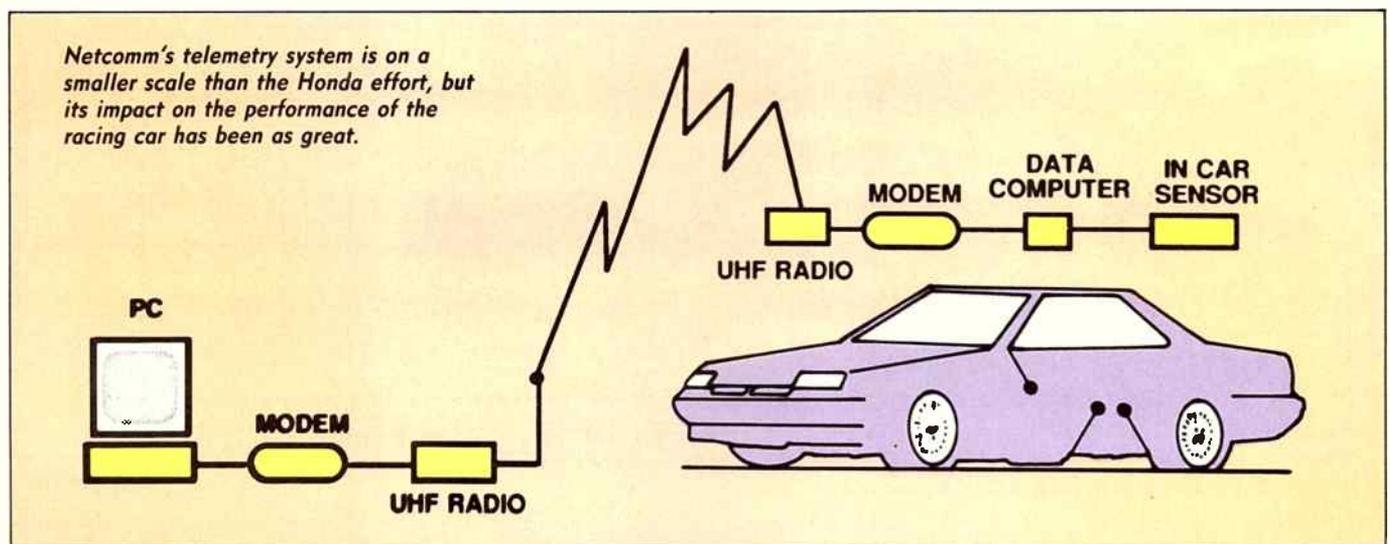
Chris Howells of Netcomm and racing driver Peter Brock.

Motor racing technology is advancing at a rate which suggests that within a few years, all a driver will need to do is . . . drive. The lads back at the pits will take care of the rest.

The main hurdle is in the design of the engine management computers. These already complex devices will need to be modified so they contain a vastly increased amount of information — a wider array of value "maps" which can

be accessed by technicians while the car is racing so as to improve performance or solve a possible problem which could affect reliability. Winning is now, more than ever, a team effort.

While the winning driver will always wear the winner's garland and accept the trophy, in future the real power to decide victory or defeat will rest with those behind the pitlane keyboards.



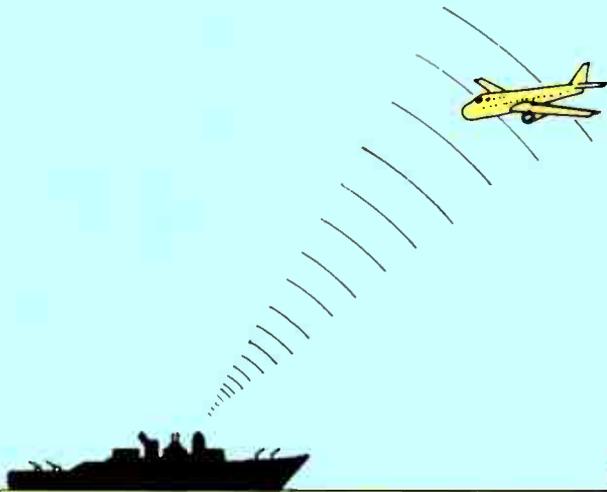


Figure 1: SPY 1 Radar on the USS Vincennes illuminates the Airbus A320 at 12,000 feet.

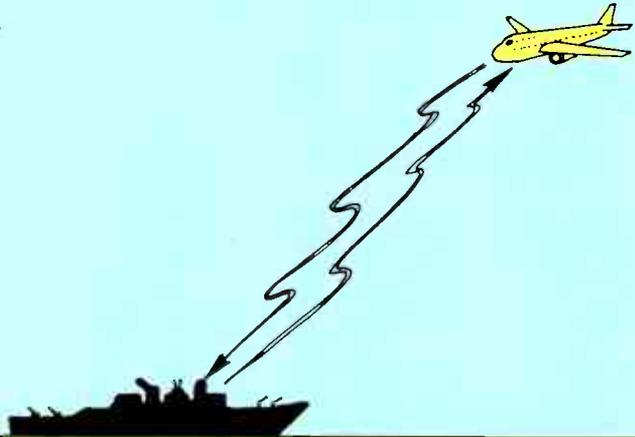


Figure 2: USS Vincennes interrogates IFF on the Airbus. According to congressional evidence, the signal may have been confused with the signal from a C130 cargo plane at a nearby airfield.

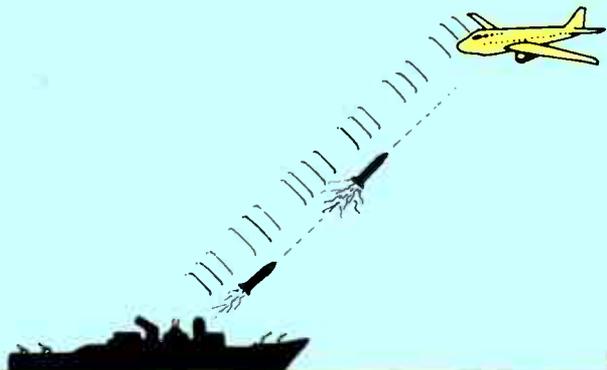


Figure 3: SPY 1 steers missile radar onto the target. When the missile radar acquires the Airbus, the SAM is launched. Aegis computer guides the missile towards the target.

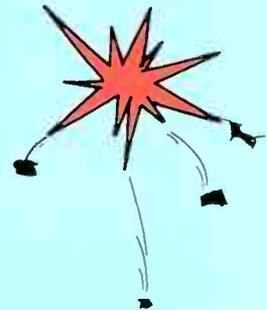


Figure 4: 220 lives added to the misery of the Gulf war.



TECHNOLOGY

HI-TECH HOLOCAUST

A civilian aircraft gets caught in the crossfire of the Gulf War. Anna Grutzner, ETI's defence columnist, looks inside the technology that allowed the death of 220 innocents.

**Electronics
error
blamed
for Gulf
disaster**

The United States' self-perceptions of its role in the Gulf War were severely shaken when news reached Washington on July 3 that the USS Vincennes had shot down and destroyed Iran Air Flight 655, killing all on board.

Transformed from bystander into a victim by the Iraqi air attack on the USS Stark just weeks before, an electronics error in the USS Vincennes sophisticated radar-weapons system was initially said to be what turned the US into the unwitting aggressor in this second incident.

Early reports on the findings of the enquiry into the disaster suggest the crew of the USS Vincennes wrongly interpreted misleading computer data about the Airbus' speed, altitude and flight path. It appears that hyped-up crew members were able to interpret the airbus, steady at 12000 feet as a diving f16, 4000 feet lower.

Given the complexity of that system and the secrecy surrounding such military disasters, we are unlikely ever to learn exactly why the guided-missile cruiser mistook a commercial Airbus for an F14 fighter aircraft three times smaller. But it is worth examining the respective capabilities of the communications, surveillance and weapons systems aboard the USS Vincennes in a bid to understand the circumstances under which the captain found himself that day.

The US Navy's three-tiered long-range identification strategy in the Persian Gulf relies on radar, communications via IFF (identification friend or foe) transponder, and on simple verbal messages between parties.

The naval combat system aboard the USS Vincennes is the Rolls-Royce of integrated radar tracking and weapons systems called Aegis. It was built to specifications for the US Navy's US\$1 billion Ticonderoga-class (CG-47) guid-

ed-missile cruiser, which entered service in 1984. The Navy plans to acquire 27 of the ships to use in its aircraft carrier battlegroups and battleship-led surface action groups.

Despite persistent hiccups in the early days of Aegis' development, it was not under a cloud at the time of the Airbus accident. The problem had long been ironed out of the sophisticated array of 840 equipment components, including 19 computer bays, 20 computer units and 22 tactical displays. Aegis is capable of searching for and tracking the speed, course, range, altitude and radar signature of more than 200 airborne ob-

'In fully automatic mode, the system chooses the response, right through to firing'

jects simultaneously. It can also provide mid-course guidance to 18 missiles at the same time.

Friend or foe?

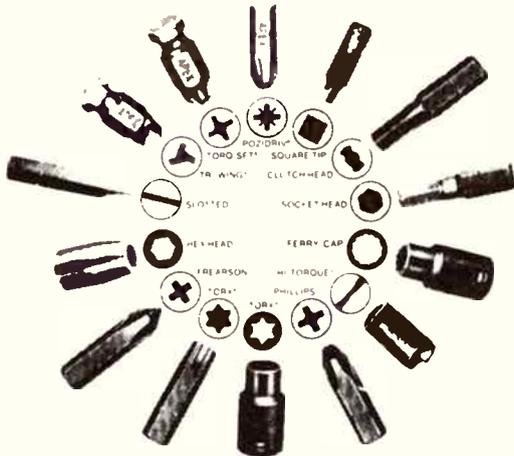
The IFF (identification friend or foe) transponder (transmitter-responder) aboard the USS Vincennes allows the ship to establish the identity of aircraft in the region by sending out a stream of radio signals in coded pulses. The radar-activated signalling device asks electronic questions, seeking an unidentified object to pick up the code and reply that it is friendly.

All civilian aircraft recognise and are identified by type or destination by a single international code via air traffic control. Had the Iran Airbus been a military aircraft, it would also have responded to "Mode Two" pulses, which identify military aircraft types. A third encrypted code, decipherable only by allies in possession of the code, could



Fastener Tools

A bit more for the money.



Fastener tools that fit better, last longer.

An Apex fastener bit is machined with precision machine tools from a solid bar of shock resistant steel.

Frequent tool changes and careful inspection mean the angle and thickness of each wing on the bits is held to exacting standards of accuracy. It fits each fastener snugly and securely.

For further information in Vic. & S.A. contact:-

ENDEAVOUR TOOLS PTY. LTD.

31 Cleeland Rd, South Oakleigh 3167 Tel: (03) 562 8266 Fax: (03) 562 8363

In Qld. & N.S.W. contact:

In W.A. contact:

A.B.W. TOOLS PTY. LTD.

54 Raynham St, Salisbury, Qld 4107
Tel: (07) 275 1288 Fax: (07) 865 1242

Ace Industrial Distributors

63 Collingwood St, Osborne Park, W.A. 6017
Tel: (09) 446 5577 Fax: (09) 446 6586

READER INFO No. 2

SHARP

ELECTRO LUMINESCENT & LIQUID CRYSTAL DISPLAYS



* Flat Packaged, low power EL Display LJ 640U26. Featuring 640 x 200 dot.

* Dot Matrix LCD, 40 characters x 2 lines. Positive or negative transfective display. LM 402X01. With built in backlight.

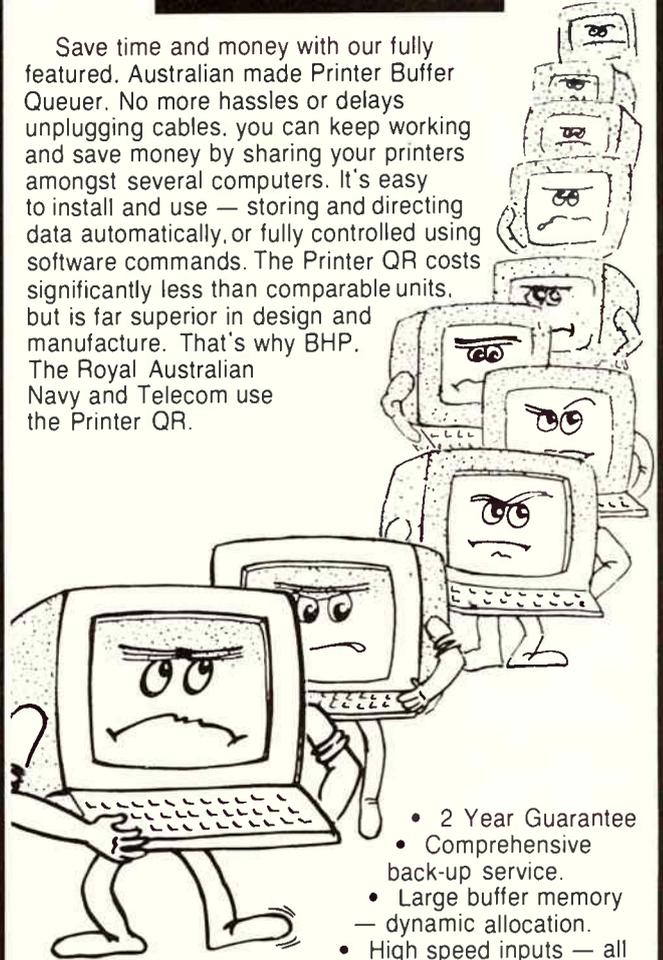
MANUCO

ELECTRONICS PH (03) 650 3977
FAX (03) 650 2715

READER INFO No. 5

Computers Hate Queuing

Save time and money with our fully featured, Australian made Printer Buffer Queuer. No more hassles or delays unplugging cables, you can keep working and save money by sharing your printers amongst several computers. It's easy to install and use — storing and directing data automatically, or fully controlled using software commands. The Printer QR costs significantly less than comparable units, but is far superior in design and manufacture. That's why BHP, The Royal Australian Navy and Telecom use the Printer QR.



- 2 Year Guarantee
- Comprehensive back-up service.
- Large buffer memory — dynamic allocation.
- High speed inputs — all can be active simultaneously.
- Sophisticated character compression techniques eg. A 750k desktop graphics file used only 120k buffer space.
- User friendly memory resident software makes command usage a breeze.

Diamond Systems

7 Barreenong Rd, Cottles Bridge,
P.O. Box 105, Hurstbridge, 3099.
Ph: (03) 714 8269 Fax: (03) 714 8554

READER INFO No. 29

Hi-tech holocaust

provide even more specific identification data to a "friend".

IFF is useful not only as an extra layer of tracking capability beyond radar, it actually works well when the effectiveness of radar is limited by bad weather. Its weakness is that IFF relies on the cooperation of the other party. Though the transponder is automatic, an aircraft

pilot can turn it off or ignore incoming signals.

The Aegis Mark 7 weapons system integrates virtually all of the ship's weapons in an impressive anti-air warfare (AAW) battery, the principal radar of which is the AN/SPY-1A. The three-dimensional E/F band radar is composed of four 13.25 x 12.75 ft fixed octagonal

arrays, each with about 4480 elements that give the ship 360-degree vision from horizon to zenith.

It represents a quantum technological leap, as it scans the sky electronically within a second, instead of the mechanical multi-second action of conventional rotating radar. Built by RCA, the SPY-1A systems can verify and establish a target's track almost immediately and its high resolution and accuracy allows it to effectively control or "enslave" the ship's four I/J band SPG-62 missile illuminating radar. The US Vincennes is also equipped with a long-range two-dimensional rotating airsearch radar, the SPS-49, and a range of electronic radar-jamming devices and state-of-the-art sonar array.

The SPY-1A's four radar display screens installed in the ship's Combat Information System can present four different scale views of the "battlefield", distinguish aircraft from ships, and, in theory at least, friend from foe. The computers store profiles of hundreds of aircraft, which are constantly matched with radar signals. Simulated voices give audio updates on the data.

System takes control

Major improvements were made in later ships, which carry the SPY-1B radar. The newer system has a higher output, increased effectiveness against low-flying and small-radar-cross-section targets, and better anti-jamming features.

'... electronic indications led the captain to believe the Airbus was an F14'

Once a target is detected and tracked, the Aegis Command and Decision (C&D) system take control. The complex process, integrating sensor information and pre-programmed tactical doctrine and priorities data, produces an avalanche of information to test the target's legitimacy, and, in turn help the captain decide the appropriate course of action.

If he decides to attack, the weapons control system (WCS) assigns the missiles and gun systems, orders their launch and firing, and gives mid-course guidance instructions to the SPY-1. The Standard SM-2 medium-range missile replaced the SM-1 in 1981. Two Mk 26 twin-rail guided missile launching systems can take 88 Standard and ASROC missiles, 44 forward and 44 aft.

The surface-to-air missile is believed



USS Vincennes.

Hi-tech holocaust

to reach a speed in excess of Mach 2 and has a range of about 40 nautical miles, which made the Airbus easily within firing range at 14 kms distance. The ship's inertial guidance system, whereby accelerations within the missile are compared with pre-programmed data to give velocity and distance measurements, allows the missile to maintain an accurate track even in rough launching conditions.

The Aegis system can be programmed to operate under a range of rules of military engagement. An Auto Doctrine Statement enables the system to actually target any aircraft, ship or missile entering a given radius of the ship. It will go through all the motions of attack — locking on the target and preparing to launch missiles — but stopping short of engaging. It leaves the captain to make the ultimate decision.

In fully automatic mode, the system itself chooses the response, right through to firing. Useful in times of imminent attack or extreme tension, the Auto Special Doctrine Statement would draw a second more localised parameter around the vessel and fire automatically at any object identified as enemy within it.

It is improbable in the current Gulf climate that the US Vincennes' system was programmed to the latter level. To that extent the captain was responsible for the mistaken move, though apparently relying on misleading data interpretation from Aegis. In fact, the chairman of the US Joint Chiefs of Staff, Admiral William Crowe, was quoted as saying it was "electronic indications" that led the captain to believe the Airbus was an F14.

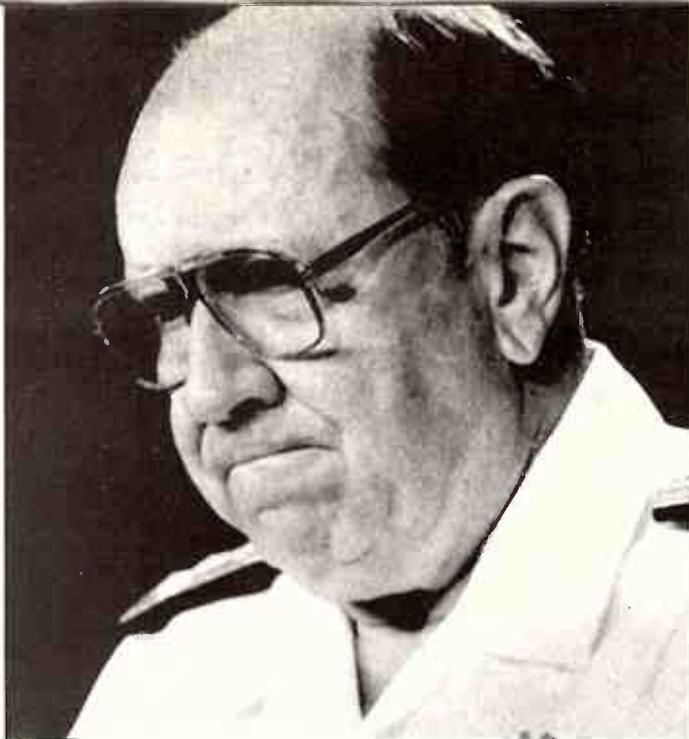
Crux of the issue

The decision to fire or withhold and the extent to which that decision has been programmed out of human control, are the crux of the whole issue. Does one

'Does one bridge the vulnerability gap by increasing the human element or by phasing it out?'

bridge the vulnerability gap by increasing the human element or by phasing it out?

The Iran Airbus accident was by no means the first of its kind. In the days before advanced IFF, during World War II, warships frequently fired at aircraft first and asked questions later, sometimes with disastrous consequences. Yet the fact that the technology was still far from perfect even in the early 80s was



Chairman of the US joint chiefs of staff, Admiral William Crowe.

evident during the Falklands War. On May 1, 1982, an FAA Mirage attempting to make an emergency landing at Port Stanley accidentally fired, probably as a result of an electrical fault, its two Mirage anti-aircraft missiles (AAM). The plane was promptly shot down by fellow Argentinian flak, killing the pilot.

The case for long-range and beyond visual range (BVR) radar identification is a mixed one. On the one hand, it eliminates the risks associated with getting too close to an unidentified object, entering its range of missile fire and becoming the victim instead of the aggressor. On the other hand, it increases the risk of firing blind at a friendly target. The speed of modern weaponry leaves no time to verify a target or contemplate the response. Such was the dilemma facing the Iraqi pilot who saw a large blip on his radar screen and sent two Exocet missiles on their destructive path into the side of the USS Stark, or that facing the captain of the USS Vincennes.

Soviet ICBM's?

One can only surmise, from the direction technology leaders take radar and weapons development in the future; what lessons military strategists have learnt from disasters like that on July 3. But while naval strategists may be tempted to toy with alternatives to Aegis in the wake of the Airbus tragedy, cheaper, less sophisticated radar-weapon systems are not the answer.

The US Navy's next most capable AAW battery merely limits the detection and tracking capabilities of the ship, and therefore the likelihood of mistake attacks. The Tartar-D System, known as the New Threat Upgrade (MTU), is designed around a traditional rotating radar, the SPS-48. Given that Aegis took 20 years to develop, the prospect of another alternative in the near future is remote.

Quest for safety

The quest to keep warfare safe, will only become more difficult as the technology race produces more advanced radar-avoidance weaponry and platforms. Already advanced phased array radars, like the Jindalee project under development in Adelaide, are tracking to hitherto unknown ranges. The "radar invisible" or "stealth" aircraft, which is shaped to avoid radar-absorbing angles, is off the drawing board. So, too, is the disposable remote-control aircraft that launches its missile load and then itself becomes a smart bomb. The US air force is also developing a computerised pilot helmet which would use radar and infra-red signals to detect targets instead of the pilot's eyes.

What's the greatest threat facing the computer today?

Australian and American experts agree on what it is, although their estimates of how much it costs you in downtime varies. Americans believe it accounts for more than 30% of all computer failures. Yet some Australians say their practical experience leads them to believe 70% would be a far more accurate figure.

Surprisingly enough, the greatest threat to your computer is the very power it runs on.

The way to control the power to your computer and avoid these costly breakdowns is with Clean Line Systems. Their power conditioners, uninterruptible power supplies and other products and services can eliminate all disruptive power line disturbances. They provide stable, clean electrical energy. They can combat the damaging effects of lightning and even have inbuilt safety systems to ensure the power to your computer is never cut off unexpectedly.

Clean Line Systems is a wholly Australian-owned company that designs and manufactures its own equipment. They are the people more computer companies choose to protect their corporate computers.

All Clean Line Systems equipment conform with the most stringent specifications here in Australia, America and Europe. It is so advanced that it is half the physical size and weight of most comparable competitive systems. And it outperforms them too!

Clean Line Systems equipment is not noisy, it runs cool and does not emit any damaging magnetic fields. Best of all, it can grow with your computer needs. Plus, if you ever need it, full service back-up is available 24 hours a day, seven days a week.

Clean Line Systems can eliminate the greatest threat to your computer today. You can purchase, lease or rent immediately.

Call us on the number below, or else take your chances with the power threat



The ultimate power support systems.

Head Office: 33 Maddox Street,
Alexandria, N.S.W. 2015
Sydney: (02) 698-2277
Melbourne: (03) 565-1634
Brisbane: (07) 394-8272

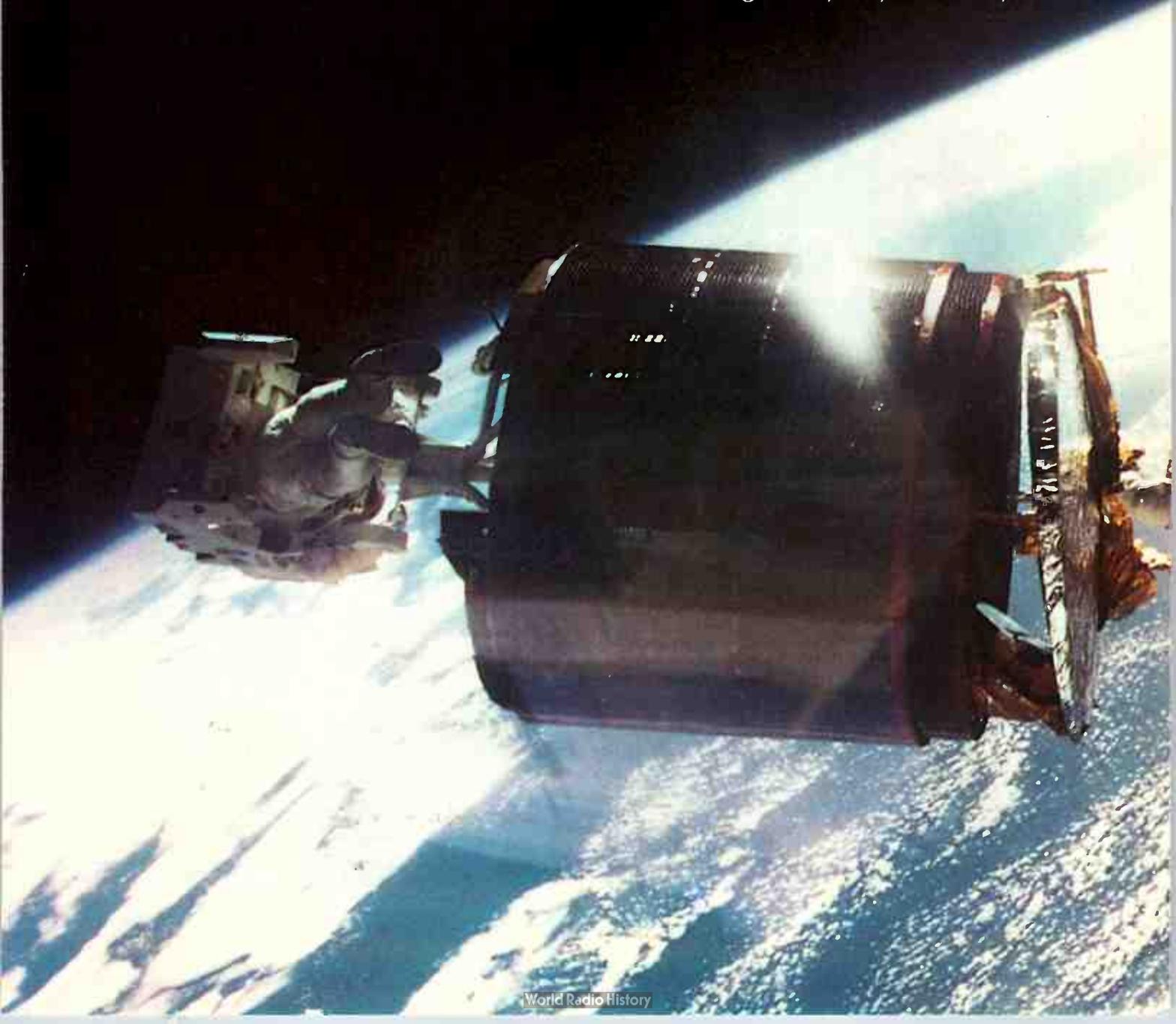
DEXTERITY AT ZERO G FORCE

Astronauts often have to perform skilled manipulative tasks in space. Dr Helen Ross, Dept of Psychology at the University of Sterling reports on how experiments carried out during repeated periods of weightlessness in parabolic flight are now providing data about changes that occur in manual control and the extent of errors in aiming.

If manned spaceflight is to be worthwhile, astronauts must be able to repair equipment in space and carry out other delicate tasks. But what limits are there to human dexterity in orbit? Even in the 'shirt sleeves' environment of a space station astronauts may be handicapped in their work. In orbit, gravity is almost completely eliminated and its absence can reduce the manual skills of a right-handed astronaut to about the level of that of his left hand on Earth.

I began investigating motor skills in space during the preparation for the first Space mission, a joint venture between the US and European Space Agencies, NASA and ESA.

The work arose through my doctoral research on weight perception on orientation and motor skills in divers. This enabled me to get an experiment on mass-discrimination in weightlessness accepted by ESA for the space mission.



Estimating mass

The question was, how would the ability to discriminate between masses in the weightless state (0 G) compare with that for 'weights' under Earth's gravity (1 G)? Strictly speaking, 'weight' should be 'weight plus mass', for we perceive pure weight only when we hold an object statically; when we move the object we impart to it an acceleration and we can perceive its mass through inertial information. On Earth we habitually move objects slowly up and down to judge their weight and mass, and in so doing we make use of several sources of sen-

sory or motor information including the pressure on the hand, the effort needed to hold the hand in raised position and the information about inertial mass that we derive from accelerating or decelerating the object. Mass is defined as the ratio of force to acceleration, so we can estimate it by imparting a constant force to an object and noting its acceleration, or by noting the force that is

needed to produce a given acceleration, or by a mixture of these strategies; the first is the one most commonly used. No such information is available when the hand is either still or moving at constant velocity, so we might expect dis-



TECHNOLOGY

HANDS OFF — Astronaut Dale Gardner (left) delivers the Westar VI to Joseph Allen who is standing on the Discovery's remote manipulator arm foot restraint. Crewmate Anna Fisher works the arm from inside the Shuttle. The action took place while they were orbiting the Earth at an altitude of about 360 kilometres and at a speed of about 27,000 kilometres per hour.



FOOTHOLD IN SPACE — Astronaut Bruce McCandless prepares to use a special tool to conduct an experiment on the Shuttle pallet satellite (SPas-01A) located in the centre of Challenger's cargo bay. His feet are anchored in the mobile foot restraint which is connected to the remote manipulator system arm. The experiment simulated future extravehicular missions of the Shuttle program.

Parabolic flight

crimination to be poorer under weightless conditions than under normal gravity.

There is a second reason why discrimination might deteriorate whenever the gravitational force increases or decreases: the brain takes time to adapt to the change. Previous experiments under water (where buoyancy reduces the effective weight of the arm) have shown such deterioration on first entering the water, followed by recovery to almost the normal level of performance after being immersed for about 15 minutes and by a deterioration in air immediately after leaving the water. Similarly, performance deteriorates in the human centrifuge (which increases the effective weight of the arm) and on leaving the centrifuge, compared with the performance before entering the centrifuge.

Spaceflight experiments are very expensive, so it is a good idea to get as much data as possible during the brief periods of zero gravity that can be produced during parabolic flight. Not that parabolic flights are particularly cheap; they are reputed to cost NASA about US\$10,000 per flight, or US\$250 per parabola if 40 are flown. NASA runs these flights from Ellington Air Force Base near the Johnson Space Centre (JSC) at Houston, Texas. Each flight lasts about two hours, and up to 40 parabolas are flown over a period of about one hour. Each parabola gives about 20 seconds of nearly 2 G acceleration, followed by about 25 seconds of approximately 0 G and another 20 seconds of high G.

During the parabolas I was able to carry out a mass-discrimination experiment in collaboration with Dr Mil Reschke of JSC. We tested subjects repeatedly over the high and low G phases of the parabola, and during straight and level 1 G flying. The subjects had to pick up and shake pairs of balls (all the size of golf ball), and decide which was heavier or had the greater mass.

Discrimination

The results showed that discrimination was impaired under 0 G by a factor of about two. That is, the difference in mass that could just be discriminated was about twice as large as the difference in weight under 1 G. However, it was also impaired to nearly the same extent under 2 G. It was therefore not clear how far the impairment under 0 G was due to loss of gravity and how much to incomplete adaptation.

The experiment was eventually run on Spacelab 1 in 1983. The astronauts per-

formed the test before, during and after the flight. Performance during the flight was quite similar to that in parabolic flight, being impaired by a factor of about 1:8, but there were not enough tests to measure any adaptation over several flight days. Performance was also impaired for two or three days after flight while the astronauts were adapting back to Earth's gravity. It is probable that the major part of motor skills adaptation takes place over the first two or three days in flight. However, after a few days of weightlessness mass-discrimination remained impaired, so it is unlikely that the main cause of impairment was lack of adaptation. Individual astronauts varied in the way in which they shook the balls, and in their ability to discriminate. Those who shook more vigorously, thereby imparting higher ac-



A parabola provides about 25 seconds of weightlessness, in which time it is possible to float and conduct experiments.

celerations, performed better. The experiment was repeated on the D1 Spacelab mission in 1985 (the first German mission), in collaboration with Edwin Schwartz of the DFVLR Institute for Aerospace Medicine, Cologne, and Dr Paul Emmerson of Aston University. This time the astronauts used two different methods of shaking the ball, producing high or low accelerations. On the ground low acceleration shakes gave the better discrimination, while in space high acceleration shakes were better. The impairment in space ranged from a factor of 1:2 to 1:9, depending on what was compared with what. This confirms the idea that the loss of information in 0 G is an important factor in the impairment, and that it can be partly overcome by using an optimal method of shaking. However, incom-

plete adaptation may also be important because, as before, weight-discrimination deteriorated immediately after the flight.

Skills

Although this work was scientifically interesting, I was often asked what the practical purpose was. The impairment of discrimination under 0 G was about the same amount as the impairment caused by using the 'wrong' hand for a strongly handed person. This suggests that there might be a general clumsiness under 0 G, equivalent to being 'cack-handed'. So when the next chance to fly a space experiment arose I decided to go for something more practical.

An opportunity loomed when the first British astronaut was due to fly in a Shuttle mission in 1986, to help launch a British Aerospace Skynet satellite. It was agreed that he would also run a few small British experiments, including one of mine. Unfortunately, due to the Challenger accident in January 1986, those plans have been shelved. But it proved possible to run the experiment in NASA parabolic flights in February 1986, with financial assistance from British Aerospace, Ferranti, Carnegie and Kuwait Airlines. It was a sombre occasion, following immediately after a memorial service for the Challenger astronauts at JSC. The data looked interesting, but more were needed for statistically significant results, so I repeated the experiment in October 1987 on flights sponsored by ESA, with a grant from the MRC.

The experiment was to do with errors made during rapid aiming. It is known that there is a tendency to reach too high when aiming straight ahead under water or in a condition of 0 G, and too low when aiming in high G, but it is not clear how long it takes to adapt to changes in the force environment. If movements are slow there is plenty of time to make corrections, so few errors occur, but fast 'ballistic' movements produce errors.

One test often used by psychologists is known as reciprocal tapping: the subject has to tap as rapidly as possible within two target bars, moving to and fro between them, and wears a portable cassette recorder which times the test with a series of beeps. Sheets of paper with targets marked on them were fastened to a clip board and attached to the back of the seat in front of the subject, who was then required to make dots in the target areas with a coloured pen, to be counted later and measured using a digitising pad. The level of diffi-

★ **NEW PRODUCT** ★

AutoDial



Introductory Offer \$399

Use your IBM Compatible to dial phone numbers for you!
Kit Includes: Telephone dialer, power supply, manual and software.

Features: 48K Memory Resident, Personnel/Company address database with sort function, Print Command, Label, and MS DOS Compatible.

Ideal for office & home use!

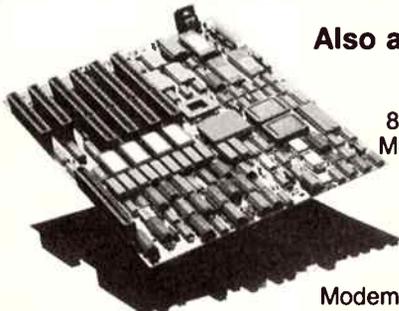
Key Mouse \$299



New Combination Design Keyboard & Mouse

One of the Best 386 Main Boards in the World.

Also available



- 80286-16 Mhz AT
- 8088-1/20 10MHz XT
- Multivideo Display Card
- AD/DA CARD
- Hand Held Scanner
- Eprom Writer Card
- Talk Card
- Voice Card

Modems, Monitors & Printers

80386 — Main PCB 20 MHz

HI-COM UNITRONICS INT P/L

7 PRESIDENT LANE, CARINGBAH, N.S.W. 2229
 P.O. BOX 626 CARINGBAH, 2229 PH: (02) 524 7878

Mail Order	Postage	Mail Order	Postage
Less than \$50	\$3.50	\$100-\$250	\$7.00
\$50-\$99	\$4.50	Above \$250	\$10.00

Heavy items adds extra.



REMEMBER THE FIRST TIME YOU HEARD DOLBY SURROUND® SOUND IN A THEATRE?

WAIT 'TILL YOU HEAR IT AT HOME!

AUDIO

About the Shure HTS 5000

"Once you have seen and heard a proper Dolby Stereo movie presentation in your own home, you'll never be satisfied with ordinary, garden-variety television."

(With the Shure HTS 5000) "... the whole effect was over-whelming. Dialog was crisp and clean, and the stereophonic music and special effects were reproduced by the system with stunning clarity and impact."

"You can actually achieve a much higher quality of sound than in most Dolby Stereo theater installations."

Bert Whyte

"AS GOOD AS OR BETTER THAN THEATRE SOUND"



If you have any doubt about how good Dolby Surround® Sound is with home TV, read these brief comments by independent authorities.

STEREOPHILE

About the Shure HTS 5000

"It is rare in audio to find a clearcut "best" of anything, but in surround decoders, the Shure is the hands-down winner. Simply put, the reason is its superb sound. It has focus, detail, definition and aliveness that I'd not previously heard from any surround decoders or synthesizers..."

"The overall effect is spectacular and authoritative—precisely what one wants from theatrical sound."

Bill Sommerwerck

SHURE HTS 5000 HOME THEATRE SYSTEM



AUDIO ENGINEERS PTY. LTD.
 342 Kent St, Sydney, NSW. 2000
 Ph: (02) 29-6731

MARKETEC PTY. LTD.
 51 Scarborough Beach Rd,
 North Perth, WA. 6000
 Ph: (09) 242-1119

AUDIO ENGINEERS (QLD) AUDIO ENGINEERS (VIC)
 Ph: (02) 29-6731 Ph: (03) 879-0320

AE13

Parabolic flight

culty of the subject's task was varied by increasing the distance between the bars and by decreasing the width of the bars.

Slow under difficulty

When the difficulty increases the subject slows down in order to avoid errors. The movement time increases systematically with the difficulty of the task, so it is possible to fit equations to show how much time is taken up by movement over distance and how much by homing in on a small target area. Data from these experiments are still under analysis but they suggest that both high and low G increase the movement time, in different ways; high G impairs movement over distance, while low G impairs the start of the movement and the homing in to narrow targets.

A variation of this experiment is to ask the subject to tap in time to rapid beeps, thereby forcing him to make errors. In this case the errors occur in predictable directions: overshoot happens when reaching upwards under 0 G or downwards under 2 G, and undershoot when reaching upwards under 2 G or downwards under 0 G. No regular errors occur when reaching to the left or right, but the variability tends to increase when there is a change in G level.

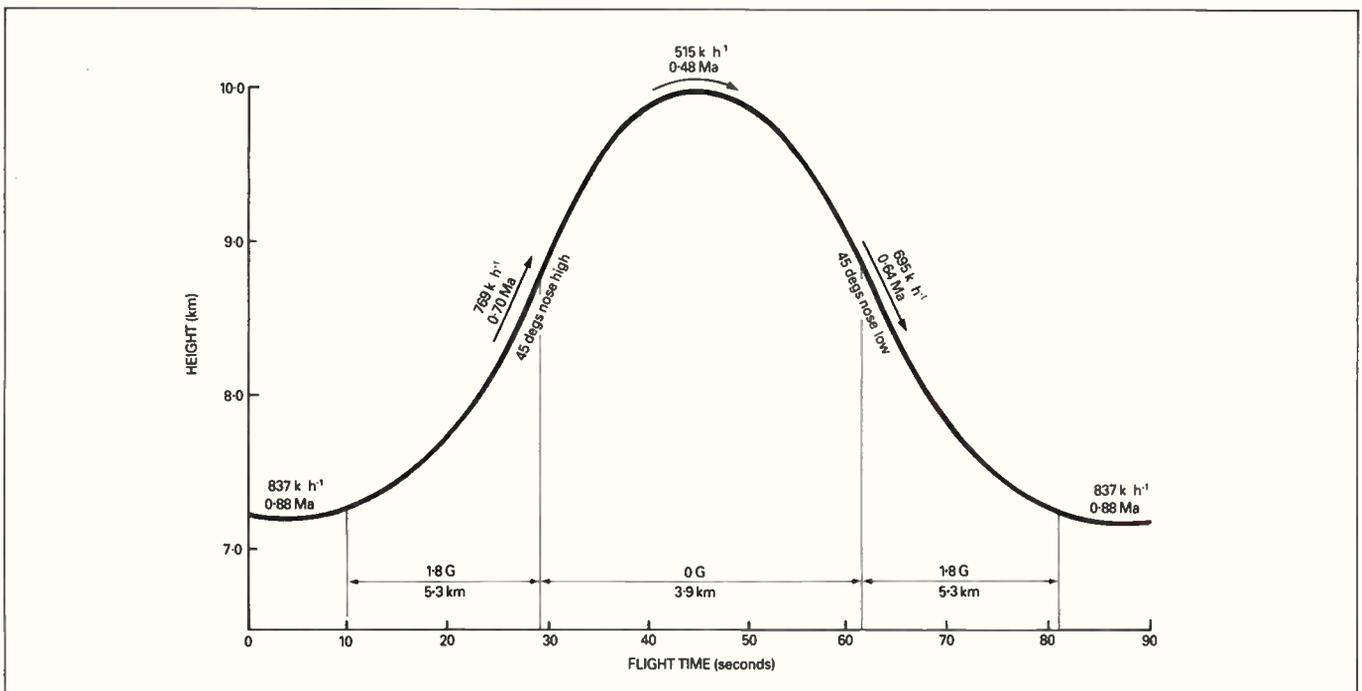
It is clear that rapid motor skills are impaired under sudden changes in gravity. The next step is to investigate how long it takes people to adapt to a weightless environment, and how the



Dr Ulf Merbold of the European Space Agency performs a delicate experiment in space. Before astronauts are able to carry out such tasks efficiently they need time to adapt to their weightlessness, and more knowledge of this is needed. Data to do with this problem have been collected in spaceflight and are being analysed.

"It was a sombre occasion following immediately after a memorial service for the Challenger astronauts"

various parts of the sensory and motor systems adapt. This is more difficult, for it means running complex space experiments over several days, or repeatedly testing the same subjects in parabolic flight. Given the international interest in human performance in space, it is certain that experiments of this type will continue.



Profile of a typical parabola flown by NASA's KC135 aircraft.



STUART CORNER

LET 0055 DO THE TALKING

Inside info on line

News, views and notes on communications by ETI roundsman Stuart Corner

Telecom's 0055 dial up information service went live recently with Australian developed technology being used by over half the 14 information providers on the service. 0055 dial up services differ from the existing recorded information services, on telephone numbers prefixed by 11, in that the information is stored on computer systems, not simple tape recorders.

This means that each caller hears the full message and a much greater number of different services can be supported. Also, 0055 services are charged at a timed rate up to 63 cents per minute with about half the revenue going to Telecom and half to the information provider, thus having the potential to be very profitable to both parties.

To recoup the massive investment in systems and promotion, the use of these systems must become very widespread. If 0055 is to work on the scale which its backers expect, picking up the phone for information will become part of our lifestyle.

Telads Australia claims to be the largest operator of the present dial up information services. In addition to its own services, it operates those of various other organisations. It now claims to be the only Australian manufacturer of equipment for the new 0055 service, as well as

the largest user of 0055 lines. However, in terms of information services, Link Communications, an Australian company in which US telephone carrier Bell South has a majority shareholding, leads with 2000 separate topics. Consolidated Press subsidiary Intelcom is second with over 1300 topics.

The Telads system was designed and developed in Perth by XDEL Technology and will be manufactured under exclusive licence by Telads. The company also hopes to export the equipment to other

'Picking up the phone for information will become part of our lifestyle'

countries. At present only the US and UK operate similar services. Telads also says it is the first commercial organisation to be linked into the Telecom network by a direct fibre optic cable and the first to have Telecom exchange equipment installed on its premises. It operates a total of 650 lines, 480 in Melbourne and 170 in Sydney.

The Consolidated Press subsidiary, Intelcom which runs Inpho, has bought equipment built for 0055 type services in the US, a Voice-tek voice processor. This is

linked into IDM computers and Intelcom has developed its own software to support Inpho.

Most of the services are at present not interactive. The choice of information must be made before the telephone number is dialled. Operators say that the present low penetration of DTMF (tone dial) telephones (about 12 per cent) precluded offering the option of choosing topics by dial tone, as some online services such as home banking and voice mail already do. Operators say that, at some stage in the future, voice recognition operating on simple one word commands will become available. At present most speech recognition systems need to be trained to the voice of each user, however, there are some that can recognise single word commands without pre-training.

Direct text to speech conversion is already being used to provide some of the information available via 0055, Intelcom's foreign exchange rate service is continuously updated by a data feed from the Telerate financial information network.

Information Dialling Services is offering interactive facilities on the 0055 facility for telemarketing. Potential customers will be able to call a 0055 number to hear information about a product. They will also be able to leave their name and address

or key in a fax number from a tone dial telephone to receive a fax of information on a product or service "within minutes of the call taking place."

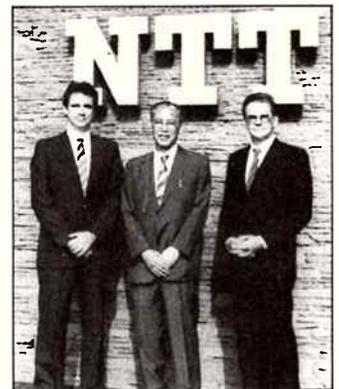
Tariffs, time, distance

The technology of modern telecommunications means that the cost of providing a telephone service is becoming less dependent on the distance and more dependent on the time for which it uses the network. Telecom is slowly moving away from a distance-to-time based tariff scheme, in spite of the dismal failure of its plan to introduce a timed charge for local telephone calls.

The tariffing scheme for 0055, and the recent price changes for local and STD telephone calls both reflect this trend. Rates for calls to 0055 numbers will be the same throughout Australia whether a system operated from say Sydney, is called locally or called from Perth.

Netcomm

Australian modem manufacturer Netcomm announced



Mr Bruce Reid, Mr H. Uryuu, Mr Chris Howells pictured outside NTT in Tokyo after signing of the Netcomm export agreement

record turnover of over \$12 million of the financial year ended in June 1988, a growth of 35 per cent on the previous year. The company is budgeting on even bigger growth, 50 per cent, for the next financial year. Its income in the coming year will be boosted as a result of two recent export successes. The company has signed an agreement with Nippon Telephone and Telegraph (NTT), Japan's national telecommunications carrier, for several thousand 2400 bps modems over the next two years. According to Netcomm managing director Chris Howells, the deal will be worth about four million dollars over this period.

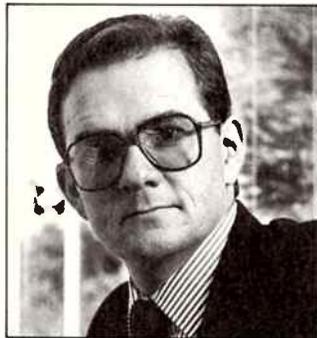
A major element in the Netcomm success was not the sophistication of its designs, but its manufacturing. "The design technology is not leading edge. The manufacturing and quality control technology is however awe-inspiring," he said.

He claimed that Netcomm had become the first Australian communications company to successfully pass NTT's prequalification process, and "the first Australian contractor to NTT, beating major potential Japanese suppliers at their own game."

The price of this success had been very high, Howells said. "The price of entry into international markets can be very big indeed. The cycle will last over 12 months before we get our money back."

Howells praised the help given by the Australian Trade Commission, Austrade "They brought this opportunity to our notice and helped us overcome the cultural difficulties as we negotiated the contract."

Netcomm's second major



Chris Howells

success has been in the US. It has signed an agreement with Apple Computer Inc which Apple has entered into as part of its obligations under the government's Corporate Citizenship scheme.

Details of the agreement have not yet been revealed, but Howells estimated that work done for Apple's US domestic market could yield Netcomm about \$12 million over the next two years.

On the domestic front, Netcomm recently acquired local modem manufacturer Avtek. Howells said this would give Netcomm "a fine low end modem range and add considerably to the cost efficiency of our manufacturing and marketing of commodity products." This market, he said was extremely price competitive because of "unapproved low cost imports and low overhead backyard operations who haven't yet added up their true sales support, warranty and R&D costings."

He called for the new telecommunications regulator, Austel due to come into operation in mid 1989, to liaise with the Department of Customs to ban the import of unapproved modems. The import of unapproved cordless phones was prohibited, and yet there were no local manufacturers of these products

threatened by such imports, Howells said.

Lawyers link up

The Law Society of Victoria has become the first organisation to make use of Telecom's iLink intelligent database access technology. iLink forms the basis of the Law Society's Link online legal information service, launched in July.

Link provides access to a variety of online services from a terminal or PC via a modem and the telephone line. Database available include real property information, Corporate Affairs Commission information, and court information.

Lawyers will also be able to use Link to access a number of the Law Society's information services, and messaging services including electronic mail via the Telecom/OTC Keylink service, send to fax or telex, deliver messages to a courier service for onward carriage as hard copy, and set up private bulletin boards.

The developers of Link say that it represents one-stop shopping for online information. They say it is designed to provide a single easy-to-use access to existing services, not to compete with them. They claim that it is not necessary to learn any commands to use the system effectively.

iLink has been licensed by Telecom from the developer, Bell Canada which operates the system under the name iNet.

Telecom's policy is to operate iLink initially as a closed service, configured to meet the needs of particular special interest groups, such as the lawyers. Telecom sees iLink as the first step in the development of integrated access to a wide range of value

added telecommunications services. Already the proliferation of these causes problems for users with each requiring a different type of terminal, different protocol and different access techniques. A recent paper in the Telecommunications Journal of Australia predicted that "the confusion is likely to worsen in the future as both Telecom and private companies offer an increased range of value added services".

The authors see integrated information access as the solution to the problem. "Integrated information access will provide a gateway to many of the (value added) services and, in its most advanced form, will considerably simplify access and use of these services by automatically tailoring itself to each customer's unique requirements."

Telecom's iLink is only the first step in the company's plans for integrated information access. The systems of the future will be able to automatically configure themselves to each user's different type of terminal, using information about that user stored in a database. They will use text to speech conversion so that information is accessible from a telephone. The system will also contain voice recognition technology and voice templates for each user so that spoken commands can be interpreted. The systems of the future will also incorporate expert systems to help users.

Text to voice conversion is already making its way into online information services. Foreign exchange information on Telecom's new 0055 dialup information service is continuously updated by a direct feed and read out to callers by a text to voice system.

REMOTE VIEW OF

Remote sensing is getting off the ground with Australia playing a big part. Jon Fairall takes a look at the results of Japan's MOS-1 satellite and its effect on the future.



TECHNOLOGY

Japan's first Marine Observation Satellite, (MOS-1) was launched from Tanegashima in February 1987. The first signals were received by the Australian Centre for REmote Sensing (ACRES) at Alice Springs in April, and an agreement on the regular use of the data was in place by June.

The speed with which ACRES was able to acquire signals from MOS-1, and the urgency with which the deal was signed, underscores the importance remote sensing is gaining in Australia among the scientific community. It's a discipline that is rapidly joining the exclusive list of areas where Australians with the will can do advanced engineering. In fact, it joins radio astronomy, some aspects of microelectronics, and modems as one of the few areas where the technology available to local engineers is on a par with the best overseas.

ETI OCTOBER '88

This is fortunate, because remote sensing as a science, much less as a part of engineering, is only just getting off the ground. Around the world, governments and big corporations are starting to wake up to the tremendous potential of spying on the world from above. And scientists are just starting to really understand the wealth of information that can be gleaned from a satellite three hundred or more kilometres up.

Remote sensing in Australia started with scientists at CSIRO receiving pictures from the early Landsats. Experiments carried out in 1974 by Dr Andy Green and his colleagues at CSIRO demonstrated the wealth of detail we were missing because of the loss of contrast on the US made tapes.

This research led directly to the setting up of remote sensing expertise in Australia. Green set up a system to

A BIG COUNTRY



MOS-1 — ACRES of signals

computer enhance the NASA images to restore their original detail and, in 1979, this system was augmented by the ability to receive Landsat Images directly.

Local industry involved

The Australian Landsat Office was set up in Alice Springs, and this facility has

of the instrumentation necessary to build a remote sensing station is available from Australian companies.

Products now available include an AVHRR (Advanced Very High Resolution Radiometer) reception system (called SAT-TRAC) being sold throughout Australia and South-East Asia by

PCM Electronics. This arose through work of Dr Garth Paltridge and his colleagues in the Division of Atmospheric Research. Other products being commercialised arose from a signal processing experiment involving the experimental modification of the facility at Alice Springs. This satellite reception station was modified to receive data from the Landsat Thematic Mapper, a new instrument introduced in 1985 but not accessible utilising the original Landsat reception system. COSSA believes the products which arose from this experiment — including the CPU system — have the potential to increase throughput in existing Landsat reception equipment around the world.

However, the arrival of SPOT, the French remote sensing satellite, showed that there was more to the world of remote sensing than playing downstation to the Americans. In fact, as remote sensing has become less of a backroom experiment and more of a mainstream commercial product, the competition among satellite vendors has hotted up.

'There is more to the world of remote sensing than playing downstation to the Americans.'

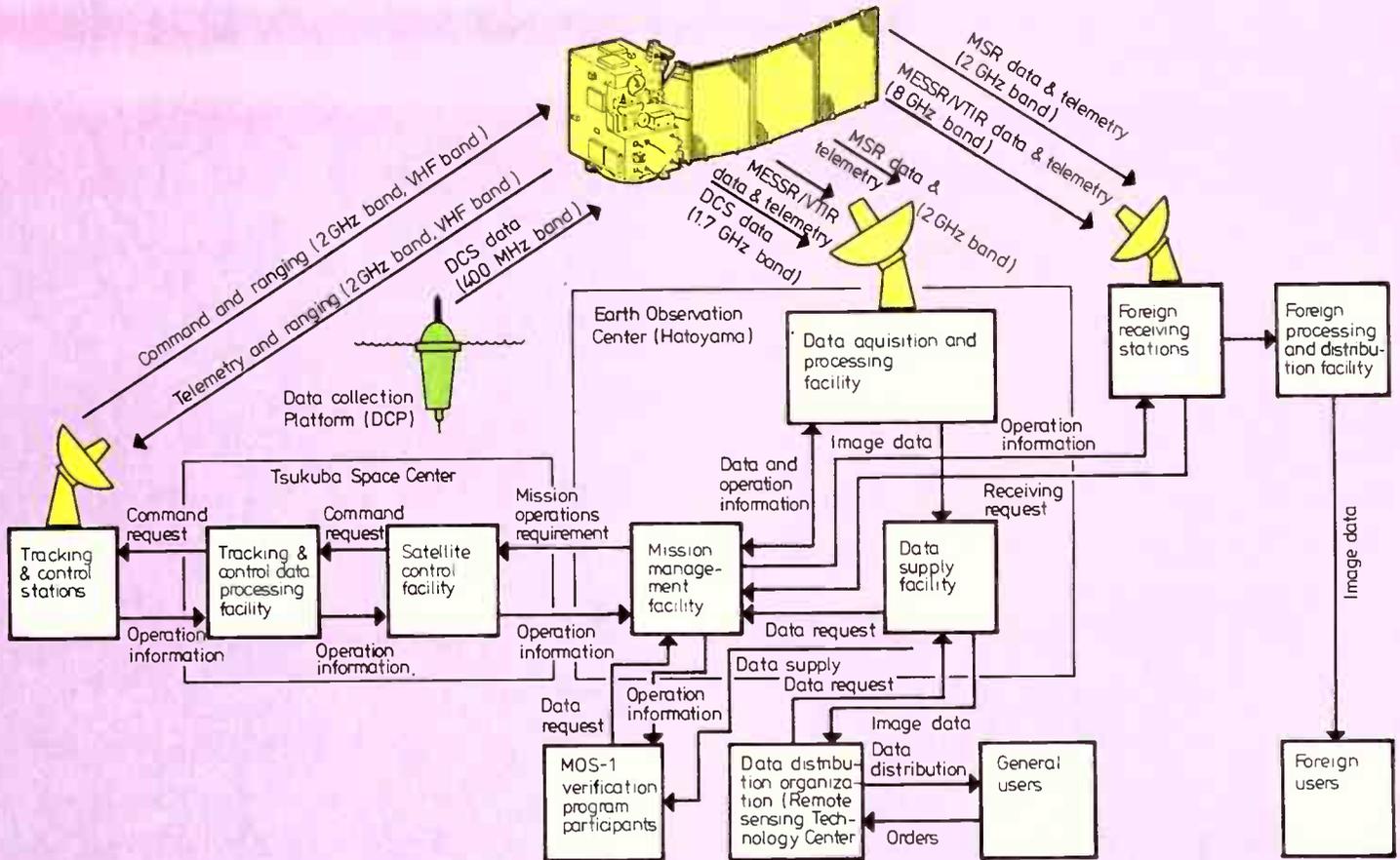
led to a steady increase in our ability to extract information from the images. From the early days, CSIRO has adopted a policy of involving industry closely in its plans. This is even more true of the CSIRO's space office (COSSA). The result is that today most

PCM Electronics. This arose through work of Dr Garth Paltridge and his colleagues in the Division of Atmospheric Research.

Other products being commercialised arose from a signal processing experiment involving the experimental modi-

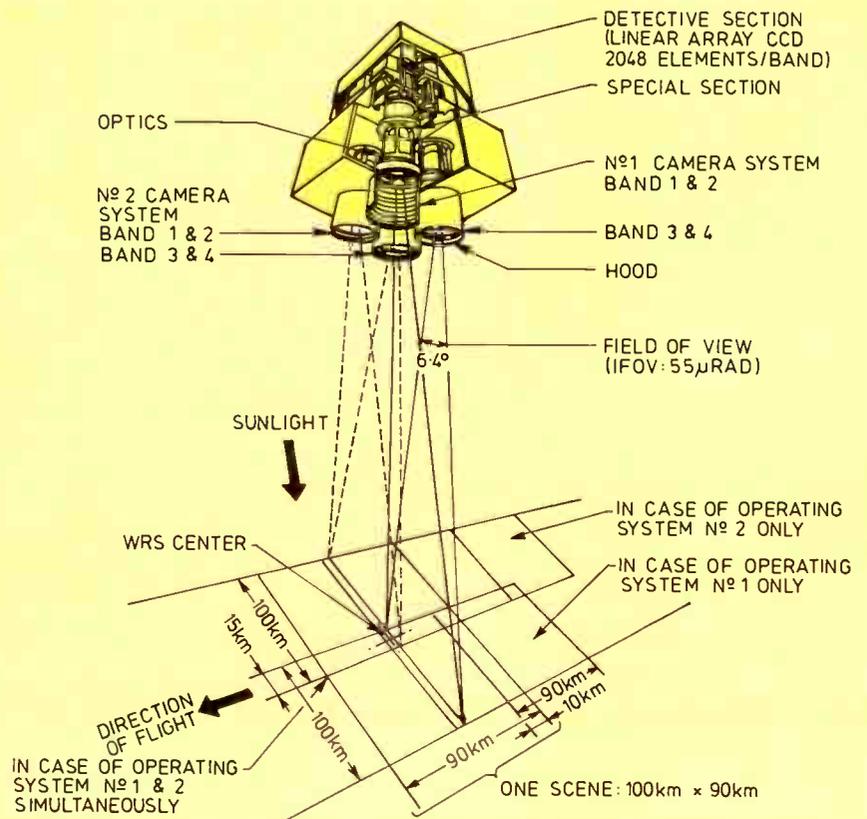
ETI OCTOBER '88

MOS-1: remote sensing satellite



MESSR

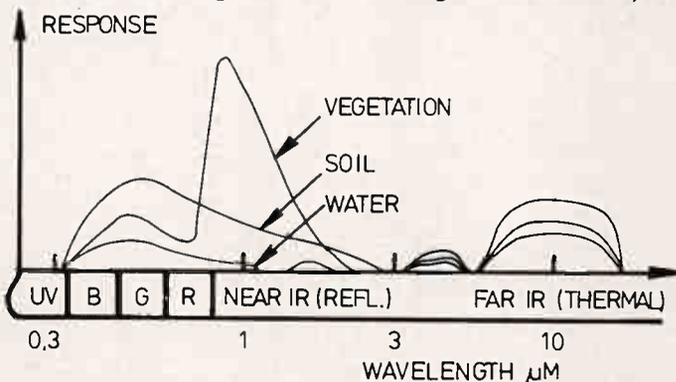
The Multispectrum Electronic Self Scanning Radiometer detects radiation from the ground in two visible, and two infra-red bands. It is equipped with two camera systems that are arranged parallel to the direction of motion of the satellite. Each camera system has two optical units, one for visual and other for infra-red observations. Each scans a width of 100 km at the surface, and between them they can scan a path 185 km wide. The imaging plane on both units consists of a CCD array with 2048 x 2048 pixels, so a single pixel is about 50 metres on the earth's surface.



HOW IT WORKS

Most of the sun's radiation reaching the Earth's surface is reflected back into the atmosphere and, like the incoming radiation, it is filtered by atmospheric particles before continuing into space. Of the remainder, blue light is mostly scattered in the atmosphere, colouring the sky its usual light blue. Other wavelengths may be attenuated, absorbed, refracted or diffracted either at the surface or above. Clouds reflect or attenuate most of the visible light but transmit some radiation from other parts of the spectrum including some infrared and microwave.

At the Earth's surface electromagnetic energy is reflected or radiated at varying degrees, depending on wavelengths and surface materials. For instance, if we measure radiation of different wavelengths reflected or emitted from a particular substance, considerable variation is observed and may be plotted as a "spectral reflectance curve" or "signature".



Similarly, if we measure reflected and emitted radiation over a large area consisting of soil, cement, water, asphalt, healthy and diseased vegetation, these changes too may be plotted, as can their changes over time. Because of this, we can identify forest, farmland, irrigated and non-irrigated crops, different timber species, different rock-types, commercial and residential areas, erosion and overgrazing, lakes, rivers, oceans, as well as a large range of other features.

Although the latest technology allows for the measurement of spectral reflectance over a continuous range of wavelengths, the data rate is well beyond current economic levels and data storage technology for routine monitoring by satellites.

To overcome this problem, specific small ranges of wavelengths are chosen to coincide with peaks or maximum difference in the spectral reflectance of specific earth cover types. These small ranges of wavelengths are commonly referred to as

spectral bands.

The Landsat-MSS instrument for example measures the earth's surface reflectance in four spectral bands, of which two fall within the visible part of the electromagnetic spectrum (green and red) and two in the infrared. The MSS measures these reflectances digitally over 64 values from black (0) to white (63).

For the later Landsat Thematic Mapper significant improvements were made both spectrally and dynamically. The number of spectral bands were increased to seven, including a thermal band, and were more finely tuned to general user needs. Dynamically, the instrument's range was improved to 256 quantisation levels.

The design of the HRV instrument of SPOT is of similar dynamic range to the thematic mapper with two bands in the visible part (green & red) and one in the infrared part of the spectrum. In addition, the HRV has a "panchromatic" band spectrally overlapping the green and red bands.

The AVHRR aboard the latest NOAA satellites only has one band in the visible part of the spectrum, crossing the green/red boundary, but has four bands in infrared, ranging from near infrared to thermal infrared. The dynamic range of AVHRR bands is much greater than any of the above instruments, as it has 1024 quantisation levels.

Suited to local requirements

A number of nations either have, or are planning, new satellites with improved characteristics. Of particular interest to Australia are Japanese plans, because Japanese satellites have orbits optimised for Japan's location. These turn out to be well suited to Australia's requirements as well.

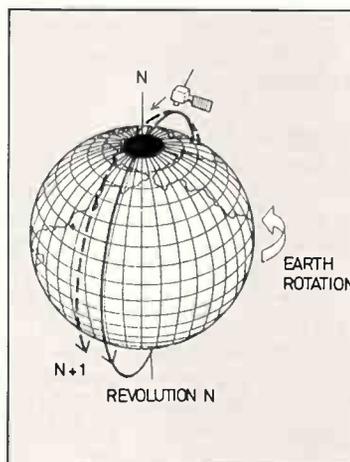
MOS-1 is the first of a new breed of satellite for remote sensing. It is not optimised for visual resolution — that would be too militarily contentious. However, it makes use of a number of new instruments and wavelengths from which it is possible to extract a surprising amount of data. (see boxes)

MOS-1 is expected to establish fundamental technologies for earth-observing satellites, primarily by observing marine phenomena like ocean colour and temperature. It is in some ways similar to Landsat, and carries sensors enabling resources and environment monitoring.

Because there is no on-board storage of data on MOS-1, coverage of the Australasian region will only be possible through direct reception of data in Aus-

tralia.

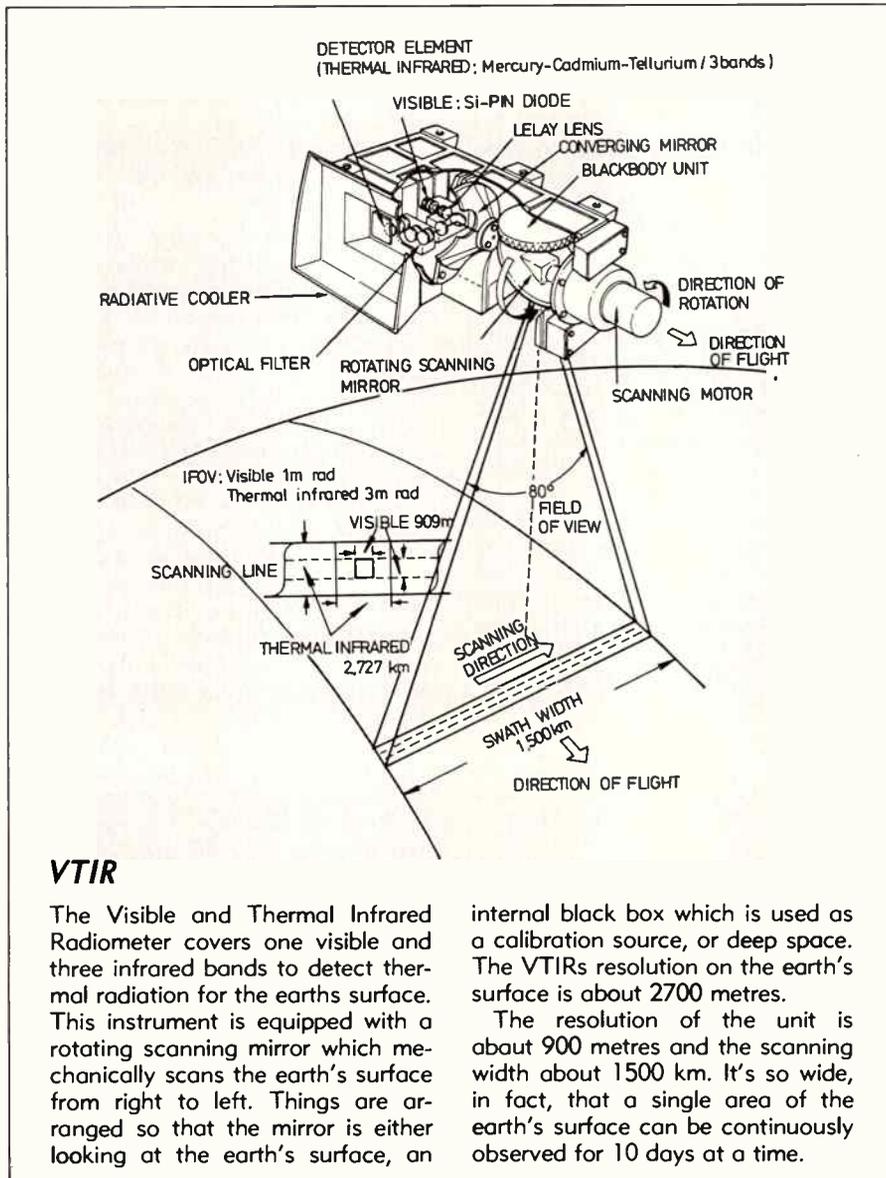
Data is therefore received at Alice Springs, which has been modified once again. The work is proceeding under an



MOS-1 orbit details

Item	Value
Altitude	908.7 km
Semi-major axis	7,286.9 km
Inclination	99.1°
Eccentricity	0.004
Period	6,190.5 sec
Coverage cycle duration	17 days (237 revs)
Revolutions per day	14-17/1 revs
Time of descending node equator crossing (local time)	10:00—11:00 AM
Ground trace accuracy (deviation at the equator)	20 Km

MOS-1: remote sensing satellite



VTIR

The Visible and Thermal Infrared Radiometer covers one visible and three infrared bands to detect thermal radiation for the earth's surface. This instrument is equipped with a rotating scanning mirror which mechanically scans the earth's surface from right to left. Things are arranged so that the mirror is either looking at the earth's surface, an

internal black box which is used as a calibration source, or deep space. The VTIR's resolution on the earth's surface is about 2700 metres.

The resolution of the unit is about 900 metres and the scanning width about 1500 km. It's so wide, in fact, that a single area of the earth's surface can be continuously observed for 10 days at a time.

agreement between CSIRO and the former Department of Resources and Energy (now Administrative Services). Modifications will be carried out by Australian industry, tertiary education institutions and CSIRO — giving Australians valuable experience in satellite ground station design and engineering.

This modification work is under the control of the MOS-1 technical team led by Dr Green. Contracts have been let to Australian industry for the modification and Dr Green's Division as well as the Division of Radiophysics are providing vital design input.

Companies involved in the project include Techsearch, Baber Enterprises, MITEC, and Hawker de Havilland. Hawker's Ian Bryce, the project man-

ager for the reception system, reports that the equipment is functioning well, even at the low elevation angles which will provide the ocean data sought by many of the experimenters.

Data co-ordination

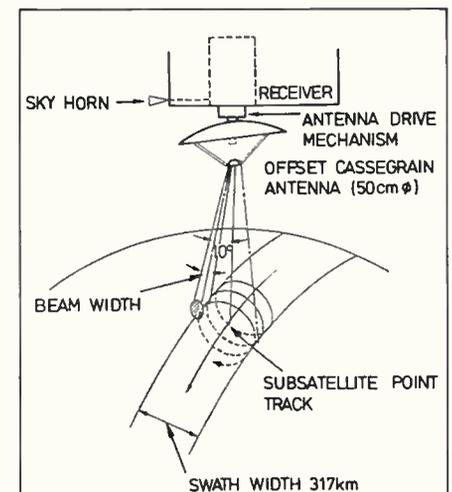
COSSA has established a science team for MOS-1, led by Drs Carl Nilsson and Graham Harris from the Marine Laboratories in Hobart. They will co-ordinate data requirements from around Australia, and formulate an experimental program for acquisition of data from particular instruments at particular times. Reception commenced in the second quarter of this year and the Project Scientist Team, led by Dr Harris and Dr Nilsson, will develop an experimental program of

data acquisition and interpretation.

COSSA's role is in co-ordinating participants in both the modification of reception facilities and in the experiments connected with the MOS-1 data.

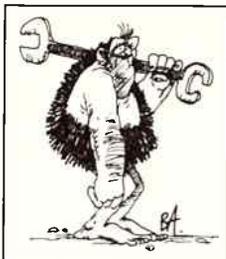
What is it good for

The importance of remote sensing to Australian commercial interest is already helping Australian fishermen find the big catches. CSIRO has pioneered the use of NOAA (US meteorological satellite) sea-surface temperature imagery by the fishing industry to cost-effectively locate fish stocks. The Division of Water Resources has assisted in the development of a system for sending processed imagery to the western waters bluefin fishing fleet via telephone. In the east, Atmospheric Research also has a contract to provide daily NOAA imagery of south-eastern Australian waters to the fleet in that area. The Division collaborates with Tasmanian fishermen to direct satellite data to the fleet, showing the likely areas for catching jack mackerel. In Perth, satellites are used for research into the lucrative Western Rock Lobster fishery.



MSR

The Microwave Scanning Radiometer measures the quantity of water, snow and ice. Its front end is a parabolic antenna. This antenna revolves slowly, establishing a conical scan pattern on the surface of the earth. It receives radio waves at 23.8 and 31.4 GHz, both of which wavelengths respond strongly to the presence of vapour. Water vapour has an absorption line at 22.235 GHz. Its resolution is of the order of 20-30 km.



TECHNOLOGY

In this Bicentennial year tributes to Captain Arthur Phillip are an everyday occurrence. Yet the achievements of far earlier visionaries which may well have aided Cook with his initial discovery and Phillip with his First Settlement go unrecognised and unheralded.

Some historians believe that it was a Greek who actually discovered Australia. One story goes that when Alexander the Great reached India in the 4th century BC he sent one of his senior officers to explore the southern hemisphere. Upon returning, the officer excitedly reported that a boundless land existed . . . the expanse of today's Australia.

During the second century AD, in his map of the then known world, the Egyptian-born Greek mathematician, astronomer and geographer, Ptolemy, sketched in the known coasts of Asia showing what is now the Indian Ocean as an enormous lake and placing a huge unknown land which he called "Terra Incognita" to the south of it. European explorations 1500 years later by the Portuguese, Spanish and Dutch proved that "Terra Incognita" really did exist.

While the details about any such discovery and subsequent documentation are obscured by the mists of time, one thing is certain: the term "Greek connection" took a new meaning on August 27, 1829. It was on that date that the first Greeks (a group of seven young Greek seamen convicts transported along with a shipload of British and Irish prisoners) stepped ashore at the fledg-

ling settlement of Sydney. The two who remained (five returned to Greece in 1836 after being pardoned and freed) became pioneers of the Greek community in Australia, a well established group that has now grown to an estimated size of 700,000 members.

A handful of these maintain a daily link with Greece. As licensed amateur radio operators in Australia they regularly participate in several Greek language nets that originate from the capital of a country which has not always looked favourably upon the specialised electronics hobby.

Foundations

While the foundations of the first amateur radio organisation — the Union of Greek Amateur Transmissions

'One of the association's main activities has been the establishment of an extensive repeater network for emergency communications'

(UGAT) — dates to May 1926, there was no amateur radio legislation before 1972 and no exams for the three classes of amateur license before 1977. Until that year operation was authorised on a 'temporary' basis.

In 1988 the situation is totally different. The Department of Post and Communications within the Ministry of Transport and Communications is responsible for administering amateur radio exams in Athens as well as in three or four other major centres each year.

There are nearly 1000 licensed radio amateurs in Greece. They belong to the Radio Amateur Association of Greece, the organisation created in 1958 to supersede the UGAT. Radio clubs in Thessaloniki, Crete and Rhodes are affiliated to the Athens-based headquarters of RAAG (PO Box 3564, Athens

THE GREEK CONNECTION

Radio and TV are both used by the Greek government to keep in touch with their countrymen abroad.



The Greek/Australia connection continues at Greek Radio & Television. Amalia (Vassiliadis) Travasarou (left) at Melbourne's 3EA for 6 years is now at ERT while Australia's Noulie Skoumbas on a brief visit to ERT gets an updated Greek perspective for future SBS programs. ERT's Athens-based broadcaster and promotions executive Irene Kamperidis, is regularly seen on SBS though a series of Greek mini programs.

ETI OCTOBER '88

Greek connection

10210).

One of the association's main activities has been the establishment of an extensive repeater network for emergency communications. A dozen RAAG VHF repeaters have already been sited on selected mountain tops across country.

VHF communications were put to the test in September 1986 when disaster struck the town of Kalamata. All municipal utilities including electricity were cut but as power (supplied by solar panels) was available for the 2400 m high R0 repeater on the Peloponesian Peninsula, amateurs were able to co-ordinate emergency communications during extended relief operations.

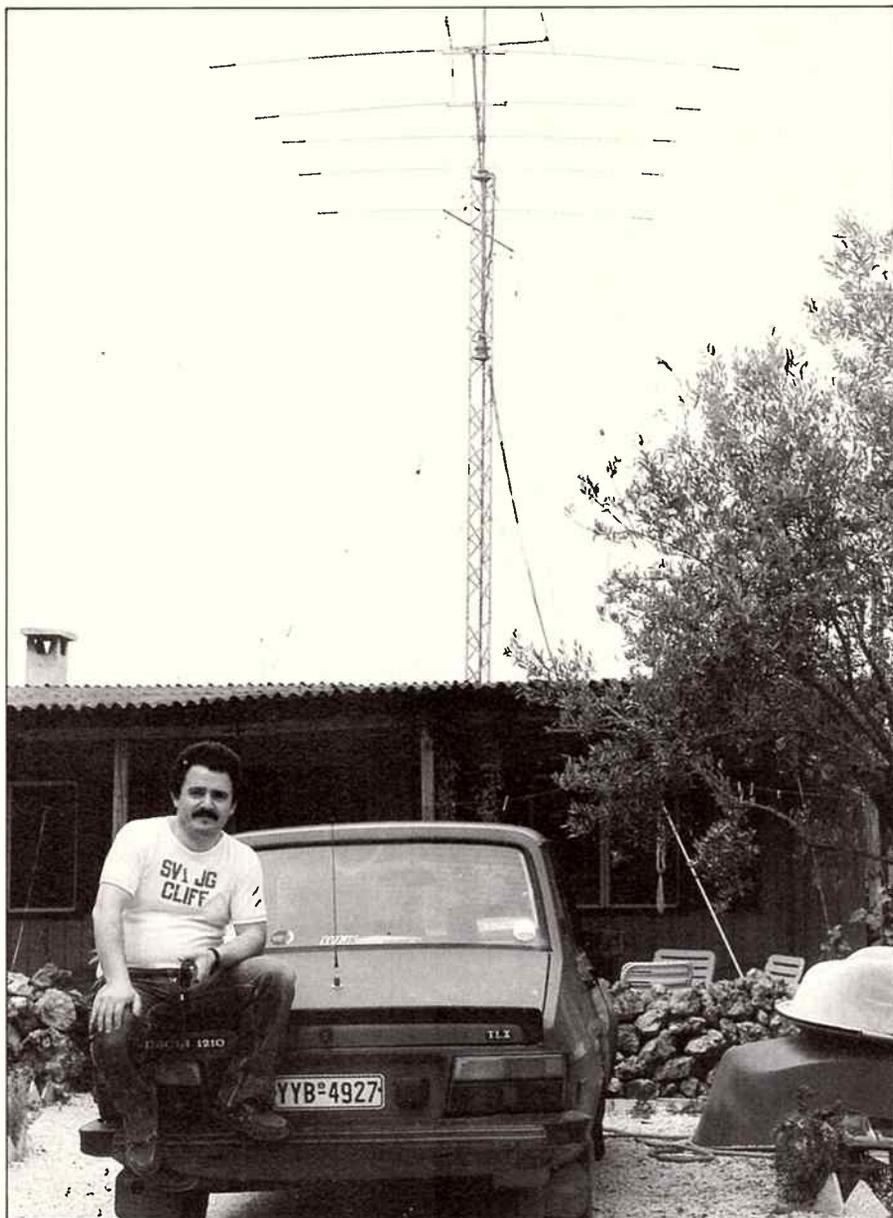
Even though numerous amateurs volunteered for this life saving exercise (as they have done many times before) and provided invaluable time and expertise as well as use of their communications equipment those in government who determine tariffs and taxes have not made life any less costly for Greek radio enthusiasts. An effective tariff of about 63 per cent currently placed on amateur radio equipment has not only put the price of commercial units out of the reach of the average amateur it has dramatically slowed the growth of the hobby in Greece.

One Greek company shines a tiny light of enterprising encouragement over this unfortunate taxing situation. For the past several years, Athens-based C & A Electronics has manufactured a number of HF and VHF kits. Perhaps the most popular range of kits is a series of low power transmitters plus receivers suitable for the FM broadcast band.

Controlled by military

The domestic manufacture and local marketing of such easily accessible consumer communications items would have been unheard of during the period between 1967-73 when the country was ruled by a harsh military government. Strict controls over electronic and print media began to ease only when the military was ousted by an elected civilian government. A December 1974 referendum resulted in the proclamation of a republic.

The return to democratic rule was a much welcomed event widely reported by all broadcast services of Elliniki Radiophonia Tileorassi (EPT in Greek and ERT in English). Although this wasn't the first time such a significant political event had been covered by the Hellenic Broadcasting Corporation since



Providing many with their first Greek QSL card is Cliff Saccalis SV1JG, one of Athens most active amateur radio operators.

continuous radio broadcasting began in 1937, all Greeks are unanimous in hoping it will be the last!

Fifty one years ago when ERT commenced regular transmissions, listeners living in the then kingdom of Greece were satisfied with limited operation of an AM service. In the intervening half century technology has broadened the broadcast horizon so that Greeks now have a wide choice of AM, FM, TV as well as shortwave services.

"Currently there are 13 ERT medium wave AM stations in Greece", said Kofossis Theophanis Technical Director for ERT. (Another 12 AM stations are operated by ERT-2, a separate organi-

sation.) Radio 1 (150 kW) is the 'official' station carrying news and serious programs on 729 KHz while Radio 2 (50 kW) broadcasts light popular music on 1386 kHz. Classical music is the mainstay of Radio 3 which still uses the original 51 year old 15 kW transmitter. (A new 300 kW power house is due for installation.) ERT-2 operates a 200 kW transmitter on 981 KHz in Athens which broadcasts 'mixed programming'.

Some 17 different centres are served by FM radio. Most areas have two channels although Athens has 10 kW ERT transmitters on 91.6, 93.6 and 95.6 MHz. FM broadcasting took on a new dimension in late May 1987 with the

start of private stations. Radio Athens on 98.4 MHz was the country's first private commercial FM broadcaster. (All other FM, AM and TV services are commercially supported, government owned operations. Although they accept advertising, Greeks need to pay for a license fee which is included in the domestic electricity bill!)

ERT (PO Box 19, Aghia Paraskevi, Attikis, Athens) and ERT-2 (136 Messo-gion Street, Athens) each have a network of SECAM format television stations plus around 120 low power relay stations. In the capital nearly four million Athenians can watch the channel 11 30 kW ERT transmitter. In addition, ERT-2 has a channel 5 Athens 1 transmitter and a channel 39, 30 kW Athens 2 transmitter providing afternoon to late night programming. During the summer season TV DXers in Egypt, Libya, Italy, Israel and other relatively nearby countries can frequently view transmissions from various ERT transmitter sites.

Shortwave

More consistent year round reception from Greece is available through ERT's shortwave service. While shortwave broadcasting began in 1950 it was only in 1972 when the announcement "Edo Athine Elliniki Radiophonia Tileorassi. This is Athens. You are listening to the Voice of Greece" could be regularly heard around the world. In that year two 100 kW Marconi vapour cooled transmitters sited 70 km north of Athens at Avlis and a 250 kW transmitter at Kavala were put into operation. (Using a massive curtain antenna with reflector there is an effective 19dB gain.)

"The Voice of Greece shortwave transmitters are vitally important", said Irene Kamperidis, ERT broadcaster and public relations co-ordinator, "to maintain cultural contact with Greeks living abroad and to present Greek heritage to the world."

Greek programming for Greeks living abroad — now estimated to number around 3 million — began in 1975 although ERT only established a Department of TV and Radio Programming for Greeks Abroad in 1982. Until recently Andreas Arnakes, a 31 year broadcasting industry veteran, headed the department responsible for providing "a service to all Greeks in all countries".

This is primarily achieved through a virtual 24 hour Greek language shortwave service "which carries news of everything from politics and the economy to technology and cinema plus radio features". While news in Greek is

broadcast to all target audiences, the transmission of features is somewhat more specific. For instance, feature material for Greeks living in Scandinavia would not be very relevant for Greeks in Australia listening to beamed broadcasts around 7.430, 9.395 on 9.420 MHz at 2100 GMT.

In addition to its multitude of Greek broadcasts the Voice of Greece transmits daily programs in English, Portuguese, Spanish, German, French, Turkish, Arabic, Serbo Croatian, Russian, Roumanian, Bulgarian and Albanian to

audiences as far afield as Scandinavia, Japan, South America and Australia. The Voice of Greece transmits to Australia in English every day at 0900 GMT on frequencies around 15.625 and 17.565 MHz.

Apart from ensuring the supply of suitable material for shortwave broadcasts to Greeks resident outside the country the Department of TV and Radio Programming for Greeks Abroad has several other important activities: preparing prerecorded programs for overseas radio and television stations and assisting with radio and television co-productions.

New venture

A relatively new venture, Greek radio programs from ERT are now regularly distributed to ethnic radio stations in many parts of the world. Radio stations 2EA and 3EA are among the users of ERT prerecorded material in Australia.

The multicultural SBS also makes use of prerecorded TV material produced by ERT. Irene Kamperidis, a frequent on-camera personality said, "the emphasis of these segments is to present the civilisation of Greece to middle Australia. This is done by showing the splendours of ancient Greece together with its modern aspects. Travel, cooking, fashion and music are important elements in understanding what Greece really is about."

The Greece/Australia communications connection was further enhanced mid last year with the signing of a co-production agreement between ERT and SBS. To initially operate over a three year period the protocol accord calls for the joint production of an English language TV series featuring international stars. As well, a documentary series of six half hour episodes is also on the drawing boards.

If the past professionalism of both broadcast organisations is any indication to the standards expected of this new co-production it is certain to receive rave reviews from a worldwide audience. With such a satisfied global following, the resulting increased volume of letters could, however, prove to be a mail room hazard!

As it is now, ERT receives some 20,000 letters a year. While nearly all of them are complimentary the odd letter of complaint is not only remembered it is acted upon, if possible. In one instance nothing could be done. A listener in Guatemala wrote in to say that while he was an ardent fan in Central America he wasn't always able to receive the medium wave signal from Greece!

'... it was only in 1972 when the announcement "This is Athens, you are listening to the voice of Greece" became a regular shortwave sound around the world'



A rise in disposable income coupled with a heightened awareness and interest in electronics and communications has encouraged the establishment and prosperity of shops selling made-in-Greece kits.



TECHNOLOGY

The Society of Motion Picture and Television Engineers held its international conference and exhibition recently. Barrie Smith describes the new techniques, processes and systems.

SOUND & VISION /88

It's video vs film!



Third time for Sydney: the SMPTE held its international conference and exhibition in June of this year at the Sydney showground. The show was a big deal — videowise; but there was precious little for film industry types. For those with a need to update equipment it was definitely a show for the fat cheque book.

Three halls housed the equipment, with one doubling as presentation hall for industry experts to present new techniques, processes and systems.

The papers presented covered a wide variety of subjects: Loudspeakers for

Cinemas: a spokesman from Bose criticised the current use of horn-loaded speakers for cinemas with low fidelity and dynamic range, and stressed that installation of constant-directivity horn loudspeakers was incorrect for stereo playback. EMI presented a new sound effects library recorded by two mics with vastly different pick-up patterns. Sony, Ampex and Bosch each presented papers on their individual approaches to digital video recording.

Speakers from Channel 9 Sydney, NBC and Telegram US described their approach to three widely different Out-



Sony's BPV505 combo unit in SP format.



The JANDS and Kodak stands.

side Broadcasts: Australia Live, Calgary Olympics and Seoul Olympics — the latter speech entitled 'Advanced Technology or TV form a Parking Lot?' and Andrew Mason from Sydney film special effects company, Mirage, went to considerable lengths to convince his audience the elaborately complex scenes in Australian feature 'Time Guardian' were extra special — even if the film was a critical and commercial failure. Seems paying customers just won't shell out nine bucks for an hour and half of laser battles anymore.

Kodak heaved a weighty pebble into

the High Definition camp by pointing out its limitations as compared to film — including erroneous financial advantages, the limitations of its plumbicon picture tube, and a low indicated speed, in film terms, of close to 50 ASA.

The chuckle event of the papers given was a carefully presented dissertation on sync in TV broadcasting given by a gentleman from the Finnish Broadcasting Co. Helsinki must be a quiet place for such complicated research to occupy so many minds for so long a period.

Using a mixed test audience of

trained and untrained viewers (producers and directors were described as 'untrained'), some surprising results arose. Film editors were the only ones able to pick a half frame shift. Untrained observers were blissfully unaware of 2 to 2.4 frame shifts.

At the movies

On the second night a special presentation was given at a Sydney theatre. The Greater Union people had gone to a great deal of trouble altering the cinema's projectors to run 35 mm film at 30 frames per second, Super 35 anamorphic and a sample of three perforation pulldown release print. Viewers were able to judge in split screen format 24 and 30 frames side by side. There was little doubt the portrayal of action and apparent sharpness was much improved. Many had read and heard of these proposed changes to a 90 year old medium, but few had seen them.

Then, a screening of Super 35 — in 1.85:1 ratio. Speakers from US labs and Sydney's Colorfilm waded through all the pros and cons, production and lab-wise, of the three pathways opening up to 35 mm producers and DOPS.

HDTV is approaching, causing much fear in TV broadcast and production circles. 35mm film seems to present the optimum as an original sourcing medium for high quality programming. The need will be for 30 fs — to align with NTSC specs; shooting in 3 perf pulldown will save 25 per cent stock cost; and Super 35 shot flat on 3 perf will not only save stock but fit in very well with the near widescreen ratio of HDTV, as well as provide a property for release on the anamorphic screen. The philosophy is very sound.

Product

In the exhibition halls little of showbiz was apparent as manufacturers of expensive hardware tried to attract paying customers, with one exception being the Ampex stand where Network 7 Sydney personality Graham Webb hosted demos of the pioneering company's clever bits of machinery. With the ADO just about becoming a generic name in the business, Webb described a live performance of the digital effects equipment as though it was a sporting event.

Most times a crowd thronged around the company's VPR-300 D2 format Digital VTR. It uses 19mm cassettes and is claimed to be able to recue a 30 second TV commercial in 1.5 secs. In all fast forward, reverse and jog modes the picture is viewable in colour. Edits are dead accurate, no phase shifts. And it's capable of more generations than



the House of Windsor.

The same company also declared their interest in Betacam SP — soon in PAL for our shores. Apparently Ampex have signed an 'enhanced Betacam agreement' with Sony. Portable remote recorders weighed a mere 6.8 kg. Using a component signal the company claims a lift in the quality of graphics, titles,

'... little of showbiz was apparent as manufacturers of expensive hardware tried to attract paying customers'

better video to film transfers — and the capacity to record a scene with chroma key background — at last in a portable video medium.

Innovators

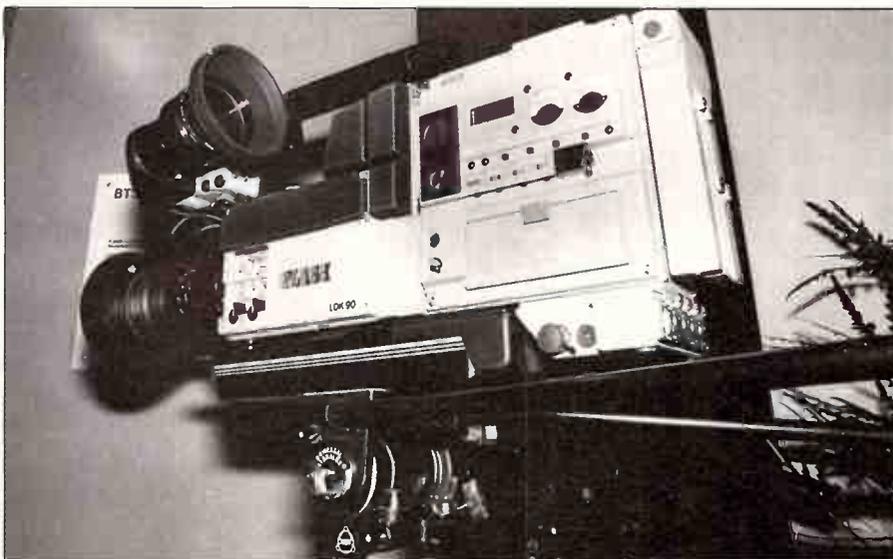
Sony impressed with its range too. Obviously a company aware of the growing trade in documentary and lower level production they showed a range of hardware that takes aim at the growing

educational and corporate video market. Sony were innovators of the original Betacam in 1982, now they offer SP. It probably offers sufficient quality leap to last until digital cameras arrive. Their BUW-SOS UTR-in-camera uses a three chip CCD on image sensor. Claimed figures are an operating stop of F5 at 2,000 lux, with 500 lines horizontal resolution. SP (Superior Performance) recording format relies upon the use of metal particle tape for improved picture quality. Using a higher FM carrier frequency has improved luminance bandwidth (25Hz to 5.5MHz), S/N (50dB), and other parameters. SP is compatible with the existing Betacam format.

The CCD camera front end exhibits the usual no lag, no burn in attributes. The record end gives a neat trick in allowing viewfinder replay whilst recording. The combo BVW-505 measures a compact 403 x 244 x 116mm.

Sony also showed the Bertacam SP production facility: cameras, editing medium.

SP comes like a knight in shining armour. Their Digital Cassette Recorder opens arms to all signals, with input/output interfaces to RGB, Betacam or parallel video sources. It promises more



Bosch's LDK 90 as a camera recorder.



Panasonic's entry in the tiny camera stakes.

than 20 generations of dub without loss, plus recognizable colour pictures at replay speeds of up to 40x.

Visiting the GEC/Matsushita stand I noticed a small ball and socket head, walked away, then returned. The ball and socket was there for a purpose — it held a colour camera that was so small it was ridiculous. Sized about a third the length of a fountain pen, and about as thick it produced a very acceptable picture.

Matsushita is now in the process of erasing the brand name National from our collective consciences, to be replaced with Panasonic. More revenue for the ad agencies and confusion for the public?

A quiet, but nonetheless intense war rages between the forces of MII and Betacom SP formats. The former is Matsushita's runner in the ENG higher quality stakes. SP has been accepted by all major networks in Australia, with no orders as yet for the MII. Also at the GEC/Matsushita stand was a healthy array of MII equipment. Notable was the F200CD cam-corder, and the AK-400 camera front end. Using metal tape it can take 90min loads of its 1/2" tape.

It's noteworthy that although the Pano-

sonic boys admit that Betacom SP has quite a lead in the race, their system is still doing well, and consider there are unique benefits in MII.

In Japan, NHK currently uses 200 VTR units for recording, editing and telecast — plus another 40 units for satellite and local relay work.

NBC have taken on a total of 1,010 assorted pieces of MII gear. The network expects to be pumping out 180 hours of vision from the Seoul Olympics. In stereo too, plus separate music and effects tracks via MII's four track audio function. Cost of a basic setup, including two cameras, and post production equipment gets into the \$150,000 zone. A fairer gamble than the high tech, but high cost, digital path.

Bosch

Bosch showed its excellent LDK90 ENG model, plus the LDK900 studio camera, using the same frame transfer operating principle. Unusual in a studio camera it features a shutter speeded to 1/500, which makes it an ideal unit for outside sports broadcasts. Its smaller brother, the LDK90 is a CCD camera that weighs a mere 2.35 kgs and has a 350,000 pixel imaging section. At the

end of the first quarter of this year the company had sold 250 of the model 90. Jointly developed by Bosch and Philips is the DCR-100 Digital VTR, using the accepted standard 19mm cassettes. Recording an 8-bit component signal it can be switched between 525/60 NTSC and 625/50 PAL standards. Audio is captured on four digital tracks and one analogue, frequency range 60 Hz-18 kHz at ±2db.

JVC exhibited some nice post production gear, including Time Base Correctors for 1/2" and 3/4" sources, and the EC-740 Editing Controller. The RM-G850E Auto Edit Unit pairs with the PR-900 3/4" High Band recorder. The former offers a useful feature in that edit points may be entered in both still mode — and on the fly. For many it should make 3/4" High Band recorder. The former offers a useful feature in that edit points may be entered in both still mode — and on the fly. For many it should make 3/4" cutting a whole lot more desirable.

Attracting quite a curious crowd was the BR-8600E VCR Editing Recorder. It offers most of the ease of use and features of 3/4" systems. Using 6 heads — 2 for record, 2 for search and still and 2 rotary heads for insert edits it gives

Sound & Vision '88

such useful aids as variable speed search forward and reverse. The system offers horizontal resolution of 250 lines, and stereo sound.

Abekas — not a name that comes tripping to the lips — presented a healthy array of post production gear. The A64 Digital Disk Recorder is intended for complex multi layer post effects. The A53 DPE, a single channel unit and its partner, with dual channels — the A53-D — emodies a warp option, allowing the picture to be bent in a third dimension. Its like the Quantel Mirage, but smaller and less expensive.

One, a nice line in high res Character Generators — the A72 — will sure attract the Art Director fraternity. Normally stocked with 15 faces, it can be bumped up to 1,500. Its capable of grabbing external graphics and text for presentation down the line for visual manipulation. The company's equipment has been sold into Videolab, Video Image in Queensland, plus Channels 9 and 10.

Long established Australian company, Magna-Tech showed an array of equipment that covered most of the disciplines of the communications industry: Hitachi's CCD broadcast camera, the well-known Chyron Character and Graphics Generator, Pinnacle Digital Effects, and audio products. The Chameleon Paint System is new: without breaking the bank the system will create a graphics from familiar drawing tablet, image grab, or text input; 256 on line colours, 14 standard brushes and 16 levels of zoom and pan, it dumps to a 10Mbyte memory disk drive.

Predictably Quantel was there in force. Attracting a lot of interest was the Graphic Paintbox — purely for the print media.

Late April saw the first GPB delivered

to Adcolor in North Sydney. At the show, stunning pictures were thrown up on a High Definition Video Monitor, proudly displaying its exceptional definition, colour and range on the 1125 line screen, with wide screen ratio. It is the print media's counterpart of the successful Video Paint Box, but with 16 times the resolution. The quality it achieves was enough for the creation of a 24 sheet outdoor poster for BMW cars in London.

As I mentioned the GPB demo was on an HDVS monitor (or HDTV), rigged up purely for still pictures. The only one at the show, it gave an insight to what all the fuss is with this new medium. The picture was extraordinary, but can you broadcast it?

Fairlight

Jet fresh from Kings Cross: our friendly geniuses from Fairlight. Missed by many, but worthy of note was Iain McGregor's address in the Mazda pavilion. In it he described the company's MFX option for their successful Computer Music Instrument. MFX allows timecode based sound effects and dialogue to be accurately laid in using a conventional music keyboard or custom console. Storage is on hard disk. As yet only in prototype form, the MFX will surely be a great bonus to video and film sound mixing facilities. We're going to hear more of this one.

AEC had the new Equator 24 channel auto mix system; an interesting 2/3" CCD industrial camera capable of delivering 380 lines resolution, aided by a 1/1000 sec shutter.

Eastman Kodak displayed their range of video materials: In broadcast video cassetted the type 950 3/4" will be a great aid to production and mastering, timed right for the dramatic upsurge in the retail video feature film market. The

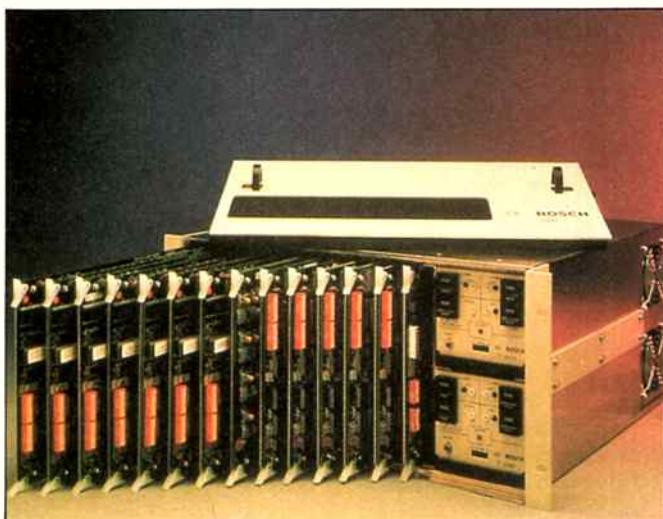
coating is smoother, and optimised to a low dropout rate of 3 per minute. Cassettes in 10 to 60 minutes are now available for the new Betacam SP format. MII? Eastman are 'looking at it' — but obviously a rise in market demand will be a factor. VHS? Big things are happening, as the company is about to launch a new 'Master' standard in this growingly popular low end pro format.

Sydney company, Filmlab, showed the Colormaster 200 Digital Video Colour Analyser. It offers digital stability in the analysis and grading of 16 and 35 mm colour negative. The operator faces a colour TV monitor and spools through the negative roll; having established the density and colour settings for one scene it can be stored in a frame store for retrieval and display split screen style with any later scene. Provision is also made for display of graded scenes on rewind or replay, and fine adjustment for different neg types. And, for the first time in my knowledge, access to colour grading is accorded to the customer: as the operator stores his coloration a still frame of the scene is recorded onto a VCR along with its slate number and details of selected RGB data; the cassette is then sent to the customer for consideration.

SMPTE may well stand for The Society of Motion Pictures & Television Engineers but, these days, the MP of the acronym gets short shrift. The video industry is striding relentlessly forward across the land, while the film technology seems to have reached its own outer fence.

Only time, and major advances in video imaging techniques, will determine the outcome of the still undeclared war: Video vs Film.

On the evidence presented at this show, the outcome is still unclear.



TVS/TAS-2000 Distribution Switching System — by Bosch.



Artwork entirely produced on the Graphic Paint Box.

eti

No. 16 \$1.00

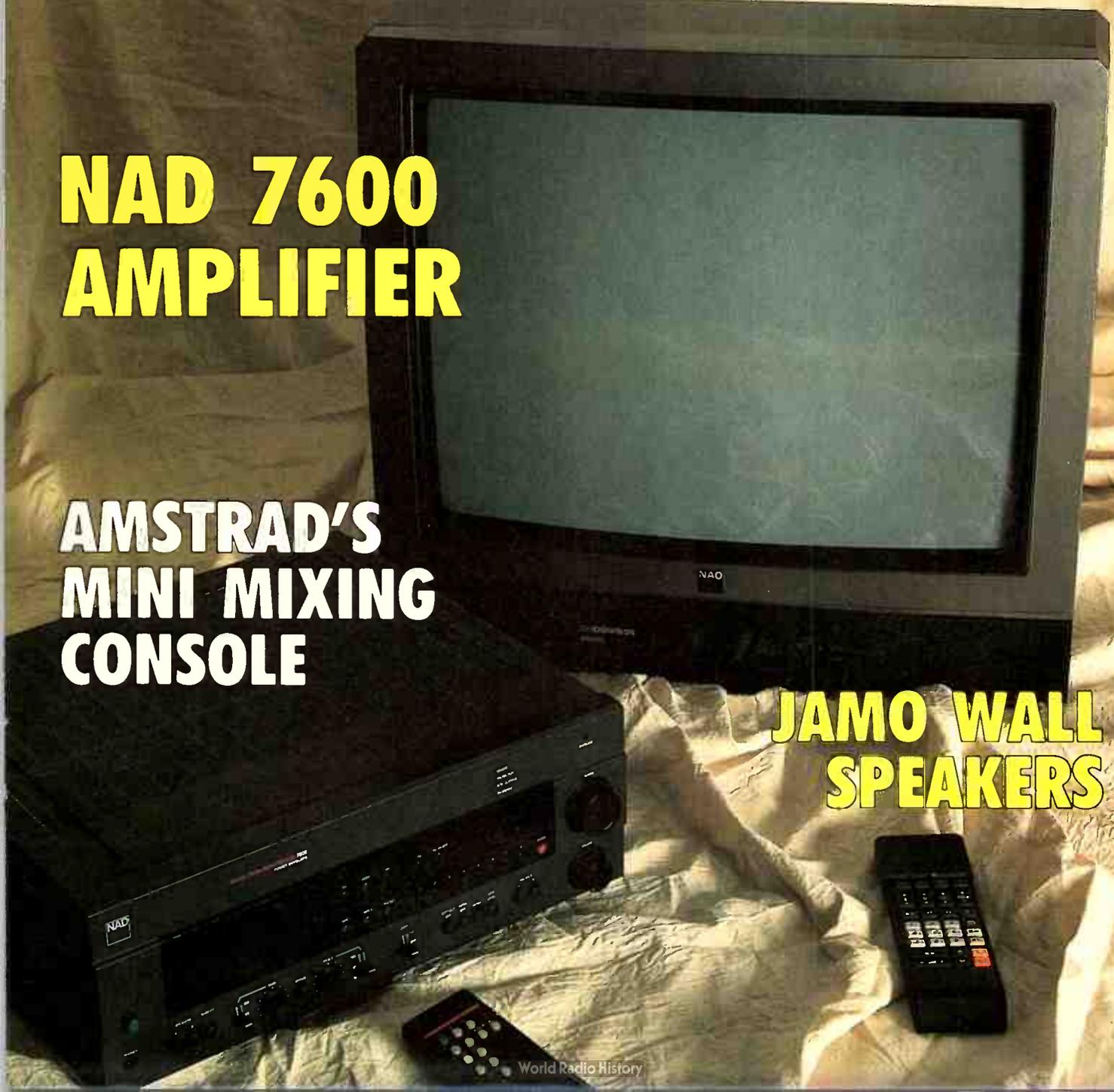
SOUND INSIGHTS

AUSTRALIA'S HIGHEST CIRCULATING HI-FI MAGAZINE

**NAD 7600
AMPLIFIER**

**AMSTRAD'S
MINI MIXING
CONSOLE**

**JAMO WALL
SPEAKERS**





Our cover

NAD describes the new Model 7600 Monitor Series Receiver as "the most powerful, most sensitive and most flexible receiver" on the market today. At \$2999 it is also one of the most expensive. It combines the three top-of-the-line Monitor Series components — the 2600 Power Amplifier, the 1300 Pre-Amplifier and the 4300 Tuner and adds a unified remote control that can handle the functions of an entire Monitor system.

The NAD 7600 Receiver

EDITOR

Jon Fairall B.A.

PRODUCTION EDITOR

Henk H van Zullekom

JOURNALIST

Mary Rennie

DESIGNER

Clive Davis

ART STAFF

Ray Eirth

PRODUCTION

Mal Burgess

ADVERTISING MANAGER

Mark Lewis

ADVERTISING PRODUCTION

Brett Baker

ACOUSTICAL CONSULTANTS

Louis Challis and Associates

PUBLISHER

Michael Hannan

MANAGING EDITOR

Brad Boxall

HEAD OFFICE

180 Bourke Road,
Alexandria, NSW 2015
PO Box 227, Waterloo, NSW 2017
Phone: (02) 693-6666
Telex: AA74488, FEDPUB
Federal Facsimile: (02) 693-9997

ADVERTISING

New South Wales & Queensland: Kim Bucknole, The Federal Publishing Company, 180 Bourke Road, Alexandria, NSW 2015. Phone: (02) 693-6666. Facsimile: (02) 693-2842. 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) 646-5494. Telex: AA34340 FEDPUB.

employs the same dual-voltage, signal-tracking power supply as the 2600. Rated at 150 watts per channel (8 ohms, 20 to 20,000 Hz), the design provides massive headroom by making it capable of over 400 watts per channel for up to 200 milliseconds. NAD designers consider this period to be more representative of actual musical requirements than either the standard 20 millisecond dynamic power test or the continuous power test. They call it their "power envelope" rating and, while it has no official standing, it is gradually being adopted by reviewers around the world.

Like many NAD amplifiers, the 7600 receiver is bridgeable. In this mode, it delivers 480 watts continuous power and 1200 watts "power envelope" power. When paired with a "bridged" 2600, the combination can deliver over 3 kilowatts into 4 ohm speakers!

NAD originally designed the Monitor Series for professional applications and so rack handles are available for all models in the range, including this receiver.

NAD have also released a range of TV receivers. The monitor style Model 3598 is the first in a series of NAD PAL video products. In the USA, NAD has enjoyed great sales success and critical acclaim with the NTSC monitors but to achieve this with PAL has been much more complicated.

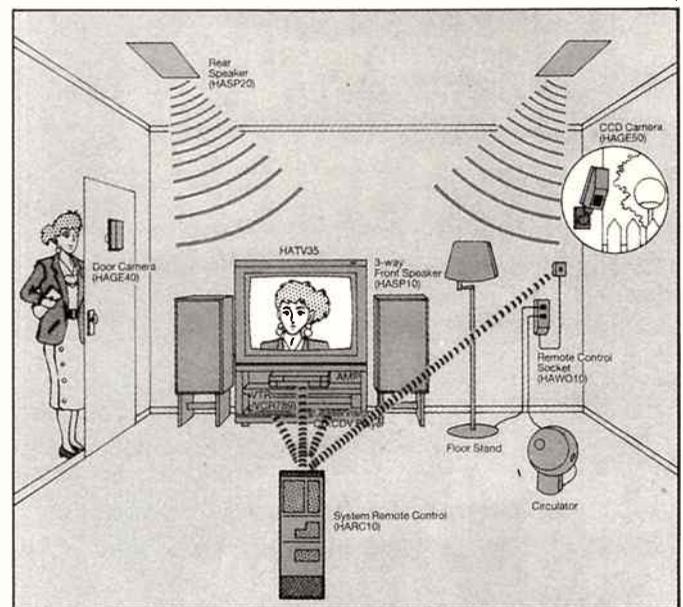
NAD felt that a joint effort with an established leader in PAL technology was necessary. Eventually they chose to work with the German electronics giant ITT, because of their breakthrough work on digital television. Interestingly, the Australian Government

came to the same conclusion recently when it chose ITT for the prestigious new Parliament House project.

NAD claim the 3598 to be a technological tour-de-force incorporating state-of-the-art digital circuitry, including built-in video enhancement and Colour Transient Improvement. "Picture-In-Picture" is an option but Digi-text, with 8 page text memory is standard. The Hyperband Tuner receives up to

200 channels, including cable networks and decoded satellite broadcasts. It will even accept NTSC and SECAM video.

Other features include on-screen audio display, a flat-square picture tube, full function remote control and SCART connection. Despite this, the set still fits well with the NAD tradition for functional, "no-frills" appearance. It will sell for just under \$2000. READER INFO No. 172



Taking guess work out of guests

In addition to the capabilities found in conventional systems, (ie, remote and centralised control of hi-fi, video, lighting, etc, throughout a premises), a new Fujitsu-General audio-visual system uses the peep hole on the front door to relay a picture of a visitor on the TV. This serves two purposes. Firstly the person being called on gets a good picture

of the person at the door; and secondly, the system can record the image of the caller and any message. Via the remote control the system controls the ON/OFF operation of electrical appliances throughout the premises too.

READER INFO No. 173



First S-VHS for local market ▼

After much fanfare and announcing, Panasonic and JVC have finally shown some of the S-VHS products meant for the Australian market.

Although both companies are keen to emphasise the compatibility of Super-VHS with the existing VHS technology, to derive full benefit of the new system special S-VHS tape, a new VCR and a television equipped with a special "S-connector" are required. The much clearer, sharper picture of S-VHS is achieved in part by the use of tape with a higher density of particles and by separating the chrominance and luminance signals of the picture. This requires a television monitor with an appropriate input that can receive the separate signals, i.e.: the S-connector. (See ETI Sound Insights May 1988 for a fuller description of S-VHS.)

Panasonic and JVC have, thus, manufactured products accordingly. Scheduled for re-

lease before the end of the year, Panasonic has displayed its NV-FS1 S-VHS hi-fi video cassette recorder and its NV-NS1 S-VHS movie camera, as well as its own brand tape.

JVC has a range of professional products available including the BR-S410E portable camcorder, the BR-S610E stand-alone recorder and the BR-S8 10E editing recorder. These units are part of JVC's Euro system which accommodates signals recorded in the SECAM or PAL broadcasting standards.

Another JVC product is a new 21-inch high-resolution colour monitor, the TM-210PS. Designed specifically for use with the S-VHS system, it has a seven-pin separate luminance/chrominance input terminal as well as BNC terminals for a composite signal.

READER INFO No. 184

LCD TV on due course ▼

As with the laptop computer, liquid crystal display screens are giving new scope to the portable television, especially now that colour LCD is a reality. Panasonic recently released a 3-inch LCD colour TV, the Minivision TC-L3, which can be powered through the mains or with rechargeable NiCad batteries. The little portable has 102,672 pixels with a better than 30:1 contrast ratio and viewing angles of ± 40 degrees horizontally, and ± 30 degrees vertically.

However, in Japan developments are on a grander scale. According to a recent report, Sharp has successfully developed a 14-inch thin-film transistor LCD TV. The proto-



type has 308,160 pixels, with contrast ratio of 100:1. Horizontal viewing angle is 60 degrees, up is 20 down is 30.

READER INFO No. 174



Surround sound ▲

Explaining that the DSP-1 surround sound processor doesn't bring home the sound of a real movie theatre, Yamaha has released the DSR-100 Pro surround sound decoder which uses circuitry developed for Dolby decoders of commercial theatres, and interfaces with the DSP-1.

The DSR-100 uses "steering logic to co-ordinate the position of sound with its relative position on the screen. A separate front-centre channel fixes the dialogue position, and the separation of the left front and right and surround channels is expanded.

Other features are a master volume control using seven voltage-controlled amplifiers for adjustment of each chan-

nel's volume and a built-in test tone oscillator.

Used in conjunction with the DSP-1, Yamaha suggests the highly directional surround matrix can be superimposed upon any environment created.

Nevertheless, at the Summer CES recently in Chicago, Yamaha exhibited its new DSP-3000 which adds to the basic features of the DSP-1 17 new environments, new movie theatre modes, four to 10 output channels, master volume control, pink noise generator, on-screen display, two analogue and one direct digital inputs, dual hi-bit DACs and four times oversampling. The new model adds to, rather than replaces, the DSP-1.

READER INFO No. 175

Two-faced piano

The Yamaha company has brought out an electronic grand piano which can operate either as an ordinary piano or as a control keyboard for electronic synthesizers.

According to an article in the July issue of *New Scientist* the instrument is called the MIDI because it conforms to the industry standard Musical Instrument Digital Interface. It has a conventional keyboard and strings but also light sensors under each key that detect which ones are being pressed. The light sensors are connected by optical fibres to a control unit that converts light pulses to electrical signals in digital MIDI code. When a key is pushed down the light circuit is broken. At the same time, pressure sensors under the keys register "aftertouch", the lingering

pressure which pianists apply after striking a key.

A row of buttons and a liquid crystal display over the keyboard let the pianist assign different synthesised sounds to the notes of the musical scale. A solid-state memory inside the piano stores these so the pianist can switch between sound patterns in the middle of a piece.

The company has also gone a stage further and built electronic circuitry into a grand piano to copy the old mechanical pianos which play themselves. The traditional pianola roll thus being replaced by a floppy disc.

To record a performance, a pianist sits at the keyboard and plays. Each key stroke is electrically sensed and a corresponding code is recorded on the disc.

READER INFO No. 176

Production changes

An ongoing survey of the Electronics Industry Association of Japan has revealed that 58% fewer black and white TV's were manufactured in January to February 1988 than the same period in 1987. The biggest increase in consumer electronics was in the manufacture of CD players with a 76% increase. This EIAJ survey often re-

flects the shifting of manufacturing offshore locations (from Japan) and is thus not always an accurate indicator of consumption. But these particular results do not fly in the face of expectation. The same report states that the biggest increase in any category of electronics was for 900 MHz radio communications equipment.

READER INFO No. 177



ME upgrades amps

Among the range of new ME amplifiers is the high-end ME 1400 power amplifier. The new range basically consist of upgrades of existing models, and this new amp is based on the current ME 1500 100 watts class A power amplifier.

The ME 1400 differs from the 1500 by eliminating the preset class A point and significantly reducing the cost. The 1400 has an rrp of \$5995 and the 1500 an rrp of \$7995. Their specifications are otherwise the same: less than 0.07 per cent thd; dynamic headroom 0 dB; output current 100 amps continuous; hum and noise 110 dB; gain 30 dB.

The cooling system used in the ME1400/1500 is built on an optically-coupled speed sensing circuit to give precise control of the twin demand responsive ac fans. The fans, with ball and sleeve bearings, work to maintain a constant operating temperature of 60 degrees C.

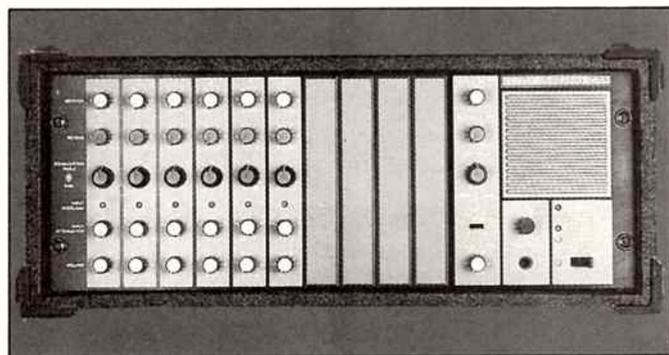
The power supply in the

amps consists of a 5kVA quadfilair secondary, double C core power transformer coupled through high current bridge rectifiers to an energy store matrix. This comprises 92 custom-manufactured low inductance, low ESR, high speed capacitors totalling over 300,000 uF. ME enthusiastically claims the result is such good dynamic headroom that the limiting factors are the power point and wiring, not the amplifier.

The amps can drive loads in the sub 1 ohm range and supply rated current continuously.

The ME 1400/1500 amps are the top-end of the ME range. Others decline in price to \$1000 and include professional models. Another of the ME products currently available is a loudspeaker switch centre with volume level adjustments for particular zones in the premises and a headphone socket.

READER INFO No. 178



Sound reinforcement system ▲

Audio Engineers has introduced the Shure Audiomaster, a compact sound system with optional six, eight, or ten inputs and 200 Watts output.

The Audiomaster system consists of the Audiomaster 1200 Mono Powermixer which is a mixer/amplifier with six inputs, expandable to 10. Power output is 200 watts minimum with 4 ohm speakers and 120 watts with 8 ohm speakers. It weighs 12 kilos, is 7 inches high and mounts in a standard 19-inch rack. There are separate monitor and reverb mixes

and concentric EQ controls for each input and monitor mix.

A range of compatible options such as the 3200 speaker, the 1200 MX expansion module, the M64A magnetic phone amplifier which permits the 1200 to be used with turntables featuring low output magnetic cartridges, carrying cases, microphones and speaker cable are available.

The Audiomaster is from Audio Engineers, 342 Kent Street, Sydney 2000. ☎ (02) 29-6731.

READER INFO No. 179

Hi-fi range boosted

Technics has launched a whole new range of hi-fi equipment comprising 16 systems as well as components in response to an increasing demand for high quality speakers and amplifiers through which digital sound, notably compact discs can be played.

Because the biggest percentage of market growth has been in remotely controlled home entertaining, every model in the new Midi Series (X-900) now features remote control.

There are five shelf systems and one full-component floor system in the range which also features AV surround in two of the models.

Top of the Midi range is the X-980D which features an optical digital link system to guarantee signal transmission free from noise and distortion.

To cater for the youth who wants power and the buyer who is looking for a system which will reproduce true digital sound value from a compact disc player, the company is introducing the full-sized, infra-red remote controlled Sigma Z980 rated at 100 watts/channel output. It has

six input terminals including two for VCRs, allowing the user to play a hi-fi video recorder through the hi-fi system's amplifier.

The Class A amp features digitally encoded volume which can also be operated by remote control.

The Sigma Z980 will sell for around \$2000.

Technics has also expanded its compact disc player range. There are 11 new models.

Also to be released is Technics first multi-disc player. The SL-P400C can be loaded with up to six discs for continuous play operated by remote control.

The top of the line player is the SL-P150K which features two DACs, four times oversampling digital filter, high speed linear instant access system, 20-step random access, preset editing, dedicated keys, large metallic insulator feet and remote control capability.

In conjunction they have produced two new colour catalogues — a 14-page systems catalogue and a 24-page components catalogue.

READER INFO No. 180



Seven new CDs

Yamaha has released a new range of seven CD players ranging in price from \$399 to \$1899. The three top-of-the-range products, the CDX1110 (\$1899), the CDX910 (\$1199) and the CDX810 (\$799) are equipped with 18-bit, 8 times oversampling digital filters. The first two have dual, series loaded hi-bit digital-to-analogue converters, while the CDX810 has dual, series loaded high speed DACs.

The most recent CD player release, the CDC610 (\$999), has a 10-disc magazine tray with an auto changer mechanism to deliver about eight hours of material.

Most of the players offer the features of infrared remote control, direct track access, 24 track programmable playback, tape edit facility, random playback and four-way repeat play.

READER INFO No. 181

IN BRIEF

Prospective loudspeaker buyers

Anyone contemplating purchasing new loudspeakers in the \$500 to \$700 range might consider consulting the June and August issues of the Australian Consumer's Association magazine *Choice*. *Choice* tested 27 loudspeakers for its June issue and evaluated them according to listener's responses rather than objective specifications, although it did run objective tests. The listening panel was made up of people with musical backgrounds, eg, musicians, hi-fi specialists, etc, and it is interesting to compare the subjective evaluations with the technical results. The August issue reports on seven midi hi-fi systems which are evaluated for their objective characteristics and their ease of use. Consideration is also given to their operation by the disabled. Keeping good faith with *Choice* prevents us from revealing the recommendation — you'll have to look for yourself.

Good sound n'est pas?



Loudspeaker manufacturer Celestion has won the French Diapason D'Or Hi-Fi 1988 award for its System 6000.

READER INFO No. 182

Cables compared

The July edition of American hi-fi magazine *Stereophile* includes a comparison study of speaker cables. Recommended as "the greatest bargain in cable" was the Australian product Space and Time Phase 11. In terms of absolute performance Kimber Cable 4AG was rated best followed by Cardas Hexlink and then the Space and Time Phase 11, but at about one/twentieth the price of its close competitors the Mathew Bond Group has been vindicated.

Turn it up ... or down

"That's too loud!" "No, it's not!" "Is that muffler legal?" "I'll report you to the EPA." "Will that noise make me go deaf boss?" "I think that's about right for the band." Now the arguments can be settled once and for all. The Rion NA-24 is a hand-held sound level meter suitable for field use. When pointed at a sound source it gives a digital readout in decibels. It features a maximum level hold, over and under range indicator and AC and DC signal outputs for data analysis and recording. The NA-24 costs \$1550 plus tax, its big brother, the NA-25, \$2350 plus tax from Anitech, 1 Carter Street, Lidcombe 2141. ☎ (02) 648-4088. If you would prefer to build a sound level meter. All Electronic Components has re-released the ETI-483 as a kit for \$98.

Stop, read then listen

Miranda Hi-Fi stores have available on their counters a very handy brochure worth consulting before connecting up a hi-fi system. The brochure provides written instructions and illustrations of wiring, components and techniques. It also gives a check list of possible remedies should something not work and some helpful hints.

Before you it's best to get

Never before in the history of high fidelity sound has a range of hi-fi equipment received such rave reviews from the world's experts.

NAD, standing for New Acoustic Dimension, is a European company which set the entire hi-fi world on its ear by providing the previously unheard of. Superlative quality sound at a ridiculously low price.

We're not just talking about superior sound performance to competitors in NAD's price bracket, we're talking about superior performance to competitors at any price.

As you can imagine, this really put the woofers amongst the tweeters.

Just how much it did, you can judge from the following:

"Nothing gives us more enjoyment than that rare event of finding a product to rave over and the cheaper the product the bigger the thrill. So when something (like this NAD) comes along that is both ridiculously cheap and ridiculously good, we tend to get rather ridiculous?"

HIFI ANSWERS-(U.K.)

"What makes this receiver congenial to knob-shy listeners is that fact that it hides

its sophistication behind a facade of rare simplicity. In welcome contrast to gaudy models speckled with flashing lights that make them seem like refugees from a penny arcade, NAD opts for visual reticence. In terms of audio styling, this is Saville Row. Front panels are dark, matte and muted. Controls are happily kept to an unconfusing minimum but amply serve all normal needs?"

NEW YORK TIMES-(U.S.A.)

"All in all, this new NAD compact disc player is an obvious sonic winner. As a further bonus, its front panel controls are a pleasure to use, in contrast to (others, which are) baulky, frustrating and touch sensitive?"

I.A.R. HOTLINE-(U.S.A.)

"Clearly the tuner is far above average: indeed there is no other we know of that can match its overall measured performance?"

STEREO REVIEW-(U.S.A.)

"The NAD 6220 is a new cassette deck on the market and is yet another example of (NAD) putting all of their effort and most of their budget into producing a machine with excellent sound quality performance rather than offering lots of

buy a hi-fi a few quotes.

extra facilities. It is this very excellence of sound quality at a low price that gains this player the winner's prize in the budget category this year (1986)."

WHAT HI FI-(U.K.)

"If you believe that I'm impressed with NAD equipment you're right. In some 25 years of audio experience I have rarely encountered such fine sounding equipment at such realistic prices?"

SUNDAY TELEGRAPH-(AUSTRALIA)

"...the NAD 5120 (turntable) stands out for me as the most interesting to listen to. Quite simply it allows you to hear more of the music than any of the other three, (Sansui, Harman/Kardon or B&O)"

POPULAR HI FI-(U.K.)

"In fact, the NAD units had such a good measured performance that no product (of the five) in this group could manage significantly better, which is astonishing (since all were double or triple the price and very highly regarded). It is directly due to the ability of their London based designer Bjorn-Erik Edvardson. As a comparative guide, I have never tested a Japanese amplifier that could match the NAD in this sort of detail?"

NEW HI FI SOUNDS-(U.K.)

"In the case of the NAD 3020, we're dealing with an inexpensive, modest integrated amplifier. Don't let that fool you. It is capable of real-world performance far in excess of what its specifications indicate and cannot be judged by the same standards as other equipment in its price or power class. Quite simply, it's one of the best buys in audio?"

STEREO/HI FI EQUIPMENT-(U.S.A.)

Now you've read what the hi-fi critics had to say. (Although you couldn't say they found much to criticise.)

However, if you can hardly believe your eyes at what you've just read, you are cordially invited to visit the specialist NAD dealer near you or phone (02) 597 1111 for further information.

We're confident you won't have any trouble believing your ears.



"Ridiculously good.
Ridiculously cheap?"

AMSTRAD HI

What have hi-fi, disc jockeys and recording artists got in common? Terry Kee discovers the



TECHNOLOGY

Amstrad, the UK based company has released an unusual piece of audio gear in the form of the Studio 100 onto the Australian market. It is not only a hi-fi system consisting of a belt-driven turntable, tuner, stereo cassette recorder, power amplifier, pre-amp with tone controls and a pair of speakers but also a DJ console, 6 channel mixing desk and a four track recording system to boot! Top that with 4 microphones, table mic stands and head-

phones and we have a complete system on our hands. When the unit appeared on our doorstep along with a price tag of under \$1000 we thought it deserved to be put through its paces.

Description

The unit is housed in a black plastic enclosure that weighs in at 10 kg. The shape of the box takes on a "skyscraper" effect with dimensions of 410 mm(w) x 430 mm (d) x 370 mm (h).

SOUND INSIGHTS, OCT. '88

AS IT ALL...

answers in reviewing the Amstrad Studio 100

The rest is up to you



The turntable is situated right on top. The tuner and twin cassette mechanism are located on the right hand side of the mixing console with the 4 VU meters sitting neatly along the top. At first glance, the vast array of knobs, faders and switches looks complex, a feature that would certainly impress your friends! However a basic understanding of what the unit can do should make it quite easy to use. The mixing console consists of 6 channels with the facilities

of each channel configured in individual columns. The knobs and faders are labelled in colour code to identify the relevant hardware to twiddle in the hi-fi, dj or studio multi-track mode. Yellow markings relate to dj, silver to hi-fi and white to studio mode. With this concept in mind the panel layout should become more user friendly.

Specifications and features

The power amplifier is rated at 10 watts

RMS per channel and has quoted 0.5 per cent distortion and a frequency response of 20 Hz to 20 kHz. The speakers supplied with the unit are two way units measuring 240 mm(w) x 250 mm(d) x 170 mm(h) and weigh 3.8 kg each. The belt-driven turntable has dual 33 and 45 RPM speeds with a quoted wow and flutter figure of 0.1 per cent and is supplied with an arm and cartridge. The stereo FM tuner has an 87 MHz to 109 MHz frequency range, a

SOUND INSIGHTS, OCT. '88

Amstrad Studio 100

sensitivity of 5 μ V, IF and AM rejection of 50 dB and 40 dB respectively. A 75 ohm unbalanced co-axial aerial input is supplied at the rear of the unit. Note that a VHF aerial is required and is not supplied. Automatic frequency control (AFC) is used in the FM section to prevent fading once locked onto a transmission. A built-in aerial is supplied for the am receiver with a medium frequency range of 520 kHz to 1650 kHz. A long wave frequency range of 145 kHz to 290 kHz is also included which is not terribly useful in Australia. A mono/stereo (M/S) allows stereo programmes to be switched to mono. This can sometimes reduce background noise when the signal strength is weak.

Two headphone stereo sockets are provided, one for monitoring mixer level and the other for amplifier level.

Both the stereo 2-track and 4 track cassette recorder are record and playback machines and run at normal tape speeds of 4.75 mm per second. Auto-stop, 3 digit mechanical tape counters and external motor (punch) control are common to both machines. The 4-track transport has an additional speed (pitch) control which can be used to finely tune the pitch of the playback tracks to a musical instrument or to

vary the tempo of the replay tracks; a common trick used in multi-track recording. The 2-track has automatic level control (ALC) when recording and cannot be changed manually. Tape to tape dubbing can be done as well as recording direct from the tuner, turntable or Aux input.

Continuous play is a useful feature included to extend the replay time by allowing both tape machines to be played in sequence. When both Play buttons are depressed simultaneously the lower tape deck (tape 1) will operate, while the upper deck (tape 2) remains inactive. When the tape in tape 1 reaches the end or the Stop button is pressed then tape 2 will start playing automatically. (This feature could be very useful for raging parties!) Continuous play cannot be disabled so the two machines cannot be put into playback mode simultaneously.

Hi-fi mode

To operate the unit as a conventional hi-fi, set the 3-way mode switch to the hi-fi position. Select an internal sound source (tuner, turntable or tape) and increase the rotary volume control. The six faders have a dual function and in this mode act as the controls of a 3-

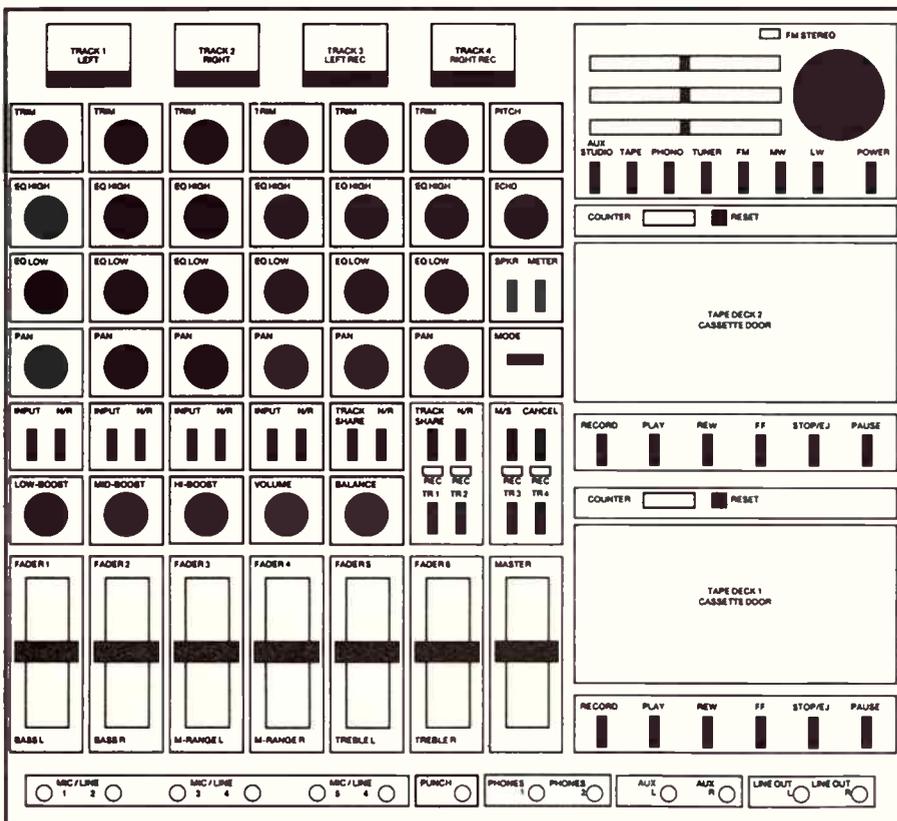
band equaliser for the left and right channels. The equaliser has ± 10 dB of gain and cut at 100 Hz, 1 kHz and 10 kHz. Unity gain occurs with the faders set to midway. Note that the mixer portion is disabled in this mode. Switching in the Aux inputs connects the RCA Aux sockets which are located under the lower tape transport, into circuit. An external sound source, for example a CD player, can be connected into the system. A speaker mute switch allows the speakers to be muted.

A slightly unusual feature that is active in all 3 modes is the Cancel facility. Lead vocals or instruments that are recorded centre-stage are suppressed when the Cancel feature is switched in. This allows the music to be accompanied by your own vocals or instrument. In practice some sound quality is lost and the originally recorded vocals are not suppressed entirely and can still be heard but it can be a novel "sing-along-to" feature.

DJ mode

For the budding dj it is simply a matter of switching the mode switch to DJ and the yellow marked controls come into play. It is worthwhile considering what sound sources are to be used in your disco set-up. Any aspiring dj would want to use a microphone to rap in between songs. Channel 5 and 6 are dedicated for this purpose and to enhance the vocals an echo effect can be added to these channels. Rotating the Echo knob brings in a metallic sounding reverb, not unlike a "singing in the shower" effect. My guess is that the reverb is produced by a bucket-brigade delay (bbd) device. Some hiss is apparent when the control is set to maximum. The trim, eq and pan can be used to tailor the gain, frequency response and balance respectively of the mic channels. If the internal sound sources (tuner, tape or phono) are selected and one or two mics are used on ch 5 and 6 then the master dj fader is used to fade in the music and fade out the microphone or vice versa. With the fader set to midway there is a mix of mic signal and music. Incidentally the level of the left and right channels of the internal sources are controlled by faders 1 and 2 respectively.

If two external sound sources are required then the internal sources cannot be used. The first stereo pair can be connected to the Aux inputs and with the Aux/Studio button activated brings in the aux pair on channel 1 and 2 of the mixer and disables the internal sound sources. The second pair is connected to ch 3 and 4. Fading in the mi-



crophone via the dj Master fader fades out both pairs of sound sources, so fading from one source to another needs to be done on the respective channel faders. This can be rather fiddly and would take some practice to perfect the art of smooth cross fading. Nothing comes easy does it?? It would have been nice to be able to cross fade the sound sources using the Master dj fader with a special switch to bring in the microphones. Another configuration that is not mentioned in the handbook is to connect an external source to channel 5 and 6 and to connect the microphone to one of the unused channels. This means that the Master dj fader can be used to cross-fade between the two sources, however the mic still needs to be faded individually with the faded in source.

An important aspect of a dj's job is to cue up a song when it is faded out by the Master dj fader. This can be done with a pair of headphones connected to the Phone 1 socket and enables monitoring to be done whilst the source is faded out. The whole show can be recorded onto cassette, if desired, and the level will not be affected by the Master

nels. Note also that the Trim control does not operate with the internal sources to prevent the channel from overloading. Channels 5 and 6 can be sub-mixed with the first four channels by using the Track Share switches.

Multi-tracking

In this mode the lower tape transport (tape 1) transforms the Studio 100 into a full-blown 4-track recording system. On conventional stereo cassette recorders, the bottom two tracks across the tape are used, and the other half is used when the tape is flipped over. The 4-track differs as the four full tracks are available for recording or playback either in single tracks or simultaneously. A tape with a four-track recording can be used on one side only, for example: a C-60 cassette will have 30 minutes of replay time.

The channels are arranged so that any inputs connected to channel 1 to 4 will be recorded on track 1 to 4 respectively. To set the track for recording it is simply a matter of switching the Track switch to record and the selected Rec light will illuminate. The Record and

be added to the four recorded tracks. Another popular trick is to record the three recorded tracks on to the fourth track which frees three more tracks. This technique is often called "Bouncing" or "Ping Ponging". The main disadvantage is the loss of sound quality when making second generation recordings but the results can be quite impressive. The mixer has the capabilities to do this and the handbook for the Studio 100 describes a method of generating up to 10 tracks.

The recording levels needs to be carefully monitored with the signal levels peaking around 0 VU on the meters. The tape counter becomes especially important in multi-track recording as one has to return to the start of the song to record the other tracks quite frequently.

Comments and gripes

My main criticism of the features provided is the lack of an Auto-stop-zero which is common on other four track systems. This means that the tape counter has to be watched with eagle eyes to stop the tape at the start of the recording.

The handbook did not recommend the type of tape to be used with the tape machines. A quick test indicated that a good chrome oxide tape produced good results.

One of my gripes with the design is that the Mode switch produced annoying clicks at the speakers when switching through the three modes. Amplifier hiss was also apparent especially with the Volume knob set past midway and some hum was noticeable with the Volume set to maximum. However under "normal" listening conditions it should not be a problem and the hiss was masked by the signal.

Conclusion

The "all-in-one box" concept is a good one and the unit certainly provides features that are not available elsewhere. I cannot think of another similar unit on the market, that packs in all the features in one box. The sound quality is reasonable but cannot be considered hi-fi in the true sense. The trade-off is the three-into-one application together with a price tag of under \$1000. I suspect that the Studio 100 would be of interest to punters with disc jockeying and multi-track tendencies. If you are that way inclined then the Amstrad Studio 100 is an ideal and inexpensive way to start.

RRP — Amstrad Studio 100 — \$999.

For further information contact Amstrad Pty Ltd, P.O. Box 115, Rushcutters Bay, 2011. ☎: (02) 360 3144.

'At first glance the vast array of knobs, faders and switches looks complex . . . it would certainly impress your friends.'

dj fader. The individual faders must be used however to fade in the music to be recorded. For serious dj applications, the unit needs to be hooked up to a pa system and the Line Out (left and right) RCA phono sockets are available for this purpose. The outputs are taken from the Master fader and the amplifier volume and balance has no effect on the level fed to the external device.

Studio mixer

The studio section can be used as a stand alone 6-channel mixer with each channel having individual gain trim, bass and treble eq, pan, channel fader and input switching facilities. The 6 inputs can be mixed down into two channels which are available to be recorded, played through the speakers or sent to an external device for e.g: a pa system via the Line Outputs.

The mic/line inputs are brought into circuit on channels 1 to 4 by switching the 3-way Input switch to External. When using an internal sound source (tuner, phono or tape) it is automatically routed to ch 1 and 2 so an external source cannot be used on these chan-

Play buttons of the tape machine then need to be pressed simultaneously to initiate the recording. To play back the recording, the input switch of the playback channel needs to be routed to Tape and the selected Rec switch set to play back. It is highly recommended to use the noise reduction (NR) when doing multi-track recording as the tape hiss can be quite apparent. Unfortunately the NR used in the unit is not Dolby compatible. The six channels can have the NR switched on or off individually.

Overdubbing

This process will be of most interest to the solo musician who wants to build up several tracks of self accompaniment. One track is recorded, then played back whilst the second track is recorded and so on. Up to four tracks of first generation recordings can be made. However this does not limit us to record four channels. As the mixer has six useful channels there are techniques available to extend the number of tracks. For example, whilst mixing down the four tracks into stereo, a fifth channel can



Melbourne's first International Audio-Video Fair seems to have met with the general approval of exhibitors and visitors. The exhibition in July was staged on the Wesley College campus, normally a short trip by tram out along St Kilda Road from the city.

The main accent at the Fair this year, was on audio — from regular hi-fi components, systems and accessories, to esoterica — although there were a number of video attractions. Pioneer featured its CD-Laservideo-CD kombi player Model CDL 1050, and AV Surround Sound systems were demonstrated regularly with videomovies and clips throughout the Fair weekend, by Yamaha and Atsui (Sansui).

An enthusiastic contingent from Oz-Fi, The Australian Hi-Fi Manufacturers' Guild, proved very popular with Fair patrons who were able to take advantage of the rare opportunity at shows such

as this to talk with the people directly behind the products. Loudspeaker and amplifier designers and builders were on hand to discuss some of the unique features of their exhibits and to give their expert advice on hi-fi matters, generally. Their services appeared to be in constant demand; and understandably so.

Oz-Fi members George Pinchink (GNP Acoustics) and Peter Stein (ME Amplifiers) also gave up time with their exhibits in order to speak at seminar sessions conducted for show patrons. Both speakers stimulated vigorous discussion and debate on two of audio's perhaps most interesting components, amplifiers and loudspeakers. I doubt, though, that Pinchink really convinced the lady in the audience who wanted to know whether speaker systems really had to look the way they do to sound good, and why we needed so many. Oh, well!

Pioneer's Rob Costello also joined the seminar sessions to present an overview

Despite the elements and a crippling public transport strike, ETI's audio roundsman Les Cardilini made it to Melbourne's International Audio-Video Fair and reports . . .

A FAIR TO REMEMBER



Melbourne displays Audio-Video equipment

SOUND INSIGHTS, OCT. '88

of digital audio and laser video disc technology, and the marriage of the two in current AV systems and those in the pipeline. Costello's sound product knowledge sustained a lively question and answer session that followed on his presentation which included Digital Audio Tape (DAT) recording.

Some of the highlights

MAXELL

The age of digital audio has brought more pressure to bear on analogue systems to perform. Cassette tapes are no exception. In the past, however, it usually has been the developments in the recording layers of the tapes, that attracted attention. But, increasingly, the mechanical features of cassettes are coming under closer scrutiny.

At the Maxell stand visitors were shown how a variety of tapes responded to induced vibration and how the kind of mechanical resonances apparent in typical traditional cassettes were either reduced significantly or eliminated altogether in Maxell's new Resonance Proof Mechanism. With less mechanical dis-

'... mechanical features of cassettes are coming under closer scrutiny'

turbance it follows that a cassette is likely to introduce less measurable wow and flutter into the sound being recorded on, or playing back from its tape. By way of demonstration a sensitive turntable pickup was used to detect the mechanical responses in a variety of cassettes excited by swept frequency vibrations. Results obtained for different tapes were displayed openly on a video monitor screen for evaluation.

SYMPHONIA — AUDIO-O IMPORTS

Symphonia showed a variety of esoteric gear mainly for the audiophile. Apogee electrostatic loudspeakers, synonymous with Symphonia in Melbourne, and a new range of Cambridge amplifiers and compact disc players with 16 times oversampling were demonstrated.

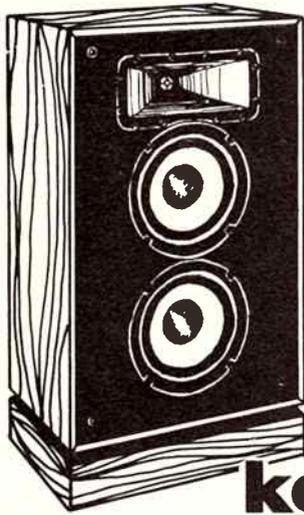
Symphonia also showed the new Cambridge DAC-2, digital-to-analogue converter (DAC). The DAC-2 is a component-style unit with a digital input that can be connected to any compact disc player which has a digital output socket. Why, you say? Well, the DAC-2 uses 32-bit, 16 times oversampling and can effectively extend the performance



Richter speakers from OZFI chairman Ralph Waters.

 **klipsch**[®]

A Legend In Sound.[™]



kg4[®]

Paul Klipsch, one of the founding fathers of the Audio Industry, built his first loudspeaker in 1919 at the age of 15.

In 1946 he formally established KLIPSCH & ASSOCIATES in Hope, Arkansas and 2 years later produced 30 of the famous KLIPSCHORN speaker systems.

Today, (40 years on) the KLIPSCHORN is still an industry standard but at \$12,000.00 a pair, a little out of the reach for most.

With the new KLIPSCH KG4 you can experience the essence of KLIPSCH loudspeaker technology at one sixth the cost of the KLIPSCHORN.

Like all KLIPSCH loudspeakers, the KG4 is hand built from genuine timber veneer panel and matched for colour and grain structure. One tiny flaw and the pair is destroyed.

There is no finer speaker in performance and craftsmanship than a KLIPSCH.

We build them for a lifetime of listening pleasure.

Write for your free copy of KLIPSCH - The making of a legend.

TASC

133 Market St.,
South Melbourne 3205.

Ph. (03) 696 2277

Audio-Video show

of any CD player with a digital output, to that degree.

A high oversampling rate means gentler filtering can be used after digital to analogue conversion and this, in turn, means less phase distortion in the recovered analogue sound. Higher oversampling rates are a feature of higher priced CD players, typically. The DAC-2 can extend the performance of existing players which use lower oversampling rates provided they have a digital output, says Vince Testa at Symphonia. The DAC-2 can also operate on sampling rates between 40 kHz and 48 kHz, suggesting possible DAT applications, as well. Essentially, the DAC-2 takes over from the CD player to which it is connected, to decode the digital data stream and provide the Left and Right channel audio outputs for the system amplifier.

ROCKIAN TRADING

Rockian distributes a wide range of compact discs under a variety of labels, Koss headphones and related accessories. Proprietors Bev and Ian Hooper reported an increased awareness and interest shown by visitors this year, no doubt spurred on, in part at least, by the controversy surrounding the aluminised playing surface on compact discs and its supposed tendency to self-destruct, that was gaining momentum at the time.

Laser videodiscs have been around for a lot longer than compact discs which use similar manufacturing technology, and that such a generic problem might have arisen in a shorter time with respect to compact discs is puzzling. Both Philips and Australia's DISTRONICS report that non-destructive testing held in the United States by their respective interests in that country suggest that their aluminium-coated compact discs will last in excess of 300 years!

VTL

An impressive range of VTL valve amplifiers with filaments softly aglow was a comforting sight on a cold day. Mike Kontour of Leading Edge Audio hastened to point out, however, that the VTL amplifiers were coolly efficient in their performance and did not exhibit "traditional bad habits of valve amplifiers", per se.

The VTL tubes are biased at one third of their maximum ratings to extend their lifetime to an estimated 2000 hours, and the amplifier's frequency response

of around 10 Hz to 100 kHz was attributed to "excellent transformer designs", it is claimed. A lifetime warranty is offered. In all, there are now 11 all-valve models in the VTL range, five preamplifiers and two compact disc players utilising valve technology.

WHATMOUGH SPEAKERS

Colin Whatmough featured his Online speakers in a lounge area where visitors were able to relax and listen despite the activity of the Fair below; the audition area was situated on the third level of the exhibition and enjoyed quite tolerable low noise intrusion.



In fact the tendency to have relative aural isolation was enjoyed by most exhibitors. Systems and components could be discussed in the quiet of the spacious rooms, without having to shout over music from a neighbouring exhibitor who might have been demonstrating power at the same time. Conversely, exhibitors felt freer to wind up the wick without having to check first with surrounding tenants.

Conclusion

On the causeways and in corridors visitors had plenty of space to move about and the show generally reflected a comfortable openness without being too



The Pioneer VH-780D digital hi-fi video

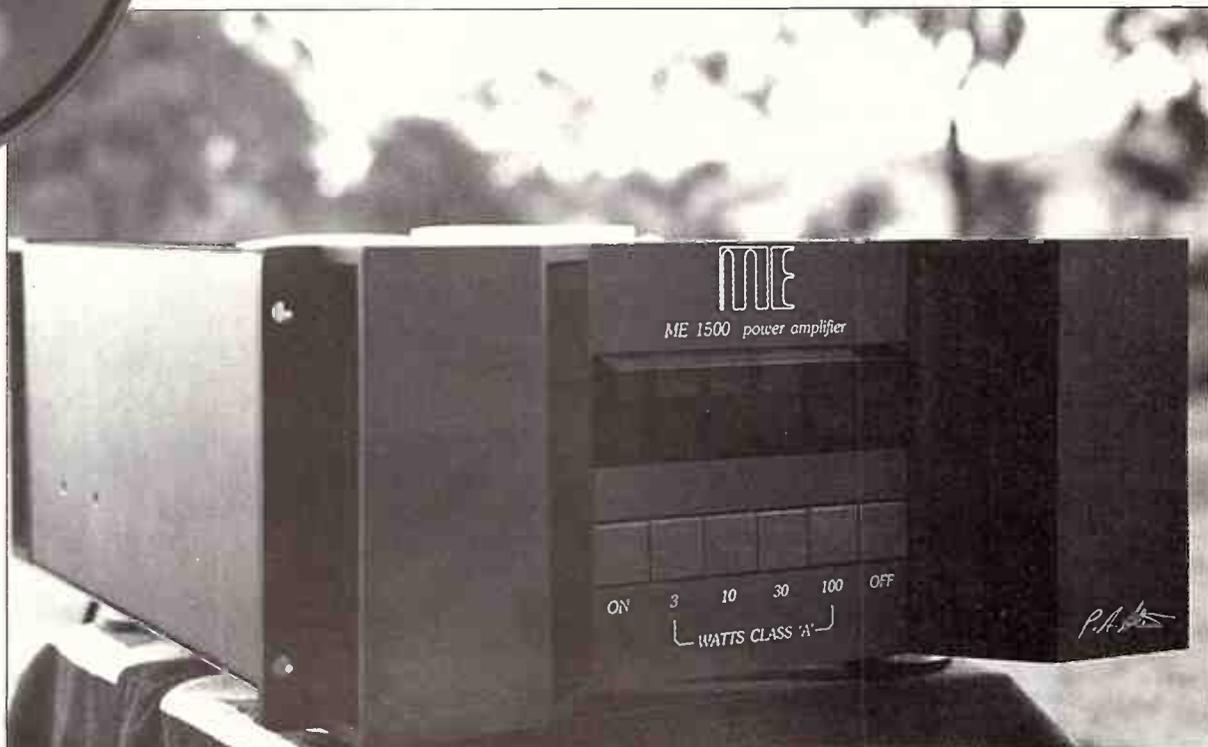
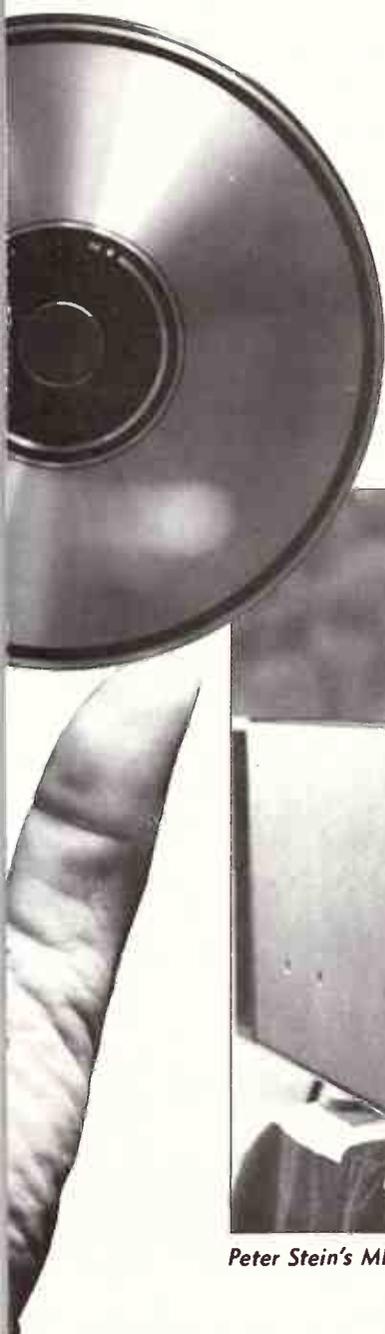
spread out and rambling. It certainly contrasted with the more confined, motel-style approach. The "expandable" nature of the school buildings and facilities, the available open space for parking, and the (it is hoped) handy tram service to the city would also give a regular show of this kind room to grow.

One thing even an audio-conscious city like Melbourne can do without, however, is two similar shows in town at the same time, not only from the points of view of the organisers and exhibitors

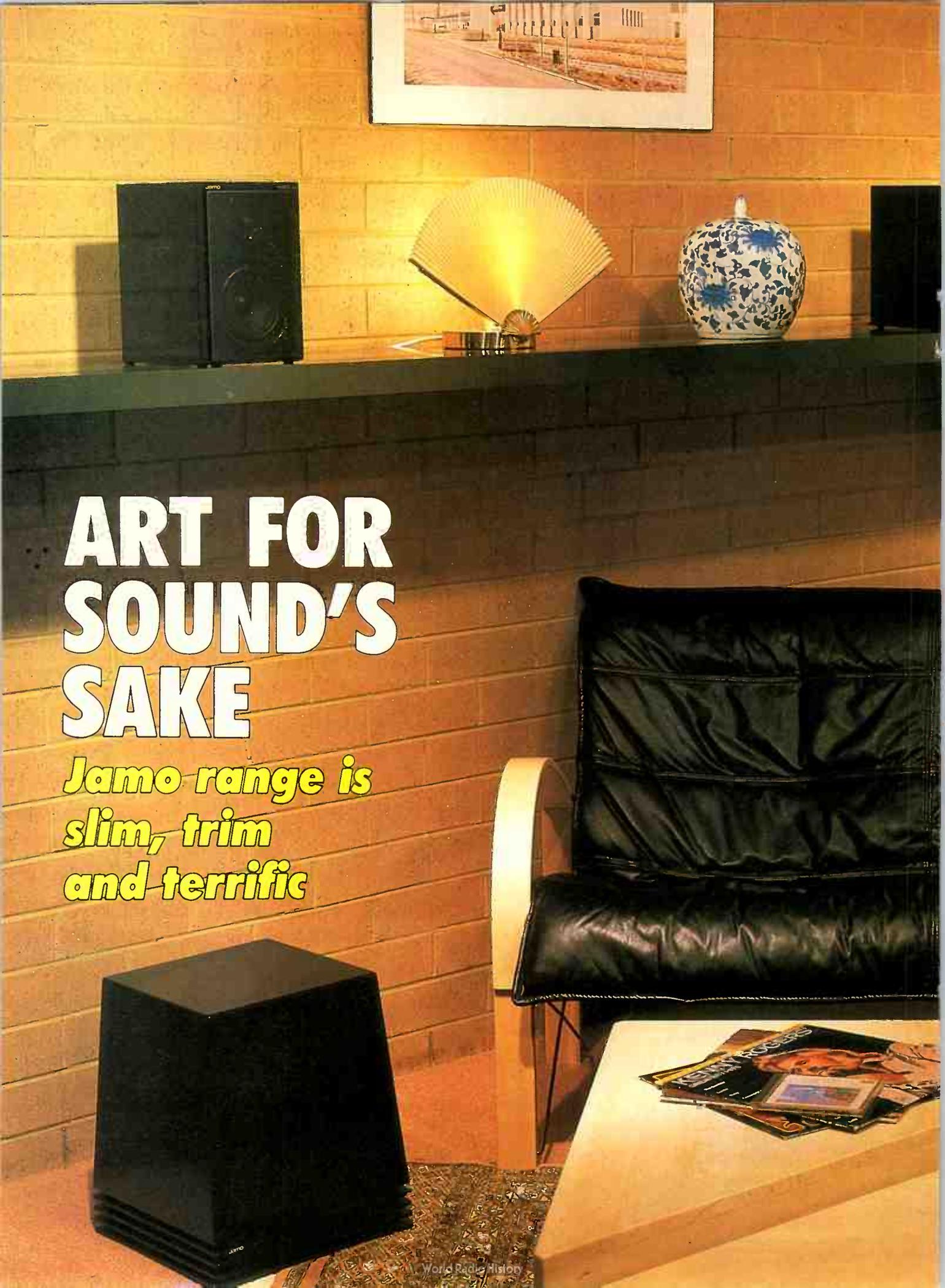
but also the many patrons who, in the case of the recent events, made the effort to get to both.

What also would surely be well received by the hi-fi and video public is some participation in these events by those notable popular brands that never seem to get along to them.

Most, if not all, of the exhibitors who were present on this occasion were quick to praise the quality of visitor interest shown at the International Audio Video Fair, and the standard of their co-exhibitors' efforts at the show.

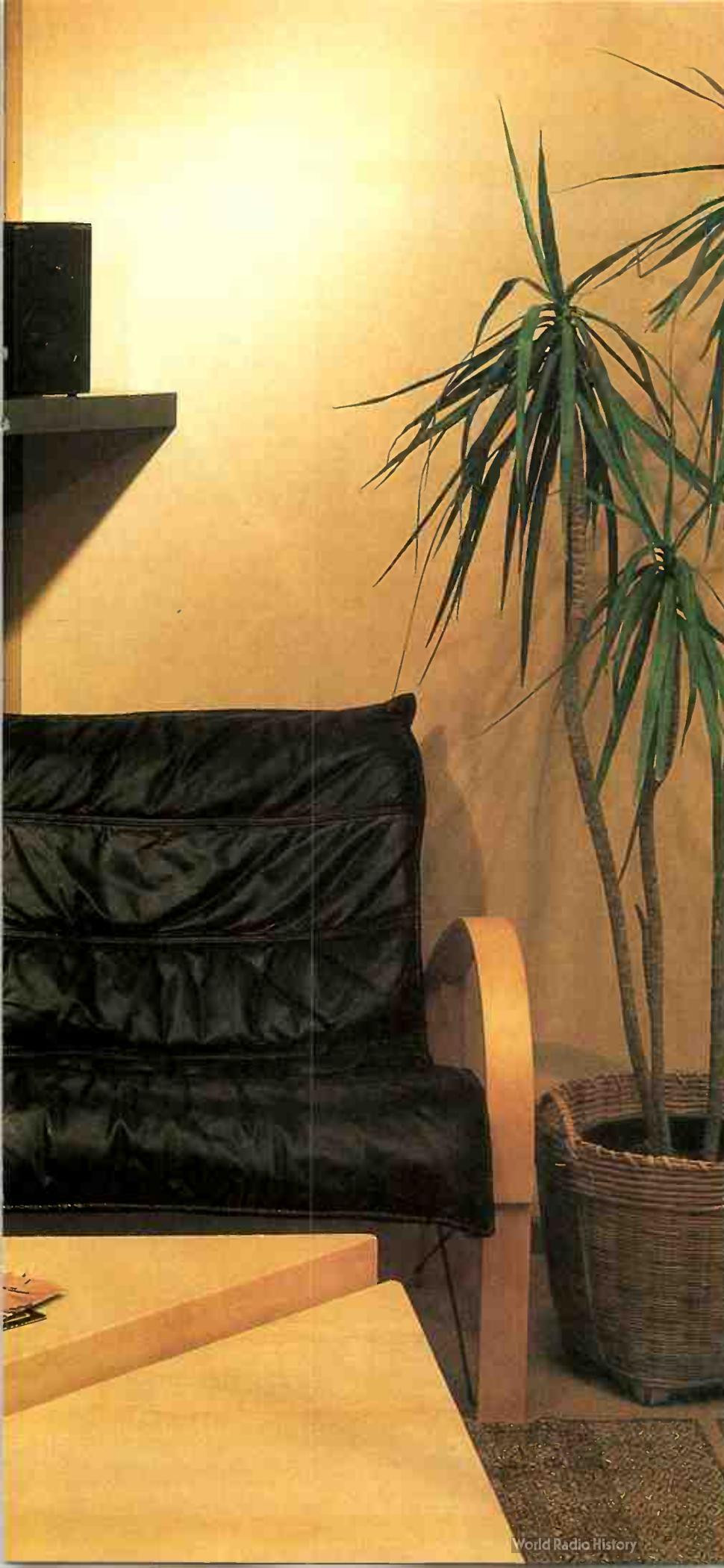


Peter Stein's ME-1500 amplifier



ART FOR SOUND'S SAKE

*Jamo range is
slim, trim
and terrific*



INNOVATION

Pat Hayes looks at a new range of speakers from Jamo in Scandinavia.

The phrase that art experts have no answer for or, at least, no polite answer, goes something like: "I don't know much about art but I know what I like". Some golden-eared audio enthusiasts tend to trot out a similar line when they are talking about speakers.

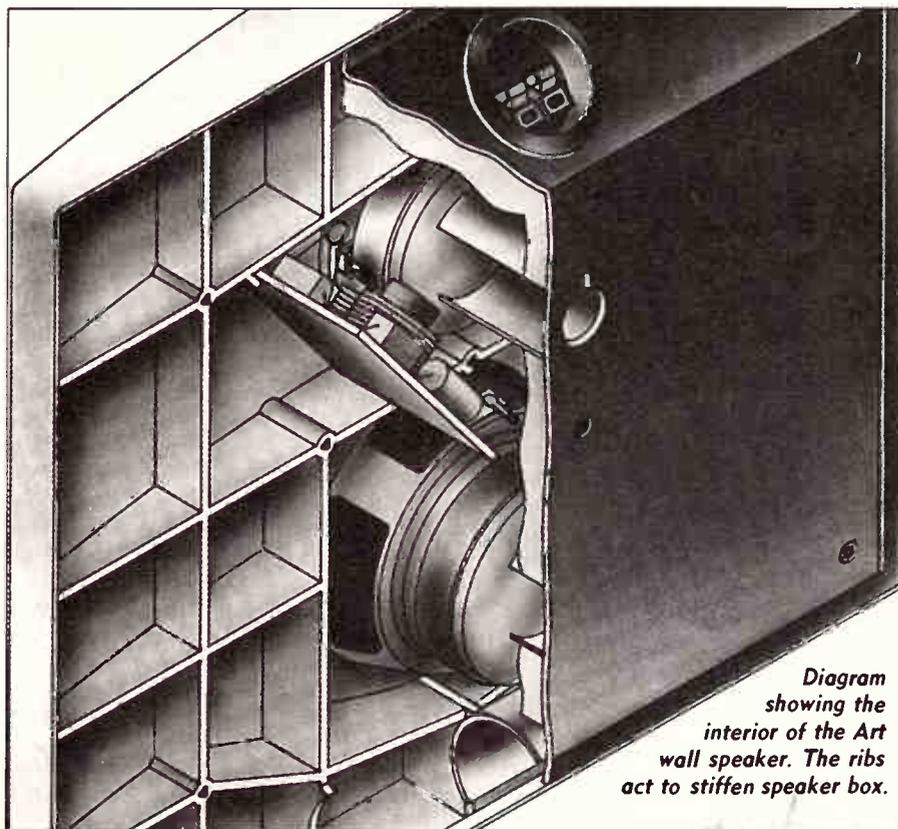
Now that Jamo has released a speaker called the Art, both camps can get together to discuss the thesis that a discriminating eye and ear compensates for a lack of knowledge.

These ruminations were prompted by the recent release of a new speaker range by Jamo. The most interesting speaker is undoubtedly the Art.

Sometimes it helps not to know too much about the technical side of things. Any properly qualified sound wizard can tell you that to get a big sound you need a big speaker; there are all those computer studies to prove it. Furthermore, and notwithstanding what sort of mid-range performance is achieved by some tiny speakers that appear to break all the rules, a little speaker is not the way to go if you want to rattle the windows with Bach's Toccato and Fugue or frighten the dog next door with the thumping bottom end of Pink Floyd.

Which bring us to Jamo's Art which is a small flat speaker that hangs on the wall. It is about the size of a record cover (35 cm x 40 cm) and looks even slimmer than its nine centimetres. Unlike some other small speakers that can be hung on a wall only if a loss in performance is acceptable, the Jamo Art *MUST* be fixed to a wall because its bass reflex port is at the rear and the wall itself becomes an integral part of the sound-producing complex.

Jamo speakers



I have heard the Art in full cry in three different locations and each time have seen experienced hi-fi folk start looking for the subwoofer.

With a suitable amplifier (it can handle up to 90 watts) a pair of Art speakers was able to fill a large room at a Melbourne reception centre with solid, thumping sound.

A pair on the wall either side of the television when the big stone starts rumbling forward in "Raider of the Lost Ark" would be a severe risk to any family member with a dicky ticker. These small, slim speakers, which house a 25 mm wide-dispersion tactile dome tweeter and a 130 mm rubber roll surround woofer, are capable of matching the bass output of much larger, floor-standing models.

Design

The design has been aimed at preventing the cabinet resonances that damn most slim speakers when they try to reproduce low notes. The front section of the Art is a one-piece unit made of what appears to be a heavy plastic. It is criss-crossed with deep ribs whose design, Jamo tell us, was calculated by computer.

The rear panel has been made from steel plate, damped with synthetic foam.

THE ART OF LISTENING

JAMO ART, a superflat elegant bass reflex loudspeaker designed to be hung on a wall. The unique computer designed slightly curved front panel is a labyrinth of specially formed ribs, giving the ultimate stiffness and yet minimising high frequency diffraction. This newly developed and highly sophisticated JAMO 2-way design utilises a powerful 130mm bass/midrange driver, with high efficiency and low distortion.

A new 25mm impregnated soft textile dome tweeter has smooth performance and great dispersion. The frame of this elegant wall panel is finished in either black or white lacquer to blend perfectly with any decor.



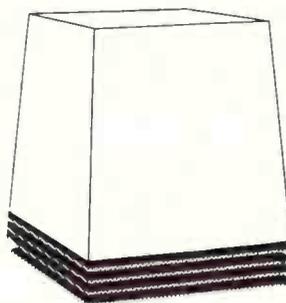
JAMO MONITOR ONE \$650 pair*

If your decor does not permit a wall panel loudspeaker the new JAMO MONITOR ONE, a bookshelf version of JAMO ART, is highly recommended. White or black lacquer.

*Recommended Retail Price 1/6/88.

For full details see your nearest JAMO dealer or call Sole Australian Distributor:
SCAN AUDIO Pty. Ltd.
P.O. Box 242, Hawthorn 3122.
Phone: (03) 429 2199 (Melbourne)
(02) 522 5697 (Sydney)
(07) 357 7433 (Brisbane)
(09) 322 4409 (Perth)

JAMO ART \$750 pair*



JAMO SW-50 ACTIVE SUBWOOFER \$950*

The ultimate accessory for both JAMO ART, JAMO MONITOR ONE or any other quality hi-fi loudspeaker. This new active subwoofer is designed to blend discreetly with your decor, yet provide the subtle low frequencies found in today's excellent digital recordings. Black or white lacquer.

Jamo HI-FI

EXPERIENCE THE TRUE ART OF LISTENING

When the two sections are fixed firmly to each other they make a remarkably stiff cabinet that can handle frequencies down to about 40 Hz with a minimum of boominess.

Jamo is a giant Danish speaker manufacturer whose outstanding success on world markets can be put down to both the product and the expert fashion in which it is marketed. The company makes a wide range of models which include relatively cheap speakers for systems, sturdy, high power handling models for rock enthusiasts and some nice, neutral-sounding ones for the mid-fi to hi-fi market. It is able to tailor the range it sells in any country to suit any section of the market where it sees a demand. When the Melbourne distributor, Scan Audio, first started distributing Jamo here in 1982 the speakers were aimed at the mid-fi market and did surprisingly well. They were easy to drive and offered a clean, uncoloured performance with high efficiency, that made them the ideal partners for a system that did not pack a lot of punch.

In succeeding years Jamo exploited its early reputation by selling lots of cheaper speakers through the big dealers. The Art is part of a swing back in the other direction. Despite its novel shape and position on the wall it should be regarded as a mid-fi speaker. It is part of a new Jamo range that Scan Audio will be distributing through specialist hi-fi stores.

A speaker that hangs on the wall has to be aimed more at the general market of affluent home entertainers than at the hi-fi enthusiast who is prepared to put up with boxes on the living room floor. An enthusiast will quickly realise that and the performance of the Art can be equalled for less money in more conventional

models. Indicative of the same marketing strategy, Art seems to have been swung away from the Scandinavian neutrality of the top Jamo models towards a harsher, American west coast sort of sound that keeps the treble bright and sells speakers more easily to people who haven't heard a real symphony orchestra recently.

With a recommended retail price of \$750 it offers an excellent compromise for people who for all sorts of practical or aesthetic reasons can't have speaker boxes cluttering up their floor space.

Bookshelf unit too

The same components that go to make up the Art are also available in a small bookshelf unit called the Monitor-1 which has a recommended price of \$650, can be housed in a bookshelf or on a floor stand and produces excellent, uncoloured sound from the mid-range up but nowhere near as much bass as the Art. The little Monitors do sound superb, however, when teamed with another new Jamo speaker, the SW-50 active subwoofer.

The subwoofer has a built-in 55 watt amplifier which makes it well worth consideration by anybody who feels the need to replace an amplifier merely because they need higher output. The amplifier driving the subwoofer will give any system's amplifier a new lease of life if it only has to deal with the mid-to-high frequencies.

Easily sited

Another advantage of a subwoofer is the way it can be put anywhere in the room because low frequency sound is virtually non-directional (which is also why you need only one subwoofer in a stereo system). A subwoofer tucked away under a table or behind a couch (they tend to perform better when placed near a wall) will provide deep, accurate bass sound while a pair of tiny speakers up front will keep the stereo image accurate and realistic.

The Jamo subwoofer switches itself on and off automatically when it receives sound signals from the system amplifier and can be adjusted for sensitivity and crossover frequency. It is also good looking in an understated sort of fashion and has a recommended retail price of \$950.

Also in the new range just released by Jamo is a cheaper two-way bookshelf speaker, the S-60 at a recommended \$390, and two conventional larger models aimed straight at the hi-fi market, the Concert II (\$990) and the Concert V (\$1990). For more information contact Scan Audio, 52 Crown Street, Richmond, Victoria 3121, ☎ 429-2199.

Pat Hayes is a journalist specialising in audio at The Age newspaper, Melbourne.

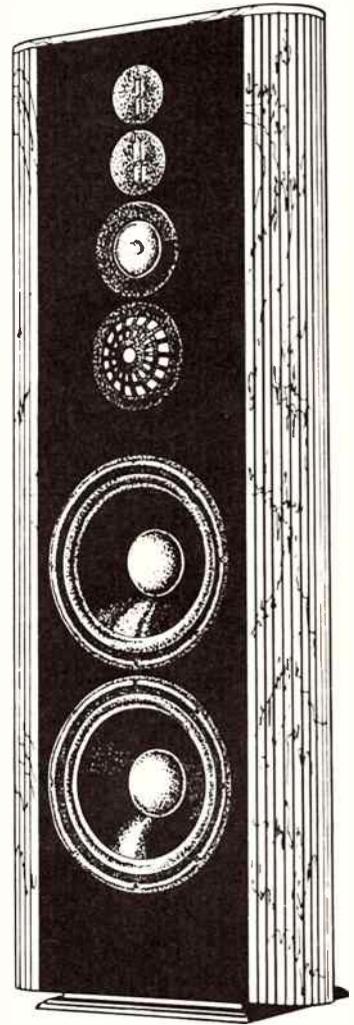
Technical Data:

Type:	Jamo Art
System:	Two-way, bass reflex
Woofer/	
Midrange:	5"/130 mm
Tweeter:	1"/25 mm
Music	
Power:	90 watt
Continuous	
Power:	60 watt
IEC:	35 watt
Sensitivity	
1W/1m:	88 dB
Frequency	
Range:	40-20,000 Hz
Crossover	
Frequency:	3000 Hz
Impedance:	8 ohm
Weight:	4.8 kg
Total Volume:	13 liter
Dimensions	
(HxWxD):	35x40x9 cm
Finish:	Black or white lacquer

How in Infinity can this be the ultimate?

RS9 Kappa simply is.

The top-of-the-line Reference Standard 9 Kappa is one of the few five-way systems available to roll over Beethoven and cool down Oscar Peterson.

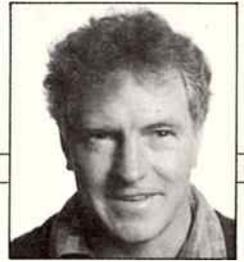


Infinity

Distributed by:
Silver Australia Pty. Ltd.

4 Rushdale Street, Scoresby, Vic. 3179.
Ph: (03) 763 0177, Fax: (03) 763 0677.

READER INFO No. 11



ANTHONY O'GRADY

CD reviews



MORRISSEY

VIVA HATE (HMV)

CDP 7 90180 2

It's all too easy to mock Morrissey as a doom singer whose songs ran the gamut from tedium to unrelieved despair.

His lyrics readily lend themselves to parody "This morning I woke up and the sky was raining mud/On the stairs I found the pool of blood/where you'd killed yourself, your mother, brother and four sisters last night/Then while making breakfast/I burnt the toast."

More to the point is: why does this man so revered in England, remain an obscure joke everywhere else? The answer would seem to be the very special Englishness of Morrissey and his former group The Smiths.

As led by Morrissey, The Smiths consciously espoused the foppish decadence of Oscar Wilde and Cecil Beaton. Even when fixating upon the legend of American James Dean, Morrissey maintained the distanced demeanor of British academic.

None of this would have meant anything very much, if

The Smiths hadn't emerged from Manchester on an independent label, Rough Trade, and cleaned up in the UK with a series of hit singles, albums and high grossing tours.

From 1983 to 1986, they were an English phenomenon, though the rest of the world seemed to find The Smiths very resistible.

Now it's Morrissey solo, same clear, bell-like voice, same blend of jazz-tinged folk rock and propensity for song titles like *Late Night, Maudlin Street*, with lyrics to match.

It's already been *Big In England*, but, as yet, the rest of the world still finds this charming man, very resistible.



FRANK SINATRA

SINATRA-BASIE

(Reprise) 927023-2

One of the very few joys of owning a CD player in the late 80s, is the quantity of generations-old masterpieces now becoming available as digitally remastered, compact discs.

This 1963 Sinatra-Basie collaboration is a case in point.

(The sessions were, of course, recorded on analog equipment, prior to noise re-

duction techniques such as Dolby and some top-end noise, present in the master tapes, could not be removed during digitally re-mastering. Happily, there proved to be no obtrusive noise or distortion on the master tapes, though the top ends of Sinatra's vocals and the horns of the Basie orchestra are somewhat muddled and compressed.)

Sinatra is on record as saying he'd waited 20 years to get into a studio with Basie and when the sessions finally happened in October 1962, both these New Jersey boys were at the peak of their musical maturity.

In particular, this line up of the Basie band must be counted as one of the best of the maestro's career, featuring an all-star, 13-piece horn section and the scintillating rhythm section of Buddy Catlett (bass), Freddie Green (guitar) and Sonny Payne (drums).

Not to mention the Count, front and centre, on piano.

To some ears the arrangements might seem a tad lightweight, a little cliched perhaps, but one of the Count's greatest strengths always was the luscious inevitability of his arrangements — and even when you knew what was coming next, the pleasure was in the smoothness and dexterity of the delivery.

Sinatra's vocals have rarely been so muscular or authoritative, or his self-trained ability to swoop and sustain his voice like a trumpet, so evident.

Songs include *Pennies From Heaven*, (*Love Is*) *The Tender Trap*, *I Only Have Eyes For You* and *Learnin' The Blues*.

Definitely more Broadway than Chicago, but what else

would you expect from two Yonkers kids.



k. d. lang

SHADOWLAND

(Sire) 925724-2

Last year, on her joyous debut album, *Angel With a Lariat*, k. d. lang proved that even if cowgirls do sometimes get the blues, a dose of hot rock and blistering vocals is a surefire remedy. *Angel* was an album which dared to explore a different sort of country — a mix of standards and originals infused with an almost punk-like energy.

This year's model showcases the same singer in a more traditional setting. Her regular band, *The Reclines*, have been rested, and she teams with veteran country producer Owen Bradley (*Patsy Cline*, *Brenda Lee*, *Webb Pierce*) for an album of languorous country tunes that explore traditional country concerns — how to find the strength to combat loneliness, heartache, Saturday night on the town, and Monday morning coming down.

With lang's pure tones to the fore and Bradley stirring up a potent moonshine musical brew behind her, the strengths of this album are always obvious.



LOUIS CHALLIS

Classical



Murray Perahia's

Schubert

Sonata, Op. Posth. D.959

and Schumann

Sonata, Op. 22

Artist: Murray Perahia, Pianist
 Label: CES Records — Masterworks
 Catalogue: MK 44569
 Format: DDD

Schubert and Schumann were contemporaries in Vienna so, it appears to be quite appropriate to combine two of their Sonatas on the same disc. Schubert was regarded as an enigma by his peer group and it is clear to us that his music was considerably ahead of its time. Regrettably neither he nor his music received appropriate acclaim during his lifetime.

Schubert's sonatas are

masterpieces of lyrical warmth and display a deceptive simplicity. The D.959 Concerto in A Major is typical of the best of his work that had to wait until after his death to be published (and subsequently acknowledged for its quality). Regrettably Schubert was just not a 'showman' and his music does not glitter in quite the same way as does Schumann's, yet its sincerity, warmth, and the way it naturally sings along tends to deceptively mask the skill of the composer. This particular Sonata seems to delightfully place the notes at just the right place and at the appropriate time.

Edison Prize

Murray Perahia is now regarded as "a fascinating American" who is also a most outstanding concert pianist. As an almost self-taught musician he has followed an entirely different path to most other great pianists in reaching the top. Having won a number of

major international Pianoforte competitions, he is now very much in demand because of his brilliant interpretations of Mozart, Beethoven, Schubert and Schumann's works. This particular disc is in the same class as those for which he received the 'Edison Prize' in 1978 and 1981.

His rendition of this Sonata is memorable and it leaves a lasting warmth once you have sat down to listen either to the music or to assess Murray Perahia's skills. Schubert may not have been appreciated and acknowledged in his own lifetime, but this particular rendition of one of his works is worthwhile purchasing or auditioning right now.

Music Quality,	
Interpretation	*****
Realism	****
Recording	
Technique	****

Schumann's Piano Sonata Op. 22 in G Minor bears little similarity to the Schubert Sonata, as Schumann was much more worldly in his outlook (than Schubert). Much to my surprise, I discovered that Schumann was a music critic for 10 years and consequently had a much better appreciation of what the public wanted, even though he didn't necessarily pander to that public. The strength and complexity of his music gives some indication as to his emotional instability, regrettably a feature of his personality. Many people believe that he was schizophrenic. His music shows some evidence

of this, especially the G Minor Sonata.

Forceful, delicate

The Piano Sonata Op. 22 is typical of his earlier works, when he composed almost exclusively for the piano and apparently led a somewhat debauched and indolent lifestyle. This piece exhibits an inner fire, and Murray Perahia provides us with a wonderful melodic interpretation, which has justly earned Schumann the title as one of the greatest composers of his time. Perahia's interpretation of the music is extremely forceful where it needs to be and yet this is counter-balanced by a delightful delicacy of interpretation for most of the music.

The recording technique chosen for both of these Sonatas warrants some comment. The recording engineers have chosen to follow a trend they regard as reasonable (but regrettably, from where I am looking, an unreasonable) in terms of the spacing between the primary recording microphones and the open keyboard.

Although this recording is good, I believe it could have been enhanced had the pressure response microphones been placed closer to the piano to provide a better balance between direct sound and the reverberant field generated in each of the recording studios.

Music Quality,	
Interpretation	*****
Realism	****
Recording	
Technique	****



MARY RENNIE

PRIDE AND PREJUDICE

The hi-fi what and why

To get some insight into the motivations and strategies of manufacturers and marketers of hi-fi, ETI's Mary Rennie finds the answers....

What makes the hi-fi world go round? Well, money does, of course. But other ingredients are just as necessary: dedication, pride and discernment. In this article, Ralph Waters, designer of the Australian Richter Speakers and Rob Egan, marketing manager for British company NAD respond to some questions most often asked by the audiophile.

Do hi-fi products have a particular national characteristic that you could describe?

Waters: Successful Australian hi-fi products certainly do have characteristics which can be identified. Because the market is generally so critical and discerning, the successful Australian product has to be of superior quality, and represent excellent value. Without both of these ingredients, the product doesn't even get to square one. Secondly, the successful Australian product must be professionally packaged and presented. Effective point of sale materials, efficient service, detailed literature, comprehensive warranty provisions, and an attractive product with aesthetic appeal, are all essential, but neglected areas for many otherwise sound products.

Lastly, the successful manufacturer must be able to supply product! A reliable and rock solid supply is crucial if retailers wish to feel confident and happy about supporting locally produced goods.

Egan: Yes British products do. A dedication to sound quality above all else. In fact, their manufacturers do much to enhance the British reputation for eccentricity. They often ignore price, appearance and practicality in their pursuit of better sound and sometimes it costs them dearly.

NAD is based in the UK and has become the largest selling brand of amplification there by marrying British sound with practicality and realistic pricing.

Even though the Brits are a funny lot, their influence on hi-fi in general is enormous. There is no doubt that, without their inspired fanaticism for sound quality, true hi-fi would have progressed very little in the past decade or two.

In your opinion is there a loudspeaker sound which is fashionable at present in Australia?

Waters: I am glad to say that in my opinion, there appears to be no one single loudspeaker "sound" which is fashionable within the Australian hi-fi market. This in itself may be a tribute to the increased sophistication of the marketplace, since by definition, if a particular sound is evident, then this must mean that the loudspeaker is not providing a clear picture of the music, but contributing its own coloration and injecting its own sound into the music.

As an illustration of what I mean, Scandinavian loudspeakers frequently have an elevated high frequency content, supposedly accurate British sound is often characterised by a lack of attack or transient response, and Japanese sound is often denoted by a distinctly metallic and often hard sound in the mids and trebles — which sounds fine, incidentally, when playing oriental music.

Egan: Not really, because every loudspeaker is totally dependent on the environment in which it operates. In recent year, the hi-fi specialists, have all set up proper sound lounges, and we have since seen a strong trend toward the British sound which is accurate, open,

seamless and non-aggressive.

Outside these sound lounges anything goes, because sound quality is no longer the dominant factor. Speaker placement, efficiency, music selection, ambient noise and salesmanship all have a far greater influence. Choosing good sound under these conditions, is like buying artworks by torchlight.

By far the worst environment of all is the hi-fi show — but people still buy there. Perhaps those who do, live in huge auditoriums and like to listen in the company of 100 or so neighbours!

What technical innovation has been the most important for hi-fi in recent times? Could you explain its effect?

Waters: The most important technical innovation in the hi-fi world is undoubtedly the advent of the compact disc player. The player has brought relatively high fidelity sound into the reaches of the average family. This is a desirable and happy state of affairs. Digital technology has also meant that there has been an amazing amount of mythology generated about the performance of digitally based equipment. For example, the compact disc player was mooted as a perfect device. I was amazed to find that my 10-year-old AR turntable with a middle of the road ADC cartridge provides far less listener fatigue than either of my two other CD players. So for the stereo buffs, the advent of the CD has meant another round of spending on cartridges, arms, and turntables, to ensure that the analogue potential of the humble black vinyl is obtained.

Whatever your personal views on the compact disc player, the emergence of the new technology has had a similar effect that the genesis of stereo technology had a couple of decades ago.

Egan: Undoubtedly the compact disc. It has revolutionised hi-fi by making very high quality sound both convenient and affordable. Debate will continue to rage among audiophiles about the relative merits of record and disc, and so it should. For non-audiophiles, to whom music is just a beautiful distraction and not an all-consuming passion, the CD is a giant leap forward.

I think we are yet to feel the full impact of this medium, in the years to come, it and its offspring will probably change the hi-fi industry beyond recognition.

What is the currently available product of which you are most proud and why?

Waters: My new 'Secret Weapon' series. They encompass some radically different ideas in the approach to loud-speaker design. In essence, the Secret Weapon series attempts to recreate the spaciousness and ambience of a live performance. But unlike most omnidirectional speakers, they retain a clear stereo image, a very large soundstage, and have very clear front-to-back image information, without sacrificing anything to clarity or stability of the stereo image itself.

To do this we have utilised some exciting ideas — such as a full range mid-range unit acting from a very low 100 Hz to a high 5000 Hz — thus ensuring that all critical areas of musical reproduction are covered by the same driver, with no crossover points (and eliminating their attendant problems of phase anomalies, transient distortion and frequency aberration); vertically firing chimney port, and electronic and physical time delays in the high frequency range. The design concepts work so effectively, that it is difficult to tell where the speaker is located exactly, if the listener closes their eyes.

Egan: That would have to be the NAD 3020 amplifier, simply because it began a courageous new approach to design that changed the course of hi-fi history.

Before the 3020, most successful manufacturers followed the tried and proven Japanese formula. The key was to design for the point of sale, so products had to work well and look good in hi-fi shops.

Shops were busy, colourful and brightly lit, so shiny, sculptured front panels with lots of flashing lights demanding attention worked best. Demonstrations were usually just short, loud bursts of dramatic music, so performance had to be edgy and aggressive to

stand out, while ambient noise levels helped to mask any deficiencies. Impressive specifications and all the latest gadgets were a must.

With the 3020, NAD began designing products for use in the home instead of sale in the shop. They wanted them to blend into the decor rather than dominate it. They had to be functional and easy to use in subdued lighting. Performance was everything. They had to sound their best under the toughest conditions — quiet rooms and over extended listening periods.

Today, positive feedback from owners and reviewers and outstanding sales success, has shown that they were right and the NAD 3020 is "now part of hi-fi folklore".



Ralph Waters

What is your biggest selling hi-fi product?

Waters: The Mentor, an 8-inch 2-way speaker. At \$633, it is competing effectively with speakers as much as twice their price.

Egan: NAD still claims the 3020 to be the largest selling amplifier in the history of hi-fi. Here in Australia it is also our number one seller, but the 3240PE amplifier and 5220 and 5240 CD players are catching up fast.

How does the fiscal year 87-88 compare with previous years in sales?

Waters: Richter sales have doubled in the last fiscal year. It seems highly likely that this trend will continue — I'd be surprised if we didn't double sales this fiscal year also.

Egan: NAD has been growing steadily for many years but in '87-'8 we had our

largest ever increase in turnover.

How would you profile the typical customer?

Waters: The typical Richter customer is about seven foot tall and very hairy. No seriously, the average Richter customer listens with his or her ears. They also appear to be showing a high degree of brand loyalty, as my retailers tell me that they sell a lot of speakers through satisfied customers by recommendation.

Egan: That's too difficult. Let me answer by giving you an analogy. Hi-fi is, in many ways, like the car industry. The Japanese multinational fight over the bottom end of mass markets. At the top you have the weird and wonderful esoterics like Porsche, Ferrari, Lamborghini, etc. While in between are the "Europeans" — Saab, Volvo, Mercedes, BMW, Citroen etc.

We see ourselves as catering for those same "European" buyers, the middle market who want quality without excess. We do differ from the car industry, however, in price. Hi-fi involves much smaller amounts and very different comparisons. With NAD, for instance, you can buy the Saab for around the same price as the Toyota!!

This, DAC and DAT

The hi-fi industry's commitment to digital technology and the extent of existing analogue components was illustrated by a product release at the recent Consumer Electronics Show in Chicago. Sansui showed a dual analogue-to-digital converter, the DA-607i, a separate component to reduce or remove both types of distortion and eliminate the need to build expensive digital conversion circuitry into every component. Also at the show, when TEAC announced plans to sell its Esoterica brand DAT recorders the Recording Industry Association of America responded by stating its intention to file suit if these units reached the United States.

YAMAHA'S NEW CDX 1110 CD PLAYER OWES ITS BRILLIANCE TO A PIECE OF TWO-BIT TECHNOLOGY.



Until now, CD players were limited to 44.1 kHz and 16 bit technology. Now Yamaha has, as Audio Magazine states, "found a way to improve on perfection". Introducing the world's finest CD player that features 18 shifting bits and 8 times oversampling digital filters. A technological progression that quadruples both sampling frequency and density to produce exquisite wave-form resolution.

The result is unsurpassed sound quality. We could mention its 44 key wireless remote control, its new 3 beam laser pick-up, its 24 track direct access and random access programmable playback. Or we could compare it to our previous model, the CDX 1100. Of which Audio Magazine said "As to how a CD player is ideally supposed to sound, we do not hesitate to say that it should sound like the

CDX 1100". All of which proves that the new CDX 1110 won't sound one bit better than any other CD player. It'll sound two-bits better. Starting at \$399, our entire CD player range is there for the picking in your local Yamaha Hi-Fi store.

The Yamaha logo, consisting of the word "YAMAHA" in a stylized, multi-colored font where each letter is a different color (Y: blue, A: red, M: green, A: yellow, H: blue, A: red).

5 YEAR WARRANTY.

CD2

COMPACT DISC PLAYER

To own a Cambridge Compact Disc Player has become the ambition of so many music lovers. Now the unique Cambridge 16 x 16 process releases the music from the numbers in an affordable player. The CD2 makes your dream a reality.

cambridge



CD2 Compact Disc Player
With the lessons learned from our CDI Compact Disc Player, we have developed our technology still further to produce an audiophile Compact Disc Player at an affordable price.

The CD2 offers an hitherto undreamed of 16 bit x 16 time oversampling and our own laser mechanism suspension system.

To release the full musical experience from the recorded numbers, Cambridge Audio have had to explore regions unreached by today's technology.

"The difference between the CD2 and most CD players is of a proportion which makes chalk and cheese look like soul mates. In a nutshell, what the CD2 doesn't sound is synthetic. It has the dynamic freedom and breadth of bandwidth which characterise some of the best record players." Hi-Fi Answers April 1988

Australian Distributor: AUDIO Q IMPORTS — (03) 813 3691.

READER INFO No. 1

CD2

COMPACT DISC PLAYER

22,000,000 bits of data every single second.

16x16
16 BIT x 16 TIMES
OVERSAMPLING

AUDIOLAB

8000A Integrated Amplifier

MUSICAL
AFFORDABLE
... LOGICAL



For full data, and details of your nearest Audilab dealer call or write to:

M&G Hoskins
PTY. LTD. (Inc. in NSW)

268 Princes Highway, Arncliffe,
NSW 2205, Sydney, Australia.
Tel: (02) 597 3683. Facsimile: (02) 597 7241



5 YEARS GUARANTEE

READER INFO No. 23



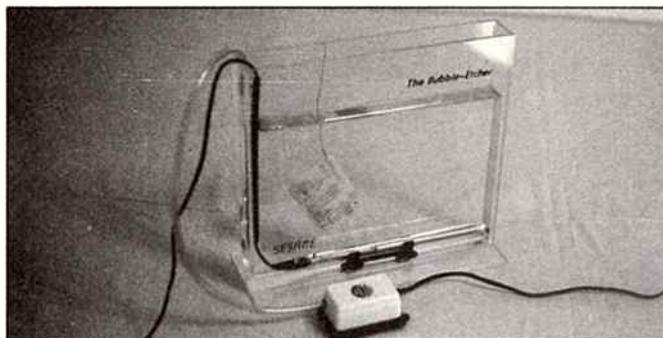
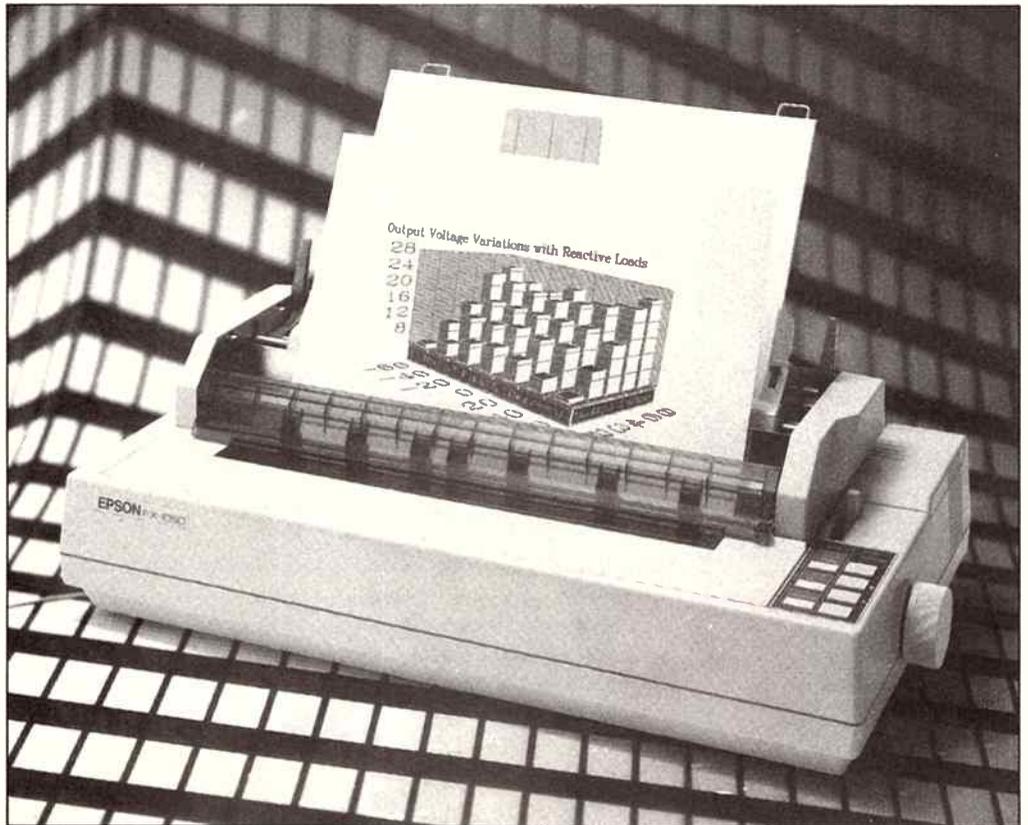
Smart handling

Epson has upgraded its FX-Series of impact dot matrix printers.

The FX-1050 and FX-850 models are 136 column and 80 column 9 pin dot matrix printers, which print at 264 cps in draft mode and 54 cps in near letter quality mode. The noise has been reduced to 65 dBA.

Further information from Epson Sales Offices ☎ (02) 452 5222.

READER INFO No. 150



Hot bubble-etcher

Sesame Electronics have added a heater to their Bubble-Etcher.

Instead of throwing the etchant away after it cools down, you can heat it up again and etch more printed circuit boards.

The Bubble-Etcher is a

clear acrylic tank, holding the etchant in a narrow, vertical slot. Bubbles are pumped into it by an air pump, and the movement of the fluid rinses away the dissolved copper, etching the board clean, without stirring. ☎ (03) 527 8807.

READER INFO No. 152

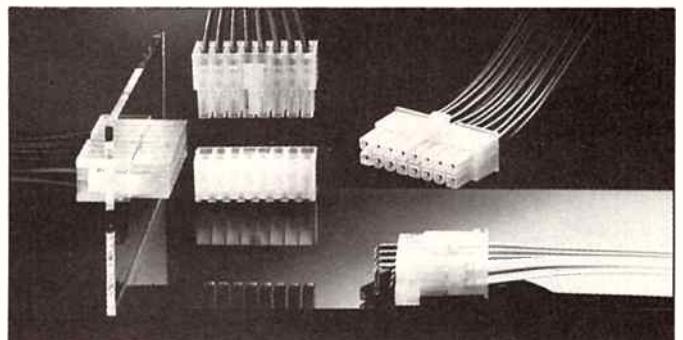
Miniature power connector

Molex have taken the miniaturisation of power connectors a step further with the introduction of the Mini-Fit Junior range.

The mated length of the wire-to-wire version is only 34.6 mm. The mated height of the wire-to-board version is

only 23.5 mm. The terminals in the dual row PCB assembly are set in a 4.2 mm by 5.5 mm ladder arrangement, the minimum spacing for a connector with its 9A current carrying capabilities. ☎ (02) 436 0784.

READER INFO No. 151

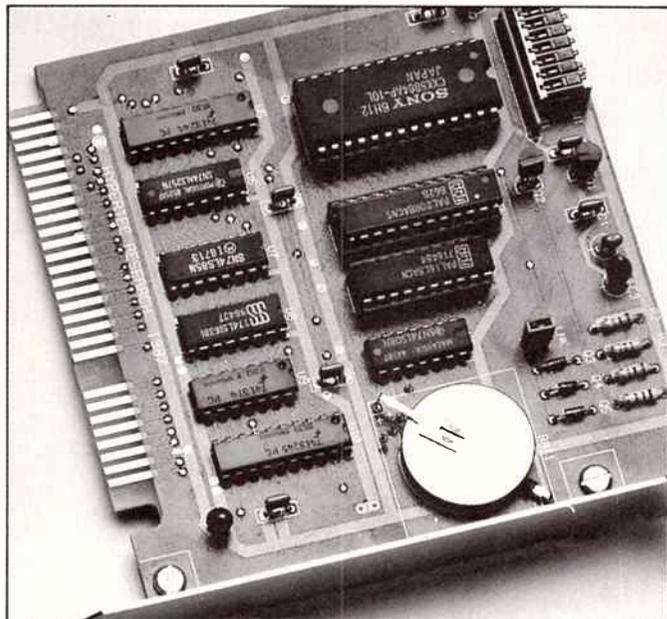
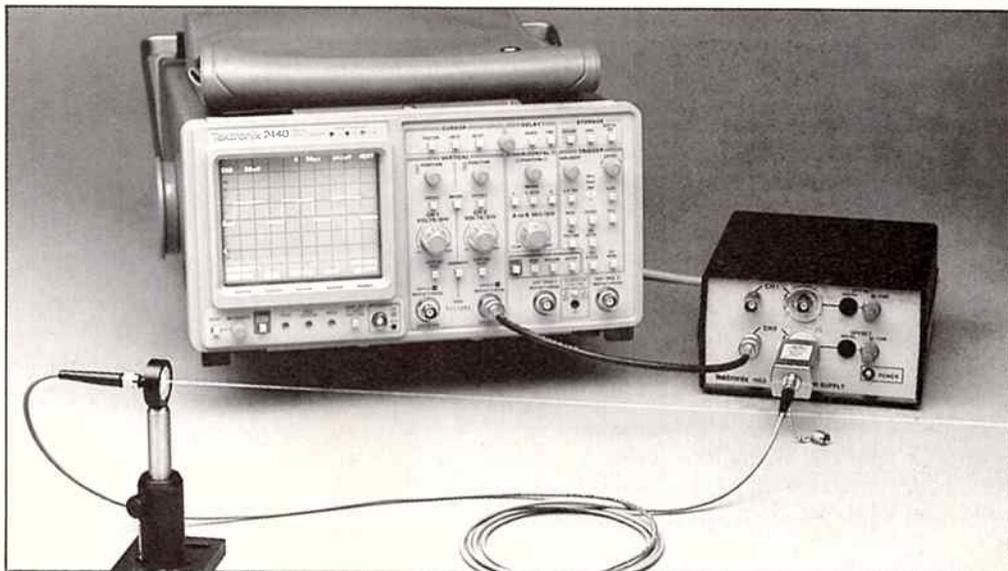


Optical measurements adaptor

The new power supply introduced by Tektronix adapts P6701/02 optical/electrical converters for use in measuring optical signals on any conventional oscilloscope.

It enables electro-optic engineers to accurately measure optical power, rise time, aberration, bandwidth, dynamic range, or noise equivalent power in electro-optic components with any conventional oscilloscope. ☎ (02) 888 7066.

READER INFO No. 153



PC security

Hypertec has announced the release of Hyperlock, an add-on board that makes unauthorised access to IBM PCs virtually impossible as the unit verifies usernames and passwords before granting access to the computer. It

can store up to 50 usernames and passwords.

The only way access can be gained without a valid username and password is by physically removing Hyperlock. ☎ (02) 819 7222

READER INFO No. 155

Potentiometer with potential

IRH Components is now stocking the VRN 780 series square cermet single turn potentiometer. It caters for pcb mounting and is only 9.5 mm square, available in resistance values from 10

Ohms. to 2M. Power rating is 0.5 watt at 85°C. It is specifically designed for immersion soldering and cleaning.

For information: IRH components ☎ (02) 648 5455

READER INFO No. 154



Commercial band transceiver

Imark have released the Sawtron KG 17-ECB Scanning Transceiver for use in the 470-485 MHz commercial band and the CB Radio band.

It is a UHF FM frequency synthesised mobile transceiver with two banks of 99 channels providing a total of 198 channels. It has an RF

power output of 25 watts on the commercial frequencies and 5 watts on the UHF CB frequencies. Its circuitry includes a microprocessor and EPROM for frequency and function control.

Further details from Imark ☎ (03) 329 5433. or (046) 272 535. INFO No. 156 ▲

Portable recording system

Australian Metrosonics has released the dl-721 Multi-channel Data Logger, a battery operated digital data recording and analysis system with the combined functions of signal measurements, data analysis, reduction, and output formatting for transmission to printers or computers.

Eight analogue input channels can be individually programmed for zero, span, and engineering units of measure. Input signals can be volts, mV, or current loops spanning 20 full scale ranges. Up to 7200 measured or computed values can be saved in memory such as minimums maximums, and averages at user selectable intervals. ☎ (03) 233 5889.

READER INFO No. 157



UV MATERIALS

3M Scotchcal Photosensitive

		Pack Price	
		250 x 300 mm	300 x 600mm
8001	Red/Aluminium	\$79.00	\$90.00
8005	Black/Aluminium	\$79.00	\$90.00
8007	Reversal Film	\$43.00	\$58.00
8009	Blue/Aluminium	\$79.00	\$98.00
8011	Red/White	\$71.00	\$81.00
8013	Black/Yellow	\$71.00	\$81.00
8015	Black/White	\$71.00	\$81.00
8016	Blue/White	\$71.00	\$81.00
8018	Green/White	\$71.00	\$81.00
8030	Black/Gold	\$100.00	\$121.00
8060	Blue/Aluminium	\$71.00	\$81.00

RISTON 3400 PCB MATERIAL

SIZE INCHES	SINGLE SIDED	DOUBLE SIDED
36 x 24	\$96.00	\$124.00
24 x 18	\$48.00	\$ 62.00
18 x 12	\$24.00	\$ 31.00
12 x 12	\$16.00	\$ 20.80
12 x 6	\$ 8.00	\$ 11.00

KALEX UV LIGHT BOX KALEX ETCH TANK

All prices plus sales tax if applicable

KALEX 40 Wallis Ave
East Ivanhoe 3079
(03) 497 3422
497 3034
Fax (03) 314 7400

ELECTRONIC COMPONENTS & ACCESSORIES
• SPECIALIST SCHOOL SUPPLIERS

READER INFO No. 15

Software and Hardware for controllers professionally made to your specification

We specialise in converting fixed logic designs to 8039, 8749 and 6805 single chip microprocessor systems with enhanced capabilities at economical prices.

Enquire about out PC based 4800 and 6805 series cross-assemblers that will assemble a 20K source file in 10 seconds.

VANDATA

Suite 8, Midway Arcade
145 Maroondah Highway
Ringwood 3134
(03) 870 6078

V262/AME

READER INFO No. 16
ETI OCTOBER '88

82

Brand New

LASCAR



Digital Panel Meter Catalogue

NOW available

Tick reader service card or send large SAE to

Jaycar
ELECTRONICS

PO Box 185
Concord 2137
or phone

(02) 7471888

8 Locations

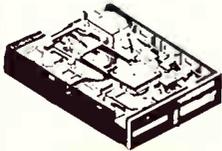
Gore Hill, Sydney, Hurstville,
Concord, Carlingford, Brisbane,
Melbourne & Springvale



20 M/BYTE HARD DISK
Tandon drive with controller card.
IBM* compatible. 12 month warranty
X20010 **ONLY \$549**

40 M/BYTE HARD DISK
Seagate drive, IBM* compatible.
12 month warranty.
X20020 **ONLY \$649**

80 M/BYTE HARD DISK
Seagate drive, IBM* compatible.
12 month warranty.
X20030 ... **ONLY \$2,490**



FUJITSU 5 1/4" 1.2 M/BYTE DRIVE
● 1.2 M/Byte unformatted.
(720K formatted).
● IBM* AT* compatible
● Quality at an affordable price
Cat. C11906 **\$249**

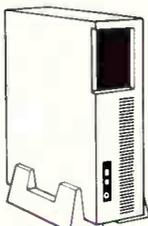
FUJITSU 3 1/2" DRIVE
● 1 M/Byte unformatted
640K formatted
● Double sided, double density.
● Affordable quality
Cat. C11905 **\$255**



150W SWITCH MODE POWER SUPPLY FOR IBM* PC*XT* & COMPATIBLES
DC OUTPUT: +5/13A, -5V/0.5A
+12V/4.5A -12V/0.5A
Cat. X11096 **\$129**

200W SWITCH MODE POWER SUPPLY FOR IBM* AT* & COMPATIBLE
DC OUTPUT: +5/16A, -5V/0.5A
+12V/5A -12V/0.5A
Cat. X11097 **\$199**

180W SWITCH MODE POWER SUPPLY FOR BABY AT* COMPATIBLES
Cat. X11098 **\$189**



VERTICAL COMPUTER STAND
FREE VALUABLE DESK SPACE
OF YOUR PC BY PLACING IT ON
ITS SIDE ON THE GROUND!
(4 1/2" x 7 1/4")
● Adjustable width from 115-188mm
● Accommodates IBM* PC*XT*AT
and most compatibles
● Light weight, durable construction
C21076 **\$24.95**



COPY HOLDER (YU-H33)
● Copy area 9 1/2" x 11"
● Sliding line guide
● Flat metal base
C21060 **\$39.95**



PRINTER LEAD
● Suits IBM* PC*XT, compatibles
● 25 pin "D" plug (computer end) to
Centronics 36 pin plug
P19029 (1.8 metres) **\$14.95**
P19030 (3 metres) ... **\$19.95**



THE BUTTON SPIKE PROTECTOR
Surges and spikes are caused not
only by lightning strikes and load
switching but also by other equipment
being switched on and off, such as
fluorescent lights, electric motors,
fridge freezers, air conditioners, etc.
For effective protection such spikes
must be stopped before they reach
your equipment. Simply plug The
Button into an outlet and it will protect
all equipment plugged into adjacent
outlets on the same branch circuit.
The Button employs unique metal
oxide varistor technology and will
dissipate 150 joules of electrical
energy (nearly twice that of
comparable surge arresters.)
SPECIFICATIONS:
Voltage: 240V Nominal
Total Energy Rating: 150 joules
Response Time: 10ns
Protection Level: 350V peak
..... **\$34.95**



8087
Genuine Intel chips with manual
and data sheets packed in boxes!
8087-3 (4.77MHz) **\$195**
8087-2 (8MHz) **\$295**
8087-1 (10MHz) **\$395**
80287-6 (8MHz) **\$349**
80287-8 (8MHz) **\$499**
80287-10 (10MHz) **\$549**
80387-16 (16MHz) **\$899**
80387-20 (20MHz) **\$1499**
80387-25 (25MHz) **\$1799**



PRINTER RIBBONS TO SUIT:
CP80, SX80, DP80, BX100 MB100
(C22036) 1-9 **\$8.95** 10- **\$7.95**

MX70/80 FX70/80 RX70/80
1-9 **\$8.95** 10- **\$7.95**
(C22031)

MX100, FX100, RX100
1-9 **\$19.95** 10- **\$18.95**
(C22002)

LX80
1-9 **\$9.95** 10- **\$8.95**
(C22003)

LQ1000
1-9 **\$27.60** 10- **\$25.00**
(C22012)

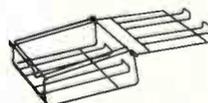


THOMSON EGA MONITOR
Top quality high resolution EGA
monitors with a space-age design.
SPECIFICATIONS:
CRT: 14 inch (360mm) diagonal,
90 degree deflection.
Display Size: 245(H) x 180(V)mm
Phosphor: P22, non glare, tinted
screen.
Dot Pitch: 0.38mm
Video Bandwidth: 18 MHz
Resolution: 15-75KHz - 640 x 200
21-85KHz 640 x 350
Input Signals:
1. RGBI - positive, H(+), V(+)
2. RrGgBbl - positive, H(+), V(-)
Input Impedance: 330 ohms
Dot Scanning Frequency:
Horizontal: 15-75 KHz or 21-85 KHz
+ - 10Hz
Vertical: 50 - 60 Hz
Connector: 9 pin, D-type
Size: 312(H) x 363(L) x 380(W)mm
Weight: 10-8 Kg (Net)
X14525 **\$695**
EGA CARD **\$195**

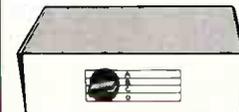


Z-DIN 12" TTL MONITOR
X14500 (GREEN) **\$139**
X14502 (AMBER) **\$139**
10 OR MORE **\$129 EACH**

Z-DIN 12" 20MHz COMPOSITE MONITOR
X14514 (GREEN) **\$119**
X14516 (AMBER) **\$119**
10 OR MORE **\$109 EACH**



PRINTER STANDS
● Restores order to your work area.
● Conveniently stacks paper printout
in document tray automatically
● Made of black plastic coated steel
● Suitable for most printers
(80/132 column)
● Excellent value at these prices!
C21054 **\$26.95**



DATA TRANSFER SWITCHES
If you have two or four compatible
devices that 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 RS232 X19120
..... **ONLY \$49**
4 WAY RS232 X19125
..... **ONLY \$59**
2 WAY Centronics **\$49**
X19130 **ONLY \$49**
4 WAY Centronics **\$59**
X19135 **ONLY \$59**



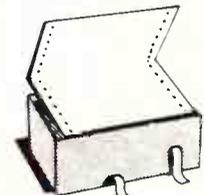
VERBATIM DISK SPECIALS!
ALL PRICES PER 10 DISKS

DESCRIPTION	1-9 boxes	10- boxes
3 1/2" 1S 2D	\$39.95	\$37.95
3 1/2" 2S 2D	\$46.95	\$43.95
3 1/2" 2S HD	\$99.00	\$89.00
5 1/4" 1S 2D	\$22.00	\$21.00
5 1/4" 2D 2D	\$26.00	\$24.00
5 1/4" 2S 4D	\$75.00	\$70.00
5 1/4" 2S HD	\$41.00	\$39.00



MICRODOT DISKS!
FREE PLASTIC LIBRARY CASE
WITH EVERY 10 DISKS!

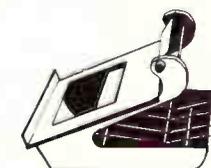
DESCRIPTION	1-9 boxes	10- boxes
3 1/2" 2S/2D	\$32.95	\$30.95
5 1/4" 1S/2D	\$11.95	\$10.95
5 1/4" 2S/2D	\$13.95	\$12.95
5 1/4" 2S HD	\$29.95	\$27.95



COMPUTER PAPER
Quality paper at a low price!
2,000 sheets of 70 gsm bond paper.
C21003 11 x 9 1/2" **\$39.95**
C21005 15 x 11" **\$67.95**



PANASONIC KX-P1081 DOT MATRIX PRINTER
● 120 CPS
● Pica or Elite character set
● Print Modes: NLO, Dot Graphics,
Draft, Proportional Font
● Reliable and Compact
● Proportional Printing
● Logic Seeking
● 1K Printer Buffer
C20035 Normally \$595
We won't be beaten! **only \$379**



DELUXE PRINTER STAND
● Restores order to your work area
without occupying extra space.
● Feeds and refolds paper under the
printer automatically.
● Adjustable paper deflectors to
ensure smooth flow of paper.
● Made of moulded plastic
● Suitable for most printers
C21058 80 column **\$89.95**



"NO BRAND" DISKS

Now you can buy absolute top quality
disks that are probably the cheapest
in Australia! They even come with a
lifetime warranty! So why pay 2-3
times the price for the same quality?
Packs of 10, 2S 2D without boxes,
or brand name, just their white paper
jacket, and index labels
(5 1/4" disks includes write protects).

5 1/4" 2S/2D DISKS
100-DISKS **\$6.95^{ea}** 1000-DISKS **\$6.75^{ea}** 1000-DISKS **\$6.50^{ea}**
(ALL PRICES PER 10 DISKS)

5 1/4" HIGH DENSITY (DOUBLE SIDED)
10-DISKS 100-DISKS 1000-DISKS
\$27.95^{ea} \$26.95^{ea} \$26.95^{ea}
(ALL PRICES PER 10 DISKS)

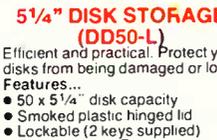
3 1/2" 2S/2D DISKS
10-DISKS 100-DISKS 1000-DISKS
\$27 \$26 \$24
(ALL PRICES PER 10 DISKS)



5 1/4" DISK STORAGE (DD100-L)
Efficient and practical. Protect your
disks from being damaged or lost!
Features...
● 100 x 5 1/4" disk capacity
● Smoked plastic hinged lid
● Lockable (2 keys supplied)
● High impact ABS plastic base.
● Contemporary design
C16020 **only \$15.95**



JUMBO 5 1/4" DISK STORAGE (DD120-L)
If you have lots of disks, you'll
appreciate the extra capacity of this
disk storage unit when it comes to
locating a particular disk.
Features...
● 120 x 5 1/4" disk capacity
● Smoked plastic hinged lid
● Lockable (2 keys supplied)
● High impact plastic base
C16028 **only \$19.95**



5 1/4" DISK STORAGE (DD50-L)
Efficient and practical. Protect your
disks from being damaged or lost!
Features...
● 50 x 5 1/4" disk capacity
● Smoked plastic hinged lid
● Lockable (2 keys supplied)
● Contemporary design
C16025 **only \$14.95**



3 1/2" DISK STORAGE (DD80-L)
● Holds up to 80 x 3 1/2" diskettes.
● Smoked plastic hinged lid
● Lockable (2 keys supplied)
● High impact plastic base
● Contemporary design
C16038 **only \$19.95**



40 channel synthesised mobile transceiver ▲

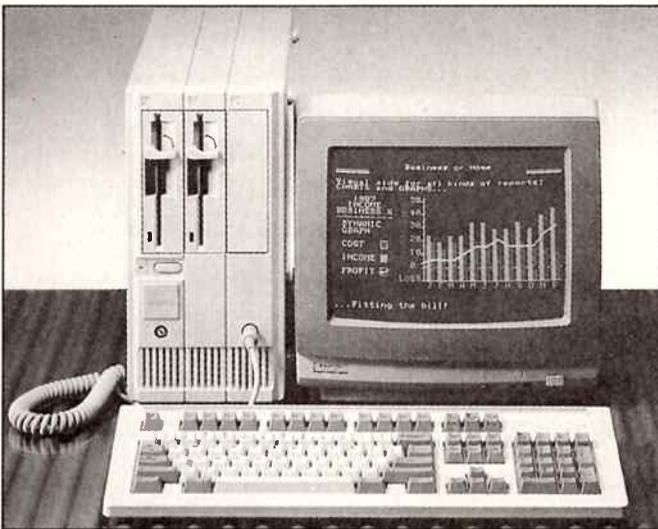
Standard Communications has announced the release of the new GME Electrophone TX472S 40 Channel Synthesised 5 Watt Mobile Transceiver operating in the 476.425 to 477.400 MHz Citizen Band.

At the heart of the TX472S is a micro computer that of-

fers two modes of field programming and scanning. Group scanning allows a user to program in any group of nominated channels along with their own selected priority channel, whereas open channel scanning allows all 40 channels to be scanned.

☎ (03) 584 8099.

READER INFO No. 158



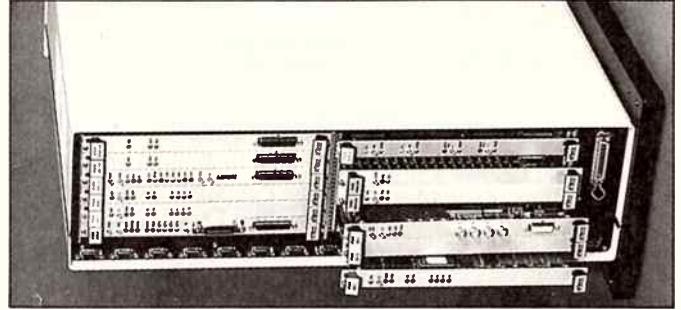
High speed 32-bit PC ▲

Sanyo Office Machines has released its new 16 mHz 80386 processor based PC. The MBC 18 Plus has a 1Mb standard RAM memory, and is designed to run a wide range of software for PC and AT compatible machines.

The MBC-18 Plus also features a 101-key 'snap membrane switch' keyboard, the standard 5¼" disk drive is 1.2 Mb, and an optional hard disk drive is available.

☎ (02) 498 2799

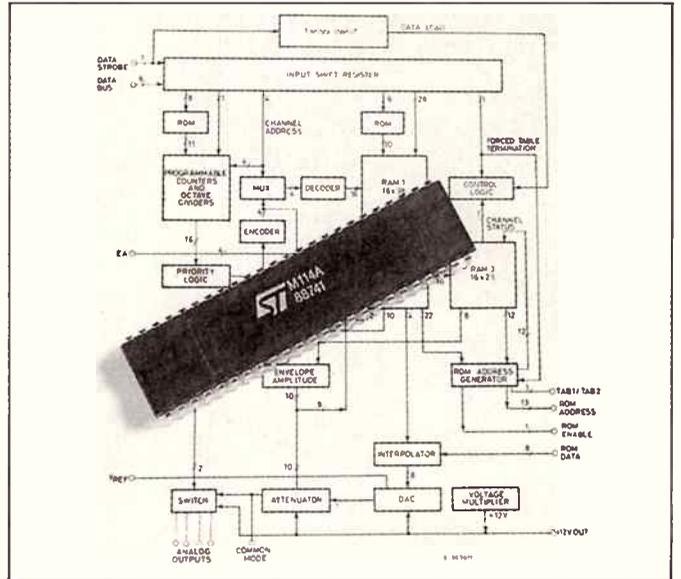
READER INFO No. 160



Focus on Force ▲

The Focus 32 PDOS System 21A features a custom-designed power supply and a 16-layer VMEbus backplane. The system is supplied in a standard configuration utilising six of the twelve available slots. This leaves six double height card positions available for expansion with interfaces to both the VMEbus P1 and P2 connectors. ☎ (03) 873 4749.

READER INFO No. 159



Sound memory ▲

SGS-Thomson Microelectronics has introduced the M114 digital sound generator IC for electronic musical instruments which produces sounds by processing specially compressed samples in ROM look-up tables. Thanks to the compression technique very little memory is needed to effectively synthesise a wide range of sounds.

The M114 is a microprocessor peripheral containing 16 independent digital sound generator channels, a 12-bit equivalent resolution D/A converter, a 10-bit attenuator and four selectable analog outputs. Sounds, coded either in delta modulation or absolute values, are stored in an external ROM. The M114VS version can address up to 8 Kbytes of external sample memory; an expanded version, designated M114A, addresses up to 256 Kbytes.

Samples of the M114 and an evaluation board are available ☎ (02) 439 6571.

READER INFO No. 161

Suppression work lab kit ▼

To assist design engineers involved in EMI/RFI suppression work Rifa have introduced a Lab Kit covering a selection of their wide range of specialised suppression capacitors.

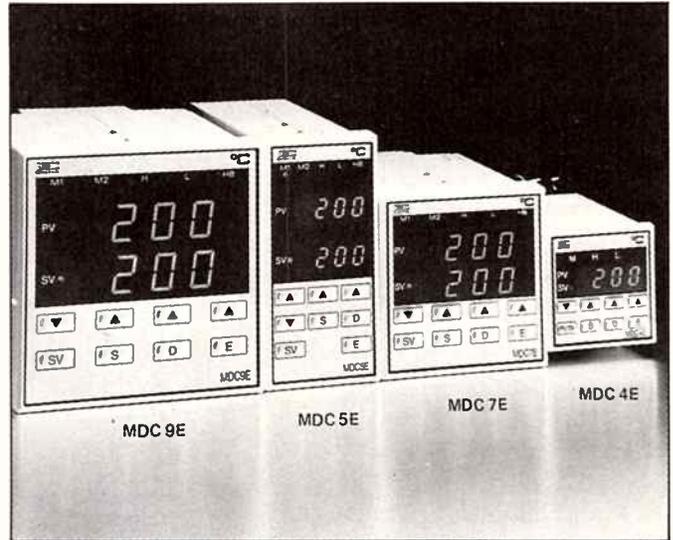
The Kit is supplied in a briefcase with over 200 capacitors covering delta, single

capacitors as well as RC networks.

The capacitors employ metallised paper construction giving them very high dV/dT ratings.

Further information: Rifa ☎ (03)-4801211

READER INFO No. 162



Microprocessor based controller ▲

The E Series PID Controllers from Electromark offer a new generation of temperature and process control software in a range of conventional case sizes to suit the users application. They are available in 96 x 96 mm, 72 x 72 mm, 96 x 48 mm and 48 x 48 mm with a depth of only 100 mm. Weight is from 0.4 kg to 0.15 kg.

Front panel press keys can set the following parameters:

- * Direction of control and sensor break protection.
- * Selection of scale range, Digits and decimal position.
- * Alarm point and alarm hysteresis setting.
- * Zero shift for input and set values.
- * Nominal heater voltage.

Details from Electromark ☎ (02) 570 7287.

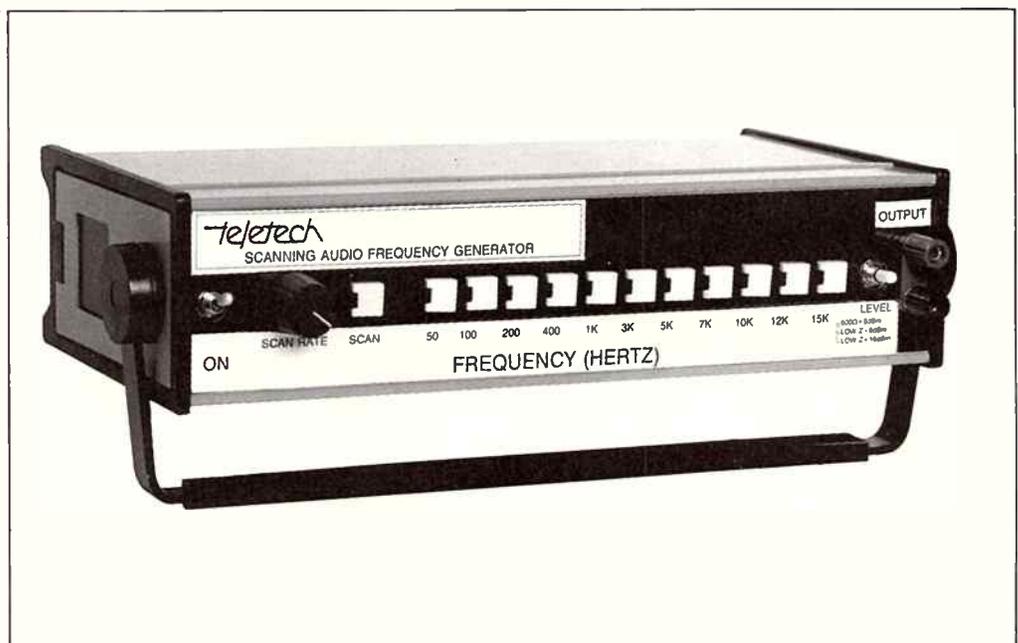
READER INFO No. 163

Scanning audio frequency generator ▶

A scanning audio frequency generator, Model TX50, has been released by Teletech which is battery operated, fully portable and serves equally well as a laboratory or field instrument.

The TX50 provides 11 spot frequencies ranging from 50 Hz to 15 kHz. It operates in two modes: scanning repetitively throughout the range or, at the push of a button, providing a continuous tone on any of the designated frequencies. ☎ (03) 873 2777.

READER INFO No. 164

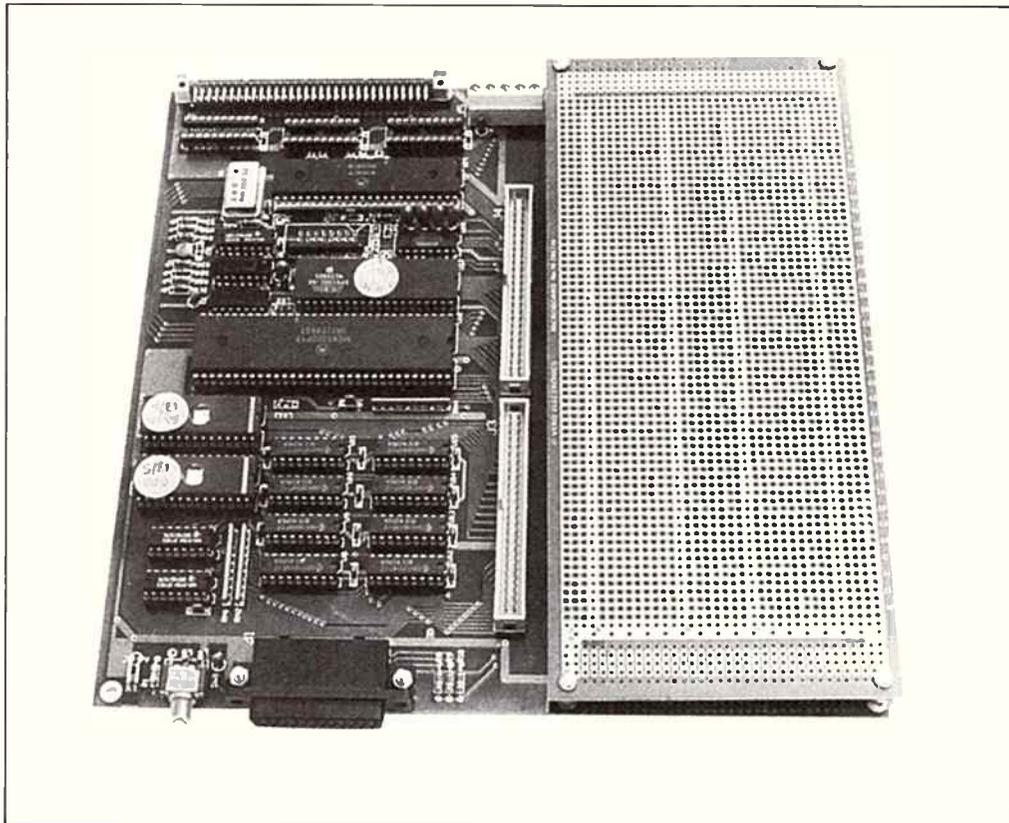


**New 68000
single board
computer** ▶

The 12.5MHz 68000 Single Board Computer from Interrupt Systems in Melbourne is a computer system core based on the Motorola 68000 16/32 bit processor. With up to 128 Kbytes of on-board DRAM, RS232 communications, 68000 bus access and a reusable prototyping area this computer is intended for a wide range of real-time design applications.

More information from Interrupt Systems ☎ (03) 233 9622.

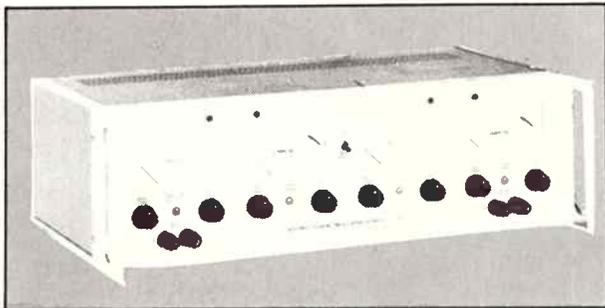
READER INFO No. 165



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



SCIENTIFIC DEVICES AUSTRALIA PTY. LTD.
VIC 2 JACKS RD. SOUTH OAKLEIGH 3167
PHONE (03) 579 3622 TELEX AA32742
NSW 559A WILLOUGHBY RD. WILLOUGHBY 2068
PHONE (02) 95 2064 TELEX AA22978
S A 31 HALSEY RD. ELIZABETH EAST 5112
PHONE (08) 255 6575 TELEX AA88125

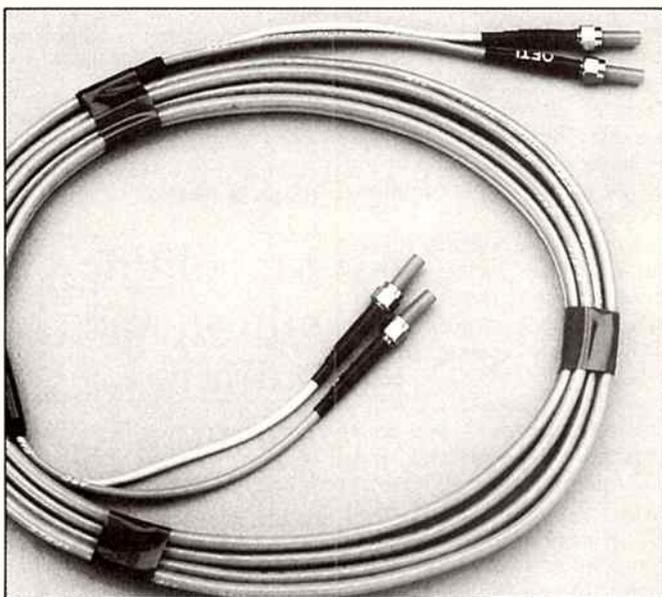
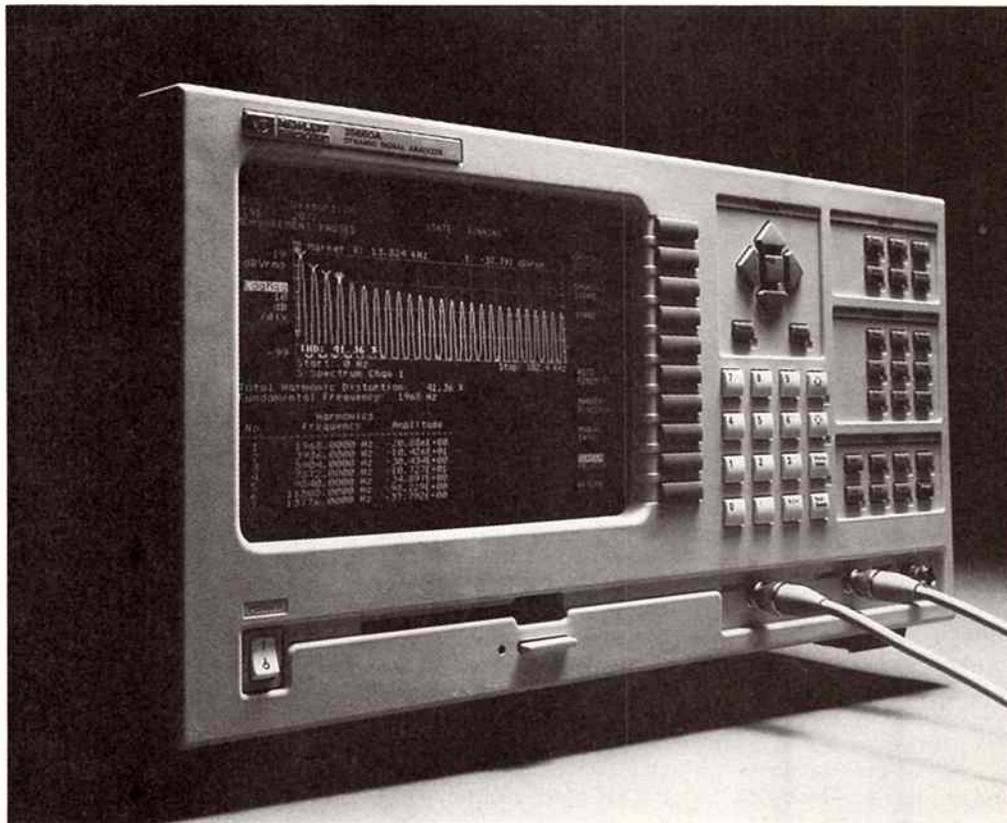


Quick and easy path to solutions ►

Hewlett-Packard Australia has announced a fast fourier transform (FFT)-based signal analyser.

The WP 35660A gives spectrum analysis from dc to 102.4 kHz and network analysis from dc to 51.2 kHz. The FFT provides 400 lines of resolution in both one and two-channel modes. Complete alias protection and digital zoom ensure high-resolution measurements with accuracy. For information ☎ (03) 895-2644

READER INFO No. 167



Pigtails and Patchcords ▲

A new range of optical fibre pigtail and patchcord accessories is being manufactured by Austral Standard Cables.

Connectorised single fibre and dual fibre, figure eight, cables are tight buffered with nylon and strengthened by a

surrounding layer of aramid yarn. The outer sheath is of flame retardant PVC. The length of connectorised leads and the connector type can be specified by the customer.

Details ☎ (02) 821 9777.

READER INFO No. 168

NOTHING MATCHES THE DIC SC-5000 DESOLDERING TOOL FOR COMPACT SIZE, LIGHT WEIGHT, FEATURES AND PRICE

The DIC SC-5000 solder cleaner, unlike conventional desoldering stations, is so easy to handle because it has a vacuum pump built in and requires no connecting tubes or separate compressor. Just one power cord and that's all.

The integration of the suction nozzle and vacuum pump results in greater suction power. Due to its powerful 60 watt ceramic heater, it heats rapidly and recovers immediately during use. Exact temperature control is accomplished by a zero-crossing feedback circuit, eliminating RF interference and preventing damage to integrated circuits, multi-layer boards and through-hole-plated PC boards. With the flick of a switch the DIC becomes a hot blow gun.

And at the recommended retail price of \$495 the DIC SC-5000 won't burn a hole in your pocket.

Available now in Australia exclusively through Tecnico Electronics and appointed Distributors.

SYDNEY 439 2200 MELBOURNE 235 3686
11 Waltham Street, Artarmon, NSW. 2064.



TECNICO ELECTRONICS
 For electronic components & instrumentation

the UN 1526

READER INFO No. 19



SEMICONDUCTOR WATCH

ETI engineer Terry Kee takes a look at the latest available in semiconductors.

Two-tone frequency generator

A two-tone frequency generator that provides the two-tone warble common in modern telephones has been released in Australia by Siemens. The IC SAE0700 contains a bridge rectifier which can be

used to detect ringing on telephone lines, in which case no additional power supply is necessary, as the ringing voltage provides the IC's power supply. Alternatively it can be dc operated. Apart from telephone ring detection, applications include any alarm requirements such as automotive malfunction or other cabin warnings.

Tone and warble frequencies are set by a single capacitor and resistor respec-

tively, and the IC can directly drive a loudspeaker or piezoceramic resonator.

Further information from Electronic Components Department at Siemens ☎ (03) 420 7314.

Flash 10-bit A/D converter

TRW LSI Products have released details of their TDC1020 flash analog-to-digital converter. It is quoted to be the first monolithic A/D converter to offer 10-bit resolution with guaranteed sampling at 20 Megasamples per second. Tight process control ensures close matching of the 1,024 comparators contained in the converter.

Applications include studio-quality video, radar, medical imaging and general high-speed data conversion. The TDC1020 is packaged in a 64-pin DIP (dual-in-line package) and dissipates 3.5 Watts (typical). Literature and samples are now available with full guaranteed performance over the commercial 0 to 70 C degrees ambient range. More information from Email Electronics ☎ (03) 544 8244.

World's first line for 8-inch wafers

IBM has claimed to be the world's first manufacturer to fabricate semiconductor chips

on 8-inch diameter (200mm) silicon wafers. After undergoing several hundred process steps the wafers are diced into tiny microchips.

Until recently, the company processed 5-inch wafers exclusively, each capable of yielding about 150 chips. Now it is possible to get up to 400 chips on an 8 inch wafer in the same amount of time.

This new manufacturing line will yield larger productivity at reduced cost. The company's one megabit Dynamic Random Access Memory (DRAM) chips have been put into production using this new process.

For further details contact Janet Bell, Coonara Ave, West Pennant Hills, NSW 2120 ☎ (02) 634 8648.

Monolithic silicon and gallium arsenide ic

According to Texas Instruments, their researchers have developed the first monolithic integrated circuits to use silicon and gallium-arsenide (GaAs) transistors and other semiconductor components fabrication and to have them interconnected on the same piece of silicon. The chips were produced using a coin-tegration process developed in TI's Central Research Laboratories.

"For the first time we've been able to build chips that

COMMUNICATIONS

Modem KIT from \$95.00
Multi speed Modems also available.

20Meg hard disk drives
\$520.00 complete with controller card.
Diskettes DD/DS \$10

Telephone Safety Device \$39.50
A must for any Modem or Fax machine.
This will prevent static Electricity blowing up your unit. It is also recommended for Answering machines.

APL Cards complete range in stock.
ABE Computers of 24 Burwood Highway, Burwood in Victoria.
Phone: (03) 288 2144 / (03) 288 9067
fax: (03) 288 0781

combine the high speed and optical capabilities of gallium arsenide components with the greater density and lower cost of silicon components. Conventional techniques used to produce components in either silicon or GaAs are incompatible, forcing chip designers to choose one technology or the other,' said TI Chief Technical Officer, George Heilmeyer.

Richard J. Matyi and Hishashi (Sam) Shichijo, developers of the cointegration process, demonstrated it by producing several ring oscillators which are simple monolithic test circuits comprising of 76 silicon and 76 GaAs devices. Although the circuits demonstrated are small, TI's cointegration process will be suitable for the production of highly dense integrated circuits. Other laboratories have shown individual silicon and GaAs transistors working together, but this is the first time a complete ic consisting of these two materials has been fabricated on the same silicon wafer.

Further information from Texas Instruments ☎ (02) 887 1122 or DWR Communications Group P/L ☎ (02) 909 3188.

Australia's FFT chip

A VLSI fast fourier transform (FFT) chip has been developed by the CSIRO's Division of Radiophysics in con-

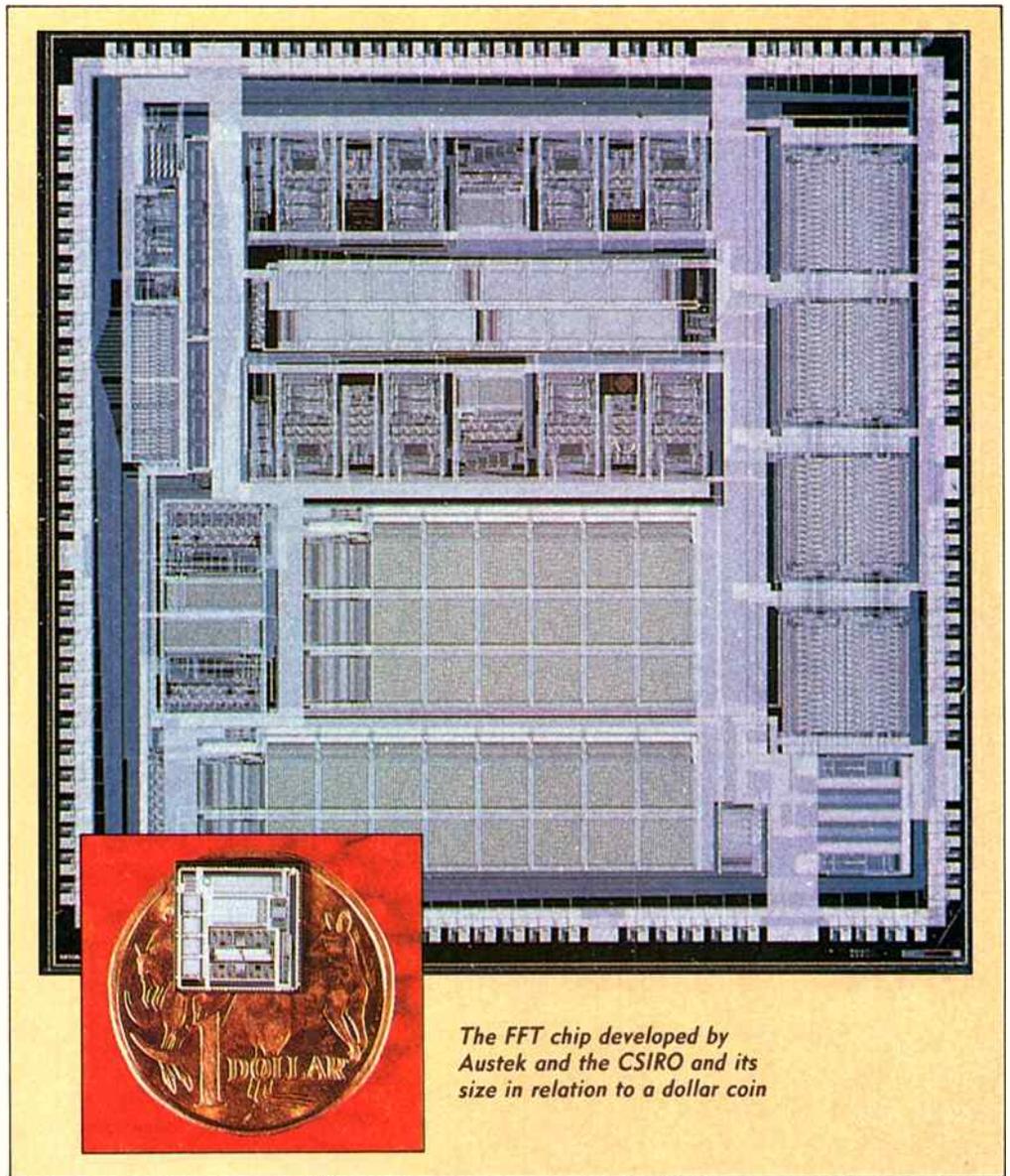
junction with Austek Microsystems. The chip performs FFTs on digital data in real-time. It has been quoted that the prototype chip performs a FFT process a hundred times faster than a \$150,000 Vax computer. In the past FFT algorithms have been implemented in software using either general-purpose signal

processors or high-speed computing systems. Now it is possible to realise FFTs in a single chip or multi-chip configuration and will be a cost effective method of achieving it. These features will open up new areas of applications including communications, voice and signal recognition, medical diagnosis, geophysics

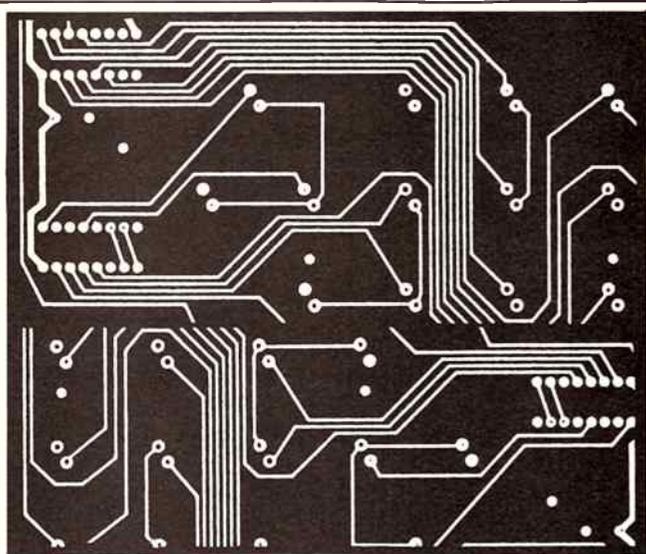
and image processing.

Inevitably it will eventually filter into the consumer electronic market and possible areas of applications are digital audio, television and home computers.

More information from: Dr John O'Sullivan at the CSIRO Division of Radiophysics ☎ (02) 868 0222.



The FFT chip developed by Austek and the CSIRO and its size in relation to a dollar coin



Power and Speed at an affordable price, on your IBM PC.

OrCAD the powerful and easy to use Electronic Design Software now provides complete End to End Design.

First design your circuit using the Schematic Design Tools (SDT).

OrCAD/SDT Features:

- Over 3700 unique library parts and graphic parts editor
- Unlimited levels of hierarchy
- Standard macros supplied and user entry of keyboard macros
- Netlisting to 22 other packages plus other post processing utilities
- Variable size worksheets, text and output

Simulate your design with Verification/Simulation Tools (VST).

OrCAD/VST Features:

- 14,000 gate capacity from up to 50 channels input
- 10,000 events per second (8MHz AT)
- 10 breakpoints, 16 AND/OR signals per breakpoint
- Logic analyser format simplifies data analysis
- Selectable minimum or maximum delays and model library source

Finally produce your design using Printed Circuit Board (PCB).

OrCAD/PCB Features:

- Auto routing up to 32" x 32" with 16 copper layers maximum
- Selectable track, via and isolation from 0.001" to 0.255"
- Square, rectangular, round, oval and SMD pads
- Grid bases of 100, 50, 25, 10, 5 mils. Off grid to 1 mil.
- Ratsnest, force vector for placement optimization

All OrCAD products are full compatible and include 12 months free updates and support.



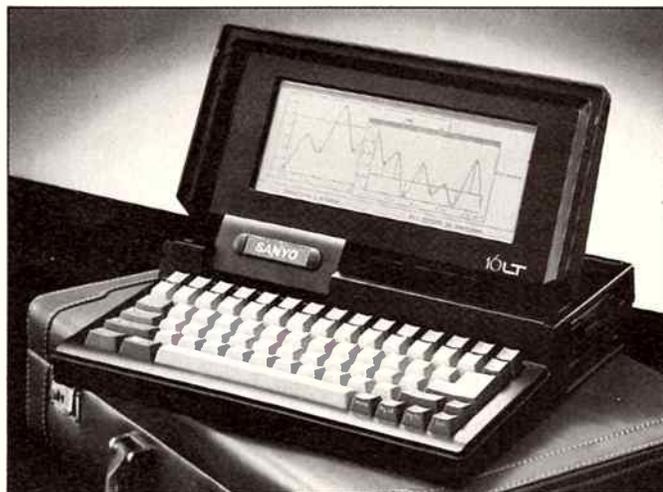
CUT OUT AND MAIL TODAY.

We will send you a FREE Demo and Literature.

Name _____
 Title _____
 Company _____
 Address _____
 Telephone _____ Fax _____

Prometheus Software Developments Pty Ltd
 260 high Street Kew. Vic. 3101.
 Telephone: (03) 862 3666.
 Fax: (03) 862 2092.

READER INFO No. 22



Featherweight PC

Claimed to be the world's lightest and most compact personal computer, Sanyo's MBC-16LT will fit into an average briefcase. Its weighs 3.57 kg and measures 320 x 289 x 61.5 mm. It has two 720 Kb 3.5" disk drives and 640 Kb RAM, and the 8088 CPU is switchable 8 MHz/4.77 MHz. It sells for \$2995.

For information: Mark Fischer, Sanyo Office Machines ☎ (02) 929-4644
 READER INFO No. 169

LISTEN TO THE WORLD

Captain Communications has Australia's best range of shortwave listening equipment, scanners and frequency registers. Our expert technical staff will help you to select the right equipment for your needs.

Frequency Registers:
 Find out what you're listening to! We stock a complete range of these exhaustive listings.

Buy with confidence.
 Our technicians service and repair everything we sell.



OPEN 7 DAYS
 28 Parkes St., Parramatta, NSW 2151
Phone 633 4333,
 Fax 891 2271
 Bankcard, VISA, Mastercard, AGC, Diners, Leasing, Cash and Layby



ICOM IC-R71 100kHz - 30 MHz
 IC-R7000 25MHz - 1300 MHz



KENWOOD RZ1 500kHz - 905MHz



KENWOOD R5000 100kHz - 30MHz



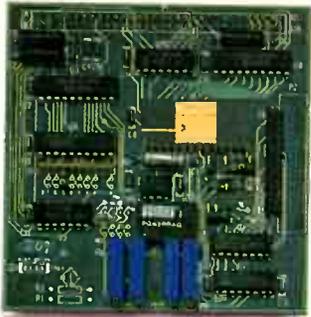
SANGEAN ATS803 150kHz - 30MHz plus FM



KENWOOD
SANGEAN

READER INFO No. 21

One PC data acquisition system grows up: PCI-20000.



Analog input modules: programmable gain or high speed (180kHz).



Special function modules: trigger/ alarm, simultaneous sample/hold.



Expandable digital I/O module (to 128 points per carrier).

DMA carrier board with clock and digital I/O transfers data at 360 kBytes/sec. Holds 3 modules.



Analog output modules: 2 or 8 channel, 12 or 16 bits, V_0 or I_0 .



Counter/timer, clock, pulse generator & frequency measurement module.



Expandable analog input module (to 80 channels per carrier).

The others just grow old.

Some personal computer data I/O systems make you pay for functions you don't need. These same inflexible systems can't be updated—at any price.

The unique **PCI-20000 modular system**, on the other hand, is easily configured to provide literally thousands of data acquisition, test, measurement and/or control options. Just plug the application-specific modules you need into a carrier board. Then plug the carrier into your IBM/compatible PC. Change or add modules as your needs change. In other words, the PCI-20000 grows up, not old!

Up to 128 digital I/O points or 80 analog inputs can be configured on a single carrier board. A unique DMA carrier/module combination transfers analog, digital and/or counter data at

speeds limited only by your computer. Capture, analyze and react to real-world events in real-time. Plus, ruggedly constructed termination panels provide long-lasting screw-in connections to analog and digital I/O signals.

No programming experience needed. Many easy to use, menu driven software packages support the entire PCI-20000 family. Multiple language software drivers are also available. Best of all, years from now when other systems are collecting cobwebs, your PCI-20000 will still be collecting data.



Free 300 Page PC Data Acquisition Handbook.

For fast service, return the coupon to **KENELEC Pty. Ltd.** 48 Henderson Rd Clayton, 3168. For even faster response, call (03) 560 1011

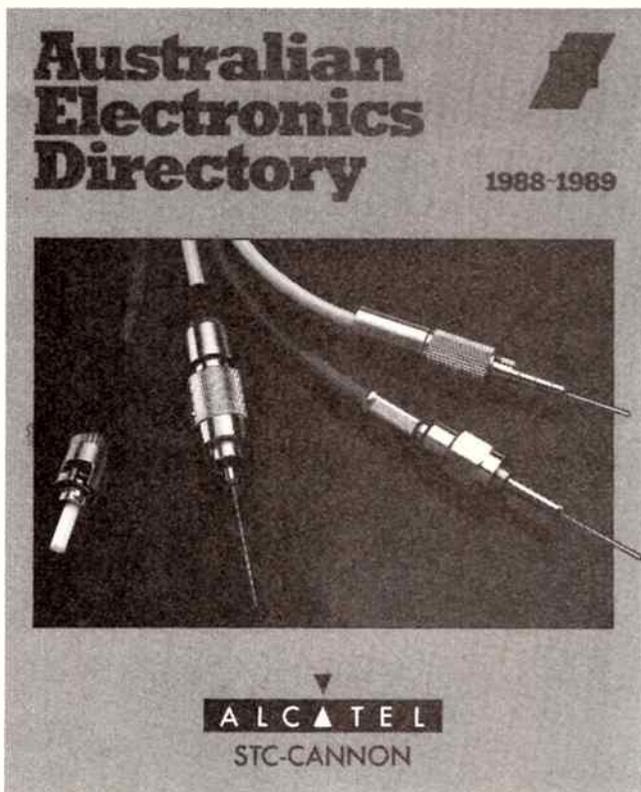
Name _____
 Title _____
 Company _____
 Address _____
 Phone _____



READER INFO No. 44

World Radio History

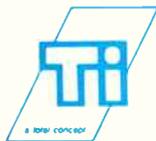
ELECTRONICS BUYERS GUIDE



The 20th Edition of the Australian Electronics Directory (Australia's only true directory to who's who in the electronics industry) has had many thousands of company information changes since last year including:— agencies and overseas principals represented, address, telephone, fax etc., along with management sales and technical staff.

There are also 124 additional product headings, including 2 new charts on SURFACE MOUNT TECHNOLOGY. The 5 major product categories covered in this unique directory are:

- Electronic Components
- Construction Materials
- Measurement & Test Equipment
- Systems and Sub-Systems
- Construction Services



Technical Indexes Pty. Ltd.

H.O. Vic. P.O. Box 98, Cheltenham, 3192
Tel: (03) 584 4777 Telex: 34007 Fax: (03) 584 6871

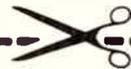
N.S.W. P.O. Box 8, Collaroy, 2097
Tel: (02) 981 5666 Fax: (02) 982 1619

Qld. P.O. Box 272, Red Hill, 4059
Tel: (07) 856 4055

A WHOLLY-OWNED AUSTRALIAN COMPANY

- ★ Nearly 700 Australian Companies, giving their head office, branch and distributor locations plus a listing of key personnel. These companies represent approximately 2000 world-wide manufacturers in the electronics industry.
- ★ Over 2300 product categories specific to the electronics industry.
- ★ More than 5200 Principal and Trade Name cross references.
- ★ Easy-to-use format with 97 computer generated Charts which break product areas into detailed sub-groups and identify the Australian suppliers for each one.
- ★ Used as an Index to Technical Indexes' Electronics Data System which contains over 195,000 pages of technical product data on microfiche.

The Australian Electronics Directory is priced at \$83.00 (including delivery within Australia). To obtain your copy, complete and return the coupon below or contact our nearest Sales Office.



Australian Electronics Directory 1988-89 Edition

PLEASE SEND ME COPIES AT \$83.00 EACH
(including delivery within Australia)

I ENCLOSE MY
CHEQUE/MONEY ORDER FOR \$.....

Please Charge me — my Order No. is

Name:

Title:

Company Name:

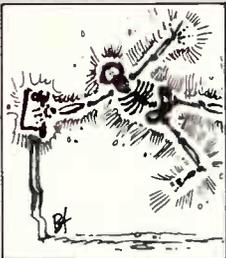
Address:

.....

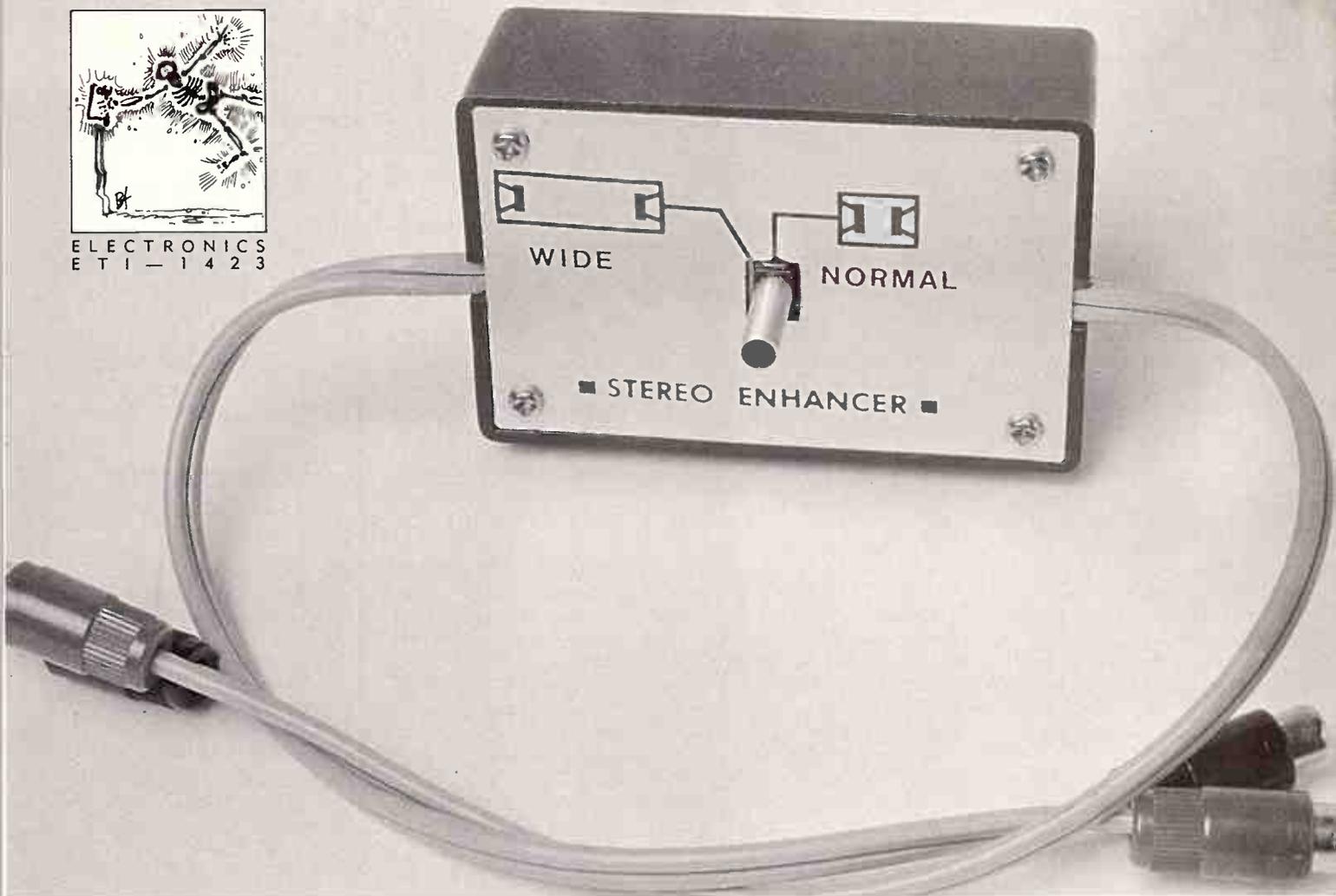
Postcode: Telephone:

Signature:

READER INFO No. 24



ELECTRONICS
ETI - 1423



SOUND ALL OVER THE PLACE

Spatial Stereo Encoder

Peter Phillips describes how to add another dimension to stereo sound with this simple encoder.

These days, virtually everything in the sound media is stereo. The recent introduction of stereo AM radio followed hot on the heels of stereo sound for TV, which was preceded by stereo FM, and so on. With the evolution of stereo has come the equipment to reproduce it and consumers are now faced with a bewildering array of products that are labelled 'stereo', even if the speakers are placed a mere hand's width apart. The most typical product of this genre is the ghetto blaster, a multi-function playback machine, usually fitted with an AM-FM tuner and a tape deck. The more up-market types even have a compact disk player built in, and it is now relatively common to see a ghetto blaster hanging off one shoulder of a spaced-out audiophile. It is arguable whether the stereo effect is evident when heard primarily with one ear, although listening with both ears is probably unlikely to improve things. After all, two channels through speakers so close together is asking a bit much.

Stereo TV is another example of a system with closely spaced speakers, usually the width of the cabinet. Philips,

(and probably other manufacturers) incorporate in their range of stereo TV sets an option called 'spatial' stereo, intended to enhance the stereo effect and to make it audible from all points of the room. Some portable tape recorders also have a 'stereo-wide' feature, although it may not be as sophisticated as in a stereo TV. Either way, the effects produced can be most effective under the right circumstances.

I decided to investigate this technique, as it can improve one's listening pleasure and seemed to have potential as a project that may interest readers. Literature on the subject seems fairly scarce, so experimentation was called for. After much trial and error the final result turns out to be disarmingly simple, resulting in a project with capabilities that contradict its simplicity and size. Spatial stereo is not a panacea for all stereo problems, but it does give an enhanced width to the sound and can add another dimension to the right kind of music.

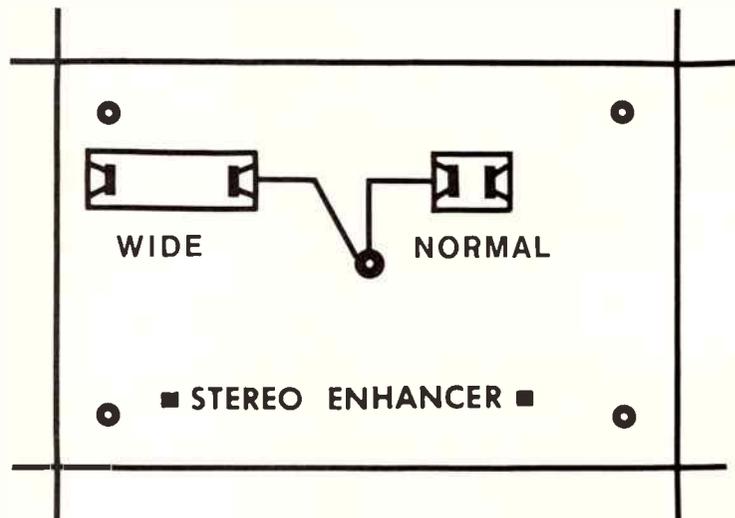
The theory behind it all

Probably the simplest way to fool the ear into hearing sound that appears to

Spatial encoder

emanate from all over the place is to connect one speaker of a stereo system so that it is out of phase with the other. The subjective effect is a reduction in the bass content, and the inability of the system to project a central image. The bass is reduced as one speaker effectively cancels the other, as low frequency sound is usually arranged during recording to be produced equally by both speakers. This gives the system the best chance to reproduce the bass, as separating low frequency sound is relatively pointless anyway, and having both speakers move the air mass makes good sense. However, frequencies over a few hundred Hertz are fair game for stereo separation, and a good recording will create the effect of the various sounds being placed at points between the speakers. A central image is achieved by having each speaker produce an equal level of sound output, as in a mono recording. However, if one speaker is reversed to the other, the mono effect becomes the inverse of what it should be, creating a 'hole in the middle'. This effect, on its own, can be confusing to the listener and is not really useful.

However, there is a lesson in this. Obviously, if phase inverting one channel



can create a wider image (albeit a confusing one), than fiddling the phase content of the stereo channels must be the answer to 'spatial' stereo. I decided to experiment by mixing phase-inverted portions of the left and right channels to the normal signals. During the experimenting it became obvious that the effect was most noticeable on speakers placed fairly close to each other, although some interesting effects were

created with widely spaced speakers. I cannot say whether my technique is the same as that employed by the various manufacturers, but I can say it produces the same effect, although with some subtle differences. I was able to compare the results with my stereo TV and a small 'ghetto blaster', both of which have the 'spatial' or 'wide' stereo option. I suspect the latter device merely phase inverts one channel when on

HOW IT WORKS

Amplifier IC1 is wired as a non-inverting amplifier with a gain of 2, and outputs the signal 2R. Amplifier IC2 is an inverting amplifier, also with a gain of 2, producing -2L at its output. Amplifiers IC3 and IC4 are both wired as summing amplifiers, and receive 2 inputs each. If the value of R8 is assumed to equal that of R5, the output of IC3 is $-(2 - L)$ which equates to $(-2R + L)$, as the signal from IC1 ($=2R$) receives unity gain, while the output of IC2 ($-2L$) is attenuated by 0.5. In fact, R8 is chosen to produce an overall reduction to maintain a subjective volume level of unity. Similarly, IC4 produces the output signal $-(-2 + R)$, which sign cancels to $(2L - R)$. Note that the two components of each output signal are out of phase to each other, which means a mono signal will produce the original signal. Also, the overall phasing of both outputs are opposite, giving two anti-phase signals for a mono input. In effect, each output contains twice the original component, but with half the other channel's component arranged to subtract from the original. Thus, each channel is a composite signal, giving a subjective sound

that appears to emanate from 2 sources, with the second source out of phase to the first.

Amplifier IC1 could have been dispensed with, by connecting the right channel directly to R5, and reducing the value of this resistor to half its stated value. However, this would mean an unequal input resistance for both chan-

'It is relatively common to see a ghetto-blaster hanging off one shoulder of a spaced-out audiophile'

nels, and as the fourth amplifier was available anyway, it seemed technically appropriate to opt for the ideal if possible. The input resistance of each channel is 220 k, which is high enough to prevent any significant loading on the signal source.

The dual polarity supply required by the op amp is derived from the potential

divider of R11 and R12, with their bypass capacitors of C1 and C2 respectively. This arrangement works on the assumption that the current values from both the positive and negative supplies are equal, as is the case in this application. The common line is the junction of the potential divider, and is therefore the earth of the circuit. Because the supply voltage is limited to around 4.5 V for both voltages, the maximum output excursion of any of the amplifiers is limited to approximately 3 V. This implies the maximum input signal level is 3 V (or 6 V peak to peak) which should cater for most situations. Increasing the supply voltage would increase the available output swing.

The 4-pole, 2 position selector switch S1 disconnects the battery and connects the inputs to the outputs when in the off position. Thus, current (around 10 mA) is only consumed when the spatial effect is selected. The IC is a type 774, a quad FET input device, with a frequency response suitable for this application. Other pin compatible types might work, but the frequency response may be a limitation.

'wide', but the TV is certainly more sophisticated. So, what are the effects?

In fact, spatial sound from TV can be a mite worrisome. Unless the sound operators cater for it, spatial stereo will tend to reduce the common mode signal, and enhance the remaining sound. Thus, a talk show will have the commentator being drowned out by the audience applause. Sporting commentary is particularly affected, as the spectators are now louder than the commentary (an improvement perhaps?), although stereo sport is perhaps rather pointless anyway. But, music or the sound track for an action movie is definitely enhanced compared to having the same sound as conventional stereo from the TV speakers. The stereo effect is now everywhere in the room, although it is rather scattered. However, in some instances there appears to be a slight reduction in bass content, perhaps for the same reasons as already described.

With this project, the stereo is enhanced in much the same way as with the TV set. However, possibly because of differences in the matrixing, the bass and treble content appears, if anything, to be increased, depending on the type of sound. The overall volume may in-

crease slightly for a stereo input, although monoaural sound retains the same volume, but has the 'hole in the middle' effect added. Another noticeable effect is an apparent increase in the depth of the music. The subjective effect is an increase in the size of the listening area, as the sound is no longer emanating from specific points, but rather from a number of points, but with different volumes. Orchestral music takes on an almost cathedral quality,

where $L = R$, will produce output signals of $-R$ and L . Yes, the speakers are now out of phase, and the mono image is everywhere. But then, that's what spatial stereo is all about, and switching off the spatial effect when listening to mono sound is therefore necessary. But then, is there any sound left that is not stereo? Altering the amount of out of phase component ($+L$ or $-R$) did not seem to vary the width of the simulated sound, and the best effect occurred with

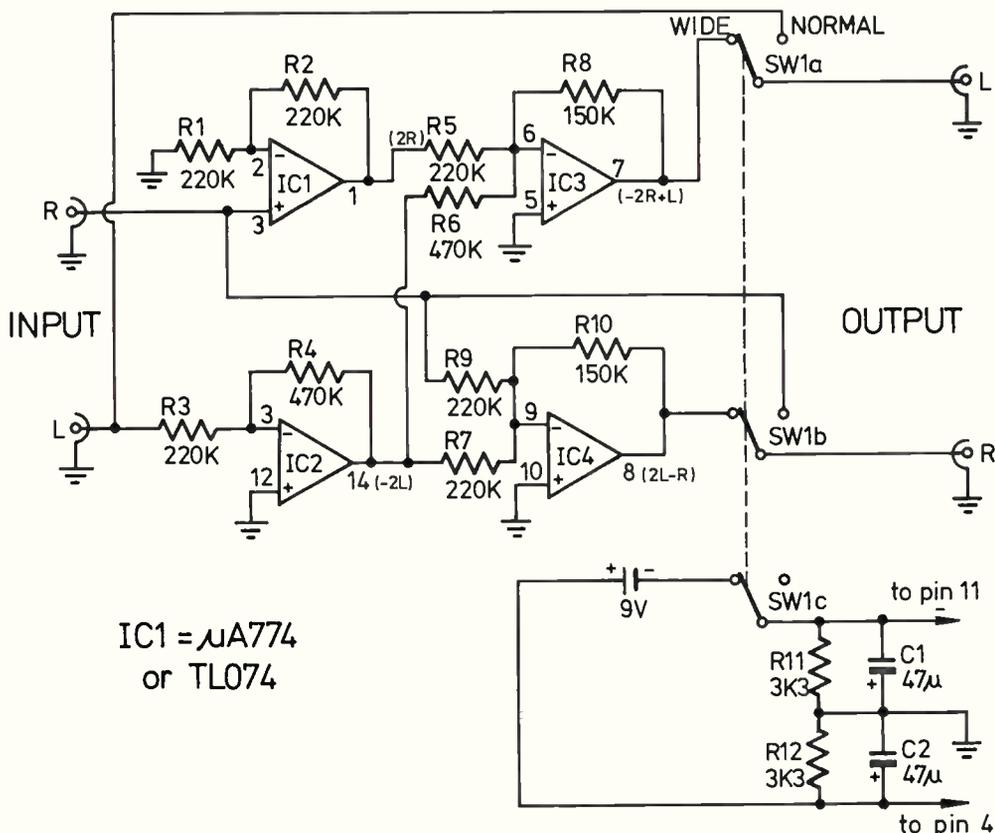
'Spatial stereo is not a panacea for all stereo problems, but it does give an enhanced width to the sound and can add another dimension to the right kind of music.'

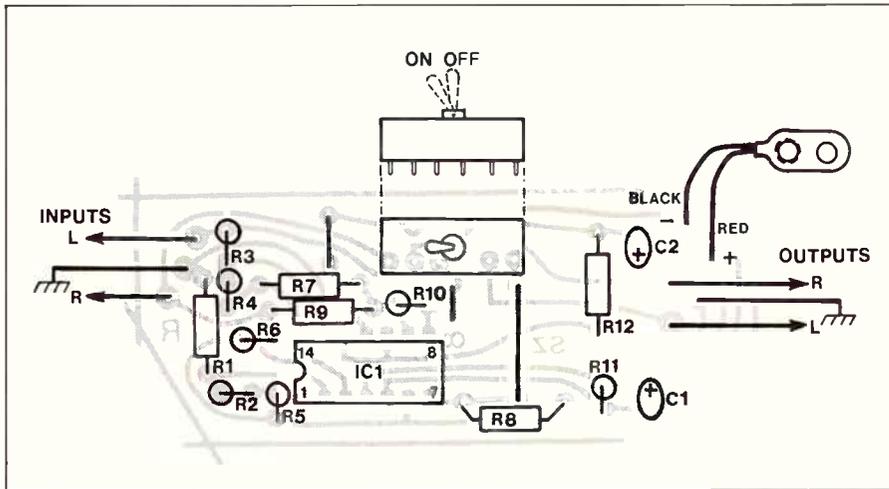
and pop music (Gracelands for example) seems to have a degree of reverb added. In general, the enhancement is more effective for some types of music than others and the ability of switching the encoder in and out of circuit is essential.

The circuit I have developed uses a quad op amp, and produces at the right channel (R) output the signal $-2R + L$, and at the left channel (L) the signal $2L - R$. This implies that a mono signal,

this equation. The minus sign means, of course, that the signal is 180° out of phase. The circuit is arranged so that power on-off and spatial on-off are jointly selected with the one switch, which means the switch simply connects the inputs directly to the outputs and isolates the battery when in the off position.

To some, this device may be a tad gimmicky and the more serious listener will probably not be interested in some-





thing that mucks around with the recorded sound. However, its inclusion in a sound system which has closely spaced speakers is most effective, and using it with a conventional stereo system can provide enhancements that will improve one's listening pleasure. For me, it's another device that can enhance a musical experience, although I would use it to suit the occasion. Anyway, it's such a simple device, why not try it and listen for yourself.

Construction

The assembly is all on one pcb, including the selector switch. The example is shown fitted in the smallest size jiffy box, but constructors may decide to make the device part of a system. In either case, the pcb is held to the front panel by the switch. The holes in the pcb to accept the switch need to be drilled with a 1.5 mm drill, which doesn't leave a lot of copper on the lands, so be careful. The holes to accept the input, output and battery leads should be drilled to 1mm (1.5mm for the earth braid) and all other holes can be the usual 0.8 mm size. Before commencing the electronics it is best to complete the mechanics, which means drilling the panel that will hold the switch. If a jiffy box is being used, drill a hole in the centre of the lid, and file it to accept the switch. Then locate and drill the screw holes for the switch. In the prototype, I decided to hide the screw heads under the Scotchcal label, which meant trimming and cutting the label with its adhesive-side cover still fitted.

Once the lid (or front panel) is correctly drilled and the label cut ready for fitting, the components can be fitted to the pcb. Fit the 3 links first, followed by the 12 resistors and 2 capacitors. Six of the resistors are 220 k in value and if fitted last, will help to facilitate correct

resistor placement. An IC socket is certainly not necessary, but can be fitted if required. Once all components and the IC are fitted and soldered, mount the switch. Take care not to apply too much force, as the switch is relatively flimsy, and may separate from its metal body. Note particularly which way the switch is orientated if you intend matching it to the front panel which shows the vertical position of the toggle as selecting OFF. Finally, attach the external wires. The input leads on the prototype were fitted with RCA sockets and the outputs with RCA plugs to allow the device to plug into the input sockets of an amplifier and the signal source to plug into the encoder. However, this is a matter of choice.

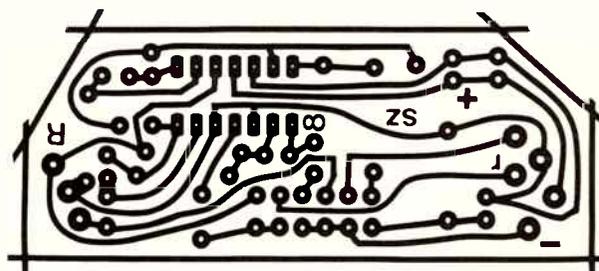
Once the board is complete, confirm that the circuit takes around 18 mA of current from the battery (or equivalent 9 V supply) when the switch is on, and 0 mA when off. Also, check that the voltage at pin 4 of the IC (with respect to earth) is approximately 4.5 V (positive) and that pin 11 has 4.5 V (negative). Finally, apply a stereo sound source to the input of the device and plug the output into an amplifier. Operation of the switch should give conventional stereo when off, and the spatial effect when on. The volume may increase slightly on spatial due to the mixing effects of the signal, although resistors R8 and R10 have been chosen to maintain

the volume at approximately the original level.

If required, the circuit could be operated from any dc supply, (9 V minimum, 30 V maximum) providing it is not referenced to the earth of the system. Thus, you can't use the same supply within an amplifier to power the encoder, unless this supply only powers devices not connected to earth. An example may be where an amplifier or tuner has a separate winding on the transformer to supply panel indicator lights that aren't electrically connected to the chassis or ground line. The supply voltage to the encoder is not critical and could be derived, for example, from a 6.3 V winding of a transformer connected to a full wave rectifier comprising a bridge rectifier and filter capacitor. If a dual polarity supply is available, (limit of ± 15 V) this can be used directly. In this case, remove R11 and R12, and connect the supply to the points used by the battery. Connect an earth wire as well, using a land previously occupied by R11 or R12. Alternatively, any stand alone supply could be used, depending on individual requirements. The battery idea is simple, but requires the device to be turned off when not being used to conserve the battery. And you never know, you may want to use the encoder so much you'll get sick of changing the battery.

Parts list

- Resistors: — all 1/4W
- R1, R2, R3, R5, R7, R9 220k
- R4, R6 470k
- R8, R10 150k
- R11, R12 3k3
- Capacitors:
- pcb mount, 25VW
- C1, C2 47uF
- Semiconductors:
- IC1 uA774 or T1074 quod op amp
- Switch: 4PDT — toggle action slide switch.
- Available Dick Smith, catalogue number S-1301
- Miscellaneous:
- Zippy Box, 28 x 54 x 83mm; 2 x RCA line plugs; 2 x RCA line sockets; battery snap, to suit 216 type battery; shielded lead; printed circuit board; front panel
- Approximate Cost: \$12, including zippy box.



DataSat Information Systems Proudly announces:

"A breakthrough in micro-electronics that has produced two high performance Modems designed by DataSat to provide speedy and reliable access to vital information from just about every on-line database at the most competitive price."

The ALLEGRO 2424 Compact Modem

- ★ High performance 2400 full duplex
- ★ Full Hayes compatibility
- ★ Elegantly styled cabinet
- ★ 2400/1200/300 speeds
- ★ 1K non volatile memory
- ★ Telecom authorised
- ★ 12 months warranty
- ★ Competitively priced (rrp)

\$459.00

The VTEX Internal Modem

- ★ IBM-PC/XT/AT compatible
- ★ Videotex compatible
- ★ Access most BBS at 1200
- ★ Auto dial
- ★ Hayes 1200B compatibility
- ★ Desktop version also available

- ★ Rated as "Excellent value and Very good performance"

by Australian PC World
review 18-Apr-88

\$259.00
reduced from \$399.00

Training and Support

Available from your local computer supplier.
Contact DataSat now for details of your nearest supplier.

Telephone (02) 821 1622 Facsimile (02) 602 6770
Videotex (02) 887 4644 OR AUSPAC 01923
IDENTIFICATION=*23822100222#
USER=DATASAT# PASSWORD=MODEM#

DATASAT
INFORMATION SYSTEMS PTY. LTD.

THE ELECTRONIC COMPONENTS SHOP

289 Latrobe Street,
MELBOURNE
(03) 602 3499

ARE YOU PAYING TOO MUCH FOR POWER TRANSISTORS?

Compare these prices

2N3055	@ .95c	MJE3055T	@ .70c
MJ2955	@ .98c	MJE2955T	@ .70c
MJ802	@ \$2.50	TIP31C	@ .40c
BUX80	@ \$2.80	TIP32C	@ .40c

GENERAL PURPOSE TRANSISTORS

BC546	BC556
BC547	BC557
BC548	BC558
BC549	BC559

All
Just **10c**

IC MASTER 1988 3 Vol. Set

A must for all electronic
professionals and
enthusiasts

\$215-00

IBM™ and OMEGA™ DB CONNECTORS

DB19 Plug	@ \$1.90
DB19 Socket	@ \$2.00
DB19 Backshell	@ \$1.50
DB23 Plug	@ \$1.90
DB23 Socket	@ \$2.00
DB23 Backshell	@ \$1.50

All quality 'Gold Flash' connections

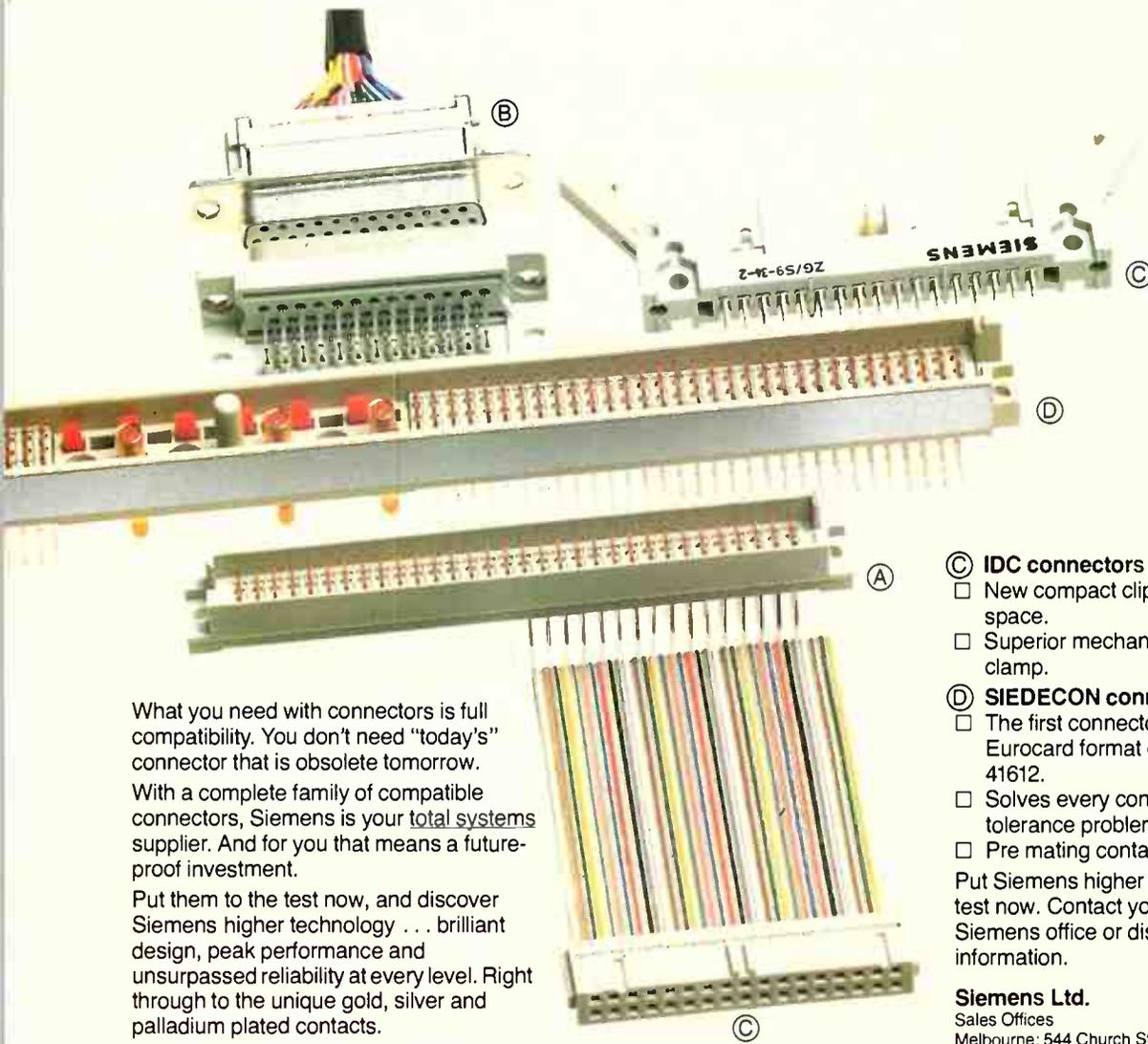
ALL PRICES INCLUDE SALES TAX. TAX EXEMPT AND OEM P.O.A

Freight: The prices quoted are ex Store, cost of delivery and the risk of loss in transit fall upon the purchaser. For the convenience of customers, delivery can be arranged through the supplier at the schedule of rates set out below.

Minimum Charge Only

1. Local Post \$2.50	only SMALL ITEMS will be sent by post.
2. Interstate Post \$3.50	
3. Carrier: Melbourne & Metropolitan — \$5 up to 3kg	
4. Carrier: Intrastate — \$8 up to 3kg	

At last ... a complete range of future-proof connectors



What you need with connectors is full compatibility. You don't need "today's" connector that is obsolete tomorrow. With a complete family of compatible connectors, Siemens is your total systems supplier. And for you that means a future-proof investment. Put them to the test now, and discover Siemens higher technology ... brilliant design, peak performance and unsurpassed reliability at every level. Right through to the unique gold, silver and palladium plated contacts.

Consider the benefits of our range:

(A) DIN 41612 connectors

- The world's largest range, with various polarisation systems.
- Protection against static charge through pre mating contacts.
- Available in surface mounted devices.

(B) D connectors

- Huge range
- Wide variety of functions in the one housing design.
- Time and space saving installation.
- Screw locking available.
- Pre mating contacts.

(C) IDC connectors

- New compact clip-on head saves space.
- Superior mechanical strain relief clamp.

(D) SIEDECON connectors

- The first connector for double Eurocard format conforming to DIN 41612.
- Solves every connection and tolerance problem.
- Pre mating contacts.

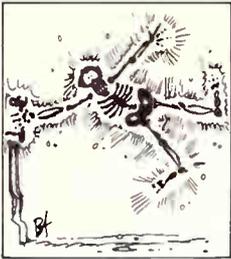
Put Siemens higher technology to the test now. Contact your nearest Siemens office or distributor for more information.

Siemens Ltd.

Sales Offices
 Melbourne: 544 Church Street, Richmond, Vic., 3121. Phone: 420 7318
 Sydney: 383 Pacific Highway, Artarmon, N.S.W., 2064. Phone: 436 8711
 Brisbane: 9 Parkview Street, Milton, Qld., 4064. Phone: 369 9666
 Perth: 153 Burswood Road, Victoria Park, W.A., 6100. Phone: 362 0123
 New Zealand: Level 9, Marshall House, 142-146 Wakefield Street, Wellington, N.Z. Phone: (4) 846 068

Siemens. A higher technology





ELECTRONICS
ETI-1613

THE BABY AT: *Build a high performance AT drop-in board*

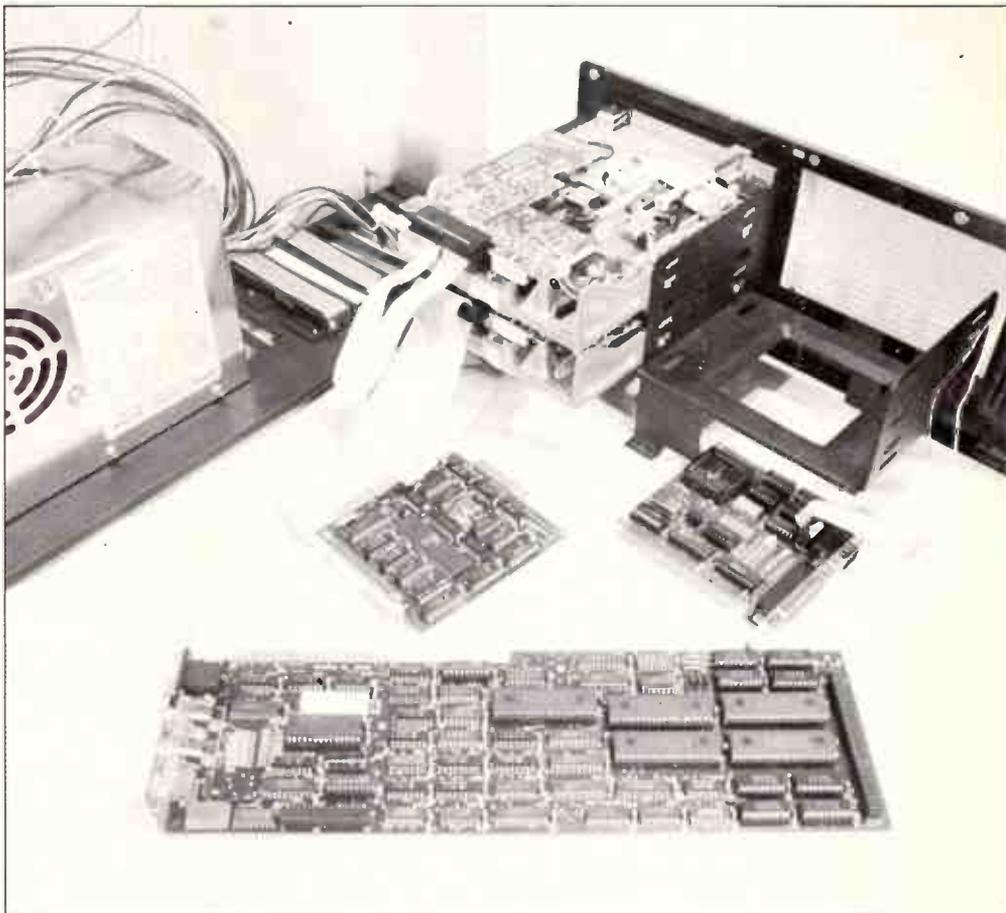
This is the third part of our series that looks at a PC-AT design using high level integration. We deliver a system speed 16 times faster than the standard XT.

The kit supplied by Energy Control in Brisbane (07 376-2955) comes with a high quality, solder masked, four layer, pre-socketed board especially designed for easy construction. An overlay on the board should make component misplacement virtually impossible. To make a viable computer out of it, you will need a power supply, keyboard, disc drives and monitor. We used it to beef up an existing office PC, and no doubt most people will do it this way, so all the peripherals are already supplied. However, even if this is your first MS-DOS machine, these bits and pieces are readily available. With a little bit of hunting around, you should be able to put together an entire AT for less than \$1500.

Construction

Building the AT is quite straightforward, even if you don't have a great deal of experience of computers. You should be able to put the entire thing together in an afternoon, with enough time left over for a few circuits and bumps in the Flight Simulator.

First step is to get the board ready. Check that all the sockets are in place and that the soldering is OK. It's worthwhile spending a bit of time on this, as a few minutes spent now could save days of trouble later on. Note any missing components, like resistors and capacitors, and solder them into place. Use a small, low wattage iron, with a



Ready for assembly: the case and boards. The drives have been removed while still bolted to the front panel.

The Baby AT, part 3

thin tip, and you will stay out of trouble. Do not attempt to work with a spade tip, or you will surely make a mess of things.

When you have finished soldering, and once again checked all your work carefully, insert the ICs. It's not a bad idea to protect yourself against static, since the VLSIs are all CMOS. Solder some wires into both the earth and power lines at the power connector J20, and also earth your tools by tying bits of earthed wire to them. Even so, handle the chips as little as possible. When you are inserting, take care to observe polarity on all the ICs. The VLSIs are not symmetrical, so its impossible to get them in the wrong way around, but the DIL packages, of course, can be inserted back to front.

Having done all this, put the board to one side, and open up the PC. Exactly how you go about the next steps depends, of course, on the design of your existing PC. However, if you have the standard PC style case, as we have, you should proceed as follows. Remove the cover by unscrewing the nuts that hold the folding arms at the back. Then remove all the boards from their slots, unplugging the disc drives first. It's a good idea to make a note of the slot you removed the board from, so you can replace them in the same place. Most boards are not slot critical, but its a good idea to assume they are, unless you know otherwise for certain.

The next step is to remove all the wiring from the original board. As you do this, identify the power LED, battery, power supply, speaker and keyboard connections, and note them down. You will need to be able to plug them back in to the right points later.

Now you should be able to remove the board, by unscrewing the 10 nuts you can see holding the board down. If you have a hard disc installed, you will obably find it impossible to actually manoeuvre the board out, in which case the best plan is to remove the drives. The easiest way on my machine was to unscrew the front panel, (six screws) and the supports on the bottom of the case (three screws), and lift the whole assembly out. Other, better designed boxes, have individual carriages for the drives, and it may be possible to easily move the hard disc forward to get the board out.

At this stage, you can drop the new board in the case. Make sure the screw holes are correctly aligned. If they are not, then you have more work to do. Remove the drives, and the power supply, and mark and drill out the case. Be

careful to remove any metal filings afterwards, as if they are left behind, embarrasing short circuits can occur.

Whatever happens, installing the new board is now just the opposite process of removing the old board. Before you do that however, its convenient to set up the jumpers at this stage. Make your choices and follow the table:

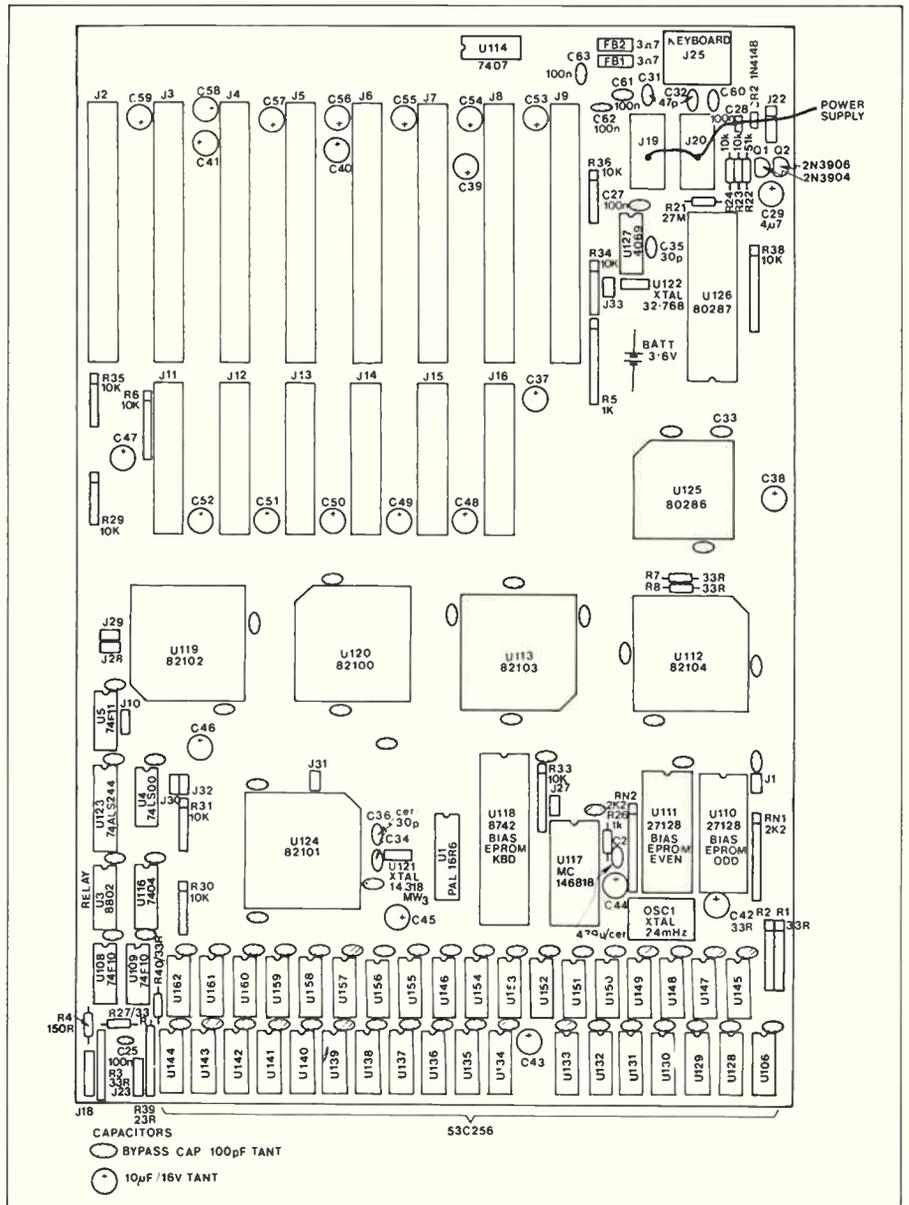
Use	Close	Jumper number	Open
Eprom size	27256	1	27128
Monitor	CGA	27	Mono
RAMsize	512 or 610	28	610+expansion
	512 or 610+expansion	29	610
Fostrmode	fast	30	slow
Wait States	0	31	1
ROM wait states	2	32	1

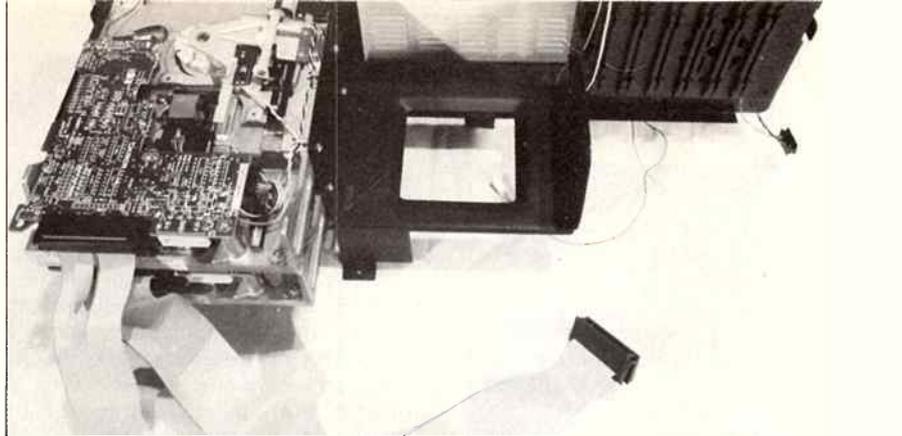
Note that if you are using 80 nS RAM, you should join the bottom two

pins of J10 and select zero wait states on J31. With 100 nS RAM, jumper the top two pins of J10 and set J31 to one wait state.

Drop in the new board, bolting down the ten screws onto the standoffs. Incidentally, don't scrimp on screws, especially across the back. It's important that the board be held rigidly because of the amount of stress you impose whenever you slide boards into the slots. Also, be careful to use insulating washers on both sides of the board. In some place tracks come very close to the holes and it's possible to short the tracks to ground.

Now connect up the flying leads. The Baby AT board uses the standard connections, so you shouldn't have any trouble, provided your existing machine





A close up of the front panel with all the disc drives, which comes away as a complete unit. Removing this makes access to the board very simple.

follows the conventions. Notice in particular that if your power supply is not of the "AT" type, you may need to reconfigure it before use. If you are not sure, use a multimeter to test it. In case you do have trouble, we have included pin-outs for each jumper. If you are in doubt, it will be necessary to go around and check these:

Pin	Assignments
J18:	Keylock + LED
1	Power LED
2	nc
3	GND
4	Keyboard Inhibit
5	GND

J19: Power		
Pin	Assignment	Colour
1	Power Good	Orange
2	+5	Red
3	+12	Yellow
4	-12	Blue
5	GND	Black
6	GND	Black

J20: Power Supply		
Pin	Assignment	Colour
1	GND	Black
2	GND	Black
3	-5	White
4	+5	Red
5	+5	Red
6	+5	Red

J22: External Battery	
Pin	Assignment
1	+6
2	nc
3	GND
4	GND

J23: Speaker Connection	
Pin	Assignment
1	Data out
2	nc
3	GND
4	+5

J25: Keyboard Connection	
Pin	Assignment
1	Keyboard clock
2	Keyboard data
3	nc
4	GND
5	+5

Once the board is connected up, you should remount the disc drives if you had to remove them. Now plug all the boards back into the slots, and the hardware part of the job is more or less finished.

Software

The next step is to plug the keyboard and monitor back in and apply power.

ELECTRONICS TODAY



Reader Information Card

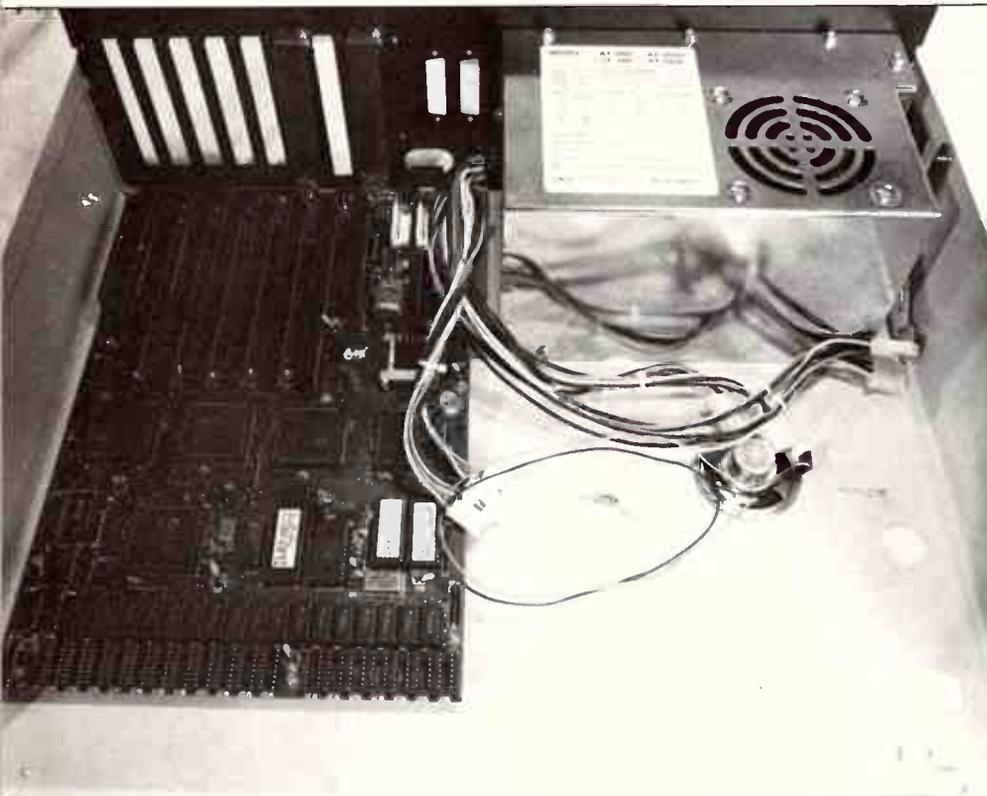
On the reverse of this page you will find the Reader Information Card. This is a service ETI provides free to readers who want more information about products advertised or otherwise mentioned in the magazine. At the bottom of the article or advert you will find a RI number. Just circle that number on the card and send the card to us. We will pass on your

address to our contacts, either the advertiser or our source for the story, who will then inundate you with literature on the product of your choice. Another feature: to the right, there is a blank space. Why not use it to drop us a line, and let us know what you think of the magazine. We are particularly interested in ideas from readers on how we can improve things.

Note to the Editor:

Name:.....
 Address:.....

 Postcode:.....



The case with the new board installed.

As always, heave a big sigh of relief if there is no explosion and you can touch the case without a shock. It means you did something right. The monitor should show the setup programme which is resident in the BIOS. Before you attempt to boot the system, you should go through this to ensure that the BIOS is configured correctly. You will be prompted from the screen to set the time and date, the details of the display and drives.

This is all fairly straightforward, except perhaps for the drive selection. If these are incorrect, you will need to change them to make the machine run properly. Defaults are 5¼ inch drive on A and B, and no hard disc installed. You will also be prompted to enter the type of drive in C, the hard disc slot. If your configuration is something other, then you need to reset the programme. The BIOS will also tell you how much memory it can see. If it's less than you installed, then you have a problem in the memory somewhere.

After you have been through all the menus, setup will repeat all your instructions back at you. Read it carefully to ensure that both you and the system are looking at the same hardware.

READER INFORMATION SERVICE COUPON

ELECTRONICS TODAY!



READER INFORMATION SERVICE

To find out more about the products and services in this issue, circle the READER INFORMATION SERVICE numbers from the advertisements and articles and send today! Send to: FREE POST No. 4

The Federal Publishing Company P.O. Box 227 WATERLOO, NSW 2017

- A. Engineer/Designer
- B. Technical Officer
- C. Technician
- D. Programmer/Analyst
- E. Manager
- F. Teacher/Lecturer
- G. Student
- H. Other (please state)

Please circle the category that best fits you.

1	26	51	76	101	126	151	176	201	226	251	276	301	326
2	27	52	77	102	127	152	177	202	227	252	277	302	327
3	28	53	78	103	128	153	178	203	228	253	278	303	328
4	29	54	79	104	129	154	179	204	229	254	279	304	329
5	30	55	80	105	130	155	180	205	230	255	280	305	330
6	31	56	81	106	131	156	181	206	231	256	281	306	331
7	32	57	82	107	132	157	182	207	232	257	282	307	332
8	33	58	83	108	133	158	183	208	233	258	283	308	333
9	34	59	84	109	134	159	184	209	234	259	284	309	334
10	35	60	85	110	135	160	185	210	235	260	285	310	335
11	36	61	86	111	136	161	186	211	236	261	286	311	336
12	37	62	87	112	137	162	187	212	237	262	287	312	337
13	38	63	88	113	138	163	188	213	238	263	288	313	338
14	39	64	89	114	139	164	189	214	239	264	289	314	339
15	40	65	90	115	140	165	190	215	240	265	290	315	340
16	41	66	91	116	141	166	191	216	241	266	291	316	341
17	42	67	92	117	142	167	192	217	242	267	292	317	342
18	43	68	93	118	143	168	193	218	243	268	293	318	343
19	44	69	94	119	144	169	194	219	244	269	294	319	344
20	45	70	95	120	145	170	195	220	245	270	295	320	345
21	46	71	96	121	146	171	196	221	246	271	296	321	346
22	47	72	97	122	147	172	197	222	247	272	297	322	347
23	48	73	98	123	148	173	198	223	248	273	298	323	348
24	49	74	99	124	149	174	199	224	249	274	299	324	349
25	50	75	100	125	150	175	200	225	250	275	300	325	350

POST TODAY!

Name

Company

Address

Postcode

For a prompt reply: Post today! ETI OCT '88

Data logging and analysis for those more interested in production than computers.

Now you can record, analyse, manipulate and display production data without programming skills. The easiest to use and the most sophisticated data analysis programs are now available for Datatakers - the world's most versatile loggers.

Decipher

The terminal, graphing, reporting and file handling program specially for Datatakers. One to 800 channels of digital and analogue information can be individually allocated and monitored with ease. Decipher includes bar charts, histograms trend plots, cross plots, reports, keystroke macros and many more features. \$195

Labtech Notebook

The world's leading software for sophisticated analysis and control now customised for Datataker. \$995.

Datataker 100

46 Analog/8 digital inputs. Matches common transducers and sensors. Built in software /RS 232 communications. Portable, dedicated or stand alone. The complete

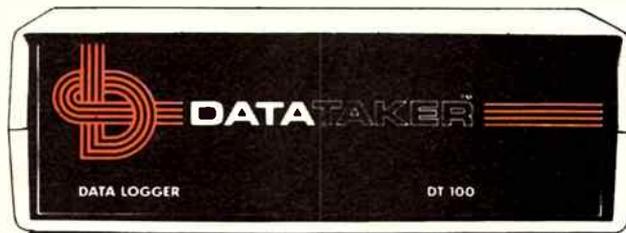
solution. No cards, modules or software to buy. No programming knowledge required. Datataker does it all. Industrial and field models available.

Datataker 200

A DT200 new logger with up to 50 analog and 114 digital channels. The ideal unit for process control monitoring and alarms. All the Datataker features. The new standard for industrial data logging.

Write or call for your descriptive brochure today.

54 analogue and digital channels for \$2400.



Data Electronics
46 Wadhurst Drive,
Boronia 3155
Tel (03) 801 1277.
Fax: (03) 800 3241.

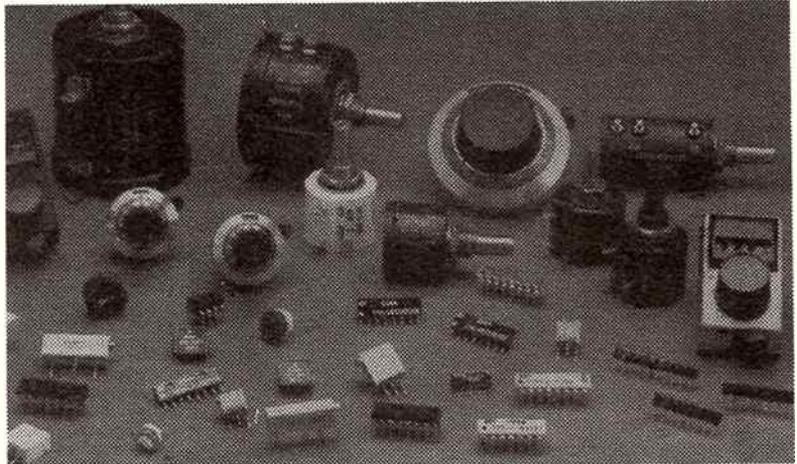
Your answer to a full range of quality resistive components

Combine the national marketing and distribution know-how of top electronic components distributor, NSD Australia, with the comprehensive quality product range of world-famous manufacturer, Beckman Industrial, and the result is quality resistive component products at competitive prices wherever you are.

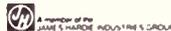
NSD, a member of the James Hardie group, stocks and supports the full range of quality, world-famous, Beckman Industrial electronic components. These include precision potentiometers, dials, trimmers and resistor networks.

And, we even have the expertise and resources to solve diverse requirements through custom components and assemblies from the Beckman Industrial product range, no matter how sophisticated your application is.

Call us today and we'll show you how a leading combination can solve your resistive electronic component requirements.



VIC 205 Middleborough Road,
Box Hill, 3128. Phone: (03) 890 0970
Fax: (03) 899 0819



NSW Unit 3, 12 Victoria Street, Lidcombe, 2141.
Phone: (02) 646 5255 Fax: (02) 646 5728

QLD 62 Doggett Street, Fortitude Valley, 4006.
Phone: (07) 854 1911

SA 108 Gilbert Street, Adelaide, 5000.
Phone: (08) 211 8499 Fax: (08) 211 7292

MKAd01 1142

READER INFO No. 45

IREECON '89

IREECON '89 TO HIGHLIGHT BENEFITS OF TECHNOLOGICAL CONVERGENCE

IREECON '89 is up and running with Exhibition Space filling fast.

The next decade will see an increasing integration of technologies, bringing significant benefits to the work-place and to the home.

This technological integration – summed up in the single word 'Convergence' – is the theme of IREECON '89, the 22nd International Electronics Convention and Exhibition organised by the IREE.

Experts from Australia and from around the world will be **converging** on IREECON '89 to discuss the exciting future ahead of us. **Can YOU afford NOT to be there.**

All roads lead to



• FOR AN EVENT TOO IMPORTANT TO MISS CONTACT:

The Institution of Radio and Electronics Engineers Australia
Commercial Unit 3, Edgecliff Court, 2 New McLean Street
(PO Box 79), Edgecliff, Sydney NSW 2027
Phone (02)327.4822 – Fax (02)327.6770
Publx: AA21822 (Quote User No. SY135)

DATES: MON, SEPT 11 – FRI, SEPT 15, 1989

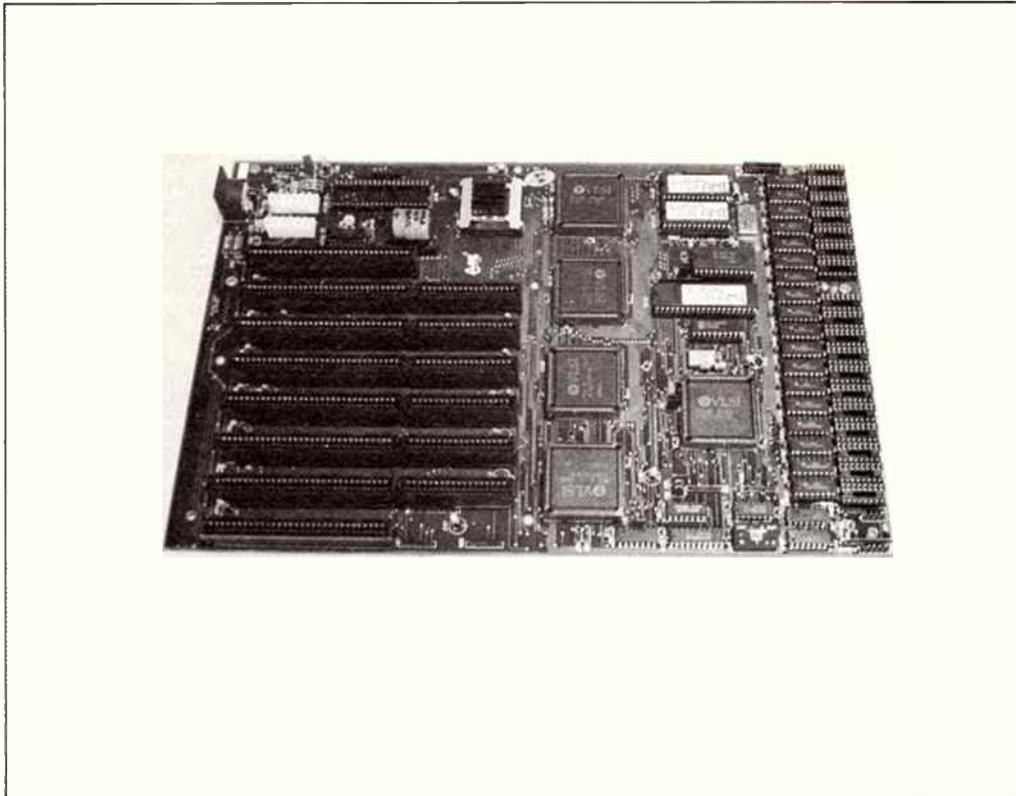
The Convention

READER INFO No. 3

When this is done, you can boot with your MS-DOS disc.

We ran all the MS-DOS discs in the office without the slightest hiccup. Included in our pile was Peter Norton's utilities programme, which gives a report on the system configuration and performance indexes so you can rank it against a bog standard PC. We achieved SI=13.4, thus implying 13.4 times faster operation than the standard PC. However, this was with the 100 nS RAM installed, so forcing us to run with one unnecessary wait state. To achieve the theoretical maximum of SI=16, it is necessary to buy the 80 nS version.

Even so, the Baby AT is a hot performer. While the occasional AT is available with 16 MHz clock speed, most commercial models seem happy to offer 8 or perhaps 10 MHz. 12 MHz puts us in the high performance category. It is also an efficient user of its processing power. An equivalent design being sold by DSE, for instance, which uses the Chips and Technologies chip set running at 12 MHz, struggles along at 11.7. This is a more typical figure for ATs, and perhaps reflects the very large scale integration in this design.



The Baby AT board.

ARE YOUR P.C.B. LAYOUTS RIGHT FIRST-TIME?



Professional P.C.B layout

- Single sided boards
- Double sided boards
- Multi-layer boards
- Surface mounted devices

- Services:**
- Layout
 - Editing
 - Pen plots
 - Checkplots
 - Netlists
 - N/C drill output
 - P.C.B. assembly

Specialists in:
Fast - Accurate - Quality service

MAXIDATA

Phones: (03) 698 0264
(03) 531 1775

READER INFO No. 48

UV · visible · IR
RSO 6000
Optical
Spectrum Analyser

We measure light. *fast and direct*



Rofin Australia Pty. Ltd.

P.O. Box 38, Mordialloc, Victoria Australia. 3195
Telephone: (03) 580 0802 Fax: (03) 580 1480

READER INFO No. 30



TECHNOLOGY



An instrument in perfect working order
SELF-TESTING A SP

Paul Merrick looks at the self-test strategy inside a new high performance spectrum analyser.

A typical spectrum analyser is a complex piece of equipment, made up from many sub circuits. Each of these building blocks must perform perfectly if the final result is also to be perfect. In the real world, this is unlikely to happen, and even if it does happen for a short period, it will not continue for long. As a result most of us learn to live with the errors in our test gear, happy if periodic calibration checks keep them reasonably accurate.

Today, the microprocessor can take much of the hard work out of keeping an instrument in perfect working order. Many modern instruments already use microprocessors for control and data manipulation, and this gives an opportunity for automatic calibration facilities to compensate for errors in both the specification of components and in more fundamental design faults.

A typical modern spectrum analyser, Marconi's model 2383, is shown in block diagram form in Figure 1. Like all spectrum analysers, its a superhetrodyne receiver which receives an rf signal at its input. This is mixed with a local oscillator to produce an intermediate frequency (if), which is then detected by a diode, so that the voltage across the diode is proportional to the input signal. This output is used to drive the vertical deflection of a CRT. The local oscillator is swept across a frequency range by a tracking generator, which is also used to drive the horizontal output of the display. Thus a particular input frequency is associated with a particular horizontal position on the screen, and a graph of frequency versus amplitude results.

In practice, it is not possible to design filters to meet all the constraints we would like to place on them, or if it is possible in theory, its not economically viable. As a result, a real spectrum analyser circuit is a lot more complex than this simple description would sug-

gest. The if strip, for instance, consists of four stages in fact, each with a different frequency. The first three strips have a bandwidth of 7 MHz, and the final one is selectable down to 10 kHz. In fact, even narrower bandwidths are available by using a fifth if, at 100 kHz. This can have a bandwidth of only 3 Hz.

To be of any use, however, it is necessary that one be able to put numbers on the screen, and this is where the problems come in. No matter how well designed, there will always be certain errors associated with every reading. Knowing their maximum extent, thus controlling them, is the object of the exercise.

'The microprocessor adds the correction as it processes the data to the screen'

Sources of error

Mercifully, the errors in an electronic machine can be systematically analysed. In our spectrum analyser, for instance, there are a number of specific problems.

The RF input attenuator covers a range of steps using various combinations of 5,10,20 and 30 dB pads. Errors in attenuation build up as combinations of pads are used, and are also affected by aging and temperature.

The first mixer mixes the attenuated input signal with the synthesised swept local oscillator. The mixer introduces an insertion loss, and a frequency response, both of which vary with time and temperature. After this mixer there is no frequency response problem, since

all circuitry works at the IF frequencies.

The second, third and fourth mixers with their associated stages of gain bring the IF frequency down to 2.6 MHz. The gains of these sections can vary with time and temperature. It is switched in 10 dB steps and a small amount of variable gain is controlled by the microprocessor via a Digital to Analogue Converter (DAC) giving an approximate range of 12 dB.

This can be done in error.

The final analogue section is a switched gain logarithmic amplifier (log amp), a design chosen because it gives good linearity over its full 100 dB range. It works by autoranging the input signal and producing an analogue voltage that is linearly proportional to the IF signal over a 12.8 dB window. A digital output indicates which of eight such windows the signal fits into. The linearity of the whole unit is only dependent on the linearity of the last 12.8 dB amplifier.

Self calibration

The analyser can compensate for these sources of error by using built-in signal sources and the microprocessor system. The signal sources used are the internal 50 MHz standard, and the tracking generator. As can be seen from the block diagram, either of these can be selected at the input under microprocessor control. The 50 MHz standard is designed to be very stable both with temperature and time. It can be calibrated during production testing with ± 0.09 dB uncertainty using a power meter. It is contained in its own oven, heated to 80 C, hotter than ambient conditions are ever likely to get. The temperature is controlled to within 0.1 C. In this way, the fundamental frequency is protected from its prime cause of variability. However, there is no protection against natural aging, but this is not a problem, since the 50 MHz carrier is available on

SPECTRUM ANALYSER

Spectrum analyser testing

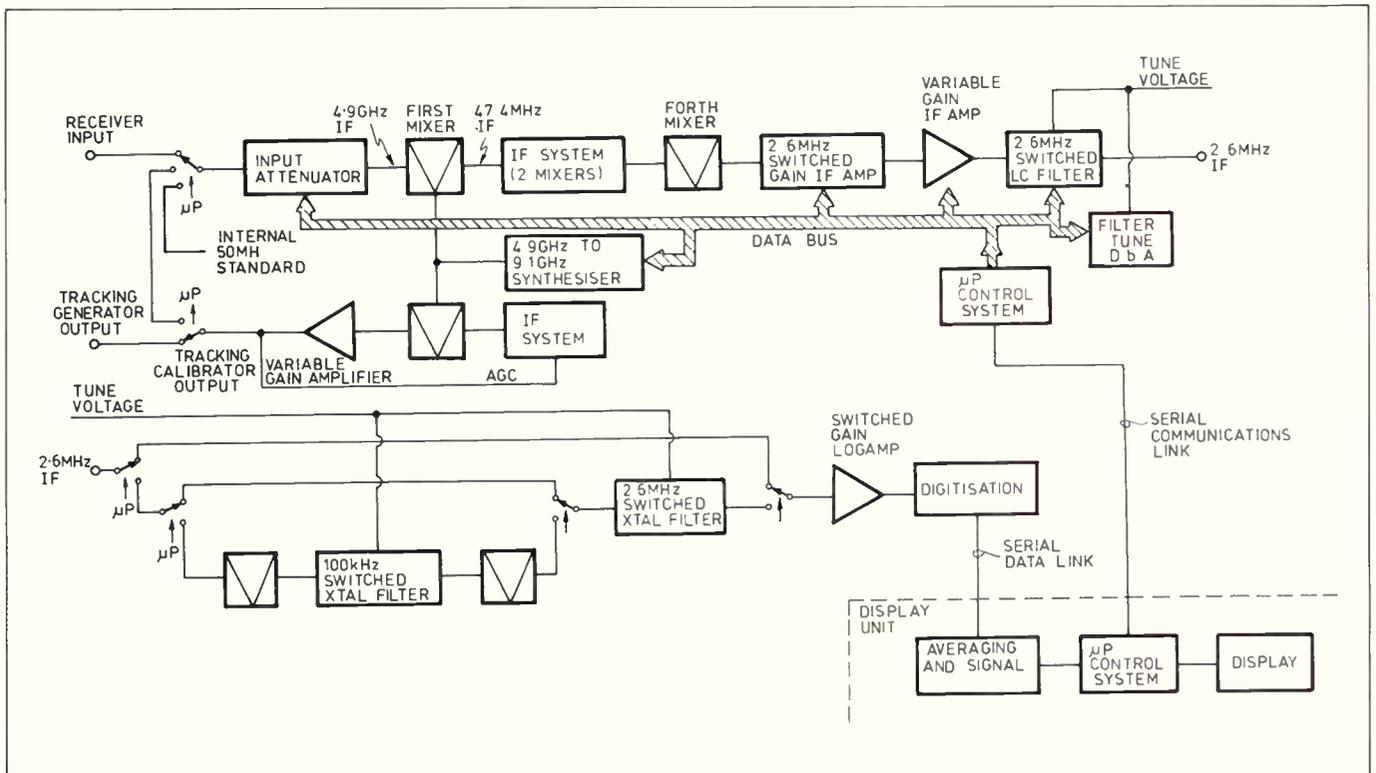


Figure 1: Block diagram of the Marconi 2383.

the front panel and is readily calibrated against TV line sync pulses or a lab standard.

Self testing

The first step towards building a self testing analyser is to develop the circuitry to alter component values under microprocessor control. There are two methods used: one is to use varactors-voltage controlled capacitors to act as variable capacitors. These can be controlled by a voltage specified by the processor via a DAC. This allows one to change the behaviour of filters at will.

The second technique is to use the processor to compensate for amplitude fluctuations. Essentially: one establishes that an analogue circuit should read voltage x , but is in fact reading y . It is a trivial problem for the processor to make $y = x$ in all its processing.

These two simple techniques make it possible to do some powerful manipulations.

For instance, figure 2 shows a generalised version of the if filters. It can be seen that both series and parallel elements can be remotely tuned using the varactor diodes. One pulls the filter centre frequency slightly by changing the series capacitance, the other nulls the stray inductances. All of the filters use the same sections, their width being set by changing the 'Q'.

Null strays

The first step of the calibration sequence is to null the stray inductance and capacitance. Each element in the filter acts as if it has a small amount of stray capacitance sitting across it. This shows on the filter characteristic as spurious or uneven response to the input. The processor applies the 50 MHz standard to the filter.

Successive sweeps are taken by varying the value written to the 'Filter Tune DAC'. After each sweep the marker to peak facility is used to find the position on the screen of the signal peak. At first large steps are taken, but as the centre of screen is approached they are reduced to single counts on the DAC. The value written to the tune DAC is re-

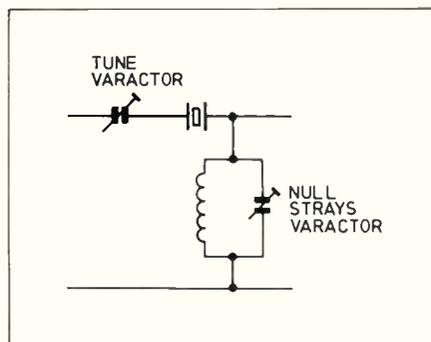


Figure 2: Generalised adjustable filter section.

corded for the filter in a software table. Every time this filter is subsequently selected in use, this value is written to the DAC ensuring it is correctly tuned. The filter now has an acceptable shape. However, we still have no guarantee that it reaches resonance at the correct value, or that it is passing a signal of the correct amplitude. To achieve this, we need to employ the tracking generator, so the next step is to calibrate its output.

This is done against the 50 MHz standard.

The tracking generator is controlled by a microprocessor driven DAC, and is known to be flat across its entire range to within 0.25 dB. However, it can vary quite wildly in its amplitude with temperature, so it needs to be calibrated. Since the signal is known to be correct across the entire frequency range, a single measurement at 50 MHz suffices to calibrate it.

Tune and level

Now it is possible to get into the real motherlode of the calibration routine. Each filter in the circuit can be tested for both resonance frequency and attenuation. The narrowest filter is used to tune each blank to the if frequency as the filters within a bank are set up to track. Each filter can vary in insertion loss, so they are all calibrated for level.

A table is built up with each filter having a tune and level value.

Still leaving the synthesiser set to 50 MHz, and the tracking calibrator as the source, the 3 Hz filter is selected. The filter must be on tune before it can be levelled. A series of three measurements are taken varying the filter tune DAC in steps of 10% of its range. After each change the RF unit waits for the filter to settle and then requests the signal level from the display unit. The three signal levels are recorded, and the pattern checked. If the middle DAC value gives the highest signal level the next measurements are taken around this point with smaller steps. Otherwise the DAC is moved to the end giving the highest signal and the sequence repeated. Eventually, when the filter is tuned to the IF, the signal will peak. The value written to the DAC is recorded in the table as the tune value for the 3 Hz filter.

With the filter correctly tuned the DAC that controls the variable gain IF amplifier is increased in steps of about 20% of its range. After each adjustment the RF unit waits for the filter to settle and then requests the signal level from the display unit. As the measured level approaches the -10 dBm of the tracking calibrator the steps are reduced to one DAC count. The DAC value for -10 dBm is recorded in the table as the level value for the 3 Hz filter is entered in the table for the 10 Hz and 30 Hz filters. The tune DAC is set with this value before the levelling routine is run for the 10 Hz filter and then the 30 Hz filter. The 100 Hz filter is the narrowest in the 2.6 MHz crystal filter bank, so this is first tuned and then levelled. Its tune value is applied for the 300 Hz filter before it is levelled, but the shunt varactor values are used for the 1 kHz and 3 kHz filters before they are adjusted. The 2.6 MHz LC filters all use the tune value for the 10 kHz filter. Whenever any filter is set the correction values in the table are applied to the tune and level DACs.

Attenuator inaccuracies

The attenuators cover a range from 0-65 dB in 5 dB steps using four blocks. They are corrected for inaccuracy at 50 MHz by using the same variable IF gain used for the filters.

With the system as it was for calibrating the filters the 100 Hz filter is selected. This filter is narrow enough to give a low noise with 65 dB of attenuation, but wide enough to settle in a reasonable amount of time. The algorithm

used to correct the filter levels is used for the attenuators, starting at 0 dB and increasing to 65 dB in 5 dB steps. Each increase in attenuation means that an increase in IF gain is required. Thus the attenuators are calibrated against the highly accurate IF gain blocks. The difference between the recorded value of the level DAC to give -10 dB and the value in the table for the 100 Hz filter is recorded in the attenuator table for each combination. Every time attenuator pads are selected this correction is added to the filter correction and written to the level DAC.

Frequency response

At this stage we have cleaned up the machine as much as possible. There will, however, still be some residual variation from the optimum. This is corrected by recording the frequency response deviation of the receiver using the tracking generator.

Each time a sweep is set up in use a working error store is set up that has a point-for-point match with the display.

*'The calibration method
offers more than high
accuracy measurement . . .
It is foolproof'*

The microprocessor adds the correction as it processes the data to the screen.

The analyser is set up to sweep with a 10 MHz span from 1 MHz.

The display unit is set to sweep data into the reference error store instead of onto the screen. The data for the range 1 MHz to 10 MHz is recorded into the 90 points of the reference error store for the decade (a sample every 100 kHz). The process is repeated through the frequency range, and then all lower frequency points are back-filled with the value of correction at 1 MHz, and the higher frequencies filled with that at 4.2 GHz.

The data is not used until the instrument is back in normal use. Each time a span or a reference frequency is changed, the data in the reference error store is used to correct the displayed data. The display has 500 points or ordinates across the screen, and a 500 point working error store is generated that is a point for point match to the display. For wider spans the data in the reference error store may have to be

compressed as it is transferred. However if a narrow span is selected there may be only a few samples in the reference error store over the range of the span. To prevent steps occurring under these circumstances straight line interpolation routines are used when filling the working error store. The data stored in the working error store is the inverse of deviation from the correct tracking generator level, and therefore has to be added to the display data.

This is the end of the calibration sequence, so finally the original settings are reinstated, but this time as the filters and attenuators are selected the DACs are adjusted with the correction values found during the calibration, and when the frequency span is set the working error store is filled with the new correction data. The whole calibration sequence only takes about 40 secs and gives a total amplitude accuracy of ± 1.0 dB up to 1.5 GHz and ± 1.5 dB from 1.5 GHz to 4.2 GHz. A 'Calibrated' message to displayed on the screen.

For the occasion when even greater accuracy is required a normalisation facility is provided for use with the tracking generator. This allows external cables and test fixtures to be compensated for when making transmission measurements. The tracking generator output is connected through the test fixture with its connections shorted together to the receiver. A sweep is taken and the data is used to fill the working error store directly. It is only valid for the settings at the time of the normalisation. It does however give an accuracy of ± 1 bit of DAC value (± 0.025 dB). When the normalisation is turned off the previous calibration data is replaced.

The calibration system offers more than high accuracy measurement. It is foolproof. There are no external connections or operator adjustments. The calibration compensates for temperature effects, so it is valid over the entire temperature specification of the instrument. It also compensates for aging thus maintaining long term accuracy. There are also maintenance benefits. A successful calibration exercises most of the instrument, and thus forms a comprehensive self test. Any failures are flagged as errors, and the extensive diagnostic facilities can be used to identify the problem. The calibration data is available on screen and over the GPIB, and this allows monitoring in automatic test systems. Should components need to be replaced, after a functional check the calibration routine will take out errors.



TECHNOLOGY
ETI-1418

Monitor

The monitor section is contained on the Subgroup 3 board (AAC-04). It is used to drive a pair of stereo headphones with signals tapped from various points in the signal paths. The selection of monitoring points can be made from one or any combination of the following:

1. Auxiliary 1 input.
2. Left and right output channels.
3. The combined subgroup monitor mix-down.

The headphones can then be used to keep a track on all the individual sounds that are both input and output from the system. For instance, if the sound engineer wishes to listen to only one input channel the L/R switch is pressed on the monitor section and the input channel put into SOLO by pressing its SOLO button. This has the effect of muting all channels routed to the Left/Right busses except the channel/s put into SOLO. Any combination of input channels can be listened to in this manner. If you wish to hear what is happening on any of the subgroup outputs, the monitor is switched to the position marked 1-2-3-4 (subgroups) and the subgroup mixdown controls adjusted accordingly.

Talkback

The talkback station is simply a feature that allows the engineer to talk to a remote monitoring point by injecting his or her voice onto the Left/Right output channels. This is achieved by having a microphone housed in the mixer and routing its signal through to the L/R busses when the press-to-talk switch is activated. This switch is momentary action, turning the microphone off when the switch is released.

Bargraphs

The LED bargraph circuit is usually the

part of the mixer that takes the greatest amount of power supply current. This is because each of the LEDs requires at least 10 mA of bias current. In this mixer there are 6 LED bargraphs with 10 LEDs each, hence a total of 60 LEDs and therefore 600 mA current as a minimum. However we opted for a different design approach that would reduce the current requirements by a factor of 10, saving a lot of expense in the power supply and removing power dissipation problems in the meter bias circuitry. This was done by creating a separate, higher voltage supply called V_m (meter voltage), which allows the LEDs to be run in series with each other (this is a part of the mixer that can have series type circuit configurations because it does not effect the signal in the sound path). The series arrangement means that the same 10 mA LED current will flow through all of the LEDs that are active and not require 10 mA for each.

This supply does not have to be highly regulated, so each meter has its

In this final article we complete the description of the mixer, present a testing and trouble shooting guide and discuss the operation of the mixer in a recording or live situation.

own zener diode regulator circuitry. This again has the effect of dissipating the power over a larger area and larger number of components thus removing the need for heat sinking components.

The input signal is precision half wave rectified and filtered to provide a dc voltage into the LED bargraph chip (LM3915) which is proportional to the peak of the input. The meter has been calibrated by means of adjusting the driver chip's reference voltage so that the red LED will light up when the input is within -4 dBm.

Power supply

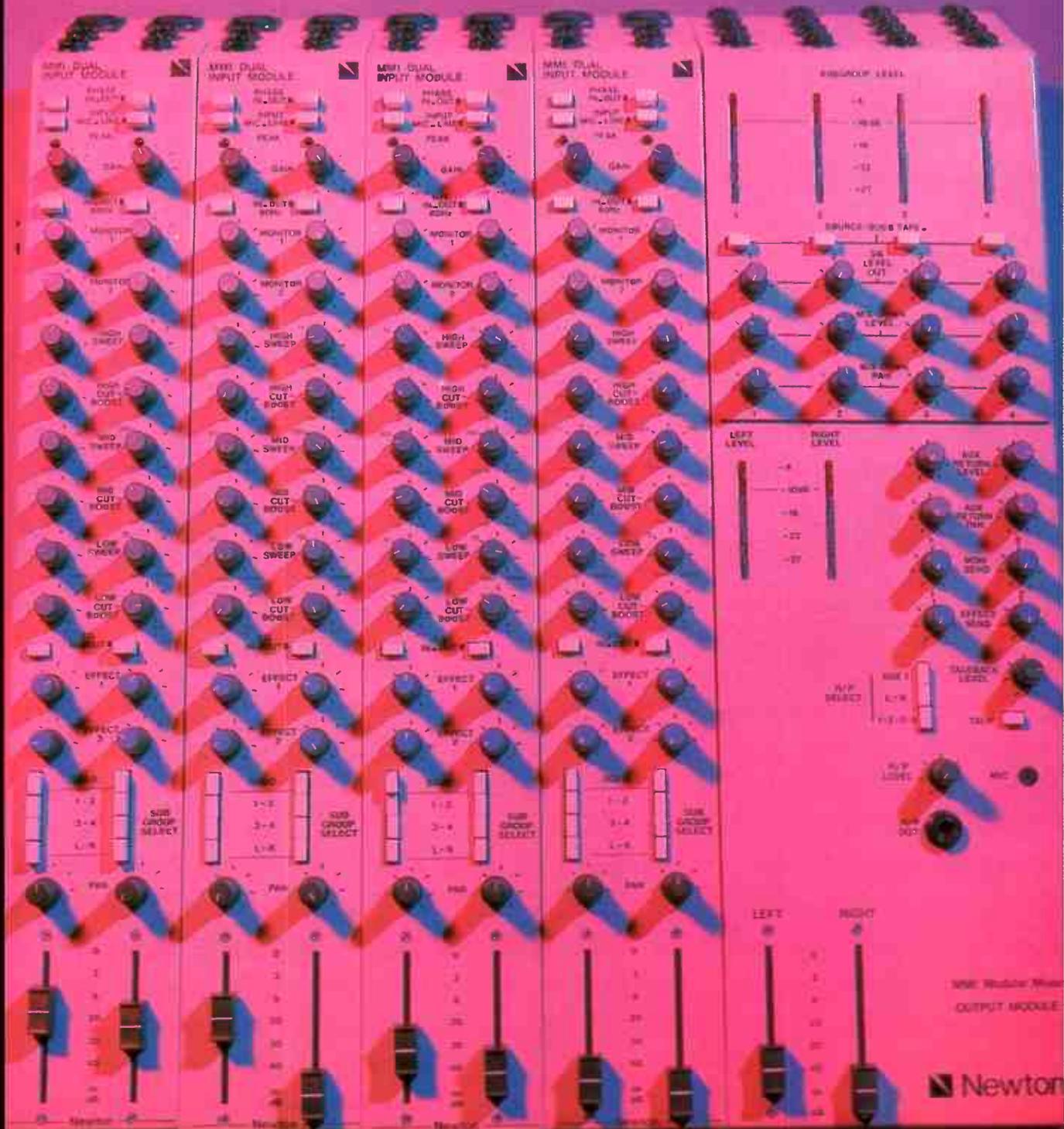
The power supply needs to provide three output voltages: +18 volts, -18 Volts and 25 Volts (V_m). The current rating for the ± 18 Volt rails had to be great enough to supply up to 48 input channels as well as the output module. The design uses a shunt transistor to increase the current output from a standard three-pin regulator. The output voltage of around 18 Volts was obtained by biasing the 12 Volt reference voltage regulators up by 6.2 Volts using a zener diode.

Another feature of the power supply is the use of a toroidal transformer. These transformers have the great advantage of producing very little 50 Hz

This is the final part in the series by Andrew Robb and Glen Thurecht on the design and construction of a high quality expandable mixing console.

EXPANDABLE MIXING CONSOLE

A mixer is born . . .



WIN WITH SONY

Win with Electronics Today!

This incredible \$10,000 SONY prize giveaway can be yours just by subscribing to Australian Golf Digest. On purchasing a subscription, your name and address will enter the draw! You have 6 chances of winning!



Simulated TV picture

1st prize

*This
Plus*

KV-27 VX1MT, flat square black screen television. System memory and display. Detachable hi-fidelity stereo speakers, output jacks and speaker terminals.

CCD V50 video 8 camera, high performance instant playback on 8mm cassettes. Zoom with macro feature. Linear auto-white balance. Flying erase head ensures noise free picture. Brilliant clear pictures even under low light.

- 1st prize:** SONY Trinitron & Camcorder. Total value \$6,225.
- 2nd prize:** SONY Hi-Fi system. Total value \$1,300.
- 3rd prize:** SONY Portable CD player. Total value \$800.
- 4th, 5th & 6th prize:** SONY sports walkman — three people will win one of these beaut SONY sports walkmans. Valued at \$270 each.

SonyTape

Audio : Computer : Video

Sony Tape's HF series utilises magnetic particles resulting in even higher music clarity. The range symbolises the combination of fine performance and reliability that characterises all of Sony's Audio and Video tape products.

ALSO subscribe and enter the draw early and you'll receive a SONY twin tape pack. **FREE**





2nd prize

FH-203, sleek new and exciting Hi-fi look, handle allows portability. 3 band graphic equaliser with independent 3 colour level metre. 3 way speaker system. FM/MW/SW2/SW1 manual tuning with tuning indicator and fine-tuning knob. Dolby B for crystal-clear playback. Low frequency sound with super acoustic turbo (SAT) for powerful bass reproduction.

**12 months
subscription
only \$42**

TO SUBSCRIBE simply fill out the coupon attached — or if missing, send name, address, phone number and cheque, money order or credit card details (card type, card number, expiry date and signature) to **Federal Publishing Sony Deal, Freepost No. 4, P.O. Box 227, Waterloo, NSW 2017. Any enquiries phone 693-9515 or 693-9517.**



3rd prize

D-100, portable stylish Disc player, super compact, ultraslim, uses rechargeable batteries, rich sound, liquid crystal display. Able to set track numbers for playback, can connect to AC or DC to your home or car hi-fi system.



4th prize

WM-F63, Waterpof Sport Walkman with FM stereo/AM reception. Tape type selector (Normal, CrO2, Metal). 2 mode auto reverse with splash resistant headphones. 3 to be won!

OFFER CLOSES 31st OCTOBER, 1988

CONDITIONS OF ENTRY

1. The competition is open only to Australian Residents authorising a new renewal subscription before last mail October 31st 1988. Entries received after closing date will not be included. Employees of the Federal Publishing Company, Sony and their families are not eligible to enter. To be valid for drawing, subscription must be signed against a nominated valid credit card or if paid by cheque, cleared for payment.
2. South Australian residents need not purchase a subscription to enter, but may enter only once by submitting their name, address, and a hand drawn facsimile of the subscription coupon to The Federal Publishing Company, PO Box 227 Waterloo NSW 2017. NZ residents ineligible for draw.
3. Prizes are not transferable or exchangeable and may not be converted to cash.
4. The judges decision is final and no correspondence will be entered in to.
5. Description of the competition and instructions on how to enter form a part of the competition conditions.
6. The competition commences on July 20, 1988, and closes with last mail on October 31st. The draw will take place in Sydney on November 2 and the winner will be notified by telephone and letter. The winner will also be announced in The Australian and a later issue of this magazine.
7. The prizes are as follows: 1st prize — Sony Trinitron + Camcorder \$6225, 2nd — Sony stereo system \$1300, 3rd — Sony Portable compact disc \$800, 4th — 3 x Walkmans \$270.
8. The promoter is The Federal Publishing Company, 180 Bourke Road, Alexandria, NSW 2015. Permit No 1C88 1650 issued under the Lotteries and Art Unions Act 1901. Raffles and Bingo Permits Board Permit No 88 995 issued on 10/6/88. Permit No TP88 538 issued under the Lotteries Ordinance, 1964.

Expandable mixing console

mains hum, compared to conventional transformers, making them ideal for audio applications. The toroidal does best when under the greatest load and does not show as great an increase in external field as the load is increased.

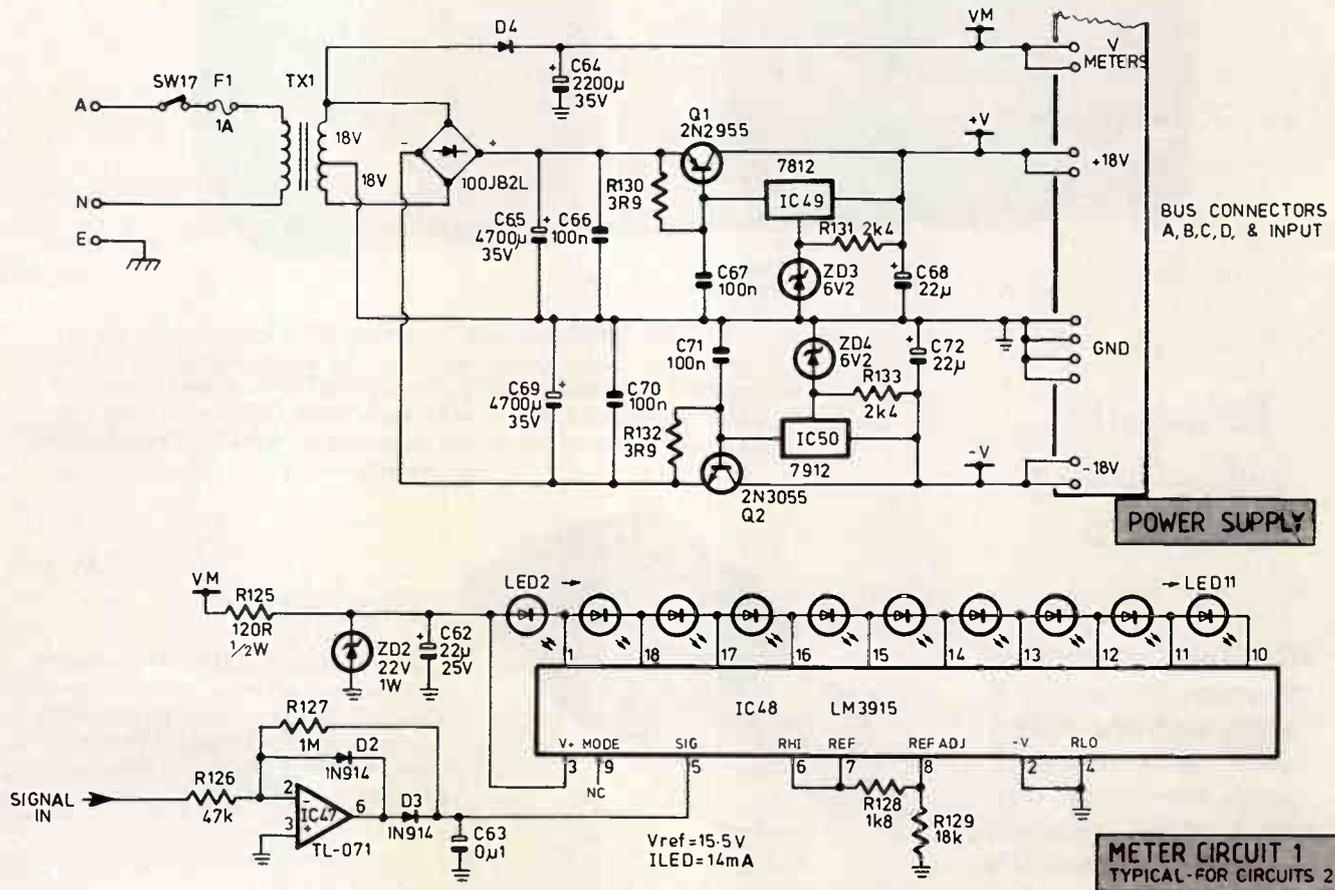
Testing

By this stage you should have all your

boards finished, mounted in their modular cases, and bolted together. Now comes the fun part — power up and testing. Each step of the testing will be described. If at any stage your circuit does not perform as per the test, the same response applies — go back to the board overlay, circuit diagram and component list and make sure every component associated with that stage is

inserted correctly. Also recheck for solder bridges and bad joints.

AAC-05 is the first board to check, as it has the power supply. There should be no interconnecting ribbon cables used at this stage. Plug in the mixer and turn on. If anything goes bang, turn off, and return to the construction section, to recheck your soldering, and component layout. In particular, check the ori-



HOW IT WORKS — THE ANCILLARY CIRCUITS

The ancillary circuits are broken up into four sections:

MONITOR — The monitor has three input signals: the Auxiliary 1 input, the Left/Right signals, and the subgroup mix-down signals. These inputs are summed in the summing amplifiers of IC40 and IC44, after being selected through switches SW13, SW14, and SW15. IC39, R109, and IC43, R116 provide a sum of all the subgroups after being adjusted on the subgroup mixdown controls (see sheet A from last month's edition). R108 and R115 then add the mix-down of the subgroups onto the main Left/Right output channels. R110 and R117 are the summing resistors that provide input current to the virtual earth point on op-amp's IC40 and IC44.

The output of the two summing amps is then ac coupled to the headphone amplifier circuit. The supply rail is generated for the headphone amplifiers by IC42, C59, C60, R113, and R114 to reduce the power dissipation of the LM396s. The combination of R113 and R114 lift IC42's reference to give an output voltage of $V_p = 9$ Volts approx. IC11 and IC15 are monolithic amplifiers that can directly drive a set of 8 ohm headphones. C55, R112, and C58, R119 are used to remove high frequency oscillations when the amplifier is driving into a high current load, C54 and C57 remove the DC component from the signal before it reaches the headphones.

HEADPHONES — The electret microphone is biased by the 10 Volt supply

formed by R120 and ZD1. C100 is used to increase the ability for this supply to give transient current. R121 is used to bias the microphone. IC40 amplifies the signal by a factor of $R122/R_x$ and the output is then sent to the level control formed by RV38. SW16, the press-to-talk switch, passes the signal to the Left and Right output channels via the summing resistors R123 and R124.

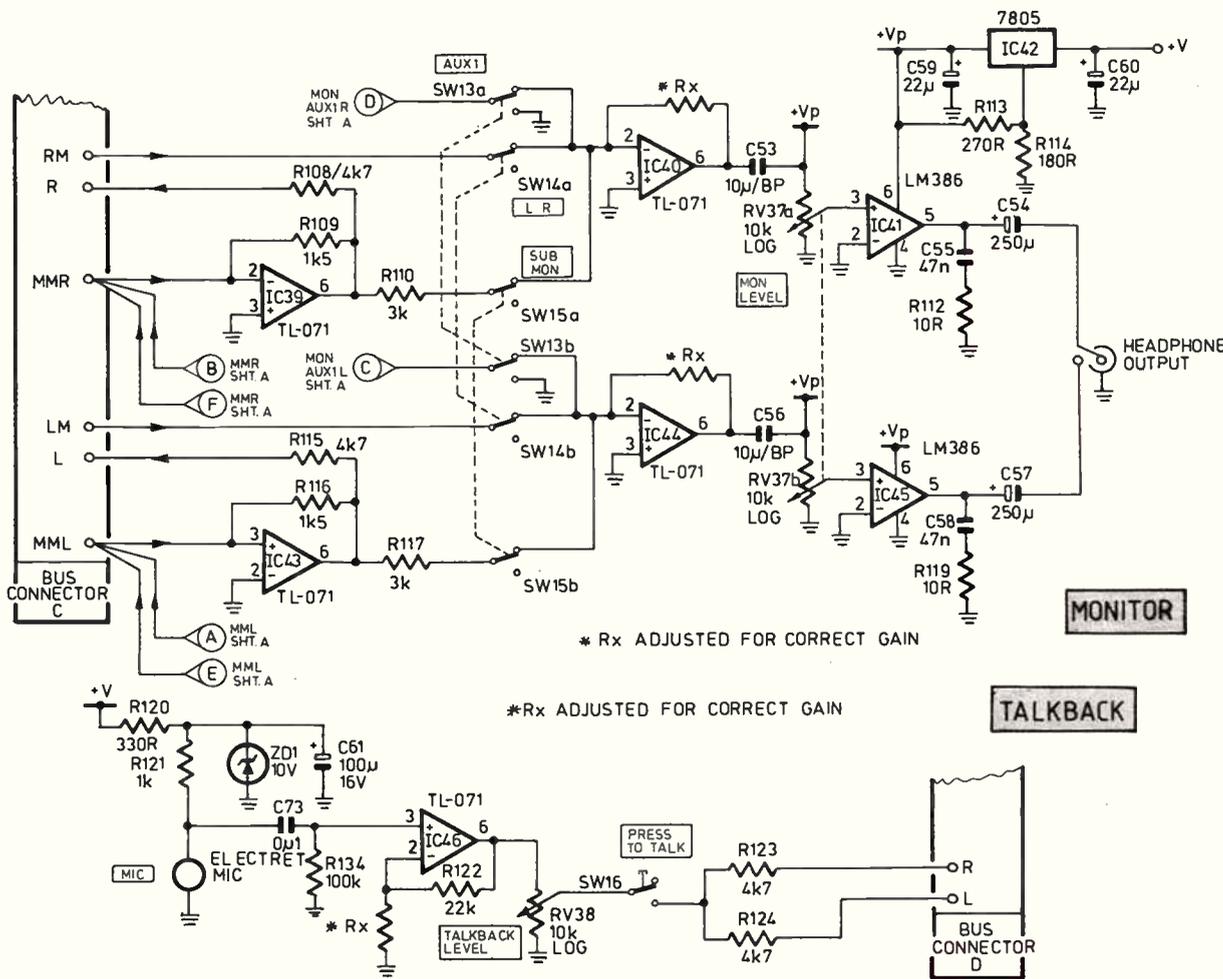
METER CIRCUIT — The input signal that is to be monitored by the meter is first passed through a precision half wave rectifier detector circuit which is formed by R126, R127, D2, D3, and IC47. The precision rectifier is needed to provide the dynamic range required by the 30 dB range of the meter (10 LEDs at 3 dB spacings — 30 dB). If it

entation of the two regulators, the large electrolytic capacitors, zener diodes and diode bridge. Check the 8 wires against the wiring diagram, and ensure the TO3 transistor cases are not shorted to the case. Using a multimeter, check the three power rails: C68+ should have +18 V +/-1.2 V, C64+ should have +25 V +/-4 V and C72- should have -18 V +/-1.2 V. Also check the zener

diode ZD1 for 10 V and ZD2 for 22 V.

Turn power off and connect the next board, AAC-04, to the first, using the 34-way ribbon cable. Turn power on and check the power supply rails on the second board. The easiest place to do this is on any op-amp, where pin 4 is -18 V and pin 7 is +18 V. The meter voltage can be checked across the 22 V zener diode.

Repeat this for the other two output boards, so that all four are connected and powered up. Now connect the closest input channel board to the left output board, using the 20-way cable. Make sure the orientation of the ribbon cable connector is correct, with no twists in the cable. Check the +/- rails. Now connect the next input board and continue until all input boards have



was not used, the forward voltage drop of the detector diode (0.7 Volts) would limit the detection range to about 26 dB (i.e.: $20\log(15/0.7) = 26.6 \text{ Db}$). The output of the rectifier is then filtered by C63 to obtain a dc voltage proportional to the peak level of the input and is then passed on to the LED driver chip, IC48. The input bias current to the IC48 is negligible and so the discharge time constant of C63 is controlled by R127, tied to the virtual ground on pin 2 of IC47. This discharge time constant is approximately 30 msecs.

The reference voltage, or switching point for the last LED, is set by R128 and R129 to about 15.5 Volts. The LED currents are supplied through the 22 Volt power supply formed by R125,

ZD2, and C62. The current passed through the LEDs is set internally by the IC48 driver chip to 10 times the current output from pin 7. This makes the LED current about 14 mA.

POWER SUPPLY — Mains is applied to the circuit via SW17 to allow the mixer to be turned off without switching power off at the wall socket. F1 provides the normal current limiting protection. Transformer, TX1, is a 160 VA 18-0-18 toroidal to step down the mains voltage. D4 half wave rectifies one half of the centre tapped transformer and C64 filters to provide the meter supply voltage, Vm. Also the transformer output is full-wave rectified by BR1. This provides a positive and negative voltage with respect to the centre tap on the

transformer, which is taken to be the common or ground point. C65 and C69 filter the rectified signal and C66 and C70 are low inductance capacitors used to remove higher frequency transients that may be present on the supply. R130 and R132 are biasing resistors that set the current to the base of the shunt transistors $0.7/3.9 = 180 \text{ mA}$. The output voltage is set by IC49 and IC50 in association with the zener diodes, ZD3 and ZD4, to $12 + 6.2 = 18.2 \text{ volts}$. The zeners are biased by R131 and R133. The bulk of the output current is supplied by Q1 and Q2 however, since the input current to the regulator is limited by R130 and R132. C68 and C72 are used to remove any unwanted high frequency components.

JOIN THE WIRELESS INSTITUTE OF AUSTRALIA

The Wireless Institute of Australia (W.I.A) represents radio amateurs in local and international matters and provides assistance, education and many other services. As a member you will receive:

- **AMATEUR RADIO** the monthly magazine of the WIA.
- News of DX, propagation, clubs, satellites, etc.

OTHER SERVICES INCLUDE:

- A world-wide QSL service
- Weekly news and information broadcasts
- Books and publications sales
- Classes for students for the Novice, Limited and Full Call Certificates
- Lessons by correspondence
- Participation in contests, seminars and field days
- Sole representation for amateurs at government level

Learn more about the W.I.A. and AMATEUR RADIO

Forward this coupon, or write to:

**W.I.A.
RO. BOX 300
CAULFIELD SOUTH
VICTORIA 3162**

Registered Address 3/105 Hawthorn Road, Caulfield North

Please send a WIA membership form to:

NAME

.....

Address

.....

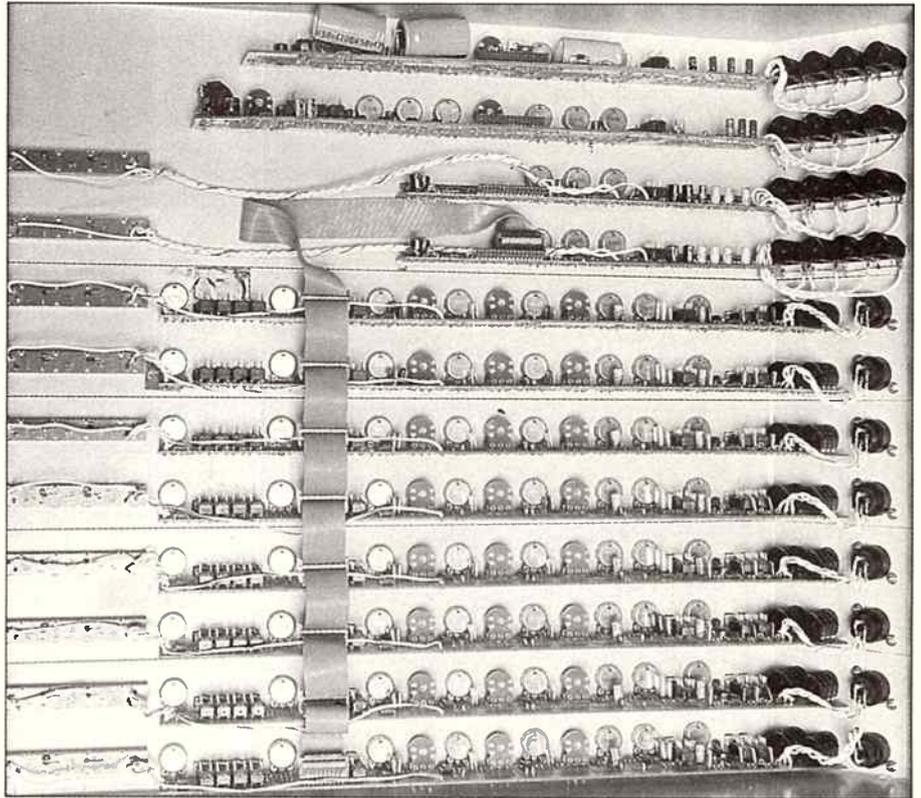
.....

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

BKP88/129A

READER INFO No. 31

Expandable mixing console



The underside of the mixer. All connections to the boards are made via the ribbon cable.

THE NEWTON MM1 MIXER

The Newton MM1 mixer is available in kit form only from APPLIED AUDIO CONSULTANTS. The kit comes complete with all components, printed circuit boards, metalwork, power supplies, wire, etc. A fully comprehensive construction manual is also supplied which gives a step by step guide through all stages needed to complete the mixer.

Costing of the components is as follows:

1.	DUAL INPUT CHANNEL MODULE:	\$280 each
2.	OUTPUT MODULE: (including power supply)	\$490 each
3.	2 SUPPORT RAILS: (to enable modules to be bolted together)	\$40 each

An example of how to order an 8-4-2 mixer would be:

4 x	DUAL INPUT MODULES	4 @ 280 = \$1120
1 x	OUTPUT MODULE	\$490
1 x	2 SUPPORT RAILS	\$40

\$1650

Shipping and Handling

\$25

\$1675

All prices are tax inclusive.

Orders may be placed with:

APPLIED AUDIO CONSULTANTS
PO Box 733
CANBERRA CITY 2601

For further information feel free to call APPLIED AUDIO CONSULTANTS on (062) 43-3345 or Fax (062) 47-0985.

Shipping and handling costs are: \$25

been connected and checked. We are now ready to begin signal path checking.

Set up all input channels as follows: Phase IN; Input MIC; HPF IN; Gain, Mon 1, 2, Eff 1, 2, all at 0; all EQ pots centred; EQ In; SOLO, 1-2, 3-4, L-R all at 0, PAN centre; Fader down. The output module should be as follows: source bus; SG Level, Mix Down Level, Aux Ret Level, Mon Send, Eff Send, Talk-back, H/P Level all at 0; Faders down; Pans centred.

Connect an amplifier to the LEFT channel output. There should be no LEDs lit on the console. You will need a signal source, such as a microphone beside a radio or a signal generator. Feed the source into channel 1. Increase GAIN until the LED flashes, indicating clipping. If the LED does not turn on, check its orientation, and the reference junction of R38/R39, which should be around 7.8 Volts. Now select L-R, to route the channel through to the left and right busses, slide the channel fader and the Left and Right faders to about 3 dB. The Left and Right Level indicators should now be showing about -10 dB. By swinging the Pan pot from one side to the other, the Left and Right channels should respond accordingly. You should also be getting sound from the amplifier. If there is no sound or LED display, check the fader and connector wiring and the orientation of the LM3915 LED driver IC's. Make sure the LEDs are all inserted correctly. Try switching the HPF and EQ out and the PHASE switch. Also try the LINE input. These steps isolate the fault to a particular area of the circuit. If you are still having problems, go on to the next input channel. If this one works, the problem is in the first channel. You may have to go directly to checking Monitors and Effects. The best method is to check as much as possible. This will help to isolate any problems.

Connect the amplifier to the Right Output to sound test it. Check the EQ by adjusting each cut/boost in turn, and varying the centre frequencies. Pushing EQ OUT should bypass the EQ and return the sound to a flat response. If the EQ is not working, check IC 6, 7, 8 and associated components.

Deselect L-R and select 1-2. Turn all SG LEVEL OUT controls fully clockwise. The SG1 and SG2 Levels should be displaying about -10 dB. Again by adjusting the channel PAN, the signal should swing from SG1 to SG2. Turn up the MIX DOWN controls for subgroups 1 and 2. The signal should appear on Left and Right, and should be adjustable via MIX DOWN PAN between Left and Right. Insert the signal source into

ETI-1418 PARTS LIST — ANCILLARY CIRCUITS

Resistors:

R108, R115, R123,	
R124.....	4.7k
R109, R116.....	1.5k
R110, R117.....	3k
R111, R118.....	10k
R112, R119.....	10
R113.....	270
R114.....	180
R120.....	330
R121.....	1k
R122.....	22k
R125.....	120 ½ Watt
R126, R127.....	510k
R128.....	1.8k
R129.....	18k
R130, R132.....	3.9
R131, R133.....	2.4k
RV37.....	10k dual pot
RV38.....	10k Log

NOTE that R121-R129 are repeated 6 times — one for each of the meter circuits.

Capacitors:

C53, C56.....	2.2µF-10µF Bipolar
C54, C57.....	250µF 16 Volts
C55, C58.....	47nF Greencap
C59, C60, C62,	
C63, C68, C72.....	22µF 25 Volts
C61.....	100µF 16 Volts
C64.....	2200µF 35 Volts
C65, C69.....	4700µF 35 Volts
C66, C70, C67,	
C71.....	100nF Chip ceramic

NOTE C62-C63 are repeated 6 times — one for

each of the meter circuits.

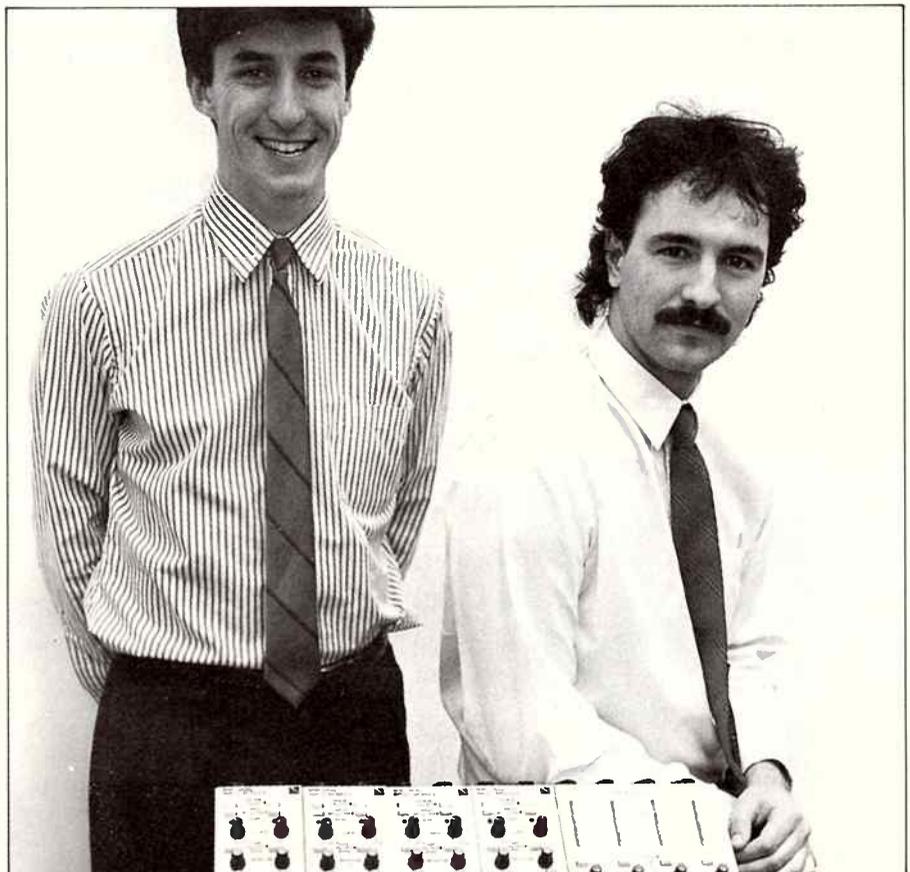
Semiconductors:

IC39, IC40, IC43,	
IC44, IC46, IC47.....	TL-071
IC41, IC45.....	LM386
IC42.....	µA7805
IC48.....	LM3915
IC49.....	µA7812
IC50.....	µA7912
ZD1.....	10 Volt Zener 400 mW
ZD2.....	22 Volt Zener 1 Watt
ZD3, ZD4.....	6.2 Volt Zener 400 mW
LED2, LED3,	
LED4, LED5,	
LED6, LED7, LED8.....	5mm x 2mm Green
LED9, LED10.....	5mm x 2mm Yellow
LED11.....	5mm x 2mm Red
D2, D3.....	1N914, 1N4148, etc.
D4.....	1N4004
Q1.....	2N2955
Q2.....	2N3055
BR1.....	100BJ2L or equiv.

NOTE ZD2, LED2-LED11, IC48, IC47, D2, and D3 are repeated 6 times — one for each of the meter circuits.

Miscellaneous

SW13, SW14,	
SW15.....	2P/2P Push Button
SW16.....	2P/2P Momentary action
SW17.....	210 V toggle
6.35 mm phone socket, 2 x pot knobs, electret microphone, fuse holder, fuse, toroidal transformer 18V-0-18V 160 VA, mains cable, main cable clamp, wire, solder.	



Glen Thurecht and Andrew Robb of Applied Audio Consultants.



PROTEL — \$890.00*
 available now from
R.C.S. DESIGN P/L
 728 Heidelberg Road
 Alphington Ph: (03) 49 6404

*excluding Tax, delivery and training

READER INFO No. 46



ADVERTISERS' INDEX

Abe Computers	88	Monuco	30
Adiom	99	Moxidoto	107
AME	82	NSD	12
Audio Engineers	38	Philips	IFC
Blue Chip-Eastern Micro Electronics	33	Ritronics	10, 11, 83
Bose	IBC	Rofin	107
Coptoin Communications	90	Prometheus	90
Cleanline Systems	4	RCS	120
Dato Electronics	105	Reader Info Card	103, 104
Dato Sat Modems	97	R. Gunz	OBC
Diamond Systems	30	Rockby Electronics	130
Dunn and Bradstreet	122, 123	Scan Audio	SI 19
Dynamic Components	120	Scientific Devices	86
Electromark	120	Siemens	99
Electronic Components	98	Silver Australia	SI 18
Endeavour Tools	30	Solorex	15
Folk ElectroSound	SI 6, SI 7	Sany	114, 115
Hamilton Island	106	Symfonio	SI 25
Hicom Unitratics	38	TASC	SI 14
IREE	12	Technical Indexes	92
Joycor	82	Tecnic	87
Kolex	82	Texas Instruments	8
Kenelec	91	WIA	118
M and G Hoskins	SI 25	WES Components	129
Magnomail	18, 19	Yomoho	SI 24



DYNAMIC COMPONENT SALES PTY. LTD.

Showroom 1, 17 Heatherdale Road, Ringwood 3134, Victoria.
 P.O. Box 476 Ringwood 3134, Victoria. Telephone: (03) 873 4755. Facsimile: (03) 872 3478

WHY PAY INFLATED PRICES?

INTEL MATH COPROCESSORS

8087 80287 80387 to 25 MHz
(80387 SX FOR COMPAQ 386S DUE SOON)

STATIC AND DYNAMIC RAM

256k x 1 -150, -120, -100, -70nS
 1 Meg x 1 - 120nS

EPROMS

SCSI Interface Controllers

Low Prices for PROM & EPROM BURNERS, also IC TESTERS (for PC/XT/AT TYPE COMPUTERS)

READER INFO No. 32



MULTI-FUNCTION HAND HELD THERMOMETER

- Low Cost — 5 Models
- Luminous LCD display
- Peak-Valley Temperature Hold
- Average Temperature
- Select °C or °F (Temperature reading)
- Select 1.0 or 0.1 Resolution
- Alarm and Computer Interface Models available
- Matching Printer available
- 0.05% Reading Accuracy Model available
- 2 Channel Input Differential Model

ELECTROMARK PTY LTD
 43 Anderson Road (PO Box 184)
 Mortdale, NSW 2223
 Telephone: (02) 570 7287
 Fax: (02) 57 5128

READER INFO No. 33

TAPE 1 IN. The same subgroup mixing should be obtained when SOURCE TAPE is selected. Repeat for TAPE 2 IN. Troubleshooting should again begin with the IC's and components associated with the particular area being tested.

To check the LINE input and the 80 Hz filter, select LINE in, insert a lead into the 6.5mm LINE INPUT socket and touch the other end with a bare finger. You should hear a 50 Hz hum from the amplifier. By pushing the 80 Hz filter, the hum should be noticeably reduced.

That takes care of the left and right output boards. Check subgroups 3 and 4 in the same way.

Check the monitor sends by connecting the amplifier to MON 1 out, then turn up MON 1 on the channel and MON SEND on the output module. Re-

peat for MON 2, EFFECT 1 and EFFECT 2. The headphone system can be checked by selecting L-R and turning up the headphone level. Any signal sent to L-R should be heard on the phones. Press TALK and speak into the console microphone. This should appear on the left and right channels and on the head-

*'Now comes the fun part
— power up and testing.'*

phones. The headphone amplifier will operate on a full supply. Check pin 6 of the two LM386s for 9 V, and the orientation of the 7805, IC42.

You will need a stereo plug to check the AUXILIARY section. We have followed the connector convention of Tip-

Left, Ring-Right. Feed a signal into AUX 1 IN (Tip) and turn up the AUX 1 level. The signal should appear on the Left channel, with AUX 1 PAN swung to the left. Check AUX 1 Right by sending a signal on the connector Ring. Repeat for AUX 2 left and right.

Having verified the output module operation, go through the rest of the input modules in turn, checking all functions. SOLO can be checked by using two two signals. Pressing SOLO on one channel should cut out the other channel from the Left-Right bus.

When you have completed the testing and troubleshooting, the base plates can be installed. Remove the rails, place a base plate under each module and refit the rails. The mixer should now be very sturdy, and ready for use in the studio or on the road.

USING A MIXING CONSOLE

For people who have had little experience with recording systems here is a brief introduction to using a recording mixing console.

The first thing to do whenever you start playing around with a new mixer is to become familiar with its structure and features. Understand the way in which the signals can be routed to different places in the system. Once this is done you are ready to connect it to your 2 or 4 track recorder. The four subgroup outputs are connected to the 4 tape-ins from the output module. Input channels are most often wired to a patch bay having some connections to the room that the musicians will perform and some in the control room allowing effects returns etc to be inserted.

Once the system has been wired together, input signals may be injected. The first thing to do is to set up the correct gain for your particular input. This is done by increasing the gain (using the GAIN control) until the peak LED just starts to flash. If the signal has an objectional amount of hum or other unwanted low frequency noise, the HPF (high pass filter) should be inserted in the signal path. This should not be used, however, if it is not needed since it will add another amplifier to the signal path thus increasing the overall noise.

The signal can then be EQ'd to your liking. Get the feel of the parametric EQ by playing with one band at a time, giving 15 dB of cut or boost, and sweeping the frequency control up and down its range. This will show how individual frequencies can be pinpointed and adjusted to your requirements. Sometimes the EQ

is not needed and can be removed by activating the EQ IN/OUT switch. This will also reduce the channel noise since three amplifiers will be removed from the signal path. Note that as the EQ's setting is changed, the peak LED may start to flash. This is because the peak detect is connected after the EQ so that peaking can be seen when boosting frequencies. If this does occur, the gain should be reduced to compensate.

The output channel is next selected by pressing in any combination of the 1-2, 3-4, or L-R select switches. The respective levels in each of the related channels can be adjusted with the PAN control. The fader is used to adjust the channel output level in comparison to the other channels.

The output levels of the subgroups are controlled by the output module. The meters are calibrated so that the correct output level is sent to the recorder. As such, the maximum output level should be set by the meters to -10 dB.

The Left and Right output channels are usually used to drive either a two track recorder or a monitor amplifier.

One very useful feature of this system is that the input levels can be monitored on the Left and Right output LED bar graphs by simply putting the channel into SOLO mode. This effectively routes the output of that channel directly to the Left and Right outputs.

The monitor sends are used to provide a headphone mix individually tailored to the musician's requirements. The effects sends are used to add echo,

reverb, etc to individual channels as required. Input levels to the effects units can be adjusted by the EFFECTS SEND control on the output module.

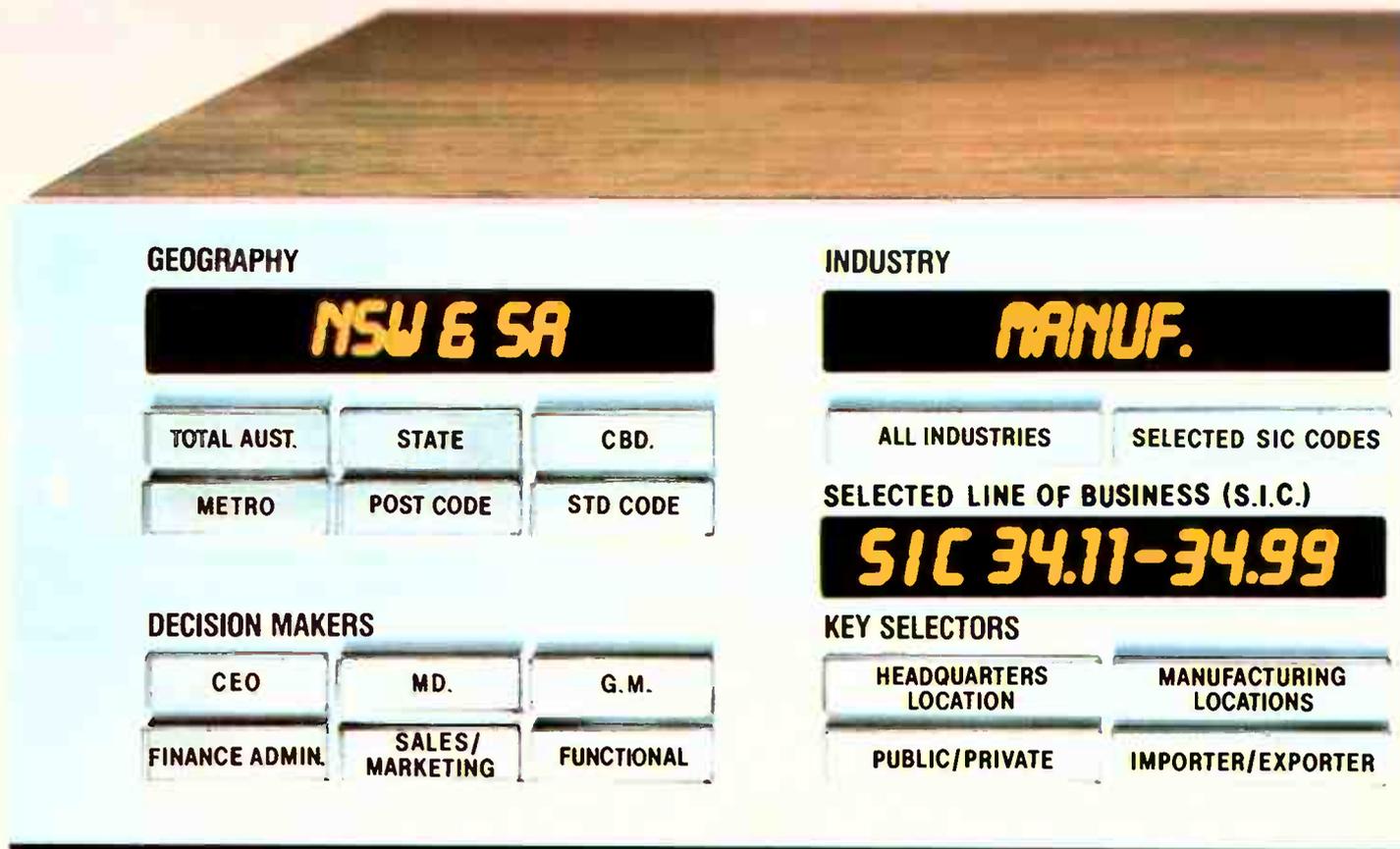
If you wish to communicate with the musicians in the studio, a monitor speaker may be set up which carries the Left and Right signals. The press-to-talk switch can then be activated to send your voice through these channels using the internal microphone in the mixer.

When using this mixer in a live situation, a number of important points need to be remembered. Firstly, the SOLO control mutes the Left and Right output channels when any channel is put into this mode, hence it is recommended that two of the subgroup output channels be used as the main output of the mixer. This does not restrict your mixers capabilities and it avoids the possibly disastrous situation of losing your "front of house" signal.

Secondly, the output levels used in a live situation will usually be a lot higher than those used in a recording environment. The metering has values set up to indicate correctly for a -10 dB nominal output signal, in a live situation amplifiers need to be driven at higher levels.

The mixer is quite capable of supplying these levels but to make the meters indicate the headroom of the system properly, a few component values will need to be changed in the meter circuit. These changes will be clearly outlined in the instructions that will be supplied with the kit so that changes can be made at the construction stage if necessary.

Fine Tune



Dun's Marketing Services amplifies your market knowledge by tuning in to prospects according to the criteria you select.

Just as a quality stereo amplifier/tuner brings in radio signals loud and clear, Dun's Marketing Services has the power to pinpoint marketing data with amazing precision.

At Dun's, we have a state-of-the-art system for selecting your most promising prospects from the business universe . . . prospects that form a solid base on which to build sales and increase profits.

The first thing we do is screen your markets for you, identifying those that show the strongest potential. Then, we fine-tune each market to identify your best prospects – a critical capability these days, when the average sales call costs nearly \$200.

The sophisticated marketing support we provide starts

with Dun & Bradstreet's computerized database, complete with facts and figures on over 200,000 publicly or privately owned Australian enterprises. Timely, too, with over 100,000 fields of data updated each month.

It's the richest source of business information available anywhere.

Turn on the Dun's power and turn up the volume!

The information we deliver is music to the ears of every marketing and sales executive: prospects who match the characteristics of valued current customers.

Select the type of business you're interested in – using such basic parameters as geography by postcode, line of business by SIC classification, sales volume and number of employees. Are you interested in headquarters or branches, publicly or privately owned companies or both . . . companies that import or those that export? Are you interested in the names of CEOs . . . sales and or marketing

BRISBANE
(07) 371 8311

ADELAIDE
(08) 223 6555

PERTH
(09) 321 7631

CANBERRA
(062) 48 7311

Your Market.

SIZE



**MARKET
SELECTOR**

**MADE IN
AUSTRALIA**

executives . . . the top financial officers?

You select the criteria, and we'll deliver the data to you quickly and efficiently.

Suppose you are interested in all NSW & SA manufacturers "specialising" in Fabricated Metal Products with annual sales of \$500,000+ and/or 5-50 employees. It turns out there are 1134 of them in the D&B database and 117 of these have a TELEX. We can tell you everything you need to know about all these enterprises, listing them alphabetically - or if you prefer, in order of sales volume or by number of employees.

High-frequency opportunities

Information is just one side of Dun's Marketing Services (DMS). Once we have identified your prime prospects, we can also help you reach them through proven direct response and telemarketing programs.

A unique dimension of our service is the personal involvement of our experienced, dedicated people - over

25 career information consultants are available across the nation to work with you through each phase of your marketing project.

Select the kind of customers you want to reach, and then stay tuned to DMS for an on-target marketing program. The more you know about your markets, the more you want to know . . . and the more we can help.

For full information, call the Dun's Marketing Services office near you.

Dun's Marketing Services

DB a Division of
Dun & Bradstreet (Australia) Pty. Ltd. (Inc in Vic)

TOWNSVILLE
(077) 72 1523

NEWCASTLE
(049) 26 3300

MELBOURNE
(03) 698 9400

SYDNEY
(02) 269 0913

DG 5344



Programmes

CTRL-Break Disabler

VZ200/300

```
0 *****
1 *DISABLE CTRL-BREAK PROGRAM*
2 * "VZ300/200" BY G.TUNNY*
3 *(C)COPYRIGHT 1988 MAY *
4 *****
5 TM=PEEK(30897)+256*PEEK(30898)-40
10 POKE30897, TM-INT(TM/256)*256+POKE30898, INT(TM/256)
15 TM=TM-1:A=TM-65536
20 FORI=ATOA+34:READD
30 POKEI,D:NEXTI
40 POKE30846, TM-INT(TM/256)*256+POKE30847, INT(TM/256)
50 POKE30845, 195
60 REM**REST OF PROGRAM**
70 REM
100 DATA33,253,104,70,203,80,40,02,201,00,33,223,104,70,203
110 DATA80,40,02,201,243,33,44,00,01,00,01,205,92,52,251
120 DATA195,00,00,00,00
```

This small machine code program uses the interrupt to check for the CTRL-break keys. If they are pressed the program counter jumps to the start of ROM and restarts the system. But there are a few basic commands that disable the interrupt, such as DOS commands. It is advised you

save the program before you execute it.

To return the CTRL-break keys back to normal, enter POKE30845,201 and to restart the machine code program, enter POKE30845,195.

G. Tunny
Garakan
NSW

Screen Dump



```
00010 REM Screen Dump
00020 REM By Ross Gibson
00030 TO CHANGE TO SERIAL PRINTER CHANGE LINE 100 TO OUTL#5 ON
00040 IF YOUR PRINTER DOESN'T NEED A LINE FEED THEN CHANGE THE
00050 LPRINT IN LINE 150 TO LPRINT CHR*(13);
00100 OUTL#1 ON
00110 I=61440:C=16:B=64
00120 D=PEEK(I):IF D>128 THEN LET D=42
00130 LPRINT CHR*(D);
00140 I=I+1
00150 B=B-1:IF B=0 THEN LETB=64:C=C-1:LPRINT
00160 IF C=0 THEN END
00170 GOTO 120
```

This program dumps the contents of the screen to the printer. It is designed to work with a parallel printer but it can be changed by altering line 100 of the program. Note

that all graphic characters are converted into asterisks.

R. Gibson
Yamanto
QLD

Sketch 128

C128

```
10 REM *****
20 REM *** SKETCH 128 ***
30 REM *** J.VELLA JULY 87 ***
40 REM *****
50 SCHCLR
60 PRINT" SKETCH 128 INSTRUCTIONS"
70 PRINT:PRINT
80 PRINT"PLUG PADDLES IN JOY PORT 1"
90 PRINT
100 PRINT"PADDLE 1 CONTROLS HORIZONTAL MOVES"
110 PRINT
120 PRINT"PADDLE 2 CONTROLS VERTICAL MOVES"
130 PRINT
140 PRINT"PRESS ANY KEY TO CLEAR SCREEN"
150 GETA$:IFA$=""THEN150
160 GRAPHIC1,1
170 X=POT(1):Y=POT(2)
180 DRAW1,X,Y
190 GETA$:IFA$<>""THEN160
200 GOTO170
```

READY.

There are many graphics peripherals available for the C128, from a joystick, to light pen and the rest. This program allows you to use yet another — the paddles. The program uses two paddles to 'sketch' designs on the screen. One paddle controls

horizontal motion, the other controls vertical motion. It is based on a sketchagraph, and any designs that you can create on that, you can create using SKETCH 128.

J. Vella
Tregear
NSW



8-Ball percentages

```
00100 CLS:POKE257,1:POKE140,1:STRS(400):A=24:DIMN1(A),P(A),W(A),
L(A),P1(A):FORD=1TOA:N1$(D)=":NEXTD
00110 G=PEEK(256):IFG=0:A=9:N1$(1)="C. Bugg":N1$(2)="S. Ford":N1
$(3)="P. Howell":N1$(4)="G. Laming"ELSE130
00120 N1$(5)="K. Martin":N1$(6)="C. Rashleigh":N1$(7)="C. Thomps
on":N1$(8)="J. Wilsdon":N1$(9)="T. Wilsdon"
00130 CURS23,1:UNDERLINE:PRINT"PLAYER PERCENTAGES":NORMAL
00140 CURS5,3:PRINT"PLAYER GAME ":CURS19,3:PRINT"3 G3:CURS29
,3:PRINT"PLAYED WON LOST PERCENT":IFG=0THEN250
00150 M1$="LOADING DATA ":GOSUB580:IN#3:OUT#0:OUT#0OFF
00160 INPUTH1$:IFH1$(;1,5)<>"*****"THEN160
00170 A=INT(VAL(H1$(;6))):INPUTG:OUT#00N:CURS19,3:PRINT"3 G3:OU
T#00FF:IFG=0THEN240ELSEFORD=1TOA
00180 INPUTD1$:IFINT(VAL(D1$(;1,5)))=D:D1$=D1$(;6)ELSEM1$="LOADI
NG ERROR ":GOSUB580:IN#0:OUT#0:PLAY24;0;24:STOP
00190 X=SEARCH(D1$, "I"):N1$(D)=D1$(;1,X-1):D1$=D1$(;X+2)
00200 X=SEARCH(D1$, "P"):P(D)=INT(VAL(D1$(;1,X-1))):D1$=D1$(;X+1)
00210 X=SEARCH(D1$, "W"):W(D)=INT(VAL(D1$(;1,X-1))):D1$=D1$(;X+1)
00220 X=SEARCH(D1$, "L"):L(D)=INT(VAL(D1$(;1,X-1))):D1$=D1$(;X+1)
00230 P1(D)=VAL(D1$):OUT#00N:GOSUB520:OUT#00FF:NEXTD
00240 IN#0:OUT#0:PLAY24;0;24
00250 G=6+1:FORD=1TOA:M1$=N1$(D):IFD=1:M1$=M1$+ " <B>ye"
00260 M1$=M1$+ " <W>on <L>ost <R>(didn't play) game"+STR(G)+" *
GOSUB580
00270 U1$=KEY:IFU1$<>"W"ANDU1$<>"L"ANDU1$<>CHR(13)ANDU1$<>"B"THE
N270
00280 IFU1$="B"ANDD=1:NEXT# D 350
00290 IFU1$<>CHR(13):P(D)=P(D)+1ELSE310
00300 IFU1$="W":W(D)=W(D)+1ELSELET(L(D)=L(D)+1
00310 GOSUB520:NEXTD
00320 CURS19,3:PRINT"3 G3
00330 M1$="SORTING DATA ":GOSUB580:S=0:GOSUB640:FORD=1TOA
00340 GOSUB520:NEXTD
00350 IFD=1:CURS15,4:PRINT" BYE"
```

```

00360 M1$="PRESS <H> FOR HARDCOPY - ANY OTHER KEY TO CONTINUE ":
GOSUB580
00370 U1$=KEY:IFU1$=""THEN370ELSEIFU1$="H"THENGOSUB590
00380 IFPEEK(49153)<>15:M1$="SWITCH TO EDASH ":GOSUB580
00390 IFPEEK(49153)<>15THEN390
00400 M1$="PREPARE RECORDER - THEN PRESS SPACE BAR ":GOSUB580
00410 U1$=KEY:IFU1$<>" "THEN410
00420 M1$="SAVING GAME"+STR(G)+" DATA ":GOSUB580
00430 FORX=0TO14:READI:POKE788+X,I:NEXTX:X=788:POKEX+15,G
00440 T=G/10:U=G-T*10:POKEX+4,T+48:POKEX+5,U+48
00450 Y=PEEK(2258)+256*PEEK(2259)-2239:POKEX+8,Y/256:POKEX+7,Y-(
Y/256)*256:X=USR(57205)
00460 PLAY0,24:OUT#3:FORD=1TO3:PRINTLA30 331:NEXTD
00470 PRINT"*****";[I5 A]:PRINTG:IFG=0THEN500ELSEPLAY0:FORD=1TOA
00480 IFA+1-D<10:POKE61563,(A+1-D)+48
00490 PRINTI5 D];N1$(D)*"1";P(D);W(D);L(D);P1(D):PLAY0,2:NEXTD:P
OKE61563,48
00500 OUT#0:IN#0:M1$="SAVING COMPLETE - THANK YOU ":GOSUB580
00510 CURS1,15:PLAY24;0;24:END
00520 CURS5,D+4:PRINTA10 32];:CURS5,D+4:PRINTN1$(D);:IFLEN(N1$(
D))<20:S=20-LEN(N1$(D))
00530 IFS<>0THENPRINT" ";:S=S-1:GOTO530
00540 CURS32,D+4:PRINTI3 P(D)];CURS38,D+4:PRINTI3 W(D)];CURS44
,D+4:PRINTI3 L(D)]
00550 IFP(D)>0:P1(D)=FLT(W(D))*100/FLT(P(D))
00560 P1(D)=P1(D)*100:IFFRACT(P1(D))>.5:P1(D)=P1(D)+1
00570 P1(D)=(P1(D)-FRACT(P1(D)))/100:CURS49,D+4:PRINTF7.2 P1(D)
]:RETURN
00580 CURS1,16:PRINTA63 32];:CURSINT(FLT(64-LEN(M1$))/2),16:PRI
NTM1$;:RETURN
00590 FORZ=1TO2:LPRINTCHR(27)*I33,33*CHR(13);:LPRINTCHR(27)*F0,8
0*CHR(13);
00600 LPRINTCHR(14)* MILE END SPORTS CLUB INC 8-BALL TEAM*CHR(1
3);
00610 LPRINTCHR(14)* MILE END SPORTS CLUB INC 8-BALL TEAM*
00620 LPRINTCHR(27)*F10,80*CHR(13);
00630 FORY=0TO14:FORX=0TO63:LPRINTCHR(PEEK(61440+Y*64+X));:NEXTX
:LPRINTCHR(13)CHR(10);:NEXTY:LPRINTCHR(12);:NEXTZ:RETURN
00640 S=S+1:IFS=A-2:S=0:GOTO670
00650 FORD=S+1TOA-1:IFP1(D+1)<P1(D)THEN640
00660 GOSUB710:GOTO640
00670 S=S+1:IFS=A-2:RETURN
00680 FORD=S+1TOA-1:IFP1(D+1)<P1(D)THEN670
00690 IFP(D+1)>P(D)THEN670
00700 GOSUB710:GOTO670
00710 N1$(0)=N1$(D):N1$(D)=N1$(D+1):N1$(D+1)=N1$(0)
00720 P(O)=P(D):P(D)=P(D+1):P(D+1)=P(O)
00730 W(O)=W(D):W(D)=W(D+1):W(D+1)=W(O)
00740 L(O)=L(D):L(D)=L(D+1):L(D+1)=L(O)
00750 P1(O)=P1(D):P1(D)=P1(D+1):P1(D+1)=P1(O)
00760 RETURN
00770 DATA 56,66,76,76,0,0,77,0,0,192,8,30,128,1,255

```

As we have 9 players in our 8-Ball team, this program was developed to help our captain in his selection of the best 6 players to play in the next match. The percentages are calculated by wins against games played for the six singles games only and are displayed and printed in decreasing order, however, should two players have the same percentage, a further sort is performed looking at the number of games played. The reason for this is that a player having the same percentage as another in less games is obviously a better player. A few words about the program.

In line 110 change A=9 to

A= the number of players in your team then change the players names to suit.

Lines 150 to 240 are the cassette data input routine.

Lines 250 to 310 are the keyboard input routine. Should you be lucky enough to have Byes included in your 8-Ball program simply press when the first player's name appears on the command line at the bottom of the screen. The program will then step to the printout routine. Other inputs are: <W> for won, <L> for lost and <CR> for didn't play and the screen will be updated accordingly.

Line 360 asks if hardcopy is required and if so, jumps to

the relevant sub-routine. More about this sub-routine later.

Lines 380 and 390 are included because I have both EDASM and WORDBEE fitted and switch selectable.

Lines 400 to 510 are the save routine which firstly save the program proper and then the data after. Don't be concerned about any changes affecting the program length as this is taken into account in line 450. Note also that the game number is stored in the file name so that upon loading, it is shown to confirm that you are loading the correct game. The game number is also stored in the spare location at the end of the file name.

The printout sub-routine starts at line 590 and prints two copies on one page, one copy for the notice board and one for the captain's folder. Should only one copy be required then simply delete "FORZ=1TO2" in line 590 and "NEXTZ" in line 630. Change the team name to suit and all is set to go. Note that "LPRINTCHR(14)" in lines 600 and 610 are an instruction for my printer to print double width characters and line 620 to set the margins and these should be changed accordingly.

May your name take the top position in all printouts.

G. R. Laming
Mile End
SA

Letters

Super stuff

What a really great magazine. Especially all the stuff on the new Super VHS videos.

Also, many thanks for the article on satellite TV.

Terry Cosgrove
Seven Hills
NSW

benefits to members. The group has a library of FISH disks and produces its own newsletter on a disk every month.

Colin Tringham
6 Tunks St,
Waverton
2060

Normally-on not on!

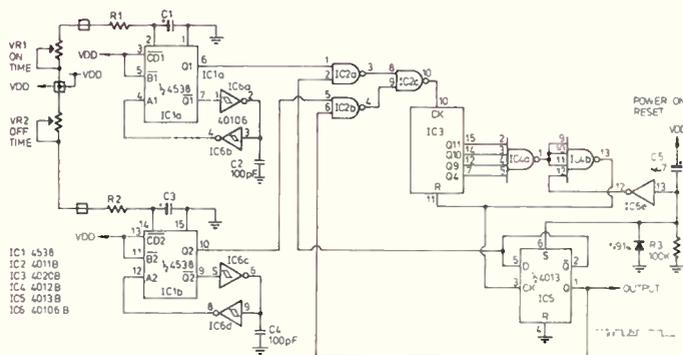
I would like to point out an error in the text for my design 'A Push-Button Joystick' published in the 'Feed Forward' column of your June 1988 edition of Electronics Today International.

The sixteenth and seventeenth lines of the text refer to 'Normally-on' push button switches but my design as submitted stated normally-open; otherwise you will confuse the computer during the time the joystick is connected.

Ian Ross
Lower Templestowe
3107

Circuits

Variable timer



The circuit gives variable on/off times, but its main interest is that, using the characteristics of the 4538 monostable, and wiring it as an oscillator, the on/off times are close to a linear function of the (linear taper) variable resistors VR1 and VR2, for a range of VDD's. The period of oscillation for the on time is approximately $T=(VR1+R1)C1$.

The discrepancy is the delay through the 40106 and 4538 which is about 800 nS with common CMOS. Thus, the maximum frequency of oscillation of the 4538 allowing close to linear frequency/resistance is about 120 kHz. The delay of the 40106 is needed to ensure

reliable oscillation of the 4538. C1 and C3 should be as small as possible, as the discharge circuit inside the 4538 is not a short circuit, and the discharge time may become significant for large capacitances.

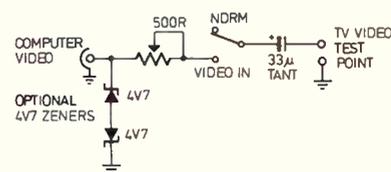
The rest of the circuit is a divide-by-1800 counter, toggle for the two oscillators, and a power-up reset. The divide-by-1800 is used to give a 30-minute on/off time for a 1 Hz frequency of the 4538 and to average out phase differences between the two oscillators.

N. Hartrick
Randwick
NSW

connection is made via an rf modulator. The signal is then demodulated by the demodulator circuit in the TV set. Eliminating these circuit blocks removes two sources of distortion. I modified an AWA Deep Image 14 inch colour TV.

The computer video signal can be fed to a suitable point in the TV video circuit and a designated test point is usually a good spot. In my modification I used test point 15. Some signals may require amplification but usually a simple trimmer and capacitor should be adequate. It may be a good idea to include back to back zeners for protection. Note that "live chassis" TV sets are not recommended to be modified.

Many people have experienced problems with the AGC circuit causing interference.



This occurs when the AGC does not find an rf signal and consequently opens its gain to maximum, picking up "Lamingtons" or noise. My solution to this problem was to disconnect the earth from the computer to TV connection and leave the rf lead connected.

This circuit was derived from my own experiments and it has been working for me for three to four years. However, I cannot guarantee results, but the idea may be useful to readers with similar problems.

Colin R. B. Stewart

Code Switch

This circuit could be used to activate and deactivate an alarm. It has the advantage that once the correct code has deactivated the alarm, any number pressed after that will activate it again. This means even if you forget to activate it, anyone not knowing will automatically do so if they try to break the code. The circuit has wrong number lockout and this can also be used to trigger the alarm.

The code is easily changed by DIL switches and the length can be set to anywhere from 4 to 8 digits long. The circuit features audible indication of any number pressed, correct code entered, reset and lockout. Power for the circuit could be supplied by the alarm.

Initially when power is applied, IC10, IC11 and IC12a are reset and the code applied via the DIL switches is stored in the shift registers (IC3 to IC6) in parallel. The output at pin 1 of IC12a is low and the alarm trigger and lockout line is high. The first number of the code appears at the serial out pins of the

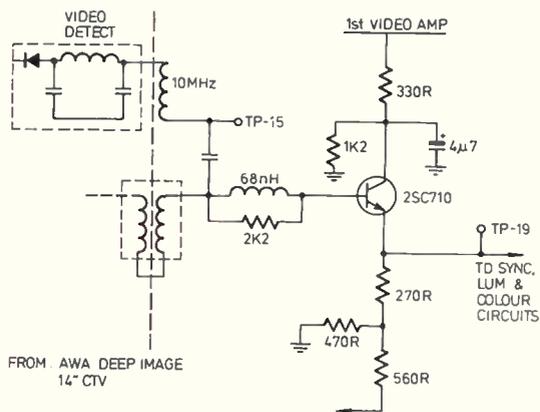
shift registers. When a key is pressed the code is compared by IC2 and if it is a match pin 3 of IC7a goes low. When the key is released pin 3 goes high and IC11 is clocked once. The shift registers are clocked serially and the next code appears at the serial out pins.

When enough numbers have been entered, the selected output of IC11 sets IC12a and it's outputs changes state. Pin 1 goes high and IC10 and IC11 are reset and the shift registers are reset in parallel again. The next key pressed after this will reset IC12a again via IC8c and IC9b.

Any wrong key or any key pressed out of sequence causes pin 3 of IC8a to go high and IC11 and the shift registers are reset and the code has to be started from the beginning again. IC10 is also clocked and when 36 wrong numbers have been counted, pin 4 of IC7b goes low and disables IC8b.

The complete circuit is disabled until the lockout reset switch is closed or power is removed and applied again.

Converting a TV into a monitor

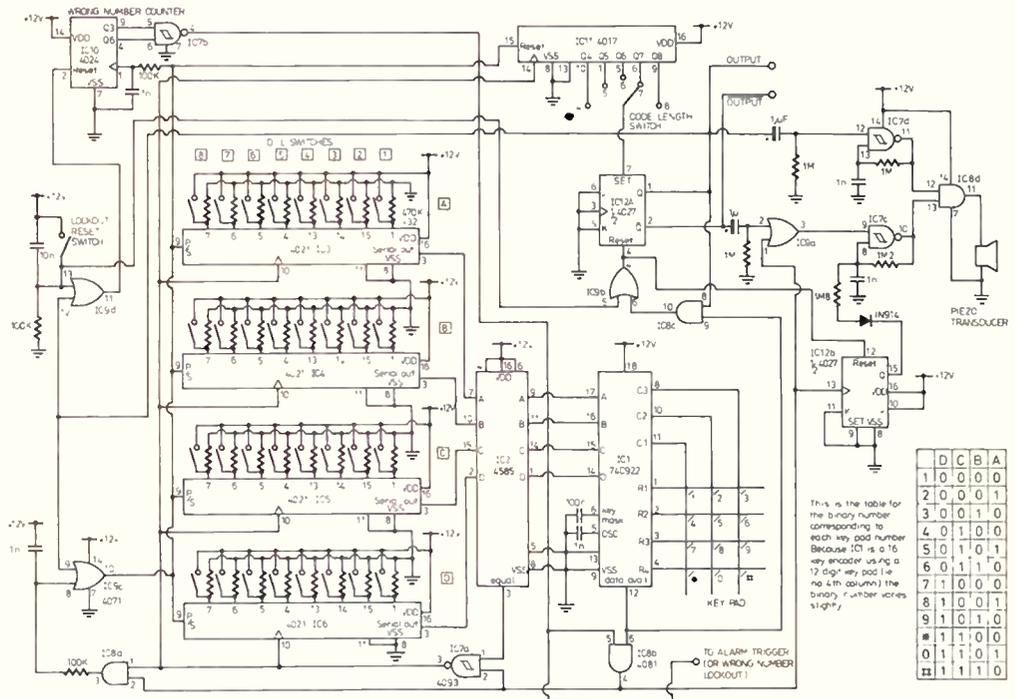


A TV is unlikely to give true high resolution comparable to a monitor but by injecting a video signal to the video

stage of a TV, the improvements can be substantial. The reason is simple and twofold. A computer to TV

The rest of the gates are used to provide sound. Any key pressed will enable oscillator IC7c and a 2 kHz tone will be heard from the piezo element. Once the correct code has been entered, pin 1 of IC12a goes high and oscillator IC7d is enabled via the 1uF capacitor for about 1 second. This tone is about 2.4 kHz. Normally pin 15 of IC12b is high and the diode and 1M8 resistor are effectively out of circuit. When the next key is pressed and IC12a is reset, pin 2 goes high and enables oscillator IC7c for about 1 second. At the same time IC12b is reset, pin 15 goes low and the diode and 1M8 resistor cause the oscillator to oscillate at a lower frequency. The next key pressed clocks IC12b and pin 15 goes high again returning the oscillator to 2 kHz.

L. Kafer
Laverton
Vic



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

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

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

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

'Idea of the month' contest

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

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



RULES

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

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

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

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

COUPON

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

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

Title of idea/program

Signature Date

Name

Address

Postcode



BUFFOONERY

SPECIAL ETI EXPOSÉ

Confessions of a field service technician

It is with a great deal of editorial pride we at ETI have extracted the following confession from a field service technician.

Relevant Definitions,

- 1: SERVE; To work for and obey.
- 2: Serviceable; That renders service, useful.
- 3: Unserviceable; useless.
- 4: Cost; Loss.

With the coming of the silicon chip a strange breed of being has come into existence. Creeping stealthily into your place of business, speaking to practically no-one, he dives beneath the "DANGER — DO NOT OPEN — HIGH VOLTAGE" warning signs on your electronic equipment. Apparently careless of the risk to himself, he has been known to disappear completely into a computer bank while other times he will simply scatter instruments of dubious nature across your receptionist's desk while he probes the depths of her Telex.

This is the Field Service Technician, a mystic apparition capable of wielding enormous power over your bank balance. For the benefit of any who may have cause to come in contact with these creatures, I will reveal here some of the rules governing our behaviour. Yes, I admit it, I am one of the wretched. Perhaps by speaking out here I may discourage some starry-eyed youth from sinking to the depths I have discovered.

Our Technical School system expends a great deal of time and expertise instilling a thorough knowledge of electronics into a great many of our young. These innocents are then thrust out into the world under the mistaken impression that it will be their task to repair a grateful customer's equipment, thus earning his or her undying gratitude, as well as the love and respect of their colleagues.

"HA"!!!!!!

The reason we need Field Service

Technicians (hereafter referred to as FST) is simple. Contrary to reports in popular electronics magazines and relevant sales material, electronics break down. (Yes, even computers). Any engineer will tell you that if you build a machine with 99 per cent reliability, then sell one hundred of them, there will always be one broken down.

In fact, that is the sort of thing an engineer will tell you if you ring with a problem from Birdsville.

Various engineers have tried to get around this problem by only building 99 pieces of equipment, which is one of the reasons why engineers generally wander about shaking their heads and mumbling to themselves. Actually I am not

"... the morals of Attila the Hun and a company car"

sure which is the cause and which is the effect, but the conclusion is obvious — NEVER LISTEN TO AN ENGINEER.

Nobody will die

The first law of FST must always be DON'T PANIC. No matter how desperate the customer sounds when calling for help, it is more than likely that nobody is actually going to die before you get there. Remain calm, finish what you are doing, check your tool kit, fill the service vehicle with petrol and answer any calls of nature before appearing at his place of business.)

Having arrived at the customer's premises a grave problem arises. The customer will be under the impression that because he is paying a great deal of money for your time, somehow you

are under some obligation to help him. This impression is usually conveyed in the person of an assistant-under-manager, who will have nothing better to do while you are present than hover about reminding you constantly of exactly how much that sum is. You are not allowed to shoot this person, nor hit him, nor even be rude. Assistant-Under-Managers are the ones who write complaining letters to General Managers about FST's behaviour. They are for this reason always No. 2 on the FST hate list. (More on No. 1 later). The customer is also furious. He has purchased, in good faith, a piece of serviceable equipment. (See Def. 2). Through no fault of his own this is now unserviceable. (Def. 3) The customer's knowledge of the equipment consists of the fact that it cost (Def. 4) him a great deal of money to buy, is costing him money while it is unserviceable, and will cost him goodness knows how much to repair. Despite the fact you have never laid eyes on his machine, his problem is all your fault.

I will touch briefly here upon the Sales Department. (No. 1 on the hate list). One of your employer's Sales Reps appeared magically on the customer's doorstep some time in the past, armed with glossy brochures, an excellent conversation technique, the morals of Attila the Hun and a company car (which FSTs seldom attain). Despite the customer's original machine being perfectly adequate for his needs, your Sales Rep managed to sell what is probably the latest in a long line of lemons, at an inflated price, before the service manual had even been drafted. The Sales Rep then disappeared comfortable in the knowledge that he would never return. I think this clarifies the FST's feelings regarding Sales Reps.

Commiserations

Never interrupt the tirade of abuse heaped upon you by the customer. Allow it to run its course, tut-tutting at the appropriate time. When he has finished, commiserate with him, assure him that his problem has never arisen before, and will never occur again. Impress upon him the reliability of the advanced system he has had the foresight to pur-



chase. It is amazing what some people will believe.

If at all possible take the equipment to your workshop to repair. This step is vital for three reasons.

- 1: Somebody there may have a vague idea how to fix it.
- 2: Any of the half-dozen curious who will gather to watch may be an electronics buff, who will mumble such things as, "Do you think that oscillator control circuit is saturated?" Which is embarrassing if you don't know where the oscillator is.
- 3: If you fix it in the workshop they have no idea of how long it took you. While this may seem deceitful, there are a thousand day to day tasks involved in running a service centre, chasing parts on the phone, maintenance of tools and test gear etc., which it is impossible to explain to someone who has just seen you repair his machine in two minutes flat. As an apprentice I once fixed something with a simple adjustment, for which I was soundly abused by my foreman. Since then I have never answered a call which did not require some fictional piece of test equipment too large and expensive to be carried in the service vehicle.

Replacement

In case you missed it, only once have I mentioned that anything actually was repaired. In 99 per cent of cases the FST brings in a replacement machine and sends yours off to a remote corner of Asia, never to return. In his normal routine the FST spends 1 day per week driving to and from calls, 1 day per week filling in paperwork, 1 day on the telephone chasing spare parts, explaining to spouses why they'll be late home. (Or trying to ring Telecom to find out why the phone's on the blink). All of which leaves 2 days for fixing things. These two days do not apply to self-employed FSTs, who spend this time doing their accounts and filling out fringe benefit forms. Consequently they spend no time fixing things and go broke rather rapidly.

The one saving grace in all this is the basic honesty of the FST. He doesn't get half of the outrageous amount charged by his employer, so he has no vested interest in ripping you off. He knows that as long as people want more and more complex electronic systems, engineers will keep designing them, so he will always have something to fix.

So next time someone tells you that your brand new \$50,000 thingamajig has to be taken away for repairs, don't rant and rave, don't ask why; just smile and open your cheque-book. The bloke telling you probably has less idea than you do what's wrong with it, because he doesn't even know what it's supposed to do when it goes. But he will take your machine away, leave you one that works, and not send you broke in the process. The charge for service of this nature is generally set by multiplying the hourly rate by the number of assistant-under-managers on the premises. The FST will then add or subtract an unknown amount, depending on how much you abuse him and what sort of day he's having.

The FST breed has nothing to fear from some of you learning a few of our secrets, because in the long run there are only two alternatives open to you. Call us or FIX IT YOUR BLOODY SELF.

Meter Milestones

Digital Auto-range Multimeter



Only
\$119

The hand held HC779 is a "budget priced DMM that packs in features normally reserved for higher priced meters" - *ETI* August '88.

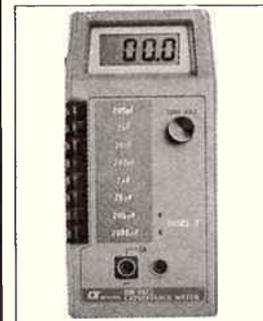
Electronic Analog FET Multimeter



Only
\$79

The HC5050 is an extra rugged, safety designed, Fuse and FET protected meter with a quick reacting analog dial. As reviewed in *Electronics Australia*, September '88.

Digital Capacitance Meter



Only
\$149

The DM6023 is an easy to use and highly accurate service instrument designed to measure capacitor values from 0.1pF to 20,000µF

A host of other meters, components, tools, audio and video parts are available from

Wagner Electronics
305 Liverpool Rd
Ashfield, NSW 2031
Ph (02) 798 9233
Fax (02) 799 7051



TRADE ENQUIRIES WELCOME

OPENING SPECIALS



VERBATIM
5 1/4" DS/2D
\$24.00



NASHUA
3 1/2" DS/2D
\$41.00



VERO
100 x 160
10-2845B
\$10.00



C&K
7201 DPDT
\$1.50



ECCO
10 — POS.
MICRO DIP SWITCH
0.90



VND. LAB. UND LAB.
MICRO SWITCH
15A 125, 250 OR 480 VAL.
\$2.50



MIC. PLUG
METAL BODY & LOCK
\$1.00

24 PIN IC SOC.
W/W \$1.50

Freight charges: \$7.00 for orders under \$50.
: Free for orders over \$50.

ALL SPECIALS INCLUDE SALES TAX

TRANSISTORS

	\$
2N 3055	0.65
MJC 2801	1.80
BC 338	0.06
BC 560	0.06
BC 558	0.06
BC 547	0.06
TIP 42A	0.35

MEMORY

	\$
2732	2.90
2764	3.30
27512	12.70
4164	3.20

IC'S

4013	0.30
4534	1.90
4034	1.10
74LS366	0.30
74LS181	1.00
74LS298	0.40
8130	2.20
8085	1.90
7483	0.40

REGULATORS

7812	0.40
LM395K	5.50
LM317K	2.20
LM320K5.2	1.20

FREE ILLUSTRATED CATALOGUE

To obtain a free catalogue just fill in this coupon and send with your business card to:—

ROCKBY ELECTRONICS
P.O. BOX 189
HUNTINGDALE 3166

Or Fax to (03) 562 8772

Company Name:

Address:

..... Postcode.....

No. of copies required:.....



The Bose® 601™ Series III Direct/Reflecting® Loudspeaker System

Bose engineers have invested more than 25 years of ongoing research seeking one goal—re-creating the realism of a live performance.

The next best thing to hearing music live is hearing it through a Bose Direct/Reflecting speaker.

Drawing on the heritage of the internationally acclaimed Bose 901® speaker, the 601™ speaker gives you the best seat in the house—wherever you sit or stand.

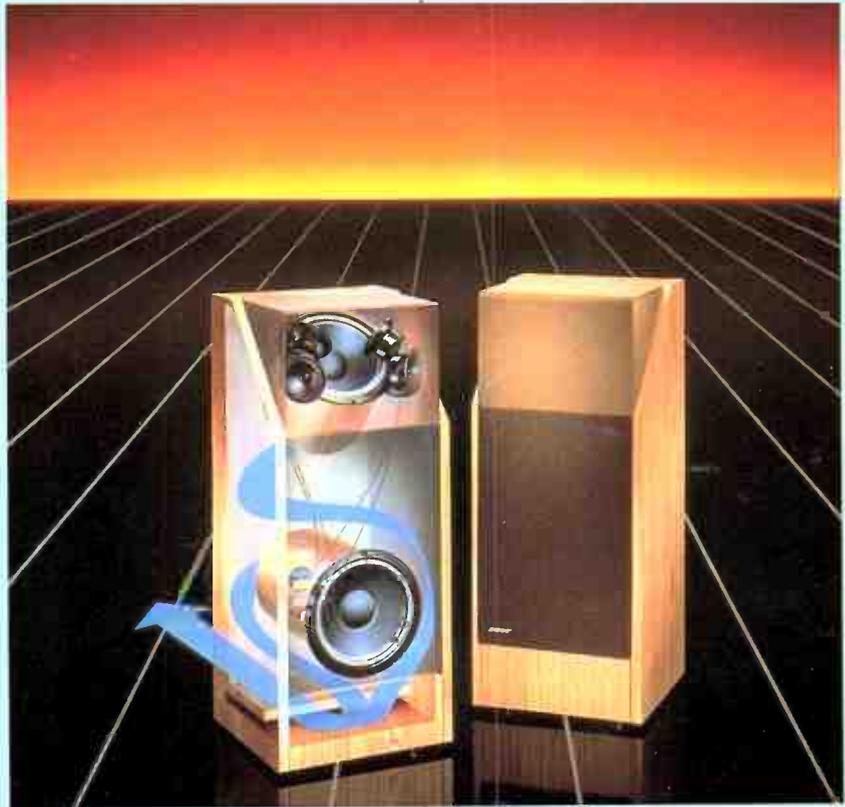
Through our extensive acoustical research into live sound, we learned that focusing on only one musical parameter such as frequency response and expecting realistic sound is like trying to create a lifelike painting by concentrating solely on colour. As with visual images, live sound has perspective, clarity and proportion.

We designed our speakers based on the natural combination of direct and reflected sound. The difference between listening to conventional speakers and Bose Direct/Reflecting® speakers is like the difference between viewing a movie on a television versus experiencing it in a theatre.

The 601 system brings a three dimensional sensation to music—giving the sound depth, height and width. In short, it seems to come alive!

In a live performance, the majority of sound reaches your ears after being reflected off the walls, floors and ceiling. With conventional speakers, you mainly hear only direct sound. Bose Direct/Reflecting® speakers add the missing elements of music by bringing you the natural combination of direct and reflected sound (see diagrams at right). The result is a lifelike soundstage that's practically like being there.

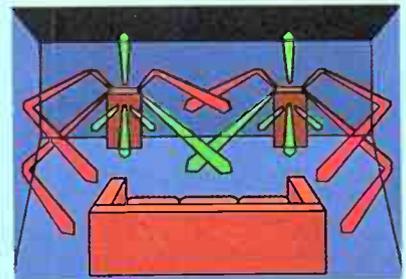
With most conventional speakers, you hear stereo in one or two parts of the room. Everywhere else, you hear primarily one speaker. The 601 system allows you to hear true stereo



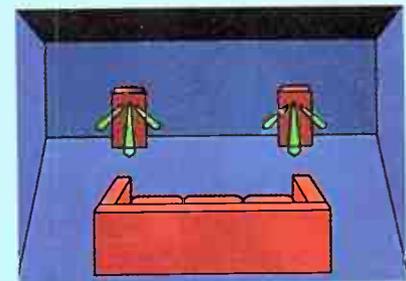
everywhere in the room—even when you are directly in front of one of the speakers.

The 601 system is the ideal cornerstone for a complete home entertainment system. It unleashes the full potential of your sound system, efficiently produces excellent sound and easily handles high power. This rare performance combination allows you to enjoy today's power-demanding sound sources such as digital audio at true-to-life volume levels.

The Bose 601 system also makes it possible to use your stereo system in a new way: as part of a total audio/video system. It is designed to produce greater realism with all video sound sources—especially stereo televisions, hi-fi VCRs and video disc players.



Bose 601 Direct/Reflecting® system.



Conventional speaker system.

Bose Australia Inc., 11 Muriel Avenue, Rydalmere, NSW 2116 Telephone: (02) 684 1022, 684 1255

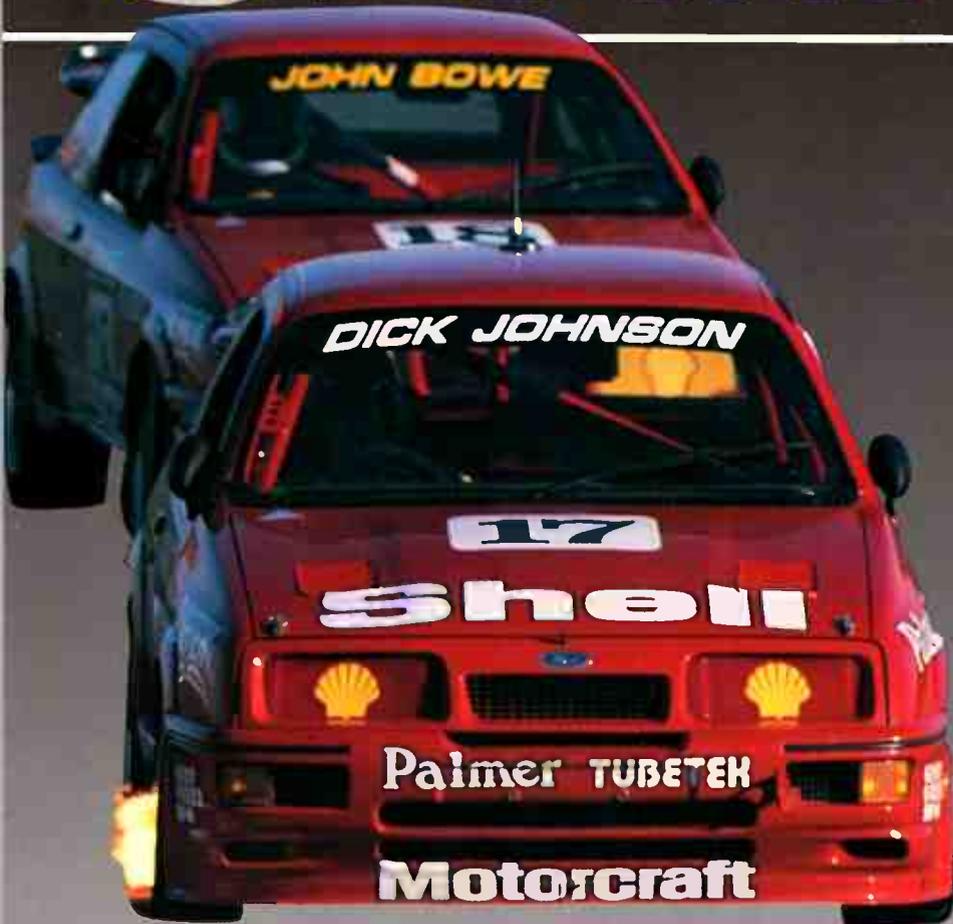
Bose Distributors:

NSW and VIC: Bose Australia (Reverse charge (02) 684 1022); QLD: Stereo Supplies (07) 229 7930; WA: Prosound (09) 325 1066; SA: Blackwood Sound (08) 278 1281; TAS: Chessman Distributors (003) 26 4622.

Bose 7

OLYMPUS

AZ-300 SUPERZOOM



A revolutionary new concept in camera design by Olympus, which combines the best of S.L.R. and compact cameras to put the AZ-300 into a class of its own.

With built-in 38-105mm Power Zoom, plus Auto-focus, Auto-exposure, Auto-advance and rewind, this is an easy to use camera shaped to be operated with one hand.

Some of the amazing features included in this camera are: switchable flash for off/auto/fill-in; exclusive dual Auto-Zooming modes; lowlight AF illuminator; spot-metering; single or continuous autowind; macro; Infinity or Servo-focus settings; Zoom flash; double exposure and filter capability.

The Program Auto setting allows one-touch control for hassle-free snapshooting, or by switching to the concealed override buttons you can extend the range of photographic creativity.



OLYMPUS AZ-300 — The New Dimension in Photography

READER INFO No. 8

Available from your nearest Olympus stockist. Olympus cameras are distributed in Australia by: R. Gunz (Photographic) Pty. Ltd. P.O. Box 690 Darlinghurst NSW 2010.

World Radio History