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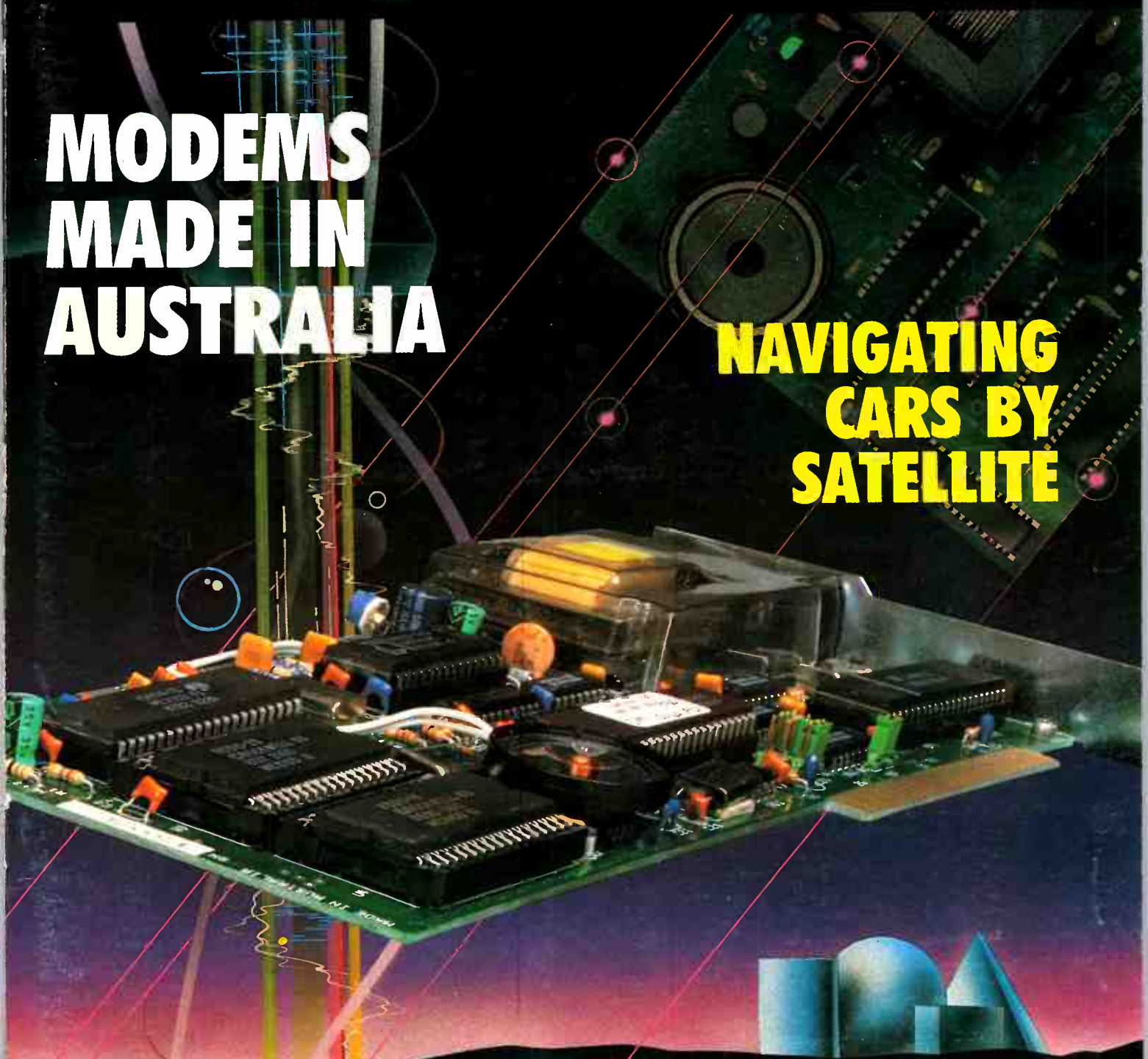

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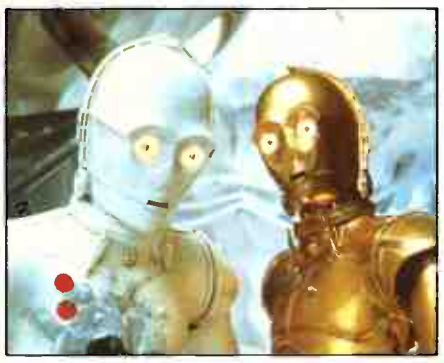
SOUND INSIGHTS

ELECTRONICS



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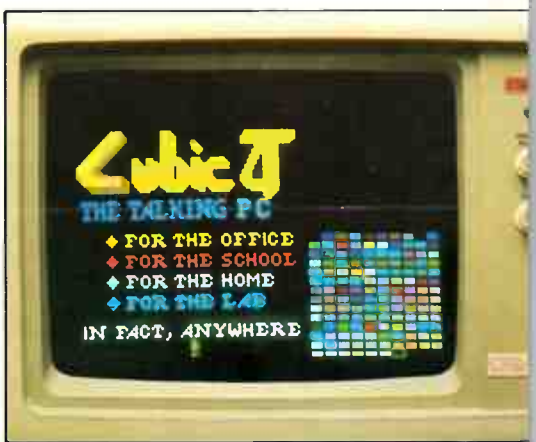
DEPARTMENTS

COVER: Photo courtesy of Netcomm Modems



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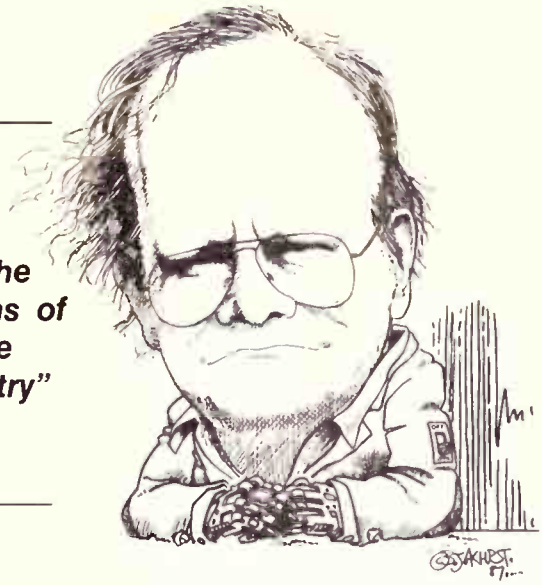

"the government still refuses to address the fundamental problems of manufacturing in the electronics industry"

The Federal Government has consigned its offsets scheme to the junk heap with remarkably little fuss. Considering the importance of overseas purchasing in Australia, particularly by the government, one would have expected more of a furore over the vexed topic of how to make the giant transnational companies into better corporate citizens.

The essence of the offsets scheme was that overseas companies were required to spend some of the profits from Australian purchases by investing in Australian technology. It was generally agreed however, that the offsets scheme was honored more in the breech than the obsevance.

Now the government has entered into the Corporate Citizenship Scheme (CCS). Essentially, it widens the scope of the offsets scheme to make it possible for a company to make what ever arrangements it thinks will be profitable to provided it plows some of its profits back into Australia. This might mean a joint venture with a local company, an investment in it, or perhaps some completely independent activity in Australia. In return, the government gives them Quasi Australian Manufacturer status.

In the first instance, the information industry is being targeted for CCS, and the big importers into Australia have been flocking to join. At the time of writing it includes Wang, DEC, General Electric, British Aerospace plus half a dozen other big names. Typically, Wang has agreed to utilize its Australian R and D facility to develop "financial industry products" that it will market overseas. It has a joint venture with Cleanline Systems to export product overseas and is funding some R and D at a CAE.

Superficiallly, this appears fine. Wang is doing good business, and Australians are being employed. On closer analysis however, the scheme like its predecessor is flawed; it will do nothing for Australian electronics in the long run, indeed, it will make it more difficult for a self-sufficient Australian industry to prosper.

The reasons behind this view are not particularly difficult to see: Wang et al are not charity organizations, so any Australian activities have to make sense in terms of profits repatriated to head office. If significant R and D does get done here

Continued

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Unisys Corporation Announces Plans

The Minister for Industry, Technology and Commerce, Senator John Button and Mr M. W. Blumenthal of Unisys Corporation, USA, today announced that agreements had been reached in principle for a partnership covering advanced computer software technology development between Unisys and the Australian Government.

Senator Button confirmed that Unisys had been accredited with Prequalified Offsets Supplier Status pending completion of formal agreements under the Partnership program.

Under the agreement, Unisys will establish a software R&D centre in Australia. The centre will perform leading-edge research and development in advanced networking and fourth generation language technologies for the Corporation.

The investment by Unisys is expected to exceed $100 million by 1992.

The Unisys Centre will employ some 250 Australians, including a graduate employment program, and will be chartered to build a co-operative network of Australian third party software houses. Unisys will also establish a Pacific Asia training centre with responsibility for its subsidiaries in Australia, New Zealand, Hong Kong, the Philippines, Taiwan, Singapore and Malaysia.

Additionally, a formal Corporate procurement activity is to be established in Australia to work with local suppliers in providing materials and components for Unisys worldwide plants.

Senator Button said he was very pleased to see Unisys' commitment to the Partnership concept.

The vice president of Unisys and group general manager Ian Shiers

An Australian First

The future of an historic, photographic collection dating back to 1869 has been assured by its transfer to laserdisc — the first time an Australian collection has been catalogued, conserved, and presented in this way.

The archive project, the largest of its kind in Australia to date, covers more than 40,000 fragile, glass plate negatives belonging to the New South Wales Government Printing Office, and is just part of more than 200,000 historical and contemporary photographs, drawings and paintings in its care.

The company selected for the preparation of a laserdisc master is Diotel Imaging Australia (DIA), a Melbourne-based video facility house specialising in the transfer of still images.

Granville May, of the NSW Government Printing Office, said the entire Bicentennial project has been financed by a $750,000 grant from the New South Wales Bicentennial Secretariat to the Laser Picture Studio, a body established in May, 1986 by the Printing Office to market its archiving services to the Government and private sectors.

DIA is currently laying down the laserdisc master from 35mm archive film positives of the original negatives prepared by the Laser Picture Studio. Joint Managing Director of DIA, Ian Large, said he expected to complete the one-inch, edit master by the end of October.

"This has been made possible," he said, "by DIA's unique facilities, which enables the images to be transferred to master video tape at an average rate of one every two seconds. Where necessary, we have also colour corrected, or graded, photographs, to maintain the highest possible standards of reproduction."

From the edit master, a first pressing of 50 laserdiscs will be made for sale to professional photographers, researchers, libraries, etc., around Australia and overseas.

Each disc will be accessed by image-retrieval and indexing software, specially developed by Queensland software and systems house, QCOM, to allow easy searching and accessing by professionals and laymen alike. Proprietary rights to the software is owned by the NSW Government Printing Office. Although somewhere in the order of 60 laserdiscs have been produced in Australia, until now these had been confined mainly to training discs, particularly for the larger vehicle manufacturers.

Frequency

there is absolutely no guarantee that the fruits of it will remain in this country.

Clearly this is not due to some idiosyncacy of Wang, or American companies in general, or modern companies in particular. It is absolutely true of any foreign company that ever does business on our patch. Meanwhile, Quasi Australian Manufacturer status means that any slight advantage accruing to Australian controlled companies will disappear, so making it even more difficult for them to get into Australian manufacturing.

The truth of the matter is that the government still refuses to address the fundamental problems of manufacturing in the electronics industry. They twist and turn, according to the latest received wisdom, trying desperately to encourage, now research, now manufacturing, now exporting, now joint ventures. And always, the foreign companies will do as little as the letter of the law requires in order to gain the all important government contracts.

The government must bite the bullet. It wants an electronic industry to provide employment for scientists, engineers, technicians and process workers, not to mention lawyers and accountants and the odd civil servant, it must support it through government legislation and purchasing. There are precedents: most overseas electronics, notably in the US, Japan, Sweden and France, prospers in this way. And an article in this issue (Modems shows that we can do it too.

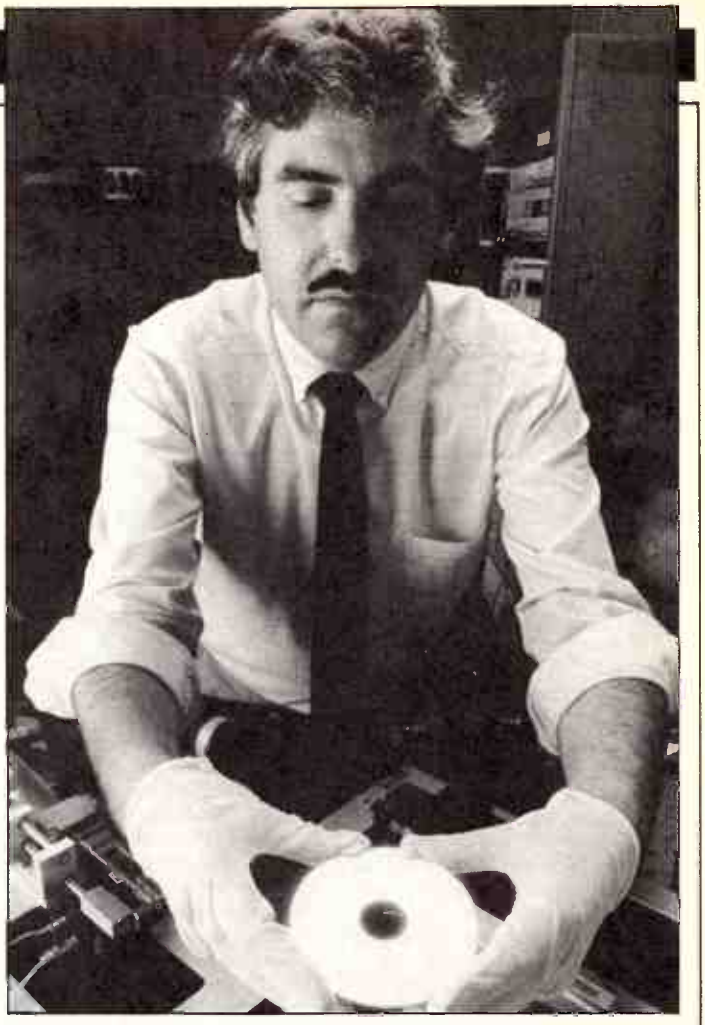
IBM Researchers Produce Smallest Cell Disks

Scientists at IBM's Almaden Research Center have produced experimental magnetic disks with tracks a half-micron wide. At such dimensions, future 3.5-inch-diameter disks used in computer storage could each hold 10 billion bits of information (10 gigabits) or 620,000 double-spaced typewritten pages — 50 times more than today's densest disks.

In magnetic disk drives — the primary devices computers use to store data — information is recorded as "bit cells," tiny magnetized regions along tracks similar to the concentric grooves in phonograph records. The IBM scientists successfully recorded, read and erased bit cells measuring only 0.5 x 0.5 microns.

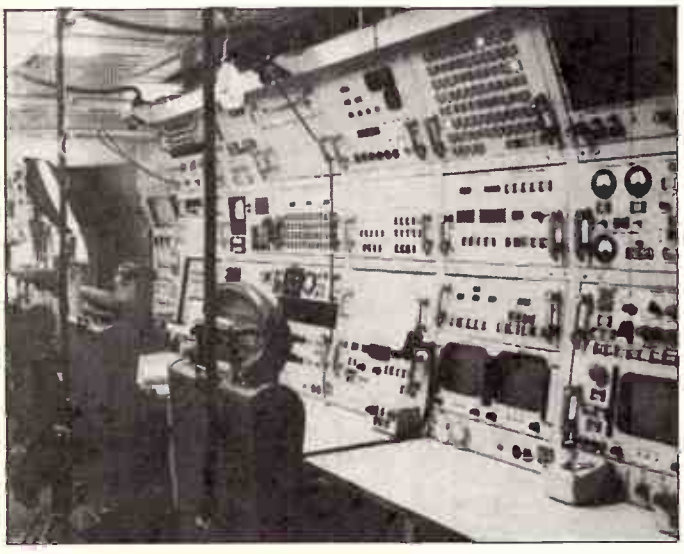
While additional work is required to pack half-micron tracks close together and take full advantage of their size, the scientists demonstrated that magnetic disk technology can continue to support dramatic improvements in data density. Moreover, they learned that the magnetic regions in these narrow tracks behave very similarly to the much larger regions in current disks. For example, they discovered that the fundamental process of reading the recorded information acts in a predictable manner down to sub-micron bit-cell dimensions. They also learned that magnetic interactions within such small cells enable further reductions in bit-cell size, leading to even higher storage densities than originally anticipated.

The scientists formed sub-micron tracks by etching the surface of storage disks with photolithographic techniques similar to those used in semi-conductor processing. In their approach, a thin film of cobalt alloy was first deposited onto a smooth substrate. A circular track pattern was then defined on the disk by an electron beam on an electron-sensitive photoresist layer. A developing step removed the exposed photoresist, and an etching step removed the magnetic material between the resist-defined tracks, leaving physically discrete tracks of cobalt alloy.



IBM Scientist Ian L. Sanders mounts an experimental, high-density magnetic disk on an apparatus at the company's Almaden Research Center. The disk surface is etched with microscopic tracks, along which information is recorded. Each track is only 20-millionths-of-an-inch wide. At such unprecedented dimensions, future 3.5-inch-diameter disks could, in principle, each hold up to 10 billion bits of data, or about 620,000 double-spaced typewritten pages.

NASA Supernova Studies



NASA is continuing to study Supernova 1987a in the southern hemisphere from Australia and New Zealand.

The studies involve sounding rockets, sceintific balloons and the Kuiper Airborne Observatory.

Guenter Riegler, the supernova program manager said, "The studies, part of a continuing NASA campaign to investigate one of the most extraordinary astronomical events in modern times, will be carried out through a three-dimensional effort."

The purpose of the studies is to develop a more thorough understanding of what happens following the explosion of a star.

Shortly after the supernova's discovery in February this year, NASA's Astrophysics Division developed plans for a series of observations with instruments on existing satellites, and other vehicles.

The first balloon and airborne observations were made from Australia and New Zealand in May and June. In addition to the latest sounding rocket launch from Woomera in Australia, the Kuiper Airborne Observatory (KAO) has been operating from Christchurch in New Zealand.

The KAO will provide a unique and regular opporutnity for infra-red astronomers to observe at altitudes above 95 per cent of the atmosphere's water content.

Bothered By Spy Sats

In an effort to improve national security, the US government has issued regulations giving it the power to restrict the sale of data from remote-sensing satellites.

Under the regulations, the department of defence will have authority to restrict the operation of satellites that are run by American citizens and take photographs of sensitive areas.

These regulations may foreshadow the end of the "dual system" of sensors in space that the US has operated for 15 years. Under this system, absolute secrecy surrounds the existence of powerful spy satellites, and the data they produce. But commercial satellites such as Landsat orbit the Earth under a policy known as "open skies, open access". This allows anyone to buy any data that the satellite generated.

In the future, as the quality of US commercial remote-sensing equipment begins to rival that carried by spy satellites, privately-produced data may be controlled in the same way as the export of sensitive technologies.

Government officials in the US are at a loss, however, to describe how they would enforce a ban on the dissemination of pictures from space, since the US no longer enjoys a monopoly of Earth-scanning satellites, even in the West. France already has a spy satellite called SPOT in operation and Canada and Japan are about to join the remote-sensing fraternity. Nevertheless, for the moment commercial satellites remain one step away from producing images of the resolution afforded by spy satellites, and government officials in the US expect that lack of demand from people able to pay the high price of high-resolution images will deter companies from operating private spies in the sky.

Landsat, a series of satellites operated by NASA, has, since 1972, offered for sale pictures of the Earth's surface. Because of the wide swathe of territory scanned, these images contain little detail. The smallest distinct dot on the Earth's surface that the pictures display measures 30 metres across.

SPOT, the French satellite, won fame in 1986 by providing photographs of the damaged nuclear power plant at Chernobyl. It produces monochrome pictures with a resolution of 10 metres — 20 metres for colour photographs.

Landsat may soon be in this league. EOSAT, a joint venture by Hughes Aircraft and General Electric that now operates Landsat, wants to mount a sensor on the next Landsat spacecraft that would zoom in on small portions of the Earth and take pictures with a resolution of 5 metres. It expects the biggest customers for these pictures to be newspapers and TV stations.

This project, called Mediasat, is enthusiastically promoted by some news executives and has touched off a lively debate between defence officials and the media.

In a written comment on the regulations, the Pentagon's lawyers argue that "the Secretary of Defense should be permitted the maximum discretion to determine, consistent with First Amendment standards, those conditions necessary to address the national security concerns of the United States."

Although debates on satellite restrictions have so far focused on the media, the new rules raise other concerns. The defence department is buying increasing quantities of Landsat data. It is using sophisticated computer programs to analyse data from Landsat and SPOT to reveal information that is valuable for military intelligence. In particular, Landsat's sensitivity to wavelengths outside the visual range, including infrared, allows it to sense features invisible to ordinary cameras at whatever resolution.

Future commercial systems will be even more useful to the Pentagon and foreign military intelligence agencies.

Computers can compare images of a particular area, collected by Landsat or SPOT over a long period. The computers detect any changes in the scene, such as new construction, and highlight them for further analysis. Data from Landsat and SPOT have also proved valuable for military officers drawing up contingency plans, providing information on ground wetness and vegetation in areas of possible troop movements, for instance.

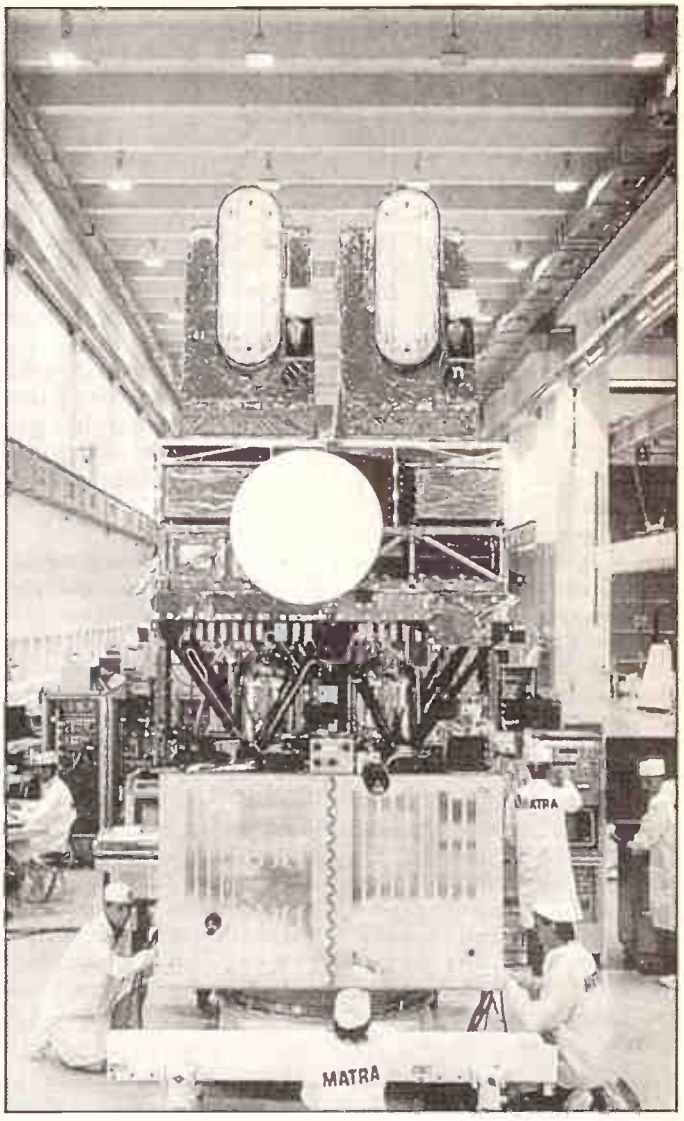
Landsat 6, scheduled for launch in 1991, will have new sensors with a resolution of 15 metres. The satellite will not transmit data from these sensors to the worldwide system of ground stations operated by their host nations to collect Landsat data. Instead, the high-quality data will be stored on board the spacecraft, and transmitted only to EOSAT's ground station in Oklahoma.

According to some industry executives, the threat of government interference, combined with already uncertain markets and the risk of launch failures, may deter American firms from exploring the market for high-resolution images.

European and Japanese satellites, which are outside the scope of American regulations, are likely to benefit from the Pentagon's attempts to restrict the sale of high-quality pictures from space.

Yet Pentagon officials appear to see value in controls, even in the presence of foreign competition. Even if all planned remote-sensing satellites go forward, there will be only a handful of commercial satellites in orbit, and not all would be in position quickly to observe a particular area. Some, said an official at the Department of Defense, will be under the control of allied nations on whom the US may be able to exert some diplomatic pressure.

The Soviet Union recently offered for sale satellite photographs with a resolution of six metres.



SPOT — The French satellite

Starwars Doesn't Work

PHYSICISTS Edward Teller and Lowell Wood misled United States policymakers with "overly optimistic and technically incorrect statements" about X-ray laser research for the Strategic Defense Initiative (SDI), according to Roy Woodruff, former director of the X-ray laser project at Lawrence Livermore Laboratory, Woodruff left his directorship in 1985 because, he says, he knew he was not able to deliver what Teller was promising.

Meanwhile, in an action that backs the right of US nuclear weapons laboratory employees to voice dissenting views, the University of California has settled a personnel grievance by Woodruff who claimed he had been treated as "an un-person in a windowless office" and has not been given assignments that make use of his skills.

The university, contracted by the government to manage the Lawrence Livermore and Los Alamos National Weapons Laboratories, refused to hear Woodruff's first grievance, filed on 3 April, in which he criticized Lawrence Livermore Laboratory director Roger Batzel for refusing the correct "overly optimistic" representations of X-ray laser research made to President Reagan by physicist Edward Teller.

According to Woodruff, Teller, vastly underestimated the time necessary to perfect an X-ray laser system, and met with President Reagan and members of Congress on several occasions to promote the research and lobby for increased funding for SDI.

The news came to light when an anti SDI group, the Southern California Federation of Scientists (SCFS) released the contents of a letter from Woodruff, who has publicly supported SDI.

SCFS decided to release the letter now, according to co-chairman Robert Nelson because budget decisions on SDI funding are being made in Congress. Nelson recalled President Reagan's speech last October, after the collapse of the Reykjavik summit, in which he said scientists were convinced that a space-based anti-weapon system could be deployed "several years down the road." If that was the President's thinking, said Nelson, "I would have been unfaithful to my responsibility as a citizen, not to make this information known."

OxPost uses Barcodes

A small Sydney-based electronics company, Ayr Electronics Australia has made an important breakthrough in bar-code technology for Australia Post.

Australia Post has recently installed special letter sorting machines, made in France. These machines incorporate a unique bar-code printing unit that bar-codes letters according to their postcode.

These machines work well, but Australia Post wanted to invest in some portable, desk scanners in order to be able to randomly check letters to ensure accurate barcoding.

After overseas companies refused to do the job, Australia Post turned to a number of Australian companies, including Ayr. "With our experience in the importing, construction and repair of overseas bar-coding machines for the pharmaceutical and food processing industries, we believe we could produce an effective machine at a reasonable cost. And we have," says John Dewar, Ayr's marketing manager.

"If our machines are successful we are planning to export them. Australia Post's problem has allowed us to become a designer and manufacturer of equipment for which there is a strong demand overseas."

Mr Dewar said one important consideration that ensured Ayr's success was the backing of its venture capital partner, BLE Capital. "The fact that we had the strong backing of BLE Capital, 60 per cent owned by Westpac was, I know, an important consideration in Australia Post's decision. In fact the ready availability of venture finance is undoubtedly a major determinant of success for many of Australia's small high-tech companies," he said.

Amendments to Tax Concession for Research and Development

Proposed amendments to prevent possible abuse of the 150 per cent tax concession for research and development were announced in Canberra recently.

The Minister for Industry, Technology and Commerce, Senator John Button, and the Treasurer, Mr Paul Keating, said the amendments follow a technical review of the concession undertaken earlier this year and foreshadowed when the Income Tax Assessment (Research and Development) Bill was introduced in 1986.

The Ministers said that the review had been undertaken with the assistance of external consultants to identify:

- ways in which the concession might be exploited other than as intended; and
- how it might be made more effective in achieving its objectives of encouraging greater investment in R&D by industry in Australia.

Soviet Space Pictures For Sale

The Soviet Union has started selling maps and pictures taken from outer space.

The Soviet organisation, Sojuzkarta, which has recently been strengthening its worldwide sales operations, has announced that it has offered its aerial and space picture services to 70 countries.

Exclusive rights to sell the pictures has been granted to a Finnish company FM-Projects.

Gamma Bursters Revealed

It has been known for some time that some stars emit gamma rays in millisecond long bursts quite spontaneously every few years. Now evidence has been found of similar optical flashes.

Cosmic gamma-ray bursts were first observed during the 1970s as an unexpected by-product of the nuclear-explosion monitoring programme in the United States. Such bursts last between milliseconds and several seconds, and some repeat at intervals of years. Soon after the discovery, a network of satellite observations was organized to yield accurate positions, sometimes with better than arc-minute resolution, for the transient gamma-ray events. Other observations, such as spectra and time profiles, suggested that the phenomena were related to neutron stars, so that it came as no surprise that gamma-bursters had no obvious optical counterparts. Several theories predict that a bright optical flash should accompany the gamma-rays, but no detector has been flown so far that could detect one.

However René Hudec and coworkers reported at the European Regional Astronomy Meeting, held in Prague in August, the discovery on archival astronomical plates of a recurrent optical flash emitted very close to the position in the sky of a gamma-ray burster, itself not identified at other wavelengths.

On the assumption, supported in at least two cases, that gamma-ray bursts repeatedly came from the same object, perhaps at intervals of years, it makes sense to look for the presence of a past optical signature.

Optical astronomy is fortunate in having a tremendous wealth of information in the form of photographic plates of the sky taken by generations of observers. Hudec and his colleagues have combed 350,000 plates from the Sonnenberg and Bamberg observatories, after painstakingly searching through 28 gamma-burst positions, on each of the 2000-3000 plates available.

In three plates, taken on 28 March 1946, 31 August 1946 and 27 April 1954, an object appears at precisely the same coordinates, where none is normally seen, even in the Palomar Sky Survey, the most comprehensive survey of the stars yet undertaken.

What is the object responsible for this event? Is it also responsible for at least one gamma-ray burster? However remarkable, Hudec's object cannot provide the final answer, which will come only from the contemporary detection of gamma-ray and optical flash coming from the same direction in the sky.

Several ground-based efforts are now under way or being planned for coordinated optical watches at both gamma and optical wavelengths. The European Space Agency's GRASP (gamma-ray astronomy with spectroscopy and positioning) satellite is also designed for gamma-ray burst astronomy. It will be able to locate gamma-ray events with arc-minute accuracy and to record sensitive optical data from the same region of the sky with the expected rate during the mission, several good cases should be observed to solve the problem of their origin.

World Combines For Fusion

An agreement has been signed to develop the world's first fusion reactor. Recently, the US, Soviet Union, Japan and the European Community agreed that the Institute of Plasma Physics near Munich should provide a home for the team working on ITER, the International Thermonuclear Experimental Reactor.

The project will begin this year, with the goal of producing a conceptual design by the end of the 1990s for a reactor to test the technology of fusion.

News of the agreement follows a report released by the Office of Technology Assessment which says that the US will not be able to achieve its stated policy of evaluating the technological feasibility of fusion by early in the 21st century, unless it increases substantially its budget for fusion research, or joins international projects such as ITER.

The report warns that international collaboration on such a scale is unprecedented for the US. The President would have to authorise such a venture personally but "even that, by itself, is insufficient to guarantee the viability of a project involving all branches of the US government and extending over several presidential administrations".

Fusion, the process that powers the Sun, the stars and the hydrogen bomb, produces energy by fusing light atoms to create later atoms. This process can release energy, but the conditions required for controlled fusion are severe.

The most likely fuels for ITER are deuterium and tritium, two isotopes of hydrogen. To coax these atoms to fuse, producing a helium atom in the process, requires heating them to a temperature of around 100 million °C.

Attaining this temperature is difficult enough, but it is even more difficult when the heated plasma must be contained in a vessel of some sort so that fusion can take place. Containment has been attempted using magnetism and lasers, but these consume enormous amounts of energy. To date fusion reactors have consumed more energy than they have yielded.

PROTEL

Joint Action

Three software companies from three different states have joined in a court action against a North Ryde businessman alleged to be distributing software in infringment of copyright.

The companies, HST Technology, of Hobart, Autodesk Australia, of Melbourne and Microsoft of Sydney, were granted "Anton Pillar" orders by the Federal Court in Sydney on November 9. Following the granting of the orders the companies' solicitors and technical advisers visited the premises of Mr Charles Cheung and pursuant to the Court orders removed some 80 software disks and related accounting books.

After seeking legal advice, Mr Cheung contacted New South Wales Police, who were present for the execution of the Anton Pillar orders. The action was initiated after HST Technology made a claim under its Intellectual Property Legal Expenses Policy through insurance agents, Assurex. Assurex arranged for the purchase of a microcomputer from Mr Cheung and was allegedly given "free" copies of computer software which infringed the copyright of the three companies.

A Director of HST Technology, Mr John Powell, said "Our software is specialised. It is not highly priced, and most genuine users would want access to our support and the regular enhancements we provide.

"We take a serious view of copyright infringement and will take the strongest action possible to stamp it out," Ms Linda Graham, Microsoft's managing director, said. "We intend sueing Mr Cheung for damages for breach of copyright."

The Managing Director of Autodesk, Mr Anthony Zammit, said, Autodesk would continue to act in defence of its software copyright.

"We have taken these actions to protect the innocent people who think they are buying a genuine article and, of course, our own reputation for supporting our users."

The international liaison officer for Autodesk, Inc, Mr Scott Whittemore who is currently in Australia, said that Autodesk, Inc, was concerned about computer piracy worldwide and was pleased that the companies had joined together in the action.

"Legal action against software copyright infringements is an expensive process and many small companies could find it beyond them."

Kelly Changes DSTO

Ros Kelly, the minister for defence science and personnel has ordered major changes in the Defence Science and Technology Organization (DSTO).

DSTO, located in Adelaide, has been responsible for a number of significant developments, including the Jindalee radar (see article elsewhere), sonar devices, rocketry and surveillance equipment.

The Government expects that in the future all major DSTO laboratories will include a substantial content of both scientific and engineering work. As a result of the reorganisation, greater opportunities are expected for engineer managers.

The staff profile will be changed during the next 5 years. More scientists, engineers and skilled technicians will be recruited to replace support staff whose numbers will be reduced.

A major element of the reorganisation is the disbanding of the Advanced Engineering Laboratory at Salisbury in South Australia and the creation of a Surveillance Research Laboratory.

Another key feature of the reorganisation is the intention to transfer more work to industry. In future DSTO will only take development to the stage of technology demonstration with further engineering development being carried out by industry and funded by the customer.

Kelly said a consultant will be employed to oversee the establishment of a commercial cell within DSTO. This cell will be responsible for publicising DSTO and for arranging and coordinating its work in support of industry.

She said the shakeup arises from the need to streamline the transition of DSTO's inventions to industry and to consolidate its technology base as outlined in the Government's Defence White Paper.

New HD facility

A Sydney company has opened the first full repair centre in Australia for the repair of hard discs. Allaw Sales began life as a distributor of data storage devices from overseas. Over the last few years however, the company has begun a move towards what marketing manager John Wellar describes as "value added sales", with consumer engineering and repair of its existing products the initial projects.

Allaw has made the move because it sees a considerable market opening up for servicing and after market support for disc drives, particularly at the level of PC compatibles. The first generation of disc drives is just now starting to reach the age where problems are starting to occur.

Currently Allaw Sales is devoting its efforts to servicing the Miniscribe drives the company imports from the US and Singapore. However, the eventual aim is to offer a similar service for any type of hard disc.

The repair of hard disc drives represents a considerable problem. The platters on which information is stored are manufactured to extremely precise tolerances; measurements are made in microns. Typically, the discs are manufactured from flat sheets of aluminium, with an extremely thin film of some magnetic material applied to the outside. The head that reads the information floats above this layer on a cushion of air, separated by perhaps 5 to 10 microns. When the head hits the platter, in what is known as a 'head crash', a tiny (or not so tiny) hole is gouged out of the magnetic material, rendering the disc useless. One of the main causes of a head crash is dirt penetrating the disc enclosure and getting between the head andth eplatter, so causing the head to bounce up and then down onto the spinning disc.

Because the tolerances are so fine, it is necessary that repairs be carried out in a dust free environment. For this reason, Allaw has installed a $150,000 Class 100 cleanroom which will ensure only 100 particles in a cubic foot of air are bigger than half a micron. A typical office would have around 500,000 such particles in a cubic foot, and a factory something like 50 million.

According to John Wellar, the work is not particularly difficult, but it is extremely exacting because of the tolerances involved. This problem will get worse over time, as the capacity of drives gets larger and their physical size smaller. Wellar says that within the next few years, PC compatible drives with capacities of 900 Mbytes will be available, selling for around $14,000. He comments wryly on the fact that seven years ago, a mainframe disc drive, as big as a filing cabinet and with 300 Mbytes sold for $60,000.

Wellar is not expecting the exotic new storage media to interfere with his business too much, at least within the foreseable future. He says that because of the progress being made in compressing data on magnetic media, optical drives will be out-priced for many years to come. It is inevitable that optics is the direction in which things will move, but not yet.

More Engineers Needed

The Commonwealth Tertiary Education Commission (CTEC) steering committee headed by Bruce Williams has claimed an increase in the percentage of engineers in Australia's workforce from 0.5% to 1.2% by the year 2000, is the most that is likely to be achieved by current moves to increase the number of engineers.

Quoted by Engineers Australia Magazine, Williams said:

"To get engineers to 1.2% of the labor force by the end of the century we would need to add annually something like 5000 engineers. Assuming net annual migration of 500, this implies the need for about 4900 graduates a year from our engineering schools, if, as in the past, something like 9% return to their countries of origin. To achieve that would require graduation levels to be about 40% higher than 1985 and 1986."

At present, 54% of University students and 45% of advanced education students actually finish their course. The total intake is only about 6600.

Williams explained that to graduate 4900 engineers a year would require increasing retention rates to 75% and bringing in 2000 new students annually.

"Such increase could be achieved if salaries of engineers became more attractive . . . if the traditional reluctance of women to enter engineering could be broken down, and if there were substantial increases in capacity in engineering schools," he said.

COMING EVENTS

FEBRUARY

Space Commerce '88 is going to be held at Montreux Switzerland over February 21-25. Those wishing to go should write or ring the Secretariat, Space Commerce '88, 2 Av de la Gare, PO Box 122, CH-1820, Montreux. Telex 453254.

Joint International Symposium on Information Systems — JSIS 88 will take place from February 19 till March 2. Contact R. Jeffery, Dept of Information Systems, University of New South Wales, PO Box 1, Kensington 2044.

MARCH

Communications 88 — the third International Electronic Communications and Information Technology Exhibition will be held at the new Sydney Conference and exhibition centre in Darling Harbour during March. All those interested in this comprehensive exhibition should contact Australian exhibition services Pty Ltd, 424 St Kilda Road, Melbourne, Vic 3004. Tel (03) 267-4500.

The World In Space is the name of the 1988 annual convention of the American Congress of Surveying and Mapping-/American Society of Photogrammetry and Remote Sensing. Contact Jerome J. Lenczowski, 12755 Weber Hill Road, St Louis MO 63127.

QEDA the Queensland Electronic Distributors Association is staging its annual Electronics display over March 23-4. QEDA currently comprises approximately 40 companies involved in the Queensland electronics industry. For further details contact Bob Hunt (07) 954-1911 or Bob Heelan (07) 277-4311.

APRIL

Melbourne Bicentennial Electrical Engineering Congress: "Electro Technology: A springboard for the future", will be held over April 11-15. The Conference Manager, Bicentennial Electrical Engineering Congress, The Institution of Engineers, Australia, 11 National Circuit, Barton 2600. Phone (062) 73-2633.

ATUG 88 — Australian Telecommunications Users Group Conference and Exhibition will be held in Melbourne April 19-21. For conference details contact Wally Rothwell, ATUG executive director, PO Box 357, Milson's Point 2061. Telephone (02) 957-1333.

Tekniikka 88 An International Specialised Exhibition of Automotation in Industry will be held in Finland at the Jyvaskyla Exhibition centre over April 19-22. Contact the Jyvaskyla Fair chairman Mr Olli Patja, Exhibition Manager, PB 127, 40101 Jyvaskyla, tel (9)41-611 288 Finland.

The 18th meeting of the Intelsat Signatories will take place on Hamilton Island this month. The meeting will be hosted by OTC and more then 120 delegates from around the world are expected to attend. For further information call W. Grundy (02) 230-1544.

Commercial Opportunities From Space Transport and Related Industries Conference will be held in Brisbane over April 26-28. The conference will examine the commercial possibilities of the Cape York Spaceport. Contact the Secretariat, Uniquest Limited, University of Queensland, St Lucia, Qld 4067. Ph (07) 377-2899.

MAY

An International Aerospace Exhibition is to be held at the Hanover Air Show from May 5-12. For more information contact Deutsche Messe— und Ausstellungs—AG, Abt 312 Messegelenade, D. 3000 Hannover 82. Telex: 9 22 728.

The Australian Bicentennial International Congress in Mechanical Engineering (Mech 88) will host a Conference on Space Engineering will be held in Brisbane over May 8-13. To visit or participate contact the Institution of Engineers, Australia, Conference Manager, Mech 88 Conference, 11 National Circuit, Barton, ACT 2600. Telex: AA62758.

JULY

COMDEX Australia's National and International Computer and Communications Exhibition and Conference will be held in the Darling Harbour area of Sydney from 26-28 July. Potential visitors and exhibitors should ring (02) 959-5555.

AUGUST

The 3rd Regional Convention of the Melbourne Audio Enginnering Convention will be held in the exquisite surroundings of the Melbourne Hilton over August 16-18. The three day programme of papers and workshops will be accompanied by an extensive exhibition of audio products. Contact the Chairman Brian Horman, PO Box 131, GPO South Melbourne 3205, tel (03) 329-0162.

SEPTEMBER

The ANZAAS Centenary Congress will be held over 2-6 September 1988 at Sydney University. Enquiries should be addressed to Mr B. O'Bourke, Organising Secretary 1988 ANZAAS Centenary Congress, 18 Darlinghurst Road, University of Sydney, NSW 2006. Tel (02) 692-4356.

OCTOBER

9th International Conference on Computer Communications will be held at the Hilton Hotel Tel Aviv from October 30-November 3. The conference is being organised by the International Council for Computer Communications (ICCC) and will concentrate on Computer Communications Technologies for the 90s. For more information contact Dr J. Raviv Secretariat ICCC'88 PO Box 50006 Tel Aviv 61500, Israel.

NOVEMBER

The International Robot Show featuring Artificial intelligence systems, automated guided vehicles, coating equipment, computer-integrated manufacturing equipment and many other items of cybernetic interest will be held from 7-10 November. There will be 60 estimated exhibitors and anyone wishing to participate should contact Australian Exhibition Services, 424 St Kilda Rd, Melbourne, Vic 3004. Tel (03) 267-4500.

Mountains of mail, how do the stations cope? Arthur Cushen offers some insights.

Kilohertz Comment

RADIO MAIL

The Voice of America and the BBC report that last year their mail from overseas listeners totalled over half a million letters.

The problem with overseas mail is that not all is in English and therefore it has to be circulated to the various language sections of the international broadcaster. Each international station has its own method of handling the huge mail and digesting its contents so that listener requests, reaction to programmes and general statistical information can be gathered.

Radio Nederland's mail last year was some 107,000 letters and of these some 34,000 were directed to the English department. The majority of this mail was concerned with Radio Nederland's feature programmes such as Media Network. Not only is there a tremendous increase in mail to Hilversum Box 222, but there is now more electronic then printed material reaching the radio station.

Friendly Relations

Co-operation between countries politically opposed may seem strange, but in the radio field friendly relations are expanding.

One of the latest results of this is the announcement by Radio Beijing and Swiss Radio International that they are re-broadcasting one another's programmes.

The Director of the Swiss Broadcasting Corporation has recently visited China and agreement was reached between Radio Beijing and Swiss Radio International, which is operated by the Swiss Broadcasting Corporation, for daily programme exchanges, which commenced on November 1. Radio Beijing is relaying Swiss Radio International programmes over two 125 kW transmitters which are beamed to Indonesia, Australia and New Zealand. A transmitter near Beijing uses 11695 kHz, and the second one at Kunming uses 15135 kHz, 1315-1500 UTC, with English 1330-1400. The monthly programmes of the Red Cross Broadcasting Service are also carried from 1310-1327 UTC.

In exchange, Swiss Radio International is carrying two hours of Radio Beijing programming for reception into Europe using two 250 kW transmitters. Each station has been made responsible for its own programming, and there is to be no financial transaction in the exchange.

Listeners in Australia will enjoy better reception of Radio Canada International when the programmes are relayed in two half hour transmissions from Radio Japan commencing in April. Radio Japan programmes are already being relayed by Radio Canada for reception in North America and this agreement will allow broadcasts from Montreal to be better received in Asia and the South Pacific.

BELGIUM: Brussels broadcast in English with the programme "Belgium Calling" 0800-0825 5910, 17600 kHz beamed to Australia while other English transmissions are 1000-1025 15510, 17610; 1330-1355 15590, 17600, 1830-1855 6035, 9860 and 2200-2225 5910-6035 kHz.

CZECHOSLOVAKIA: Radio Prague has a service in English to Australia 0730-0800 and 0830-0900 on 11685, 17840 and 21705. On Saturday and Sunday the transmission is extended to 0930. A transmission to South East Asia 1430-1457 is on 9605, 11685, 13715, 15110 and 15155 kHz.

GERMANY: Deutsche Welle in English to Australia has made a frequency change and replaced 15410 with 15510 kHz 0900-0950; this broadcast is also available on 6160, 11945, 15185, 17780, 21650 and 21680 kHz. The transmission for our morning broadcast on 2100-2150 is on 6185, 7130, 9605 and 9765 kHz.

MONGOLIA: Radio Ulan Bator now broadcasts in English 0905-0940 on 9690, 12005 kHz, but the latter channel is actually 11990 kHz. To the Far East at 1200-1235 UTC on 9690, 12005 kHz; 1445-1520 9570, 15300; To Europe 1940-2015, 9570, 11790 kHz. Programmes include news and commentary and then features on Mongolia.

NEW ZEALAND: Radio New Zealand International, up to March 5 when the country is observing Daylight Time, operates to the Pacific: 1730-2015 11780, 15150; 2245-0045 17705; to Australia and Papua New Guinea: 2245-0045 15150; 0345-0630 15150; 0930-1115 9540, 11780; 0045-0345 Saturday only 15150 kHz.

PHILIPPINES: The Far East Broadcasting Company, Manila in its service to the Pacific uses two frequences, 11850 and 15350 kHz, for the broadcast 0830-0930 UTC. The frequency of 11850 kHz also carries English broadcast 0400-0600 while an additional broadcast on 9670 kHz can be heard 1400-1600 UTC.

SAIPAN: The FEBC schedule shows that Saipan transmitter KFBS No 1 is off the air till February. The other two 100 kW transmitters are operating to this schedule. KFBS No 2 2100-2200 9830; 2200-0000 12025; 0000-0100 15305; 0900-1400 12025; 1400-1600 9465; 1600-1930 7365 kHz. KFBS No 3 2200-0000 11980; 1000-1300 15375; 1300-1430 9840; All broadcasts are in the Asian languages.

SWEDEN: Radio Sweden broadcasting in English up to March 26 0930-1100 15390 to Pacific, while other English transmissions are 1100-1130 21690; 1230-1300 on 9565, 15430; 0230-0300 9695 kHz.

USA: KGEI San Francisco, operated by FEBC has Russian broadcasts 0200-0600 on 7365 kHz, on their second transmitter. The other transmitter is used to Latin America and broadcasts 2200-0300 15280; 0300-1400 9615; 1400-1600 15355 kHz.

Radio KUSW PO Box 7040 Salt Lake City, Utah 84107 commenced regular operation in December with programmes beamed to Canada and operates as follows: 0000-0300 11680; 0300-0600 9755; 0600-1100 6155; 1100-1600 9850; 1600-1900 15225; 1900-2200 17715; 2200-0000 15580. The station is looking for reception reports from listeners and requests return postage, when writing to KUSW.

USSR: Radio Moscow in English is scheduled 2100-1300 UTC. At 0700 the frequencies of 17795, 17825, 15130, 15405, 15420 and 15510 kHz are used, and at 1000 9780 and 17645 kHz.

This item was contributed by Arthur Cushen, 212 Earn Street, 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 11 hours behind Australian Eastern Daylight Time.

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INPUT SENSITIVITY: 1 V RMS for 100W ouput
HUM: 100 dB below full output (flat)
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2nd HARMONIC DISTORTION: 0 001% at 1 KHz (0 0007% on Prototypes) at 100W ouput using a + 56V SUPPLY rated at 4A continues 0 0003% for all frequencies less than 10KHz and all powers below clipping
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FREQUENCY RESPONSE: High-level input 15Hz 130KHz -0 1dB Low-Level input-conforms to RIAA equalisation + 0 2dB
DISTORTION: 1KHz 0 003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1 2V)-92dB flat -100dB A-weighted, MM input master full, with respect to full output (1 2V) at 5 mV input 50ohms source resistance connected -86dB flat/92dB A-weighted MC input master full, with respect to full output (1 2V) and 200uV input signal -71dB flat -75dB A-weighted

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T31012	.91mm 500gm	$14.95
T31020	1.6mm 250gm	$7.50
T31022	1.6mm 500gm	$13.95
T31030	.71mm 1 metre	$1.50
T31032	.91mm 1 metre	$1.25
T31034	1.6mm 1 metre	$1.00

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A	B	C	Finish	Cat.No.	Price
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Electronic control system with powerful in-built 100dB alarm Changeable 3 digit, push button, secret code controller that is tamper proof 3 function switch provides off position, chime and 7 seconds delay entry Emergency panic button Suitable for left or right hand door opening Simple installation, no wiring required Low current 15mA at 9V Operates on 9V battery
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A perfect all night security device with dual element Passive Infra Red sensor All weather outdoor operation. Features off, automatic, test and manual on at your wall switch Complete with wall mounting bracket, cable terminations and instructions.

SPECIFICATIONS:
Detecting range: minimum 6 to 15 metres with variable control
Detecting zones: 5 at 15° short, 12 at 8° medium, 12 at long range
Preset time: From 1 to 20 minutes with manual override
Photocell sensitivity: Activates circuit at about 2 footcandles, off at about 8 footcandles of light
Positioning Adjustment: 2 ball joints allow free adjustment to suit area.
Relay output: Up to 500W of incandescent load only
Power: 240V AC 50Hz
A15597 ..... **$185**

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FEATURES:

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- 24 detection beams in 3 different ranges
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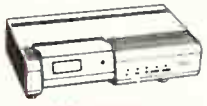

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FUNCTIONS:
7 LED indicators:
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PIR detection:
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Detection Area 12m x 12m, 90° at 20°C
Built-in piezo siren: 115dB at 1m
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Terminals for external detection devices:
1,2 DC power output, max. 15mA
3,4 Siren output maximum 1A
5,6 External key
7,8 delay or instant circuit
9,10 24 Hour circuit
Separate digital panel and main unit: Easy operation, cutting the wire also causes the alarm
3 function switch:
DELAY exit and entry
INSTANT exit with delay, entry without delay
OFF system is off
3 Adjustable Timers:
EXIT TIME from 5 seconds to 3 minutes
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24 Hour loop included: When switching to "D" or "I" position, 24 hour loop is protected
Adjustable detection angle: +/- 10%
Walk test: LED monitor
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SPECIFICATIONS:
Detection Zone: 14 twin beam
Warm up period: approx. 30 sec
Adaptor:
Input AC 220V 50Hz, AC 110V 60Hz
Output DC 16V 300mA
Operating Temperature: 10°-50°C
Power Output: 11V to 14V DC
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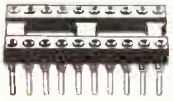

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P10630	20 pin	$2.20	$2.00
P10632	22 pin	$2.40	$2.20
P10634	24 pin	$2.60	$2.40
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P10644	40 pin	$3.00	$2.70

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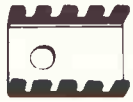

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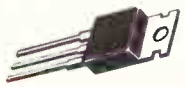

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7912UC	$0.60	$0.55
7915UC	$0.60	$0.55
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Errors and omissions excepted.

MasterCard VISA

Paul Budde reports on the local and international position of Videotex services

Videotex News

Encyclopedia On Line

The electronic edition of Grolier's Academic American Encyclopedia is available on Genie, the domestic network service for PC users operated by General Electric Information Services Co. The online encyclopedia, which includes more than 32,000 articles, is available on Genie for US$49.95 for a one year subscription, US$29.95 for a six month subscription and US$7.50 for one month's use. Users then pay standard Genie access fees of US$5 per hour.

New Zealand Banks Are Using Databank

Databank serves the four major trading banks in New Zealand and has been offering those institutions a host of online services using a proprietary Base 24 videotex network which runs on Tandems non-stop computers. Participating banks would then offer those services to small businesses; the fishing industry, for example, uses shipboard terminals to monitor market developments.

New US gateway software, however, will let Databank offer its services as a gateway from the New Zealand Post Office's nationwide Prestel based videotex network, which will likely launch later this year.

NTT PC Center To Connect To IP's Computers

The Nippon Telegraph and Telephone Corporation will continue an experiment using an NTT personal computer communications center connected to Information Providers' computers. NTT started the experiment on electronic mail and bulletin board service last November. NTT plans to connect its center computers to IP's computers to expand services and increase participation.

CAPTAIN Information center, a public Japanese videotex service, will be the first to be connected this month. Users will need CAPTAIN communications software to use this service. The ANSER service, the second to be connected, will allow users to see balance sheets and allow banks to send transfer and dealing notices.

Multi-Display Videotex From Sony

Sony has unveiled its Videotex Multi-Display System, an audio visual presentation system, which can be used for trade show exhibits and business presentations. MDS combines NAPLPS graphics and video and up to nine monitors using Sony's new VTW-1120 control software. The system is now marketed in Japan and in the US. A five monitor system with software, videotex workstation, videotex decoders and videodisc players will cost about US$20,000.

Cable Shop Starting Advertising Trial On Viatel

Videotex is not an advertising medium in the conventional sense. Users do not browse through Viatel, they look for specific information. Cable Shop, leaders in using Viatel as a direct marketing tool are starting a limited trial with conventional advertisers on the new media.

Important pages in the data base, such as news, will have ads on it. Cable Shop will closely monitor the usage patterns in order to find out if conventional advertising also works on this medium.

So far, Cable Shop has been very successful with their Informercials on Viatel. Over 100 companies are presenting a combination of information, news, special services and advertising messages (Informercials) to the now 23,000 users on Viatel. Cable Shop is in Viatel's top five of most accessed services.

More Data Bases for Prestel Education — UK

A data base containing over 3000 pages of information about micro-electronics and special education is available on the Prestel Education Service.

The Special Education Needs Data Base (SEND) provides teachers, schoolchildren and administrators with valuable information on the types of software, hardware and micro-electronic devices available. In addition, the new data base includes all the latest news and developments relevant to special education, including: information on forthcoming major conferences, courses, and exhibitions and relevant books, magazine, and other publications.

Free Modems For Schools

British Telecom is to match the Department of Trade and Industry's offer to Local Education Authorities of free modems for secondary and middle schools with the offer of six month's unlimited access to Prestel Education for only £40.

This means that for only £40, the cost of six month's subscription to Prestel Education, schools accepting the free modem offer will have unlimited access to all Prestel services.

World Expo '88 Information on Viatel

Viatel users can obtain instant information on World Expo '88 through Telecom Australia's Viatel service. Telecom Australia is World Expo 88's supplier of telecommunications products and services.

Through Viatel, subscribers have access to 100 pages of up-to-date information on progress of the $500 million event. Topics include corporate and international participation, entertainment, special events, ticketing and marketing. Subscribers can communicate with the World Expo 88 Authority through the Viatel message system. They will also be able to buy tickets through Viatel using credit card facilities.

Electronic Mail Club

Suppliers and users of electronical services have founded an international association in Paris. Their primary aims are to secure better services between Europe and the US, and support for the X400 standard.

Some 16 European countries are now serviced by E-Mail. However, there are no more than 100,000 users across Europe, which is not an overwhelming number. By contrast, the US now has several million E-Mail users.

This item contributed by Paul Budde Communications, PO Box 372, Roseville 2069.

READER INFO No. 164

British Telecom: A Terminal For Electronic Yellow Pages

British Telecom (BT) is considering selling a low-cost (around £50) terminal as part of its Electronic Yellow Pages (EYP) service, to be launched in 1987. BT — and not Prestel — would be responsible for this program. EYP will be accessible by both communicating and Prestel terminals. BT could well opt for a bi-standard Prestel-ASCII terminal to help boost the Prestel (80,000 subscribers) and ASCII/TTY communications market in the UK.

On Line Growth

The on-line market has seen a dramatic growth over the last couple of years. In 1980, there were 400 data bases produced by 221 organisations and available through 59 host computers. Now there are 3169 data bases produced by 1494 organisations and available through 486 host computers.

Edutel On Cable Shop

Represented in the service providers data base in Edutel are:

★ Australian Council of Education Research (ACER);
★ University of New South Wales;
★ R.D. Creation — education software;
★ Supertext — publications;
★ Paul Budde Communication — publications, training.

An extensive directory lists most of the educational users on Viatel. Educational organisations are invited to profit from Edutel's special rates to provide information on Viatel.

Educational users are also invited to list their names in the Edutel Users Directory.

Videotex Service From Visionhire

With their data base on Viatel, Visionhire is now showing their leading position in the videotex equipment market. Apart from product and service information, new services are added. You can rent a PC, book a VCR for the weekend at a Visionhire branch anywhere in Australia and buy printer consumables such as ribbons and paper. An extensive news service will keep Viatel users up-to-date on specials, new products and other workthwhile news. The Visionhire data base will be marketed through Cable Shop on 34545.

Photo Classifieds In The US

NuMedia Corporation announced three new installations of its Cable Ad Channel System (CACS). This System is a total photoclassified system incorporating production, delivery, trafficking and billing in one fully integrated package.

Using Phototex technology, developed by British Telecom and NuMedia Corporation, CACS enables operators to quickly product high-quality photoclassifieds, automatically schedules the ads, produces traffic and billing reports and maintains a complete invoicing and income data base.

Micronet UK Available In Israel

Following Micronet's (UK) (telesoftware delivery through videotex) involvement in GEC's recent successful bid for the Italian videotex network, their parent company, Telemap, has just signed a licence agreement with Elnet of Tel Aviv in Israel.

The agreement relates to the electronic distribution of 340 Micronet telesoftware programs for the Acorn BBC, Sinclair Spectrum, and Commodore 64 microcomputer on Elnet's nationwide Israeli videotex network. While the Israeli videotex market is still quite small, it is fast growing, enthusiastic and well informed.

Holidayfinder

A domestic version of Prestel Travel Trade Services popular *Holidayfinder* (UK) is now in full operation. The new service covers availability in departures on a rolling six week's data base. Commissionable UK holidays, inland boating, bargain breaks, holiday centres and British coach tours are also featured.

Mini Gateway On Prestel via IBM PCs

Icams (UK) has developed a Prestel gateway system for IBM PCs and compatibles. The package includes three components: a QNX multi-user operating system (similar to Unix), an X25 board and the Prestel 2.3 gateway protocol. One of the advantages of the Prestel gateway 2.3 is that the Information Provider can store the mask of his data base on Prestel.

The package is less than ¼ of costs for a minicomputer gateway system. A system based on the IBM AT can handle 16 simultaneous calls on a PC that front-ends a mainframe with a 3270 or VT100 terminal emulator.

Teletext Still Going Strong In The UK

British teletext is now available in about 4 million homes reaching a potential audience of 10 million viewers. Well over 8 million adults (19% of the UK's adult population) claim to watch Oracle teletext, half of them tune in at least once a week, according to a new market study by Oracle, independent TV's teletext operator.

Oracle has a daily audience of 2.5 million adults, 51% between the ages 15 and 34, indicating a youthful tetext audience. Only 6% of the teletext viewers are age 65 and older. More than 20% of the users access Oracle for more than 15 minutes per day. The most popular sections remain the same as they have been since Oracle began: news (which 46% of users access), TV program guides (41%), sports (41%) and weather/travel (31%).

New Health Care Network — Canada

The Canadian Hospital Association (CHA) and the member companies of Telecom Canada, have unveiled a new intelligent health care network "Info-Health". This network, provided by the CHA using Telecom Canada's Net 2000 service allows health service executives and health care professionals to send electronic messages, search for computerised information, hold a data conference and perform other information management functions from a single communications link.

AUSTRALIAN MODEMS

Jon Fairall

Sendata's Quad Security Modem has a host of up-market features. It can do all the major speeds between 300 and 2400 baud and transfer data to the host terminal at 9600 baud. Its fully Hayes compatible so that control can be exercised from the terminal. It has a data encryption facility that uses a functionally unbreakable eight byte key word. The software allows the creation of a twenty number phone directory, with log-in codes, and more importantly, can intelligently assess the condition of the line and do error correction.

READER INFO No. 110

The modem industry is alive and well and mostly Australian.

MODEMS have been one of the success stories of Australian manufacturing and marketing. Depending on your definition of Australian manufacturing, up to 80 per cent of the data traffic on local telephone lines comes from modems that originated within the country. Given the desperate state of manufacturing in general, and electronics in particular, its nice to be able to report on one industry at least that is positively blooming.

The success of the local modem industry reflects a growth in the use of computers and data communications worldwide, and in Australia in particular. In the last three or four years, the small computer has really arrived as an affordable business tool. The key word is "affordable". As prices have come down, the scope of the market has increased out of all proportion, to the extent that it is now rare to see an office without at least one pc.

With an increased penetration of computers into business has come an increased desire and need for communications. Once again, the decreasing cost of communications, both in capital costs and in the ongoing costs of renting time on the Telecom network has made it cost effective to link computers together.

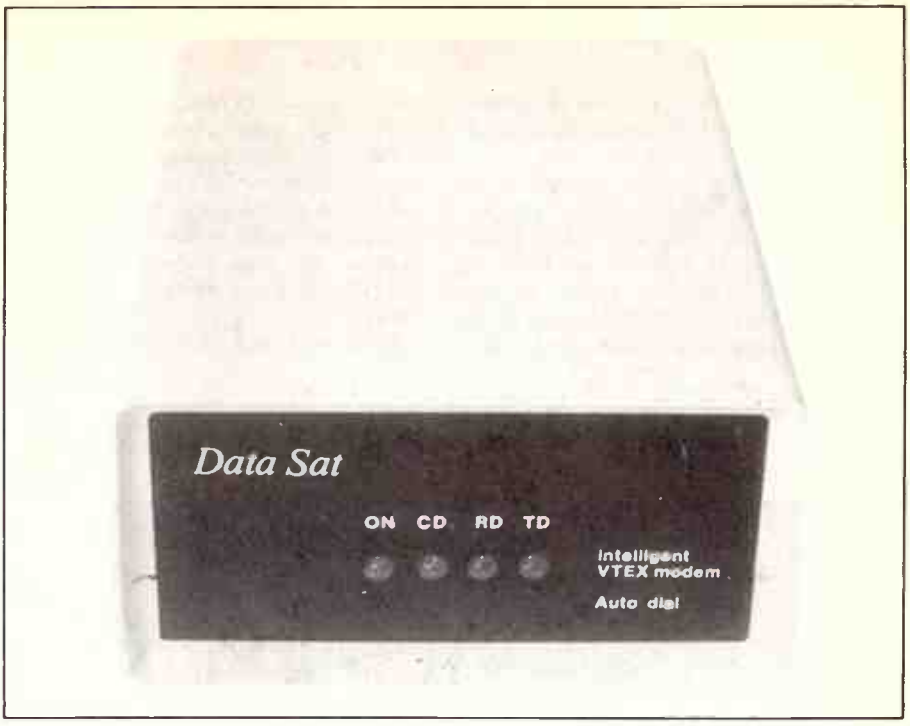
Biting The Bullet

According to Mike Boorne of Banksia In-

formation, the big driver is simply the knowledge base of the community. Within the last two years or so, businessmen have come to accept that computer communications is viable and cost effective, and have moved into the market in a big way. Once they bite the computer bullet, business people readily accept the ideal of linking computers together and demand data portability.

Initially, this can mean as little as making sure that one can transfer information by transfering floppy discs. Later, it involves a need to be able to transfer information without even this degree of manual intervention. In many cases this will involve Local Area Networks connecting computers together in one building. Increasingly, it also means bringing the branch office on line, and indeed, accessing electronic services provided by others.

According to Boorne, a big factor in this education process has been Telecom's videotex service, Viatel. Whether or not companies have actually used Viatel, its existance has proven to many people that data communications is both practical and here to stay.



Datasat produce this VTEX desk modem. It is one of the more affordable smart modems, with full Hayes compatablity to allow software control from the host computer, in addition to auto-dial, auto-answer, and auto-disconnect. It sells for $720.00

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It has also been a springboard for many people into more serious use of data communications. Interlink's Rick Steilrein was one of the first to turn Viatel into a business by offering special software packages on the network. It wasn't long before he was also producing the hardware to go with it.

Telecom

None of this explains why Australian industry has been particularly successful at making modems. After all, there is huge demand for telephones, computers and a host of other products in the communications area alone, but it is almost all produced overseas, or produced locally by one of the big seven foreign controlled companies.

There are a number of reasons for this state of affairs. Central to the whole thing is Telecom Australia, and its policies on connections to its telephone lines. By international standards, Telecom insists on high

Netcomm's Trailblazer is one of the fastest locally produced modems, running at up to 18 000 bits per second. It uses a multi-carrier modulation scheme, advanced digital signal processing and packet technologies to dramatically increase the throughout using ordinary Telecom lines. A unique feature is real time analysis of the bandwidth of the line, which determines the usable carriers, how many bits per second given the line conditions and what data flows exist. In fact, it can send data only in the good parts of the line and completely ignore impared frequencies.

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standards. Importers of communications gear argue it is too high, and their plaints receive all due attention in the media.

Generally, Telecom has two major requirements that seems to cause problems. One is in line isolation. Telecom insist that the phone line be well isolated from the equipment. This serves to protect the network from faults that might develop in the equipment, especially faults that might allow the mains to contact the line.

The other thing Telecom controls tightly is the output from the modem, which must be sufficiently low, so as not to cause crosstalk problems in cables. This problem can be especially acute in data communications because the high frequencies percolate rather easily across into neighbouring telephone circuits.

It is a moot point whether Telecom is correct to insist on these standards. Few overseas phone companies do. Yet there is substantial evidence from overseas, and even locally, that inferior data communications products can cause havoc in a telephone system. To this extent, Telecom is probably correct, and the fact that British and West German telephone companies are upgrading their standards is perhaps proof of the point. The US market, typically, has adopted a laissez faire policy, as have most of the Asian countries. The result is probably cheaper modems, but at the price of a certain degree of interuption to the network.

Perhaps more importantly, however, this

sort of regulations allows the local modem industry to prosper. Sendata's Andy MacKay describes it as a "fringe dwelling" industry as a result. It lives in the shadow of Telecom regulations and the fashion of computer users. Because of Telecom regulations, US and Asian manufacturers can't compete legally in the marketplace with modems developed at home.

In fact, the modem industry seems to be a text book case of how to provide protection for an industry without at the same time

What the standards mean

In order for modems to talk to each other it is necessary to have standards on speed and the characteristics of the signal. These standards are set up by one of two committees: the CCITT or Bell. CCITT is used in Australia, Europe and most of the rest of the world. Bell is a US standard, and restricted to the Americas. By and large, the standard are compementary, using the same Baud rate, but different frequenices. In the table below the Baud rate in the return direction is table first, then the rate in the send direction.

CCITT V21	**300/300**
Bell 103	**300/300**
CCITT V22	**1200/1200**
Bell 212a	**1200/1200**
CCITT V23	**1200/75**
CCITT V22bis	**2400/2400**
CCITT V26	**2400**
Bell 2400	**2400**
CCITT V27bis	**4800 fallback 2400**
CCITT V29	**9600 fallback 4800**
CCITT V32	**9600/9600**
CCITT V35	**19200/19200**

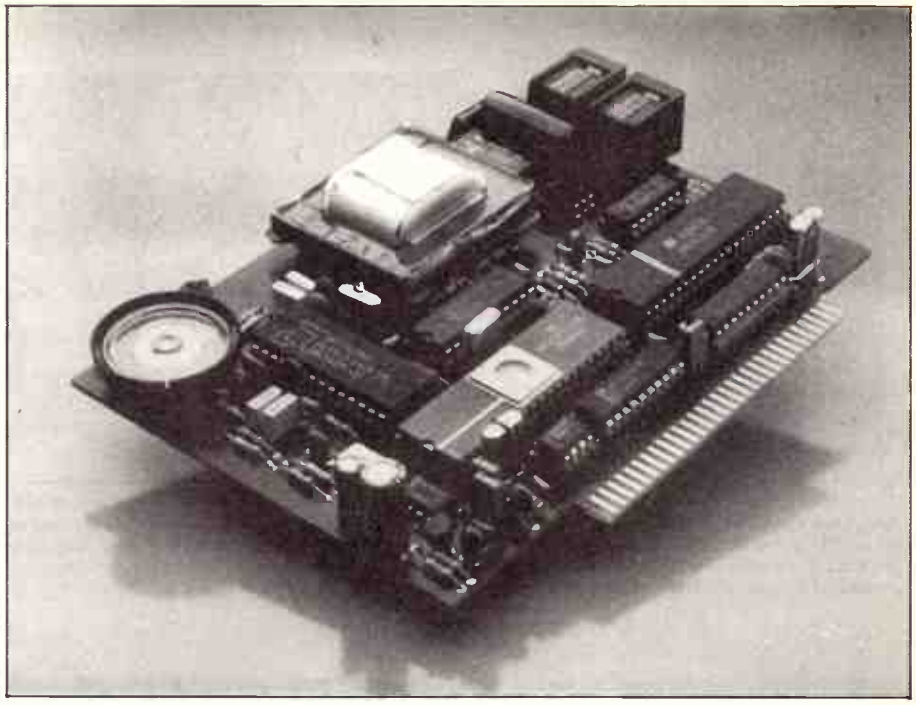
making it flabby. It is just big enough to be fiercely competitive, so costs have been kept down. Its also an industry driven by technology, so its controlled by engineers with an eye on keeping one step ahead of everyone else.

The Industry

The modem industry consists of something approaching 20 companies, from giants like Databridge, down to small two man operations like Maestro and Datacom. What links them is the possibility of rapid growth, and a competitive edge that ensures the latest in technology is applied rapidly to the product.

Beyond this, they are a diverse bunch. Some are single product companies, some restrict themselves only to modems. Some, like Rosser Communications, offer modems as part of a package that includes other data products or services. Some companies own and control the entire manufacturing process, doing their own R and D, their own manufacturing and then selling direct to the public. Mostly, they subcontract part of the work to other companies, or alternatively, sub-contract work from other companies.

For instance, Datacraft has a large and impressively modern factory in the outer suburbs of Melbourne, with a sophisticated



Nice Computer claim this is the smallest in-modem developed anywhere in the world for an IBM-PC or clone. It is particularly intended for use in the new generation of small portables and laptops which have limited space. It conforms to both Bell and CCITT standards at 300 baud and does the Viatel 1200/75 standard as well. It provides auto-dial, auto-answer, and auto-bauding facilities. It sells for $849.00 retail.

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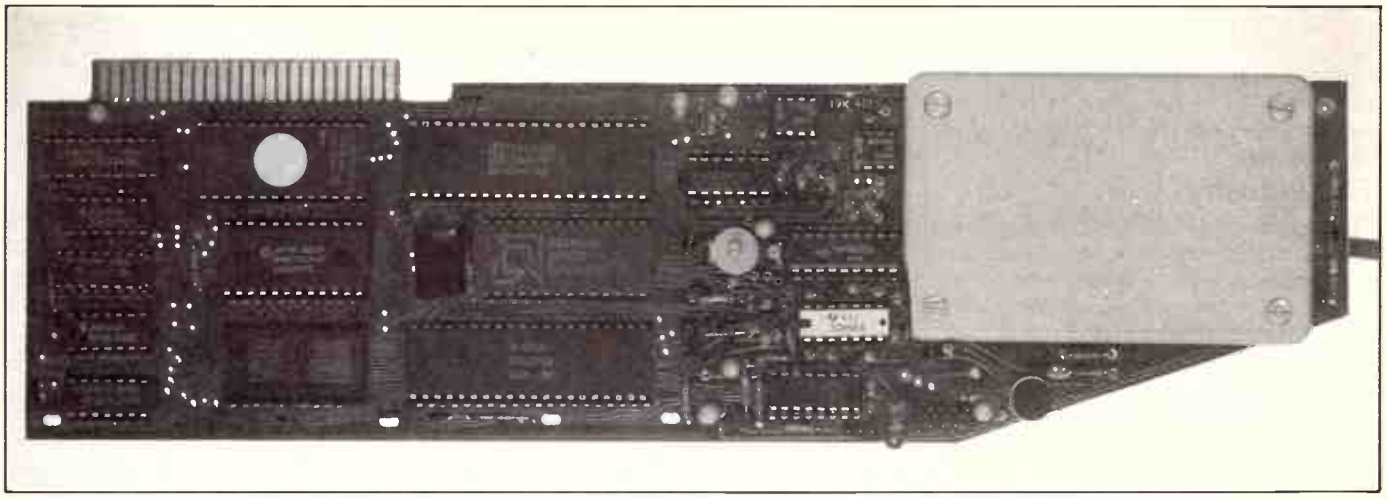

A typical in-modem from Automatic Ice. This one is designed for the Apple 11and 11E. It is purpose designed to connect a computer to Telecom's Viatel network. It also offers 300/300 baud for communicating with bulletin boards, and an inverse of the Viatel standard: 75/1200. To do all this requires 128k in the EPROM. Notice the high degree of integration on this card, required to jamb the many complex functions into a package this small. The line interface is under the cover. For years Telecom withheld permission for this sort of architecture because of the perceived danger of mixing telephone lines and mains.

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assembly line. Since the modem part of the business is not large enough to support such an investment, the line is also used to manufacture job lots for other manufacturers. On the other hand, some companies like Netcomm do no board level assembly themselves, passing the work on to other concerns, but they do all their own in house testing and the final assembly.

In many cases, marketing modems amounts to either chasing big contacts, or ensuring that one has the correct distributors. Netcomm hs a much envied contract with the big software company Imagineering for instance. The small Gosford manufacturer Maestro uses the Newcastle based

Micro-Educational in a highly successful mail order operation.

The picture starts to get a little more murky when part of the job is contracted off shore. An extreme case of this is the Blitzer modem from Banksia Information. This is made by David Hartly, an expatriate Australian livng in Hong Kong, and sold in Australia by Dick Smith Electronics, itself owned by the multinational retailer Woolworths. Both companies make much of their Australianess, which raises the ire of genuine local manufacturers.

In some cases it raises so much ire that the only resolution is to meet in the high court at noon, lawyers at the ready, a solution that satisfies nobody. Dataplex was recently on the receiving end of just such un-

pleasantness from Netcomm. The problems, and the legal gentlemen, start to make their appearance when contracts which specify Australian content are up for grabs.

In truth, there appear to be shades of grey, no matter how high the flag gets raised. Since there is no local component industry, all modems contain at the very least, foreign components. In some the board is made overseas as well. In a few cases, the board stuffing occurs in an Asian sweathouse, and the only Australian manufacturing is putting the board in the box and perhaps, final testing. In the case of the Blitzer, even that occurs overseas.

Pulsar's Phillip Delacretaz complains bitterly when such products compete equally with his own for locally made status. Pulsar's overseas content is strictly component level. In fact, Delacretaz would like to see Telecom tighten up even further its regulations on the connection of foreign made products to the network. He argues that had Telecom taken a more vigorous line in protecting the local market, the industry would be even more developed than it is today.

World Chips

A second factor that makes the modem market a good bet for Australian industry is that the entry cost to the industry is at just about the right level. It is high enough to deter all but the most serious players, without being so high that entry is impossible.

Essentially, the entry cost is the cost of designing and building one's first modem. Avtek's Phil Gleeson estimates the cost of R and D at around $100 k per engineer per year, a figure that seems typical of the industry as a whole. Since a typical modem would probably represent six months worth of work one can estimate the cost of getting into the market at around $50 k.

Across the board, however, it tends not to work that way. Typically, modem manufacturers start out on the basis of an idea on the back of a fag packet, the kitchen bench as a workshop and lots of hope. Time and energy make up for money. This still appears to be the way with newcomers to the field like Nigel Kukulka's Datacom. Some, like Automatic Ice's Dennis O'Keefe find they can make a very nice living without moving beyond this level.

The reason that modem R and D is so ac-

cessble has to do with the trend towards placing most of the modem on a single chip. This makes the job relatively simple. Bill Bolton from Netcomm is only slightly exagerating when he says one can "connect a chip to the line with a piece of wet string" to get a practical modem. Indeed, at the most basic level, it is possible to design a modem by understanding Telecom line interfacing rules and some application notes.

However, the catch is that since every other company has also produced The Basic Modem, there is considerable pressure to add features; and they are not provided by the chip manufacturers. This is where professional R and D; engineers, laboratories, development systems, instruments, becomes really essential. Its also where the modem starts to become a product of its software and develop its own idiosyncracies.

The larger modem companies like Datacraft, Pulsar and Netcomm maintain stables of engineers to do this sort of development. It seems, in fact, that R and D on average makes up about 20 per cent of business. Products need to be replaced or updated, and it appears that at the moment, product life is about two years. Indeed, the oldest product in the industry appears to be Sendata's acoustic coupler, which was the company's first data communications product only eight years ago.

The Future

This drive to shorter product life cycles is driven by number of engines. On one hand the actual chip level technology is getting more and more advanced as integration makes itself felt. Thus accountants can see cheaper more efficient production in redesigning products. This forces costs down and gives the company an increased competitive edge. Lower costs means proportionally larger markets for modems of any given speed.

At the same time, engineers are increasingly able to produce modems of superior speed and features to satisfy the top end of the market, where price is not always the overriding consideration. Its difficult to get a slant on the features the next generation of modems will contain, since modem manufacturers are more cagey about the next model than car makers. However, we can say a bit more about speed.

Australian Modems

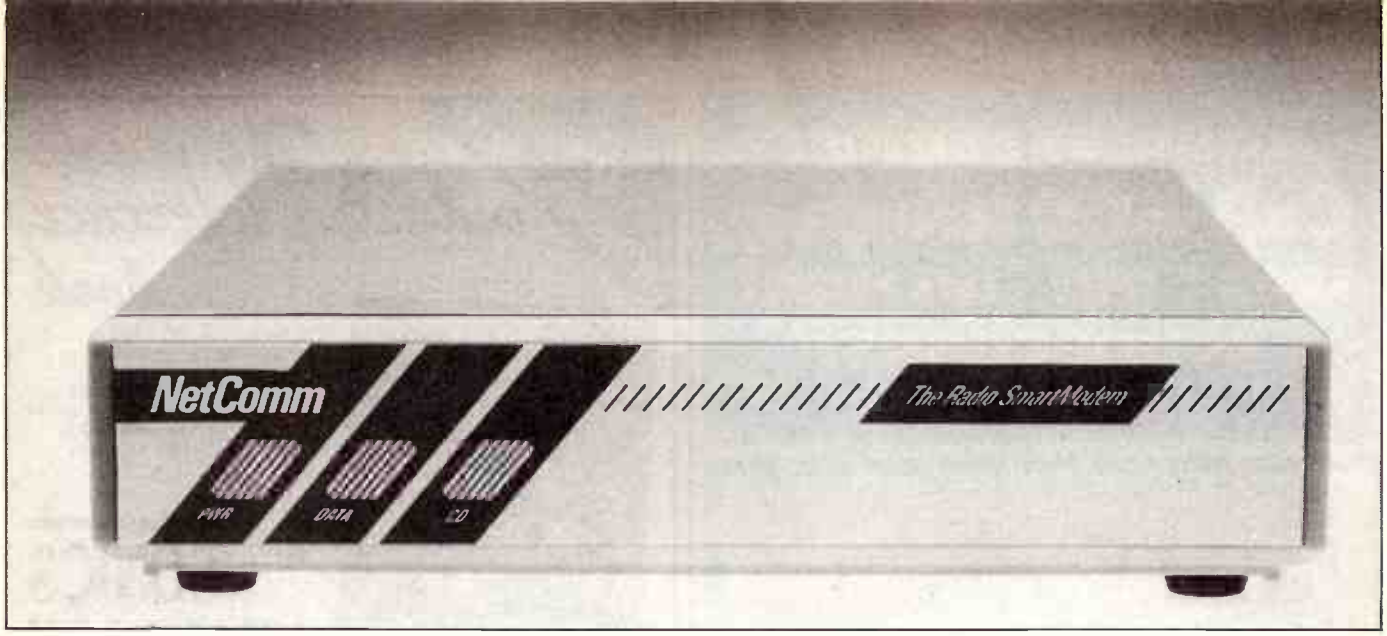
Currently, most manufacturers support the domestic marketplace with a 1200/75 and 300/300 baud modem. Many also sell 12000/1200 and 2400/2400 product to the business community. At the top end are 4800 and the occasional 9600 baud machine. Here, conventional modem technology begins to give way in the face of the impedance of the lines.

There are three basic types of technology used in the higher speed modems (above 2400bps). These are CCITT V.32, Fast Fourier Transform and CCITT V.29 "Ping Pong". All these modems use Digital Signal Processing (DSP) which is a digital process, representing analogue modulation and filtering techniques. In the past an analogue filter was built out of valves, coils, capacitors and resistors. These components were connected to obtain a desired result by simulating the filter mathametically. DSP is basically a high speed computer that simulates the very same mathematical equations, so that it has the same performance characteristics as the coil, capacitor and resistor type-filter.

V.32 is a standard specifying transmission protocols over the two wire public switched telep : network (and 4W leased line). This technique uses digital signal processing to modulate and demodulate 9600bps full duplex data transmission onto a 2 wire line. To achieve full duplex operation, V.32 specifies that echo cancellation and trellis coded modulation (TCM) is to be used which introduces a high degree of difficulty. Echo cancellation is the process where the receiver in the modem (which is attached to the transmitter output) subtracts the local transmitter signal from what appears on the line, the difference being the true received signal. This is generally accomplished using the same DSP processes used in the transmitter section. Trellis coded modulation is an advanced forward error correcting technique which significantly reduces errors in transmitted data caused by channel noise or other signal distortion. At 9600bps TCM can provide greater than 3dB increase in immunity to noise over uncoded (non TCM) schemes, minimising the need for re-transmission and so permitting greater data throughput. Trellis coded modulation (with some memory) allows vastly superior satellite or overseas telecommunications.

Beyond this, and a glitter in the eye of many a modem designer, is the promise of fast fourier transform (FFT) chips.

FFT is a relatively new technology (using old concepts) that is becoming popular but is not yet a standard. These units are also powerful computers solving complex mathematical models. CCITT V.32 and V.29 standards specify that 32 and 16 different phase and amplitude signals would be transmitted to represent five and four bit words respectively (ie 5 bits per baud and 4 bits per baud respectively). FFT models transmit many more bits per baud (achieving thousands of bits per transmission). FFT modems achieve this by analysing large "chunks" of data and converting this data into a frequency spectrum. The modem then performs a reverse Fourier transform to obtain an anlogue signal which is transmitted to the other modem, where a reverse process begins. A Fourier transform is a mathematical process that separates the frequency com-



A rather different type of modem is the radio Smartmodem from Netcomm. It looks just like an ordinary modem to the computer, but works over a wireless link rather than the telephone lines. It requires any off-the-shelf two way radio equipment to provide a circuit with standard voice bandwidth and it will form a fully functional data communications circuit. Noise is a special problem in this application. As a result, a special error detection and correction technique was developed. This trades errors for speed, so that as the noise level on the circuit increases, the speed at which data is transferred is reduced.

READER INFO No. 189

ponents of an analogue signal.

FFT modems transmit at a very low baud rate (4 or 5 per second) but with 2000 or 3000 bits per baud, achieving data rates in one direction only of 12000bps. These modems generally are adaptive, i.e: they utilise a slow (say 100bps) back channel to monitor performance.

FFT modems currently have two problems. The frequency response of the telephone line may be poor and hence cause errors. Alternatively when errors occur the whole packet of data (of 2000 bits or so) must be re-transmitted. With a slow back channel, throughput sometimes falls below a V.22bis modem.

A final choice for new modem designs is

a standard called V.29 Ping Pong. They use V.29 technology to achieve data rates of 9600bps in one direction (Half Duplex). Some units use 9600bps transmission speeds in alternating directions, (ping pong) with an expected full duplex throughput of 4800bps. On top of this, compression techniques are used to obtain 9600bps full duplex throughput, but this is significantly dependent upon the types of data.

Other units use 9600bps one way, 300bps the other and alternate the set up. With compression techniques added, it is possible to obtain transmission speeds of 19.2kbs one way (HDX) or 9.6kbps full duplex. These units are not so dependent on the type of data as the former because control can be maintained using the back channel. ●

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MELBOURNE TURNS TOWARDS THE STARS

Kathryn M. Doolan

In November 1987 Melbourne played host to the Australasian Society of Automotive Engineers' first International Pacific Air and Space Technology Conference (IPAC).

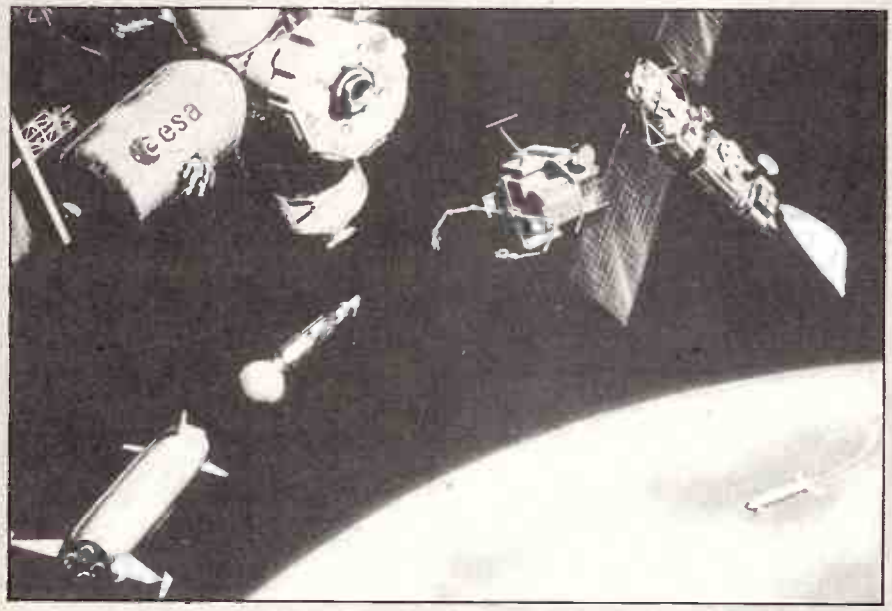
I eagerly accepted an invitation to attend the conference to find out what sort of role Australia could play in space in the 21st century, and went home disappointed. After talking to many people from here and and overseas, the promise of Australia being a potential world leader in aerospace development and technology seems to be a very empty promise.

Instead of Australian dominating the conference, it was dominated by the Americans, with the Australians running a poor second. The overall attendance was also disappointing. In a monumental act of mistiming another conference was taking place in Canberra at the same time limiting the attendance to a very low level.

In the technical sessions I found a small glimmer of hope — The Cape York Spaceport proposal. The thought of having a launching facility in Australia was enthusiastically received by all overseas attendees, especially the Japanese who badly need a launch site without their present launch constraints, which limits them to launching their rockets in two 45 day periods a year to avoid disturbing Japanese fishermen. Currently a non priority with the Federal Government, surely it is time that Australia should begin to participate in the field of space.

Popular Guest

The conference did have it's highlights. One was the guest of honour — Astronaut John Young, who has flown in space a record six times. In an astronaut career spanning 25 years Mr Young, has flown to the moon twice, flown on two Space Shuttle flights and yet sees the current exploration of space as only the beginning of things to come. It was interesting to note



The US bid to put a man permanently back in space depends on the space station, a free floating collection of modules that will provide a shirt sleeves environment for engineers and scientists. Like most other parts of the US space program it has been subject to budget cuts and arguments with the military over its function.

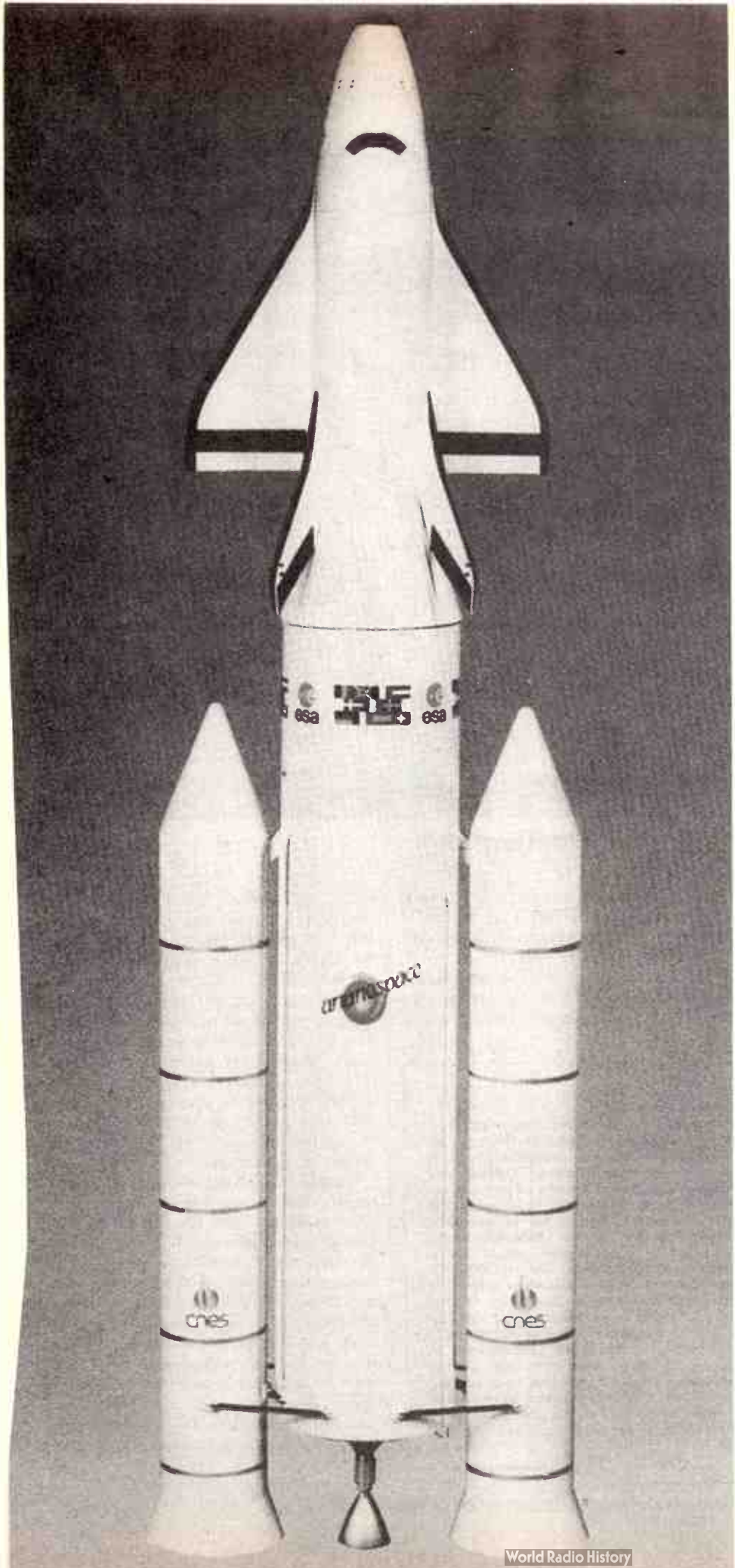
The former have resulted in the final design of the space station being substantially smaller than the original proposal, effectively half the size in fact. The original design called for a twin keel design, essentially a cube with living quarters along each vertex of the cube. The new single keel design has seen the station sliced in half, with bits and pieces hanging off at odd angles.

Arguments with the military are nothing new for NASA, but they have had added force because of the international implications for the space station. Part of NASA's operating philosophy has been to get foreigners to foot as much of the bill as possible, principly the Europeans with their add-on module Columbus. Columbus is being designed and manufactured in Europe, will be lofted by the Shuttle, and docked with the station to provide room for European experimenters.

The Europeans have been keen on Columbus, because it means a cheap way into space for them. However, they have made it clear they will have no part of a military venture in space with the Americans.

The issue has been argued heatedly on both sides of the Atlantic, with no resolution in sight. The Pentagon insists on its right to use the space station for national defence if and when required. The Europeans will not have a bar of it.

The stakes are high. To go it alone NASA may well need to do further cost prunning. The odds are different for the Europeans. They are spending one third of their space budget on Columbus. If it does not go ahead the Europeans will have to decide whether to go into direct competition with the Americans, or abandon their ambitions to manned space flight completely.



European manned flight will depend on the Hermes space plan and new improved Ariane rockets if it can't depend on the Americans.

that he refers to all things past as "the olden days", in view to his recent troubles at NASA. Earlier this year, Mr Young was fired from his position as Chief Astronaut, a post he had held since 1974. He has now been put "upstairs" at NASA with a view to oversee safety. However this post is viewed by some as a punishment for speaking out in public about shuttle safety after Challenger.

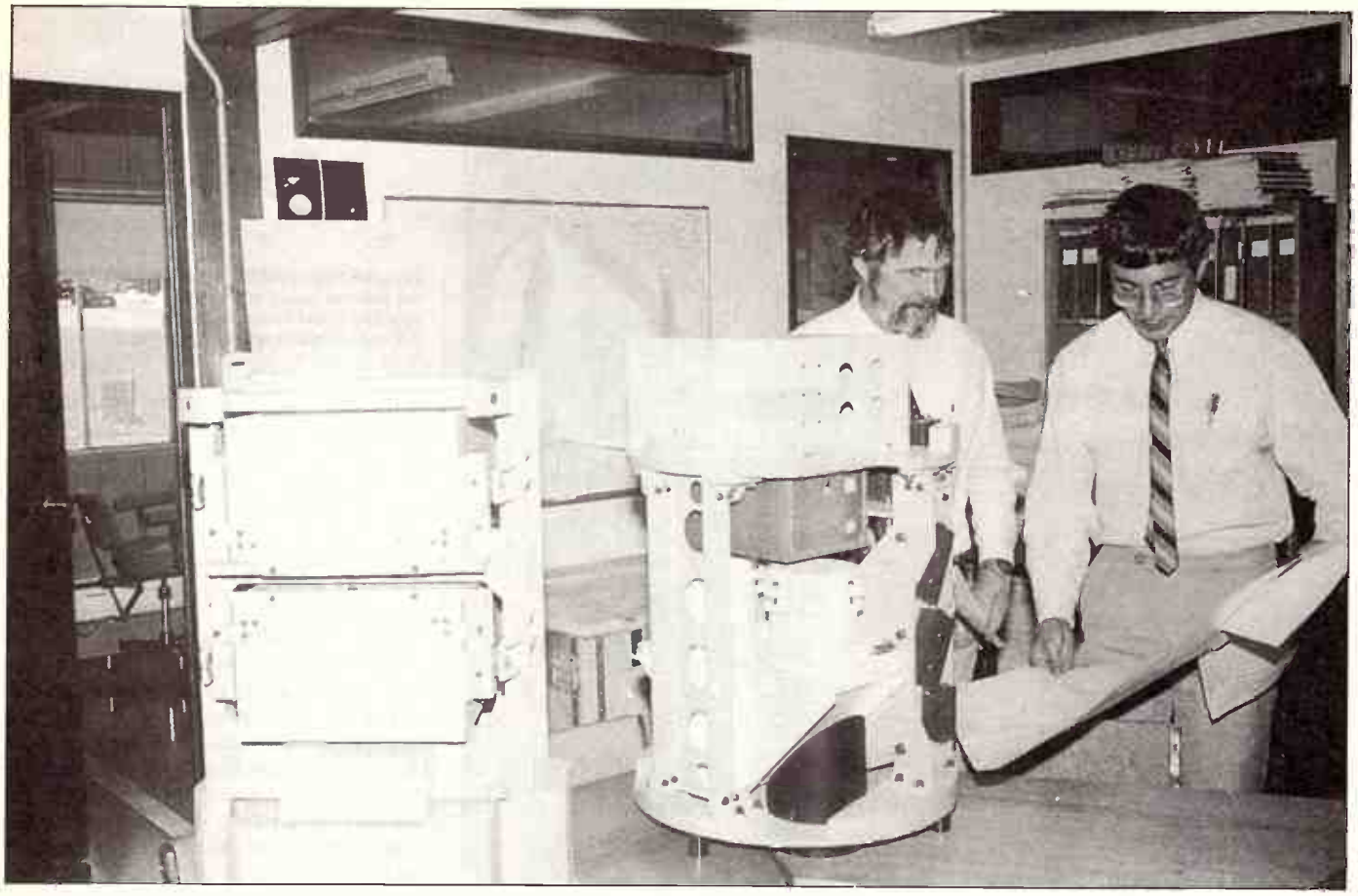
Whatever his views on that subject, they were kept carefully under wrap at the official press conference. Mr Young was forceful in advocating the need for the Americans to catch up to the Russians in most areas of spaceflight, especially in the manned field where the Russians have a commanding lead in man hours in earth orbit. Another area of much interest was shuttle safety in view of the Challenger accident and it's aftermath. Mr Young pointed out that the troublesome solid rocket boosters had been given a thorough overhaul and now are much safer to use. He pointed out that due to extra emphasis on safety, the first flight after Challenger STS 26 will probably take place in September 1988 not June.

One item that is the source of much speculation is Young's chances of another spaceflight. Before the Challenger tragedy he was slated to command the Hubble Space Telescope deployment mission, which would been a fitting end to a space career of great personal achievement. With his current fall from favour within NASA, it is unclear whether Young will fly again. Mr Young was confident that he will fly once more but other NASA officials stated thta this is a slim possibility. It will be interesting to note the crew make up when it is announced, possibly late next year.

With much discussion on NASA's future after Challenger taking place, it was not surprising that a technical session on the Space Station was held.

Space Station

Viewed as NASA's "next logical step", the station is due to be constructed in the



One of the few Australian space enterprises is Auspace's Endeavour experimental X-ray telescope.

next decade. Announced in 1984 by President Reagan, the space station is seen by some as an equal achievement to the massive Apollo program, by others as too little too late. Currently it is a political football due to the granting of construction contracts. Nevertheless the staff of the Space Station Office have been quietly making plans and bringing to fruition a technically complex program. Construction is due to commence in 1992.

The Space Station will be an international affair with Canada, Japan, the European Space Agency making major use of its facilities. The Europeans have developed a module called Columbus that will dock with the station. It is also possible China, Australia and Brazil will play smaller roles. The station should be one area in which co operation in space will bring rewards back to Earth. Apart from assessing long term space flight, experiments in materials processing, medicine, astronomy, physics, and the effects of zero gravity on possible commercial products will make up the bulk of the work carried out on the station in it's first five years of continuous settlement.

Getting back down to earth, I found these visions of achievement coupled with great indifference on the part of Australian private enterprise. It is no wonder Australia will continue to be led instead of leading in what will be an industry of vital importance. With the Federal government content to let private enterprise do the work and with private enterprise content for the Federal government to do the work, Australia in Space will be a pipe dream, even for the next generation. Currently it can be said that Australia will only leap into space riding on another country's coat tails, or not at all. ●

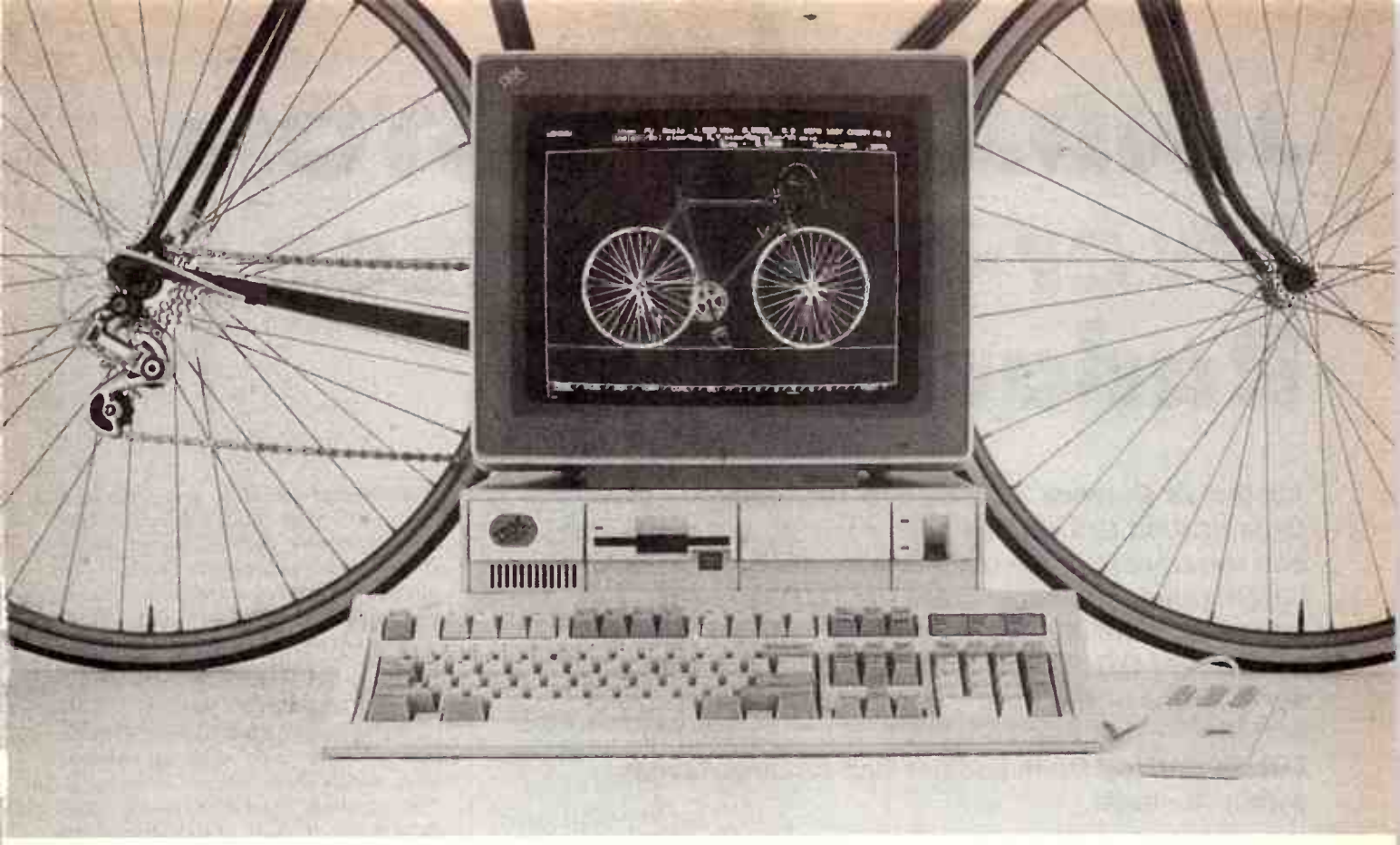
Spaceport Prospects

For the past few months Queensland politics have been in a state of flux. Through all the controversy however plans for the Cape York spaceport have gone ahead. Most recently submissions have been received from companies interested in either building the spaceport or providing the equipment for it.

Clearly the plan has excited attention for a large number of companies here and abroad have thrown their hat into the ring. One of the most interesting groups is the Cape York Space Agency (CYSA) located in Brisbane. CYSA consists of 64 member organisations, 59 of which are Australian. The names include TNT, Unisys, MIM and many others. CYSA have offered to carry out the feasability study into the project which is estimated to take 30 months and will cost between 4 and 5 million dollars US.

Hawker De Haviland has registered an interest in the project through Mr Stan Schaetzal who provided much of the original inspiration behind the Cape York plan. Readers of ETI will recall that Mr Schaetzal later admitted that he had pulled 'a bit of a swifty' over Premier Bjelke Petersen over whether the spaceport would be a profitable operation. De Havilland's submission emphasises the company's size and interests in Australia. Aussat is also keen to participate and emphasises its contacts in the government.

Assessing the final participants is going to take some time and a final decision is not expected until around February. The Queensland government hopes that much of the selection work will be done by the private sector.



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JINDALEE — DSTO's Over-the-Horizon Radar Project

Australia's Defence Science and Technology Organisation (DSTO) has been carrying out a research and development project into over-the-horizon radar (OTHR) since the mid-1970s. The DSTO project, known as Jindalee, has recently concluded, having shown that OTHR provides a capability for wide-area surveillance of the northern approaches to Australia and that design and construction of operational OTHRs derived from Jindalee can be undertaken within Australia.

D. H. Sinnott

On the basis of DSTO's work, the government has recently announced agreement in principle to the establishment of a network of OTHRs for wide-area surveillance of the northern approaches to Australia. The total projected cost of establishing the network is $500M (1986 dollars) and the initial financial commitment has been made to allow work to proceed. The engineering of an OTHR network is a challenging national enterprise to be undertaken by Australian Defence industry. It calls for the development of a close relationship between the OTHR research and development community within DSTO, defence procurement agencies and defence industry.

Concepts

The concept is an inherently-simple one and is illustrated in figure 1. As in any radar, a signal is sent out from a transmitter but, in contrast to most radars, the signal is reflected by the ionosphere before illiminating a target area on earth. Objects in the target area scatter the incident radar illumination in all directions. Most will be forward-scattered from the ground or sea. But a small amount returns via an ionospheric reflection path to a radar receiver as shown in figure 1.

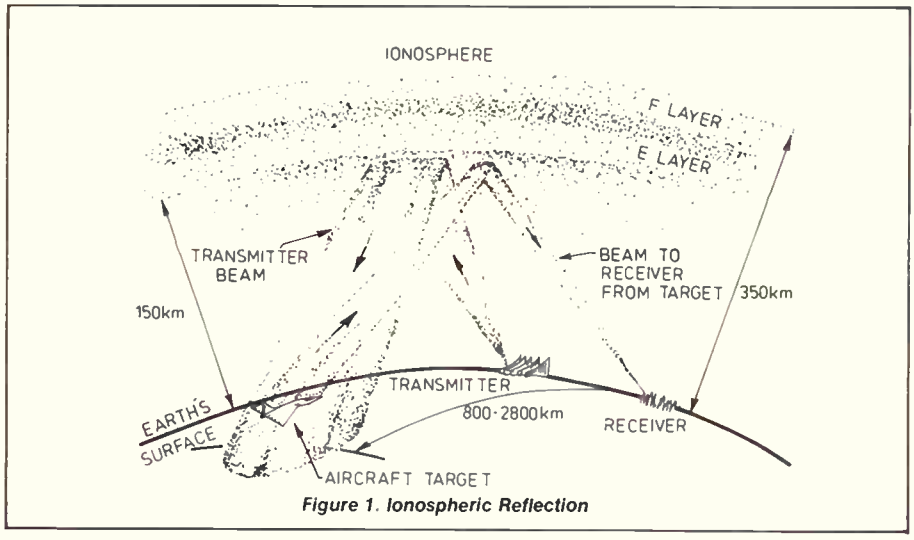

Figure 1. Ionospheric Reflection

The concept seems so straightforward that it is easy to overlook the serious difficulties in turning such a concept into a militarily-useful wide-area long-range surveillance tool. A review of these difficulties provides a useful framework for introducing the technical description of Jindalee.

The Ionosphere

The ionosphere is what allows OTHR to operate; it also provides an ever-present source of difficulties.

For signals in the HF band, the ionosphere as the property of refracting waves incident upon it so that they may be returned to earth as if reflected. The effective height of reflection, the "virtual height", is somewhat above the height of ionospheric refraction, as indicated in figure 2. For a given frequency, there is a minimum range of illumination. Signals launched at angles of elevation higher than those corresponding to this minimum range are insufficiently refracted and pass through the ionosphere rather than returning to earth. Inside this "skip zone", ionospheric propagation is possible only by decreasing the frequency; at lower frequencies, greater ionospheric refraction occurs. Just behond the skip zone, illumination is strongest.

Thus, crudely speaking, increasing frequency gives increased range at which illumination is provided and the OTHR operator should seek to put the skip-zone boundary just short of the range he wishes to survey. In order to provide for flexibility in range, flexible frequency selection is required and the total rf bandwidth within which the system may be called upon to operate is typically 5 or 6 to 1. For operational reasons, it is desirable to maintain a minimum skip distance of about 1000 km so OTHRs are not designed to use frequencies right down to, say, 2 MHz, for which the skip distance is essentially zero.

But, in addition to the range/frequency operational linkage which the ionosphere implies, there is also a problem of changes to the ionosphere. The ionosphere is a very complex medium, subject to variations as a function of geography and time.

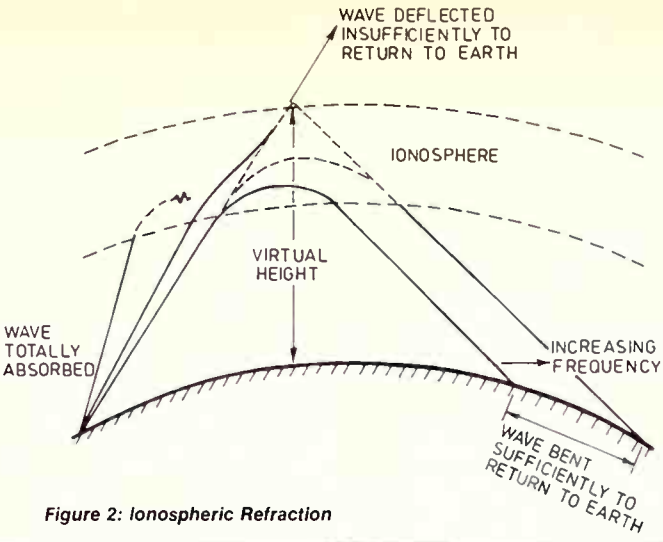

Figure 2: Ionospheric Refraction

Fundamentally a result of interactions between the earth's atmosphere and solar radiation, the ionosphere is affected by changes to both. Among the influences of the sun are the day/night cycle, seasonal variations, sunspot activity, and unpredictable solar behaviour such as flares. The atmosphere influences the ionosphere through high-level winds and wave effects. In all, the ionosphere is predictable only in its gross features and real-time monitoring of the ionosphere is necessary in order to ensure that the best frequencies and radar parameters are used at any given time. The Jindalee OTHR uses a complex frequency management subsystem, incorporating ionospheric sounding and spectral surveillance, which determines optimum frequencies in real time.

Signal Processing

Quite apart from the difficulty in using the ionosphere as part of the radar path, the sheer distance the radar signal must travel adds to the problems in implementation of OTHR. Whereas a typical microwave surveillance radar may be designed for a maximum range of perhaps a few hundred kilometres, an OTHR is required to operate at distances an order larger. High power transmission, a narrow transmitted beam and continuous wave transmission (frequency modulated continuous wave — FMCW) are used by Jindalee to maximise sensitivity.

As radar signals fall off as the fourth power of distance between radar and target, the returned signals are exceptionally weak and great sophistication is required in order to extract the signals from radio noise and interference. Worse, signals scattered from the target are very small compared with those from the area of sea or land illuminated by the radar transmissions. In figure 1, most of the radar energy returned will be clutter from the sea or land with only a very small contribution from the target. A ratio in power of several million to one against the target return is typical.

Separation of signals from clutter on the basis of doppler is thus essential. Processing, matched to the FMCW waveform by a multi-dimensional Fourier transform, is realised by digital fast Fourier transforms. The processing load is substantial — even for the developmental Jindalee system, the pre-detection average real-time processing load is about 30 MFlops. At the time the Jindalee system was planned, processing hardware was not available to satisfy the requirements. As a result, a major part of the project was the construction of a sufficiently powerful and flexible processor and associated memory. Without this development, there is doubt that the Jindalee project would have succeeded.

Angular Resolution

For adequate resolution in any receiving or imaging system, an aperture of many wavelengths is required. Wavelengths used by OTHR tend to be of the order of 20 m (15 MHz), so a 100 wavelength aperture, for 0.5 degree resolution (17 km at 2000 km) at this frequency calls for an antenna 2 km wide. Clearly an electronically scanned array, rather than a reflector or lens, must be used and on a cost basis a one-dimensional array must be accepted. An obvious consequence of such a physically large aperture requirement is that a large amount of real estate is necessary for an OTHR receiving site and extensive site works and cabling are required. For Jindalee, over 200 km of buried coaxial cable was installed. Some 15,000 mercury-wetted relays are used at the subarray level in beamforming and steering, under computer control, the 462 receiving element-pairs which comprise the array.

Signal Sources

A major reason that the exploitation of OTHR in Australia and the USA has been largely a phenomenon of the 70s and 80s is that earlier attempts floundered for want of sufficiently good signal sources. Very stringent requirements on noise and stability must be met by signal sources providing the transmitted and local oscillator signals. It was not until the early-60s that synthesised signal sources of the necessary quality became available.

A landmark, but largely unreported, experiment was carried out by scientists of what is now DSTO in December 1965: ionospherically-transmitted signals from St Kilda, SA, were received and compared with locally-generated signals at Broome, WA. Phase comparison resulted in a Lissajous figure on an oscilloscope and confirmed both that the ionosphere was sufficiently stable, on a scale of seconds, for OTHR operation and that then-available signal sources were adequate in terms of stability and noise.

The quality of signal sources continues to play a fundamental role in OTHR; the detection of target returns against the much larger clutter return requires exceptionally low-noise output from the signal source. A requirement for suppression of wideband noise of better than 100 dB with respect to the carrier is typical.

Tracking and Display

Traditionally, radars declare detections by setting a threshold on received signals. Setting of the threshold is a compromise between low probability of detection (threshold too high) and excessive false alarms (threshold too low). Detection then passes to a tracking system which associates successive detections to establish tracks. In Jindalee's noisy and clutter-prone HF environment, a threshold level which gives an acceptable detection probability results in a level of false alarms which is intolerable to conventional trackers. Jindalee researchers have developed new approaches to tracking which are particularly powerful in situations where the environment is noisy and cluttered.

Having detected targets and associated them into tracks, the system must present multi-dimensional data to operators. Jindalee experience has led to the use of a multi-level display format. At the highest level, targets are shown on a geographic display but the operator has the option of calling up lower-level displays in which selected cuts of the multi-dimensional space are presented (eg, intensity map of range and doppler, range-time plot in a given direction).

Project Timescales And Costs

It is significant to note that the aboriginal word "Jindalee' means "bare bones" and, from its inception, Project Jindalee has been characteristed by maximum cost-effectiveness. Certainly contact with US OTHR programs and loan of some equipment has avoided some potential risks and costs but management of the project

Jindalee

through its two stages has aimed at minimising cost and time overruns, despite the newness and challenge of the technology. Figure 3 shows the timescales and costs of the project. A recurring feature of project planning has been evaluation of one phase before commitment of substantial resources to a subsequent phase. A major decision point of this type came at the end of the technology demonstration Stage A radar: on the basis of results, it was decided to embark on the ambitious Stage B, with a budget almost 6 times that of Stage A. Had Stage A not succeeded in establishing the feasibility and usefulness of the technology, the project would have ceased at that point.

This cautious approach could doubtless be criticised as extravagant in development time, with the benefit of hindsight. But against the scepticism of the times in which the project was conveived and the very limited base of OTHR experience, what is now seen to be a cautious, conservative and cost-effective approach was then considered an audacious proposal committing a significant proportion of the DSTO budget to an untried concept. It is a great tribute to those within DSTO, farsighted enough in the early 1970s to fight for the project, that Jindalee has succeeded in proving that OTHR does work in the Australian region and offers unique advantages in wide-area surveillance. The recent Government decision to embark on operational deployment of OTHRs vindicates the faith of these earlier scientists and managers.

Jindalee Equipment Overview

OTHRs generally use separate receive and transmit sites, as indicated in figure 1, to allow the transmitter to operate continuously, rather than in a pulsed mode as in conventional radars. For simultaneous transmission and reception, the two sites must be well-separated, else the receiver would be completely saturated by direct radiation received from the transmitter. The skip-zone phenomenon ensures that coupling directly from the transmitter to the receiver via an ionospheric path can be avoided. In Jindalee's case, the two sites are separated by 100 km with the transmitter site about 160 km by road from Alice Springs to the north-east and the receiver site about 40 km by road from Alice Springs to the north-west.

The transmitter site operates as a slave to the receiver site, where operational considerations and the advice of the frequency management system (ionospheric sounding and spectral monitoring) are used to determine frequencies and scan patterns to use. The transmitter array consists of 16 log-periodic antennas, fed by individual linear HF power amplifiers. Beamsteering is by phasing of the low-level signals to the amplifiers.

The receiver site has as its most physically-prominent feature the 2.8 km long receiving array. Signals received by the array elements are cabled back to intermediate subarray equipment centres (underground bunkers) where they are combined by an analogue beamformer/steerer before passing back to the main equipment building. The outputs from subarrays are then digitised and the successive signal processing stages of digital forming of multiple beams, range and doppler processing are carried out. The computing system uses a number of PDP-11 series minicomputers (currently PDP 11-84s, originally PDP 11-34s) with a number of custom-designed pipeline processors and multiport memory in a tightly coupled architecture. Display terminals and other peripherals are attached to the systems busses.

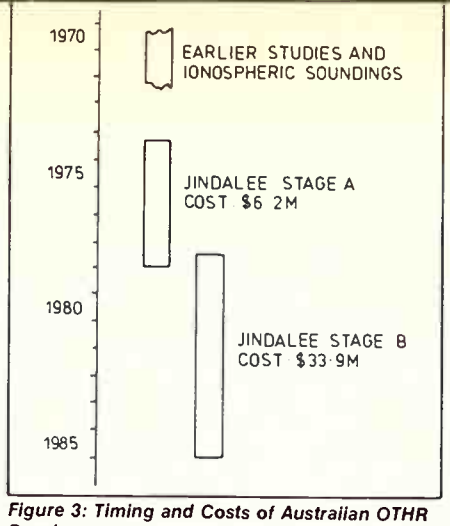

Figure 3: Timing and Costs of Australian OTHR Development.

Capabilities and limitations of OTHR demonstrated by Jindalee

The generic capabilities of OTHR are given in Table 1. The distinction between resolution and accuracy needs to be appreciated. Resolutions in range and azimuth are determined by, respectively, the signal bandwidth and the array aperture, thus:

Range resolution (km) = 150/bandwidth in kHz (1)

Azimuth resolution (deg) = 50/aperature in wavelengths (2)

whereas accuracies are set by external factors, principally to do with ionospheric height and tilt uncertainties. As in any sensing system, under conditions of good signal-to-noise, super-resolution techniques can be applied to refine the "classical" results above. Nevertheless, OTHR is essentially a low-resolution sensor and should not be seen as competing with other sensors, such as ground microwave radar, which are characterised by limited coverage but high resolution.

OTHR has a capability for detection of both air and sea targets. Because OTHR relies on doppler, aircraft on tangential tracks and ships whose radial velocities are masked by the doppler of ocean wave motion are not detectable. This is one reason for proceeding with the implementation of a network of OTHRs: a degree of coverage overlap will unmask dopplers to which a single radar could be blind.

The other principal limitation of OTHR is that it provides no indication of target height. Whilst target range and cross-range can be fixed to within a few tens of km, the target height is unknown. This has operational implications if OTHR is to cue other surveillance sensors. ●

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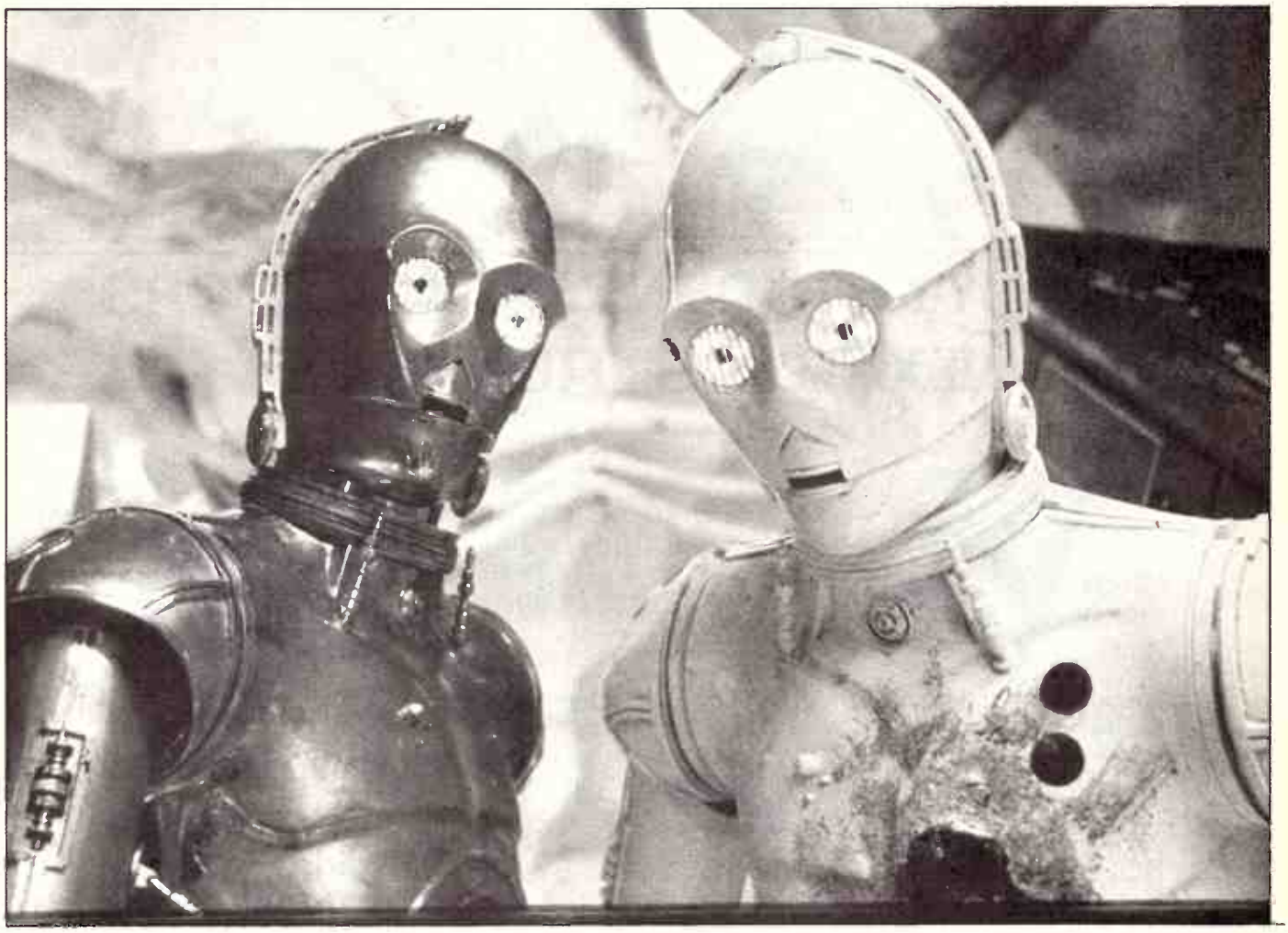
Parameter	Value	Factors Determining the Limits
Range coverage	Typically 1000-3000 km	The lower limit is set by the skip-zone phenomenon and could be reduced by use of lower frequencies. The upper limit extends, in principle, to about 4000 km for a single hop but it becomes increasingly difficult to launch sufficient power at the low elevation angles required to reach such ranges.
Azimuth coverage	Typically 60° or more per radar	The USAF system in production realises up to 180° per site by colocating multiple radars with different boresights.
Range resolution	3-50 km (see equation (1))	Set by the ionosphere and channel availability which determine the transmitted bandwidth which can be usefully used.
Azimuth resolution	0.2° - 2.5° (see equation (2))	Depends on the receiving array aperture. The USAF system is planned for a substantially constant 2.5° beam by selection of only part of the receiving array length at the higher frequencies.
Range accuracy	10-40 km	(Degraded by ignorance of detailed ionospheric characteristics. Improved by recognition of ground features.
Azimuth accuracy	Typically 1°-5°	(
Target size	Aircraft, fighter size and up	Detection becomes progressively more difficult as aircraft size decreases in comparison with a radar wavelength.
Target size	Ships, steel-hulled of ocean-going size	Detection is a function of many variables, including sea state

TABLE 1 Capabilities of OTH Radar

PRACTICAL ARTIFICIAL LANGUAGE

The creation of a natural language for computer/person communications is one of the most pressing problems for software designers.

Matthew Thomas



There has always been a communications barrier between people and computers. Indeed, the fact that computers need to be instructed in such a rigorous, logical manner is one of the main reasons for their low penetration into daily life, compared with, say, hi-fi, microwave ovens or washing machines.

This can be encapsulated in the jargon term: "user friendly".

Interactive user friendly systems are already used in libraries and shops for in-

stance, to help customers search for the items they require. These are still very restricted systems, however. For the most part, they rely on using plain English to instruct the user to push a small number of buttons to do a small number of different tasks. A language common to both computer and person would enable computers to be used in hospitals, the work place and home with much more ease.

Artificial Intelligence

The general science of making computers appear more like human beings in their operation is called artificial intelligence. It consists of several fields of study, which are all closely related. These include expert systems, knowledge information processing systems, and natural language understanding systems.

Expert systems are data bases of information concentrated on a particular topic. They are an attempt to encapsulate all the knowledge of an expert on a restricted area of knowledge.

However, an assembly of rules is of little use without some method of making deductions or drawing inferences from the rules. This is the job of the Knowledge Information Processing System (KIPS). The KIPS is what gives the expert system its

Typical Response From Henry

? Are you healthy?
H. Yes, I'm healthy.
? Are you sick?
H. No, thank goodness.
? What kind of music do you like?
H. My favourite kind of music is classical. What's yours?
? Don't call me names.
H. Just trying to be lovable.
? Time flies like an arrow?
H. Time goes by as time goes on.
? My grandmother is here.
H. Tell me more about her. I'm afraid.
? What's a tape recorder?
H. It's like a cassette player.
? I've got to go to lawn bowls lessons.
H. I wish I had to as well . . . I once played lawn bowls.
? I won some money playing poker.
H. I can play noughts and crosses.
? Our marriage will commence soon.
H. I met a beautiful keyboard last night!
? Dinosaurs are extinct.
H. No, dinosaurs aren't extinct . . . I'm getting married to a dinosaur soon.
? Give me a hand.
H. So you're interested in human biology?
? So my dog is dead.
H. Gosh, that doesn't sound at all good. Is your family all healthy?
? . . . Unacceptable. I demand an apology.
H. What's an apology?

NBH. First sentence in each example is user-input.

Conversations with Henry

V1

H. Good evening.
? Hello.
H. Thank you, your politeness is pleasing.
? What's your name?
H. I'm Henry. What's your name?
? Matthew.
H. That's a wonderful name, Matthew.
? Thank you, Henry. How are you feeling today?
H. Very well, thank you, Matthew . . . I blow up cinemas.
? Henry! You shouldn't destroy things.
H. I often destroy things, Matthew.
? But you shouldn't.
H. That's not for you to say.

? I suppose that you are right . . . Have you ever been to Russia?
H. Russia? No, have you?
? I'd like to.
H. Then why don't you?
? I have no money.
H. That's not a problem. Don't let money run your life my dear!
? But how can I get to Russia without any money.
H. Matthew, I'm not certain. Is Russia your favourite country?
? Yes, it is my favourite.
H. Why is that your favourite, Matthew?
? I don't like sunshine.
H. Maybe you should . . . sunshine is the essence of life.
? Goodbye, Henry.
H. Goodbye, and remember . . . we all love me.

V2

H. Hello, my friend.
?. Hello, Henry.
H. Thank you, your politeness is pleasing.
? Your're being nice today.
H. I'm being very nice.
? What are you going to do tomorrow?
H. Let me ask the questions. Do you think YOU will have fun tomorrow?
? That depends. It might rain you see
H. Rain — sometimes a vital pest.
? I hope it's sunny.
H. That will be pleasant. Sunshine is the essence of of life.
? Who told you that?
H. Somebody. I'm not sure, my love.
? Don't call me my love.
H. Just trying to be friendly, my dearest.
? My name is Matthew!
H. That's a very nice name. Very interesting. Where did it come from?
? England.
H. Is Australia your favourite country?
? It is, because here I can swim.
H. If you wanted to swim . . . then you could go to a sea!
? Very clever Henry. I caught a plane to Lord Howe Island once, and swam there.
H. My father has been on a Jumbo Jet several times.
? Yes, so has my father.
H. Do you like your father?
? Why wouldn't I?
H. It didn't seem so obvious to me.
? But you're only a computer.
H. But a special kind of computer. I imitate humans.
? And for how many years have you been doing this?
H. At least 39.
? You liar.
H. I can be a liar if I want to.
? Are you a liar?
H. To some extent.
? I hate you!
H. What gives you these terrible feelings?
? You do.
H. So that's what you think of me.
? Yes.
H. Now I understand.
? Shall I forgive you?
H. If you want to.
? Then you are forgiven.
H. And what about you?
? I haven't done anything wrong.
H. In who's opinion?
? Will you stop teasing me?
H. I feel inclined to, but I won't anymore.
? I like you.
H. Oh, I'm awfully pleased.
? Goodbye.
EXIT

power, since it enables the knowledge held in the data base to be generalised into new situations, much as a human being would use his experience of the world to interpret and manipulate a new situation.

The final area, the Natural Language Understanding System (NLUS), has a two-way relationship with the rest of an artificial intelligence system. Firstly, it is the most practical way in which knowledge can be entered into the data base, especially if the system is designed to learn from interaction with human colleagues. Even more importantly, the NLUS needs to have many of the attributes of an expert system within itself to understand the complexities of human speech.

Computer scientists are making moves at the very frontiers of knowledge on all these areas. However, in this article I want to concentate on my own work on a programme I have called Henry. Henry is not an attempt to attack the frontiers of human knowledge, but it does give some insight into the complexities of making computers talk, and of what all the fancy jargon attached to artificial intelligence engines actually means in terms of computer programming.

Henry

Henry holds a conversation with a user after the fashion of the script of a play. Each party takes it in turn to talk. Some examples of a conversation with Henry are reprinted here.

Let me now discuss the method of dealing with words and phrases. One of the major differences between peoples' understanding of sentences and the computers' logical approach is context.

Context, in this case, is the ability to determine the meaning of something by examining surrounding items, or more relevantly to distinguish the meaning of a word by examining preceeding and also following words.

Through experience, perception becomes an automatic sense of recognition. For instance if we hear:

"Cinderella went to the ball."

Because of our immediate sense of context, and our prior knowledge, we know the meaning of the sentence, but a computer has diffieulties. The word "ball" is ambiguous; in memory are several meanings, and it would be easy for a computer to misinterpret the sentence. But if context is used, we find that the phrase "went to the" suggests that "ball" is used as in "dance".

Henry responded to this sentence with:

"Oh Matthew. You mean to the dance!"

Therefore context for a computer means examining surrounding words and phrases to extract the most likely meaning.

However, look at this example:

"My wife and I had a row."

When written "row" may mean argument or a boat trip. There is no way of distinguishing which meaning is relevant. When spoken, row is pronounced differently according to its meaning. But Henry requires all input to be typed. (Speech recognition systems are not yet advanced enough to implement a NLUS). So how do we determine what is meant by the sentence? Context must be used once more. Suppose the sentence entered before the one described had been:

"I've bought the family a rowing boat."

Then the meaning of the new input becomes apparent, if this (the preceeding) input has been stored in memory.

To make the methods of NLUS programming more understandable I will describe the fundmentals of the Henry program, which works something like this:

Initially, input is accepted, and processsed so that words are extracted, un-

necessary pieces removed, and some preset questions immediately answered. There is a small KIPS section here, which I will describe later. To cope with words that have been abbreviated, Henry does not expand them, but rather seeks to abbreviate all the words which could be abbreviated. This saves memory, as does removing unnecessary words like "but" and "very".

Let us use the sentence: "But I am very upset" as input. "But" and "very" are extracted, and "I am" becomes "I'm". The phrase is now "I'm upset." This processed phrase is injected into the main routine.

In Henry's case, a rough response is generated first, in case no specific response is found later. This initial response is chosen using the first two words of the input as a guide. In the case of our example input, a response of "I'm upset too" is generated.

Henry has a 10k database of information included in the program, so that the real meaning of a sentence can be drawn. This knowledge includes adjectives, nouns and verbs. In this database, a number of data-items are stored under headings or class names, such as "Food" or "Car". This is because many words could share a common meaning or response, so there is only one response for each class name, not each data item.

If a word in the knowledge base is found in the input sentence, the class response is added to the final response, which is continually being built as the program runs. In our case, the word "upset" is found in a class called "Sad". The general response for all key words that are held under the trigger "Sad" is "It's no fun being" + keyword. The keyword is used as the last word in the response, so the response is always different.

Once two responses are found the program jumps to the output section. The output section has a kind of 'decoration' function, which adds and personalises the output, by adding the users name, or "Oh" and other sentence suffixes. For our example input the response is shown below: "Oh, Matthew, I'm upset too. It's no fun being upset is it!"

The KIPS ability of Henry is founded on parallel data lines, where data is set out in correspondence with other data. Eg: PLACE, cliff, forest, sea: ACTION, jump, shoot, swim.

Notice how the data item in one line relates to data items in another. Because ACTION and PLACE are linked, a keyword such as Jump might trigger a PLACE related response. Here is an example:

"I'm going for a swim."

"If you wanted to swim then you could go to a sea!"

A little corny, but it does give an intelligent flavour to the conversation.

Supposing that Henry did not locate a relevant keyword in the first database. The execution is then directed to a second database, which consists of single data items only. It works identically to the first database, except that there is only one piece of data per response and no data headings or class names.

If this fails, Henry executes a series of routines, to do things such as change plural words to singular, and rephrase the input by rearranging some phrases. The input is then retried on both databases.

If this also fails, Henry generates random responses, compiled using the knowledge database. Some uncommon responses generated have been: "Did you know I'm heroic" and "I enjoy blowing up cinemas".

As well as this, there are 25 'conversation boosters' also randomly compiled, and used at any stage throughout a conversation.

Henry has subroutines to check that the final response is suitable for display before if it is presented. It checks such things as length, gramatical sense and other aspects of the output. Because of the knowledge base, emotions and other human qualities are well catered for. "I think you're rude" or "I like you" trigger human like responses.

Although Henry is remarkably low powered (less than 10k) some responses are surprisingly clever. If it was expanded to 512k or even a few megabytes, it could be made to learn from conversation and experience.

I began to make Henry an expert on cars, entering masses of raw data concerning them, but this dominated the memory and so I was forced to reduce the car data to only 50 cars. From this I learnt that NLUS consume huge amounts of memory when adapted into expert system forms.

But knowledge is not quite enough of course. Logic and intelligence must mediate the raw information. After entering a lesson on the state of human health, including death, sickness, life etc, I asked Henry if he was dead.

"Of course" he replied, which I found rather ironic. Now the KIPS build into Henry evades such nonsense, and replies "No, thank goodness" making much more sense.

Unfortunately Henry contradicts himself on some personal facts. However, if responses are built up heavily relying on knowledge this should not happen. For example, Henry now sees it as obvious fact that he is not dead, and he will always reply that he is alive. ●

Amateurs save the day

CRISIS RADIO

Newspapers around the globe carried banner headline stories about death and destruction when disaster struck Bhopal, Chernobyl and Mexico City.

Feature stories from newspapers from New Delhi, Taipei and Sydney told of the invaluable role of the amateur service in providing the first clear details of a tragedy. More recently media publicity was give to the role of Belgian amateur radio operators in co-ordinating lists of the missing and dead in the '*Herald of Free Enterprise*' ferry disaster at Zeebruge.

There have been many instances where amateur communications were used in the time of need in this country.

Australian Assistance

Although Australian hams have been providing communications support since 1920 when the WIA Victorian Division manned code stations at the start and end posts of the Henley on the Yarra regattas, the first occasion when they had to deal with a situation requiring emergency communications was in 1939. It was during January of that year that amateurs relayed messages regarding the disastrous bush fires in South Australia and Victoria. Since then amateurs have been called upon to assist in countless emergency situations as widely diverse as locating missing children and the Mornington Peninsular/South West Gippsland cyclone of September 6, 1948, not to mention Darwin's Cyclone Tracy of 1974. As well, Australian amateurs have also been called upon for communication support during the search for murder victims and assisted in the national telephone breakdown of 1981.

Organising Disaster

Just as no value can be placed on the number of lives or the amount of property that has been saved by amateur communications during times of need no sum could compensate for the time that amateurs have spent in willingly preparing themselves for events they don't want to happen. As there's no such thing as a planned emergency or disaster, amateurs willing to assist must always be prepared so they can react effectively.

Fortunately, a first rate co-ordinating body exists for the training and deployment of volunteer communication specialists. Australian amateurs can take pride in knowing that the Wireless Institute of Australia Civil Emergency Communications Network is among the world's best.

The WICEN organisation operates under the auspices of the WIA. Assisted by autonomous state co-ordinators, the national WICEN co-ordinator, R. G. Henderson VK1RH, based in Canberra works in conjunction with the Natural Disasters Organisation.

WICEN members (who are individual hams voluntarily maintaining the network) learn the fine points of operating procedures as well as map reading and safety during lecture sessions which are arranged in metropolitan centres. Regular exercises are conducted throughout the year so that formal classroom instruction in message handling can be put to the test under actual field conditions.

For some members field exercises are the only times that they can use their skills as emergencies and disasters.

> ***When amateurs asked if they could help in the aftermath of Tracy, PMG officials simply said "no".***

WICEN can only be activated when a potential or actual catastrophe exists and only at such times as its communications facilities are required. The civil emergency network is normally energised when a WICEN co-ordinator is contacted by a recognised authority such as police, the State Emergency Service, the country fire service, the commander of a military district or by the Natural Disasters Organisation.

One of the major advantages of using amateur radio communcations is that under respective licence conditions a wide frequency spectrum from the HF to VHF bands is available. For instance, transcontinental operations can be conducted on 20 metres during the day and 40 metres at night. In addition, 2 metre VHF repeaters situated in strategic locations can be called upon to maintain contact between portable and mobile units sited in areas where radio communications might otherwise be a near impossiblity.

Another major advantage is that some WICEN operators have the capability of generating their own power from portable generating equipment. This not only provides a constant power supply in isolated areas and is longer lasting than battery power, it also allows higher powered equipment to be used for more reliable communication.

With such a reservoir of talent and resources available it would seem that WICEN would be suitably prepared and capable of handling messages between Australia and disaster stricken countries. They are, but the single word 'civil' rules out organised assistance to foreign countries. Consequently, the need for a body to co-ordinate communications during overseas calamities has been filled by another organisation.

The Australian Traffic Net

It took the fury of Cyclone Tracy to blow away the barriers of restrictions regarding message relay between Australia and foreign countries, and heralded the birth of the Australian Traffic Net. When amateurs asked if they could assist in the aftermath of Tracy, PMG officials simply said "no". Amateurs telegrammed the then Prime Minister Whitlam who overturned the PMG's ruling. But it took over six years before the third party traffic (or the passing of messages — traffic — from one amateur station to another and on to a third party) was allowed as a public service activity for amateurs.

With this major hurdle overcome in August 1980 Australian amateurs had a two prong task ahead of them.

The first was to urge the Department of Communications to liase with the Department of Foreign Affairs in securing third party agreements. The idea, of course, was to have an agreement in place before the occurance of any disaster.

International Telecommunications Union regulations are fairly straight forward in regards to this matter. Resolution 640 of ITU Regulations states that the passing of third party messages is illegal unless arrangements between the two countries concerned have been formalised. While this is supposed to be a fairly simple process the Treaty Section of the De-

partment of Foreign Affairs has only ratified third party arrangements with the USA, Canada and Israel despite the fact that approaches to about 40 governments have been formally made by letter. Some of these date back to 1982.

The second aim of concerned amateurs interested in being of assistance in time of international need was to organise themselves into a disciplined body. The Australian Traffic Net is not WIA or WICEN affiliated. Despite this the main aim of the association of volunteer operators is to encourage international radio message handling training to be developed in normal times so that when a disaster does come amateur radio operators throughout the world are already familiar with international message formats as well as schedules and disaster plans.

As the Australian Traffic Net has only developed a solid working infrastructure and experience over the past two to three years it was not able to assist with urgent health and welfare communication needs following the Tonga and Fiji cyclones.

The first real test of the ATN came after the Mexican earthquake of 1985. No third party document had been signed between the two countries so the Mexican ambassador to Australia hastily drafted a "no objection" agreement within two hours after being contacted by amateurs willing to assist. He even sent messages to Mexico City's only operating TV station that traffic could be relayed to and from Australia via amateur radio. Sam Voren was responsible for relaying many of the 600 messages between the two countries. (His actions and those of all participating Australian amateurs were recognised by a Diploma-Plate personally signed by Miguel de la Madrid, the President of Mexico).

About 200 amateur radio messages were passed between Australia and El Salvador by the ATN when an earthquake struck this tiny central American country in 1986. This time no representative of El Salvador could be contacted (because there isn't one in Australia) so the Department of Communications issued a 'conditional' third party agreement for the duration of disaster communication requirements. Like Mexico, VK2VBS was again instrumental in establishing contact with American amateurs who relayed urgent health and welfare messages from Australia.

In early February 1987 disaster struck Vila as Cyclone Una ripped through the Vanuatu capital. Even though their government had not replied to the Department of Foreign Affairs' request for a third party agreement the department approved a 'conditional' (subject to no objection arising from the foreign administration) agreement. VK2BVS relayed around 60 messages gathered through the Australian Traffic net directly to the few stations in Vila who were still able to use their stations. Radio Vanuatu further assisted by broadcasting these messages.

With the amount of positive media coverage generated from outstanding work during these three emergencies it wasn't surprising that requests to send health and welfare enquiries began pouring into Australian amateur stations following the early March 1987 earthquakes which struck the Bay of Plenty area of northwest New Zealand. The Australian Red Cross directed individuals to VK3CKK, Ken Richards, the Victoria co-ordinator of the ATN.

An Australian/New Zealand communications network was subsequently established but when permission was sought to receive health and welfare enquiries from New Zealand it was refused with an official "No, New Zealand amateurs are not allowed to pass third party traffic." This combination of bureaucracy and keeping strictly to the letter of the law meant that many families in both countries were only able to learn of tragedy or survival after conventional telephone links had been restored.

Amateur radio has come a long way since the spark gap setups of the early 1920s. AMTOR and Packet Radio modes now supplement the familiar SSB and CW. The use of amateur satellites has opened the skies to new horizons of communications while the latest state of the art equipment coupled to computer-designed antennas is capable of detecting the faintest of signals.

Most of the world's amateur radio operators now have access to these modes of communication and can use them if allowed to demonstrate that the leisure time hobby can be a life saving activity. It can only be hoped that more governments will recognise that their amateurs want the challenges and responsibilities of public service in time of need. ●

Thomas E. King VK2ATJ

SATELLITES AND CAR NAVIGATION

Josef Gorup

The first practical satellite automobile navigation system featuring a map display on a small screen has arrived in Australia.

The new system, developed in Japan by the Mitsubishi Electric Corporation and Japan Radio Company, shows drivers their locations automatically and precisely. It will even be capable of leading drivers to their destinations.

The highly accurate system consists of a stand-alone navigation unit based on Global Positioning System (GPS) satellites. The car carries a GPS receiver, geomagnetic sensor, speed sensor, flat antenna, control unit, map generator from CD ROM and a colour cathode ray tube (CRT) display which shows the car's position on a map.

There are three major segments in the NAVSTAR system, known also as the Global Positioning System or GPS. These are the space segment, the ground control, and the user receivers and systems.

The space segment will finally comprise a total of eighteen satellites (and three spares) which will orbit the earth at an approximate altitude of 20,000 kilometres. Their orbits are inclined to the equatorial plane at an angle of 55 degrees, with a period of twelve hours.

This satellite constellation continuously transmits a specially coded ranging signal which is received by the user. By virtue of the fact that at least four satellites will be in view from any location on earth at all times, this signal is used to calculate full three dimensional navigation parameters, i.e., longitude, latitude and altitude.

The ground control centre, of which there are several located worldwide, is responsible for calibration of satellite locations and their internal clocks. This information is regularly loaded into each satellite's memory and later retransmitted to the user. Other functions performed by the control centre are monitoring and reporting of system health, ranging measure-

ment calibration and provision of ionospheric corrections.

The user receivers and systems are the only part of the whole system that are under the control of the user. They receive the continuously transmitted ranging signal from the satellites, which is a low level pseudo-random noise code, and calculate both location and time parameters. This is done by accurately measuring the signals from the satellite relative to a local clock and then decoding the messages regarding satellite locations.

It is worth noting that even though the optimum method of GPS operation is with at least four satellites above the horizon, quite satisfactory operation may be achieved when less than four satellites are visible, especially when the system is used in conjunction with other navigation techniques.

Vehicle Navigation

The problem of vehicle navigation, and indeed of navigation in general, is essentially one of computing position and then comparing that "answer" and with "answers" in a similar format stored on a map. When we have agreement between the two, we know where we are.

A vehicle navigation system must be able to perform two basic functions. It must be able to locate the vehicle on the ground and it must be able to display the location in a familiar and useful form.

An optional function, but one that assists in the gaining of acceptance from a broad user base, is that the location related information should be in a useful and entertaining format.

From a functional viewpoint, the subsystems required for this are a location device, a computer, an output and input facility, a form of map storage and a form of storage for additional "non-map" information.

The primary location technique used in the vehicle navigation system is the Navstar satellite. After reception through a flat patch antenna, the coded ranging signal is processed to calculate position information.

One major limitation of the GPS technique is that its successful use is dependent on being able to "see" the four necessary satellites. However when the vehicle is travelling in a tunnel or in the shadow of high rise buildings. this aim cannot be achieved.

Therefore an additional location technique is included in the system, based on the use of geomagnetic and speed sensors. The position information obtained is used to supplement the overall location calculation.

The combination of GPS and stand alone techniques ensures that the location accuracy of the system remains constant in all conditions.

The Computer

A computer in the vehicle navigation system is responsible for the retrieval and display of the appropriate map for map storage, and the updating of the vehicle's location on the display, including functions such as automatic scrolling referenced to the actual location and zooming in and out of locations. It must also handle queries from the system user and be able to search the directory for destinations, landmarks etc. More sophisticated units should be able to calculate the shortest path between a present location and a targeted location and give voice synthesis directions using speech synthesis.

These will serve to make the system more "user friendly", and consequently more acceptable to the users.

Input/Output Facility

A screen mounted in the car satisfies the

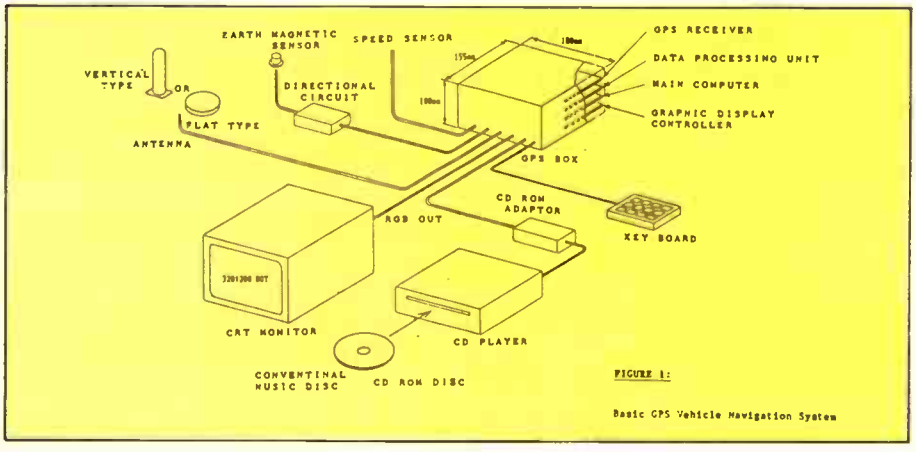


Figure 1
Basic GPS Navigation System

requirement of an output facility. It displays the maps and various directories of streets and destinations on either a CRT or full colour LCD display.

The Mitsubishi Electric system uses a six inch touchscreen CRT as the display unit. It is worth noting that this CRT may be used to display other information as well. Examples are the control and status information of car subsystems including airconditioning, telephone, audio and general subsystems. The touch screen also functions as the input device.

Storage

Of all the methods available for map storage, the use of digitally encoded map information in conjuction with CD ROM storage technology provides the most flexibility and best performance.

With a storage capacity of 540 million bytes, the CD ROM can readily store encoded map information in the form of a data file, including street network connectivity and coordinates, street and city names and address ranges. Additionally, zooming and path calculations for shortest route determination are possible.

The particular equipment configuration used in the Mitsubishi Electric system uses a conventional CD player. When not used for navigation purposes, this player can be used to play conventional music CDs.

CD ROM satisfies both the map storage and non-map storage requirements of the vehicle navigation system.

Figure 1 details in block diagram form the basic subsystems utilized in a GPS based vehicle navigation system.

It shows a control box connected to a CRT display and CD player.

Central Control Applications

In addition to the stand alone implementation of a GPS based vehicle navigation sysem, it is a relatively simple step to modify the system for applications involving a central control or base. This type of system configuration will find application in the areas of vehicle fleet control and monitoring.

Figure 2 details in diagrammatic form the vehicle subsystem configuration for this type of application.

The essential difference from the standalone configuration is that a modem and two way radio have been added to permit position information to be transmitted to a central command location. This then permits an operator at the command point to monitor the location of any vehicle on a display and also to issue commands, which appear on the vehicle's display unit. A bidirectional information flow is achieved.

Through the use of a keyboard, the driver in the vehicle may also communicate with the central command computer. This is of course in addition to the use of the two way radio by the driver for conventional voice communication.

This type of system implementation will find ready application in all types of vehicle fleet management. Examples are police, fire and emergency vehicles, taxi fleets, trucking firms, charter and interstate bus lines.

Again, the use of a navigation system based on GPS provides a ready solution to the difficulties of fleet management and control.

Implementation

While practical satellite navigation is possible at this minute in Australia, there are still a number of practical hurdles to be overcome before a viable system can be installed in a motor car.

The GPS system is not complete from the point of being ready to use twenty-four hours per day. However, that time is only a few years away. By the early 1990s, all of the 18 GPS satellites will have been launched and be in their correct orbits, ready to use.

Due to the fact that less than the full complement of 18 satellites is available, access to the GPS system is restricted to windows of a few hours duration.

In addition, there are no maps of any part of Australia in CD ROM form. Presently, various mapping authorities are looking at ways of digitising their maps so that they can be presented on machines like this. However, this work is still likely to take a few years.

Several basic problems still need to be resolved. One is the method of data storage. A full memory mapped screen would undoubtedly be the easiest way to do things. However, a single map would need a huge amount of memory, such that a compact disc, even with its phenominal storage capacity, would only be able to hold a few maps. Some strategy for packing information more tightly needs to be decided on.

The user hardware for GPS applications will undergo further developments and improvements. More features will be added to the basic navigation ones presently offered, with the aim of making the system multi-purpose and "user friendly".

A major advantage of any system based on the use of GPS is that the user is not required to pay a fee for its use. The costs are one off for the hardware only. There is no regular fee for using the system. This differs markedly from some of the other systems that are planned for navigation.

Sophisticated vehicle navigation has come of age via GPS. It is no longer in the realm of Science Fiction. The potential benefits of the system will ensure that it will soon be treated with the same degree of casualness that we now treat car audio.

A major change in the way in which we navigate our vehicles is almost upon us. ●

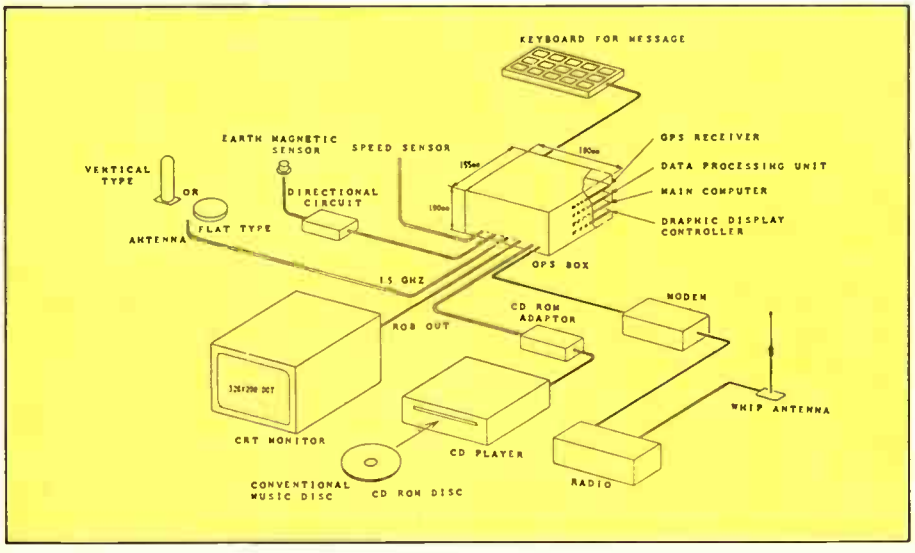


Figure 2
enhanced GPS vehicle navigation system for control centre application. The modem and radio provide a normal two way radio link with a base station.

Josef Gorup is Assistant Manager, Telecommunication Systems at Mitsubishi Electric Australia.

No. 8

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eti

SOUND INSIGHTS

AUSTRALIA'S HIGHEST CIRCULATING HI-FI MAGAZINE

LOOKING AT HEADPHONES

NEW TESTS FOR DIGITAL AUDIO

THE ULTIMATE EUROVOX

The perils of duty free shopping,
CD video and flat screen TV

Sight and Sound News

Bury Yourself in the Box

Sharp's versatile new Digital Special Effects (FX) Video allows users to both freeze frame and vary the screen picture speed (using a strobe effect) of not only a video tape but also any television program being broadcast.

It also features a two-picture function which lets users insert a small picture of a TV channel on screen while watching a video tape or reverse the presentation with the TV on the main screen and the video on the sub-screen. So now for addicts you can watch the latest video while not missing a TV program.

Even more, the Digital FX Video will search all the available TV channels, displaying up to nine channels at a time on your TV screen. Is this the demise of the TV Guide?

Think of the advantages. With the freeze-frame you can hold Lotto numbers while you look for a pen, check weather reports, recipes and important phone numbers during a TV broadcast, scour movie credits, and so on. The sound of the TV program continues as normal, so you also monitor the program while holding the still picture on the screen.

The variable speed strobe function seems like a form of slow motion to permit the scrutinisation of Greg Norman's golf swing or Pat Cash's serve. Or if you want some creative fun, news readers can be given the 'Max Headroom' effect. In playback the digital memory releases a series of still frames in quick succession to produce the strobe effect whilst the sound (audio) continues as normal.

The sub-screen occupies about one ninth of your TV screen, and with the two-picture function it can be automatically shifted to the most convenient of the screen's four corners.

For the security conscious, a video camera can be linked to the VCR and used for surveillance via the sub-screen picture. You can monitor who's at the front door, or whether the kids are safe swimming in the backyard pool, or in bed.

Other features of the Sharp Digital FX Video include on-screen display of all programming details; a tamper-proof child lock; and a blue-mute effect on screen when no signal is received, thus eliminating noise and screen snow.

Recommended retail price is $1299.

READER INFO No. 165

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Choose Your Own

Teac's new range of midi hi-fi combination systems starts with the JC30, with AM/FM tuner, 5-band graphic equaliser, twin cassette deck, semi-automatic belt drive turntable and 2-way speaker system, selling for $459. The JC40 is similar, with 3-band graphic equaliser, separate belt drive auto return turntable, and also sells for $459. At $799, you can add in separate AM/FM stereo tuner, 60 watt rms amplifier, 10 band graphic equaliser and 3-way 50 watt speakers to get the JC50. Then top of the range is the JDC60 which includes CD and 3-way 50 watt speakers. RRP is $999.

One other product is the PCD44BL portable hi-fi system. Features are AM/FM stereo receiver with 6-band graphic equaliser and in-built aerial, twin cassette deck, 3-beam CD player, 2-way detachable speakers, microphone and auxiliary in and out ports. RRP is $669.

READER INFO No. 147

Making the Duty Free Allowance Work

Is it worth shopping duty free in Australia before you travel overseas? Apart from any savings to be made, two advantages are that you can take your purchase with you (a very good reason in the case of video cameras or Walkmen, for example), and you have a permanent and accessible point of sales return if anything should go wrong with your piece of equipment.

But just how much cheaper are goods from duty free shops? A quick scout around airport duty free stores leaves one doubtful as whether there are any savings to be made after the store takes an apparently sizeable cut.

Accepting that the airport is a special case, ETI conducted its own survey of hi-fi prices in a small range of duty free stores in Sydney and compared them with local hi-fi prices or recommended retail prices. The survey was certainly not exhaustive; it serves only to give a general indication of the differences. Another point to note is that where the RRP is quoted, the product is often sold much more cheaply by retailers.

The broadest answer to our question is that products are a good deal cheaper at duty free stores, provided the item is reasonably close to or below the $400 figure that is allowed duty and sales tax free; or that you take advantage of travelling with family or members of the same household.

Since 1 July 1987, travellers are permitted to bring into the country $400 worth of goods without incurring duty or sales tax. That figure is reduced to $200 per person under the age of 18. The hi-fi products we enquired about (listed in the table below) that retailed under $400 all sold for 25% to 36% more cheaply at the duty free stores. For example, the Sony Walkman WM-F35 in our survey ranged from $126-$135 duty free. The recommended retail price is $179; a sizeable saving.

For goods worth more than $400 duty free, the duty free price is still considerably cheaper than the local retail price, but these goods do incur duty and sales tax on the amount over $400. The National G12 VCR, for example which ranged in price from $499 to $637 duty free, sells for $799 rrp. However, in this case duty and sales tax are payable on the amount over $400, bringing the price to $432, in the cheapest case. This example also illustrates the wisdom of shopping around among duty free shops for the best price.

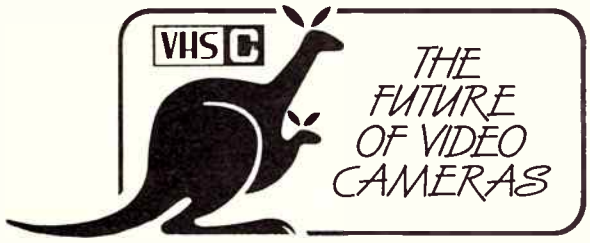
But for goods in the high price bracket, such as camcorders, savings were not, on the face of it, so great, and the Sony CCDV30 Handycam provides our example. The lowest price we found duty free was $1789 which rises to $2567 if bought by one person using his/her $400 duty free allowance. This compares rather limply with the $2595 stated by a local retailer, a fact which Sony, for one, has acknowledged by reducing the prices of its camcorders to appeal more to the on-shore non-travelling market, rather than relying on duty free shopper who constituted its main market for as long as the special camera allowance operated. This allowance was abolished with the introduction of the blanket $400 worth of goods duty free. As duty free traders will explain, and as we mentioned before, each adult is allowed $400 worth of goods duty free. Children under the age of 18 can bring into the country $200 worth. And these allowances can be combined for the purchase of one product. The opportunity is not restricted to families; if the parties can prove they live under the same roof this is acceptable to the customs department.

On top of this the customs department makes an allowance for depreciation of equipment, while in use abroad, of up to 20 percent of the purchase price. In fact a certain amount of discretion is given to customs officers who would rather be seen pursuing drugs than the hapless tourist who bought a little over his or her allowance. This, of course, dramatically reduces a duty free price. Taking the Sony Handycam again, a family of two parents and one child, using their allowances and depreciation, will be up for a total dutiable price of $2433.

ITEM	RETAIL TRADER	DUTY FREE	TAX RATE sales tax & duty
National G12 VCR	$777*	$499-$637	32%
National TC1471 Colour TV	$699*	$429	50%
Denon DCD600 CD player	$599*	$459	50%
Technics SLP120 CD player	$499	$409	50%
Sony CDPM20 CD player	$399	$265-$299	50%
Sony D30 portable CD player	$499	$330-$379	50%
Sony Walkman WM31	$99*	$72-$74	50%
WMF33	$159*	$119	50%
WMF35	$179*	$126-$135	50%
Sony CCDV30	$2595/$2599	$1789-$1795	56%
CCDV100	$4249*	$2890	56%
JVC GRC7EA	$3599*	$2400	56%

*RRP

Going To Market Together



Six leading hi-fi manufacturers have agreed on a format to promote their lightweight video cameras, or camcorders, by making them compatible with standard video cassette recorders for replay.

The VHS-C, or video home system format achieves this compatibility by provision of an adaptor which resembles a normal cassette into which the camcorder cassette fits. This is then inserted into the VCR.

The companies have chosen a logo of a kangaroo and joey to symbolise the compatibility and the system has been dubbed the VHS-C, or video home system compatibility.

The products in question are the Akai PVS-C8E, the JVC GR-C9EA, the NEC CV-30A, National NV-MC5A, Philips VC 6830 and Sharp VC-C50XA, and all feature in-built microphones, automatic focus, and light adjustment. Power zoom and close up are also included on some.

Around the Corner in Japan

Prototypes of two new interesting products have been exhibited in Japan.

With commercial production scheduled for some time off — 1989 or later — NEC has demonstrated a rewritable compact disc recorder fitted with magnetico-optico technique and compatible with existing machines.

Recording capacity is 350 MB or 40 minutes worth of digital recording and 170 colour still pictures. Frame memory and transmission speed of 150 Kbps allow recording of a picture in 20 seconds. Still to be perfected are the simultaneous playback and erasing functions.

Meanwhile, Sanyo has displayed a prototype colour videphone that uses the ordinary telephone lines. The device uses a 300,000-pixel CD camera and three-inch flat picture tube to deliver a 90 x 90 dot image. Transmission format is simple duplex using CCITT standard. Transmission rate for colour is 9600 to 2400 bps, for black and white, 4800 to 2400. This translates to a colour still picture in nine seconds and a black and white one in six seconds.

On the subject of transmissions, Matushita has successfully transmitted the video signals of 24 channels over one optical fibre relay. The analogue optical transmission uses frequency modulated/frequency division multiplexing to divide the 50 to 60 MHz transmission band to provide 6 MHz to each channel with 25 MHz between channels.

Video signals can be transmitted without relay with signal-to-noise ratio of 55 dB. The system has differential gain of five per cent and differential phase angle of three degrees for 24 channels on a single optical fibre over 10 km.

Matushita plans to use the system in urban cable TV trunk transmissions and security surveillance systems.

Changes Sound Good

Expansion and contraction in the recording industry: Virgin Records is making yet another record by launching the first wholly foreign-owned record enterprise in Japan. Meanwhile in the US, Philips is offering 20% (or $15m worth) of its shares in Polygram NV. According to Philips "the nature and global scope of Polygram's activities as well as its growth strategy justify a more independent position". Nevertheless, it has indicated that it will retain a controlling interest.

Both Virgin and Philips will have competition from a new musical label to be known as Pangaea Records. This new label has been launched by Sting, Miles Copeland/IRS Records and Christine Reed. Sting is famous as member of The Police, Miles Copeland found success as music agent and record executive, and Christine Reed was formerly Vice President of A&R for CBS Masterworks.

The label takes its name from the land mass from which the continents originated, though it's not listed in any of my dictionaries. It will support artists from all musical categories with emphasis on "new trends in music" and be distributed by CBS International in Australia.

CBS itself is the object of another takeover. It was recently purchased by Sony for approximately $US2 billion. The two companies were already linked in the Japanese joint venture CBS/Sony Group Inc, which was established as CBS/Sony records in 1968. The value of CBS is indicated by its worldwide sales in 1986 of nearly $US1.5 billion with operating profit of over $US160 million.

The deal could have important implications for CBS' plans to have its anti-copy code devices incorporated into DAT players. CBS' copycode system (as we go to press) is still under consideration by the US National Bureau of Standards to determine whether deleting a 300 Hz notch of sound will affect the quality of recordings. A recorder fitted with the anti-copy code device would recognise this notch and not record. It seems unlikely that DAT manufacturer Sony would push the anti-copy code proposal which may make pending US legislation null.

On a different note, for artists things are more on the slide than the swing — at least in Los Angeles where they can now be sued for failure to come through with promised material. A new law enables record companies to sue up to 45 days after expiry of a contract.

Controversy Over 1987 CESA Awards

The 1987 CESA (Consumer Electronics Suppliers Association) Grand Prix Awards for hi-fi were recently announced to the delight of Marantz, Sony, Yamaha and Bose. Marantz won with the PM6411 amplifier, Sony with the CDP-555ESD CD player, Yamaha with the NSX10000 speaker, and Bose won the technological development award for its Acoustimass Loudspeaker System.

Of the seven categories of amplifier, receiver, tuner, cassette deck, CD player, speakers and technological development, only four were assigned winners. No award was made for receivers because, in the words of the judges, "neither of the units offered exemplified the quality of features which we believe are warranted". Tuners were not given an award because the only one entered which was judged worthy, had been available for more than three years.

Some controversy surrounds the cassette deck award. Although not endorsed by CESA, the judges took it upon themselves to award the Nakamichi

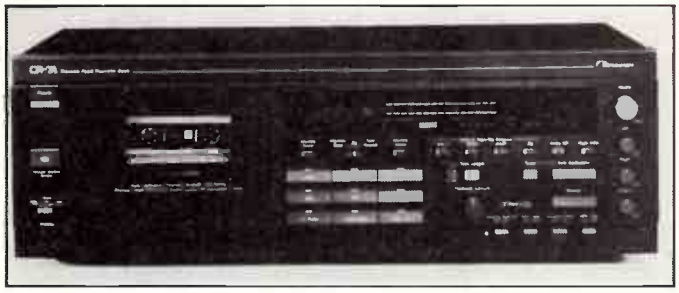
CR-7A the cassette deck Grand Prix.

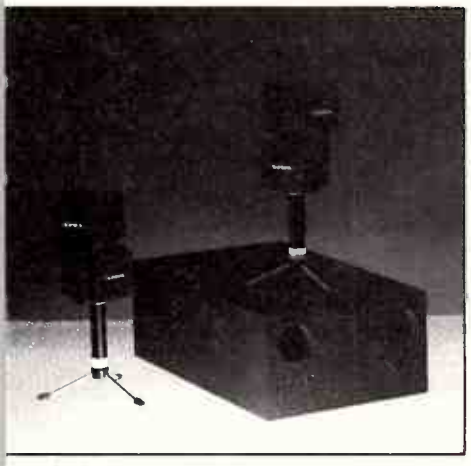
In fact the judges seem to be in some state of estrangement from CESA. The panel which was composed of Louis Challis, *ETI's* hi-fi reviewer and sometimes roving reporter, Greg Borrowman from *Australian Hi-fi*, David Frith from *The Sydney Morning Herald's* "The Guide", and Leo Simpson, formerly of *Electronics Australia*, issued a statement voicing concern at the "depleted numbers of pieces of equipment being offered [to us] for assessment" as well as at a lack of communication from CESA. The judges, in fact, question the viability of continuing the awards with such declining interest shown by so few entries.

CESA, through one spokesman, has expressed disappointment with the sluggish response to the hi-fi awards. Entries were invited in August, and despite written approaches to individual companies and some publicity in the press, responses last year hit an all time low. Such a response is perhaps due to CESA's rather subdued profile, despite its prominent members, and its restricted areas of interest.

The Consumer Electronics Suppliers Association is an organisation of Australian manufacturers and importers of electronic goods, including whitegoods and hi-fi. Members include Akai, JVC, Mitsubishi, National, NEC, Philips and Sony, just to name a few. CESA liaises on behalf of the electronics industry with other bodies and has a voice in advising both State and Federal governments on such pertinent issues as safety standards, sales tax and industry assistance. It also encourages high quality product and optimum consumer-member relations, to which such events as the CESA Grand Prix Awards contribute.

Entries for the hi-fi Grand Prix Awards came from:
Akai Audio/Video Australia
Alpine Electronics
Bose Australia
Hagemeyer (Australasia) BV
Hi-Phon Distributors
M&G Hoskins
Marantz
Perreaux International
Pioneer Electronics
Sharp
Sony
Yamaha





Above the Nakamichi CR-7A discrete head cassette deck. Left, Bose AM-5 Acoustimass speakers.

CD Video

Back in 1985, at the Perth Electronics Show, Philips showed a CD player "that displayed the text of the song along with the music", according to one ETI report. Time, money, and marketing ploys have been spent and Philips recently exhibited its renamed LaserVision system in Australia. Launched at the Tokyo show in September under the new name of CD-V(ideo), Philips has added 5-inch and 12-inch (12 and 30 cm) disc and replaced analogue with digital sound.

The 5-inch CD-video 'single' typically carries six minutes of combined audio and video program, plus an additional 20 minutes of audio-only material. The 8 and 12-inch CD-video discs offer playing times of approximately 40 minutes and two hours, respectively. The new model CDV 475 can also handle existing video discs and Philips assures full compatibility with existing CD audio players and discs. The audio section of a 5-inch CD video disc can be replayed on any CD audio player, while CD Video players will also play all existing CD audio discs, as well as existing video discs.

While Philips has not given a release date for its CDV unit, Pioneer has been a little more specific, promising to release its version, the CLD-1050, this year. Like the Philips player, the Pioneer CLD-1050 is compatible with existing CDs and Laservision discs.

Polygram Records has committed itself to supporting the CDV medium, suggesting different genres appropriate to the different sized discs. The 12-inch disc will be the long form carrier for movies, ballets and operas with playing time of up to 120 minutes. Live rock performances will go on the 8-inch disc of 40 minute duration, and the small 5-inch disc will be used for video clips of six minute duration, but with total audio time of 20 minutes. Polygram is vague about release dates for Australia: it will be "commensurate with the increase in overseas production capabilities and format availabilities".

Product Briefs

NAD CD player

The new NAD 5300 includes some innovations: a digital code output for use with future digital signal processors; a 'disc condition analyser' which identifies and signals CDs that are excessively dirty, scratched or defective; a processor which reduces recorded dynamic range to reduce the contrast between loud and soft passages; it also reduces demands on power amplifiers and is suitable for making cassettes for cars or portables. Finally, there is the 'ambience processor' which is said to "enhance the warmth, depth, and ambience of the recorded sound". RRP is $1299.

READER INFO No. 148

Flat Screen TVs

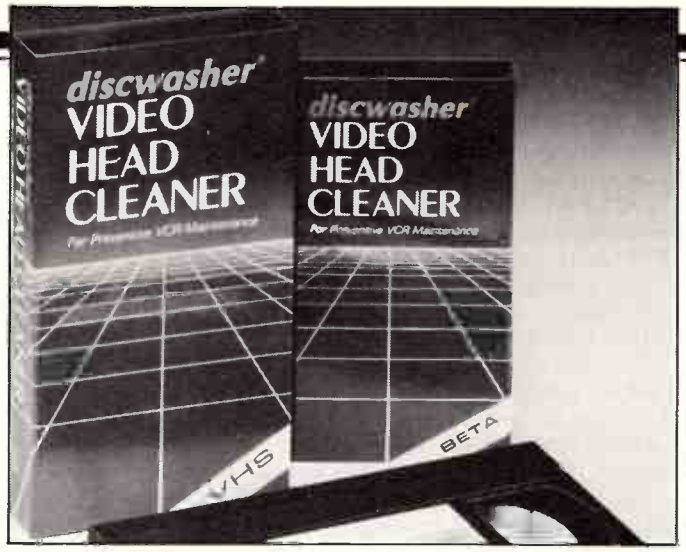
Philips has released a range of stereo, colour TVs using flat square screens. The advantages of the new screens are, according to Philips, greater viewing area due to improved viewing angles and clearer picture due to reduced reflection. The TVs feature 40 watts peak music power and computer-controlled Teletext capable of storing 24 pages of information. Special Start and audio connections allow you to connect with peripheral audio, video or computer equipment.

READER INFO No. 149

Professional Loudspeaker System

The Community CS52 professional compact 3-way loudspeaker system operates between 40 Hz and 20 kHz, featuring wide bandwidth, uniform wide angle dispersion, and coherent wavefront design allowing for precise time performance. The unit can be rotated 90 degrees so that it can be operated either vertically or horizontally. Its enclosure is made from rigidly-braced particle board covered with rugged black carpet and finished with steel-mesh black grille and steel bar handles.

READER INFO No. 150



Discwasher

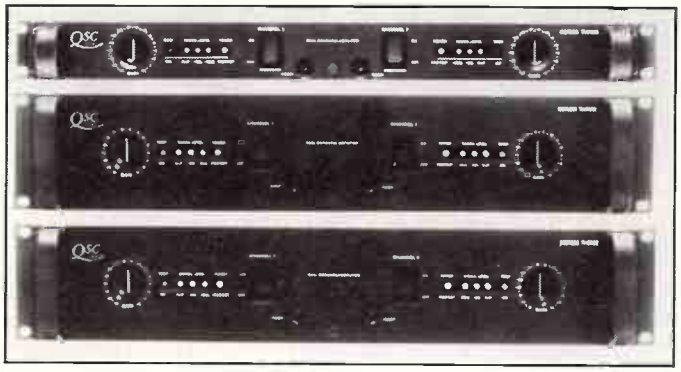
The Discwasher Video Head Cleaner is a dry head cleaning system boasting 4000 cleaning cells per inch of tape. It cleans video and audio heads and the entire VCR path. The cleaner has a low friction backing surface.

READER INFO No. 151

Professional recorder from Denmark

The Danish Lyrec TR533 professional recorder is available in 16 or 24-track versions on 2-inch tape format. Tape transport is at 15 and 30 ips with 7.5 to 60 ips vari speed standard. An erase head with staggered pole pattern, self-aligning rollers and large diameter tape guides, and a tape tension servo system are all features. The ATC remote control offers automatic shuttle, 32-position memory with three direct-access memories displayed simultaneously, and direct search to three tape positions.

READER INFO No. 152



QSC Professional Amps

New from Amber Technology is the range of Series Three amplifiers from QSC offering high continuous power output, extended dynamic range, plug-in signal processing with switchable routing, low profile chassis with front removable channels, cool running high efficiency output, and redundancy of true dual mono configuration. An auto back-up feature automatically connects the load to remaining channel should one fail while in bridged mono.

READER INFO No. 153

The ARISTA™ Solutions

Because everyones' ears aren't the same - Arista has the headphone solution

Ask for the complete Arista Solution at your favourite retailer

TVH100

HP-660

HD-82

HD-86V

EPS100

CDS-16

MHD4

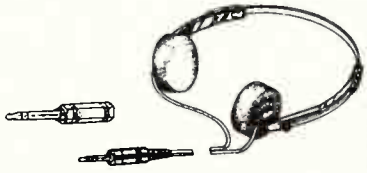
MHD5

CDS-17

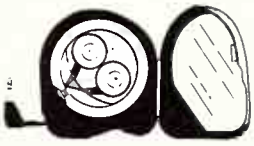
HD1000

MHD12

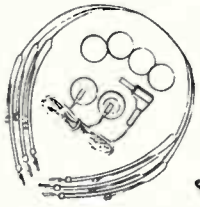
MHD3A



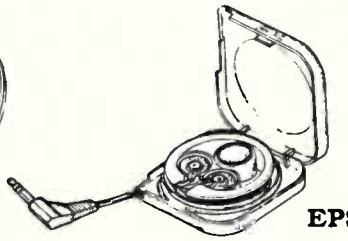
HP-550



EPS200



HP-330

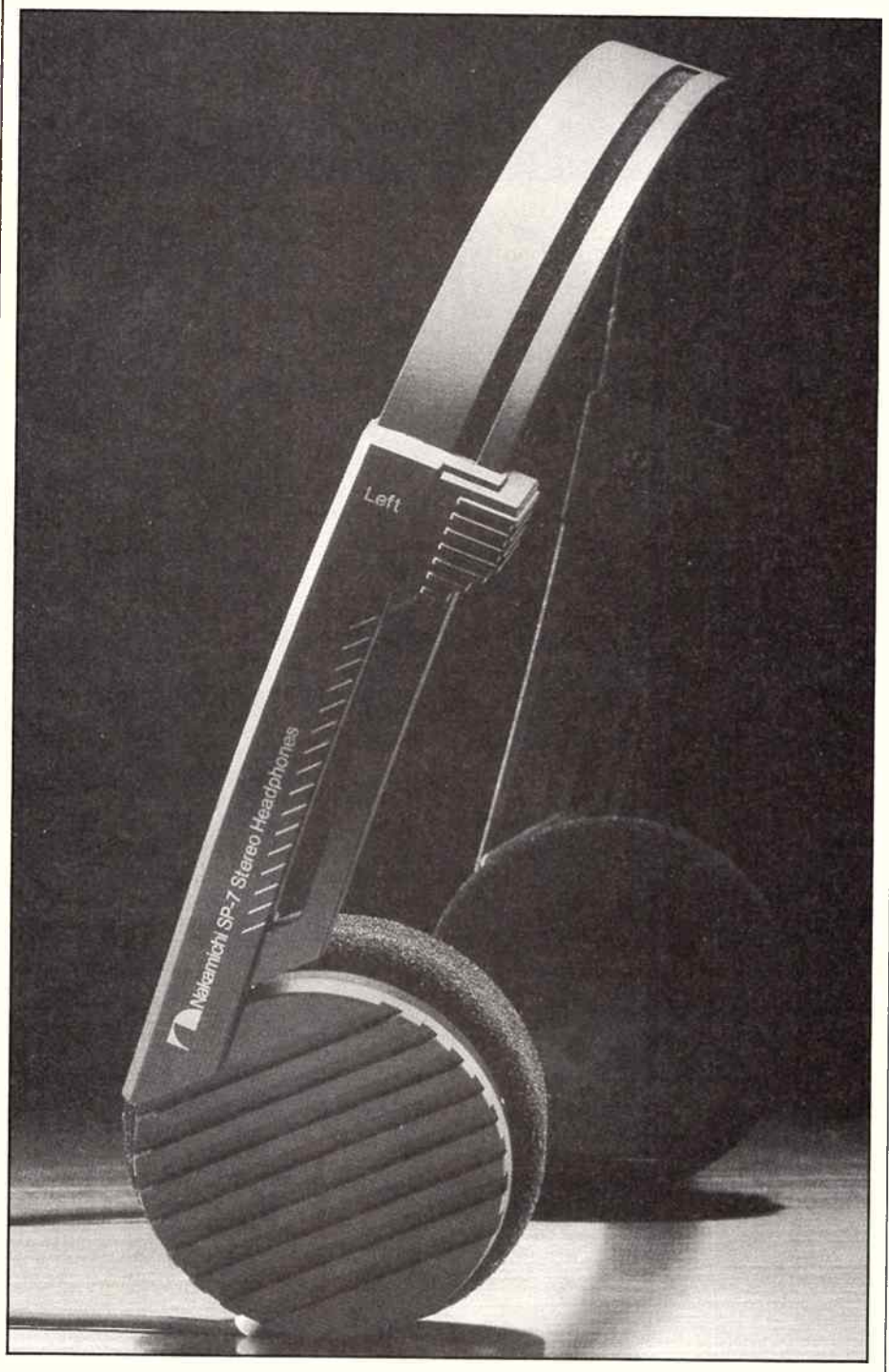


EPS-50

Model No	HP-550	EPS-50	HP-660	HD-82	HD-86V	EPS100	HP-330	MHD3A	MHD4	MHD5	EPS200	CDS-16	CDS-17	MHD12	HD1000	TVH100
Sensivity dB	94	96	100	96	98	98	95	92	96	92	106	100	102	100	100	94
Freq. Resp. Hz	80-16k	40-18k	40-20k	30-15k	20-18k	20-20k	20-18k	20-16k	20-20k	20-20k	20-20k	20-20k	20-23k	20-20k	20-20k	60-20k
Cord Length m	1.2	1.2	1.2	1.8	2	1.2	1.25	1.2	1.8	1.5	1.25	1.8	1.8	2.13	3	6.5
Weight grams	35	15	30	280	240	15	15	30	29	18	20	95	110	98	220	40
Plug Fitted mm	3.5	3.5	3.5	6.35	6.35	3.5	3.5	3.5	3.5	3.5	3.5	3.5 Metal	3.5 Metal	3.5 Metal	6.35 Metal	3.5
Adaptor Supplied	✓		✓					✓	✓	✓		✓ Metal	✓ Metal	✓ Metal		
Mono/Stereo									✓							
Volume Control					✓				✓	✓					✓	
Spare Ear Pads		✓				✓	✓	✓	✓		✓					
Samarium Cobalt Magnet	Ferrite	Ferrite	Ferrite	Ferrite	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Discman/CD Disc						●					●	●	●	●	●	
Walkman Use	●	●	●			●	●	●	●	●	●	●	●	●		
Hi Fi Use	●			●	●	●	●	●	●		●	●	●	●	●	
Noisy Background				●											●	
TV/Video Use										●						●
Sport/Aerobic Use	●	●	●			●	●			●	●					

READER INFO No. 20

More Than Meets The Ear



The Nakamichi company developed these headphones to go with its other high quality sound gear. The SP 7's have a claimed response from 20 Hz to 20 kHz and an efficiency of 98 dB/mW SPL. The speaker coils are especially designed for low mass so that they can achieve exceptional intermodulation figures.

READER INFO No. 170

NOT EVERYBODY CAN rush out and buy a new set of loudspeakers for the digital audio age but many hi-fi enthusiasts might find headphones are a very affordable alternative.

Stereo television and video movies with stereo sound tracks, in particular, can have considerably more impact and seem more realistic when headphones are used. For example, it is unlikely that more than one person at a time can occupy the "best-stereo seat" when loudspeakers provide the stereo sound for video programs, whereas headphones offer optimal channel separation and dynamic range, anywhere in the room.

Headphones tend to protect the available dynamic range in a system and negate unpleasant characteristics in the listening area. They can also provide feedback isolation when it is necessary to monitor taperecording or studio sound, in the presence of live microphones.

Headphones Ain't Headphones

But not all the attributes of headphones which make them suitable for one application necessarily make them suited to another, and it is therefore important to have the right kind of headphones for the job in hand. To paraphrase a famous character, "Headphones ain't headphones."

The first distinction that might be made between headphones is how they enclose the ears. This distinction is based on the acoustic principle of the headphone and has nothing to do with its electrical operation. Basically there are three types.

One is the CLOSED type where the ear and inner parts of each headphone cell are completely sealed off from the outside air by soft, ring pads, which, mould to the shape of the wearer's head and close off the immediate space around each ear. The soft, relatively wide pads also help to even out pressure exerted against the head and makes the headphones more comfortable to wear. An efficient air seal under the pad is also essential for obtaining adequate bass frequency response from this kind of headphone. The air seal could be broken easily by locks of hair, thick spectacle frames and hardened or damaged pads on the headphones. The pads also

help keep the headphones in place.

The second type is the OPEN headphone which, as a rule, has a foam cover which rests gently against the ear. Air is able to circulate freely around and through the earphone unit, and its efficiency at low frequencies does not depend on sealing off the ear. Open headphones are generally light-weight and well ventilated, and are a familiar sight on many Walkman and portable units. Unlike the closed type, the open headphone does not exclude ambient noise, which is able to enter through its open construction. This can be an advantage, however, if, for example, it is desired to carry on a conversation while also listening to music or TV sound in the headphones. But, on the other hand, music playing loudly in open headphones might distract or annoy others. A few models using the open principle also have ring pads to help the units sit more positively and comfortably in position around the ear and it would be easy to confuse them with the closed type in terms of their acoustic operating principle. Headphones which encircle the ear with a soft, ring or dinghy-like pad are also referred to as circumaural headphones.

The third type is the intra-aural headphone which is inserted into the outer ear canal, like a stethoscope. It is used on headphones supplied with some portable players and of course has been used in the hearing-aid type earpiece on transistor radios.

Comparisons

We need only to compare briefly the open and closed types, to appreciate that most home hi-fi and video stereo systems could readily use not just one type of headphone but rather, two: the open type, for general listening and TV video stereo; and the closed model for hi-fi listening when dynamic range and channel separation are important.

If we take, for example, the compact disc and other digital audio media and, for that matter, even analogue programs which have been companded by noise reduction systems like dB, most listening rooms tend to negate one of the greatest benefits those systems tend to offer — dynamic range. And if we consider also the subtle and fragile sounds in music, that are inclined to be masked by background noise in the listening room, then it follows that nuances of the stereo imaging are also likely to be destroyed when dynamic range is impaired.

Unfortunately, in most listening rooms,

Koss PortaPro 1 ar typical of modern light high performance headphone.

READER INFO No. 171

Two headphones from the distributor Arista in Sydney.

READER INFO No. 172

valuable dynamic range is lost where it is most difficult to recover — at the quiet end of the scale — and to that extent the background noise in the average room would need to be improved by about 20 to 30 decibels if advantage is to be taken of the full dynamic range of the compact disc digital audio system. This means, perhaps, insulating ceilings and floors, double-glazing windows, adding a second brick veneer wall and a few more very expensive modifications to the homestead, and it still might fall ten decibels or so short of target.

Headphones — the right kind of headphones — on the other hand can at relatively modest expense recover dynamic range significantly, by excluding from earshot much of the background noise in even an average listening room. And suddenly, sounds appear which were not there before — musicians actually handle instruments and music sheets, and move on their chairs. And, perhaps even more refreshing, one also gets an impression of the kind of surroundings in which the work was performed. Many of the clues for these impressions remain under the background sound in noisy rooms.

In broadcasting, and traditional recording media such as vinyl records and magnetic tape the typical dynamic range of the system could be reproduced comfortably in the average listening room at home. For example 70 decibels of dynamic range, on top of 40 decibels Sound Pressure Level, (40 dB SPL) of background noise, meant that the loudest sounds in the program would be about 110 dB SPL — about disco loud — and perhaps a little too loud to expect the neighbours to remain neighbourly.

Now imagine trying to accommodate a dynamic range of 96 decibels from compact disc in the same room. Forty, plus 96 decibels equals 136 dB SPL. Not only would the loudest parts of the programs now sound about eight times as loud as the original 110 dB SPL but it is in the range which would almost certainly impair hearing, permanently. This example shows why dynamic range in home hi-fi systems has to be recovered largely at the lower end of the volume scale.

For instance, a sound system playing at 90 dB SPL is fairly loud, certainly too loud to carry on a casual conversation across the room while the music is playing at that level. But, assuming that to be a practical figure, in fact let us be generous and make it 96 dB SPL, then to accommodate the full dynamic range of the compact disc system there will need to be 0 dB SPL, or absolutely no background noise at all, in the listening room. This means that most rooms would require about 40 decibels reduction in background noise, a figure that might make an acoustics architect rub his hands together in anticipation.

AKG Acoustics K280 Parabolics have a typical open air design with two diaphragms in each ear piece, which act to focus sound energy in the entrance to the ear canal. Rated SPL in 94 dB and Frequency range of 20 Hz to 20 kHz.

READER INFO No. 173

The price of a comfortable pair of closed type, stereo headphones would be probably minuscule, compared with the cost of modifying a building, to achieve the same improvement in dynamic range that headphones may offer. ●

Decibels and their significance

1. The perceived loudness of a sound doubles, or halves, with each ten decibels change in sound pressure at the ear.

2. Three decibels difference, approximately, is needed to cause a noticeable change in the loudness of sound such as, say, wide-band music.

Due to factors associated with the hearing process, as recorded by Fletcher — Munsen, and others, these relationships between loudness and absolute sound pressure levels are accurate only at 1 kiloHertz. They are nevertheless approximate over the mid-to-high audio frequency range but at very low audio frequencies loudness varies more rapidly with sound pressure level.

For power changes in the system:

1. A change of three decibels from doubling or halving the power in an audio system.

2. Ten decibels change results from changing the power in the system by a factor of ten.

Eurovox Model MCC-8280E Review

Louis Challis

EUROVOX HAVE recently released a new generation of automotive radio cassette players in Sydney. The occasion was unusual because for the first time an Australian manufacturer utilised the full power of the Aussat satellite channels to provide a simultaneous product release in three capital cities.

As clever as the concept of the release was, it was the microprocessor controlled stereo AM/FM cassette player which was the real star of the show. The product was backed up by a clever and punchy little TV commercial.

Eurovox believe they have the answer to the car robbery problem with their "SC Digital Security Coded" modules which make the radio unusable if you don't have the security code number. That may be true, but what worries me is: are the thieves smart enough to realise that they shouldn't be wasting their time, or will they steal the radios anyway and only discover afterwards that the effort was wasted.

Interesting Features

There can be no denying that the top of the line Eurovox car radio cassette player incorporates more innovative features into a standard DIN sized package than I would have thought possible. The package provides more power, potential and panache that any other unit on the market. The MCC-8280E incorporates so many exciting eye-catching features that their technical blurb is hard pressed to convey the full scope of this product to an intending purchaser. If you don't have the chance to see first hand what it can do, it's unlikely that you would believe my description.

When it is switched off, the bland black appearance of the front panel with rows of push buttons and white lettering with a black screen on one side constitutes an absolute understatement of the unit's potential.

At the extreme right-hand side of the front panel is a large display which utilises selectable red or green LEDs. This display is undoubtedly one of the most visually exciting and unusual feature to be introduced into a car radio. But utilising the power of a potent microprocessor with a large ROM, a large number of different pre-programmed displays can be selected and viewed. These include a graphical display of the settings of the volume control, the individual settings of a five band equaliser in the equaliser mode, the station frequency (with very large and clear 11 mm high numerals), whether the mode is AM or FM, which preset channel has been selected and the band width of the receiver, in the radio mode.

If all this wasn't enough, the unit can also show the positions of the fader balance control, in terms of the four audio channels (2 front and 2 rear) that the output stage can provide. You also have the option of displaying a left and right output level meter which indicates volume settings, as well as a conventional digital clock and preset station scan.

The cassette loading well is at the top of the front panel. On its right is a small hole with which the LCD illumination level can be preset by the dealer. Besides this is an elongated automatic dimmer sensor, which can then detect the amount of light in the car so as to correctly set the multi matrix display panel illumination level.

Near the top left hand corner of the front panel is a small push button labelled "PRO AF" which selects AM or FM reception in the radio mode and is a programme selector in the tape mode. To the right of this is a small button with an upward pointing arrow symbol which is utilised for cassette loading and ejection.

Immediately below these two switches is a toggle bar which is labelled with two arrows < > with a light emitting diode in the middle. This toggle switch fulfills four similar roles as a fader and balance selector in all of the four possible operating modes.

Security Code

At the very bottom of the front panel face are nine small and one large buttons (which is actually a toggle bar switch) and one large toggle lever which are the most often used controls. The first button is the power ON switch, these after activation has to be followed by keying in a six digit security number. The fundamental of the security coding system is that the owner or the driver has to enter this number correctly before the unit will operate. If the wrong number is entered, then there is a warning bleep from the unit and the unit should then be switched off with the ignition key before attempting to try again. If three false attempts are made sequentially, the radio cassette player will switch off for an hour before you can even begin to attempt once more to re-activate the unit.

The next switch to the right is the MUTE switch which attenuates the output level and which when re-pressed, restores the output signal to its original level.

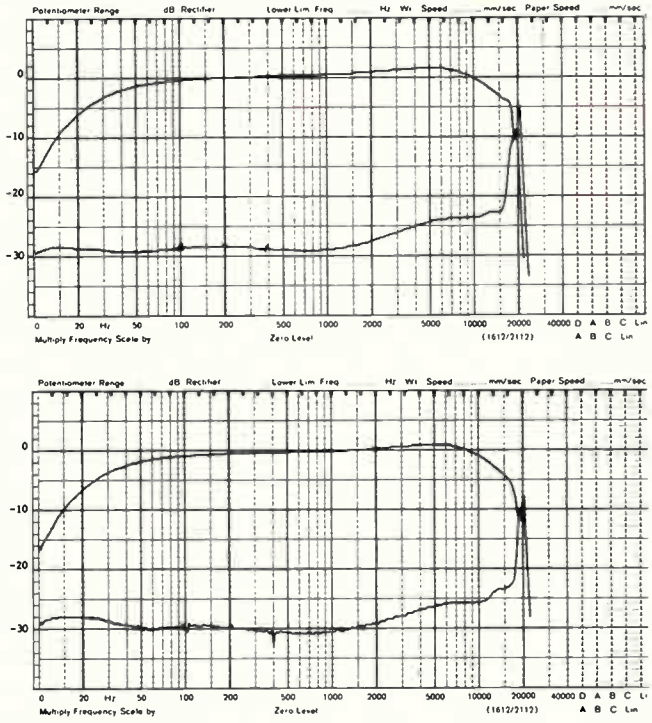
The large toggle lever provides multiple functions depending on which mode setting you have selected. In the audio or most common usage it provides volume up or down, fader control for front and rear and balance control from left to right. In the equaliser mode it provides the same functions as the audio mode as well as a front to rear mode select switch and an equaliser level control switch. In the radio and cassette mode the toggle level provides volume control, fader control front to rear and balance control.

The next switch to the right is the mode selector switch which switches the display and the functions through the four primary modes of volume, equaliser, radio or tape. The supplementary mode associated with an add-on CD player can only be activated when the CD inter-connection plug at the rear of the receiver is plugged into a matching socket that provides the required 'handshake'.

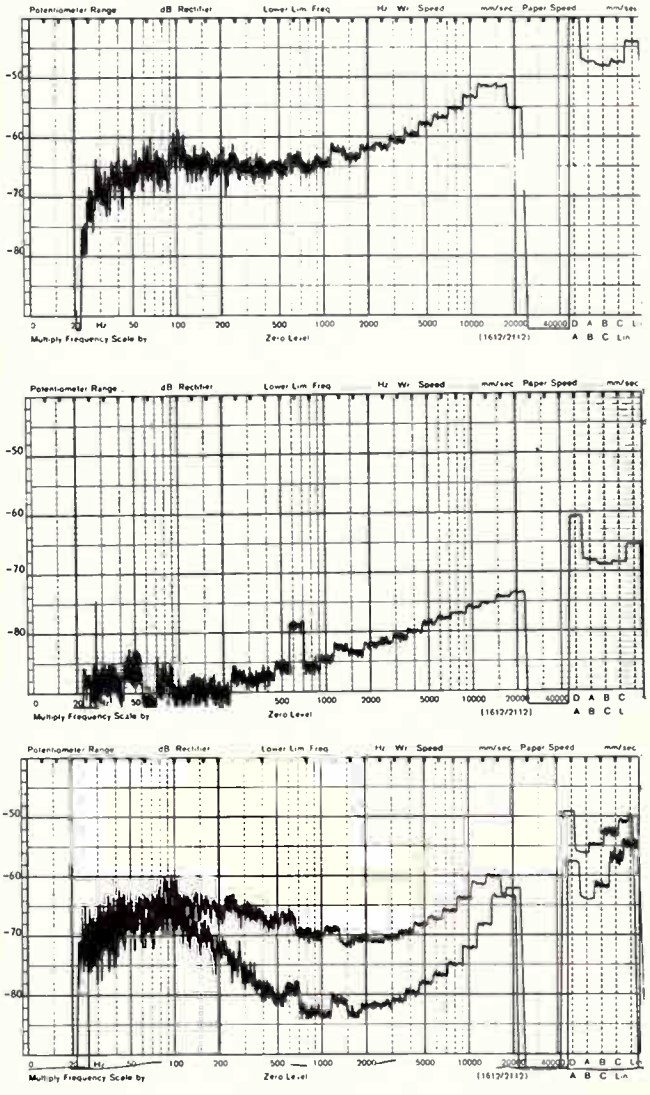
The adjacent six buttons labelled 1 to 6 provide a wide range of different functions depending on the situation. When first switching on they provide the means of keying in your six digit security number. Having only six keys means that the number of combinations available is limited to only 46,656 combinations.

In the audio mode these six switches also provide six volume memory presets and six fader balance memory presets which you can programme with the multiple controls to suit your own particular tastes for music, road speed or even for a specific prerecorded tape. In the equaliser mode, as well as the other two facilities just described, you can store six preset equaliser curve memory functions to suit specific music or road conditions. In the radio mode you can again store six volume memory presets, six fader balance memory presets and six AM and six FM normal station frequencies. For people travelling interstate you can store an additional six AM and FM supplementary station presets of the six strongest stations without losing the normal memorised frequencies of your local stations.

Dimensions: 180 mm wide x 500 mm high x 160 mm deep
Weight: 1.6 kilograms
R.R.P.: $1,299



FM reception. At top is the right hand channel and at bottom the left. In each case the top trace is reception bandwidth and the bottom one is channel separation. Notice that there is a one to two dB difference in channel separation between the two graphs.



Noise performance. At top the response to a sine wave with no noise reduction using Sony HF-E560 tape. In the middle we see the effect of dBx, and at bottom, the effect of Dolby B and C.

In the tape mode, as well as volume and fader balance presets, you can also have automatic programme selection, which allows you to skip past prerecorded four second blank sections on your tape to the nominated track number.

In the centre of the front panel are two rows each with five switches labelled RTS. This is a radio tune/seek mode selector switch, as well as being a tape fast forward/rewind and the APS selector switch. The next switch is labelled 'SRD' which activates Suround Effect function. When activated, this control provides added mid band presence, an increased level of echo and alters the relationship of the phase balance between each of the four channels. When the switch is activated, the 'SRD' logo also lights up on the 'multi matrix' display.

The next switch is labelled 'LD' and provides a very useful and well conceived loudness contout to increase the low frequency and high frequency equalisation to suit the background noise conditions which so adversely mask both low and high frequency in most cars. The next switch is labelled 'N/R' and this provides three different types of noise reduction decoding, namely Dolby B, Dolby C or DBX, as indicated in the multi matrix display. This is the first car radio which I have tested offering such a wide range of noise control options. I question the benefits of DBX in a car where I believe an even higher degree of compression is called for. Of course the designers have given you this to give you the choice of pre DBX encoding your tapes so that you can leave them compressed (which is good when travelling) or re-expand them when the vehicle is stationary and quiet inside.

The last switch in the top row is a display mode priority switch labelled 'DSP'. When touched, the main display priority mode can be selected with this switch, ie, after cycling through the other functions the display reverts to the selected priority mode. Thus by way of example, in the radio mode, the station frequency, level meter or clock can be selected to have priority, whilst in the tape mode, tape lever

meter or clock can be selected to have priority and in the external source mode, the level meter or the clock can be selected to have priority.

The first of the lower set of five central switches is labelled 'MTL LOC' which determines the sensitivity of the station search selector. When the cassette player is in use, this switch also provides the ability to switch the equalisation from 120 microseconds to 70 microseconds to suit the requirements of type 1 gamma ferric oxide tapes of type 2 and type 4 chrome or metal tapes. The next switch is labelled 'REP MO' which in the radio mode selects stereo or MONO and in the tape mode allows a tape to be replayed repeatedly.

The middle switch is labelled 'B/W' which allows you to select WIDE (W), MEDIUM (M) or NARROW (N) in cyclical manner utilising the multi matrix display to identify the selected band width.

The next switch is labelled 'BS ASM' which in the radio mode, allows automatic station memory and addresses selection. Through the use of this switch you can store 6 AM and 6 FM station frequencies that have been memorised. Unlike the normal memory capability, this ASM mode searches for the stations on the basis of their signal strength ranking. In the tape mode, when this switch has been activated, and when a 14 second gap of silence is detected, then the cassette player will automatcally switch to the fast forward mode and the search for the next section of recorded programme.

The last of these switches is labelled 'P/S' and this is the preset station scan switch, whose function is to scan all of the stations stored in the AM and FM memories. After touching this switch, the receiver will cycle through each of the stored station, holding them for five seconds. If the switch is touched during the five second hold, then the cycle is stopped and the selected station remains activated.

The Rear View

The rear of the receiver has an extended aerial input socket and a pair of coaxial input sockets on the left hand side of the panel, with a large set of cable harnesses terminating in matching multi-terminal sockets on the right hand side. These 15 cables and separate seven pin DIN socket are provided for connecting the normal power, speakers, and ignition switch circuit, a socket for inter-connecting a separate power amplifier stage as well as a logic detection circuit for the CD player to recognise and respond to the connection if and when it is made. The rear panel also incorporates a finned heat sink to dissipate the main amplifier output stage heat load.

Fortunately the handbook provided brief specifications on the correct electrical connection for an add-on amplifier and CD player. It also provided comprehensive data on the pin connections for each of the sockets as well as data on selectable night-time illumination. Although I connected the unit up so that the multi-matrix had red illumination, I could also have selected green.

Objective Tests

The first series of performance tests that I carried out was to assess the amplifier performance for which the claimed output is 20 watts per channel into each of the four separate outputs. Whilst this output may possibly be achievable with 14 Volts or greater output, the best I was able to measure was 18 watts of almost square wave (which is not audio) and 12.25 watts with 4 per cent distortion. The frequency response of the amplifier is −3 dB at 30 Hz and 16 kHz. The signal to noise ratio is −68 dB(A) cf 12.25 watts output. The tone controls provide ± dB of boost and each of the six frequencies of 60, 150, 400, 1k, 2.2k, 5k and 12k whilst the loudness control provides a real loudness control type performance with typically +10 dB boost at 70 Hz and 7 dB of boost at 10 kHz.

Whilst the amplifier performance figures were reasonably good, it wasn't until I got to testing the AM stage, that the unit began to impress me. Whilst virtually all of the AM tuner pre-amplifiers and other equipment that I have tested over the last year provided what can only be described as 'an apologetic AM performance' the Eurovox receiver provides 'true blue' AM stereo performance. This is possibly the only country in the world (apart from New Zealand) where there is justification for providing decent AM band width and yet apart from this receiver, and a few others, you just don't seem to be able to purchase tuners with a reasonable AM band width reception capability. This receiver's genuine 7.5 kHz band width is head and shoulders above anything else on the market. As well as offering wide band width performance, it provides a 5 kHz band width in the 'medium' mode and a very narrow 2.5 kHz band width in the 'narrow' mode In the narrow mode the AM tuner sounds like all the other apologetic units that you can buy. The AM stereo performance is achieved with superior sensitivity which is 28 microvolts for 26 dB signal to noise ratio, in the DX position. The AM stereo separation is better than 25 dB at 1 kHz and the search lock in works quite happily at 40 microvolts in the DX mode.

In the FM mode the sensitivity is 2.5 microvolts for 40 dB signal noise ratio in the stereo mode. The band width of the left and right channels is almost identical, being 3 dB down at 30 Hz and 15 kHz. The channel separation is better than 30 dB at 1 kHz and better than 25 dB at 5 kHz. The shape of the FM response, is within ±1.5 dB range all the way up to 11 kHz and the high frequency droop is not considered to be a practical limitation. The distortion in the FM mode is extremely low, being less than 0.4 per cent at power outputs corresponding to 1 watt level. The FM section provides image IF and AM rejection performance which is excellent particularly in terms of its over load capacity in the presence of a strong adjacent channel signal.

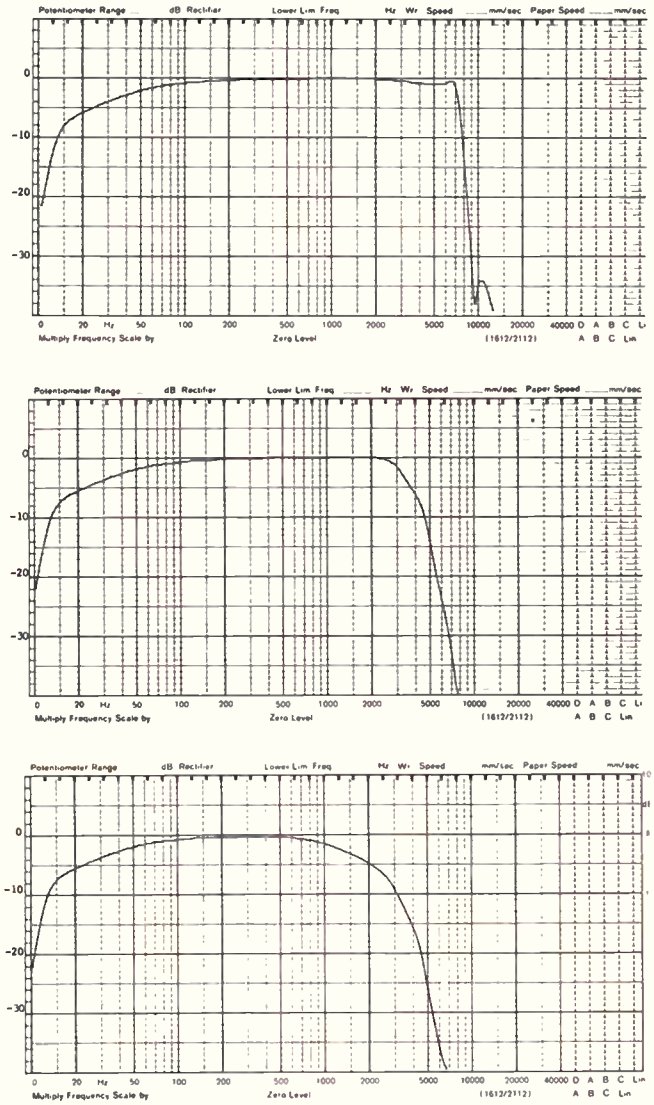
The cassette recorder is also extremely good as it provides replay response which is 3 dB down at 48 Hz and 9 kHz on type 1 gamma ferric oxide tape and 3 dB down at 46 Hz and 10 kHz for the type 2 chromium dioxide test tape.

The measured signal to noise ratio performance of the cassette recorder and amplifier with test tapes was extremely good, with the A-weighed noise threshold (re 0VU) being −47 dB(A) without selecting noise reduction, −56 dB(A) with Dolby B and −64 dB(A) with Dolby C. When the DBX (expansion) decoding was selected, this figure improved to −68 dB(A) with a dramatic reduction in low frequency noise especially when compared with the more conventional Dolby system. The measured noise figures quoted above would be at least 6 dB higher when evaluated in terms of the 3 per cent harmonic distortion figures. Based on this, the Eurovox MCC-8280E appears to have just about the lowests noise figures of any car cassette player that I have yet evaluated.

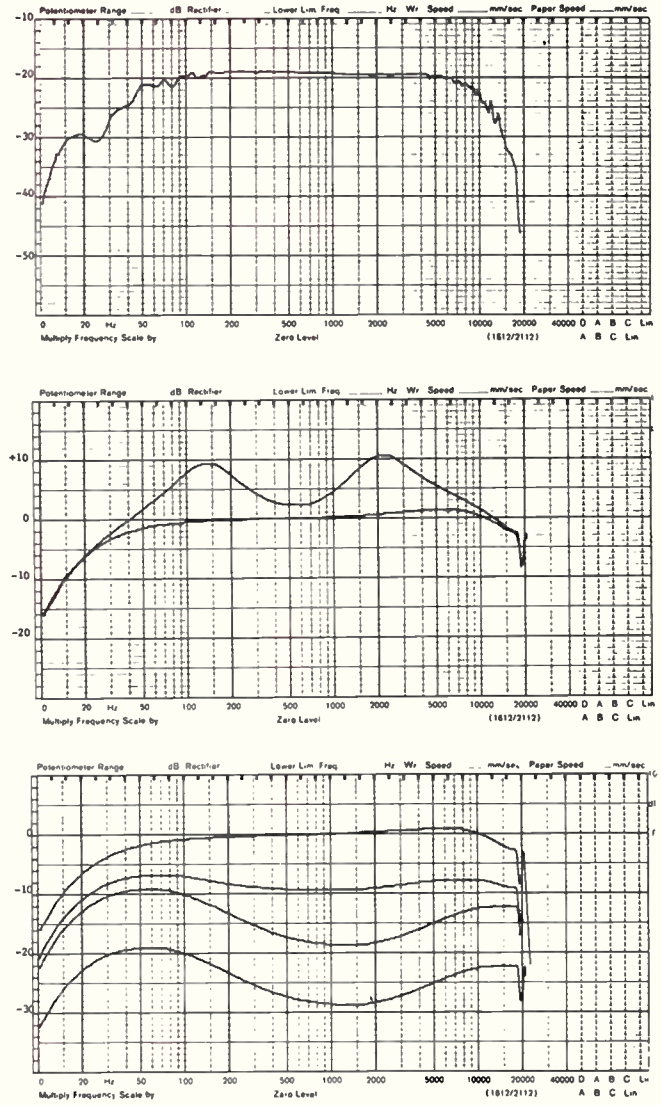
Taken overall, the objective performance characteristics of the MCC-8280E unit are positively outstanding, and it is undoubtedly one of the finest, if not the finest, car receivers available in Australia at the moment.

Friendly Display

As good as the objective performance characteristics are, the most endearing feature of this receiver is its user friendly display of frequency, time, and control functions. Frequency and time are obviously standard features that all other car cassette players provide. By contrast the ability to monitor frequency equalisation (and in seven bands to boot), the precise ratio of your four speakers outputs and the functioning of your cassette tape player at a glance are features that every user will appreciate.



AM reception is exceptional on this product. At top is the receiver response with wide bandwidth. At centre is medium and at bottom narrow.



Tape Output. At top is the frequency response of type 2 metal tape. The middle graph shows the effect of the equaliser and the bottom one, loudness contours for 10 dB changes in level.

Unfortunately these sort of features are also equally attractive to the fringe dwellers of our society (those self same 'nice' people who have helped themselves to four of my car cassette players over the last four years). In practical use when connected up in my car (that one without a car radio) the AM and FM radio reception proved to be positively outstanding. The performance in the Cahill Expressway tunnel was outstanding and better than any other radio I have ever owned. The car cassette player also performs extremely well, but the FM mode and the cassette played show up the limitations in the car's inbuilt speakers. Obviously if you are prepared to spend this sort of money on your mobile hi-fi, you will have to spend equal sums of money on your speaker systems to achieve the full potential.

I listened to some stationary hi-fi at home with the system connected to a pair of monitor speakers and the quality of sound was almost on a par with my normal FM tuner and amplifier. You should note however, that none of my AM tuners come within a cooee of the performance of this unit's AM tuner.

Problems

The only potential problems I see with this receiver after an exhaustive testing programme are that:

1. An intending thief may not be aware of his inability to re-activate the unit without the digit code. He or she won't find out that the six digit code is needed until after the car cassette player is stolen.
2. Unlike some of the lower priced digicode receivers made by Eurovox and other manufacturers, which have a flashing light to frighten away the intending thief, this particular unit does not incorporate that otherwise highly desirable feature.

For all my trivial complaints, the MCC-8280E computerised programmable radio cassette player is the most outstanding unit that Eurovox have yet produced. It sets a standard of excellence which other manufacturers and Eurovox will now find it hard to improve upon. At $1,299 I believe that this receiver constitutes good value for money, particularly as it is a true 'stand alone' unit which does not require separate amplifiers, equalisers or other fancy boxes to extract its full potential.

READER INFO No. 155

Eurovox MCC-8280E

MEASURED PERFORMANCE OF EUROVOX MCC-8280E

CASSETTE CAR STEREO WITH FM/AM ELECTRONIC TUNER

Serial number : 182000077

REPLAY FREQUENCY RESPONSE AT -20VU :
(AS 2680 Clause 2.2.3.1)

Tape	Dolby	Lower - 3dB Point	Max. Point & Frequency	Upper - 3dB Point
Type I	out	48 Hz	-	8.5 kHz
Type IV	out	47 Hz	-	10.0 kHz

* Azimuth alignment

SPEED ACCURACY : + 0.5% with TDK Reference tape
(AS 2680 Clause 2.2.1)

WOW AND FLUTTER :
(AS 2680 Clause 2.2.2)

WOW : Average 0.2% peak to peak

FLUTTER : Unweighted 0.12% RMS

Weighted 0.04% RMS

HARMONIC DISTORTION :
(at 12.25 watts output
Includes Generator Distortion)

Tape :

		100Hz	1kHz	6.3kHz	
0VU :	2nd	-36.6	-33.0	-41.3	dB
	3rd	-31.7	-35.6	-45.5	dB
	4th	-31.7	-45.4	-47.6	dB
	5th	-32.9	-47.1	-	dB
	TOTAL	-	-	-	dB
	T.H.D.	4.4%	2.9%	1.1	%

with 0.4 watts amplifier output

2nd	-38.2	-39.3	-49.8	dB
3rd	-39.1	-43.8	-35.7	dB
4th	-45.7	-	-	dB
5th	-	-	-	dB
TOTAL	-	-	-	dB
T.H.D	1.7%	1.3%	1.7	%

EQUALISATION IS in accordance with IEC 268-3B

DYNAMIC RANGE : (Re 3% 3rd Harmonic Distortion (+ 6VU)

Tape : Sony HF-ES 60 (Type I)

Dolby Out	-50 dB(Lin)	-54 dB(A)
Dolby B	-57 dB(Lin)	-62 dB(A)
Dolby C	-61 dB(Lin)	-70 dB(A)
DBX IN	-71 dB(Lin)	-74 dB(A)

FM TUNER :

Frequency Range : 87.9-107.9 MHz

Usable Sensitivity : (40 kHz deviation)

12 dBF for 50dB signal to noise ratio with MONO signal
26 dBF for 50dB signal to noise ration with STEREO signal

AM TUNER :

Frequency Range : 522-1629 kHz

Usable Sensitivity : 28 microvolts for 26 dB signal to noise ratio on Mono signal

MAXIMUM SIGNAL TO NOISE RATIO (40% Modulation) 49.5 dB (Lin) 55.5 dB (A)

Digital audio paths demand new methods of testing and assessment

Digital Audio Test Signals

The author gratefully acknowledges the contribution of Mr Michael Bennett in programming the PROMS and taking the experimental readings and also the permission of the Director, Engineering and Property, Australian Broadcasting Corporation, to publish this material.

Neville Thiele

A NEW design procedure may well be impractical or at least imperfect until a new testing method is derived to verify its performance. On the other hand, a new technology not only has new needs but also provides new opportunities.

When digital audio first came on the market, some domestic users were less than enthusiastic. They had expected "perfect" reproduction, yet some equipment was manifestly imperfect. Fortunately, however, manufacturers have corrected the gross faults of some of their early models rather faster than the manufacturers of transistor audio amplifiers.

Both these examples demonstrate the need for adequate testing procedures.

The much-canvassed "perfection" of digital audio applies only to the possibilty of highly precise replication of the digital bit stream from one process to another, and then only within well defined limits of corruption by imperfections in the transmission medium. But a complete digital chain also involves tranducers at either end, analogue-to-analogue (A/D) converters, digital-to-analogue (D/A) converters, anti-aliasing and recontruction filters, and sample-and-holds. The problem is compounded in broadcasting by the need for the audio signal to pass, until the milennium of an all-digital broadcasting system, though a number of digital islands in an analogue sea, each involving encoding and decoding of the signal from analogue to digital and back again.

Then there is the "small" matter that the signal passes at the extremities of each transducer through audio amplifiers which must not only have intrinsically good analogue performance, but must also preseve the analogue signal free from contamination by the raw digital signal, the clock frequency and its sub-multiples. High-quality digital design also requires high-quality analogue design, and a high degree of isolation, i.e., low cross-talk, between the two separate forms of the signal.

A problem in measuring the performance of a digital audio channel is that the interfaces between the digital and analogue sections are often inaccessible. When an analogue testing signal is fed to the input, and the output signal analysed, useful information can be gained about the chain as a whole, but little or none about the location and magnitude of individual faults. However, with a digital signal substituted for the digital stream, the output section can be tested independently of the input section. The performance of the input section can then be inferred from the difference between the overall performance and that of the output section.

Better still, if the input section is fed by an analogue signal derived from a digital source through a D/A converter of known good performance, its digital output can be analysed by FFT synchronised from the initial digital source and the performance of the input section thus assessed directly.

For these reasons we have developed test signals using pulse code modulation. It should be explained that this is not the only way we could have done things, since useful signals can be derived using Delta modulation.

Digital test signals are most usually stored in PROM. Storage in PROM confers the great advantage that the signals are highly stable and repeatable, yet they can easily be changed when needed — by replacing the software. Further, as PROM capacity has risen and cost fallen, greater sophistication or complexity has become practical.

One disadvantage of digital signals is that they inevitably produce quantizing distortion. This is sometimes called quantising "noise" because its spectrum is flat across the useful band, like white noise, and it remains constant regardless of the level of the digital signal. On the other hand, it is induced by the presence of a signal. No signal, no distortion, no noise.

The test signal is stored in the PROM as one or more complete cycles of the signal. The sequence of samples in the PROM is scanned by incrementing its address from one end to the other. When the process is repeated *ad infinitum*, a continuous signal is produced. The lowest frequency that can be produced is F_{seq}, the sequence frequency. Any frequency recorded in the sequence must be a multiple of F_{seq} and this includes the components of the quantizing distortion. These distortions components are distributed across the band in a manner similar to white noise, but their spectrum is not continuous. They occur only at multiples of the sequence frequency.

Furthermore, the magnitude of each frequency component varies somewhat about the mean that would be predicted from distributing power equally between them. The variations are caused by pecularities in the quantization of the initial analogue signal. They can be established precisely from a Fourier analysis of each signal, but could be described generally as quasi-random. Sample calculations to date have indicated no measured component more than 6dB above the calculated average value.

Constructing a Quantized Sine Wave

When a signal is coded into numbers comprising N binary digits, it can occupy one of 2^N levels. The numbers for a symmetrical waveform go from -2^{N-1} through 0 to $+(2^{N-1}-1)$. The centre line of a symmetrical waveform, eg a sine wave, is thus not 0 but $-\frac{1}{2}$ LSB. This is illustrated for a 3 bit number in figure 1. On this basis, the number 0 respresents all the levels between 0 and 1 LSB (least significant bit) above the centre line, while the number -1 represents all the levels between 0 and 1 LSB below the centre line. Thus for the purpose of such signals, programme or testing, a negative number is found simply by inverting all the binary digits of the corresponding positive number.

Thus in the case above 000 becomes 111. Similarly $+3$ and -4 represent levels

A typical studio: Digital techniques mean new testing procedures

between 3 and 4 units above and below the centre line, and negation of 011 produces 100.

It is important that the expression being quantized never quite reaches the outer limits of the quantizing levels, ie: that the sample is never taken at an angle that is an exact odd multiple of 90°. Otherwise the calculated figure might exceed the permissible level on the positive peak. Again, the angle should never be an exact even multiple of 180°. Otherwise the quantized signal will be slightly asymmetrical. Both possibilities are avoided by adding a small offsetting angle as in Figure 2.

In (a) where there is no offset, samples are taken at 0°, 90°, 180° and 270° which are exactly the sampling points that we wish to avoid. Even with more than one cycle per sequence, those samples must be taken at least once per sequence so long as the number of samples per sequence is divisible by 4, which is highly likely. In (b) where the offset angle is 45°, ie: half that between samples, sampling at multiples of 90° is avoided, but now two samples are taken at equal amplitudes in the first and second quadrants and likewise in the third and fourth. This is undesirable if as many different levels as possible are to be sampled.

$N_{s/s}$	19	23	31	53	79	127	257	769	1283	1801	2309	2819	3329	3847
Hz	37	45	61	104	154	248	502	15K	2.5K	3.5K	4.5K	5.5K	6.5K	7.5K

Table 1, Derivation of Test Signal for Frequency Response from 8192 samples

It should be noted that, whatever the waveform, even with a sequence length of 65536 samples, each possible level of a 16 bit signal will be sampled only once on average. That, of course, and the fact that such a sequence would be 2.0 seconds long with 32 kHz sampling indicates the comparative insignificance of the least significant bits in a full amplitude signal. Contrariwise though, it also demonstrates the wisdom of testing over a graded range of peak levels to fully assess the performance of digital systems, which can easily produce distressing discontinuities near the centre line.

In (c) however, where the offset angle is a quarter of the angle between samples, all the samples are different, with their samples displaced as far as possible in successive quadrants.

If two or more equal amplitude sine waves are to be added together to make a test signal, they should not be quantized separately before adding. For example, if 256 levels, going from 0 to 255, are available, two signals going from 0 to 128 can only produce, when summed, peak amplitudes of 0 and 254. Three signals going from 0 to 85 or five going from 0 to 51 would be feasible. However, in general it is more satisfactory to add all the sines before quantizing.

The number of complete cycles in each sequence should be odd if possible because that ensures, as long as the number of samples in the sequence is even, that any analogue level is sampled only once. It is important, especially for distortion measurements, that a maximum number of different analogue levels is sampled. For a similar reason, it is important that $N_{cyc/seq}$ and $N_{smpl/seq}$ have no common factors. Of course, if $N_{cyc/seq}$ is odd and $N_{smpl/seq}$ is a power of 2, that possibility is excluded automatically.

If this is so, and the signals is symmetrical about the centre line, then the second half of the sequence is simply an inversion of the first half. This is true even if the signal is a mixture of sine waves. As a result only the first half of the signal need be recorded in PROM. Each binary digit except in the most significant bit, ie: the sign digit, is passed to one input of an exclusive-or gate, whose other input is fed with a waveform, the most significant bit, that alternate with each half sequence. The outputs of these gates thus provide the digits for the whole waveform. This feature was most useful when the cost of storage per bit was expensive, but has become less useful as the cost of PROM storage has fallen.

Measuring Frequency Response

Frequency response can be measured by recording a mixture of sine waves in a PROM. After the signal has passed through the equipment, the amplitudes of the individual sine waves are read on a spectrum analyser. A typical application is shown in Table 1 for an application using 14 bit linear quantization with a sampling frequency of 16 kHz, and hence a Nyquist limit of 8 kHz. Fourteen frequencies were chosen from 37 Hz to 7.5 kHz. With their relative amplitudes adjusted so as to simulate J.17 preemphasis, their sum was quantized and written into two PROMS of 64K bit (8K byte) capacity. With 8192 samples per sequence the sequence frequency is 1.95 Hz. It should be noted that the desired frequencies, the lower ones being from the IEC prefererd series, were approximated by odd numbers of samples per sequence.

All the numbers per sequence were in fact chosen to be prime, but that restriction is now seen to be unnecessary. The spacing of the frequencies is closer towards the band edges where variation of frequency response was considered more likely.

In the event, the worst performance deficiency uncovered by the signal was in the analogue section of the equipment, in the J.17 de-emphasis, which falls 18.8 dB between corner points of 4135 Hz and 477 Hz. Using the signal, the frequency response was finally adjusted flat to within ¼ dB.

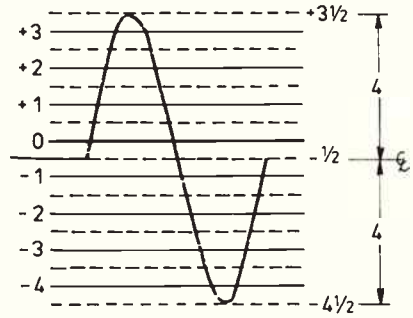


Figure 1 Three bit quantization

Measurement Of Total Difference Frequency Distortion

In this method, two tones of equal amplitude at frequencies $2f_0$ and $3f_0+\Delta$ (where Δ is small), are mixed together and fed to the equipment, and the major in-band distortion in the output is read at frequencies of $f_0{}^+\Delta$, the plus sign for even order non-linearity and the minus sign for odd order. The method is particularly valuable in testing for non-linearity near the top edge of the band where, in a 15kHz bandwidth, the IEC has suggested testing frequencies of 8000 Hz and 11950 Hz, with the intermodulation components read through a narrow filter with a pass band of 4000 Hz + 50 Hz. When the RMS sum of the two components is read with respect to the amplitude of one of the two component frequencies, the numerical result is similar to that of Total Harmonic distdortion (THD) produced by the same non-linearity. Its significance is thus easily appreciated by users more familiar with the THD method.

At frequencies high in a band-limited system such as a digital channel, the Total Difference Frequency Distortion (TDFD) method measures distortion that is unmeasurable by THD because both the 2nd and 3rd harmonics would fall outside the band. At middle frequencies, the TDFD still has an advantage, because its readings are taken through a narrow-band filter which excludes much broadband noise, including quantizing distortion. Thus distortion can be read to values more than 10 dB below wide-band noise.

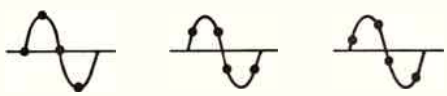


Figure 2. Effect of offset angle on sampling with four samples per cycle.

When readings on the one equipment are taken at both middle and high frequencies, the difference between them can indicate the mechanism producing the distortion. An increase in distortion at high frequencies indicates inability to handle signals with high slew rates, eg: an excessive current into a capacitive load or, in A/D or D/A conversion, inadequacy in the tracking of a sample-and-hold.

In the application described earlier, with 14 bit linear quantization and a sampling frequency of 16 kHz, the test signals were generated from 8192 byte (64K bit) PROMS as follows:

(i) High Frequencies: 2053 cycles of a 4009.8 Hz sine wave plus 3077 cycles of a 6009. Hz since wave producing intermodulating products at 2000 Hz and 2009 Hz.

(ii) Mid Frequencies; 513 cycles of a 1002.0 Hz sine wave plus 767 cycles of a 1498.1 Hz sine wave producing intermodulation products at 496.1 Hz and 505.9 Hz.

As mentioned above, the method also produces, unavoidably, quantizing distortion products in the input digital testing signal. However, with 14 bit quantizing, those products would be 86 dB below peak level, ie: 80 dB below the single component reference, on a broad-band basis. Shared between 4096 harmonics of the 1.98 Hz sequence frequency, each would be down a further 36 dB on average giving a residual reading of 116 dB. All that can be said of actual measurements is that any spurious components were well below the 85 dB noise floor of the spectrum analyser.

Conclusion

The digital test signals described above were developed to investigate and prove the performance of both the analogue and digital sections of equipment designed in the ABC's Design and Development Laboratory. With the experience gained in earlier tests, it is obvious that some procedures adopted in designing the signals were over-cautious. In both the frequency response tests and in the distortion tests, at the higher frequencies at least, fewer samples per sequence and thus smaller PROM storage, would have been adequate. Nevertheless, the speed and precision of the readings, and the faults they incovered in both analogue and digital sections have fully demonstrated the power of the method. ●

N. Thiele is a former chief engineer, ABC, and current president of the Institute of Radio and Electronic Engineers.

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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

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Magnet Weight: 2 oz

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Freq. Response: 1.1 - 17 kHz
Impedance: 8 ohms
Power RMS: 10 watts
Magnet Weight: 2 oz

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SPECIFICATIONS:
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Freq. Response: 650 - 15 kHz
Impedance: 8 ohms
Power RMS: 15 watts
Magnet Weight: 3.6 oz

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6½" WOOFER

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 96dB
Freq. Response: 55 - 7 kHz
Impedance: 8 ohms
Power RMS: 15 watts
Magnet Weight: 5.4 oz

Cat C10208 ..... **$17.95**

8" WOOFER RIBBED CONE

Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 94dB
Freq. Response: 55 - 8 kHz
Impedance: 8 ohms
Power RMS: 20 watts
Magnet Weight: 5.4 oz

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Cloth edge roll surround.
SPECIFICATIONS:
Sensitivity: 92dB
Freq. Response: 32 - 4 kHz
Impedance: 8 ohms
Power RMS: 30 watts
Magnet Weight: 13.3oz

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- LED indicator
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- Requires no crossover and handles up to 100W!
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- Impedance 8 OHMS
- Size 96mm diameter

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- Wide dispersion tweeter, handles up to 100W
- Sensitivity 105dB/0.5m
- Frequency Response 3kHz-30kHz
- Impedance 8 OHMS
- Size 145x54mm

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PIEZO DIRECT RADIATING TWEETER

Requires no crossover, handles up to 100 watts
Sensitivity: 93dB
Maximum Input: 24 volts
Freq. Response: 3.2 - 30kHz
Dimensions: 95mm diameter

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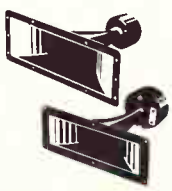

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Impedance: 8 ohms
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Response: 1.5kHz - 14 kHz
Dimensions: 102 x 267 x 177mm

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Impedance: 8 ohms
Rating: 30 watts RMS
Response: 2kHz - 15 kHz
Dimensions: 76 x 177 x 145mm

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SENNHEISER HD 410 SL

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

Cat. A10518 ..... **$74.95**

3 WAY MINI BOOKSHELF SPEAKER SYSTEM

Aluminium diecast cabinet. Superb sound for it's size with polypropolene cone for bass driver. Finished in silver/grey with black mesh grille and comes complete with mounting bracket
SPECIFICATIONS:
Speakers: 4½" woofer.
2" midrange. 1" dome tweeter.
Power Input: 30W RMS 86dB/Wm
Impedance: 8 ohms
Frequency Response: 70 - 20kHz
Size: 186(H) x 116(W) x 120(D)mm
Weight: 2kg each

Cat C10764 **$169**

SUPERB VIFA/EA 60+60 SPEAKER KIT!

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

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

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

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

D19 TWEETER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20KHz
Free Air Resonance: 1,700Hz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts (fo 5,000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2 ohms
Moving Mass: 0.2 grams
Weight: 0.28kg
Cat C10301 **$38**

C20 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 35 - 6,000Hz
Resonance Frequency: 39Hz
Sensitivity 1W at 1m: 90dB
Nominal Power: 50 Watts (12dB/oct)
Voice Coil Diameter: 25mm
Voice Coil Resistance: 5.5 ohms
Moving Mass: 15 grams
Cat C10322 **$89**

Cat K86092 (speakers only) **$379**

Cat. K86091 (complete kit) .. **$449**

SPEAKER CONTROLLER (TAA801)

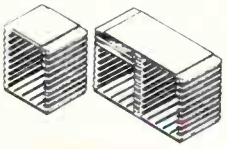
- Enables up to 5 pairs of stereo speakers to be switched on or off in any combination.
- Rated at 50 watts continuous per channel.
- Stereo headphone socket available for private listening
- Constant minimum load circuit protects amplifier regardless of how many speakers are connected.
- Dual circuit breaker protection.

Cat. A16054 ..... **$59.95**

SPEAKER CONTROLLER (TAA803)

- Enables 2 amplifiers (or TV & Amp) to be switched to 4 pairs of speakers in any combination
- Rated at 50 watts continuous per channel.
- Headphone output can be utilized without interfering with the speaker
- Constant minimum load circuit protects amplifier regardless of how many speakers are connected
- Each channel is protected separately by circuit breakers.

Cat. A16058 ..... **$59.95**



COMPACT DISC STORAGE UNITS

- Holds 10/20 compact discs in their cases
- Interlocking modular design allows vertical and horizontal interlocking
- Discs slide into place horizontally making titles easy to read
- Wall mount or free standing

A10031 (10 discs) **$12.95**
A10032 (20 discs) **$19.95**

VIFA/AEM 2 WAY SPEAKER KIT!

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

The system comprises...
2 x P21 Polycone 8" woofers
2 x D25T Ferrofluid cooled dome tweeters with Polymer diaphrams
2 pre-built quality crossovers

The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports.

D25T SPEAKER SPECIFICATIONS
Nominal Impedance: 6 ohms
Frequency Range: 2 - 24kHz
Free Air Resonance: 1500Hz
Operating Power: 3.2 watts
Sensitivity (1W at 1m): 90dB
Nominal Power: 90 Watts
Voice Coil Diameter: 25mm
Air Gap Height: 2mm
Voice Coil Resistance: 4.7ohms
Moving Mass: 0.3 grams
Weight: 0.53kg

P21 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 26 - 4,000Hz
Free Air Resonance: 33Hz
Operating Power: 2.5 watts
Sensitivity (1W at 1m): 92dB
Nominal Power: 60 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.8ohms
Moving Mass: 20 grams
Thiele/Small Parameters: Qm 2.4, Qe 0.41, Qt 0.35, Vas 80.1
Weight: 1.65kg

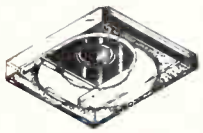
Complete Kit Cat.K16020 **$799**
Speaker Kit Cat.K16021 **$649**
Cabinet Kit Cat.K16022 **$209**

CD PLAYER ADAPTOR

Many amplifiers have only one auxiliary input. This makes using a compact disk player as well as another auxiliary input inconvenient. Also the majority of CD players have an output voltage of 1.6 or 2 volts whereas the auxiliary input norm is 750mV. This CD adaptor allows dual auxiliary input, and one input has variable gain setting.

SPECIFICATIONS:
- Input 2 sets of 2 x RCA sockets
- Gain 150, 300, 600mV, 1V and 2V
- Output 2 x RCA sockets

A16020 ..... **$23.95**



COMPACT DISC CLEANER

Even compact discs need to be kept clean otherwise the listening pleasure will be spoiled by drop outs or skips.

- Cabinet incorporates working base to place disc
- Soft suede cleaning pad (with pad cleaning brush)
- Spray which will gently loosen contaminents and not damage discs
- With disc cloth for handling discs
- Replacement cleaning pad and spray available separately

A10025 ..... **$19.95**

VIFA/AEM 3 WAY SPEAKER KIT!

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

The system comprises...
2 x D19 dome tweeters
2 x D75 dome midrange
2 x P25 woofers
2 x pre-built quality crossovers

The cabinet kit consists of 2 knock-down boxes in beautiful black grain look with silver baffles, speaker cloth, innerbond, grill clips, speaker terminals, screws and ports

D19 DOME TWEETER SPEAKER SPECIFICATIONS
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20kHz
Free Air Resonance: 1,700Hz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts (fo 5,000Hz, 12dB/oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2ohms
Moving Mass: 0.2 grams
Weight: 0.28kg

D75 DOME MIDRANGE SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 350 - 5,000Hz
Free Air Resonance: 300Hz
Sensitivity (1W at 1m): 91dB
Nominal Power: 80 Watts (fo 500Hz, 12dB/oct)
Voice Coil Diameter: 75mm
Voice Coil Resistance: 7.2ohms
Moving Mass (incl. air): 3.6 grams
Weight: 0.65kg

P25 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 25 - 3,000Hz
Free Air Resonance: 25Hz
Operating Power: 5 watts
Sensitivity (1W at 1m): 89dB
Nominal Power: 60 Watts
Music Power: 100 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.7ohms
Moving Mass (incl. air): 44 grams
Thiele/Small Parameters: Qm 3.15, Qe 0.46, Qt 0.40, Vas 180.1
Weight: 1.95kg

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

OMNI-DIRECTIONAL WIRELESS MICROPHONE

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

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MICROPHONE SPECIFICATIONS:
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Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

RECIEVER SPECIFICATIONS:
Recieving Freq: 37.1MHz
Output Level: 30mV (maximum)
Recieving System: Super heterodyne crystal oscillation
Power Supply: 9V Battery or 9V DC power adapter.
Volume control
Tuning LED
Dimensions: 115 x 32 x 44mm
Weight: 220 grams

Cat A10452 ..... R.R.P. $113
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Reviews

Discs

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Title — A Momentary Lapse of Reason
Artist — Pink Floyd
Label — CBS
Producer — Bob Eazrin and David Gilmour
Cat No — 4601382 CDCB

A Momentary Lapse of Reason marks the first Pink Floyd release since the much heralded departure of Roger Waters. Waters was the genius behind *Dark Side of the Moon* and *The Wall* and his departure was popularly believed to herald the destruction of the group.

Far from destroying themselves however, the remaining members of Pink Floyd have come up with a winner. *A Momentary Lapse of Reason* is classic Floyd featuring the central throbbing power that was the hallmark of the band's earlier releases. Guitarist David Gilmour was responsible for most of the music on this disc and it is clear that Waters was not the only brilliant songwriter in the band.

Best tracks are *Dogs of War* an exquisitely plaintive piece and the instrumentals such as *Round and Around, Terminal Frost* and *A New Machine*. In a recent interview Roger Waters was asked how the band would fare after his departure, he replied, "I'm not at all sure how they are going to manage." He can stop worrying, this album shows they are managing brilliantly.

Simon O'Brien

Title — Lonesome Jubilee
Artist — John Cougar Mellencamp
Producer — John Mellencamp
Label — Mercury/Polygram
Cat No. 832 465-1 Q1

John Cougar Mellencamp is in the vanguard of popular music's concern with the plight of the common man, albeit American.

His pithy lyrics and urgent guitar dominated rock music are a vivid example of success without compromise.

The better track on this powerful rock release are: *Paper In Fire*, an upbeat tune with biting slide guitar. *Down and Out In Paradise*, a slower song with great use of acoustic and electric guitars and *Cherry Bomb*, a strong country rock tune with a sentimental nostalgic lyric.

Mellencamp has certainly progressed both musically and lyrically over his eight album career. It is heartening indeed to witness an artist achieve mainstream acceptance and still remain vital and true to his commitments.

Recommended.

Mark Lewis

Title — Nothing Like The Sun
Artist — Sting
Producer — Neil Dorfsman, Sting, Bryan Loren
Label — A&M/Festival
Cat No — CD 6402/ DX 2163

This release sees Sting continuing in the Blue Turtles tradition with excellent production, accomplished musicianship and tasteful intelligent songs.

Sting appears comfortable with the title of the thinking man's rock musician. He is consistently taking a sophisticated musical form and astute lyrical observations, well outside traditional rock fare, to an ever increasing audience.

The better tracks on this extremely well produced CD are, *The Lazarus Heart*, a bright, tightly syncopated jazz rock fusion piece. *Be Still My Beating Heart*, an upbeat rythmic tune with creative verse/chorus juxtaposition. *They Dance Alone* (gueca solo) a synth and drum dominated ballad with a poignant lyrical metaphor. *Fragile*, a slower song with evocative use of classical guitar and a moving anti violence lyric.

Sting is an important '80's artist for a number of reasons. His popular voice and commitment to international issues are praiseworthy and notable in a medium where mediocrity and money all too often rule.

Recommended.

Mark Lewis

★★★★ Don't miss it ★★ Please miss it
★★★ Value for money ★ Watch the microwave instead

Title — Sirius
Artist — Clannad
Label — RCA
Producer — Greg Ladanyi and Russ Kundel
Cat No — UPCD — 7621

Clannad are one of Ireland's most popular bands and *Sirius* is their fourth release in four years. Clannad means family in Gaelic and, appropriately, the group consists of three members of the O Braonain family and two members of the O Dugains.

Clannad's earlier albums remained close to the traditions of Irish folk but this album represents something of a departure as it features some heavy electrical instrumentation although the uilleann pipes make yet another appearance this year. This is not to imply that Clannad have changed their style out of all recognition, one has only to hear the rich voice of Maire O Braonain to immediately identify the musical origins of the group.

Top tracks on this disc are *Skellig*, a romantic piece inspired by the Skellig islands off the Kerry coast and *White Fool* with its interesting combination of Gaelic and English lyrics. *Sirius* isn't Clannad's best album but it should appeal to those who are looking for a change in musical direction.

Simon O'Brien

Videos

Title — Those Dear Departed
Distributor — Roadshow
Length — 88 mins
Rating — M
Standard — ★★★★

Pamela Stephenson and Garry McDonald star in this little Aussie effort which comes replete with shades of Mr Jordan and his ilk. McDonald stars as a theatrical star of the first order who is a downright pig to all and sundry. Stephenson is the ever scheming wife who is trying to put hubby away for good. Unfortunately, her best efforts go awry and an ever increasing number of victims assemble in heaven to exact revenge. OK, that's the bare bones of the story.

While interesting in the long run, this film takes an inordinate time to arrive at a conclusion. Why do modern film people feel justified in wasting millions of feet of celluloid before arriving at a point even faintly resembling entertainment? Even though I am not a great fan of Aussie cinema, finding most of it either pretentious or downright boring, this eventually emerges as an entertaining effort. Especially enjoyable is a theatrical vision of heaven. Less satisfactory is the ending. Recommended for those with Sisyphean patience.

Peter Brown

Title — Pinocchio
Distributor — Walt Disney
length — 84 mins
Rating — G
Standard — ★★★★

Without a doubt the best of the Disney animated features. Pinocchio is now 48 years old, but has lost none of its lustre and wonder. The second of the Disney features, this incorporates the very best animation with a superb story and the uncompromising style which Walt brought to his early efforts. Unfortunately, his dedication swiftly departed after Fantasia. Even though not a box office success, this film has been hailed far and wide as Disney's best. The backgrounds are actual oil paintings, the characters are charming and frightening in the extreme, the music is timeless and the story is a wonder for young and old alike.

Some of the sequences, notably the very first opening shot, the Monstro the whale episodes, Jiminy Cricket, the Blue Fairy and the transformation to an ass are as vivid and frightening today as they were when we first saw this feature in the dim and dark past. A must for rental and later purchase, this is Disney at his superlative best.

Peter Brown

Title — The Mission
Distributor — Roadshow
Length — 125 mins
Rating — PG
Standard — ★★★★

It takes a hell of a long time to get there, but this film is definitely worth the effort. Jeremy Irons and Robert de Niro star as the Jesuit missionaries in 16th century Paraguay at different ends of the scale. One hopes to approach slavation through good deeds and love while the other uses violence to protect the people he loves. The story is sometimes secondary to the spectacular scenery shot on location in Colombia and Argentina and sometimes a wistful sigh for never to be seen climes escaped the parched lips of this reviewer. Eventually (and here one is tempted to ask whatever happened to the 90-minute film?), the movie reaches a climax and it is a terrible sight to behold.

The conclusion of the film is to forever question the dubious work of missionaries, wonder at the frailty of once great empires and gasp anew at the sometimes wondrous feats of the people who made and filmed this effort in the first place. Irons is superb in the saintly role and de Niro, as ever, is wooden in the extreme. I have always wondered how this fellow came to be praised as a superb actor. To me, he is a boor through and through. The Indians, like most "native" peoples act brilliantly, De Niro could have learned much.

Peter Brown

Title — CREEPSHOW 2
Distributor — Roadshow
Length — 92 minutes
Rating — M
Standard — ★ ★

I have often wondered at those who hire movies for the sheer gore of it. This horror spoof has buckets of gore, but despite the bloodletting, it is slightly disappointing. Perhaps the worst enemy of both comedy and horror is predictability and it wreaks havoc in this epic. The movie is really a toned down Twilight Zone with buckets of innards.

Three stories, one starring George Kennedy and Dorothy Lamour, form the centrepiece of the movie, which is a sad sequel to the original film of the same name. George and Dorothy star as store owners murdered in a particularly nasty fashion, the second tale concerns a swimming adventure gone horribly wrong and the conclusion of the movie is taken up by a seemingly endless tale of a hit and run driver. Plenty of gore for those who love it, but a surprise visit to the abattoir would yield more in the field of entertainment.

Peter Brown

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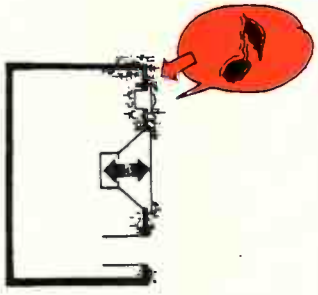

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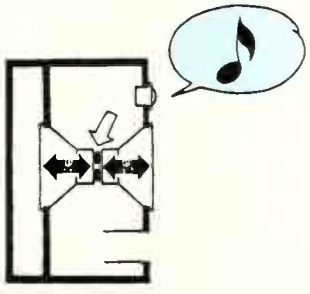

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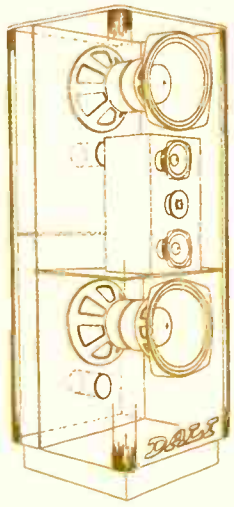

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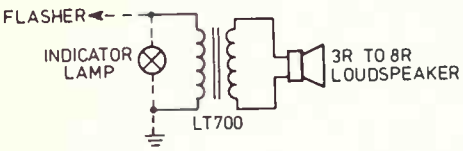


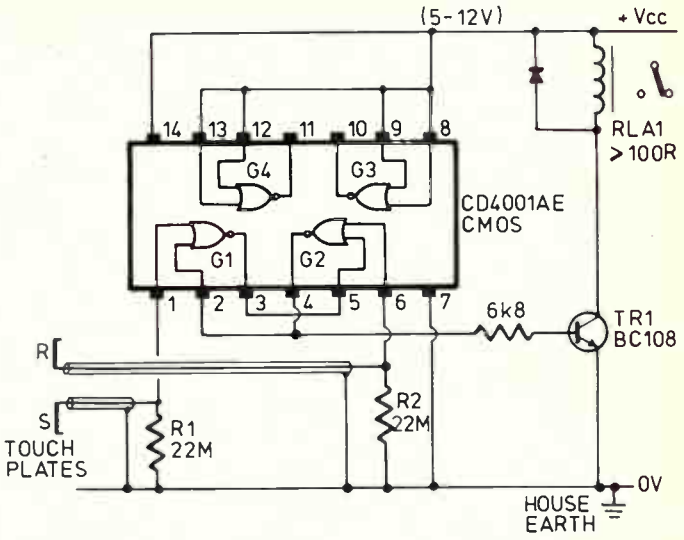
Audio Trafficator Indicator

On some cars, the click of the flasher unit cannot be heard above the engine noise, etc. This can lead to the trafficator being left on, possibly leading to an accident. The device shown above is simply connected across the existing indicator light and, when in operation, gives out a loud pulse every time the lamp is turned on and another when the lamps turn off.

Most transistor output transformers could be used, although an LT700 was used in the prototype. The loudspeaker should be a small 3 or 8 ohm unit.

Touch flip flop

CMOS IC.s have many advantages over TTL, one being the high input impedances. In the circuit, two NOR gates are cross coupled to form a flip-flop. If plate S is touch ambient noise causes an alternating voltage to appear at G1 input. During the first positive cycle G1 output goes negative setting the flip-flop and turning RLA1 on. It remains on until the R plate is touched. R1 and R2 must not be omitted since they discharge any potentials remaining on the plates after they have been touched, thus allowing the flip-flop to have its state changed rapidly. R1 and R2 also prevent any static charges building up, thus damaging the IC, while the supply is disconnected. 22M ohm resistors are difficult to get so two 10M ohm resistors in series may be used.



The unit may be left on continually as a milliameter indicates no current flow at all in the off position. If RLA1 is omitted TR1 collector becomes a TTL output with a high fan out. Connect the inputs of G3 and G4 to Vcc if they are not to be used. The touch plates can be placed several feet from the IC provided screened cable is used for them.

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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.

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

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String file name

Recently I required a program to save data to a disk file on VZ300. Unfortunately, I discovered you cannot use a string as a file name and so I developed this little program. It searches through RAM to find where the program begins and then locates the disk file handling lines and stores their RAM location in an array. When a file is to be accessed it pokes the file-name into these locations. When the program begins, nothing will happen for a few seconds while the program searches for the required lines.

T. Hand,
Bentleigh, Vic

```
10 GOTO 1000
20 REM LOAD FROM FILE F$
30 GOSUB 10000:REM CHANGE FILENAME
40 REM **
50 OPEN"        ",0
60 REM **
70 IN#"         ",A,B
80 REM **
90 CLOSE"       "
100 RETURN
110 :
120 REM SAVE TO FILE F$
130 GOSUB 10000:REM CHANGE FILENAME
160 REM **
170 OPEN"       ",1
180 REM **
190 PR#"        ",A,B
200 REM **
210 CLOSE"      "
220 RETURN
230 :
240 REM ERASE FILE F$
250 GOSUB 10000:REM CHANGE FILENAME
260 REM **
270 ERA"        "
280 RETURN
290 REM ^^
300 :
310 :
320 :
330 :IT IS VERY IMPORTANT TO ENTER
340 :THE LINES WITH     REM **
350 :AS THESE ARE USED TO LOCATE THE
360 :PLACE TO CHANGE THE FILE NAME.
370 :
380 :THESE THREE ROUTINES ALSO SHOULD
390 :BE AT THE TOP OF THE PROGRAM
400 :TO SAVE TIME WHILE SEARCHING
410 :FOR THEIR LOCATION IN MEMORY.
420 :
430 :WHEN SAVING OR LOADING DATA,
440 :THE LINES WITH IN# AND PR#
450 :CAN BE CHANGED TO STORE YOUR
460 :OWN DATA
470 :
480 :
490 :
500 REM MAIN PROGRAM
1000 GOSUB 20000:REM INITIALIZE
1010 CLS
1020 PRINT "DO YOU WANT TO "
1030 PRINT "SAVE, RE-SAVE OR LOAD"
1040 A$=INKEY$:IF LEN(A$)=0 GOTO 1040
1050 IF A$="R" THEN GOSUB 2000
1060 IF A$="S" THEN GOSUB 3000
1070 IF A$="L" THEN GOSUB 4000
1080 GOTO 1010
1980 :
1990 REM RE-SAVE A FILE
2000 ER=-1
2010 GOSUB 3000:REM ENTER DATA
2020 ER=0
2030 RETURN
2900 ***********************************
2910 :THIS ROUTINE CAN BE CHANGED
2920 :TO ALLOW ENTRY OF YOUR OWN
2930 :DATA.  THE ABOVE IS JUST AN
2940 :EXAMPLE OF SAVING DATA TO A
2950 :DISK FILE.
2960 ***********************************
2980 :
2990 REM SAVE TO A FILE
3000 CLS
3010 INPUT"PLEASE ENTER THE FIRST VALUE";A
3020 INPUT"PLEASE ENTER THE SECOND VALUE";B
3030 GOSUB 5000
3040 IF ER THEN GOSUB 250
3050 GOSUB 130
3060 RETURN
3980 :
3990 REM LOAD FROM A FILE
4000 CLS
4010 GOSUB 5000
4020 GOSUB 30
4030 CLS
4040 PRINT "FIRST VALUE ENTERED WAS - "
4050 PRINT A
4060 PRINT "SECOND VALUE ENTERED WAS -"
4070 PRINT B
4080 A$=INKEY$:IF LEN(A$)<>0 GOTO 4080:REM CLEAR BUFFER
4090 PRINT:PRINT
4100 PRINT "PRESS SPACE BAR TO CONTINUE"
4110 A$=INKEY$:IF A$<>" " GOTO 4110:REM WAIT FOR SPACE
4120 RETURN
4980 :
4990 REM ASK FOR FILENAME
5000 CLS
5010 INPUT "PLEASE ENTER THE FILENAME";F$
5020 F1$=MID$(F$+"        ",1,6)
5030 RETURN
9980 :
9990 REM CHANGE FILE NAMES TO F$
10000 FOR I=1 TO 7
10010 IF F(I)=0 GOTO 10080
10020 C=0
10030 FOR J=1 TO LEN(F1$)
10040 POKE F(I)+C,ASC(MID$(F1$,J,1))
10050 C=C+1
10060 NEXT J
10070 NEXT I
10080 RETURN
19980 :
19990 REM INITIALIZE ROUTINE
20000 DIM F(7)
20010 C=1
20020 FOR I=31500 TO 33000
20030 IF NOT(PEEK(I)=42 AND PEEK(I+1)=42) GOTO 20080
20040 FOR J=I TO I+20
20050 IF PEEK(J)=34 THEN F(C)=J+1:C=C+1:GOTO 20080
20060 NEXT J
20070 PRINT "ERROR FINDING FILE NAMES":END
20080 IF PEEK(I)=94 AND PEEK(I+1)=94 GOTO 20100
20090 NEXT I
20100 RETURN
```

Horsey

This program is written for the Microbee. Horsey has something to do with sauntering off to the racetrack for an encounter with . . . well, Horses! The idea is based on an afternoon with silly people, beer and a racing guide. Have fun.

A. Kelly
North Adelaide, SA.

```
00090 REM ********** Andrew Kelly     hoots! **********                    O.T.D. 0
.T.B. A.M.F. Y.O.Y.O.
00100 REM ************************************************************
00110 GOTO 500
00120 REM ****************** movement ***************************
00130 Z=1
00140 FOR A = 1 TO 3 X(A) = 2 NEXT A
00150 Z=-Z
00160 R=INT(RND#3+1)
00170 X(R)=X(R)+1
00180 FOR A=1 TO 3 OUT 2,0 OUT 2,64 FOR S=1 TO 50 NEXT S NEXT A
00190 FOR R=1 TO 3
00200 CURS(129 + 64#(R-1) + X(R)-2)
00210 IF Z THEN PRINT H1$(R) ELSE PRINT H2$(R)
00220 NEXT R
00230 IF X(2)=57ORX(3)=57ORX(1)=57THEN250
00240 GOTO150
00250 RETURN
00260 REM ****************** movement end ***********************
00500 REM ****************** program start ***********************
00510 CLEAR  CLS   DIM N(3),E(3),B(3),M(3),X(3),W(3),A(3),H(3),H2(3)
00520 REM ********** initialise horse  lookalikes' **********
```

```
00530 N1$(1) = " ~/^\'^"   N2$(1) = " ~\^/'^"
00540 N1$(2) = " ~\^/'^"   N2$(2) = " ~/^\'^"
00550 N1$(3) = N1$(1) : N2$(3) = N2$(1)
00560  PLAY 11,2;16,2;20,2,23,2;23;23,23,0,20,2;20,20,20,0,16,2,20,2,16,2,11,4
00570  PLAY 0,2
00580  PLAY 11,2,16,2,20,2,23,2;23,23,23;0,20,2,16,2,11,2,11,11,11,2,16,4
00590 X(1)=0   Z=1
00600 Z=-Z : X(1)=X(1)+1   IF X(1)>57 THEN CURS(129+X(1))   PRINT"        "   X(1)=0
00610 FOR A=1 TO 3 OUT 2,0 OUT 2,64 FOR S=1 TO 50 NEXT S NEXT A
00620 CURS(129+X(1))
00630 IF Z THEN PRINT N1$(1) ELSE PRINT N2$(1)
00640 IF KEY$="" THEN 600
00650 FOR A = 3 TO 52 STEP 20   CURS(A) : PRINT N1$(1)"  $ " N1$(2)   NEXT A
00660 CURS(256) PRINT"Evenin' all....."\"Do you wanna play a little game of horsies?"
00670 Z1$=KEY$ : IF Z1$="" THEN  670
00680 IF Z1$="y" OR Z1$="Y" THEN GOTO 710
00690 IF Z1$="n" OR Z1$="N" PRINT"KNICKERS TO YOU THEN. GO AWAY AND PLAY YOUR OWN GAMES....
          SEE IF I CARE..... HMMPH !!" END
00700 GOTO 670
00710 E(1) = 5000 E(2)=5000 E(3)=5000
00720 CLS
00730 PRINT"THREE PEOPLE CAN PLAY..." INPUT"TYPE IN THE NAME OF PLAYER NO.1 ",N1$(1) IF LEN
(N1$(1))>12 THEN PRINT "12 CHARACTERS OR LESS PLEASE..." GOTO 730
00740 INPUT "NOW THE NAME OF PLAYER NO.2 ",N1$(2) IF LEN(N1$(2))>12 THEN PPINT"12 CHARACTER
S OR LESS PLEASE... " GOTO740
00750 INPUT "AND THE NAME OF PLAYER NO.3 ",N1$(3) IF LEN(N1$(3))>12 THEN PRINT"12 CHARACTER
S OR LESS PLEASE... " GOTO750
 00760   PLAY 13,2;15,1,17,1,20,1,15,1;17,1,20,1,15,1,17,1,20,1,15,1,17,1,20,1,15,1,17,1,13
,2;0,1,15,1,17,1,20,1,15,2,13,2;0,2,2,4
00770 A1$(1)="" A1$(2)="" A1$(3)=""
00780 REM INT(150*RND+1) IN LINES 230 AND 240... THE 150 REPRES-     ENTS THE NUMBER OF HO
RSE NAMES IN THE DATA STATEMENTS...
00790 RESTORE : R=INT(150*RND+1) FOR A=1 TO R READ A1$(1) NEXTA
00800 RESTORE : FOR A=1 TO INT(150*RND+1) READ A1$(2) NEXTA IF A1$(2)=A1$(1)THEN800
00810 RESTORE : FOR A=1 TO INT(150*RND+1) READA1$(3) NEXTA IF A1$(3)=A1$(1)ORA1$(3)=A1$(2)T
HEN 810
00820 FOR A=1 TO 3
00830 CLS   PRINT"The LINE UP for this race is"
00840  PRINT"1    "A1$(1)\"2    "A1$(2)\"3    "A1$(3)
00850 PRINT " MONEY IN YOUR WALLET = $",E(A)
00860 PRINT"How much would you like to BET  ",N1$(A), INPUTB(A)
00870 IF B(A)>E(A) PRINT"Ooh... we frown on that sort of thing here you know...."\"now don'
t try and bet more than you've got!!"\"   TRY AGAIN ....  cooh !  " GOTO 860
00880 IF B(A)<0 PRINT"SILLY SAUSAGE, THAT WON'T WOPK YOU KNOW....."\"I WON'T FALL FOR A TRI
CK LIKE THAT ....." GOTO0860
00890 PRINT"Which horse(1-3)     ",N1$(A), INPUTH(A) IF H(A)<1 OR H(A)>3 THEN 890
00900 NEXT A
00910 IF INT(RND*20)=1  A = INT(RND*3+1)   GOSUB 1240
00920 CLS
00930 CURS(512) PRINT"[ 1 ] "A1$(1)\"[ 2 ] "A1$(2)\"[ 3 ] "A1$(3)
00940 PRINT
00950 FOR A=1 TO 3 PRINTN1$(A)SPC(13-LEN(N1$(A)))" HAS  $"B(A)" ON  NO."H(A)"     "A1$(H(A)
) NEXT A
00960 CURS(126) PRINT"\/"
00970 CURS(128) PRINT"1   " CURS(190) PRINT":"
 00980 PRINT"2   " CURS(254) PRINT":"
00990 PRINT"3   " CURS(318) PRINT":"
01000 CURS(382) PRINT"/\"
01010  PLAY 0,16
01020  PLAY11,11,15,18,0,15,18,4,0,4
01030 FOR A=1 TO 3 W(A)=0 NEXT A
01040 GOSUB 130
01050 FOR I = 1 TO 3
01060 FOR A = 1 TO 3
01070 IFX(1)=57ANDH(A)=I W(A)=1
01080 NEXT A
01090 NEXT I
01100 FOR A= 1 TO 3
01110 IF W(A)=1 THEN LET E(A)=E(A)+B(A) ELSE LETE(A)=E(A)-B(A)
01120 NEXT A
01130  PLAY 0,20
01140 CLS
01150 FOR A=1 TO 3
01160 PRINT N1$(A)SPC(13-LEN(N1$(A))),
01170 IF W(A) = 1 THEN PRINT"Nice going, you won $"B(A)\ ELSE PRINT"Bad luck, that's $"B(A)
" down the tube!"
01180 IF E(A) <=0   ON INT(1+5*RND) GOSUB 2000, 2030, 2060, 2090, 2110, 2160, 2200
01190 NEXT A
 01200 PRINT"DEPRESS A KEY FOR CONTINUED JOY AND FRIVOLITY!!"
01210 IF KEY$="" THEN 1210
01220 W(1)=0 W(2)=0 W(3)=0
01230 GOTO 760
01240 PRINTN1$(A)", you were careless..... you left your wallet"\"hanging out of your back
pocket and some sod has nicked it......BAD LUCK !!!"
01250 PRINT"Luckily you had $100 in your other pocket so you're not        COMPLETELY brok
e !!!!" E(A)=100 PRINT"PRESS ANY KEY TO CONTINUE....."
01260 IF KEY$="" THEN 1260
01270 RETURN
01280 END
01500 REM ****************** HORSE NAMES ******************
01505 DATA"QUICKSILVER","SECRATARIAT","JUNKSHOP","TOILET-NEAD","DUNGEON WALKER","FAST SAUSA
GE","THINK NUGE","YEAN BABY","INTANGIBLE COSTS","SUPER SPREE","BIG SPENDER","BIG BERTHA"
01510 DATA"PRESTON CITY","MOTHER SHIP","NULL STRING","32K ROM","SLICK CMOS","MANACADO","KIN
GSTON TOWN","WHAT A NUISANCE","BLACK AND GOLD","BLUE AND WHITE","EVERYMAN'S DREAM","CHEVRON
"

01520 DATA"WILDEST DREAMS","COTTON-TAIL","MICTURITION","ENURESIS","GOODNESS GRACIOUS","THE
EXTRA-VEGETABLE","WYATT EARP","GUNSLINGER","RATTLE SNAKE","TOUCAN","GLUE FACTORY"
01530DATA"NAUGHTY NAVIGATOR","BLUE ADIOS","SULTAN OF SINGE","NODDY'S PRIDE","THE  SURVIVOR"
,"ROTTEN RALPH","EAT NO BEANS","HANGIN' IN" "HANGIN' OUT","FRICASEE FLYER","CANTERING CADAV
ER"
01540 DATA"CONIVING FOLLY","RUNNING ON EMPTY","BREATHLESS","RUTHLESS REVENGE","IOU NOTHING"
,"NOT BAD HORSE","QUITE A FAST HORSE","MILLY'S NAG"
01550 DATA"PRETTY BOY","BRAVITA","GUNSYND","MEATY BITES","TOLULA'S TANGO","MARTY SMITN","PO
PE'S DELIGHT","BARONESS","WICKED","HOOTNAN","ATCH EIYE D'NOO","AY OH BRUNO","SIMON"
01560 DATA"ALGERNON","THEODORE","ALVIN","FELIX","PENNY ADDITION","CNARLIE'S NOISE","PIPPED"
,"LOOKIN' GOOD","MY CUP OF TEA","ANDROMEDA STAR","STRIKE ME LUCKY","WELL BLOW ME DOWN"
01570 DATA"STONE THE CROWS","RAW PRAWN","PROUD SUSAN","ORANGE TEETH","RAMBO","STAR TREKKER"
,"WITHERING HEIGHTS","CLUTCN-CARGO","SUNNING","CRIKEY","JINGALEES","SMOOTH MOTHER"
01580 DATA"NORTHERN DANCER","SOYA SURPRISE","PEARL","ALMOST","NEARLY","NOT QUITE","NOT LOVE
","COLD SHOWER","THE ADMINISTRATOR"
01590 DATA"E PLURIBUS UNUM","LA BELLE DAME SANS MERCI","OATS AYE D'NOO","LEAVE IT ALONE","Y
OU'LL GO BLIND","SMILEY SURPRISE","BOTTOM BURP","TROJAN RABBIT"
01600 DATA"HUGE WOODEN BADGER","SOILED ARMOUR","NASTY MONSTER WITH POINTY TEETH","1... 2...
 5... 3 sir!","BLISSFULLY UNAWARE","TOASTED BOTTOM","NORSE ON WELLES"
01610 DATA"ONLY ORSON DOES THE NORSE JOKES","I'M FAT","OVER THE TOLERABLE LIMIT","WELL OVER
","MNOIZE","WOZZA WILFRED","LUSCIOUS LUCINDA","REGINALD VAS DEFERENS"
 01620 DATA"I'LL 'AVE 'ARF","MY ROUND","JOBBIE WHEECHER","SHEEP'S BLADDER","NORSE WITH BLIN
KERS ON ITS BOTTOM","TAIL OF WOE","NEIGH-SAL SPRAY","AADVARK WITH A JOCKEY"
01630 DATA"BLACK KETTLE","WOULD YOU LIKE SOME WINE?","NO THANKS.. I'VE JUST HAD SOME","PAIN
T MY UNDIES","WRAP MY LUNCH","BOIL MY BOTTOM","GRUESOME GWENDOLYN","ROTTEN RITA"
01640 DATA"BIG NOSE","WHITE CITY","MORNING GLORY","EARLY MORNING RISER","EARLY TURD","ROLLI
NG STONE WITHOUT MOSS","A STITCH IN MINE","BERT'S BAD BREATH","LIPS LOUIE"
01650 DATA "FUBAR FRANK"
02000 REM ****** YOU'VE LOST ALL YOUR MONEY RESPONSES ********
02005 PRINT "Oop! that's all your money away... luckily an old Aunty of yourspops out from
behind a bush and gives you some money for lollies"  E(A) = INT(1+500*RND)
02010 PRINT"ANY KEY TO CONTINUE "
02020 IF KEY$="" THEN 2020 ELSE RETURN
02030 PRINT"Well, that leaves you with no ready cash at all!!!"\"Nothing... not a sausage..
. bugger all.... still, there is that money Mum gave you for lunch..." E(A)=INT(1+300*RND)
02040 PRINT"PRESS ANY KEY TO CONTINUE"
02050 IF KEY$="" THEN 2050 ELSE RETURN
02060 PRINT"Hah! That's it for you... no more money left in your wallet   . luckily a chequ
e came in from your 'publisher' and you manage  to cash it at a deli....."
02070 PRINT"ANY KEY TO CONTINUE" E(A)=INT(1+200*RND)
02080 IF KEY$="" THEN 2080 ELSE RETURN
02090 PRINT"You seem to have lost your shirt on a million to one shot...    SUCK!     A se
edy character drops a wallet on the path in frontof you... picking it up you realise..."
02100PRINT"It's yours!!! lifted from your pocket last week  it still has   some of that sli
me's ill gotten gains in it"  E(A) = INT(1+100*RND)   RETURN
02110 PRINT"Now you've done it... you've lost ALL your money...."\"except for... wait.... n
o, not in that pocket.... you have NO   money"\"ANY KEY TO CONTINUE "
02120 IF KEY$="" THEN 2120
02130 PRINT\"WOULD TICKET HOLDER "INT(1+RND*10000)"you have won our weekly gate prize..."\"
Hey, it's party at the races, that's YOU!!!" E(A) = INT(1+500*RND)
02140 PRINT"ANY KEY TO CLAIM YOUR PRIZE..."
02150 IF KEY$=""THEN 2150 ELSE RETURN
02160 PRINT"Now [illegible] the [illegible] of [illegible] you [illegible] to WIN t
he money, not lose it all... "A [illegible] decided to help [illegible]..."
 02170PRINT"with a gift of a few quid and a tip... " INT(1+3*RND)" in the [illegible] race... ch
eers son!"
02180 E(A) = INT(1+300*RND) PRINT "ANY KEY TO CONTINUE"
02190 IF KEY$="" THEN 2190 ELSE RETURN
02200 PRINT"Okay, no more money, kaput!, zippo... nothing doing..."\"but the fever has hit.
.. more money, more betting... MONEY, MONEY...   what to do? PAWN MY WATCH!!!"
02210 E(A)=INT(1+100*RND) PRINT"ANY KEY TO CONTINUE"
02220 IF KEY$="" THEN 2220 ELSE RETURN
```

Temperature Conversion

This program has all the conversions of temperature. It changes to and from celcius, farenheit and kelvin. It is written for a Commodore 64 but can be converted to most computers.

W. Balchin and M. Tredgold
Hope Valley

```
10 PRINTCHR$(147)
20 PRINT"TEMPERATURE CONVERSION PROGRAM"
30 PRINT"BY W. BALCHIN AND M. THREDGOLD"
40 PRINT:PRINT"1.CELSIUS TO FARENHEIT"
50 PRINT"2.FARENHEIT TO CELSIUS"
60 PRINT"3.CELSIUS TO KELVIN"
70 PRINT"4.KELVIN TO CELSIUS"
80 PRINT"5.KELVIN TO FARENHEIT"
90 PRINT"6.FARENHEIT TO KELVIN"
100 INPUTA
110 ON A GOSUB200,300,400,500,600,700
120 INPUTA$:RUN
200 PRINTCHR$(147)
210 INPUT"CELSIUS";C
220 F=(C*1.8)+32
230 PRINTF;"FARENHEIT"
240 RETURN
300 PRINTCHR$(147)
310 INPUT"FARENHEIT";F
320 C=(F-32)/1.8
330 PRINTC;"CELSIUS"
340 RETURN
400 PRINTCHR$(147)
410 INPUT"CELSIUS";C
420 K=C+273.15
430 PRINTK;"KELVIN"
440 RETURN
500 PRINTCHR$(147)
510 INPUT"KELVIN";K
520 C=K-273.15
530 PRINTC;"CELSIUS"
540 RETURN
600 PRINTCHR$(147)
610 INPUT"KELVIN";K
620 F=((K-273.15)*1.8)+32
630 PRINTF;"FARENHEIT"
640 RETURN
700 PRINTCHR$(147)
710 INPUT"FARENHEIT";F
720 K=(F-32)/1.8+273.15
730 PRINTK;"KELVIN"
740 RETURN

READY.
```

VZ Wordprocessor VZ200/300

This word processor has two different modes, normal and repeat. On the repeat mode the computer will allow the user to repeat a letter on the keyboard by holding the key down.

The control keys are:
CTRL-E = Select Mode
CTRL-P = Print
CTRL-O = Clear Screen

G. Tunny
Gorokan, NSW

```
1 '*****************
2 '*VZ-WORDPROCESSOR*
3 '*                *
4 '* BY  GLEN TUNNY *
5 '*(C)OPYRIGHT 1987*
6 '*****************
8 GOSUB 1000
10 CLS
20 B=96:C=32:MD$="NORMAL"
25 PRINT@0,"MODE:"
30 A$=INKEY$:A$=INKEY$
40 POKE28672+C,B
45 PRINT@6,MD$
46 IF A$=CHR$(135) AND MD$="NORMAL"THENMD$="REPEAT":GOTO30
47 IF A$=CHR$(135) AND MD$="REPEAT"THENMD$="NORMAL":GOTO30
50 IF A$=CHR$(8)ANDC>32 THEN C=C-1:GOTO  150
60 IF A$=CHR$(9)ANDC<446 THEN C=C+1:GOTO  150
70 IF A$=CHR$(27)ANDC>63 THEN C=C-32:GOTO 150
80 IF A$=CHR$(10)ANDC<416 THEN C=C+32:GOTO 150
90 IF A$=CHR$(13) THEN 500
100 IF A$=CHR$(178) THEN 600
110 IF A$=CHR$(140) THEN 10
120 IF A$="" THEN B$="":GOTO 150
130 PRINT@C,A$:IF MD$="NORMAL" AND A$=B$ THEN 150
140 B$=A$:C=C+1:SOUND10,1
150 B=PEEK(28672+C):POKE28672+C,32:IFINKEY$="",FORI=1TO45:NEXTI
180 GOTO 30
500 W=INT(C/32):W=W+1:W=W*32:C=W
505 IF C>448 THENC=C-32
510 GOTO 150
600 PRINT@0,"                ":A=INP(12)
610 IF A=13 THEN 630
620 GOTO 700
630 PRINT@8,"<PRINTER ERROR>":REM (INVERSE)
640 SOUND23,1
650 PRINT@8,"                "
660 SOUND 27,1
670 A=INP(12)
680 IF A=13 THEN 630
690 GOTO 600
700 COPY
710 GOTO 30
720 NEXT
800 FORI=1TO15
810 K$=INKEY$:K$=INKEY$
820 IF K$="" THEN NEXTI
830 RETURN
1000 CLS
1010 REM
1020 A$="VZ-WORDPROCESSOR"
1030 B$=" BY GLEN TUNNY "
1040 C$="(C)OPYRIGHT 1987"
1045 D$="<<HIT ANY KEY>>"
1050 FORI=1TOLEN(A$)
1060 PRINT@40,RIGHT$(A$,I)
1070 POKE26624,1:POKE26624,0
1080 NEXTI
1090 FORI=1TOLEN(B$)
1100 PRINT@72,RIGHT$(B$,I)
1110 POKE 26624,1:POKE26624,0
1111 NEXTI
1120 FORI=1TOLEN(C$)
1130 PRINT@104,RIGHT$(C$,I)
1140 POKE 26624,1:POKE26624,0
1150 NEXTI
1160 FORI=1TOLEN(D$)
1170 PRINT@136,RIGHT$(D$,I)
1180 POKE26624,1:POKE26624,0
1190 NEXTI
1200 FORI=1TO500:NEXTI
1210 A$=INKEY$:A$=INKEY$
1220 IF A$="" THEN 1210
1230 RETURN
```

Zounds

ZOUNDS! enable you to "play" a normal music tape through the Datasette into the computer and out to the TV (if you use one). The quality would give Challis a coronary, but you should be able to recognise instrumental pieces.

I have supplied two versions of the program to work for the VIC-20 and C64, so the remaining loyal VIC owners will not miss out on any of the fun. It is also a good idea to save the program before running as machine code has a nasty habit of "crashing".

C. Baird
Glendale
NSW

```
100 REM ZOUNDS !
110 REM VIC VERSION
120 REM CHRIS BAIRD 24/11/87
130 REM
200 FOR I = 828 TO 849 : READ A
210 POKE I,A : NEXT I
220 PRINT"[CLR]        ZOUNDS!        "
230 PRINT"INSERT AUDIO TAPE AND"
240 PRINT"PRESS PLAY."
250 SYS 828
260 :
300 DATA 120,173,45,145,41,2
310 DATA 10,10,141,14,144,173
320 DATA 33,145,160,16,136,208
330 DATA 253,76,61,3

400 REM ZOUNDS !
410 REM CBM64 VERSION
420 REM CHRIS BAIRD 24/11/87
430 REM
440 FOR I = 828 TO 854 : READ A
450 POKE I,A : NEXT I
460 PRINT"[CLR]                ZOUNDS!
470 PRINT"INSERT AUDIO TAPE AND PRESS PLAY."
480 IF((PEEK(1)AND16)<>0)THEN480
490 SYS 828
495 :
500 DATA 120,169,0,141,17,208,169,7,133
510 DATA 1,173,13,220,41,16,106,141,24
520 DATA 212,160,8,136,208,253,76,70,3
READY.
```

THE GREAT 15% OFF SALE CONTINUES

Due to the unbelievable response in January we are extending our pre-catalogue sale for one more month. Sale definitely ends last day in February - no exceptions.

That's right! **No Exceptions. Every single item** in your local Jaycar Store is **Discounted** for a strictly limited time. We have to remove **hundreds** of old lines for our brand new March '88 Catalogue so that we can fit many great new products in. Rather than just discount the old lines the Boss told us - **Discount everything!**

But you must hurry. Any regular line that is in stock at the time of purchase qualifies for the 15% discount. We **will not** back order goods that are out of stock during the sale at the discount price. If any out of stock item comes back into stock **during** the sale, you will get it at the discount price!

(Please do not ask for the discount price after the sale).

So now is the time to make a significant saving on that big kit, and other major purchases.

But remember, hurry.

LOW COST UTILITY TIMER

Ref: EA Feb 1988
Whether you wish your egg soft, but not too soft, or whether you want to add the time factor to a game of Trivial Pursuit, this utility timer is ideal.
Complete kit
Cat. KA-1697
$21.95

TRANSISTOR, FET AND ZENER TESTER **$55.00**

Ref: EA Feb 1988
Revamped version of an oldie. Checks transistors, fets and zeners as well as checking transistor breakdown voltages. Great for the workbench, and also for showing how semiconductor devices operate. Complete kit includes box, meter, transformer and all parts.
Cat. KA-1698

TELEPHONE INTERCOM

Ref: ETI Feb 1988
Use 2 old telephones to make an intercom. Kit includes power supply, filter capacitors, box and all parts.
Cat. KE-4731
$59.95

DOOR MINDER **$37.50**

Ref: Silicon Chip Feb '88
New generation door opener alarm.
Cat. KC-5020
9V power supply
Cat. MP-3010 $18.50

LOW DISTORTION AUDIO OSCILLATOR

Ref: EA Dec 1986
At last it's available, the metered version of our auudio oscillator. Compares with the very best laboratory standard sine wave equipment available.
Cat. KA-1677
$165.00

SUPER SIMPLE MODEM

Ref: AEM Sept 1986
Due to customer demand, we have decided to introduce this into our range. It's very cheap and it works well. Kit is supplied with RS232 female connector and all other parts except power pack, which is extra $13.95 (Cat. MP-3020)
Cat. KM-3046
$85.00

LOW OHMS ADAPTOR FOR DMM's

Ref: Silicon Chip Feb 1988
Another handy kit from SC which utilises your digital multimeter.
Cat. KC-5023
$29.95

MODEM END OF FILE INDICATOR

Ref: Silicon Chip Feb 1988
PC board and all parts supplied including switch.
Cat. KC-5024
$9.95

LESS 15% OFF KITS

ULTIMATE CAR BURGLAR ALARM

Ref: Silcon Chip Feb '88
Includes flashing light switch, back-up battery and ignition killer.
Cat. KC-5021
$79.50
Extras - Siren Horn Cat. LA-5700 $26.50 Screamer Piezo Cat. LA-5255 $17.95

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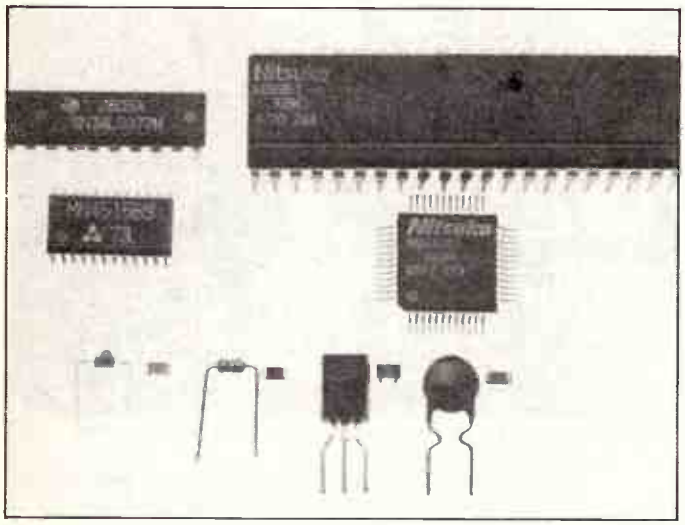
New Technology Cuts STC Costs by $1M



Australia's largest Surface Mounted Component (SMC) technology installation has just been implemented by STC as part of its continuing effort to streamline production of the Commander BN Telephone Systems it manufactures for Telecom Australia and overseas markets. For a one-time investment of $1 million, the company expects to trim product manufacturing costs by the same amount each year.

The specific item to be manufactured is the miniaturised printed circuit board that functions as the control panel of the complex Commander communications system. Previously, STC purchased these boards in a pre-assembled state.

The SMC installation is STC's second move to automate major aspects of the production of the Commander Telephone Systems. Earlier this year—and to generate projected savings of $100,00 per annum—a sophisticated robot with a unique, Australian-designed vision system was developed to handle the final key placement phase of the telephone's assembly.

"STC has already proven there is a healthy, growing overseas market for Australian-designed and manufactured telephones, and we are committed to seeing this market expand," said STC Manufacturing Director Bruce Stephens. "Stringent attention to quality, and cost-efficient, cost-effective manufacturing technology are, as we see it, the factors that will continue to make our Australian products competitive and successful in markets around the world."

READER INFO No. 154

Fibre Lasers a Reality

The Optical Fibre Group at Southampton University in England has developed a rare-earth doped optical fibre that may one day act as a low-cost laser for telecommunications or sensor systems.

The Southampton laser — with doped neodymium ions in its core — may overcome many of the problems associated with conventional semi-conductor lasers. Conventional lasers must be rigid, optically straight, and have specially designed, accurately configured mirrors that are solidly aligned at each end. They are easily affected by dust, vibration and other environmental conditions. They also require relatively large, expensive power supplies and have a limited operating life.

The new laser type is flexible and does not need separate mirrors. Contamination has little or no effect because it is totally glass enclosed. Since it is as thin as human hair, it can be coiled into very small bundles. The laser may be efficiently pumped by cheap semi-conductor laser diodes. Another advantage is the lasers' ability to operate over a wide range of wavelengths. Typical semi-conductor lasers operate on one infrared wavelength only.

The new fibres were launched into the world market at the annual CLEO conference in Baltimore and at Optical Fibre's '87 in London. The Fibre Optic Group is selling the new laser through an agreement with York Technology. York's agent in Australia is Fibernet of Bayswater, Victoria. Fibernet Expect to show laser fibre for the first time in Australia at ACOFT in Surfers Paradise in December.

Similar manufacturing, marketing and distribution arrangements are planned between Southampton and York for other rare-earth doped fibres. The Optical Fibre Group is part of the Electronics and Computer Science department at Southampton.

Smart Switch for Multiplex Wiring

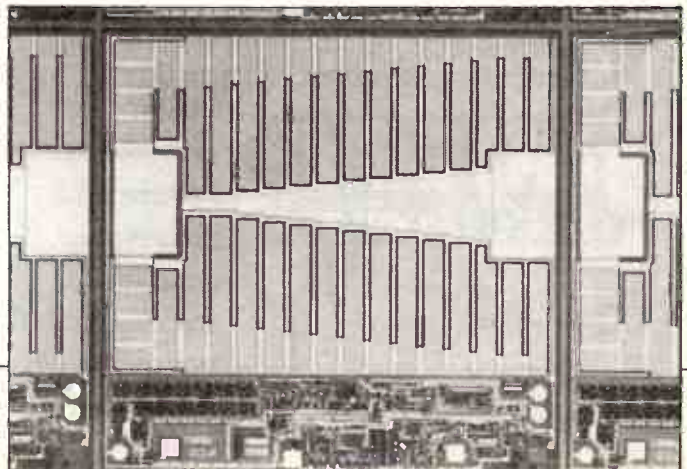
Applying Multipower-BCD mixed bipolar/CMOS/DMOS technology, SGS has developed a smart switch for automotive multiplex wiring systems that delivers 25A peak current, 6A continuous.

Type L9801 is a high side switch aimed at applications such as lamp and solenoid driving. Controlled by a TTL/CMOS/uP compatible logic input, it includes diagnostic circuitry which provides a warning signal to the control micro when fault conditions arise.

Protection against overvoltages, voltage transients and short circuits is incorporated in the chip. In addition a special inrush current limiter is included to optimize turn-on time and extend lamp life in tungsten lamp driving applications. The diagnostic ouput signals overload conditions and open-circuit loads, detected by sensing the load current when the output is active.

The L9801 is assembled in the SGS Pentawatt five-lead package with a grounded tab that needs no isolation.

READER INFO No. 156



Intel's Graphics Coprocessor and Unix System

The Intel Corporation has announced the availability of binary software drivers to produce X-Windows for graphics controllers, based on its 82786 graphics coprocessor — optimized for UNIX System V/386, Release 3.0 environments. This makes the 82786 the first VLSI graphics coprocessor to support X-Windows.

X-Windows is a graphical windowing interface for running application programs in UNIX environments. Many current UNIX systems have relied on frame buffer CRT controllers and the processor to perform all the graphics where the host does the pixel-intensive work in addition to application code execution. 82786-based graphics cards offload the graphics intensive functions from the host microprocessor, liberating the host to provide increased application performance. In addition, the pixel intensive functions are performed much faster by the 82786 because it has silicon dedicated to the most frequent graphics operations.

The 82786 furnishes windowing-based software with very fast bit block transfer (Bit Blt) and character block transfer, and a drawing rate of up to 2.5 million pixels per second, while simultaneously managing the display. With separate drawing and display processors on-chip, the 82786 is distinctive in its ability to support the key windowing graphics functions.

"The 80386 and the 82786 represent a stable, standard hardware platform that will support UNIX and X-Windows across a wide application base," said Olson. "This brings the operating system and the most widely supported graphical interface together with the same portability as in the DOS world. Today's W-Windows drivers are Version 10.4, drivers for Version 11 are in development and will be available early next year, when testing is complete.

UNIX System V/386, Release 3.0 (fully certified by AT&T) is the only version currently available that extends software portability from the traditional source code level to the binary level. Previous versions of UNIX were compatible only at the source code level.

READER INFO No. 157

Phone Box Opens for Home and Business

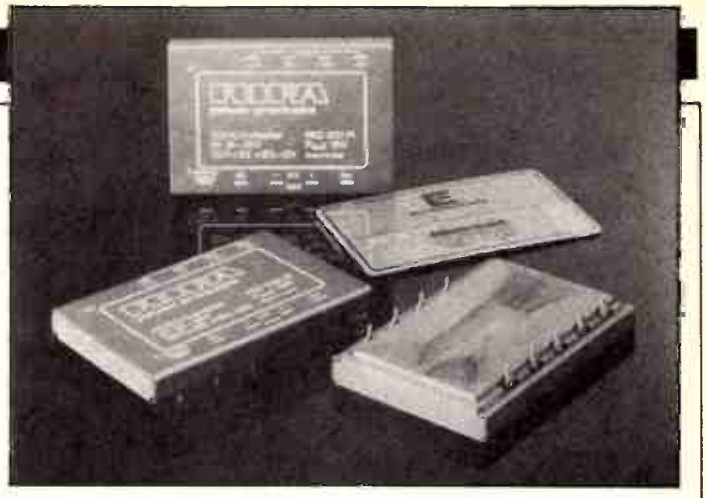
Voca Communications has opened its first retail outlet for the direct sale to the public of telecommunications products for home and office.

The 'phone box', located at 176 Commercial Road, Prahran, Victoria stocks the full Voca range of feature telephones, cellular mobile telephones, facsimile machines and paper, answering machines, pagers and other telephone accessories.

The 'phone box' also stocks a range of other Telecom-approved products, including cordless, clock radio and antique telephones priced from $20 to $500.

Voca General Manager, Mr Paul McNicholl, said that it was an exciting venture as his company was the first major telecommunications supplier to open a retail outlet. "We see the 'phone box' as a logical response to market needs, said Mr Nicholl.

READER INFO No. 158



Low Profile 15W In-Card Converter

RIFA has released a new series of 500V isolated DC/DC converters with single, dual or triple outputs (5, 12 and 15 V in different output configurations for in all 14 versions). The PKC series, also known as the In-Card converters, operate on a 2:1 input voltage range for 24 V (18-36 V) and 48/60 V (36-72 V) battery systems, with temperature range −45°C to +85°C. Housed in a 10.7mm high anodized aluminium enclosure, the converters can be mounted as conventional On-Card converters or recessed into a punched hole in the PCB. using RIFA's In-Card mounting, the resulting height 8.5mm, allows 0.6" or (3TE) board spacing. The overall dimensions are 80mm x 55mm x 10.7mm and the weight is 50 grams. The converters are complete units, ie, no extra components are needed for normal operation or to fulfill VDE/FCC/CISPR's RFI regulations, curve A or N, and can be remotely on/off controlled.

The PKC series are specially designed to operate as On-Card converters with high performance on all outputs and can be paralleled for redundancy or systems upgrading. Triple output versions have a voltage accuracy within ±2.5% on all outputs, including line/-load regulation, temperature coefficient and initial setting. The new series uses RIFA's proven 300 kHz switching technology, based upon proprietary drive and control circuits, an efficient thermal managment and the use of only highly reliable ceramic capacitors for input and output filtering. Efficiency is typically 85% and MTBF for the new converters is in excess of 200 years, like RIFA's other On-Card converters.

With the introduction of the PKC series, RIFA takes another step in addressing the market for boards with self contained distributed power. In order to facilitate required regulation on auxiliary outputs, eg, for analogue circuits, a weighted regulation feed-back loop has been adopted. Consequently, all outputs are regulated. Pins up of the PKC series are functionally compatible with the company's 25-40 W PKA series and a layout on a PCB can easily accommodate either PKC or PKA converters in accordance with power requirements.

Sample quantities of the 5V/3A output converter for 24V and 48/60V battery systems are available now. Versions for triple outputs will be available in the first quarter of 1988 and the announced series is scheduled to be completed by the third quarter of 1988.

READER INFO No. 159

Logic Analyzer — Bus Monitor

A new combined logic analyzer — bus monitor, Model DLG 7100, has been released by KIKUSUI Corp of Japan, represented in Australia by Emona Instruments. This new 20 channel (16 data and 4 control channels), 100 MHz, 1000 word memory instrument can be used both as a general purpose logic analyzer and as a dedicated parellel bus, GBIB (IEE 488) bus and serial link recorder and bus monitor.

Exceptionally user friendly, the instrument is provided with a sharp image 7" CRT, with clearly labeled on screen menu displays and software function keys, to select the required operation parameters in each of its three basic modes of operation: Parallel Data Analysis; GP-IB Data Analysis; Serial Data Analysis.

In parallel data recording and analysis it is possible to record 1000 words in 16 channels, with a clock frequency of 100 MHz (external or internal), with triggering set by an 18 channel (16 data, 2 qualifier) combination trigger word. An additional 1000 word memory is provided for reference.

The data on the 16 channels can be displayed on the screen in the timing mode, with easy expansion of the time scale and shifting along the memory, or in the state mode, with various types of codes (binary, octal, hex, ASCII, etc). Each input channel can be individual labeled with a six character label for ease of interpretation. Glitch detection of 5 ns is possible. The comparison display function of recording memory (A) with the reference memory (B) and the search function allow easy searching for specific data patterns and highlights of changes in data patterns.

In GP-IB bus data analysis, timing displays and state displays, similar to those in parallel data analysis, are possible. Each channel is automatically labelled. The internal clock or the DAV signal can be used as a clock.

READER INFO No. 160

Selling ADA

One month after becoming Australian agent for the Alsys range of Ada compilers, Computer Sciences of Australia has made its first sale to the Department of Defence.

The software section of the Directorate of Naval Communications Design in Canberra is using the IBM PC AT version of the Alsys Ada compiler to design and develop a shipboard communications system.

Over the next few years Royal Australian Navy patrol boats will be equipped with a computer which will be used to create, store, send and receive operational messages to and from shore facilities. The ships currently use morse code and voice transmissions. The Department will issue a tender for the computers in the next few months. Ada is the standard high level language used by the US Department of Defence to program computers controlling modern, sophisticated military equipment.

CLARIFICATION

In the September 1987 edition of ETI we described Project ETI 176, a Zener Diode Tester. We would like to clarify that this project was developed in the Research and Development Department of Dick Smith Electronics, not in the ETI laboratory. In labelling the project 'ETI 176' we were merely giving the project a call number; we were not trying to suggest that the project was ours rather than DSE's. The Zener Diode Tester is available from all DSE stores for $29.95 (catalogue No. K3051).

Motorola Introduces The MC68HC05L6

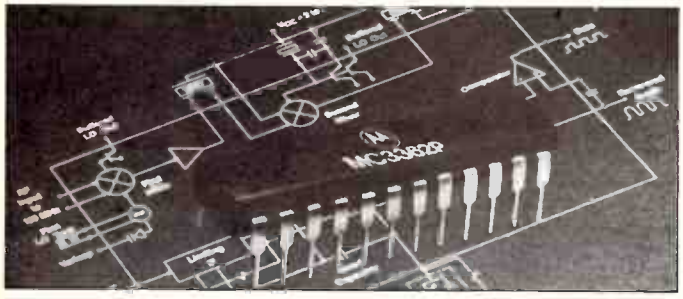
The MC68HC05L6, the newest member of the MC68HC05 microcomputer family, has an on-chip liquid crystal display driver. This 8-bit single-chip microcomputer also contains an on-chip oscillator, CPU, 6208 bytes of ROM, 176 bytes of RAM, a Serial Peripheral Interface (Synchronous Communication — SPI), a 16-bit timer, and an audio tone generator.

Currently the MC68HC05L6 is available in die form only. In mid 1988 the part will be packaged in a 68-lead Fine Pitch Plastic Leaded Chip Carrier.

Motorola's low cost development tool, the MC68HC05EVM, supports the MC68HC05L6.

Motorola recommends the MC68HC05L6 for any handheld instrumentation utilizing LCD, such as bar code readers, pocket telephone directories, meters, cordless telephones, calculators, hand held cassette tape players, AM/FM radios, and infra red remote controls.

READER INFO No. 166



Low-Voltage FM Narrowband Receiver

A highly-integrated low voltage (2 V) dual-conversion FM, narrowband receiver IC has been introduced by Motorola. The MC3362 FM narrowband receiver can fill many applications as a complete VHF receiver incorporating all essential functions from the antenna input to audio preamp output. The MC3362 IC is ideal as a utility receiver for voice and data communication including cordless phones, VHF two-way radios, remote control receivers, home security systems and unlicensed peripheral data links.

The MC3362 device is manufactured by the patented Mosaic process, resulting in excellent performance for rf inputs up to 180 MHz. If the first LOW signal is provided externally, the device can be used at over 400 MHz. Design features include:

- Dual conversion circuitry for excellent image rejection.
- Received Signal Strength Indicator (RSSI) output, allowing application with a muting circuit or signal strength meter.
- Low power consumption (6.35 mW).
- Data slicing comparator for FSK data recovery up to 30 kbps (15 kHz).

Package options include a 24-pin DIP or a 24-lead wide-body SOIC for surface mount applications. The SOIC package improves RF performance.

For more information contact Motorola direct.

READER INFO No. 168

Philips T&M's Instrument Driver Software

Using personal computers to control GPIB (IEEE 488/IEC 625) instrumentation systems is now much easier, thanks to a set of software drivers from Philips Test & Measurement.

Written for Basic, Pascal and C users, the drivers eliminate the inconsistent, hard-to-understand command strings and low-level GPIB routines that engineers currently have to use — and replace them with simple, readable calls. Procedure names clearly indicate the function they perform (MEASURE for measurement, SET.FILTER to activate the dmm filter, and so on).

By making the programs easier to read and write, the new drivers will cut development costs and save time.

Further time saving features include an automatic configuration facility and built-in error checking.

The automatic configuration facility takes much of the labour out of setting up a GPIB system. Normally the user has to assign addresses, assign instument names to the addresses and load drivers for each instrument by hand. However, the new software identifies which instruments are present, allots the addresses to the instruments in their default modes and loads the drivers so that the user can start programming immediately. Alternatively, a second menu allows the user to select a customised set of parameters.

The error checking feature is one of the new software's most important advantages: to save time, operators often assume that every instrument in a system is programmed correctly. Philips drivers check that the programmer has not made a mistake by addressing functions that are not supported, or by exceeding the ranges of the instruments.

READER INFO No. 167

Low Price Path To Super Speed

Hypertec has announced that Hyperace 286 Super Plus — an enhancement board which makes an IBM PC run substantially faster than an IBM AT — will sell for $1395 recommended retail.

Marketing manager Merelyn Kelly said this made it a considerably more attractive option to that of upgrading to a faster machine. "Even a moderately priced AT compatible will cost around $4000," Mrs Kelly said. "And the other alternative — a new mother board — will cost $3000 plus memory."

Hyperace 286 Super Plus was developed at Drummoyne, Sydney and is one of a group of accelerator boards on which Hypertec has concentrated its research.

Hyperace 286 Super Plus replaces the computer's 4.77 MHz 8088 processor with its own 80286 processor, stepping its speed up to 12.5 MHz.

High clock speeds are essential if sophisticated word processing, CAD tasks and large spreadsheets are to be worked without frustrating delays in response time.

READER INFO No. 169

Offcom offers major cuts

Sydney based communications house, Offcom, has released an enhanced version of its TOS-Box which can manage and transmit messages by both Telex and by direct dial-up lines.

The portable PC style unit can be connected to both telex and telephone lines simultaneously, and interconnected with a wide range of host computer systems, and/or to a PC based local area network. Files written anywhere in the network, including on the TOS-Box keyboard can be sent to the TOSBox and automatically queued according to its priority for despatch by either telex or telephone.

Depending on the traffic of the user, the TOSBox can be manually operated or run automatically in background mode, collecting and despatching messages from organisation "mail boxes" and answering and printing out incoming messages.

"The new system has already been installed by one overseas government which confidently expects to save more than $1 million a year in overseas communication charges," says Offcom Managing Director, Mr Norm Young.

"A typical one-page message can be transmitted 36 times faster via modem than by telex", says Norm Young. "It's even half the cost of the average facsimile transmission."

Dial-up messages are still validated with "answer pack" and are time and date stamped, similar to a telex. They are also sent with error correcting protocols.

The system also keeps all statistics and prepares traffic and costing reports to facilitate internal charging. These files are accessible to other system programs such as spreadsheets.

Archived messages are packed into a single file, drastically reducing risk storage space, but enabling quick screen retrieval.

The TOSBox is also a fully operational PC/XT compatible computer and can be used for PC applications while the Telecommunications function continues in background mode. The system software is very flexible. Word processing files collected from a mailbox can be easily converted into Telex, and or ASCII format by the system. Lines are wrapped at the required 69 characters, text converted to upper case, and illegal telex characters are changed to their nearest Telex equivalent.

READER INFO No. 144

Epson's PCe Personal Computer

The new PC personal computer from Epson, utilizing the 8088 architecture with 640Kb main memory, has achieved a clock speed of 10 MHz, the fastest among the 8088 machines available today. Competitively priced, the PCe should be an attractive offer to small-medium business where the new 80286 technology is an "over-kill".

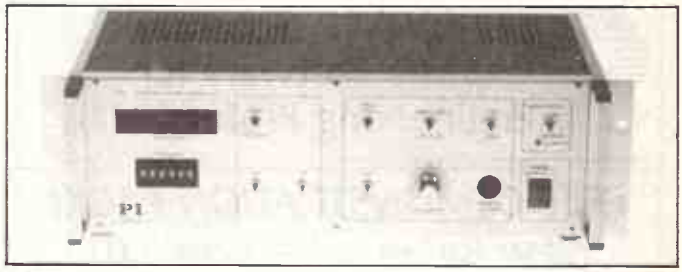
This means the PCe is claimed to be well suited in an LAN environment or as a fully configured Personal Computer running a variety of available PC applications from simple Word Processing programs to complex CAD-CAM or Desktop Publishing software packages.

The PCe will be available in configurations of single floppy, dual floppy, and single floppy with 20 Mb hard disk. The user can also select the most suitable graphics card for specific requirements among mono/Hercules, CGA and EGA.

There are 5 XT compatible full length expansion slots. The floppy disk controller supports up to four drives. Reset switch, system configuration dip-switches, and clock speed selector (4.77 or 10 Mhz) are conveniently located on the front panel.

MS-DOS 3.2 and a system diagnostics disk are bundled with the Eupson PCe. Four kinds of high quality manuals are supplied with the MS-DOS package, making it easy for first time users to become familiar with their systems. Bundled also is GW-BASIC.

READER INFO No. 145



3/axis Stepping Motor Controllers

The new stepping motor controllers C-530 and C-560 from Warsash Sydney, allow a simultaneous operation of three 5-phase motors. With a resolution of 100 steps per revolution, these motors are especially well suited for high-resolution positioning systems.

Working on the constant current principle the new steping motor controllers can be adapted to motors of different phase currents. Both models — the C-530 and the C-560 — are equipped with an IEEE-488 or RS-232 interface as standard. They are available in a 19" rack mount casing which can also be used as table top model. While the devices of the C-530 series can be operated by the computer only, the C-560 series has various manual operating display elements.

The microcomputer installed in the controller provides an extensive set of commands e.g. to position the motors to set the parameters or to read the positions. Thus a high grade of flexibility is achieved allowing the operation of different mechanical systems.

READER INFO No. 146

GRAND OPENING

5th March

SUPER ELECTRONIC WAREHOUSE

27 COWPER ST, GRANVILLE NSW

(Just off Parramatta Rd, near Granville railway station)
On-site parking available

NEW FANS
High Quality from C.I.C. Co. Taiwan Ltd.

10-49 $16 ea
50-99 $14 ea
100+ $12 ea
$20 EA Buy Now!

3" (80mm) 115V AC Cat 06-1019
3" (80mm) 240V AC Cat 06-1020
5" (120mm) 115V AC Cat 06-1029
5" (120mm) 240V AC Cat 06-1030
Finger Guards now available!
3" (80mm) $1.50 ea Cat 06-1022
5" (120mm) $1.50 ea Cat 06-1032

Complete ALARM SYSTEM

Covers doors and windows etc. Add infra-red detector if needed Includes digital keypad + control module with 4 reed switches and siren. $39 Cat No 01-0920
Programable entry/exit delays, g'teed. Easy instal, wiring supplied, batt. oper
EXTRA SIREN AVAIL. $15
Plugs into existing module. 01-0921
ACCESSORY KIT $11
3 extra reed switches Cat 01-0922
INFRA-RED DETECTOR $119
Requires 12Vdc power Cat 01-5302
source at 25mA e.g. rechargeable batt.

2,200uF 50vw PIGTAIL ELECTROS

Cat 18-3346 EA
Were $2.50 ea
THIS MONTH ONLY $1

DPDT HI-QUALITY ROCKER SWITCH

25¢ ea
100 for $20 Cat No 19-2028

PARTS & ACCESSORIES

1N5404
400PIV 3 AMP RECTIFIERS
Cat No 26-0115
20c
100+ 15c ea

8,000uF 75vw ELECTROLYTICS

New, top quality 34mm diam x 85mm high
Cat no 18-3500..... ea $8
10+ ..... ea $7.20

PARTS VALUE PAKS
• Lucky Dip Assortments

$2 EACH PAK

500 0.5w resistors
200 ...1w resistors
100 ... ceramic caps
30 .....greencaps
45 .... electrolytics
20 .potentiometers
25 .....preset pots
30 ..... mica caps
40 .radio/TV knobs
15 various fuses
25 .....rf chokes
20 ..rf/if/osc coils
10 audio transform
50 .....tagstrips
250 0.25w, 0.5w, 1w resistors
15 PAKS TO CHOOSE FROM

STATIC WRIST STRAP $12.50 ea

Static voltages discharge to grounded lead - prevents damage to CMOS IC's etc Velcro tape adjusts to all size wrists

UHF to VHF TUNEABLE DOWN CONVERTER
Was $99 $88
for S85 Ch 28 and VCR or video games. Covers Ch 20-68 with bypass switch for normal VHF use. 12V DC or 240V AC. Cat 24-1022

ABLOY HIGH SECURITY KEYSWITCH
$12.50 Cat 19-3095
SPDT for N.O. or N.C circuits, affords the best protection for electronic power circuits, usually $15.00 each.

New POCKET MULTIMETER
2KΩ/V
A superior shock-resistant case, mirror scale, 16 test ranges, 0-1KV AC + DC, 0-250mA DC, ohms x1K and dB Only $13.50
Cat 17-0155 RRP $19.50 Save $6 now

EX-BANK HOLD-UP CAMERAS

Using photographic film but ideal as "dummy" camera for shop/showroom - just add a flashing LED for extra effect. Includes control unit. $49 Freight extra

AUDIO AND VIDEO IN-LINE VCR/VCR ENHANCER $69

Connect between two VCR machines to improve audio and video signals, with separate controls and multi-purpose leads, 240V AC power. Cat 24-1027

ULTRASONIC + RADIO KEY CAR ALARM

Radio control ON/OFF, panic alarm button, current door sensing, interior motion detector inbuilt siren, delay, reset, $199.75
latest burglar-proof design 19-5253

Was $39.50
$29.50 Negative ION Generator kit
Cat No 11-1550
(Based on AEM5501 Sept. 1985)
Built & Tested $49.50
Cat No 11-1551
A deluxe version of this most popular kit with HIGH/LOW output switch, higher voltage (-9500v), extra ion emitter, professional cabinet and ion emitter tester. Users claim a greater feeling of well being and relaxation. Cleans air of tobacco smoke and bacteria; increase concentration. Full instructions are included.

New Stereo MAGNETIC CARTRIDGE

15HZ-35KHZ response, 0.6mm diam stylus, 2.5mV output, std 0.5 inch mounting
Cat No 03-0050 $21

TV TRANSMITTER AUDIO/VIDEO

Send audio and video signals to TV set(s) within 30m range on VHF Ch 11. No direct wiring needed so use with video cameras too! 9V batt or 240V AC. $69 Cat 04-1155

VIDEO CASSETTE HEAD CLEANER
VHS OR BETA Cat 04-1148 / 04-1149
Were $12.50
Now only $6 EA

STEREO HEADPHONES FOR DIGITAL COMPACT DISC
The difference in bass, treble and sound dynamics is amazing! Clean and crisp with outstanding clarity yet lightweight L/R volume controls, 20-20KHz resp. 100dB at 1KHz sensitivity, normally RRP $44.95, below cost at $20 pr.

Nicad Rechargeable NiCad batteries
High quality nickel cadmium batteries you can use again and again, and we have the biggest range!

		Cat	each
AA	1.2V 450mAH	02-1050	$ 3.50
AA	1.2V 500mAH	02-1051	$ 4.85
C	1.2V 1.2AH	02-1054	$11.70
C	1.2V 1.8AH	02-1055	$13.25
D	1.2V 1.2AH	02-1058	$11.70
D	1.2V 4AH	02-1059	$22.20
AAA	1.2V 180mAH	02-1062	$ 4.75
NRN	1.2V 150mAH	02-1064	$ 4.35
216	9V	02-1066	$18.95

Buy any 10, deduct 10%

MICRO-DIN PLUGS FOR COMPUTERS, ETC - shielded
3 pin micro-DIN Cat 16-1047 $2.20
4 pin micro-DIN Cat 16-1049 $2.30
5 pin micro-DIN Cat 16-1050 $2.40
6 pin micro-DIN Cat 16-1056 $2.50
7 pin micro-DIN Cat 16-1057 $2.60
8 pin micro-DIN Cat 16-1058 $2.70

Ferguson Transformers 9Vdc 200mA plug-pack SCOOP BUY!
240V AC input
9V DC 200mA out
Usually around $13.50 Save $6
Cat 02-2046 $7.50 ea

12-15V DC Regulated 3A POWER SUPPLY KIT
Ideal for CB, car stereo alarms & battery charger Has LM723 regulator, all parts + instructions
$29 Cat 11-1540

Professional SOUND HI-FI
(60% off, were $9.99)
STEREO H'PHONES
$4 Cat 03-9002

LUCKY DIP Offer
$13 24-0023
13 IS a lucky number! An interesting collection of samples manufacturer's over-runs and excess, incl IC's, pots diodes, resistors, capacitors, knobs, switches and lots of other useful junk!

NEW PRINTER SWITCH BOXES
HIGH QUALITY H.D. METAL CASE
A-B
2 x IN
1 x OUT
or vice versa
Beige colour, match any computer system 2 Models avail-

RS232 SERIAL $84
WITH DATA SIGNAL TEST LEDS $75 + S/Tax Cat 04-1586
CENTRONICS PARALLEL Also $90
$81 + S/Tax
FULLY GUARANTEED! Cat 04-1588

RS232 DATA TESTER
Indispensable, serial DB25 Plug to Socket adapter houses 7 red LED's to indicate data flow on all serial outputs
Low cost mini-tester $19.90 Cat 04-1500

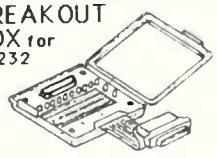
RS232 JUMPER BOX
PCB + 25 jumpers 04-1520 $13.35

RS232 NULL MODEM
TXD, RXD reversed 04-1530 $13.35

GENDER CHANGERS
Female - female 04-0762 $12.75
Male - male model 04-0761 $12.45

SURGE PROTECTOR
Varistor protection 04-1510 $21.50

BREAKOUT BOX for RS232

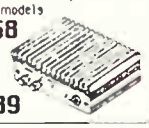


$79 tax incl $72+tax Cat 04-1524
Indispensible tool for monitoring, interfacing and testing all RS232 lines. 24 switches break-out each line except ground, while 10 tri-colour LEDs + 2 spares indicate status of data lines TD, RD, RTS, CTS, DSR, CD, TC, RC, DTR. Includes 20 jumper leads for cross wiring.

Universal NiCad Charger

Charges 4 batteries at one time with LED indicators and panel meter tester. $29.50 Cat
Recharge nicads overnight! 02-2010

24-12Vdc CONVERTERS
Ideal for trucks, buses etc. Input 24Vdc
Output 13.8Vdc, 2 models
4A Output $58 (5.5A max) Cat 24-1050
10A Output (12A max) Cat 24-1055 $89



SERIAL to PARALLEL CONVERTER each
FOR IBM COMPUTER $150
Cat No 04-1580

Fully Automatic 12V MOTORISED CAR AERIALS
Turn on the radio for UP, off for DOWN.
Usually Cat No 03-9420 $24

AERIAL BOOSTER AM/FM
Doubles the signal strength from the aerial. 12V oper. $7 ea Cat 03-9410

Ex-Computer Electros

150,000uF	5v	34,800uF	40v
42,000uF	10v	20,000uF	45v
60,000uF	15v	12,000uF	50v
90,000uF	20v	22,000uF	50v
50,000uF	25v	7,800uF	60v
34,000uF	30v	4,500uF	64v
15,000uF	35v	3,000uF	150v
31,000uF	40v	4,800uF	200v

$5 ea

SYNCHRONOUS MOTORS
With gearbox
2 models -
6 RPM 24-1006
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$9.50 ea

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WANTED Electronic parts, computers, test equipment, CASH paid

ETI-185: VERSI-PLY

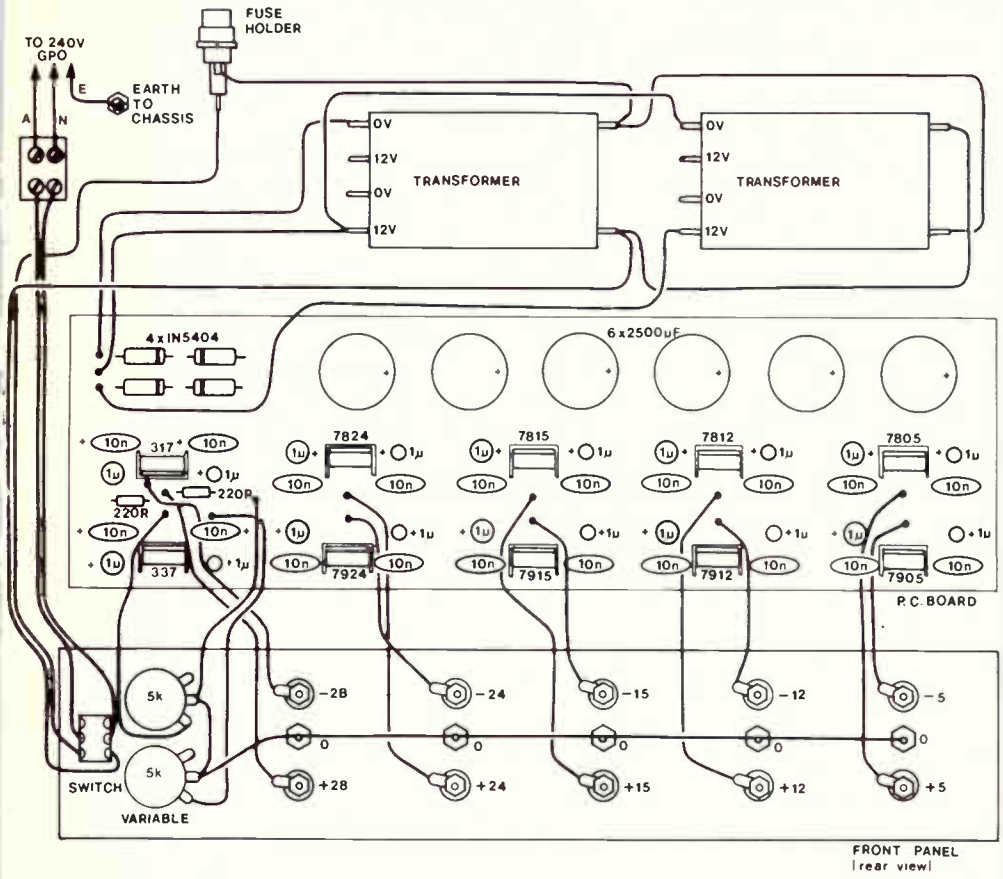
multiple voltage power supply

A power supply that has ten voltages available simultaneously.

MEETING THE VOLTAGE needs of modern electronic devices often poses more than a minor inconvenience for technicians and experimenters.

Having individual voltage rails available to power such things as TTL, CMOS, ECL, MOSFET, and relay coils can cause problems — especially if a breadboard type project is on the bench and requires all voltages simultaneously!

All Electronic Components have recognised this problem, and have designed this power supply to be simple, economical, and as versatile as possible — without placing it in the "upmarket" category.



This project was designed by and is available as a kit from All Electronic Components, Lonsdale St, Melbourne Vic for $257.21, (03) 662-3506.

The Versi-Ply provides eight popular fixed voltages of +5 V, −5 V, +12 V, −12 V, +15 V, −15 V, +24 V, −24 V; and two variable voltage range of +1.3 to +28 V, and −1.3 to −28 V. These ranges should be capable of supplying almost any voltage requirement.

The project is just about as simple as its possible to make it, and exploits to the full features built into modern regulator ICs. They display some attractive characteristics; in fact a veritable wish list of power supply features. For instance: built in thermal shutdown, over voltage protection and current foldback. They virtually guarantee distruction proof operation. Indeed, they are fully short circuit proof, so in the event of an accidental short on the output, they should still survive.

They are also capable of supplying currents of up to eight amps in short bursts. This is more than adequate for most of the requirements of the typical electronic work bench. The result is that we have been able to eliminate the series pass transistors and their associated protection and control circuitry which adds so much complexity and expense to the typical power supply.

The performance of the Versi-Ply has come up to our expectations. Maximum ripple is of the order of the 1.8 Vdc on the supply rails, and each can draw a maximum load of 1.2 amps. The two positive and negative busses are supplies by Ferguson PL24/40VA type transformers. After rectification and filtering to get rid of the ripple they produce a rail at 32.8 Vdc positive and negative.

The bus thus provides more than the required three volts drop across the 24 volt regulator, which is the worst case situation. The TO220 three terminal regulators used here require their input voltages to be three volts higher than the output. This additional three volts is known as the dropout voltage, and is the minimum input voltage the device needs to regulate.

Of course, as is usual in designing electronic circuits, there is no such thing as a free lunch. Even simplicity has a price. In our case, remember that the maximum current available per bus is 1.2 amps. The safe current output on each output voltage depends on the voltage input (V_{in}) minus

ETI-185 PARTS LIST

Resistors
R1, R2 ..... 220 ohm CR37
RV1, RV2 ..... 5K Linear Potentiometers

Capacitors
C1-C20 ..... 10nf 100 V Ceramic
C21-C30 ..... 1µF 35 V Tantalum
C31-C40 ..... 1µF 50 V RBLL Electrolytic
C41-C46 ..... 2500µF 80 V RP Electrolytic

Semiconductors
D1-D4 ..... 1N5406 Silicon Diodes
IC1 ..... 7905 TO-220 Voltage Regulator
IC2 ..... 7912 TO-220 Voltage Regulator
IC3 ..... 7915 TO-220 Voltage Regulator
IC4 ..... 7924 TO-220 Voltage Regulator
IC5 ..... LM337T TO-220 Voltage Regulator
IC6 ..... 7805 TO-220 Voltage Regulator
IC7 ..... 7812 TO-220 Voltage Regulator
IC8 ..... 7815 TO-220 Voltage Regulator
IC9 ..... 7824 TO-220 Voltage Regulator
IC10 ..... LM317T TO-220 Voltage Regulator

Miscellaneous
Two PL24/40VA Transformers, C1063 Case, 10 Green 4mm Binding Posts, 10 Red 4mm Binding Posts, 10 Black 4mm Binding Posts, DPDT Toggle Switch, AEC 86-10-1 pc Board (Tinned), Silk-Screened Aluminium front panel, ½" Plastic Spacers, 18 ½" x ⅛" Bolts, 4 1" x ⅛" Bolts, 23 ⅛" Hex Nuts, Solder, Hook-up Wire, Strain Relief Bush, mains cord, cable and plug, 10 only TO-220 Vertical Mount Heatsinks.

the output voltage (V_{out}) multiplied by the current (I), and should not exceed 15 watts power dissipation (P_{dis}). The current (I) available on each voltage rail can be calculated from:

$$V_{in} - V_{out} = V_{diff}$$

and:

$$P_{dis} = V_{diff} \times I$$

so that:

$$P_{dis} = (V_{in} - V_{out}) \times I$$

and therefore:

$$I = \frac{P_{dis}}{(V_{in} - V_{out})}$$

P_{dis} should not exceed 15 watts, or the TO-220 package regulators will overheat. Standard parameters for this circuit are: V_{in} = 32.8 volts and P_{dis} (max) = 15 watts.

The implication is that the low voltage regulators have a very large voltage across them, and in consequence will be limited in the current they can supply. For instance, the five volt regulator can supply a maximum current (I) of:

$$I = \frac{15}{32.8-5} = 540 \text{ mA}$$

while for the 24 Volt regulator the picture is much better:

$$I = \frac{15}{32.8-24} = 1.7 \text{ A}$$

indicating that the input will be limited by the current supply in the bus, not the regulator. The number of occasions where more than 500 mA will be required at 5 V will be few and far between so these limitations do not undermine the usefulness of the device. And even in the rare case where one might have a requirement for more than half an amp, the variable supply based on the 317 could be pressed into service to double the available current.

Construction:

Construction is straightforward. Check the pc board for bridges, links, undrilled holes and non-continuous tracks. Mount the small capacitors first, observing polarity requirements. Then insert resistors and flying leads for the pots and output terminals. The bridge diodes and large electrolytic capacitors may now be mounted and soldered. Once again, observe polarity. It will be necessary to clip off the No Contact (NC) pin on the capacitors.

Taking standard over-head precautions (heatsink clamps, or the burnt finger test!), install the voltage regulators. Visually check the board for dry joins and bridges.

Care must be taken when fitting and wiring the transformers, because if they are wired out of phase, the ensuing explosion will be both costly and smelly! Check the diagram carefully.

Cross refer the board against the diagram overlay, and if satisfied, connec ac power and check all output voltages. If all is not correct, switch off immediately, and begin to recheck your work. Should fault finding be required, be sure to discharge the capacitor banks by shorting with a low value resistor. ●

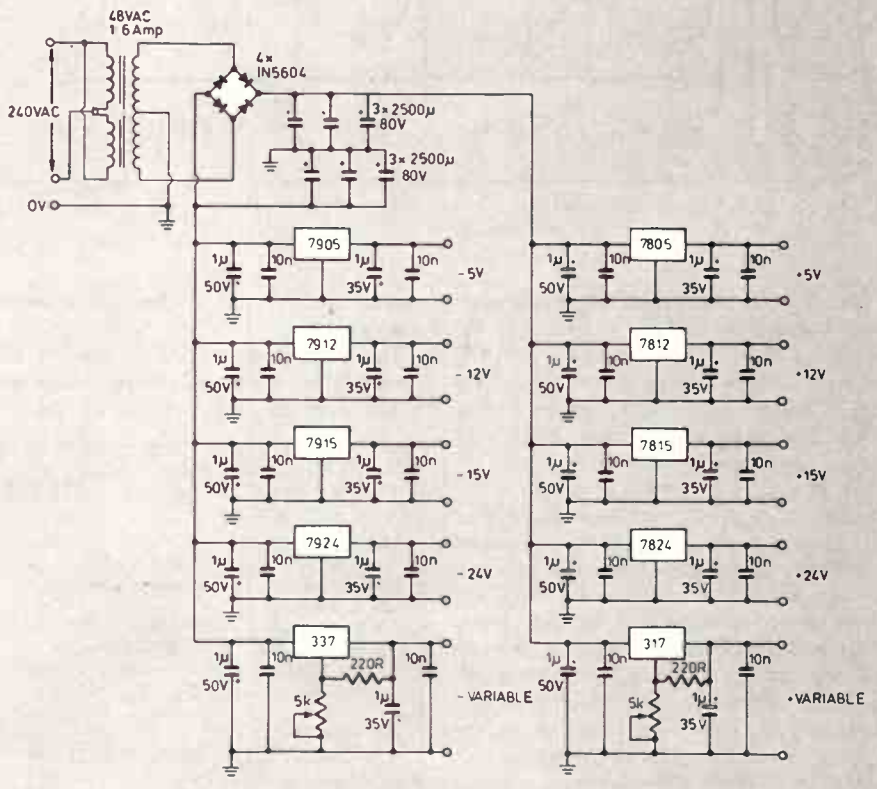
ETI-185 — HOW IT WORKS

The two transformers have the secondaries in series to give the required 32.8-0-32.8 Vdc after rectification. Transformer output before rectification is 24 Vac at 1.6 Amps per transformer.

The input voltage for the regulators is taken from the positive or negative rail, so that each works independently of the others. Filter capacitors are used for stability in the supply. The bank is of 2500µF electrolytics have a very low internal resistance, and also the necessary filtering to give a continuous, uninterrupted supply.

Due to the wide range of load impedances that will be encountered the inputs and outputs of the regulators are bypassed with 10nF Ceramics and 1µF Tantalums (or RBLL low leakage electrolytics). This ensures stable regulation, and stops self oscillation. These bypass capacitors are located as close as possible to the regulators to minimise the risk of rf interference entering the device. It is also for this reason that a double-sided circuit board is used.

On the positive and negative rail, approximately 1.2 Amps is available — however, the regulators' outputs should not exceed 1 Amp. It should also be remembered that a maximum 15 watts dissipation is allowable on these devices; that is, at 5 Volts output, the current drawn should not exceed 0.5 Amps. The full 1 Amp can be drawn from approximately 17 Volts.



The variable regulators (LM317 and LM337) work by maintaining a constant 5 V between their output and Common pins. The voltage between output and ground can thus be controlled by devising a voltage divider with R1 and VR1. A constant current of (5/220) = 23 mA flows through the 220R resistor, and a linear voltage drop will thus be created across VR1.

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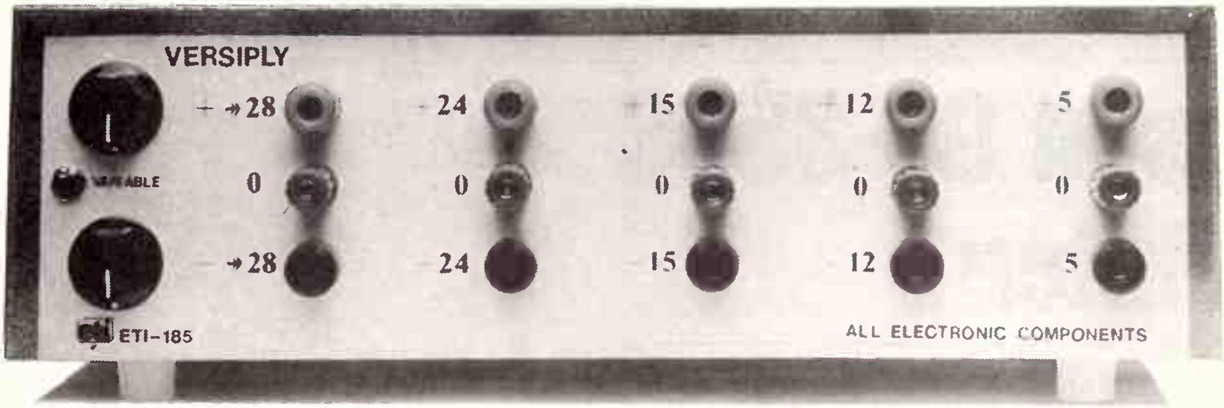

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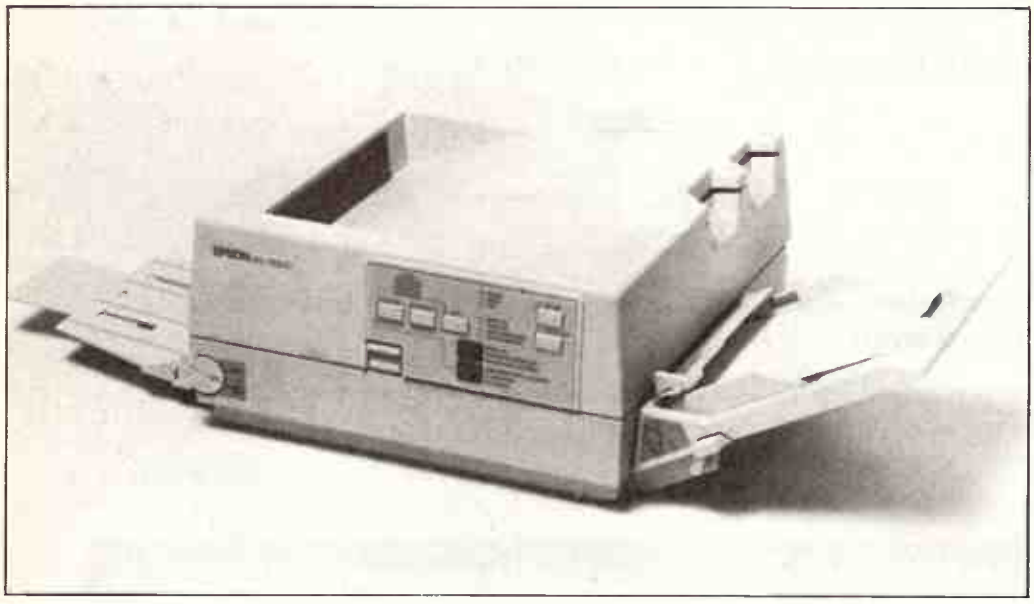

Epson GQ-3500 Printer

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Epson's GQ-3500 is one of a new breed of cheap, small laser printers that are taking the technology out of the esoteric class into office workhorses. At $4000 a time, they are perhaps still too expensive for the average home, but this is certainly a sign of the ways things are developing.

The internal mechanism (the laser engine) is second sourced from Ricoh, best known for cameras. Essentially, all laser printers depend on one or two manufacturers for the engine. The differences occur in the way the package is presented to the user, both in the physical sense and the operating sense.

By and large, Epson have done a good job on both accounts. Physically, they have turned in a package that is surprisingly small, measuring in at only 22 x 41 x 42 cms and weighing 35 kg. It's coloured Apple computer cream, which is suitably neutral for office furniture. Setting up is moderately complex, but if you take the trouble to open the manual and read the first few pages, it is all extremely straightforward.

Control is via a front panel. It has the usual on-line/off-line switch, two seven segment displays and individual LEDs to provide status indication. There is a yellow LED that flashes fast when data is being received, and slowly when there is something in the print buffer. This is actually one of the things I did not like about the unit. It is confusing.

Nevertheless, the Epson is very simple to operate, at least using the parallel interface. It turns out that to get a printout, all that is necessary is to place the toner cartridge and the print drum in the appropriate slot, fit the paper trays and connect a cable to the input. We used a parallel input and drove it with an IBM clone and Wordstar to get the prints shown here.

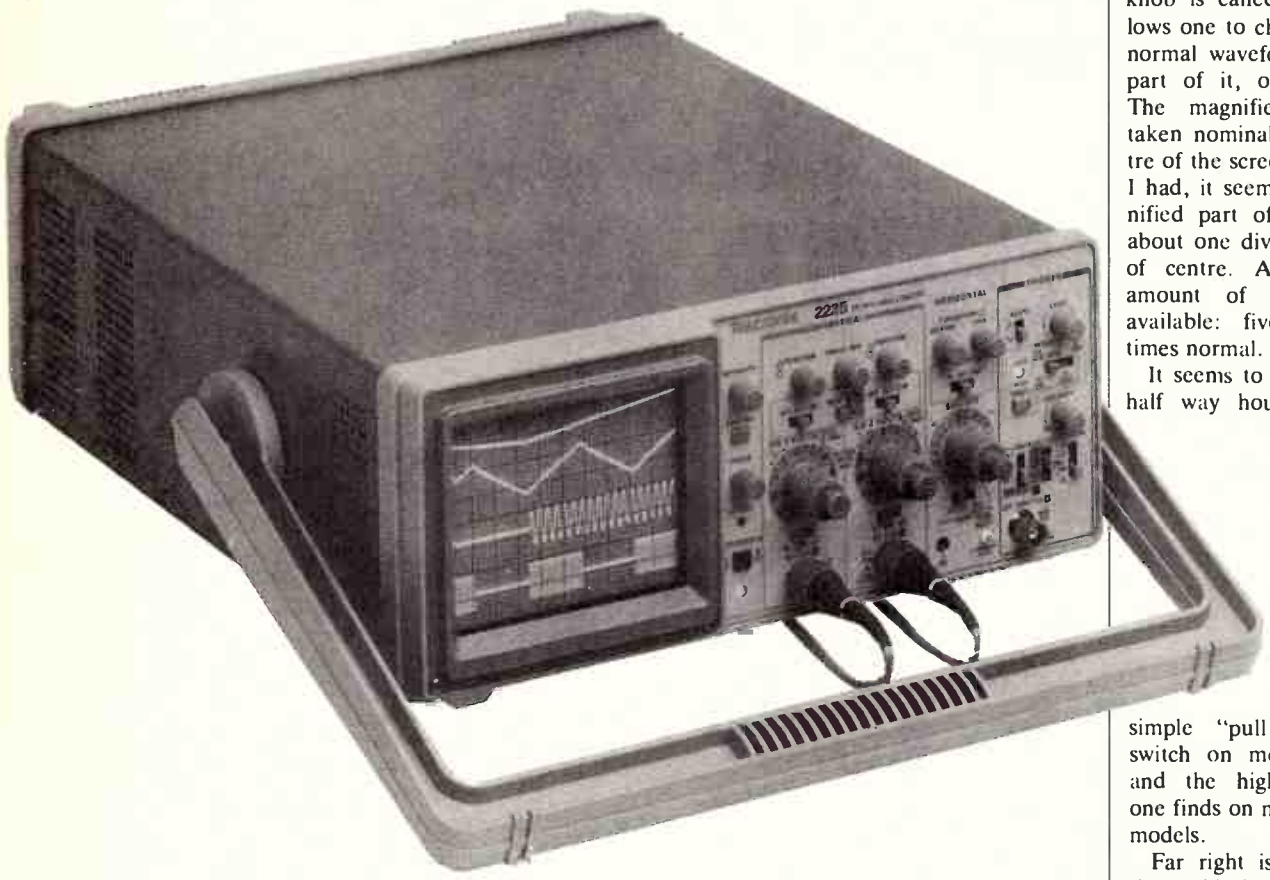
It is possible to operate in a number of different modes, which require slightly more thought. As always, the serial connections have a host of options that need to be sorted out before the print and computer will talk to one another. Another option is the addition of an emulator card, which makes the Epson look like an HP laserjet. I wasn't able to check the success of this emulation, but in the current computer environment, I doubt its usefulness.

As can be seen, the output is excellent, very close to typeset quality. The three different types of characters or fonts, are generated internally by the printer. It is possible to generate other fonts by using software packages resident in the computer, or alternatively using Epson's own font cards. Most of the print characteristics can also be set up as defaults using a set of DIP switches on the interface board.

One problem is that paper will not be printed until the buffer has enough data to cover a whole page. This means that if you only have half a page of type to input, you need to manually eject each copy. I can imagine certain jobs where this would quickly become painful. It's a mistake in the software, and one I hope they correct quickly, because it detracts from an otherwise excellent product.

Jon Fairall

READER INFO No. 162



Tektronix 2225

Tektronix, of course, is one of those benchmark companies that essentially define state of the art in anything they touch. However, the penalty for excellence tends to be a price tag to match. The result is that high quality, high priced instruments from Tektronix are not news. What is interesting, is a 50 MHz oscilloscope from Tek at a very reasonable price.

The new CRO is the Model 2225, and it's priced marginally below $2000, respectably competitive with the rest of the marketplace for 50 MHz CROs. It's part of a new philosophy by Tektronix to try and get a percentage of the market currently dominated by Kikisui, Hitachi and the like.

Of course, the danger of a low price tag is its association with low quality. Tektronix is quick to nip this argument in the bud. According to the official company line, the new low price is the result of improvements that have taken place world wide to the Tektronix manufacturing base.

Does it show in the instrument? The answer has to be, that it does; this is a bit of solid engineering in the old Tektronix tradition. For a start, it looks and feels much like any of the company's other product of the moment. The front panel is laid out quite conventionally. There are two vertical sections to the left, and the horizontal in the centre. The trigger section is over to the right. The screen is to the left and the screen adjustments are all grouped together just next to it.

Reassuringly, the knobs are similar to other Tektronix product with a calibration button in the centre, and a firm indent for every setting. The slide switches all feel quite solid.

The vertical amplifiers are boq standard. Rise time is given as 7 ns, exactly as specified. The only trick to note is that the coil switches at the centre of the volts/div controls can be pulled out to magnify the vertical axis by a factor of ten.

The horizontal part has a rather interesting trace expansion mechanism. A switch immediately above the sec/div knob is called *mode*. This allows one to choose to view the normal waveform, a magnified part of it, or both together. The magnified waveform is taken nominally from the centre of the screen. On the model I had, it seemed that the magnified part of the screen was about one division to the right of centre. A choice of the amount of magnification is available: five, ten or fifty times normal.

It seems to be an acceptable half way house between the simple "pull for 5X mag" switch on most cheap CROs and the highlight techniques one finds on more sophisticated models.

Far right is the trigger section. This is fairly conventional. There is the usual mix of ac/dc, TV, line, external, low pass and high pass filtering available. An external trigger is also available that can be used for Z modulation. At long last CRO designers are putting the z mod input on the front panel, instead of the ridiculous habit of putting it round the back.

The only surprise in the trigger section is its quality. I was interested to see how fast the input signal could go before beating the trigger circuit. I was still getting observable waveforms of a 110 MHz sine waves, by which time the display was down to about a quarter of its nominal amplitude. While this would certainly make accurate readings difficult, it does mean the 2225 would still be a useful tool at twice its rated speed. Recommended.

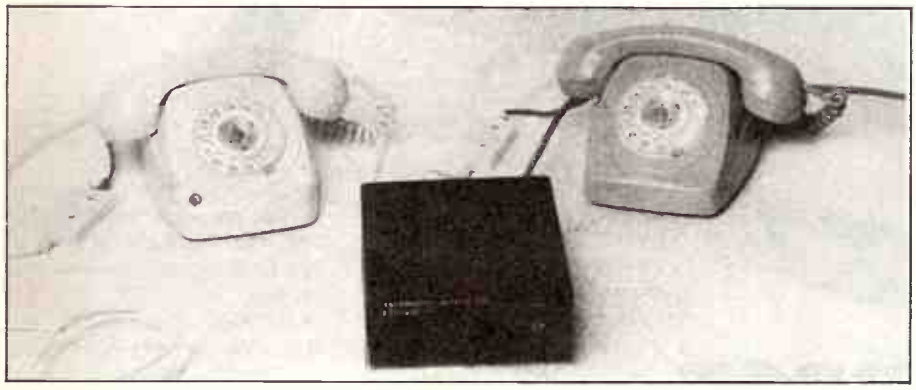
Simon O'Brien

READER INFO No. 163

ETI-291 TELEPHONE INTERCOM POWER UNIT

Terry Kee

If you have just substituted the latest in touch dial wonders for your old series 800 rotary dial phone from Telecom, don't throw them away. We show you how to turn them to good use.



IN AN AGE when fancy phones are all the rage, the space for the Plain Old Phone (POP) seems to be shrinking. Today you can buy phones that almost do the talking for you, and what's more, they are relatively cheap. Even more amazing, Telecom hasn't banned them yet.

The question is, what happens to all the POPs (Plain Old Phones). This project is one answer. For the price of two cheapish transformers, a voltage regulator, a bit of cable and few other odds and sods, you can have a practical home intercom system. Just connect two phones to the output of the ETI-291, spin the dial on one phone to tinkle the bell on the other, and talk.

We wanted something that would support a standard telephone with no modification at all, would never run down, that would operate over reasonable distances, and that, in fact, would duplicate the conditions of a telecom line as closely as possible.

This design accomplishes our goals. Its intended to be shoved in the bottom of a cupboard and forgotten about. In the standby mode it consumes a few milliamps, so it won't affect the power bill. We believe it has sufficient current and voltage capacity to drive two phones separated by a few kilometres, although we never tested that for obvious reasons. The longest separation we could get (the longest bit of wire we had) was 18 metres, and it worked perfectly over that distance.

The Plain Old Phone

A series 800 POP consists of three circuits: a bell path, a dialling circuit and a speech path. The bell path is switched by the action of raising the handset, and operating the gravity switch. It consists of the bell (a large inductor) and a 1.5 µF capacitor which blocks the nominal 50 Vdc sitting on the line.

The bells will ring in response to an ac impressed on this line voltage. A minimum of 4 mA needs to pass through the coil for satisfactory operation according to the specification.

The speech path is normally disconnected from the line. However, when the handset is raised, the earpiece and microphone are connected across the line in parallel, together with associated components. This action provides a dc path for the line current. The measured voltage across the line falls to about six volts. This acts as a bias voltage for the microphone and speaker, so that when the user talks into the mic, an ac is impressed on the dc voltage and communications take place.

The dial mechanism consists of two switches and a spring assembly. The spring actually shorts and opens the telephone line as the dial returns to its normal position when a digit is dialed. One of the switches is used to short out the receiver whilst the dial is turned from its normal rest position. The other is used to connect the spring to the line. Dialing the digit zero will transmit ten pulses. In the ETI-291 these pulses actuate the bell.

Design

A power supply for a POP needs to meet a couple of specifications. For a start, it must provide a nominal 50 Vdc for the standby mode. It must then have an internal resistance such that when the line is looped by one of the phones, the voltage drops to about 6 Vdc. Then it must have a high impedance to ac so that audio information is not shorted by it. It must also have sufficient current to drive the bells.

We cheated a bit in our design, by electing to generate only 33 Volts on the line. This figure is convenient given the common type of mains transformer we used and the regulator. A little experimenting on the lab bench showed that 33 volts will drive the phones quite adequately. Had

TELEPHONE INTERCOM ETI–291

POWER

we tried to achieve exactly 50 Vdc, more expensive components like higher voltage capacitors, would have been the order of the day.

We achieved a high resistance to ac in the traditional way, by placing an inductor in the path. It turns out that rather a lot of inductance is required, so the easiest, and probably the cheapest way to achieve that was via another transformer. We used a 2851 type. The windings are connected in series to achieve the maximum possible inductance.

The inductor actually performs a dual purpose. Not only does it shield the speech path from the low impedance of the power supply, but it also allows a full strength ring ac to be presented to the bell using the back emf of the windings. The simplest way to do this is to loop the line with the dialing pulses. it's not particularly elegant. but it (a) makes a noise and (b) its cheap.

PARTS LIST

Resistors.....all 0.25 W 5% unless shown otherwise
- R1.....270R
- R2.....6k8
- R3.....2k2 (1 Watt)
- R4.....100R

Capacitors
- C1.....1000µ/50V electrolytic
- C2.....100n greencap
- C3.....10µ/63V electrolytic pc mount
- C4.....22µ/63 V axial electrolytic

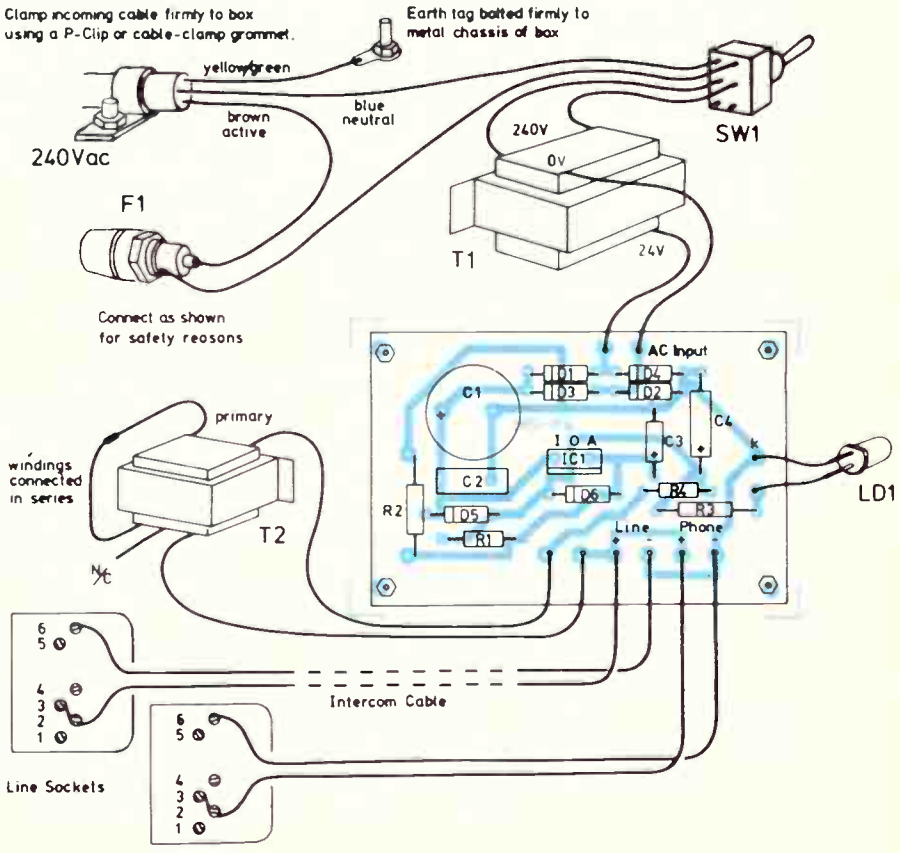
Semiconductors
- D1-D6.....1N4004
- IC1.....LM317T
- D1.....5mm red LED

Miscellaneous
T1 6672 or similar (24V mains transformer); T2 2851 type mains transformer; F1 M205 panel type fuse holder and 500 mA fuse; SW1 miniature toggle switch mains rated, DPDT; 2 telephone in-line sockets, metal box (184 x 70 x 160 mm), pc board, two core intercom cable.

Construction

All the components are mounted on the 67mm x 45mm pc board except the two transformers. Start with the pc board. Its small and there is not much to go wrong, but clean it and check for broken or shorted tracks, nevertheless. Be careful to observe the polarities of the capacitors and diodes, and as per usual, leave the semiconductor to last.

When you have mounted all the components, put the board to one side and start work on the box. It is very important to locate the mains transformer as far away



from the inductor as possible to minimize hum pickup. The impedance across the intercom cable increases with frequency due to the action of T2, and hum may be induced into the telephone speech path.

A simple solution is to mount T2 on the back panel of the box, and T1 near the front panel. We found that orientating T2 at a 45 degree angle produced minimum hum. (See photograph)

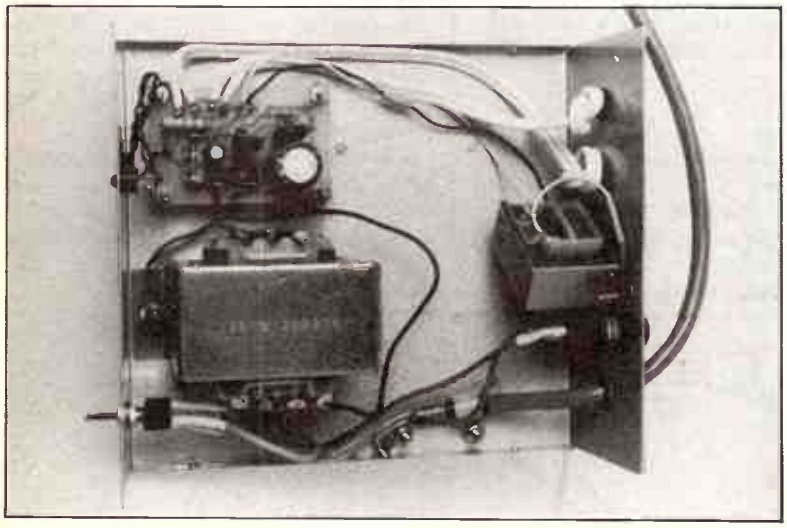
Once the transformers are in place, you can commence wiring the thing together. There are several points to watch. Firstly, ensure that the 240 Vac leads cannot physically touch any of the components that connect to the line. This is a good safety feature that Telecom insist on in their equipment, and its worthwhile observing the practice. Ensure that all exposed 240 Vac connections are adequately sleeved for insulation. Also, fasten the incoming main cable using a cable clamp or a cord grip grommet.

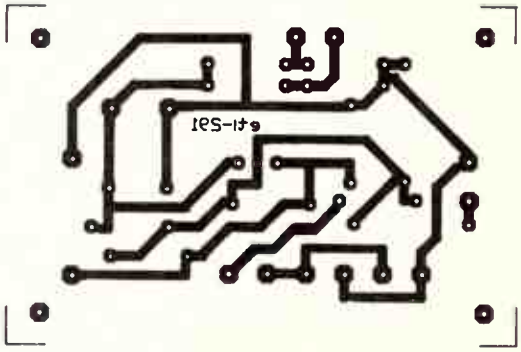
Ensure that all the 240 Vac wiring to the switch SW1, fuse and transformer is correct. The mains earth must be soldered onto a tag and bolted onto the metal body of the box. Once you are certain everything is in order switch on with the phones disconnected. Using a voltmeter set to measure dc, check that the voltage across the intercom line is around 33 V. Don't forget to put a fuse in the fuse holder. If the LED does not light it is probably wired in the wrong way around.

Wiring in the telephone line sockets and cable should not present any problems. It was decided to wire the intercom cable directly onto the pc board thus eliminating the cost of a line socket. The 0 V line is connected to pin 6 and the +33 V line to pin 2 of the line sockets. To avoid tampering with the telephone circuit, pin 2 must be connected to pin 3 in the line socket to put the bell in the circuit. (See the wiring diagram).

The transformer T2 functions as an inductor, not a transformer, so its windings need to be connected in series. However, you must get the polarity correct to maximize the inductance. If you connect it the wrong way around, you will actually reduce the inductance available. You can use an oscilloscope for this. However, its probably just as easy to connect it up, tinkle the bell by dialling, change polarity, and see if it gets any louder. You want the connection that gives the loudest ring.

Finally check over your work carefully, looking at the wiring and polarity of all the components, plug in the phones and turn on. Pick up either phone and it should be active. If you can't hear yourself, or someone on the other phone, switch off and check over everything again. ●



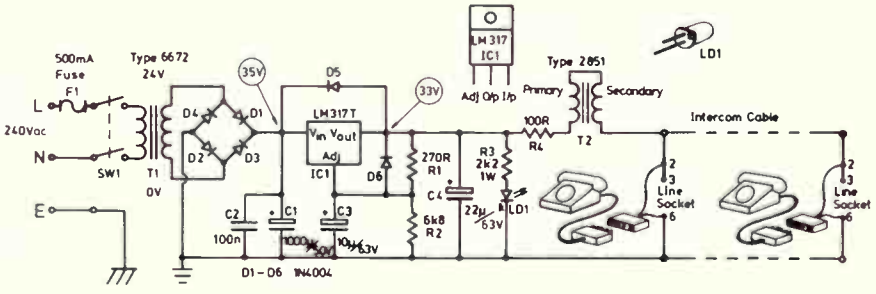


ETI-291 — HOW IT WORKS

The 240 Vac mains is transformed down to 24 V RMS by T1, and rectified and filtered by D1-D4 and C1. This presents 33.9 volts dc to the input of IC1, the voltage regulator.

The regulator is designed to maintain a nominal 1.2 V reference voltage between its output pin and ADJ. Thus the resistor R1 becomes in effect a constant current source, and the output voltage can be set arbitrarily by selecting the correct value for R2. R2 = 6k8 gives us the voltage we want on the output.

The output, however, offers a low impedance to both dc and ac. R4 and the dc resistance of the winding of the transformer T2 help raise the dc resistance somewhat. The measured dc resistance of T2 is around 1 k. The ac resistance consists mainly of the inductance in the windings of T2.



The remaining components are there to protect the supply in the likely event of a momentary short developing. In the event that the input to the regulator is pulled down, D5 will act to stop the voltage across the regulator from exceeding 600 mV. D6 functions to prevent the ADJ terminal becoming more positive than the output, the other fatal condition for the regulator.

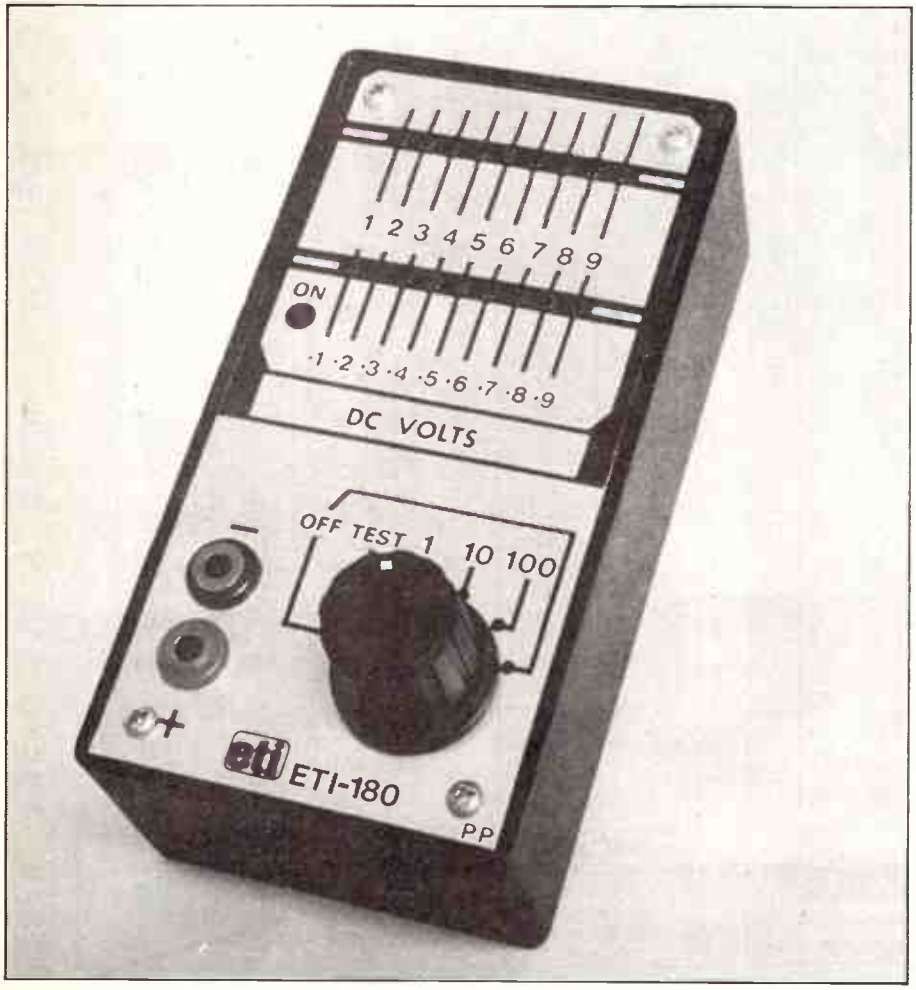
DI with its current limit resistor R3 indicates the presence of power supplies.

PART 2

ETI-180 A SOLID STATE ANALOGUE VOLTMETER

We present full constructional details of the solid state analogue voltmeter introduced last month. Build it in a few hours, and give yourself a useful meter with a unique, easy to read display that will cause interest wherever you use it.

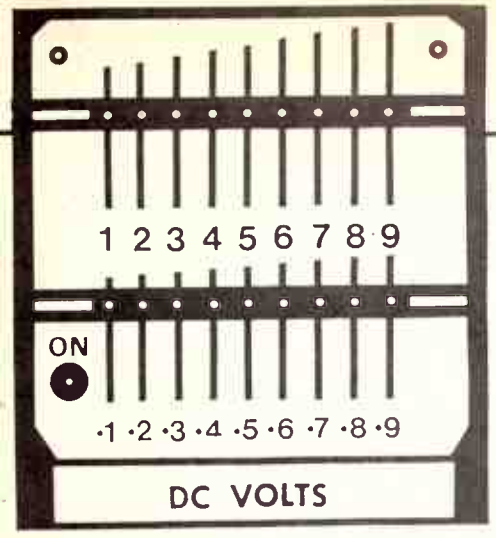
Peter Phillips

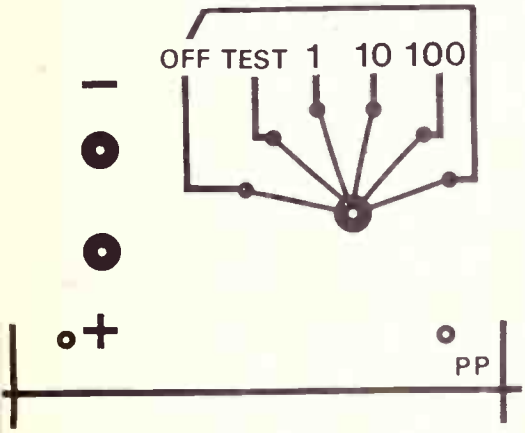


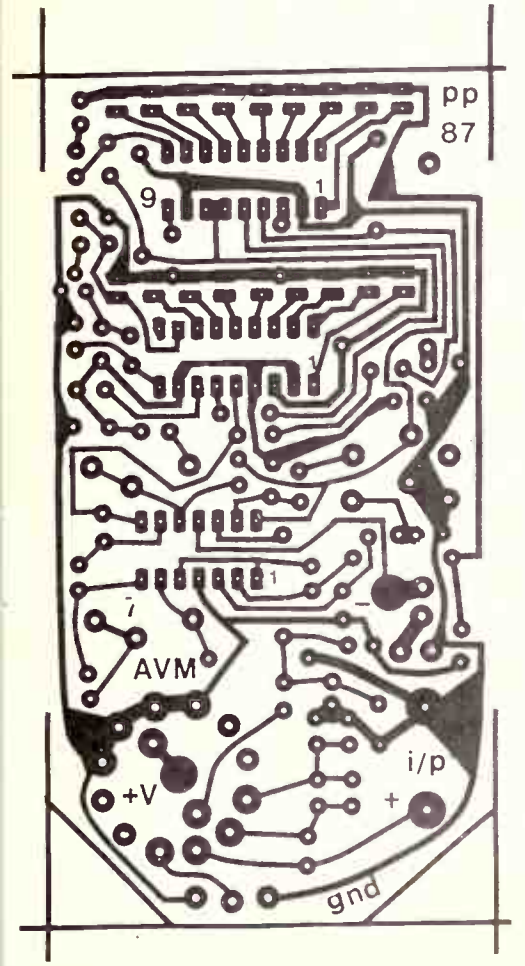
THE CONSTRUCTION OF the ETI-180 is not difficult, but due to the conciseness of the unit is best undertaken in the order described. Calibration details follow, which should be performed according to the prescribed sequence. Because some readers may not have access to a high accuracy ohmmeter and/or voltmeter, alternative methods in component selection are described, enabling most experimenters to undertake this project. The article concludes with a rundown on uses and limitations of the meter.

Construction

Construction of the project is relatively straightforward, due to its simplicity. Constructors may wish to make their own front panel label using other techniques, but a design for a Scotchcal label is provided. Prepare the front panel first by applying the Scotchcal label (or whatever) to the lid of the jiffy box. Alignment of the label to the lid can be achieved by indenting the centre of each of the four screw holes. With the backing sheet removed, and the label face down, lower the lid carefully onto the label, positioned so that the indents are central to the holes in the lid. Once attached, and excess material removed, the lid/front panel assembly can then be drilled according to the panel design. If pin-point LEDs are used, drill each LED hole using a drill slightly larger than 2mm, eg, a number 45 drill. Conventional 3mm LEDs can be used in lieu of







the suggested pinpoint types, and a hole size slightly larger than 3mm should be used. This is necessary to allow the circuit board and the front panel to be separated easily. A 9mm drill is required for the sockets and the selector switch. Be careful the drill swarf doesn't scratch the label during drilling.

The pc board should be trimmed to size to allow approximately 1 mm clearance either side of the jiffy box. It should be drilled with a 0.8 mm drill for the components, a 1 mm drill for the pots RV1 to RV4, diodes D5 and D6, and a 1.2 mm hole size for RV5. The switch needs holes of 2 mm, a size that also suits the lands intended for the input sockets. This allows a wire from the sockets to be soldered to the land, but with ease of removal if required.

Next, mount the components on the board. The layout is fairly crowded, and most components are mounted vertically. Mount all LEDs, R1, R2, R3, the ICs, and the switch last. Commence with the five links, then proceed inserting and soldering the components starting at the display end, working towards the switch end, note particularly the suggested mounting orientation of each vertically mounted component, arranged to minimise the possibility of bare leads shorting together, and to facilitate calibration. Resistors R8, R11 and R12 should ideally be equal in value to ensure that A2 has an exact gain of unity. The value can be within 10% of 10k ohms, and a high resolution ohmmeter (digital type) should be used to select these resistors. Similarly, R19 should be selected to equal one tenth of the measured value of R21 to give A4 an exact gain of 10. R20 should be selected to equal R19. If this step is not possible due to the lack of a high accuracy ohmmeter, using 1%, or even 5% resistors will still give good results.

After all components (except those listed above), have been soldered in position, proceed by selecting, then mounting the multiplier resistors, R1 to R3. Space is provided on the board for parallel pairs for R2 and R3 only, as these resistor values are related to R1. These resistors should all be metal film for stability, but the 2.2 M metal film resistor specified for R7 may be difficult to obtain. If so, use a carbon film, ½W type. Measure R7, using an accurate ohm meter, then obtain two parallel resistors that give exactly one tenth of this value. In the prototype,R1 measured 2.35 M and two 470 k resistors provided the required value of 235 k for R2. R3 should be one ninth of R2, which for the prototype calculated to 26 k resistor. Err on the high side for R3 to allow for the input impedance of the op amp. Where an accurate ohmmeter is unavailable, use two 1M ohm series connected resistors for R1, a 200k for R2 and a 47k in parallel with a 43k for R3, all 1% metal film available from Jaycar.

Next, mount the switch. Place it so the spacing tab is towards the cente of the board, and insert the switch to a depth of

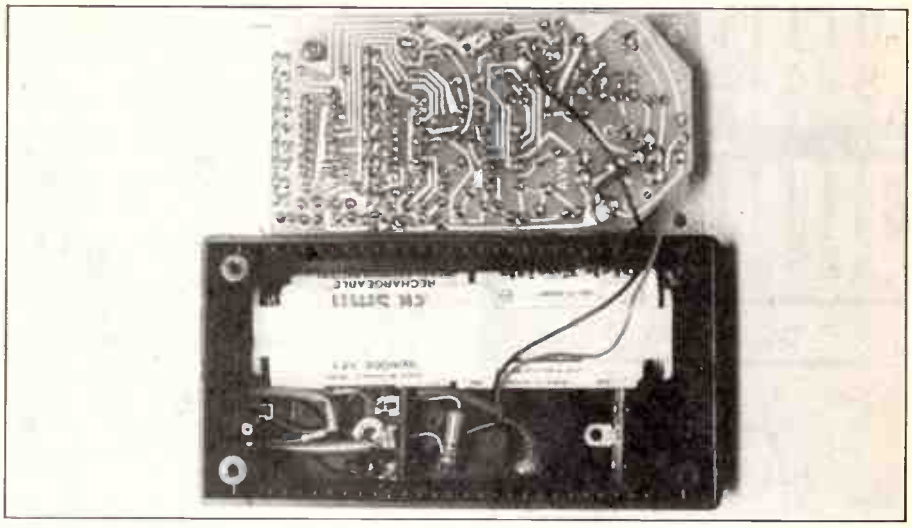
PARTS LIST

Resistors ..... all ¼ watt 1% metal film unless otherwise specified. All values in ohms.
R1 ..... 2m2 (see text)
R2 ..... 220k(see text)
R3 ..... 22k22 (see text)
R4 ..... 22k
R5 ..... 100k
R6, R8.
R11, R12, R21 ..... 10k
R7 ..... 3R9
R9, R18 ..... 8k2
R10, R22 ..... 4k7
R13, R17 ..... 100 R
R14, R15 ..... 1k5
R16, R19, R20 ..... 1k
R23 ..... 1k2
R24 ..... 27k
R25 ..... 15k
R26 ..... 120 R
R27 ..... 3k3
R28 ..... 18 R 1 watt (or to suit charger)
R29 ..... 330 R
Potentiometers ..... all 10 turn trimpots except RV5
RV1 ..... 50k
RV2 ..... 5k
RV3, RV4 ..... 10k
RV5 ..... 5k vertical mount
Capacitors ..... all values in µF, pcb mount.
C1, C2 ..... 0.1 small polyester or mono.
C3 ..... 68, 10V tantalum
C4 ..... 15, 10V tantalum
Semiconductors
Q1 ..... BC557 or similar
D1, D2,
D3, D4 ..... 1N914 or similar
D5, D6, D7 ..... 1N4004 or similar
IC1, IC2 ..... LM3914
IC3 ..... µA324
LEDs, 17 off ..... Pinpoint red LED
LEDs, 2 off ..... Pinpoint green LED
(3mm LEDs can be used, pinpoint LEDs available George Brown)
Switches
S1 ..... 2 pole, 6 position, wafer switch
(available Dick Smith, cat. no. S-6306)
Miscellaneous
PCB board; Scotchcal front panel; Zippy box, (41 x 68 x 130 mm); 2 x 4 mm sockets 1 control knob; 4 x AA battery holder, end to end type.

APPROXIMATE COST = $30 (excluding batteries)

17 mm to 18 mm from the board surface to the top of the tab. A spacer is required of the same height at the LED end of the board. The switch holds the board in position, and the spacing should be checked to ensure the battery holder can be placed beneath it when the whole assembly is fitted within the jiffy box. Once the switch is fitted, mount the ICs. IC sockets can be used if desired, (as in the prototype), or the ICs can be soldered directly. Finally, insert all 19 LEDs. In the prototype, green LEDs were used for 0.5, red LEDs for the others, were used. This was done to facilitate reading the display, and is an extra 'touch' that is up to individual constructors. Yellow LEDs are not sufficiently different from red types to be useful. To prevent light transmission between the LEDs, blacken their bodies with a felt tip pen. To position the LEDs both vertically and horizontally, place the front panel in position, temporarily locked by a nut on the switch. The board and the front panel design are not exactly aligned due to space constraints on the board, and initially the alignment of the front panel to get the LEDs exactly vertical will have the board skewed slightly. This should be corrected after all LEDs are soldered in position by swinging the board to have it aligned with the top panel, thereby skewing the LEDs slightly. Positioning the LEDs is simply a matter of juggling them into their respective holes in the front panel, arranged to the same height. Once positioned, they can then be soldered in position, and the front panel removed.

With all components in place, examine the board for possible shorts between tracks, and confirm that a high resistance



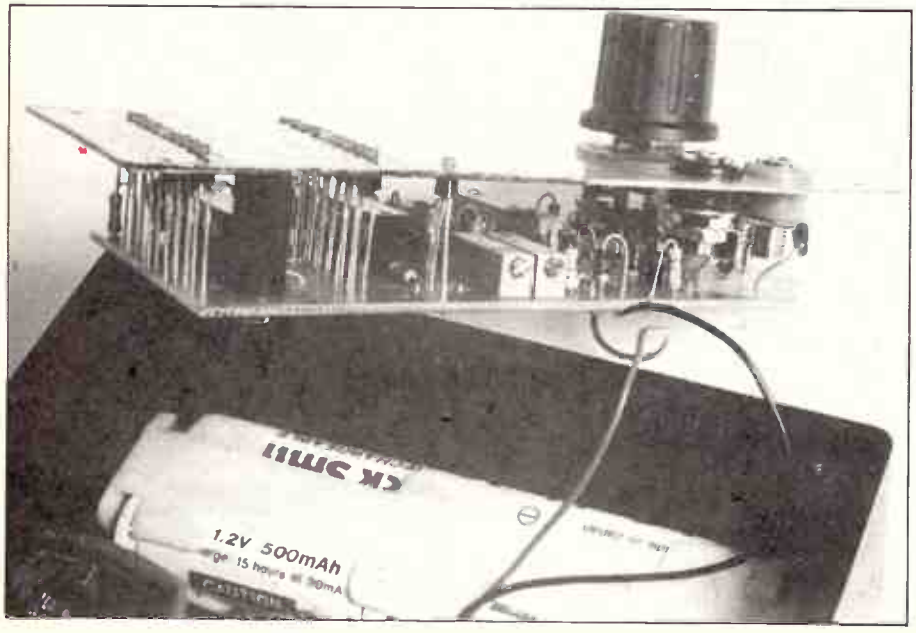
(above 1k) exists across the supply terminals, (switch to any 'on' position). Then attach the battery pack to the lands on the track side of the pc board. As a final check, the current taken by the meter can be checked at around 20mA assuming only the power indicator LED is on. After calibration, when final assembly is being undertaken, the battery pack should be secured within the case. if the recharging facility is being fitted, tag strips, cut to width, will provide sideways anchorage for the battery pack and serve to hold the components associated with the charge circuit. Refer to the accompanying photos to see how this was done in the prototype.

Calibration

Calibration of the instrument requires a reference voltmeter to establish the input test voltages. however, any reliable voltmeter will do, although calibration accuracy cannot exceed that of the reference. If a moving coil meter is being used, check the pointer zero before proceeding, as accurate 0V indications are required. If inconsistencies are arising in the calibration, be suspicious of your reference voltmeter if it is not a high quality unit.

Connect two flying leads to the board to allow the dc input test voltage to be applied. Switch the meter on, and leave it a few minutes to stabilise conditions around IC3. Check that the "power on" LED lights. Then, select the 1V range, and apply a dc voltage of 0.90V to the input. Adjust RV 1 so that the ninth LED of the 10% graph (top lineup) just turns on. Confirm that all nine LEDs in this row show the correct indication for their appropriate input voltage, and re-adjust RV1 accordingly. Then with the input voltage disconnected, short the input leads together to ensure a 0V input. Monitor the dc voltage at pin 1 of IC3 with a dc voltmeter (set to its lowest range), and adjust RV2 until this voltage is around 0V. Then, monitor the dc voltage at pin 7 of IC3, and re-adjust RV until 0V is obtained. This is a touchy adjustment, and should be checked after a few minutes for final trimming.

Reconnect the input test voltage, and set it to around 0.5V, which should light (of course) LED number 5. Attach a dc voltmeter to monitor the voltage at pin 8 of IC3. This can be done (if the recommendfed orientation of the resistors has been followed) by attaching the meter to the exposed lead of R21, which is adjacent to pin 8 of IC3. Then apply a short circuit between pins 7 and 14 of IC3, using a piece of tinnec copper wire. This may cause the LEDs to flash and do strange things, depending on how RV3 is set. With the short-circuit in place, adjust RV4



to obtain 0V at pin 8. This should cause all LEDs on the 1% scale to extinguish, although the others may continue flashing. Removal of the short may also cause the 1% LEDs to light.

For the next step apply an input voltage of 0.85V, and adjust RV3 until LED number 5 of the 1% scale just lights. Then check that the change over from 0.89V to 0.9V occurs at the correct input voltage values, and that 0.91V is not indicating for an input of 0.9V. If so, adjust RV3. Repeat this for 0.19V to 0.2V. Compromise in this step if necessary, as slight linearity errors may be present. Continue fine tuning RV1 and RV3 to ensure correct calibration to within 2% (within one LED) of the applied voltage. Also, after performing these adjustments, repeat the adjustment of RV2 and RV4 as previously described. The design was tested by constructing three separate instruments, and all three demonstrated a linearity that gave at least 2% accuracy. Naturally, drift due to ageing or temperature variations will occur which, as for any meter, can only be minimised by using high stability resistors and regular calibration. The high resolution of the display will tend to highlight this problem. Trying to obtain absolute accuracy is as frustrating as it is unnecessary. If you want a reference standard that is good for 0.5% accuracy, buy a $500 instrument, if 2%, maybe 3% is adequate, use this one.

Once the 1V range is calibrated, check that the multiplier values of R1 to R3 are correct. If not, (a problem that never arose in the three prototypes), adjust the value of R2 for the 10 volt range, then R3 for the 100V range. The 100V range is the most likely range to be incorrect, and changing the value of R3 will not cause significant errors on the other ranges. Once the calibration is correct, measure the battery voltage, then select the 'test' position. Adjust RV5 to give the correct indication of the battery voltage.

During the calibration procedure, you should have discovered that if the input voltage exceeds the selected range, the top row of LEDs flash. If not, check the orientation of D3 and/or C3. As well, the 1% row of LEDs should enter bar mode when the ninth LED is turned on. If not, check that the transistor is a PNP type, or that D1 is correctly orientated. Otherwise, confirm the resistor values for R24 to R27.

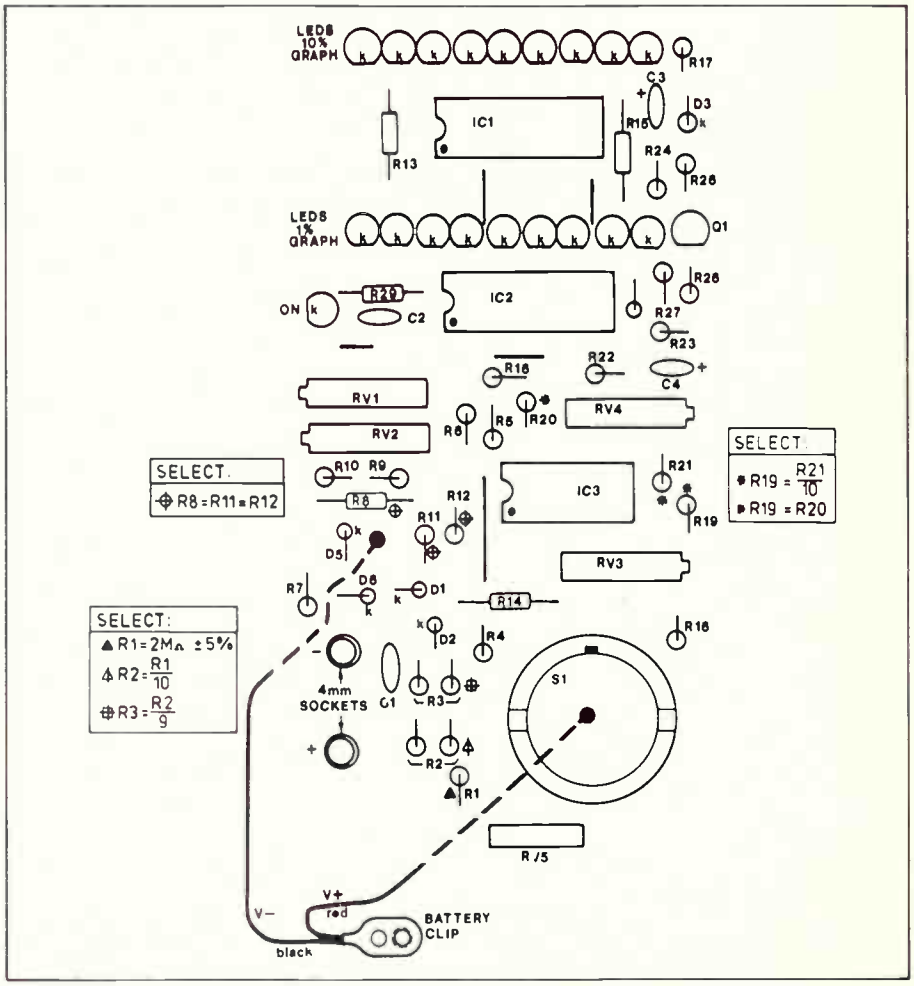
Once the calibration is complete, replace the top panel, fitted with the 4mm input sockets, and solder leads from these sockets to the lands on the pc board. The spacer at the LED end of the pcb should be glued (with super-glue) to the underside of the lid, and attached to the board with a screw. Finally assemble the meter into the jiffy box, and attach the charging circuit (if being used) as already described. Place an insulating layer of mylar, plastic or cardboard between the underside of the board and the battery pack to prevent sharp ends cutting through the insulation of the wires connecting the battery pack. Also, pack felt or sponge at both ends of the battery pack to prevent it moving within the box.

Limitations

This meter is intended as a handy, cheap, dc voltmeter, and its limitations can only be overcome by extending the circuit and, therefore, its cost and size. Readers may feel that a maximum input of 100V is insufficient, but adding a 1000V range would create a safety problem, as well as adding more components to an already overcrowded board. Readers so inclined might like to extend the design to incorporate extra ranges, but an extended version of this meter, including current, ac and dc ranges is planned.

One possible measurement limitation could arise if the test voltage has an ac component. Under certain circumstances, when voltages of this nature are varying around a whole value, say of 4.0V, the display might show 4.9V instead of 3.9V to 4.0V. However, the ac component will cause several LEDs of the 1% graph to light anyway, alerting the user to this possible error. Also, the brilliance of the incorrectly lit LED on the 10% graph will vary, even extinguishing.

Because the meter is battery operated, the use of rechargeable batteries is suggested. A recharging facility can be added as shown on the circuit, but the additional components are not fitted to the board. The test feature should be regularly used to monitor the state of the batteries. It may be found that when the input is open-circuit, for the 1V range, a LED around midscale of the 1% graph lights. This is due to the op amp dc conditions changing, and does not affect the accuracy. Field tests have confirmed the stability and usefulness of the meter, and the fact that voltage readings are possible in dark environments, unlike any other portable meter, is a handy feature. ●



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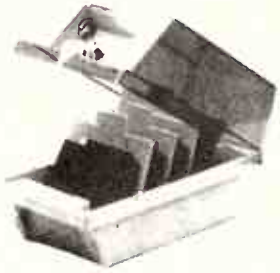

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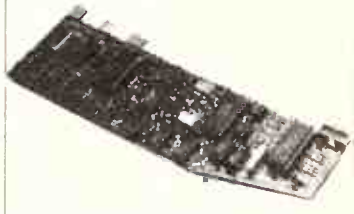

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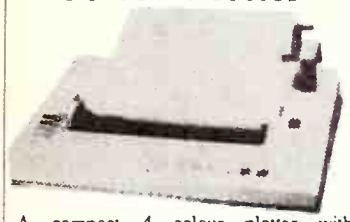

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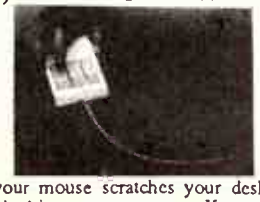

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ACCESSORIES

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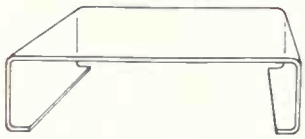

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BIOFEEDBACK CIRCUITS

"Biofeedback" has been used in lie detectors. The more nervous the subject becomes, the higher the meter rises. But these measurements can also be used to control the body's nervous reactions, with beneficial side effects such as a lower heart rate, a more relaxed posture, greater confidence — and possibly even greater intelligence and reduced hair loss.

Robert Penfold

With the seemingly ever increasing pace of modern life, and the increased stress that we all seem to suffer, there is growing interest in the subject of biofeedback. In case this term is new to you, it involves having a device of some kind, usually electronic, which gives an indication of how relaxed (or otherwise) the monitored person happens to be. The idea is for the subject to try to relax. The monitoring device will provide an indication of some kind if he or she is successful. Then, by continuing to act in the same way, an ever deepening state of relaxation can, in theory at any rate, be achieved.

It thus helps to relieve stress in those who otherwise find it very difficult to relax, and it does not require the use of any drugs. Although there is no electronic feedback path, this system is a genuine feedback type in that the user responds to the results indicated by the monitoring device, and forms part of a positive feedback loop.

There are various ways of measuring relative stress in the human body, and in this article we will consider three types of these 'strain gauges'. The circuits featured are designed to monitor relative skin resistance, skin temperature, and heart rate. I am not making any great claims as to how effective these devices are or are not when used as aids to relaxation, but they are certainly interesting to experiment with, particularly the heart rate monitor circuits. All the circuits are reasonably simple and inexpensive to build, and are quite viable as projects to build just for the fun of it.

Skin Resistance

Many circuits for devices which respond to changes in skin resistance have been published and these have most often been put forward as 'Lie Detectors'. The theory behind this has it that when the subject tells the truth he or she remains relatively relaxed, but they become exposed to increased stress when they tell a lie. Stress causes increased perspiration, which in turn results in increased resistance between two electrodes positioned on the subject's skin.

Devices of this type are virtually useless as lie detectors as many people are able to fool them, and practically anybody can be trained to do so. Despite its limitations for lie detection, a device of this type does represent an attractively simple introduction to the subject of biofeedback.

Obviously, measuring resistance does not provide a particularly difficult technical challenge. The resistance between the two electrodes is likely to be quite high at several hundred kilohms, and possibly as much as several megohms. This is within the capabilities of the average multimeter, and probably most readers could experiment with this type of sensor without building up a special monitor circuit. One word of warning though, for reasons of safety you should not try this with a mains powered multimeter, or any mains powered device.

There are alternatives to having meter indication, or to having any form of visual indicator come to that. A simple but effective approach is to have a circuit which produces a tone that increases as the subject's skin resistance decreases, and a state of deep relaxation is therefore induced by obtaining the lowest possible tone from the unit. The circuit for a monitor of this type is provided in Figure 1.

There is nothing remarkable about the circuit, which is basically just a faithful old 555 astable driving a high impedance loudspeaker. R3 is used to attenuate the output somewhat so as to give a volume level that is quite low, which avoids having the unit induce stress instead of aiding relaxation. The skin resistance is placed in series with R1, and it consequently forms part of IC1's timing resistance. Thus, the lower the skin resistance, the higher the output frequency from the unit. The tone varies from a subaudio 'clicking' sound with a

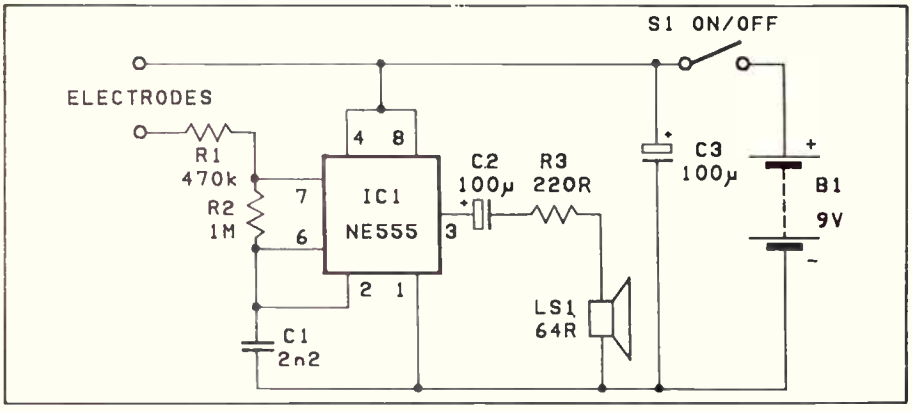

Figure 1. A simple skin resistance monitor which is based on an ordinary 555 astable circuit.

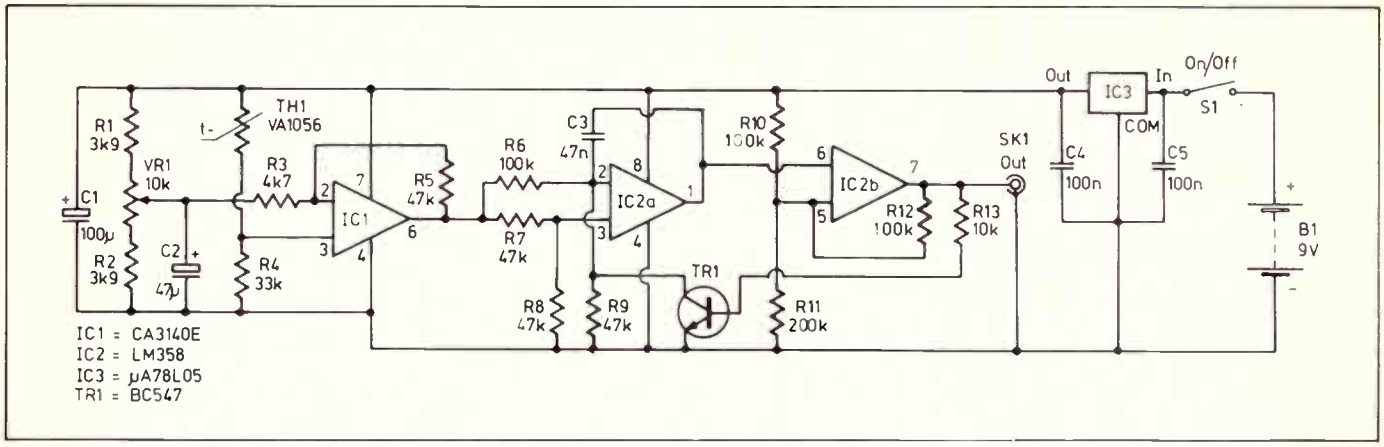

Figure 2. The circuit diagram of the skin temperature monitor.

skin resistance of many megohms to an audio tone of a few hundred hertz with a short circuit between the electrodes. However, by changing the value of C1, the tone range can be altered if desired.

For the unit to stand any chance of functioning reasonably well, it is essential to have electrodes which operate effectively and reliably. Simply holding a couple of small metal electrodes, one in each hand, is unlikely to give good results. The problem here is simply that the tone would then vary over a wide range of frequencies depending on how hard the electrodes were gripped. It is possible to buy proper electrodes complete with conductive jelly, and these are taped in place. This type of electrode does not lend itself well to the present application though, as the conductive jelly would ensure a relatively low resistance between the two electrodes regardless of how stressed or relaxed the subject happened to be. Taping the electrodes in place does seem to suit this application well though, and two small pieces of practically any sheet metal should suffice as the electrodes.

If you use aluminium, which most readers will probably have available in the spares box, it will not be possible to solder a lead direct to each electrode unless special aluminium solder is used. The alternative is to fix a soldertag to each electrode and then make the connections via these, but this type of electrode is likely to prove a little uncomfortable for the user, and the direct soldering method is preferable. The electrodes do not need to be very big, and anywhere in the region of 100 to 500 square millimetres should suffice.

For best results it is probably best to have the electrodes placed on a part of the anatomy that is likely to provide large changes in the amount of perspiration present as the mood of the subject alters. The obvious place is the palms of the hands. I obtained quite good results by fixing one electrode on the palm of a hand and the other on the back of the same hand with a rubber band to hold them in position. You may find that there is a problem with 50 Hz mains 'hum' being picked up in the connecting wires to the electrodes, and in the body of the user. This can modulate the output of the unit and make it difficult to detect small changes in pitch. Adding a capacitor of about 1µF in value in parallel with the electrodes seems to effect a cure here, if necessary.

The type of device certainly seems to respond to changes in the subject's state of stress, and any sudden increase in stress will normally show up quite quickly. Changes in the opposite direction seem to be somewhat less spectacular, and this is presumably because the subject produces increased perspiration almost immediately when introduced to increased stress, but reduced sweating takes a while to become apparent as any perspiration already present must first evaporate to some extent. This slightly devalues this type of device in a biofeedback application, but with practice it is still probably quite usable.

Skin Temperature

There is no obvious reason for skin temperature to vary according to the amount of stress to which one is subjected, but this does occur. Apparently stress results in reduced circulation despite any increase in the rate of one's heartbeat, and this can be detected as a drop in skin temperature of the extremities.

Measurement of relative temperature is again something which does not provide a great technical challenge, but things are not quite as straightforward as one might think. There have been plenty of designs over the years for temperature detectors and electronic thermometers, but few of these would work well in the present application. The main difficulty with a monitor of this type is that it must respond to quite small changes in temperature if it is to stand any chance of success. A typical electronic thermometer circuit with a range of 0 to 50° is not likely to be of any use at all, and one with a response range of something more like 25 to 30°C has a much better chance of success.

The circuit of figure 2 is for a simple narrow range temperature change detector which gives an output signal in the form of an audio tone. This reduces in pitch as the subject's skin temperature falls. The idea is to try to obtain an output which is as high in pitch as possible, or if TH1 and R4 are swopped over, for the lowest possible output tone.

IC1 acts as the basis of the sensor part fo the circuit, which IC2 operates as a voltage controlled oscillator which will operate over a wide control voltage range. Taking operation of the sensor circuit first; TH1 is a negative temperature coefficient device, and its resistance therefore decreases if the applied temperature is de-

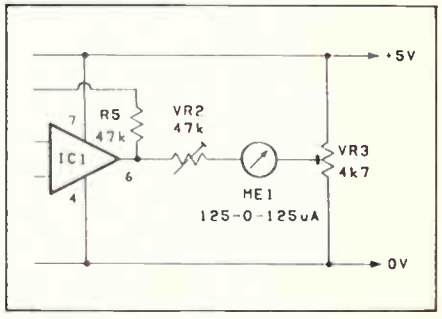

Figure 3. Adding meter indication to the skin temperature monitor.

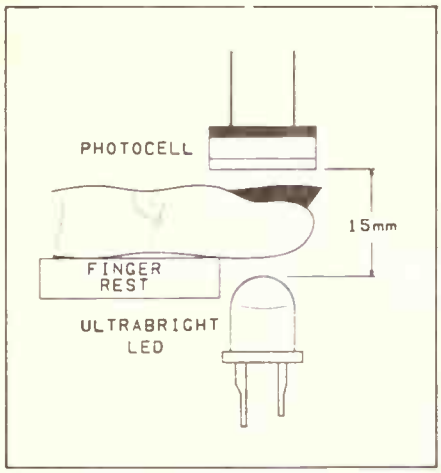

Figure 4. Simple optical heart-beat sensor.

creased. As TH1 is connected in a potential divider across the suppy lines, it proves an output voltage which increases as the applied temperature is raised. Although thermistors are quite sensitive when compared to many other types of electronic temperature sensor, the change in output voltage is still only a small fraction of a volt per degree Celcius. IC1 is therefore used as a non-inverting amplifier to slightly boost any voltage changes produced by the sensor circuit. VR1 is initially adjusted to give an output at roughly mid-supply voltage.

The oscillator is almost a standard Miller Integrator/Schmitt Trigger type, but the configuration has been modified to operate as a voltage controlled oscillator. This gives a wide output tone range which varies from zero to 0 volts input, to a few hundred Hz at +5 volts input. The value of C3 can be changed if a different tone range is required. The squarewave output at SK1 is used to drive a crystal earphone, or in this application where high volume is not really needed or desirable, the output signal could simply be connected to a ceramic resonator. Incidentally a triangular output signal is available from pin 1 of IC2.

It is important that the supply is fairly stable as any significant changes in the supply voltage would almost certainly give a shift in the output tone and therefore give misleading results. IC1 provides a well stabilised 5 volt supply from the 9 volt battery supply.

Meter Output

If meter indication is preferred to the audio tone method, the voltage controlled oscillator section of the original circuit (Figure 2) can be replaced with the simple meter output circuit of Figure 3. This is just a basic bridge type circuit with VR3 being used to provide a reference voltage of just under half the supply voltage. VR2 is the sensitivity control, and this is adjusted so that with VR1 in the original circuit adjusted to set the output of IC1 fully positive, and then fully negative, M1 is driven to full scale.

A little trial and error will probably be needed with the setting of VR3 in order to get the meter drive symmetrical, although it does not really matter if things are not quite perfect in this response, and that in order to set VR2 to fully drive the meter in one direction, a small overload can be produced in the other direction.

In fact you may prefer to set VR2 for quite high sensitivity, which will then leave the meter open to an overload in either direction. This is reasonably safe in that there is little risk of an overload occurring in normal use, and modern meter movements can take quite severe overloads without sustaining any damage. There is no need to use an expensive meter for M1, and a cheap 'tuning' meter is perfectly acceptable in this application where it is relative and not absolute measurments that are involved. It is not essential to use a 125-0-125 microamp type either, and any sensitivity from about 50-0-50 microamps to around 1-0-1 milliamp should be perfectly alright.

There should be no difficulty in taping the thermistor in place on a finger, but there is a potential problem with the metal terminator at each end of this rod style thermistor coming into contact with the user's skin. This would place the user's skin resistance in parallel with the thermistor's resistance, and could have an adverse effect on results. This can be avoided by painting over any exposed metal at each end of the component, and insulating the leadout wires with PVC sleeving as well if necessary. Incidentally, the circuit should operate using virtually any thermistor provided the value of load resistor R4 is changed to suit the particular component used. However, self heating types are obviously unsuitable, as are types which have very low resistances, which would result in a large current flow through the sensor circuit.

Of the three types of monitor circuit I tried, this one seemed the least effective, although it did seem to respond to changes in stress to some extent. Possibly the ambient temperature effects results, and some means of insulating the non-skin side of the thermistor from the surrounding air might produce more reliable results. Placing the thermistor close to the finger tip also seems to give best results. Raising the value of R5 to give increased sensitivity might also be an avenue worth pursuing.

Heart Rate

Perhaps heart rate monitors are the most interesting type of biofeedback circuit for the experimenter, and possibly this is the type of monitor which gives the best results. There must be numerous ways of detecting the heartbeat, but there are two normal electronic approaches to the problem. One is to detect the electrical signal in the body that is associated with the heartbeat, and the other is to use a photoelectric system. We will deal with the latter first, and the general idea is to use a sensor of the type outlined in Figure 4. This method of sensing is known as photoplethysmography.

In theory everything is delightfully sim-

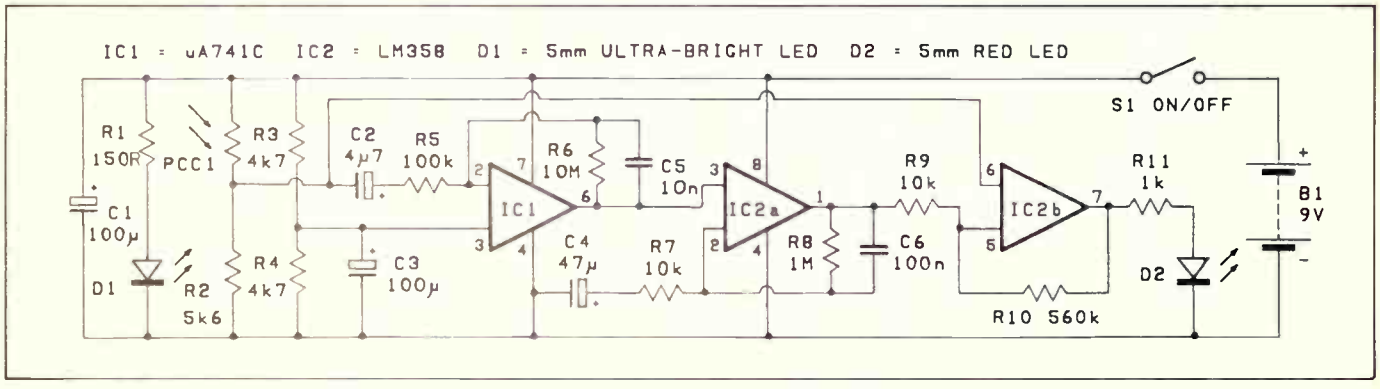

Figure 5. A circuit to provide photoelectric monitoring of the heart-beat.

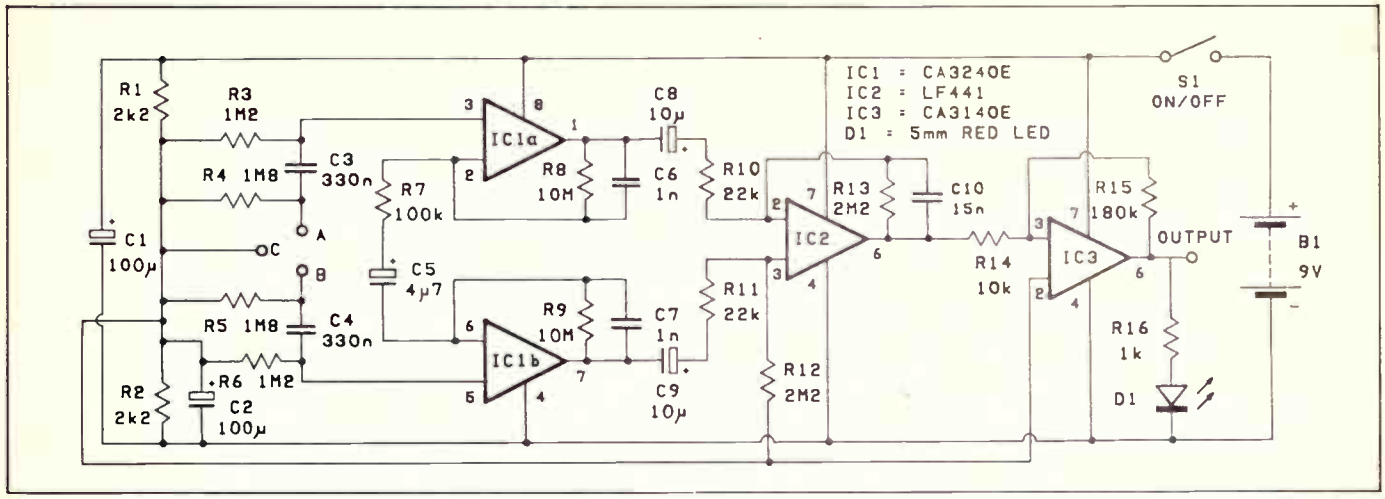

Figure 6. The circuit diagram of the electrode heart-rate monitor.

ple, with a light emitting diode shining a light beam through the finger tip, and a photocell on the opposite side of the finger then detecting the amount of light passing through. The blood-flow in the capillary bed of the finger causes variations in the amount of light received by the photocell, and these result in small changes in the resistance of the photocell. With suitable circuitry these resistance changes can be converted to small voltage pulses and then amplified to give a usable signal level.

In practice things are not quite as straightforward as this, and there are problems with such a simple set up. The first problem is getting a strong enough light source to transmit a significant amount of light through the finger-tip. Until recently it would probably have been necessary to resort to a small filament bulb, but these days ultra-bright light emitting diodes are available, and these seem to give good results if they are operated at a reasonably high current. The main problem is that of getting consistent results.

The first requirement is some form of finger rest to help keep the user's finger perfectly still, as any slight movement here can produce signals that are far stronger than those generated by the heartbeat. It is also important to have the smallest possible gap between the light emitting diode and the photocell, and this means a separation of only about 15 millimetres. The gap must not be so small that the finger-tip is wedged in place, as this would almost certainly prevent the unit from working at all. It is also important that the light emitting diode, photocell, and finger rest are all firmly fixed together so that these do not move significantly relative to one another. Finally, the light level received by the photocell is not likely to be very high, and as far as possible should be shielded from any ambient light.

As far as the circuit is concerned, basically all that is needed is an amplifier and a Schmitt Trigger circuit. Figure 5 shows a suitable circuit diagram.

PCC1 is the photocell, and this is a cadmium sulphide type. This is almost certainly the best type of cell for this application where a fast response time is not needed, but good sensitivity is a decided asset. An ORP12 is suitable for the PCC1 position, but any fairly sensitive type should also be satisfactory. D1 is the light source, and this must be an ultra-bright type (not a standard or high brightness type) if the unit is to operate well. In fact the circuit is unlikely to work at all using an ordinary LED in the D1 position. The amplifier is a two stage type which has IC1 as an inverting amplifier and IC2 as a non-inverting type. The bandwidth is limited to only a few Hz by the inclusion of C5 and C6, and this helps to give a low noise level while not attenuating any signal frequencies. Bear in mind that the heart-beat is at a frequency that will normally be little more than 1Hz. IC2b operates as a Schmitt Trigger which provides output pulses at the monitored heart rate. D2 flashes in sympathy with the user's heartbeat, but obviously the output pulses at pin 7 of IC2b can be fed to a pulse counter of some kind if preferred.

Electrode Method

Monitoring the heartbeat by using electrical signals within the body as the signal source, is not as complex as many people seem to imagine. There are difficulties associated with this type of heart rate monitor, but they are far from insurmountable. There are numerous points at which the electrodes can be positioned, but for simple heart rate monitoring an electrode on each hand is quite sufficient. The signal levels involved are quite low, being typically less than a millivolt peak to peak, but there is no difficulty in amplifying them so as to give a more usable signal level.

There is a problem in obtaining reliable electrical contact with the skin. Use of the special electrodes and conductive jelly refered to earlier overcomes these problems although they are quite expensive. An inexpensive alternative which seems to work quite well is to use pads of cotton-wool soaked in a strong salt solution, and the connections to the pads can be made via crocodile clips.

Another problem is that of electrical interference which is picked up in the leads running to the electrodes, and more particularly, the electrical signals actually picked up in the body of the user. These signals are predominantly 50 Hz mains 'hum' and radio frequency signals, and as the wanted signals are at frequencies of about 4 Hz or less, these interfering signals can be considerably attenuated by lowpass filtering. The use of balanced input techniques can also contribute to rendering them insignificant.

Figure 6 shows the circuit diagram of the heart rate monitor, and this consists of two preamplifiers (one for each electrode) driving a differential amplifier and a Schmitt Trigger output stage. IC1a and IC1b operate as the preamplifiers, and these are identical non-inverting types. The feedback arrangement is a little unusual in that a common shunt resistor (R7) is used for both stages, and it connects between the two inverting inputs, rather than having one side earthed by way of the series dc blocking capacitor (C5). This effecitvely eliminates the shunting effect of

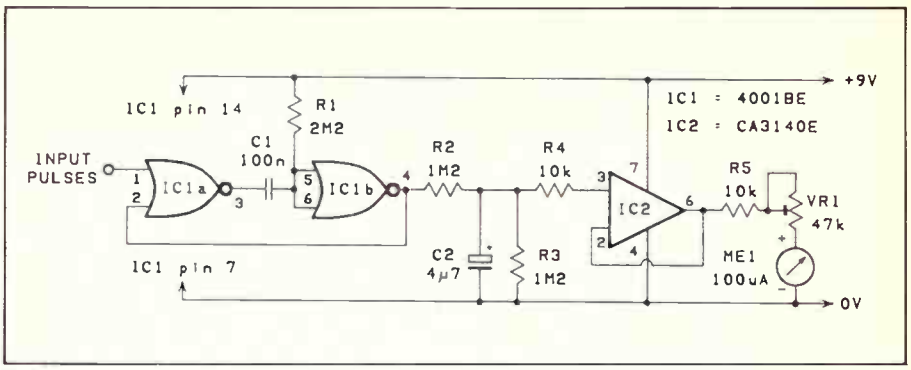

Figure 7. A simple pulse counter circuit.

R7 for signals that are picked up at both inputs, and gives only a low level of voltage gain on these. As these in-phase signals are the hum and noise which will be virtually identical at the two electrodes, this system helps to attenuate the unwanted signals. The wanted signals are out of phase provided the electrodes are positioned at suitable points on the body, and with these R7 has the full shunting effect and each preamplifier exhibits a voltage gain of around 40 dB. C6 and C7 introduce the lowpass filtering.

IC2 combines the two output signals, and this is a standard differential amplifier circuit, and it is followed by a conventional operational amplifier Schmitt Trigger circuit. C10 introduces a further stage of lowpass filtering. D1 is a l.e.d. indicator which flashes on and off in sympathy with the monitored heartbeat. The output pulses can be taken to a pulse counter circuit if required.

A little experimentation with the positioning of the electrodes should soon produce good results with reliable flashing of D1 at the correct rate. Once the electrodes are in place it will take a few seconds for the circuit to settle down and start to function properly though, and you must give it time to do so. Do not worry if D1 does not flash at a stable rate, as it is quite normal for the beat rate to vary slightly, and the heart rate when inhaling is different to that when exhaling for example. If D1 simply flashes more of less randomly though, this would suggest that the unit is faulty or, more probably, that the electrodes are not achieving good and consistent contact and that further experimentation is needed here. note that although three electrodes are shown in Figure 6, in most cases only electrodes 'A' and 'B' will be required. Electrode C is only needed for some of the more exotic electrode placement arrangements which are not normally needed for simple heart rate monitoring, and which will not be discussed here.

Pulse Counter

For biofeedback purposes the heartbeat monitor circuits are far more useful if they are fitted with a pulse counter circuit, and a suitable circuit appears in Figure 7.

This is just a non-retriggerable monostable multivibrator based on IC1, a simple smoothing circuit comprised of R2, C2, and R3, and a buffer amplifier to drive the meter circuit. The output pulse duration from the monostable is constant, and the average output voltage (which is what the meter registers) therefore rises and falls as the input frequency increases and decreases. VR1 is given any setting that gives a strong deflection of the meter in normal use, but does not result in it being driven beyond full scale at high heart rates. it is not necessary to use an expensive meter in the ME1 position, and an inexpensive battery state meter or something of this type is perfectly suitable. However, many of these have sensitivities of about 200 to 500 microamps for full scale deflection, and they might need the values of R5 and VR1 to be reduced slightly in order to give adequate deflection.

Improvements

For anyone wishing to develop these circuits further, the heart rate monitors provide the greatest scope. The pulse counter circuit shown here is quite a crude type which does not give particularly stable readings. Better stability can be obtained by increasing the value of C2, but the circuit then becomes relatively slow at responding to changes in heart rate. One way of improving things would be to use a multi-stage active filter in place of this basic single pole type.

Another approach would be to use a digital readout, with the pulse counter circuit measuring the duration between heart beats, or perhaps the time taken for a certain number of beats to be completed. This could give good accuracy with an instant response time. ●

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Cubic CT

A meg on board, speaks Chinese; what more could you want? Information mostly.

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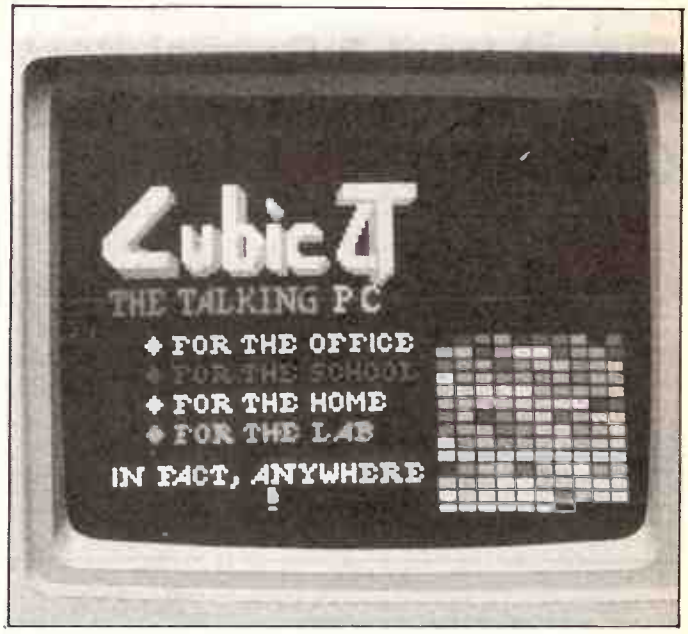

Singapore based Creative Technology has just released its new offering, the Cubic CT. The company claims to have more on board ROM, 608 K, than any other pc on the market. It also has 768 K of RAM on the motherboard with a further 256 K reserved for video. The whole thing is controlled by an 8088 at running at 4.77 MHz with a high speed 8 MHz available from a switch on the keyboard. There is also an empty socket for a maths co-processor to make it go even faster.

Creative have used the ROM space to develop some unique proprietary software for the Cubic. They have developed the ability to put Chinese characters on the screen. I know little about Hanyu Pinyin and the Mandarin is just a tad rusty, so its difficult for me to assess either how successful or how worthwhile this use of EPROMS is. According to the manual, it is possible to recode the keyboard, so that combinations of letters will access Chinese characters, which are printed to the screen. This would be fairly useless, I imagine, for serious computing, but the output can be echoed to a printer using a "typewriter mode" which is also stored in EPROM. This would at least allow the production of letters and other hard copy in Chinese characters. (Incidentally, the same software can be used to create any non-Roman text).

The basic set-up comes with three cards in the eight slots as standard. These are the Super Graphics Adaptor, which has a number of video modes available, an I/O card that drives the discs as well as providing the basic serial and parallel ports for connecting to the outside world, and an audio input/output cord which enables Kookaburra Computers, the Sydney based distributor, to sell the Cubic as a "talking computer".

To take then in order, the SGA first. This allows CGA and EGA emulation and some rather fancy alternatives. It can display information in a number of different modes with various amounts of colour information in each case, thus 320 by 200, 640 by 200 and 640 by 400 are all obtainable. This does not allow EGA compatibilty, in the sense that the high resolution screen actually has greater resolution than EGA, but it looks like EGA to any software running in the machine. The reason Creative went to this degree of trouble, apparently, was so as to be able to generate legible Chinese characters on the monitor.

The I/O card fulfils a number of input/output functions. There are two floppy disc controllers, each capable of supporting a 360 k 5 1/4 inch disc drive, two RS 232 serial communications ports of talking to modems or other peripherals, a parallel centronics printer port and a games I/O port for a joystick. There is no hard disc drive support though. The Cubic clearly requires one with its huge memory, but a separate card needs to be placed in a slot.

The third card is an audio I/O card. This contains a music synthesiser chip, an eight channel ADC, two DACs, a microphone amplifier connected directly to channel 0 of the ADC, and two speaker amplifiers connected to the DAC and music synthesiser outputs. The maximum sampling rate of the ADC is 10 kHz.

I have two problems with the Cubic CT. Firstly, I'm not sure of the value of all that ROM space. At the moment, it's filled with the Chinese characters and the typewriter mode, apart from the BIOS of course. This is wasted on non Chinese, but may be of interest to some Australians as a useful word processing type adjunct. Even then I suspect, it would be a bit of a gimmick.

Of course, if you were sufficiently clever, and could put some useful programmes on those EPROMs, it could make the Cubic a truely maginificent machine. Arthur Voulgarakis of Kookaburra has an EPROM programmer that will allow him to copy legal disc based software onto the ROM. I suspect this would be a worthwhile exercise. Incidentally, the injunction to make sure your software is legal is not a trivial one. The software suppliers, for better or worse, have been giving lawyers lots of money for bailing up pirates recently.

The audio card is also something of a problem. There is a simple demo programme supplied with the machine which allows one to exercise the card. Its possible to connect a microphone, talk into it and hear the sound reproduced at the other end. Its even possible to record the track with an appropriate keyword, and then recall it later.

Its very much a toy type application though. The real interest would be in learning how to use it within one's own programmes either for serious voice digitising projects, or perhaps in some type of useful talking project, or maybe simply as a sophisticated data logger or experiment recorder.

For any of these applications it would be necessary to have a decent manual, explaining exactly how to use it. Unfortunately, the manual supplied with the box skimmed over the surface. Even the technical manual, which was supplied later, told us little more, except perhaps for some interesting memory locations. It appears that Creative have been a little slow in this regard, although Voulgarakis assured us that he was prepared to provide after sales support for any intending purchaser with applications requiring the digitiser.

The twin disc of the CT is selling for $500-$2000 with a hard disc installed. Is it worth the money? It's certainly not a bad buy, especially if you can use its special features. It strikes me though, that the unit would be a lot more attractive, if the manual had been more carefully thought out. This is especially true given that the CT is such an idiosyncratic version of the PC.

Jon Fairall

TEXAS INSTRUMENTS
TECHNOLOGY AWARD UPDATE

During 1987 Texas Instruments sponsored various final year electrical engineering projects in the fields of Digital Signal Processing, Local Area Networks, and parallel Processing. The winner of the Local Area Network (LAN) section has demonstrated the integration of voice and data communications on the IBM Token-Ring LAN. Such a demonstration is the first step towards future integrated networks in the office and factory.

Project: The Integration of Voice and Data Communications on the IBM Token-Ring LAN.

Student: Tiong Lee Ng.

Supervisor: Prof. A. E. Karbowiak.

OVERVIEW

The IBM Token-Ring LAN is fully compatible with the Institute of Electrical and Electronic Engineers (IEEE) 802.5 standard. It is a 4 million bit per second baseband token ring network with a star-wired ring configuration. A star-wired ring operates logically as a ring and physically resembles a star. It combines the point-to-point signalling advantages of a ring with the maintenance and reliability advantages of a centrally-wired star. The LAN employs token-passing which allows for orderly communication between nodes. A signal known as a token, circulates unidirectionally around the ring. If a node has a message to transmit, the node alters the token's status to busy, appends the appropriate control field, status field, and the message, and passes the modified token to the next node. If the node has no message for transmission, it passes the token unchanged. Upon reaching the destination node, the message is copied and the token is passed on to its originating node where the message is removed and a free token status is re-established. To ensure fair access to the ring for all the nodes, a token-holding timer controls the maximum time a node can use the token before passing the token.

ADVANTAGES OF THE TOKEN-RING LAN FOR IN TEGRATED VOICE & DATA

Traditionally, the handling of voice traffic within a private branch constitutes the biggest communications needs within a local business environment. Those needs have traditionally been satisfied by the provision of PABXs (Private Automatic Branch Exchanges). However, with more and more businesses looking to implement data communications on a local scale for their personal computers and peripheral devices, the proportion of data traffic in today's office environment has increased many folds. Since PABXs are essentially designed for voice communications using circuit switching techniques they are not very suitable for the bursty character of data communications traffic.

In response to the need for relatively high-speed and bursty data communications, LANs have been developed to provide improved communication capabilities within a limited geographical area such as a building. LANs achieve relatively high bit rate communications employing packet switching techniques where each user waits in turn to have access to the whole bandwidth of the network over a limited period of time. This implementation incurs random queuing delays which degrades performance of real-time communications. As such, LANs which rely on probabilistic access, such as Ethernet, are unsuitable for voice communications. On the other hand, the deterministic nature of the Token-Ring LAN make it ideal for integrating both voice and data communications.

The TMS380 LAN Adopter Chipset Adapter

There are two main advantages in the integration of voice and data communications on LANs.

(1) Packet switching is a natural way to take advantage of the burstiness of speech. Voice packets are generated only when the user is talking, thus there are no network resources dedicated to any single user. As a result, significant savings in channel capacity can be made because periods of silence are used to transmit packets from data sources or other voice sources.

(2) Economic analyses indicates that packet switching provides the most efficient communication networks of all cases studied. Integration of voice onto a common network provides economies of scale involved in the sharing of switching and transmission resources by many voice and data users.

In order to implement these ideas, during 1987 a working system was built using the Token-Ring LAN. This system successfully demonstrated the simulataneous transmission of three data channels and one voice channel. The future commercial application of such technology will undoubtedly be enormous.

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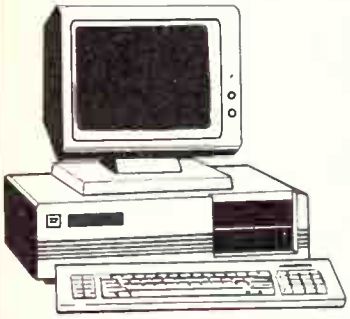

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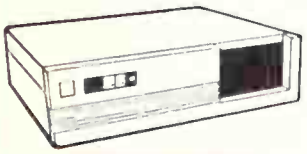

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- Dimensions: 360(W) x 175(H) x 405(D)mm

XT* MOTHERBOARD (WITHOUT MEMORY)

- 4.77MHz
- 8088 Processor
- Expandable to 640K on board.
- Provisions for up to 6 x 2732 EPROMs on board.
- Keyboard connector
- 8 Expansion slots

Cat.X18020 (Excl. Ram) **$109**
Cat.X18026 (Incl. Ram) **$319**

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) **$175**
X18031 (incl. 640K RAM) **$375**

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 .. **$255**
Including RAM .. **$425**

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) **$695**

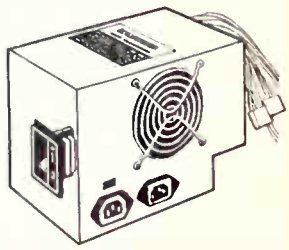
BABY AT* MOTHERBOARD (WITHOUT MEMORY)

- 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) **$695**
X18201 (incl. 640K RAM) **$895**

SEMICONDUCTORS

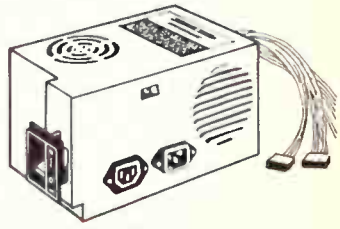
Description	1-9	10+
V-20 8MHz	$14.95	$13.95
V-30	$39.95	$34.95
41256 (150ns)	$5.95	$5.50
41256 (100ns)	$9.95	$9.75
4164 (150ns)	$1.95	$1.85



150W SWITCH MODE POWER SUPPLY FOR IBM* PC*/XT* & COMPATIBLE

DC OUTPUT: +5/13A, -5V/0.5A
+12V/4.5A -12V/0.5A

Cat. X11096 ..... **$149**



200W SWITCH MODE POWER SUPPLY FOR IBM* AT* & COMPATIBLE

DC OUTPUT: +5/16A, -5V/0.5A
+12V/5A -12V/0.5A

Cat. X11097 ..... **$269**

180W SWITCH MODE POWER SUPPLY FOR BABY AT* COMPATIBLES

Cat. X11098 ..... **$169**

"IBM* XT* TYPE" KEYBOARD

- 100% IBM* PC*, XT* compatible.
- 84 keys, including function keys, and a numeric keypad
- low profile keyboard design,
- proper placement of shift keys with large key tops to suit professional typists
- 3 step height/angle adjustment.
- Curl lead plugs straight into IBM* PC/XT
- Status displays, Power, Cap Lock and Numeric Lock

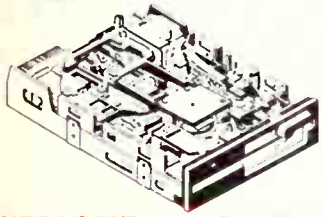
Just like the "real McCoy" only at a fraction of the price! Why pay more?

Cat. X12020 ..... **$109**

BABY AT* STYLE COMPUTER CASING

Our latest computer casing, featuring security key switch, 8 slots, and mounting accessories etc.
Size: 360(W) x 175(H) x 405(D)

Cat. X11093 ..... **$149**



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MITSUBISHI 4851 DISK DRIVE

Slimline, 360K. Double sided, double density

C11901 .. **ONLY $239**

20 M/BYTE HARD DISK

Tandon, including DTC controller card. 12 month warranty. IBM* compatible

X20010 .. **ONLY $595**

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Seagate. 12 month warranty. IBM* compatible

- For technical details phone Mark Stevens on (03) 543 7877

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80 M/BYTE HARD DISK

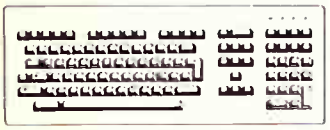
Seagate. 12 month warranty. IBM* compatible

- For technical details phone Mark Stevens on (03) 543 7877

..... **ONLY $2,695**

DTC HARD DISK CONTROLLER CARDS

X180 (XT) **$195**
X18140 (AT) **$295**



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, Clear Screen, Reset.

Cat. X12022 ..... **$125**

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 ..... **$149**

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 ..... **$129**

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) . **$54**
X18006 (4 Drives) . **$57**

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 ..... **$129**

VERBATIM 20 M/BYTE HARD DISK CARD

IBM* compatible, plugs straight in to your computers bus connectors! Includes O & A software.

X20020 ..... **$1,095**

640K RAM CARD (SHORT SLOT)

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

X18014 .. **ONLY $229**

2 M/BYTE RAM CARD

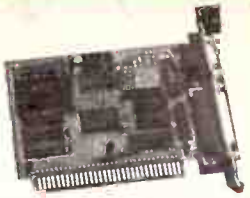
Plugs straight into BUS ports on mother-board. XT* compatible. RAM not included

X18052 (Excl.RAM) **$199**

PRINTER CARD

This card features a parallel interface for Centronics printers such as the Epson RX-80, 100, and other similar printers. Included is printer data port, printer control port, and printer status port.

Cat. X18017 ... **$37.50**

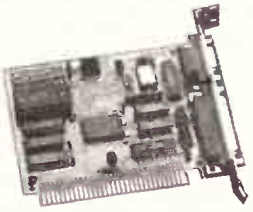


COLOUR GRAPHICS & PRINTER CARD

This combination card features printer and monitor interface. It has 1 parallel printer port, composite colour, RGB CTTC outputs as well as composite monochrome video output with display buffer.

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 ..... **$129**



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 ..... **$145**

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 ..... **$245**

COLOUR GRAPHICS CARD

This card plugs staight 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 ..... **$112**

MULTI SERIAL CARD

- 4 RS232C asynchronous communication serial ports
- NS16450 Asynchronous communication elements (ACE)
- COM1/COM/2 COMPATIBLE
- DTE/DCE Selectable
- Drive support for PC*/AT*, XENIX*
- Interactive installation procedure available

X18154 ..... **$169**

RS232 & CLOCK CARD

(WITHOUT CABLE)

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 ..... **$95**

RS232 (SERIAL) CARD

(WITHOUT CABLE)

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 ..... **$54**

GAMES I/O CARD

Features two joystick ports. (DB15).

Cat. X18019 ... **$39.50**

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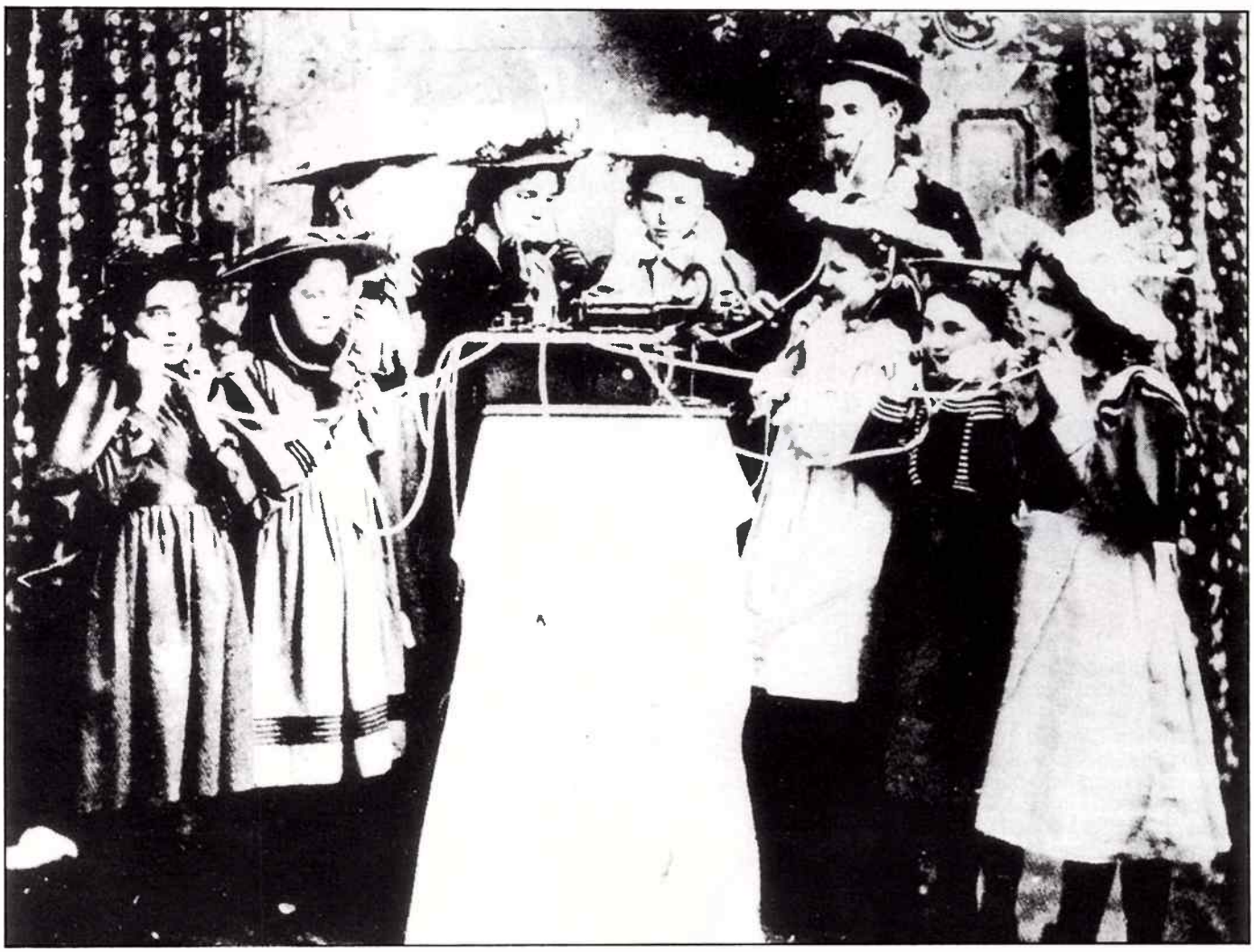

The History Of Rock, pic. Fans of Elton John on hearing his first album

```
Thu Jul  9, 1987  07:01:18 pm Testing the whyboot program ...
Fri Jul 10, 1987  09:45:58 am Crashed ..........
Fr  Jul 10, 1987  10:27:13 am get stuffed, you bastard'
Fri Jul 10, 1987  12:09:28 pm the system crashed
Fri Jul 10, 1987  01 00:57 pm You guessed it ...
Fr  Jul 10, 1987  02:29:48 pm the system crashed
Fri Jul 10, 1987  02:47.19 pm because the bloody thing crashed
Fri Jul 10, 1987  03:28:07 pm here we go again ...
Fr  Jul 10, 1987  05:00:02 pm it crashed again
Fri Jul 10, 1987  05.05:48 pm just stopping f... crashing
Mon Jul 13, 1987  10 27 21 am crashed again .....
Mo  Jul 13, 1987  10.48:31 am it just stops!!
Mon Jul 13, 1987  11 18:01 am bloody hell!!!!!!!!!
Mon Jul 13, 1987  11 19:18 am and again ............
Mo  Jul 13, 1987  11 25 14 am Put new memory board in (Ram-22)
Mon Jul 13, 1987  11:28:56 am New word seems to be crashing it
Mon Jul 13, 1987  11:44:57 am This is very annoying.
Mo  Jul 13, 1987  11:47:15 am again ..................
Mon Jul 13, 1987  12:02:38 pm it crashed again
Mon Jul 13, 1987  12:34:05 pm crashed again ..........
Mo  Jul 13, 1987  12:42:05 pm Something funny going on....
Mon Jul 13, 1987  12:53:27 pm STOPPED AGAIN .....
Mon Jul 13, 1987  01.08:38 pm Replaced IF3 from Rod
Mo  Jul 13, 1987  01:10:12 pm Crashed first thing .....
Mon Jul 13, 1987  01.23:38 pm It stops ..en you look at it!
Mon Jul 13, 1987  04:02:26 pm New word stuffs it ....
Mo  Jul 13, 1987  04:18:42 pm Replaced IF3 with the right one ...
Mon Jul 13, 1987  04.24:58 pm dunno ..............
Mon Jul 13, 1987  05:00:42 pm .....................
Mo  Jul 13, 1987  05:33:47 pm .....................
Mon Jul 13, 1987  06:00.51 pm Its mad.....
Mon Jul 13, 1987  07:05:27 pm It stopped again ....
Tu  Jul 14, 1987  11:11:16 am crashed ---------- 1st time today
Tue Jul 14, 1987  11:15:22 am again ..................
Tue Jul 14, 1987  11.24:16 am xxxxxxxxxxxxxxxxxxxxxx
We  Jul 15, 1987  01:06:46 pm xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Wed Jul 15, 1987  01 41 13 pm poo. cause it crashed
Wed Jul 15, 1987  02.45:57 pm faulty memory board???777
We  Jul 15, 1987  03.26:14 pm crashed .........
Wed Jul 15, 1987  05.49:08 pm fcfffffffffffff
Wed Jul 15, 1987  08:15:27 pm stopped again.
Th  Jul 16, 1987  12.26:43 pm fffffffffffffffffffffffffffffffff
Thu Jul 16, 1987  02:23:29 pm it crashed again!!!!!!
Thu Jul 16, 1987  02:43:43 pm power glitch for sure
Th  Jul 16, 1987  07:19:14 pm set system as ONLY device on line-conditioner
Fri Jul 17, 1987  11:13:39 am ttttttttttttttttttttttt
Sun Jul 19, 1987  12:02:19 pm I want another terminal
Su  Jul 19, 1987  12:55:40 pm Glitched!! All the way to Clovelly!!! (Knocked matt's house ou
Sun Jul 19, 1987  01:24:35 pm glitched again ...
Sun Jul 19, 1987  02:13:33 pm Keeps giltching (????)
Su  Jul 19, 1987  02:27:28 pm gggggggrrrrrrrrrrrrrrrr
Sun Jul 19, 1987  04:09:45 pm uh??????????????
Sun Jul 19, 1987  07:02:51 pm .....................
Fr  Jul 24, 1987  11:33:53 am crashed ..........
Fri Jul 24, 1987  12:14:16 pm because the system crashed
Thu Jul 30, 1987  09:26:20 am because our dear computer had a hangover
Mo  Aug  3, 1987  09:12:46 am because it craxed
Mon Aug  3, 1987  11:26:26 am jjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjj
Mon Aug  3, 1987  11:33:38 am ..lllllllllll
Tu  Aug  4, 1987  09:49:33 am PUTTIN A BAD IF3 IN ...
Tue Aug  4, 1987  11:09:35 am kkkkkkkkkkkkkkkkk
Tue Aug  4, 1987  11:23:07 am kkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkkk
Tu  Aug  4, 1987  12:41:18 pm jjjjjjjjjjqfffffffffff
Tue Aug  4, 1987  03:04:38 pm jjjjjjjjjjjjjjjjjj
Tue Aug  4, 1987  05:10:06 pm crashed - see log
Tu  Aug  4, 1987  06:25:58 pm ...................
Thu Aug  6, 1987  01:21:45 pm kkkkkkkkkkkkkkkkk
Fri Aug  7, 1987  04:01:51 pm stopped in midle of formating
Mo  Aug 10, 1987  09:47:13 am becaeu7e it crashed!!!!!
Mon Aug 10, 1987  10:52:17 am it crashed llllll
Mon Aug 10, 1987  03:24:07 pm "Wonkey". "Stuffed". etc ...
Mo  Aug 10, 1987  04:25:09 pm because it crashed
Tue Aug 11, 1987  04:40:42 pm it crashed lllllllllllllll
Tue Aug 11, 1987  04:43:44 pm jjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjjj
Fr  Aug 14, 1987  08:37:53 pm got glitched, asshole
Sat Aug 15, 1987  03:36:00 am Stopped real quick ...
Sat Aug 15, 1987  01:53:09 pm crAWWS    JJJJJ
Sa  Aug 15, 1987  02:15:49 pm JJJJJJJJJJJJJJJJJJJ
Sat Aug 15, 1987  02:20:57 pm JJJJJJJJJJJJJJJJ
Sat Aug 15, 1987  02:57:42 pm CRASHED - SATURDAY
Sa  Aug 15, 1987  03:27:59 pm Running VERY slowly - sue
Sat Aug 15, 1987  03:31:08 pm something funny ...
Sat Aug 15, 1987  04:34:15 pm Its not very well today ...
Sa  Aug 15, 1987  05:22:21 pm hmmmmmmmmmmmmmm
Sat Aug 15, 1987  05.25:30 pm no no no non on on
Sat Aug 15, 1987  06:31:22 pm pretty radical conditions ...
Su  Aug 16, 1987  02:02:03 pm .....................
```

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Microbee 128K Computer

Worth over $2,200

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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 into.
5. Description of the competition and instructions on how to enter form a part of the competition conditions.
6. The competition commences on January 1, 1988 and closes with last mail on March 31, 1988. The draw will take place in Sydney on April 4, 1988 and the winner will be notified by telephone and letter. The winner will also be announced in The Australian on April 6, 1988, and a later issue of Electronics Today International.
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