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AUGUST 1987

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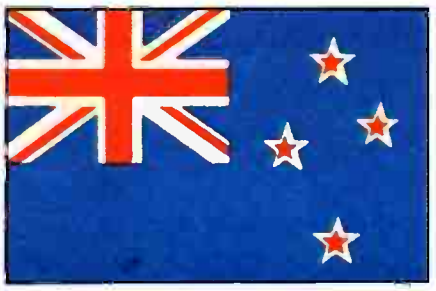
COVER: Model built by Simon O'Brien, photo by Sean Izzard 438 4773



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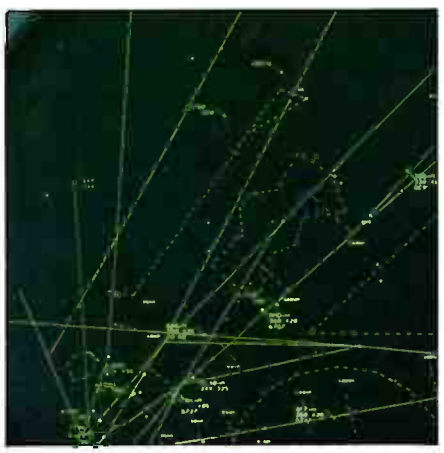

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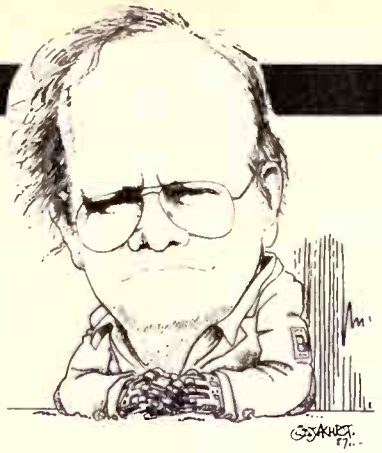

> ***Bright kids are being turned away from engineering***

Almost by default, the Australian mass media seems to accept that tax cuts are a Good Thing. But there are costs along with the benefits. It goes without saying that if taxes are to be cut, so must government expenditure, and we may like that less than we like paying taxes.

Cuts to government expenditure cause pain. However, the pain involved (to the tax cutter at least) is in direct proportion to the amount of public controversy the cuts cause. This works to the advantage of some types of government expenditure. For instance, Welfare has an extensive and effective lobby group. Defence too, is largely secure.

However, one area without effective media relations is Research and Development, defined widely to contain both investment in technical education, and in new products and processes. As a result, CSIRO will lose $10m this year, $15m next year. The research grants scheme will lose $1m. Universities will lose $12m, and no relief is in sight to the shocking state of TAFE funding. As a result, bright kids are being turned away from engineering faculties across the country. At the same time, vital research, the foundation stone on which future industries are founded, is being left undone.

There are two arguments put up for all this. One is that R and D is not a sacred cow, but must share in the general belt tightening. The other is that cuts imposed are not designed to decrease the number of places in education but to make the institutions more efficient.

Both arguments are wrong. Firstly, R and D is not a sacred cow, done for its own sake. It's investment in the future. If we are so poor we cannot invest in our future then we are indeed, as Mr Paul Keating once remarked, on the top of a slippery slide that leads to a banana republic.

Secondly, one would be silly to suggest that Universities or TAFEs are as efficient as they could be. But then there is scarcely a large institution anywhere in the world, either privately or publicly funded, that does not suffer from waste and excess. If cuts are imposed, institutions will employ the usual range of bureaucratic tactics to do less with the same amount of staff.

The technology based industries are the only ones that hold any promise of maintaining our standard of living. In the short term, cuts will make us slightly better off. In the long term this trend is cause for real alarm.

Jon Fairall
Editor

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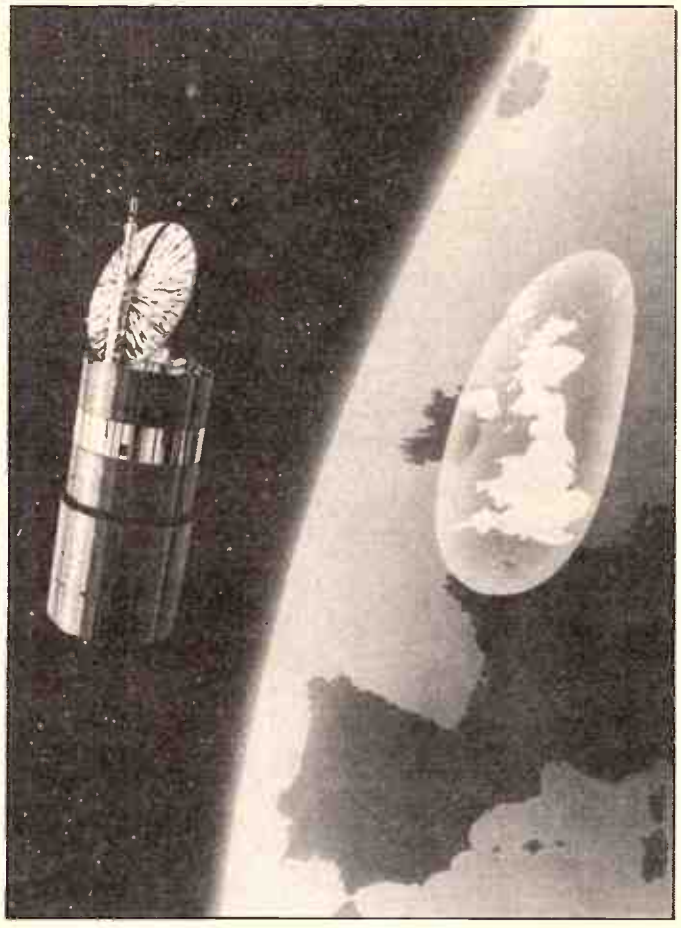


UK DBS

The $386m contract for the manufacture and launch of the United Kingdom's first direct broadcast satellite (DBS) network has been won by the Hughes Aircraft Company, the supplier of Australia's first generation of Aussat satellites, ending years of intense lobbying by most of the major satellite manufacturers, and dashing hopes of an all British venture.

The announcement was made in London by British Satellite Broadcasting (BSB), the consortium which six months ago was awarded a 15-year direct satellite broadcasting franchise by Britain's Independent Broadcasting Authority.

The contract calls for the manufacture and launch of two communications satellites, the first of which is scheduled to be in service by late 1989.

More significant is the requirement that the satellites be delivered in orbit. In orbit delivery is also a condition of tender for the second generation of Aussat satellites for which Hughes will be a bidder. This places the onus of launch insurance on the maker rather than the owner. Insurance has become a major issue since the recent spate of launch failures has driven insurance costs up to 30% of total expenditure.

Both spacecraft being offered to BSB are versions of the HS 376, the same model Hughes has supplied for Aussat. Each will be equipped with three 110-watt channels operating in the Ku frequency band.

Customers in the United Kingdom will be able to receive television broadcasts at any time of day or night through small antennas only a fraction of a metre in diameter.

Qalink

The Australian national airline, Qantas, Singer Link, the big US simulator manufacturer, and Computer Sciences of Australia (CSA), have set up a joint venture company to provide equipment, training and support for flight simulation in the Pacific and Middle East.

The first product developed by the new company is an engineering worksation simulator for the Boeing 767 aircraft. This is a small compartment below the cockpit that contains most of the avionics (aviation electronics) that help the human crew fly the aircraft. From this workstation it is possible to probe virtually the entire electronic system of the aircraft. The simulator will allow flight engineers to be trained in troubleshooting techniques without the necessity of holding up a complete aircraft. It also provides a practical classroom. The compartment on the 767 is less than a metre wide, and so instruction of more than one or two students is virtually impossible. The simultator opens up so that an entire class can be instructed at once.

CSA has developed a computer programme to allow the behaviour of all the instruments to be duplicated, and even more importantly, for virtually any fault condition to be introduced at will. There is an interface to the pilot's flight simulator as well, so that students can see how the fault appears on the flight deck, and what difference it makes to the aircraft's performance.

The simulator is believed to be one of the first in the world. Until recently, it has not been necessary. But new generation aircraft, such as the Boeing 767 and the Airbus, depend extensively on electronic systems for all sorts of functions, and this has meant a complete rethink of servicing routines.

Singer Link (more properly the Link Flight Simulation Division of the Singer Company) is the world's oldest and biggest simulator manufacturer. It designs, makes and supports simulators not only for training military and commercial pilots, but for crews of oil tankers, operators of nuclear power stations, and astronauts for all the US space programs. Singer Link has supplied 15 of the 20 flight simulators now in Australia.

CSA is an Australian-owned company specialising in computer software engineering and support. It has worked on a number of high-technology defence projects covering avionics, navigation, sensor and weapon systems, the new submarine programme, simulation of an RAN destroyer bridge, and training equipment for FA-18 fighter pilots.

Qantas has been operating flight simulators for more than 30 years. The airline has six simulators to train crews for Boeing 747 and 767 aircraft, and supports an RAAF Boeing 707 simulator installed in the Flight Training Centre at the Qantas Jet Base in Sydney.

The Brunei-Singapore Cable

The governments of Brunei and Singapore have signed a Memorandum of Understanding for the planning and construction of a submarine cable to link the two countries.

The signing of the memorandum represents the culmination of a series of joint studies and technical discussions between Jabatan Telecom Brunei and the Telecommunications Authority of Singapore. The Brunei-Singapore Submarine Cable, to be constructed at a cost of about US$50 million, will utilise optical fibre technology and will be ready for service by the end of 1990.

Rambo — look out

In the near future, it may be possible for all of us 97-pound weaklings to look like Amold Schwarzenegger or Martina Navratilova — without sweating! This is just one of the astonishing conclusions of a study just released by International Resource Development, a US based market research firm. According to the report, neuromuscular stimulators are the technology that may make hulks out of even the laziest of us. These devices — quasi-prosthetics — send small electrical impulses through the skin to underlying motor units, where they create involuntary contractions. Present applications are mostly therapeutic. Quasi-prosthetics are used to aid patients who have suffered partial denervation or immobilization — for instance, athletes recovering from knee surgery, people with spinal cord injuries, or stroke victims.

While this technology may eventually be used to assist paralysed and otherwise handicapped people regain some measure of movement, a still more radical proposal has neuromuscular stimulation taking the place of the health spa.

Devices like prosthetic hips and genitals will make it possible for an entire generation of people, who would otherwise be constrained by physical liabilities, to pursue the pleasures of the young.

IRD's research report concerns prosthetic devices which, generally speaking, are not purchased to preserve life, but are for quality-of-life reasons. The replacement knee, the mammary implant, the penile prosthesis — all are concerned with extracting pleasure from life, not survival. The pleasure derived from these devices may take the form of mobility, self-esteem or sexual gratification.

However, skeletal, skin and sexual prostheses are not only for narcissists. The art and science of plastic surgery received its greatest impetus from the scars and wounds of soldiers injured in World War II. The majority of cosmetic surgery performed is not for the vain (and wealthy), but to help those scarred by disease or accident.

Pluto's Atmosphere

New evidence has been discovered indicating that a significant atmosphere surrounds the distant planet Pluto, according to a paper in the British science journal *Nature*.

The new Pluto findings are based on results from the Infrared Astronomical Satellite (IRAS) and extensive observations through telescopes on Earth taken over the past 3 years. Astronomers at the Jet Propulsion laboratory in California reported that Pluto's overall temperature, as measured by IRAS twice in 1983, shows the planet to be very different from an asteroid or one of the icy moons of Jupiter or Saturn. The scientists said that Pluto's thermal characteristics support the suggestion that Pluto has a significant methane atmosphere.

Previous studies of Pluto found evidence of a tenuous methane atmosphere. The new studies, however, indicate that Pluto's atmosphere may be much more extensive.

The results reported in Nature also refine the poorly known diameters of Pluto and its moon, Charon, to about 2192km for Pluto and about 1280km for Charon, ech with an uncertainty of 160km. (Earth's Moon is about 2400km in diameter.)

Very little is known about Pluto, which orbits the Sun every 248 years at an average distance of 6 billion km. The planet, the smallest in the solar system, was discovered in 1930 by astronomer Clyde Tombaugh at the Lowell Observatory. Charon was discovered in 1978 by James Christy of the US Naval Observatory.

Pluto is the only solid-surfaced planet in the outer solar system. Jupiter, Saturn, Uranus and Neptune are gigantic gas planets.

A number of Pluto's characterstics have caused astronomers to question whether it deserves to be called a planet. For example, Pluto has an elliptical and sharply tilted orbit — one more suited to a minor planet or asteroid. It's orbit is so skewed relative to the other planets that it actually crosses Neptune's orbital path. Pluto has been inside Neptune's orbit since 1980 and will remain there until 1999 when it again moves back to its ninth-place position measured from the Sun.

Pluto's relatively small size and theorized ice and rock composition makes it a likely leftover from the formation of the solar system or perhaps a moon that escaped from Neptune's gravitational grasp. But the fact that Pluto has a moon of its own, and now, apparently a substantial atmosphere, strongly bolsters its standing as a planet.

COSSA Publishing

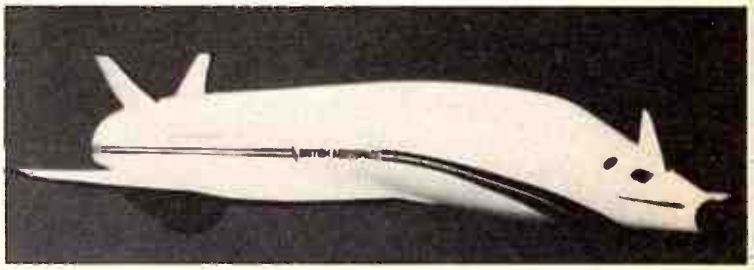
COSSA (CSIRO Office of Space Science and Applications) has published the first Australian Space Industry Directory.

The aim of this is to promote Australian industrial capabilities in space and space related fields, particulary in international markets. The first major use of the directory was at the Paris air show which ran from the 11 to 22 of June. Some 2500 copies were given away.

Private Messages

A joint research project involving the Queensland Institute of Technology Department of Computing Studies and the Queensland data systems security firm Eracom has begun examining computer security. Apparently the project has already discovered a way of testing the vulnerability of the methods now used by all major financial institutions to transfer funds through computer links. The QIT/Eracom research has also evolved an expert system to look for possible loopholes in the Key management systems or large organisations.

NEWS DIGEST



Hotol work for ANU

The local subsidiary of British Aerospace (BAe), British Aerospace Australia (BAeA), has contracted some design studies to the high speed wind tunnel facilities at the Australian National University. The work will help in optimizing designs for BAe's Horizontal Take off and Landing (Hotol) space plane.

BAe hope that Hotol will eventually replace the French Hermes as the European route into space. Hermes — a Space Shuttle lookalike — has been chosen by the European Space Agency as its first space work horse. It is limited in terms of payload however, and requires the services of an Arianne rocket to get into orbit. Hotol will take off and land from conventional runways.

Test models arrived in Australia in June and runs began in early July. The tests are being done in the Hypersonic Shock Tube at ANU and will be analysed by Dr John Sanderman from Queensland University. Sanderman will be responsible for scaling up the results so that the implications for full sized aircraft can be studied.

BAeA's Space Systems Manager, Mr Gordon Briggs, said the tests would concentrate primarily on the nose and air-intake opening of the spacecraft, as well as other critical design surfaces.

"The purpose will be to see how the nose and air-intake opening interact with the aerodynamic and thermal shocks of re-entry from earth orbit.

"The ANU wind tunnel can create conditions of re-entry from orbit by simulating wind speeds of up to 30,000 kilometres an hour, or eight kilometres a second," he said.

Spacecraft designers concede that there are still some unknowns about how air flowing over a spacecraft at hypersonic or orbital re-entry speed can effect the craft's aerodynamic characteristics.

The Hotol contract is the second space plane to be placed with BAeA in as many months.

Earlier this year, the company was awarded a contract to design a guidance system to be used by Hotol, and new American and French shuttlecraft,when they leave orbit and re-enter the earth's atmosphere.

Called READS, for Re-Entry Air Data System, the device will provide shuttle crews with information needed to ensure their craft is at the correct speed and angle of attack to optimise their trajectory so as to ensure correct re-entry heat loads.

BAeA is playing an increasingly prominent role in the development and manufacture of space hardware and satellite sub-systems.

The company recently participated in a feasibility study of a proposal by the Queensland Government to establish an international space port facility on Cape York Peninsula. The study identified a suitable site near Weipa which, BAeA says, could be developed for Hotol type operations.

BAeA is also designing, manufacturing and testing a microprocessor digital electronics unit which is part of the data processing system for the remote-sensing ERS-1 earth resources satellite.

In a recently announced joint venture with the South Australian Government, BAeA is to design and manufacture earth stations for satellite communications systems.

Hole in sky growing

The Environment Office in Berlin will soon begin talks with the chemical industry aimed at eliminating the production of Chloroflurocarbons (CFCs) from West German industry by the turn of the century. The news comes just as the world's scientific community is beginning to accept the reality of a huge hole in the ozone layer that now stretches northward from the pole to 65 degrees South. CFCs have been implicated as the major ozone scavenging agent in a number of studies.

Ozone gas in the upper atmosphere is the earth's natural protection against Ultra Violet rays from the sun. An increase in Ultra Violet radiation at the surface may be expected to lead to an increase in skin cancers. In large doses, such as would apply outside the atmosphere, they would be lethal to man and most other living organisms.

The leader of a recent US Antarctic atmospheric study, Dr Susan Solomon, said she thought changes would be felt soon as far as 40 degrees south. This is north of Tasmania, and north of most of New Zealand. The New Zealand Meterological Service also believes the hole will continue to grow past its current 65 degrees South position.

The hole was originally discovered by a British Antarctic team two years ago. They were studying the distribution of ozone in Antarctica because of interest in a general thinning of the ozone layer throughout the Southern Hemisphere during the last decade. Since 1979, the Southern Hemisphere has lost about 10% of its total ozone. Scientists now estimate that unless CFC production is halted, by the turn of the century there will be measurable losses as far north as Perth, Sydney and Auckland.

One of the most puzzling things about the hole is why it should be located over the South Pole, and indeed, why the Southern Hemisphere should be more affected than the north. Some scientists speculate that the polar climates are more conductive to ozone scavenging by CFCs.

The West German move puts the country on a course so far adopted by only four other countries — the US, Canada, Norway and Sweden. The major objectors of a ban on CFCs have been France and the UK. They argue that a ban on the compounds, used in aerosols, refrigerants and styrofoam packaging, would cause job losses and harm their trading position. Neither Australia or New Zealand, or any other Southern hemisphere country, has yet began to consider banning CFCs either.

An Australian Tail

The furore surrounding the submarine contracts is now all over bar the signing of huge checks. The new craft will be designed by the Swedish firm Kockums and the electronics by a joint venture led by Rockwell of the US. The towed array equipment in the tail however, was designed in Australia by the research officers of the Defence Department.

The new equipment, known as KARIWARRA is meant to detect ships and other submarines by listening to the sounds made by their propellers and engines. The array accomplishes this task by means of acoustic sensors known as hydrophones. The array is towed some distance behind the sub with a cable.

Apparently towed arrays in the past have been too thick and rigid to actually reel into a submarine. The KARIWARRA array is very flexible and is sufficiently narrow to enable a long length to be deployed by the submarine whilst underway.

A manufacturing contract for KARIWARRA has yet to be signed. Currently the matter is before a Defence Department committee. It is expected that tenders will be called shortly.

The Teknis Contract

The Teknis company of Adelaide was recently awarded a five year contract to supply the Department of Aviation with Remote Control and Supervisory Equipment for all capital city airports.

This particular equipment involved is the TRCS 16.32 product family. This consists of a 16 or 32 channel electronic data transmitter/receiver and are basic Teknis product. The units will be used to control and monitor the Departments satellite communications facilities at each location.

OzCAD looks up

HST technology, the Tasmanian CAD company, has announced developments of its Protel CAD package. Protel, along with an equivalent US package called Smartwork, is rapidly becoming an industry standard for small PC based CAD systems. The new packages will tend to reinforce the trend.

HST has announced it will release Protel Schematic and Protel route at the IREECON trade fair in September.

Protel-Schematic is a programme for creating schematic diagrams of digital and analogue circuits. It can be used as a stand alone design package or if used in conjunction with the Protel-PCB and the new Protel-Route programs, forms part of an automatic printed circuit board design system.

Protel-Route is an automatic track routing program for printed circuit board layout. Features include nine pass autorouting plus optimisation of track layout.

HST have stated that international sales continue to increase with over 1000 PCB sales being made into the USA during the last 7 months. Sales are also gaining momentum in Europe, Scandinavia, Middle East and Asia.

Protel software is designed to run on IBM PC, XT, AT or compatible computers with 256K RAM, 2 disk drives (floppy or hard), 1 parallel port PC-DOS, or MS-DOS version 2.0 or better. It supports both the CGA or EGA graphics adapter.

Pacific Dunlop Batteries International

From 1 July, 1987 Chloride Batteries Australia and Dunlop Batteries have combined to become Pacific Dunlop Batteries Industrial. The new general manager is Mr Brian Thorpe who was previously general manager of Chloride Batteries Australia.

Mr Thorpe claimed that "Pacific Dunlop Batteries Industrial will be by far the best equipped manufacturer of batteries for industrial purposes in Australasia". The new company also claims to be "committed to steadily increasing the Australian content to the maximum possible."

NASA comes South

The US National Aeronautics and Space Administration (NASA) is devoting a considerable amount of effort to studying supemova 1987a from Australia. Balloons have been launched from Alice Springs, and a series of rocket flights is being planned from the Woomera rocket range.

Three instruments were flown in the balloon flights during May. They were all used to study Gamma ray emissions from the exploding star. The first flight was made by a balloon with a volume

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of 0.8 million cubic metres that carried a payload of 1360 kg to an altitude of 40000 km. The main instrument in the payload was a Gamma ray spectrometer called Phoenix. This is not the first time NASA has flown Phoenix missions from Australia, although it is the first time the system has been used on the supernova.

The second flight used the same sized balloon but carried a different instrument — a high resolution Gamma ray spectrometer. The third balloon carried a Gamma ray imaging system.

The interest in Gamma rays arises because theory predicts they will slowly become visible as they penetrate the cloud of gas and debris from the explosion that currently surrounds the remains of the star. The rate at which the Gamma ray flux grows, and the amplitude it reaches, will shed light on current controversy over element building processes inside supernovae.

Meanwhile NASA has approached the Australian government over the use of the historic Woomera rocket range in South Australia. Woomera was the place where the post war generation of British missiles were tested, including Blue Streak, at one stage slated to be the first stage of a European answer to NASA's rocket programme.

Several satellites were orbited from Woomera, including the first Australian satellite WREsat. However, the range is now essentially moribund, although the telemetry equipment and other electronic gear needed to make the range fully functional is all still in place.

Now NASA want to use Woomera to launch sounding rockets to study 1987a. Sounding rockets fly for about 10 minutes, during which time they climb to about 250 km before plummeting back to earth. NASA wants to make about 10 launches during October and November. A parallel proposal has also been announced by West Germany, which will launch one or possibly two rockets.

New UK-Australian Telephone Link

Ever since the first of June Britain and Australia have been joined by a new telephone link. The link is between our OTC and Britain's Mercury, a wholly owned telecommunications subsidiary of Cable and Wireless and a rival of British Telecom.

The Mercury company already had connections with Canada, Hong Kong, Bermuda and Belize. A spokesman for the company said that the new service would use the latest digital switching techniques over both cable and satellite transmission routes.

NEWS DIGEST

AAEC & ANSTO

From April 27 the Australian Atomic Energy Commission was replaced with the Australian Nuclear Science and Technology Organisation (ANSTO).

One of the biggest projects before the new organisation at present is the development of SYNROC which purports to be a new way of storing nuclear wastes. SYNROC was developed by Professor Ted Ringwood of the ANU.

At present the newest form of technology used to store these wastes is Borosilicate glass which is manufactured in France, Belgium and India. Borosilicate glass was first developed over twenty years ago and is only now entering production in a big way.

As its name implies SYNROC is a form of Synthetic rock. It is designed to form molecular bonds with radio active substances when they cool to form crystals. The radio-active wastes are locked into the crystal lattice at molecular level, so even if the SYNROC is pulverised, the radioactive material is safely contained within it. This makes it particularly good in preventing leaching.

At least thats the theory. SYNROC has yet to be fully tested.

In order to carry out some of these tests as well as research the manufacture of SYNROC a plant has been built at Lucas Heights. Dr Keith Reeve, Assistant Manager of the project, is at pains to stress that this project does not involve the use of radioactive material. Radioactive tests are being carried out but these are taking place in Britain. Britain has an urgent need to develop new forms of storage of nuclear wastes as its 'waste dump' at Drigg is almost full and no new sites have been chosen.

If these tests are successful then SYNROC could stand as one of Australia's most valuable contribution to the nuclear age. Furthermore, since all the patents are held by this country it could well become a substantial money earner for our depressed economy.

COMING EVENTS

JULY

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

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

AUGUST

18th Annual Computer Conference. Located at the South Australian Institute of Technology. For more information contact the Institute in Adelaide.

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

ANZAAS Townsville Conference 24-28 Aug. Examination of Databases, communications and networks, videotext ect. Contact G. Gupta Dept of Computer Science, James Cook University Townsville, Qld. 4811.

COMDEX the national Computer and Communications exhibition will be held in Sydney from 19-21 August. Desktop Publishing, CAD/CAM and UNIX will be special features this year. Ring (02) 959-5555.

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

SEPTEMBER

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

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

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

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

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

OCTOBER

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

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

NOVEMBER

The International Robot Show is scheduled from the 17th to 10th of November at Sydney Centrepoint. Sponsored by the Australian Robot Association the show will display and explain the many functions of modern robots. Australian Exhibition Services Pty. Ltd. Illoura Plaza, 424 St Kilda Rd, Melbourne. VIC 3004.

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

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

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

CALITE 87. Fifth Annual Conference on Computer-aided Learning in Tertiary Education. Contact CALITE 87, Continuing Education Support Unit, University of NSW, PO Box 1, Kensington NSW 2033. Telephone (02) 697-3175.

COSSA et al are sponsoring a national tour by Gerry Perry between 1827 November. Mr Perry is an expert on satellites and will speak on a variety of subjects. Ph Lyndal Thorburn (062) 48-4554, or Geoff Davis (09) 397-5642.

DECEMBER

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

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ELECTRONIC

Ever since radar was invented, military planners have been looking for ways to thwart it. Now, scientists have come up with a new generation of paints and design practices that make the radar operators job more difficult.

Electronic warfare (EW) is an integral part of any military planning associated with an armed conflict. The objective of an EW operation is to detect the enemy before you are detected. However this may be a complex task to implement.

Modern radar systems are very sensitive and use computers to detect and thwart electronic jamming and other countermeasures. Therefore in recent times the military trend has been to render targets 'invisible' to radar signals using some form of radar absorbant coating.

German scientists were working on such a material at the end of World War 2 but did not perfect it. A type of radar absorbant sheeting was available during the 1950s for organisations engaged in the testing and design of radar equipment. This radar absorbent material suppressed spurious radiation which could interfere with other systems. The majority of experiments with radar absorbant paint were unsuccessful.

The latest radar absorbant paint is manufactured using carbon fibre technology. The paint absorbs the energy which is normally reflected by a target and converts it to heat, which is dissipated slowly into the surrounding air. However, this effect enhances the infrared (IR) spectrum of the target and permits an enemy to engage the 'invisible' radar target with an IR system and its associated weapons.

Although IR decoys are carried by the majority of military weapons platforms, an IR spectrum of any target can be accurately used to 'fingerprint' it, as almost every military vehicle has a unique distribution pattern of heat produced internally and absorbed externally.

Infrared absorption material has been developed and is fitted to the engine

Historical Aspects of Electronic Warfare

The history of EW can be traced back to World War 1, when the British Admiralty and the German Naval High Command employed radio direction finding equipment to monitor the movement of their respective opponent's battle fleets. This method of locating ship-to-ship and ship-to-shore radio transmissions was reasonably effective, but treated with scorn by some high ranking naval officers who classified it as 'black art'.

During World War 2, both the Allied and Axis Powers spent an astronomical amount of money and manpower on R&D associated with the various fields of EW.

Using scientists and mathematicians the Allies decoded the German military and diplomatic ENIGMA codes. The operation included the theft of an actual code machine by partisans who managed to send it to England for examination.

The accuracy of Allied bombing in all weather conditions confirmed German suspicions regarding the use of a radio navigation aid. The radio specialists in German Intelligence then designed and constructed equipment to render inaccurate the British 'Gee' and other similar navigation aids used by heavy bombers for target location.

During 1941, the Allies realised that German submarines were using special tactics to hunt for merchant ship convoys. Allied Intelligence found that when a submarine located a convoy, an HF radio transmission was sent to the land based headquarters of that group. This message would be relayed to all submarines, which then converged on the convoy. Although Allied warships were fitted with high frequency direction finding (HF/DF) equipment it could not discriminate between ground wave signals and skywave signals (a location signal transmitted by a patrolling U-boat was received as a ground wave signal by an escort warship).

A British-designed HF/DF receiver, using a cathode ray tube display, could discriminate between ground waves and skywaves. This equipment was quickly fitted into British and American warships to detect German submarines. This device helped to defeat the German U-boat Wolf Packs.

The early type of radar fitted to Allied coastal surveillance aircraft operated on frequencies around three gigahertz (GHz). Unknown to the designers, the local oscillator generated a strong harmonic signal at one gigahertz. The German Navy identified this signal and constructed receivers operating at this frequency for installation into submarines.

All U-boats fitted with this equipment were provided with long range warning of approaching anti-submarine aircraft (the greatest threat to U-boats travelling on the surface). This ESM system became obsolete when a 10 GHz radar was fitted to Allied coastal surveillance aircraft.

When the Allied air forces implemented 24-hour bombing raids on Germany, all heavy and medium calibre, radar-controlled anti-aircraft artillery (AAA) was placed in or near the cities. The Allied bombing losses became heavy and a radar countermeasure was required. British and American scientists, working in close co-operation developed radar jammers called 'Carpet' and 'Mandrel'. The use of this equipment saved approximately 1000 Allied bombers from destruction by AAA between 1942 and 1945.

During the campaign carried out by American submarines to prevent the Japanese Invasion Forces, entrenched in the islands in the South Pacific, obtaining sea-borne supplies, the US submarine service refined the German Wolf-Pack tactics using VHF radio equipment. This rendered them safe from Japanese signal jamming equipment, and prevented direction finding as the Japanese possessed no VHF DF facilities. This type of system then became standard equipment for all Allied ship-to-ship and ship-to-air communications.

WARFARE

*Christopher Heath

exhausts of some types of helicopter and armoured fighting vehicles. However, this material enhances its radar spectrum!

Another method of reducing the radar signature is to remove all sharp (90 degree) corners. This reduces reflection substantially, as a square corner reflects between three and four times more radar energy than a rounded corner, but the figure varies with signal frequency.

Because of this, modern aircraft are increasingly designed with rounded sections and curved wings. Aircraft like the 'secret' F-19 (see box) and their Russian equivalents are distinguished by having few, or no, flat sections.

Outwitting radar

Other methods of penetrating hostile territory undetected include using electronic countermeasures which outwit those fitted to the equipment possessed by an enemy. Any search radar operates by transmitting a powerful RF signal. When this signal strikes a target, a small amount of energy is reflected and picked up by the sensitive receiver in the radar system.

The language of ELINT

Every speciality has its own vocabulary, and the world of electronic warfare is no exception. Some definitions:

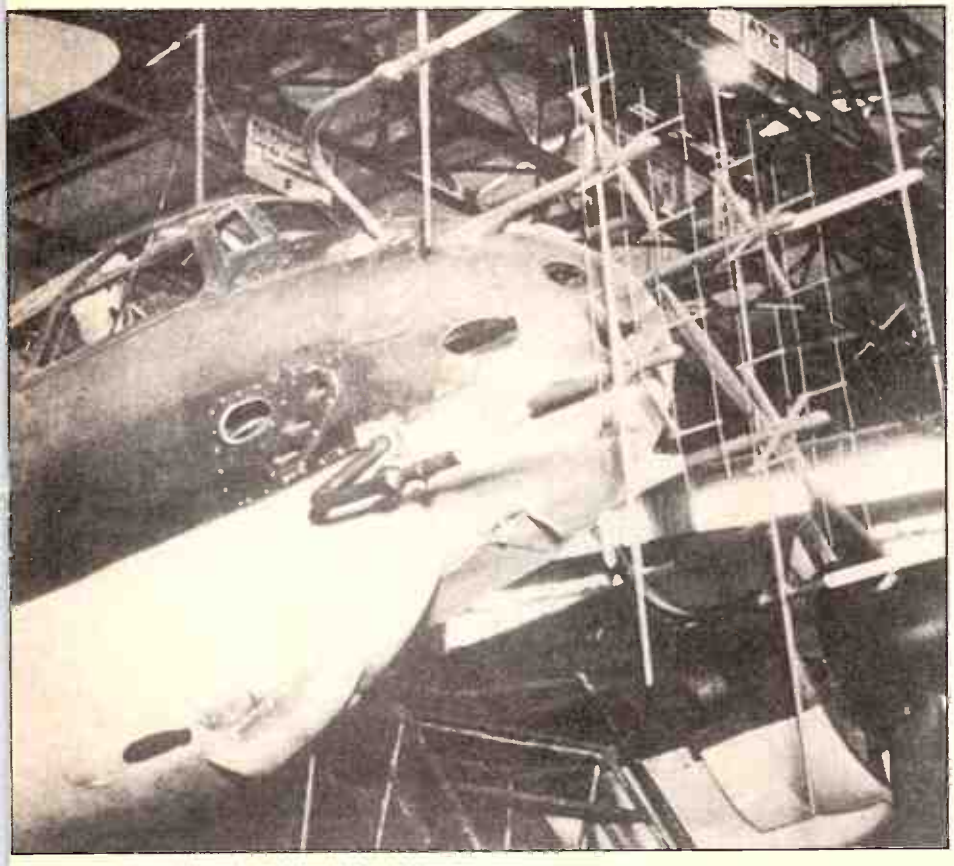
The science of electronic surveillance, intelligence, its analysis and ultimate use is called *Electronic Warfare* or EW. The following categories are classified under electronic warfare:

- Electronic support measures or ESM,
- Electronic countermeasures or ECM, and
- Electronic counter-countermeasures or ECCM.

Electronic support measures are those activities associated with the detection, location and analysis of hostile or friendly electronic transmissions. They can be sub-divided into signal intelligence or SIGINT, communications intelligence or COMINT, radar and other electronic intelligence or ELINT. There are other categories of ESM associated with the monitoring of human physiological parameters called HUMINT.

Electronic countermeasures are those activities associated with the jamming, deception and mutilation of signals which have been detected by an ESM system. The ECM equipment operates in conjunction with the ESM installation.

Electronic counter-countermeasures are the tactics associated with thwarting those operations used for ECM. These tactics include the use of frequency agile radar systems, logarithmic and anti-jamming intermediate frequency (IF) stages, the use of travelling wave tube amplifiers with variable gains as receiver RF stages, and computer controlled video signal processors which can sometimes reconstitute mutilated echoes.



Fantasy and reality. Left the nose of a Junkers Ju 88C-6c German night fighter. Above the imagined shape of the mysterious F-19.

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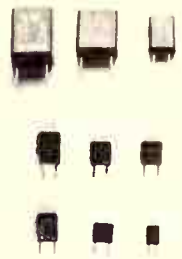

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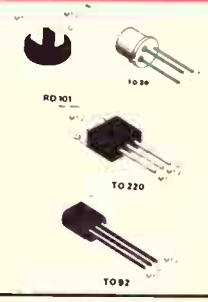

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A radar transmitter can generate several megawatts of power but only a few microwatts are reflected from a target. Therefore, hundreds of watts detected by a radar receiver designed to detect microwatts usually inhibits its operation. There are various counter-countermeasures which can be implemented at the radar installation but these can also be thwarted.

Another method of penetrating hostile airspace to gather electronic intelligence is to employ a remote pilotless vehicle (RPV) or drone. This device is a small, remotely controlled aircraft, fitted with numerous forms of electronic surveillance equipment. It is flown over the area to be investigated using a closed-circuit television link between the ground controller and the vehicle.

The telemetry transmitters in the RPV continuously relay information regarding enemy radar systems as they track it on its flight. If it is intended to use it to monitor the firing of a weapon, the vehicle can provide accurate system data up to the moment that it is destroyed. This provides useful information about the behaviour of a certain type of missile and its radar or other form of guidance system. ●

** Chris Heath is a Technical Writer and freelance defence correspondent.*

Build a stealth jet

The most open secret in military aerospace can now be bought from Australian shops for less than $14. Model shops in Australia have started selling kits of the F-19 fighter, the US's "stealth" aircraft which is invisible to radar and which, the US Air Force (USAF) says, does not exist.

The US government denies that even the designation F-19 exists. it says that its F series of military aircraft skips from the F-18 Hornet to F-20 Tigershark to avoid confusion with a Russian MiG 19.

Stealth aircraft use a number of techniques to reduce their visibility in a radar beam. Smaller objects reflect less radar energy than larger one, and flat surfaces with sharp angles make the best reflectors. The model F-19 is small and all its exposed surfaces are gently curved to avoid powerful reflections in any one direction. The curved surface reflects small amounts of the radar in all directions, so is still detectable by very sensitive radar.

Weapons and fuel tanks make good reflectors, so a stealth fighter must conceal them inside its fuselage. This means smaller fuel tanks, so the USAF transports its F-19s nearer their targets in Lockheed C5 Galaxy air freighters.

The cockpit of the F-19 is coated with an evaporated film of metal, with a technique similar to that used to make the latest recording tape. The pilot can see out through the metal film, but it bars the escape of telltale radio waves from electronic equipment inside the cockpit.

The biggest problem for any stealth aircraft is that if it uses its own radar, it gives its position away. So the F-19 relies where possible on passive radar. It senses radar signals from other objects emitting them. This is fine, unless the enemy is also relying on passive radar. Then neither plane knows where the other is.

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ETI AUG '87

IREECON preview

The biggest electronics show in the country is on again this year.

IREECON will be held at the Sydney Showgrounds between September 15 and 18th. This is the 21st IREECON. The first was in 1938, making it one of the oldest continuous electronics fairs in the world.

There are two parts to IREECON; the convention, which is being held in the Amatil pavilion and the exhibition, spread over four showground pavilions this year. The exhibition promises to be the most successful to date, with forward bookings well in excess of expectations. The Royal Hall of Industries, the largest hall in the showground, is already sold out, and space in the other pavilions is very limited. The Institute of Radio and Electronic Engineers, who host IREECON, estimate that 1500 people will attend the convention and more than 11,000 people will visit the exhIbition.

The convention consists of 280 papers covering most aspects of experimental and industrial electronics. The theme is the digitization of communications, reflecting the fact that this is one of the most important areas of change at the moment. It covers PABXs, cellular telephones, satellites, submarine cable systems, main trunk routes and the provision of new services to the subscribers premises. The keynote speaker is Greg Crew from STC (HK). Formerly he was with Telecom and the PMG.

A large number of papers will be on microwave technology, the first paper being by M. Gunn of Mitec, probably the lead-

List of exhibitors

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Utilux
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Wandel & Goltermann
Western Australian Department of Industrial Development
Yamaha Music

ing design institution in the field. Another interesting strand will involve discussion of low bit rates for encoding TV pictures. Radar also gets a considerable amount of time. Perhaps with Jindalee, the new over the horizon radar system, becoming a reality at last this is not surprising. There are also a number of papers on integrated design techniques, dominated by the CSIRO's Radio Physics division.

At the exhibition, most of the significant electronics firms active in Australia will be represented. (See Box) Also present will be several of the most significant users, like Telecom, OTC, Aussat and various government departments.

Products on display include, predictably, many from the broadcasting industry, but also general rf equipment, the latest in instruments, and specialised audio gear.

Among the more interesting broadcasting products on display, some Must See's include: The Abekas A53D three dimensional digital special effects system will be vieing with the more familiar Bosch FGS 4000 and Quantel Paintbox for the public's eye. RF engineers will be fascinated by the Mitec stand where a 14 GHz power amplifier will be on display. Also on display will be many of the bits and pieces that need to go into an rf network. Component Resources has unveiled a new series of transient barriers, and Deltex New Zealand has a voltage surge supressor. There are even humble two way radios; TR services has products that cover all the frequencies between 40 MHZ and 1 GHz. Belden Electronics will be showing off their range of cables, including specially tailored Ethernet configurations and Zetabon light armoured cable.

There is also an impressive list of things for audio engineers to see. EAV will display AKG, Amplex, Dolby, Fostex and Nagra products amoung a host of others. Cliff Electronics has plugs and sockets, particular XLR connectors, DIN and MIDI standard sockets IEC mains plugs and so on.

In the instrument section, the show is well served, with Tektronix, Philips, Elmeasco and others exhibiting. The Gould K50 logic analyser from Elmeasco is typical of new trends appearing in the field. It can be configured from 32 channels at 25 MHz to 8 channels at 100 MHz.

Also in the must see category if you are interested in instruments is Tech Rentals, which will be showing equipment from HP, Tektronix, Fluke and so on. Tech Rentals will also be showing their range of computers and peripherals, apparently now assuming an important part of their business. ●

Research is proceeding into discovering a new and more efficient form of satellite propulsion.

ION THRUSTERS

Brian Dance

Much of the launch mass and cost of a space satellite consists of the chemical rocket fuel needed to accelerate the vehicle to orbital velocity. No other way of propelling a rocket into orbit is known. However, there is intense interest in the development of a technique known as electric or ion propulsion; this can provide a small but continued thrust to a satellite as an alternative to rocket power once it is outside the atmosphere.

The main application for electric propulsion is for the generation of the small thrusts required to keep geostationary communications satellites in their correct position above the equator. Another possible use is in thrusters which compensate for the atmospheric drag imposed on satellites orbiting at low altitudes.

A far more exotic application for electric propulsion for well into the next century is the provision of a constant small thrust to satellites over very long periods of time (up to some tens of years). Such a thrust could accelerate them to a very high velocity towards the stars. Electric propulsion is regarded as almost essential for the economical acceleration of vehicles from earth orbit into deep space.

Communication satellites

Most commercial satellites are destined for geostationary orbits above the equator where they handle telephone, data, television, direct broadcasting-by-satellite and other traffic. Although these satellites are well above the atmosphere, their positions drift somewhat with time in north-south directions owing to the gravitational pull of the sun and moon. The shape and mass distribution of the earth (which is not perfectly spherical) also causes east-west drift of geostationary satellites.

These drifts result in a satellite tending to follow a 'figure of eight' in the sky. It would be very expensive to arrange for a ground station dish atenna to follow this motion. Even the radiation pressure due to sunlight causes some drift, but this effect is not large unless a satellite has large panels.

These effects act continuously and build up with time, although they are relatively small (corresponding to typical forces in the millinewton range). If the effects of the sun and moon always acted in the same direction, they would accelerate a satellite to a velocity of about 50 m/s over a year; this figure can be used as a measure of the total amount of propellant required. Initial positioning of the satellite requires the equivalent of about 60 m/s

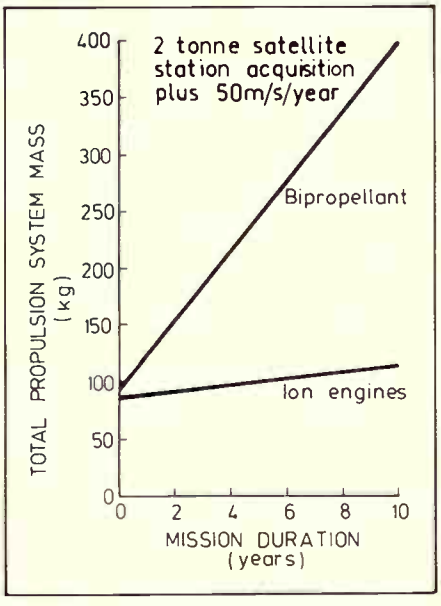


Figure 1: Ten year north south station keeping mission.

system is heavier and the reliability of biopropellant systems has not yet been established.

The biopropellant system will probably thrust once only before it is used.

Sunlight and the gravitation and magnetic fields of the earth tend to cause geostationary satellites to rotate so that their aerials no longer point accurately at the receiving stations on earth. Thrusters are required on each satellite to correct this rotation.

Drift correction

The drift and rotation of geostationary satellites can be corrected by using small jets of gas (usually nitrogen, hydrogen and ammonia derived from hydrazine). The amount of propellant required decreases very rapidly as the exhaust velocity from the jet increases. Hydrazine produces jet velocities of little more than 2 km/s. This implies that about one fifth of the initial satellite mass must be hydrazine with a consequent increase in launch costs. Once the supply of hydrazine is exhausted, the life of an expensive satellite is at an end (typically ten years).

Heavy spacecraft can benefit from the use of a biopropellant system in which two fuels (usually nitrogen tetroxide and monomethyl hydrazine) combine to produce a jet velocity of about 3 km/s. In this case the initial weight of propellant is reduced to about one seventh of the weight of the spacecraft, but the rocket be used for the next generation of heavy geostationary craft, but further improvement can be obtained by accelerating the propellant to much higher velocities using a source of energy separate from the propellant itself (Figure 1).

Ion thrust

The ion thrust engine seems to offer a

solution to this problem. In such an engine suitable ions are accelerated to extremely high velocities. The ejection of even a fairly small mass of material in the form of these high velocity ions provide a small thrust over a long period of time. A considerable impulse is thus built up. The propellant material from which the ions are formed is used only slowly in such systems, so its weight is not great enough to require much increase in the rocket power at launch.

If electric power from solar cells is used to accelerate heavy ions up to a velocity of 30-40 km/s, the mass of the propellant can be one sixtieth to one eightieth of the total satellite mass. Thus the propellant weight required per year of satellite life is 0.1-0.2 per cent of the initial mass. Although the mass of the propulsion system itself is added to the satellite mass, the use of an ion propulsion systems enables a large reduction in the total mass of the propellant to be achieved and hence an increase in the useful payload which can be carried.

It is estimated that the use of ion propulsion could save 280-300 kg in the mass of a typical 2 tonne satellite, such as those planned for major communications systems until the end of this century. This means that the communications equipment payload could be nearly doubled and that the satellite could bring far more revenue during its working life. Savings of up to 25 per cent in satellite mass could be obtained if ion propulsion is used for the intial positioning (taking about a month) or about 17 per cent is a chemical propellant system is used for rapid initial positioning.

Ion engine

In most ion thrust engines, electrons bombard atoms of the propellant so as to remove electrons and form positive ions. In the Figure 2 system used at the British Culham establishment, electrons from the cathode strike atoms of the propellant gas which are pulled through the two grids by a field of 1-1.5 kV. The ions are ejected into space and the spacecraft is thrust forward by recoil conservation of momentum. Electrons must also be ejected into space to prevent the craft from accumulating an excess of negative charge which would give it a very high potential.

The ion system of Figure 2 is placed in a weak magnetic field so that the electrons follow a much longer path between the electrodes. this increases the probability of ionisation of the propellant atoms. This field also protects the anode from damage from energetic ion bombardment. Baffles protect the cathode and control gas flow.

Position maintaining thrusters of this type require a power of a few hundred watts which can be obtained from the

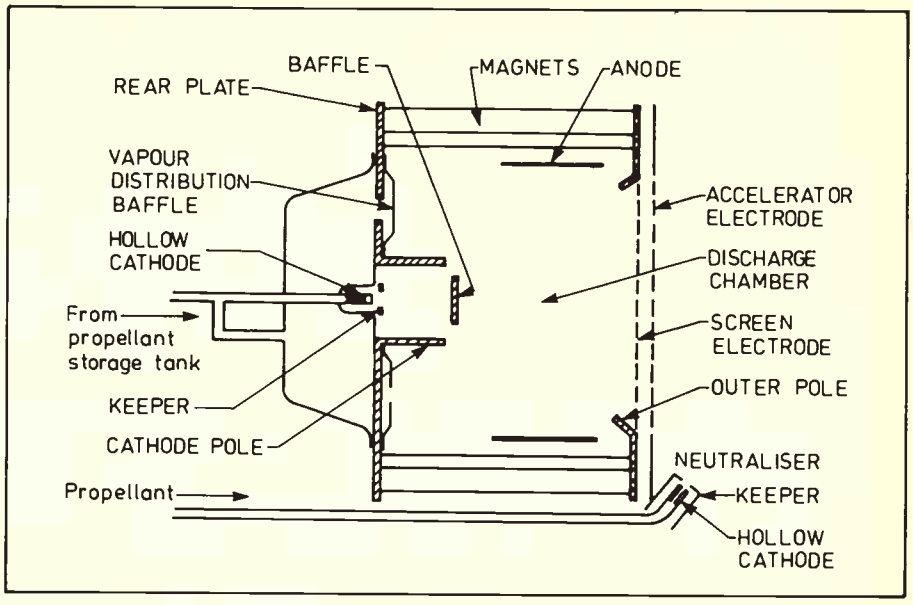


Figure 2: Schematic layout of an electron bombardment ion engine.

solar cells. It is a small fraction of the power available from the large solar arrays used on modern commuinicating satellites. Solar arrays usually have spare capacity to allow for varying demands and ageing, but battery power can also be used during eclipses by the earth.

As the equipment draws power from the spacecraft rather than from chemical reactions, higher exhaust ion velocities could be achieved through the use of higher accelerating voltages. This would reduce the initial mass of propellant required, but would involve a heavier propulsion system. It is sensible to use the heavier ion engines in the larger spacecraft and to keep a suitable balance between the mass of the propellant and that of the propulsion system.

The communication satellites of today rely on chemical rockets rather than on ion thrusters. One reason for this is the relatively low mass (up to little more than 1 tonne) of such satellites. It is only in heavy satellites that the increased communications payloads could generate enough additional revenue to make the use of ion propulsion an economical proposition. A considerable investment is required to develop ion propulsion systems to commercial status and this investment must be recouped from communications users.

Satellites used in the past have had barely enough electric power available to meet propulsion as well as other demands. Designers have naturally tended to keep to the well-tried chemical propellant systems with which they are most familiar.

Ion propulsion will be especially attractive for future satellites which must be relocated to different logitudes from time to time as the system requirements change. Similarly, the use of electric propulsion makes it feasible to keep replacement spacecraft in orbit in order to provide immediate cover for faulty craft, whereas chemically propelled craft would use too much fuel to maintain a standby position for a long peiod. Electrically propelled craft can be moved economically from geostationary orbit at the end of their life to make room for replacement craft; this is becoming increasingly important as geostationary orbits become more crowded.

Mercury has been used as the propellant in most ion thruster work. It has the advantage of high density but unfortunately it amalgamates rapidly with many of the metals used in spacecraft construction. It can attack many structures in a spacecraft including the solar cell panels, electrical connections, etc. Mercury must be heated to convert it into a vapour before it is introduced into the ion engine. Any mercury condensation could result in the shorting of high voltage insulation and consequent damage. Mercury may solidify, if not heated, during an eclipse. It is not easy to manage in zero gravity.

These problems have led to a search for more suitable propellants. Caesium vapour (the heaviest of the alkali metal atoms) has been tried, mainly in France. However, caesium is the most reactive metal, so it is not surprising that it caused damage to parts of the satellites. Krypton and argon have also been tested.

Much current work concentrates on xenon, the heaviest of the inert gases, to replace mercury as a propellant. Xenon will not react with any materials of the spacecraft and does not condense on any of the components in the craft. Unlike mercury, no power is required to vaporise xenon, as it is already as gas.

Anthony Martin of the UK Atomic Energy Authority's Culham Laboratory, feels that the economic return from large

geostationary spacecraft merits a further assessment of the benefits of ion propulsion. He believes that the time is ripe for the implementation and utilisation of this novel method of satellite propulsion. His laboratory, in association with the Royal Aircraft Establishment. Farnborough, and UK industry had a successful programme of work on ion propulstion terminated in 1978. It was felt that spacecraft at that time were too small for the system to be used to its maximum efficiency.

The Culham programme has now been reactivated towards providing ion thrusters for heavier satellites in association with the new British Space Centre. Current Culham work is centred on the use of xenon propellant for 100 mm diameter thrusters. These are very similar to the earlier mercury thrusters, except that the components to vapourise and heat the mercury are not required, Culham expects that satellite test flights will take place in 1989 followed by commercial exploitation as soon as possible thereafter.

ESA work

The European Space Agency (ESA) has been involved in a considerable amount of work on electric propulsion. Japan and the USA are both involved in work with mercury propellants, while Japan and Germany are both developing xenon systems.

A German system (initiated by ideas from the University of Giessen as long as 1960) uses a radio frequency coupled to a discharge to form the ions instead of electron bombardment. It is known as the *Radiofrequency Ionisation Thruster* (RIT). the efficiency with which the power is used to produce ions is lower than in electron bombardment systems, but RIT 10 (now renamed RITA 10) should be space tested next year. It provides a thrust of 10 millinewton suitable for north-south geostationary position keeping of satellites with an initial orbital mass of 2600 kg. It will be microprocessor controlled by commands sent daily from earth.

A RITA 35 version using mercury may provide a thrust of 200 millinewton, but it still at the laboratory stage. ESA has a interest for possible use in an AGORA (Asteroid Gravity, Optical and Radar Analysis) mission to the asteroids.

RITA is one of the electric propulsion systems in which the ESA is involved. A Field Emmission Electric Propulsion (FEEP) system using caesium is a 5 millinewton thruster with some unique advantages, such as controllable thrust. The ions are obtained directly from a liquid metal surface in a vacuum by a strong electric field. The ESA feels its relatively high power requirement/thrust ratio is outweighed by its advantages.

Following work at the Universities of Rome and Pisa in the 1970's and Japanese and US interest, the University of Stuttgart is concentrating on a third-generation magneto dynamic pulsed plasma engine. It employs a solid propellant, currently teflon, which is fed in bar form into a high energy arc. This ionises and ablates the propellant which is accelerated out of the plasma to provide the thrust. It is expelled as a neutral plasma, thus obviating any need for a charge neutralising system. It should develop a thrust of 10 millinewton.

This work, which is supported by the US Air Force Office for Scientific Research, aims at the development of a continuously operating, radiation cooled, self-induced magnetic field thruster. Eventually it may provide thrusts of up to tens of newtons using propellants suitable for raising and manoevring large space structures.

The Culham ion thruster.

Galactic measurement

The Jet Propulsion Laboratory (JPL) in California worked on ion thrust engines some years ago for possible use in the Halley comet encounter, but funds were cut off. JPL Director Dr. Lew Allen has now suggested the possibility of sending a spacecraft billions of miles beyond the solar system by electric propulsion in order to measure directly the distance to some stars in our galaxy and perhaps even in neighbouring galaxies.

He has asked husband and wife astronomers Aden and Marjorie Meinet to organise a JPL team to work on this concept known as TAU (Thousand Astronomical Units) for accelerating a spacecraft to speeds of over 250,000 miles per hour. An astronomical unit is the mean distance from the earth to the sun (93 million miles).

The proposed TAU project for the next century would employ an ion propulsion system weighing 22,700 kg of length 40 m. This would accelerate a 5000 kg science spacecraft to about 362,000 km/hour by the time it is twice the distance of Pluto (about 9.7 billion km from earth). For comparison, the Voyager craft velocity is about 58,000 km/hour.

The work of the spacecraft could commence with its 1.5 m telescope returning high, resolution images of Saturn's rings and of the first close up views of Pluto and its moon Charon. Measurements of star distances as far away as the centre of our galaxy could be made about ten years after launching of this space mapping craft. Improved accuracy can be obtained by making measurements from two widely separated points. Our current measurements are limited to observations made from points about 400 light years apart at opposite sides of the earth's orbit, a distance of 2 AU. The TAU craft could use the very long baseline of about 1,000 AU. TAU would observe stars in our galaxy and in neighbouring galaxies for a period of fifty years as it travelled some 160 billion km through space.

The TAU craft will be too far from the sun during almost all of its life for solar power to be employed. It is therefore planned to install a megawat nuclear reactor into the craft to provide power together with an ion beam propulsion system. The ions, formed from solid xenon, should appear as a faint blue glow as they emerge from the engine. Such an ion engine should produce a small but continuous thrust for a period of at least some tens of years.

After the nuclear fuel in the reactor is exhausted, the spacecraft would continue in a high velocity free flight. Its laser system could continue to return data to earth at up to 20 kbits/sec. At a distance of 1000 AU, the transmission time would be just under 6 days. The laser light would be received by a 10 m telescope on a space station for relaying to earth.

It is hoped that a TAU craft will eventually enter the Oort cloud, some 50,000-100,000 AU from the sun. This cloud is believed to contain primitive objects left over from the formation of the solar system which could become comets.

NASA sees the key work on TAU as the development of a megawatt nuclear reactor, of the electric ion propulsion system and the laser optical communications system. Nowadays scientists are confident that they can make electronics which will operate reliably in space for 50 years. This reliability will be further improved before the launch of such a spacecraft sometime after the year 2000. ●

Thomas tells us of the latest fun and games in the land of the morning calm.

SEOUL'S ELECTRONIC OLYMPICS

▲ *The Olympic stadium.*

The Hangang River which flows past the stadium. ▶

Although it's a year before Seoul in Korea celebrates the start of the 24th Summer Olympic Games virtually everything is already in place. The venues are completed, the multi lane highways are constructed and planning for the massive media coverage is over. There was even a dress rehearsal, in the 10th Asian Games last year.

Overall preparations for the Olympiad began in 1981 after the Korean capital was awarded the rights to stage the world's biggest sporting event following an International Olympic Committee meeting. Media preparations began at the same time with the Korean Broadcasting System, the nation's represenative public broadcasting authority, forming a small engineering group to establish the dimensions of resources and facilities required as the Host Broadcaster.

SORTO

In November 1982 an intramural organisation called SORTO — Seoul Olympics Radio and Television Operations was established. SORTO is charged with the sole task of providing world broadcasters participating in the Games with basic coverage and establishing an International Broadcasting Centre in order to facilitate the unilateral broadcasting activities of the participating broadcasters.

Without the Host Broadcaster not a single broadcasting organisation in the world would physically be able to cover the simultaneous occurrence of events in more than 30 different sites. Furthermore no broadcast organisation could afford the equipment necessary or the 1500 production staff who will coordinate all the live coverage into a single point for selection by the world media attending the Olympics.

About 900 journalists, broadcasters, photographers, cameramen and technicians from around the world are expected to cover the Games of the 24th Olympiad. Together with their Korean counterparts they will work to ensure that as many people as possible will have access to visual, audio and print information about the Games. Estimates of viewers run as high as 2 billion people.

The MPC and IBC

The main press centre (MPC) located a kilometre from the Olympic stadium and five kilometres from the press village will have comprehensive telecommunications facilities. A fully equipped press subcentre will be set up at each competition venue. The International Broadcasting Centre (IBC) located next to the main studios of the Korean Broadcasting System will be equipped with the best telecommunications equipment that is available to the world. State of the art items used at these centres will include optical fibre and digital communication systems to relay information between the centres and competition venues. These two options will also be used to carry information to and from data processing centres. Instant access to information on everything from event results to athlete profiles will be available through computer terminals at all venues, press subcentres, the IBC and the MPC.

Twenty-eight outside broadcast vans will be mobilised. Over 170 cameras will be used including four panoramic units as well as 70 video tape recorders, 55 slow motion machines and 29 character generators.

Two helicopters and two emission-free electric cars will be used in covering the marathons and road cycling. Cameras on two moving cars will supplement fixed camera positions for rowing and canoeing events. For satellite coverage of the games arrangements are in place to use 12 circuits on Intelsat.

There will not be any shortage of athletes or competitions to report on. Around 9000 athletes from 167 nations are

Made in Korea

expected to participate in the 16 day international sporting competition scheduled from Saturday, September 17 to Sunday, October 2. Twenty three sports are to be included in the Seoul Olympics. Of these, just two — tennis and table tennis — will be new additions.

Besides the official sports, t'aekwondo (or Korea's traditional martial art), baseball and women's judo will be staged as demonstration sports. There will also be a badminton exhibition.

A total of 121 direct competition-related facilities — 34 competition venues and 87 exercising venues — will be used for the Games. Most of the venues are located in Seoul and environs. The competitions in 10 of the 23 official sports will take place either in the Seoul Sports Complex or the Olympic Park.

The Seoul Sports Complex, about a half hour from the city centre, comprises two gymnasiums for baseball and boxing, an indoor swimming pool to be used for water polo, a baseball park and the Olympic Stadium, a gargantuan facility — set to stage the opening and closing ceremonies as well as football and athletics — that is capable of accommodating 100,000 spectators.

The nearby Olympic Park contains both a park and athletic facilities including a velodrome, three gymnasiums for fencing, gymnastics and weightlifting, an indoor swimming pool for swimming and diving, tennis courts and the Olympic Hall.

In order to make these outstanding facilities and the ones designed for athletes and the press 'user friendly', a number of amenities will need to be added ranging from colour TVs and air conditioners to video cassette recorders and small appliances. The most likely 'one-stop' source for these on loan is Samsung or Goldstar. Neither has much of a profile in Australia, but in Korea the names would produce smiles of approval as these electronic giants are household names. In fact, between them they solidly dominate the domestic Korean market. (The only other significant electronic force is Daewo with its 20 per cent share.)

Samsung

Until 1984 when Samsung took over as market leader, Goldstar was in the number one position. Founded in 1938 by Chairman Byung-Chull Lee as a general trading store, Samsung began with a total of just $2800 and 40 employees. The fledgling company operated out of Korea's southern city of Taegu enjoying only limited growth under Japanese colonial rule. Nevertheless, the company made inroads as far as Manchuria and Peking because of its aggressive trading activities. Business expansion came to an abrupt halt when the Korean War broke out in 1950.

Now in its 49th year, Samsung with its 26 affiliated companies in the largest business conglomerate in the Republic of Korea. It is also the most diversified and technology-intensive business group in the nation with more than 129,000 employees in 196 countries around the world. Total combined turnover for the group of companies was nearly $20 billion with export revenues accounting for almost $10 billion.

Yet another manifestation of the Korean giant, another Samsung Walkman.

Goldstar

Goldstar Electronics is just 18½ years old and like Samsung, its growth has been spectacular. From the production of its first black and white television in November 1972 to the preview release this year of a video tape recorder/camera (using 4 mm tape and featuring a 2.5 in colour monitor) the company has experienced a meteoric rise to the top. Sales this year are being targeted in excess of $3.5 billion.

This amount will not just come from sales of the humble transistor radio as Goldstar Electronics is involved in a diverse range of home products and industrial use electronic items.

- Video. Goldstar's research and development program made Korea the fourth nation in the world to develop VCRs. An automated VCR production plant completed in 1983 has an annual output capacity of 2 million units.
- Television. Total television production from its 1972 manufacture beginnings to date is in excess of 30 million units. Making full use of associated companies, the Goldstar Electronic Company has a fully integrated assembly of colour TVs at a single site beginning with the sand for picture tubes all the way to the finished product.

R & D facilities were given a much deserved commendation at the 1984 New York International New Products Exhibition when the Samsung "Free Volt" automatic voltage regulation system won the grand prize. (It allows connection of the TV set to any power source between 80 V and 260 V without any switching.)

- Audio. An automated factory, opened in 1985, boasts an annual production rate of 1 million stereos and 4 million cassette players. Samsung manufactures its own CD players although at this stage software is still in limited production in Korea.
- Home Appliances. The Goldstar product range includes refrigerators, washing machines, air conditioners, electric fans, ultrasonic humidifiers, vacuum cleaners, electric shavers, coffee makers, telephones, steam cookers, induction cookers and, of course, their home appliance giant, the microwave oven. Since exports began in 1980, total production has exceeded 4 million units. Oddly enough their microwave ovens are the only Goldstar-branded product to be sold in Australia.

Thomas E. King

Stewart Fist tells us of the latest developments and shortcomings of LANs

LOCAL AREA NETWORKS

Stewart Fist

Just on a year ago I wrote a whole series of articles on Local Area Networks (LANs) for a major computer magazine. I've just glanced over them again before writing this piece, and they feel as if they were written in the '60s.

The information is now antiquated or obsolete; many of the products I listed no longer exist, and the predictions I made about the boom in LANs systems has had the validity of Gipsy palm reading. It has turned out that the number of large corporations installing local area networks dropped 8 per cent in 1988.

Changing world

It goes to show how much the LANs world has changed. A year ago computer magazines were saturated with LANs stories ad nauseum, and all of these articles promoted LANs as theh way of the future for business computing. Now we have a more balanced view.

LANs appeared to be the solution because there are two sides to the office information problem. Businesses often need to share and transfer large quantities of information at high speeds.

The other side of the problem was the need to share resources within an organisation. In the early stages it was the sharing of expensive peripherals that drove LANs developments.

Declining costs

Now the cost of printers, hard-disk, etc, has dropped and continues to decline, so this isn't the main motivation any more. But the sharing of applications programs between users, and the need to share data, is on the rise.

You can achieve much the same efficiencies of resource- and data-sharing with dumb terminals linked to a mainframe, or with intelligent terminals tied to a multitasking minicomputer, but LANs seemed to do it better.

Office PABXs which offer both voice and data capability are a cheaper alternative for interchanging data, and they can have extras like voice mail and call forwarding, etc, as well.

What sets LANs apart from PABX-linking is that all LANs devices have a permanent electronic connection to the system at all times — there is no real cable switching involved. Every 'node' on a LANs can communicate with every other, as long as both speak the same language (ie use the same protocols), and they can talk through bridges, routers and gateways to other LANs systems and to the telephone network.

Since all devices on a LAN are using the same line, there are a number of techniques used to avoid the jumbling of data if two machines attempt to 'talk over the top of each other'. The two most common now in use are Carrier-Sense Multiple Access (CSMA) and Token systems.

> ***"Computers seem to be a lot like rabbits; put them into a 'group situation' and they start to develop a lust to interconnect and to breed."***

Token systems

Token-passing systems have a way of systematically allocating the control of the LANs progressively from one machine to another. Whichever machine has the 'token' controls the system while the others are blocked from access. The 'tokens' are just a digital code which is recognised by all the nodes in the network.

Token-passing is particularly suited to ring topography where all machines are connected in a continuous loop. Each station passes on the permission to transmit to its nearest neighbour until one is found with a message to send. The station with the message holds the token, and then sends the message off around the ring.

Each node in the chain reads the message-address, and passes it off to its neighbour. The receiving station detaches the message, changes the address code, and sends the message off around the ring again. The transmitting station will therefore get an 'echo' of the message back, to show that it successfully reached its destination, and at that point it will release the token back into the system.

CSMA/CD and CSMA/CA

CSMA/CD or CSMA/CA (Carrier Sense Multiple Access with Collision Detection or Collision Avoidance) systems allow each node to listen to the network, and when it finds a gap (milliseconds long) it can butt in and use the system. There is no overall dictatorial control or systematic polling of the stations on the network.

If two machines try to use a CSMA system at the same time, the collision of data is detected by both, and both close down for a random period before trying to transmit again.

Ethernet, the most popular of all LANs, uses CSMA, as does the simplest of all, Appletalk. The Appletalk network is famous for ease of installation and use, partly because the essential links between the system and the computer are already in place within the Mac. All you have to do is join the machines up with a special cable.

Appletalk will only allow the linking of 32 devices including Macs, laserprinters and other accessories, and at this level, Appletalk is an ideal solution for a small work-group. But inevitably your need to link to wider and wider groups of people and peripherals will grow if you are within a large organisation.

Computers seem to be a lot like rabbits; put them into a 'group situation' and they start to develop a lust to interconnect and to breed. And this is where the trouble begins. You want to connect personal computer A to personal computer B, and have them both share the use of disk drive C and printer D and possibly link with mainframes E. Then later you will want a gateway through a modem to the telephone system, and then to interconnect to another LAN.

The problem is that there is no optimal way to do so or to handle the expansion. There is no shortage of solutions, but each system has its advantages and its problems and it is very difficult to weave a path through the complexity of the more esoteric LAN jargon.

LANs and LANs

There are LANs and LANs. At one level they are glorified peripheral-sharing devices like Appletalk which are little more than a cable and some ROM-based software, while at the other they are full implemented packet-switching networks, equally as sophisticated as AUSTPAC or MIDAS.

There are four criteria which determine LANs classification:

1. the access method: Is it a switched, dedicated or multiple access system?
2. topology: The layout/design used; star, ring, bus, branching tree or a combination of these such as IBMs' star/ring?
3. transmission medium: Will the links be made with coaxial cable, wire or optical fibre?
4. modulation method: How much capacity do you need? How will the signal be modulated; will it be baseband or broadband?

LANs can be any mix or match of the above, and each combination has its own advantages and disadvantages.

For instance a baseband bus coaxial cable system such as Ethernet offers a simple network design. It is relatively easy to tap-in a new PC or peripheral to Ethernet, and if one machine in the system fails, the network continues to function. But baseband systems are relatively slow by modern LANs standards, and generally speed provides a limitation as the system grows.

Broadband coaxial systems provide plenty of capacity and the ability to run voice, data and video signals over the same network, but the network design is more complex and costly, and subject to faults and failures.

The choice of baseband or broadband will have a substantial effect on the range of services offered on the system, although either modulation method can be run on any of the transmission media — wire, coax or fibre.

Similarly, the choice of topographies each offer a tradeoff of throughput, flexibility, cost, and most importantly, the reliability of the system.

The Xerox Ethernet

Ring systems are newer and are still evolving. Generally reliability is not so good as the bus since a single failure at a node will bring down the whole system. For this reason IBM have chosen to use a modified Ring/Star structure.

Star topology provides greater reliability because only the central node processor can cause a complete network failure, but this means higher costs since it is usually necessary to provide a full back-up for this machine.

Undoubtedly the winner in the LANs standard-war to date has been Xerox's Ethernet which uses baseband modulation and a coaxial bus topography. The only real threat to Ethernet's dominance this year has come from IBM's Token Ring Network. Ethernet's continued success is probably due more to a widespread desire in the business community for standardisation, rather than to any intrinsic opportunity in the system itself.

In Ethernet, the lower-level protocols provide each station with three signals. The first two, "bus free' and "bus busy", trigger a decision to send or store a message, respectively. The third signal tells the station that a corrupted message has arrived, indicating either a possible data collision or noise on the line. This third signal initiates the recovery procedure.

Ethernet LANs can be up to 2 kms long, have up to 1024 nodes, and transmit at data rates of 10 megabits per second. At the longest distances it can take up to 52 microseconds for the stations to detect that they have a data collision — a considerable period when you are sending out 10 million bits per second — and this, in fact, creates the limit to the size and complexity possible.

However, we can extend LANs in a number of ways. The simplest method uses a "bridge" which extends the linear distance and the number of peripherals and PCs that can be tapped into one system. These bridges allow similar LANs to talk to each other and they will generally filter out messages on the first LAN that aren't

BANDWIDTH — Base or Broad?

Local area networks like Ethernet use a form of transmission known as baseband wher5e the digital data is transmitted in the same form as it was generated, through a single channel.

With baseband LANs only one user at a time can access the system — that's what the word 'baseband' implies. There is only one ('base') channel ('band') available, so special measures need to be taken to control potential 'collisions' between data originating from different terminals (stations) trying to use the channel at the same time.

This single-user capability sounds more of a limitation than it usually is, in practice, since LANs can move data around at very high speeds. A thousand word file (a four page letter) could be transmitted along a LANs to the hard disk in 0.008 of a second at the Ethernet speed of 10 Mb/s. Unless a system is grossly overloaded, most users won't notice any delays.

Broadband, the second form of network transmission, also needs coaxial or optical fibre links. If you've got many users and multiple-sourced, different-type transmission problems then broadband is probably the only way to go, though naturally it is also the most expensive.

This transmission approach avoids data collision problems by modulating the signals into different frequencies using band-pass filters for channel separation.

It's much the same idea as radio and television braodcasting — the signals from different stations don't "collide" because they are modulated by different carrier frequencies. We tune our receiver to the one we need.

In the more elaborate broadband systems the bandwidth may be carved up into dozens (or hundreds) of different dedicated channels. You might have a large number of channels dedicated to the transmission of 1200 bit/s data, others which are Ethernet channels superimposed onto the broadband (for those using this baseband LANs), and yet another carrying video signals to the broadroom, etc. You are not restricted to one form of data.

meant for the second.

A more complex LANs extension device is the "router" which is a bridge with enough intelligence to be able to direct (or 'route') the signals within a LAN. This allows for better utilisation of the LAN, and is particularly important on large, complex network systems. At another level again we find "gateways". These provide not only a physical interconnection for data between the LANs systems, but also supply some kind of applications translation as well.

Linking LANs

This tendency to link LANs seems to be the way networking is going. You can use a simple cable system like AppleTalk to share peripherals within a work-group, then this LANs is linked into an office-wide Ethernet LANs, which is in turn linked to a broadband optical fibre 'spine' which runs between buildings on a university campus or company complex.

At the present moment optical fibre is principally used to link baseband CSMA/CD Ethernet LANs together in wide-area applications. Probably less than half a percent of all installed LANs nodes currently installed run on fibre, one reason being that the number of nodes you can attach is limited to about 24.

Optical Fibre

Apart from its role as a 'spine' for other Lans' systems optical figure has not caught on as fast as many people initially believed. The inhibiting problem is in splicing. It is very easy to make a good optical fibre splice in a laboratory, but quite difficult under the floor of some office, or down the manhole in a city then it is not all that easy to add workstations to an optical fibre network. You have to plan your locations with care and your freedom to remove or move nodes is limited from the start.

Even once you've got your network connections in place, your problems are not over. If one LANs user tries to access a file while another user has it open, weird and wonderful things can occur. File 'clobbering' has been the bane of multi-user systems for a couple of decades, and many interesting technologies and techniques have been developed to overcome it.

Disk sharing is a very basic technique and its limitations are substantial. If 10 users are sharing a single 10 Mbyte hard disk unit, then it is easy to partition the disk into 10 'virtual' 1 Mbyte spaces. Each user can only access his/her particular space, and no one risks clobbering information owned by the other. The trouble is that all 10 users can't share information.

As soon as you have multiple access to files, you must also have system software that prevents others from accessing a file in use. Alterations to files are made by transferring the data to your own machine, updating it, then copying it back onto the hard disk.

Sometimes the file can be away from the hard disk for a long period of time and anything could happen to the disk-based 'obsolete' version in that time — it could be updated by some other user and then these updates will be lost. The solution is to 'lock' the file to prevent any secondary updating while the first updating is in progress.

Controlling this problem is one of the jobs of the file-server which sits between the hard-disk and the network: in most cases it is a dedicated PC which incorporates the hard-disk and runs special network software.

Its job is to keep track of where files are in the system and differentiate between those users who have access on a read-only basis and those who can take it for modification. The server must grant or deny access to users dependent on their status, and it must distinguish between ACQUIRE and ACCESS functions.

> ***"Undoubtedly the winner is the LANs standards-war to date has been Xerox's Ethernet which uses baseband modulation and a coaxial bus topography."***

Record-looking

Record-looking is a technique which is dependent upon the operating system of the peripheral PCs, and it is for this reason that the advent of Microsoft's DOS 3.1 and 3.2 are so important.

The early versions of MS-DOS were designed for a single user on a single PC machine; the longest link that anyone foresaw was a couple of feet to a printer. You could link one MS-DOS machine to another and transfer data, but that was nearing the limits of the systems capabilities.

If you added an MS-DOS machine into most network hardware, you didn't alter the essential single-user nature of the systeml the DOS simply treated remote disk drives or printers as if they were local. All you really got was a convenient means of extending your cable.

In short, a functioning LANs needs a hierachy of command/requests, so that "Open File — Salaries" is recognised by the server as an instruction containing many implications. It must not only open the file "Salaries" for you, but it must also block access to other users.

Microsoft have designed 3.1 with multi-users in mind and with high-level network 'primitives' (or functions) which allow it to provide a uniform interface between the application and the network.

In effect DOS becomes an integral part of the overall network operating system; one of three major components. The file-server software manages the shared resources (in particular the input and output to a hard-disk); signal routing is handled by a second component known as the 'redirector' or 'network shell'; and DOS 3.1 (or 3.2) becomes the third component, handling the presentation and the synchronisation.

Non-standardisation

The non-standardisation of LANs has been a serious problem in the development of networking. Without standards, software developers have found it impossible to write applications programs for multi-user networks with any assurance that they will work on a range of products (many IBM clones will still experience problems).

Now anyone with a LANs system on the market will now have to get into bed with MS-DOS 3.1 or 3.2. A mainstream LANs that doesn't cater for these operating systems is doomed to failure.

There are four criteria which determine a LANs' classification; the access method, topology, transmission medium and modulation method. ●

ACCESS METHOD
1. Dedicated
2. Switched
   a) PABX
   b) Data switch
3. Multiple access
   a) Contention
   b) Token passing

TOPOLOGY
1. Star
2. Ring
3. Bus
4. Branching tree

TRANSMISSION MEDIUM
1. Coaxial cable
2. Wire
   a) Twisted pair
   b) Shielded
   c) Ribbon
3. Optical fibre

MODULATION METHOD
1. Baseband
2. Broadband

Standards and confusion are multiplying in the videotex world, as Paul Budde discusses.

Videotex News

When Telecom introduced Viatel in 1985, the videotex industry tried to convince Telecom to implement a completely transparent communication network that could also be used by other videotex system operators. At that stage, such networks were in operation in France, New Zealand and Norway while other countries, such as Belgium and Spain, were still planning theirs.

In the event, Telecom chose the British Prestel standard.

As Australia was, and still is, very much oriented towards Britain, the French system was not thoroughly considered. Furthermore there were already strong ties with British Telecom, dating back to the early 80s, when Telecom consulted the British over its proposal to implement public videotex in Australia.

The decision to go for a proven technology proved to be the right one. Australia is now one of the world leaders in videotex. Viatel is amongst the largest and fastest growing public videotex services in the world.

But there were costs. Limiting Viatel to the Prestel videotex technology meant problems for some of the existing videotex operators who were using different technologies. Their problems were exacerbated by Telecom's marketing success. In fact, not only did Telecom have the advantage of good marketing, but also many technical advantages. This resulted in the disappearance of several systems such as Austel (Control Data), Aftel (AFTA) and Bulletin (ICL). Others, like Farmlink (Elders) and Information Express, saw their growth hampered.

On the other hand, Viatel's success stimulated private organisations to invest in the videotex technology — be it on Telecom's Viatel service itself or their own private system.

But now things are changing. Phase one — education — has been completed and a need for a more sophisticated system is starting to be felt by operators and service providers. Unfortunately the present Prestel technology is very inflexible. It is mainly a communication switch and therefore does not offer the flexibility available in normal data processing systems.

Viatel has reacted to the demand for more sophistication by offering flexible gateways into its service. What they are actually doing it trying to bypass the inflexibility of the Prestel technology. One method is the so called transparent gateway, whereby it is no longer necessary to have special videotex software in the host computer of the service provider. Another method is VASAS (Value Added Services Access Service) which has many of the best features of the service in France.

The push for VASAS did not come from the videotex industry. It was the EFTPOS (Electronic Fund Transfer and Point of Sale) service that triggered its introduction.

Organisation tendering for EFTPOS service were asked to include the possibilities of other value added services on their networks such as requested by the Australian Videotex Industry Association (AVIA) back in 1982 to facilitate more sophisticated videotex services.

Today both EFTPOS and VASAS are using the Austpac network (Australia's Packet Switched Network) in different configurations. Banks, for instance, need a more secure system than operators of plain videotex services.

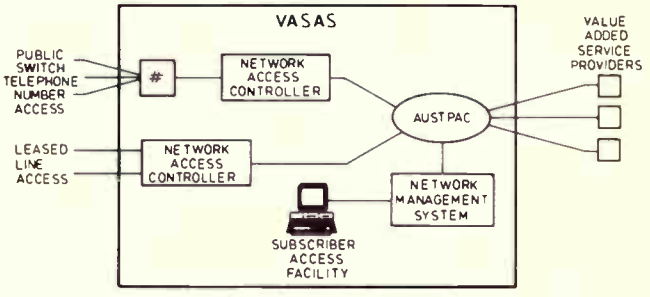
At this stage Austpac is the most sophisticated network technology available, so both EFTPOS and VASAS run on it. Even so, services on this network are not as flexible and as competitive as most potential system and service operators would like. However, services on EFTPOS and VASAS will eventually use ISDN technology. This technology hopefully will offer service providers the necessary flexibility and cost efficiency they urgently need, but even on a global scale, it is still not clear exactly what ISDN will offer users.

So in Australia we have a problem. By first offering Viatel based on a less sophisticated technology, we created a success story. Now Telecom is offering two solutions; gateways into Viatel and VASAS. This is not primarily a technology problem; it is more importantly a marketing problem; how best to package the services to the users; who is charging who and how much; are the different departments within Telecom co-operating or will they compete with each other (it looks as if they are competing) and how will this effect service providers. The usage of the VASAS technology will be 50-100 per cent more expensive than the present Viatel network!

Recently, Viatel confirmed that they fully support the transparent gateway. The Viatel network has proven to be an excellent marketing tool to deliver new electronic services cheaply so in most situations where electronic services have to be marketed, Viatel is the network to use.

VASAS will not be available until early 1988 and from 1989 onwards, ISDN will become available. For an intermediate period as short as this, the question is whether it's worthwhile developing a new network; it makes the market even more confusing.

After Austpac, Viatel and VASAS, ISDN will be the next step. Communication specialists such as Telecom have to organise themselves in such a way that users no longer have to worry about yet another technology. They only need to see the extra benefits. We have to prevent technicians causing any further confusion in the market. That is something *they* should worry about and not the users.



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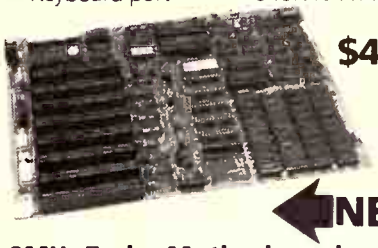

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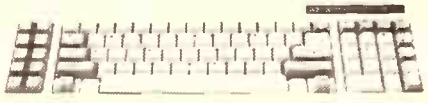

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- Light pen interface
- Fully CGA compatible
- 40 x 25 & 80 x 25 (text), 640 x 200 (mono) and 320 x 200 (colour)

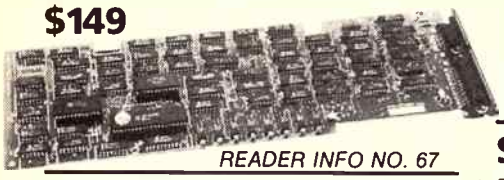
$115

Mono-Graphics/ Printer Card

- Hercules compatible
- Interface to TTL monitor
- 720 x 348 resolution
- 80 character x 25 lines with 9 x 14 dot characters

Reduced for this month. Was $165.

$149



READER INFO NO. 67

MEMORY 512K Ram Card Short Slot

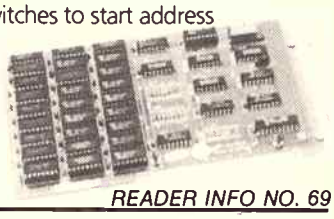
- 512K RAM installed (41256 chips)
- DIP switches to start address

$195

READER INFO NO. 68

640K Ram Card – Short Slot

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



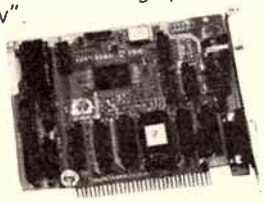
$225

READER INFO NO. 69

Colour Graphics/Mono Graphics – Short Slot

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

$195



READER INFO NO. 70

2MB EMS Memory Card

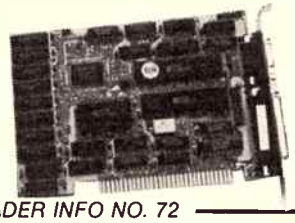
Yes, an affordable "Above Board" memory card. Full 2MB of high speed RAM. At a low introductory price: **$995**

READER INFO NO. 71

Turbo Mono Graphics/ Printer – Short Slot

If you want fast, flicker free scrolling and full Hercules compatability, this is it! Perfect enhancement for slow scrolling programs like Microsoft Word etc. The ultimate monochrome graphics card.

$175



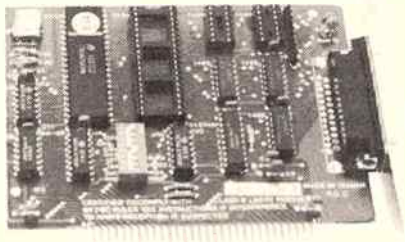
READER INFO NO. 72

Serial RS-232 Card

- Independent receive clock input
- 2nd serial port option
- Full buffering eliminates need for precise synchronisation

$55

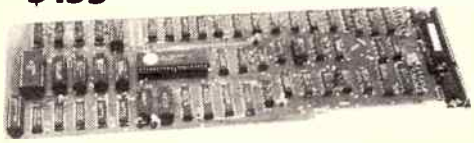
READER INFO NO. 73



Colour Graphics/ Printer Adaptor

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

$155 READER INFO NO. 74

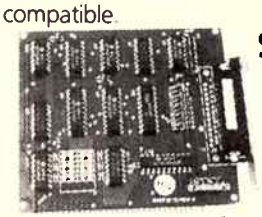


SUPER SPECIALS

10MHz V20 chips	$29.00
10Mhz V30 chips	$49.00
NEC Multisync monitor	$1350.00
TAXAN TTL Amber	$299.00
TAXAN TTL Green	$289.00

Parallel Printer Card

- Standard TTL level
- Centronics printer port, full IBM, EPSON printer compatible



$44

READER INFO NO. 75

Multi I/O Card

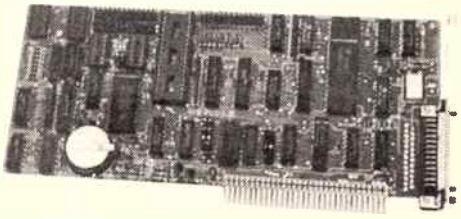
- Floppy disk adaptor, 2 drives DS/DD
- 1 serial port, 1 parallel port, 1 joystick port
- Clock/calendar with battery backup

READER INFO NO. 76 **$175**

I/O Plus Card

- 1 serial port, 1 parallel port, 1 joystick port
- Clock calendar with battery backup

READER INFO NO. 77 **$136**



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Shortwave power battle

WINNING HEARTS AND MINDS

Arthur Cushen

The battle for the ears of the shortwave audience continues as international broadcasters realise that poor propagation and interference can only be beaten by high powered equipment, relay bases and attempts to get a signal through the noise on the shortwave bands.

France has announced a major move in its new 24 hour a day operation and joins the BBC and Radio Moscow as a 24 hour World Service.

Deutsche Welle, Voice of Germany, is also finding they are lagging behind in the number of transmitters and output. The Germans must considerably increase their transmitter capacity for the German voice to remain audible abroad. Deutsche Welle's technical director says that Deutsche Welle is currently in 10th place internationally in terms of the number of shortwave transmitters. In view of the expansion plans of numerous states, the Federal Republic will fall further behind without additional efforts.

With 15 additional transmitters, Deutsche Welle should be able to maintain its international position. For this, however, additional funds of 100 million marks annually would be required. Currently the DW's annual budget amounts to 270 million marks, with 80 million of that marked for the technical broadcast programmes.

Radio France

Radio France International (RFI) as well as using its relay base in French Guiana is looking at additional facilities in South East Asia and has plans to operate from Sri Lanka. On the programming side Radio France International is now operating 24 hours a day. The President of Radio France International said that the new programming would include 23 daily news bulletins in French. The President was concerned that Radio France was not reaching the South East Asia region except for its special broadcast of three-and-a-half hours each day and plans are underway to ensure better reception in the Asian continent.

Radio France International broadcasts 756 hours a week in French and 12 other languages on shortwave, as well as the transmissions being carried in the Paris region on FM. Radio France International has increased its English news broadcasts, and these are now heard 0200, 0330, 0415, 1110 and 1600 UTC. In the South Pacific the 0200 session is best on 9790 as is the transmission at 0330, while at 0415 9550 is the best signal of many carrying this news service. The new transmission at 1110 UTC is also on several frequencies, with 9790 and 1167 kHz providing the strongest signal. The staff of RFI consists of 430 and of this over 200 are journalists.

Radio Yugoslavia

The long awaited 500 kW transmitters of Radio Yugoslavia are now being completed with the first transmitter already in operation. This increase in power will be of interest to many Yugoslavian Australians who will be able to hear home broadcasts at a reliable strength. The first new 500 kW transmitter has commenced in Jabanusa, near Bijeljina. Three more transmitters of this power will be commissioned later this year. The majority of the technical equipment was supplied by a Swiss manufacturing firm, according to a recent BBC report.

Kilohertz Comment

ALASKA: KNLS Anchor Point, Alaska is one of several stations which found their winter frequency schedule inoperable and made last minute changes. For listeners in the South Pacific the broadcast in English between 0900-1000 UTC scheduled for 11850 kHz had to be changed as it caused interference to FEBC Manila. KNLS made the change to 11820 kHz and is providing good reception on that frequency.

ECUADOR: HCJB Quito, broadcasts to the South Pacific 0700-1030 UTC on 6130, 9745 and 11925 kHz. A new frequency to North America has been heard up to 0500 when 11775 kHz is used. This frequency is in operation with 6205 and 9870 kHz.

FINLAND: Radio Finland's new 500 kW transmitters are in operation and three of these units are now carrying the international service. English broadcasts from 0430-0455 UTC are well received on 11715 and 11755 kHz, while the transmission for Australia between 2100-2125 is on 11945 kHz.

GABON: Radio France International is using the second transmitter operated by Africa Number One. They are a commercial organisation which operates shortwave transmitters at Moyabi. The new transmitter is on 4890 and can be heard 0400-0455 with broadcast in French. At 0500 6175 kHz is used. This channel is also operated by RFI Paris so transmitters are synchronised on the frequency.

GUAM: KTWR Agana was assigned 11840 kHz for its service to Australia 0930-1030, but the frequency was already occupied by Radio Japan broadcasting to this area between 0900-1000 UTC. KTWR has therefore moved to 11805 kHz and is well received on the new channel.

NEW ZEALAND: Radio New Zealand's service to Australia and Papua New Guinea has also made a frequency change for the two transmission 0345-0730 and 1030-1215 UTC. Both transmissions are now on 9540 in place of 9630, while at 0345 117-80 kHz carries that broadcast and at 1030 6100 kHz is the alternative frequency.

TASHKENT: Radio Tashkent in Uzbekistan broadcasts in English 1200-1230 and 1330-1400. The transmissions are now on 7275, 7325, 9540, 9600, 11785 and 15440 kHz.

VIETNAM: The Voice of Vietnam, Hanoi has several broadcasts in English and the tranmission at 1000 is well received on 9840 kHz. The station is also using 9755, 12020 and 12035 kHz for these transmissions, but all these frequencies suffer from interference leaving 9840 as the only reliable outlet.

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

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4164-15P	$2.00	$1.70	$1.65	$1.60
41256	$6.00	$5.50	$5.00	$4.50
6116P-3	$3.00	$2.90	$2.20	$2.00
2716	$7.50	$7.00	$6.50	$6.00
27128	$7.00	$6.50	$6.00	$5.50
2532	$10.50	$9.50	$8.50	$7.50
2732	$7.50	$6.10	$5.90	$5.50
27256	$9.00	$8.00	$7.00	$6.50
6264	$6.50	$6.00	$5.50	$5.00
2764	$6.00	$5.00	$4.50	$4.00

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Cat.No.	10+boxes	100-boxes
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Have a look at these prices! These are 100% certified, prime spec. disks in labelled jackets. (not like our oppositions)

Description Cat.No.	1-9 boxes	10+ boxes	100+ boxes
S/S D/D C12440	$14.50	$13.90	$13.00
D/S D/D C12445	$16.50	$14.90	$13.50

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Attention Schools, Government Depts etc FREE sample disk available on request! (Please send $2 to cover postage)

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Cat.No.	Descript.	1-9	10-	100-
Q10500	MU45 0-1mA	8.50	7.95	7.75
D10502	MU45 50-0-50uA	8.50	7.95	7.75
D10504	MU45 0-100uA	8.50	7.95	7.75
Q10505	MU45 0-50uA	8.50	7.95	7.75
Q10510	MU45 0-5A	8.50	7.95	7.75
D10518	MU45 0-1A	8.50	7.95	7.75
Q10520	MU45 0-20V	8.50	7.95	7.75
Q10535	MU45 VU	9.50	8.95	8.75
D10530	MU52E 0-1mA	9.95	8.35	
D10533	MU52E 0-5mA	9.95	8.35	
D10538	MU65 0-50uA	12.50	11.35	10.90
D10540	MU65 0-1mA	12.50	11.35	10.90
D10550	MU65 0-100uA	12.50	11.35	10.90
D10560	MU650 0-20v	12.50	11.35	10.90

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- Seagate hard disk / Microsclence
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Cat.No.	Description	1-99	100-	250+
S15020	AA .5AH	$2.00	$1.90	$1.70
S15021	C 1.2AH	$5.55	$5.45	$5.15
S15022	D 1.2AH	$5.75	$5.50	$5.25

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¼ Watt E12 carbon
Bulk packed $6.50 per 1,000
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SUPPLY E24 VALUE

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Descript.	10+	100+	1000+
7805uC	.45	.44	.43
7805KC	1.50	1.40	1.20
7812uC	.45	.44	.43
7815KC	1.50	1.40	1.20
7818uC	.50	.49	.48
7818KC	1.50	1.40	1.20
7905uC	.70	.60	.55
7912uC	.70	.60	.55
uA323KC	4.50	3.90	3.75

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TRANSISTORS

Desc.	10+	100-	Desc.	10+	100-
2SJ49	5.50	4.90	2SK134	5.50	4.90
PN2222A	.11	.09	PN2907A	.10	.09
PN3563	.18	.16	PN3565	.12	.11
PN3566	.15	.13	PN3567	.10	.08
PN3569	.18	.16	PN3639	.18	.16
PN3640	.18	.16	PN3641	.11	.09
PN3642	.11	.09	PN3643	.11	.09
PN3644	.15	.13	PN3645	.15	.13
PN4250A	.15	.13	PN4355	.18	.16
PN4356	.19	.17	MPSA42	.20	.15
MPSA43	.11	.09	MPSA55	.18	.17
MPSA56	.19	.16	MPSA92	.12	.11
MPSA93	.14	.12	SC141D	1.00	.90
BU126	1.90	1.85	BUX80	3.60	3.50
BU208	2.75	2.50	2SD350	3.90	3.75
BU326	2.25	2.15	BC547	.10	.09
BC548	.10	.09	BC549	.10	.09
BC557	.10	.09	BC558	.10	.09
BC559	.10	.09			

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TANTALUM CAPACITORS

Cat.No.	Description	10+	100-
R16124	4.7uF 16V	$0.24	$0.18
R16125	10uF 16V	$0.25	$0.23
R16126	15uF 16V	$0.38	$0.36
R16128	22uF 16V	$0.42	$0.40
R16132	47uF 16V	$1.55	$1.20
R16134	68uF 16V	$1.80	$1.50
R16220	4.7uF 16V	$0.35	$0.33
R16224	10uF 16V	$0.38	$0.37
R16228	22uF 16V	$1.20	$1.00
R16300	0.1uF 35V	$0.13	$0.12
R16302	0.15uF 35V	$0.13	$0.12
R16304	0.22uF 35V	$0.15	$0.12
R16306	0.33uF 35V	$0.15	$0.14
R16308	0.47uF 35V	$0.15	$0.14
R16310	0.68uF 35V	$0.16	$0.15
R16311	0.82uF 35V	$0.18	$0.15
R16312	1uF 35V	$0.15	$0.12
R16314	1.5uF 35V	$0.24	$0.20
R16316	2.2uF 35V	$0.24	$0.23
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R15131	.001uF	0.06	0.04	.03
R15137	.0012uF	0.06	0.04	.03
R15138	.0015uF	0.06	0.04	.03
R15140	.0022uF	0.06	0.04	.03
R15142	.0033uF	0.06	0.04	.03
R15143	.0039uF	0.06	0.04	.03
R15145	.0047uF	0.06	0.04	.03
R15146	.0056uF	0.06	0.04	.03
R15147	.0082uF	0.06	0.04	.03
R15148	.01uF	0.07	0.05	.04
R15150	.015uF	0.07	0.05	.04
R15152	.022uF	0.07	0.05	.04
R15154	.033uF	0.07	0.05	.04
R15155	.039uF	0.07	0.05	.04
R15156	.047uF	0.08	0.06	.05
R15157	.056uF	0.08	0.06	.05
R15158	.068uF	0.08	0.06	.05
R15159	.082uF	0.08	0.07	.05
R15160	.1uF	0.09	0.08	.07
R15162	.15uF	0.11	0.10	.09
R15164	.22uF	0.15	0.14	.13
R15165	.27uF	0.16	0.15	.14
R15172	1uF	0.70	0.55	0.50
R15176	2.2u	1.20	1.10	1.00
R15178	3.3uF	1.50	1.20	

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Amber Cat. X14508	$165	$155	$145

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Cat No.	Descript.	10-	100-	1000-	10K
Z10135	IN4148	0.03	0.02	0.015	.015
Z10105	IN4002	0.04	0.03	0.03	.025
Z10107	IN4004	0.05	0.04	0.03	.025
Z10110	IN4007	0.10	0.06	0.05	0.04
Z10115	IN5404	0.18	0.14	0.09	0.08
Z10119	IN5408	0.20	0.16	0.10	0.09

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Yellow	$0.15	$0.10	$0.09	$0.08

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Cat No.		1-9	10+
C12010	5" Plastic 10W Max	6.00	5.80
C12015	5" Metal 10W Max	6.00	5.80
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Per 200m Roll

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75 OHM COAX CABLE IN 100M ROLLS

Cat No.	Descript.	1-4	5+	10+
W11222	3C2V	25.00	24.00	23.00
W11224	5C2V	30.00	29.00	28.00

(5C2V WHITE DR BLACK)
LINE LDSS PER 100 FEET (33M 200MHz)
W11222 3C2V 6 2dB (Approx)
W11224 5C2V 3 9dB (Approx)

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Cat No.	Description	1-99	100+	1000+
P10900	DB25 Plug	1.00	0.70	0.60
P10901	DB25 Skt.	1.10	0.75	0.70
P10902	DB25 Cover	0.80	0.65	0.55
P12210	Cent. Solder	3.50	3.15	2.50
P12200	Cent. Crimp	4.50	4.00	3.50
P10880	DB9 Plug	1.30	1.20	0.90
P10881	DB9 Skt.1.40	1.30	1.00	
P10882	DB9 Cover	0.60	0.55	0.50
P10890	DB15 Plug	1.30	1.20	0.90
P10891	DB15 Skt.1.40	1.30	1.00	
P10892	DB15 Cover	0.65	0.55	0.50

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Cat.No.	Desc.	1-3	4-9	10-99	100-
W12614	14 Way	19.50	18.50	18.00	14.00
W12616	16 Way	21.50	19.50	19.00	16.00
W12620	20 Way	29.50	28.00	26.50	20.00
W12625	25 Way	32.50	29.00	28.50	25.00
W12626	26 Way	34.00	32.00	29.00	26.00
W12634	34 Way	44.00	42.00	39.00	34.00
W12636	36 Way	49.00	47.00	42.50	36.00
W12640	40 Way	55.00	52.50	49.50	40.00
W12650	50 Way	62.00	59.50	58.50	50.00

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M12851 2851 240V 12-6V CT 150mA	3.50	3.30	2.90
M12155 2155 240V 6-15V 1A tapped	6.00	5.75	5.50
M12156 2156 240V 6-15V 2A tapped	9.00	8.75	8.50
M12840 2840 240V to 9V C.T. at 150mA	3.50	3.30	3.10
M12860 2860 240V to 15V C.T. at 250mA	3.50	3.30	3.10
M16672 6672 240V 15-30V 1A tapped	8.95	8.75	8.40

Plus 20% tax where applicable

FANS

Cat.No.	Descript.	1-9	10-	100-
T12461	240V 4½"	11.00	10.00	9.00
T12465	240V 3½"	11.00	10.00	9.50
T12463	115V 4½"	11.00	10.00	9.00
T12467	115V 3½"	11.00	10.00	9.50

(Fan guards to suit also available)

Plus 20% tax where applicable

SPECIALS!

COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER KIT

Here's what you've been asking for, a full trasmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microbee, tips are available on interfacing the unit to other computers. (ETI Nov '84) ETI 755)

Cat K47550 Normally $135

SPECIAL, $99

LOW OHMS METER

How many times have you cursed your Multimeter when you had to measure a low-value resistance? Well with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms (ETI Nov '81) ETI 158

Cat K41580 Normally $44.95

SPECIAL, $39.95

SLIDE CROSS-FADER

Want to put on really professional slide show? This slide cross-fader can provide smooth dissolves from one projector to another, initiate slide changing automatically from an in-built variable timer, and synchronise slide changes to pre-recorded commentary or music on a tape recorder. All this at a cost far less than comparable commercial units. (EA Nov '81) 81SS11

Cat K81110 Normally $99.00

SPECIAL, $89.00

30 V/1 A FULLY PROTECTED POWER SUPPLY

The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both voltage and current metering is provided. (ETI Dec '83) ETI 162

Cat K41620 Normally $73.50

SPECIAL, $63.50

MULTI SECTOR ALARM STATION

Protect your home and possessions from burglars with this up to the minute burglar alarm system. It's easy to build, costs less than equivalent commercial units, and features eight separate inputs individual sector control, battery back up and self-test facility.

Specifications:

- Eight sectors with LED status indication
- Two delayed entry sectors
- Variable exit, entry and alarm time settings: entry delay variable between 10 and 75 seconds, exit delay variable between 5 and 45 seconds, alarm time variable between 1 and 15 minutes
- Resistive loop sensing: suits both normally open and normally closed alarm sensors
- Battery back-up with in-built charger circuit
- Built-in siren driver

The RIE kit includes a superb printed and prepunched metal case and inside metal work, plus a gell battery! Unbeatable VALUE!

K85900 complete kit only $159

K85901 without battery backup $134

15V DUAL POWER SUPPLY

This simple project is suitable for most projects requiring a dual voltage. Includes transformer (ETI 581, June '76)

Cat K45810 **$34.95**

50 W AMPLIFIER MODULE (ETI 480)

Cat K44880 **$31.80**

(Heatsink optional extra)

100 W AMPLIFIER MODULE (ETI 480)

Cat K44801 **$34.80**

(Heatsink optional extra)

ELECTRONIC MOUSETRAP

This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again!

(ETI Aug '84) ETI 1524

Cat K55240 **$39.95**

RADIOTELETYPE CONVERTER FOR THE MICROBEE

Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr '83)

Cat K47330 **$19.95**

MUSICOLOR IV

Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety.

(EA Aug '81) 81MC8

Cat K81080 **$114.95**

MOTORCYCLE INTERCOM

OVER 500 SOLD!

Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build!

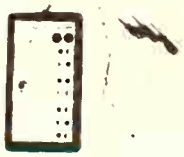
(EA Feb '84) 84MC2

Cat K84020 **$49.95**

MICROBEE SERIAL-TO-PARALLEL INTERFACE

Most microcomputers worth owning have an 'RS232' connector or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel 'Centronics' interface printers. Save money by building this interface. (ETI Jan '84) ETI 675

Cat K46750 **$49.50**



TRANSISTOR TESTER

Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester, such as the EA Handy Tester. (EA Sept '83) 83TT8

Cat K83080 **$18.95**

12/240V 40W INVERTER

This 12-240V inverter can be used to power up mains appliances rated up to 40W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May '82) 82IV5

Cat K82050 **$69.95**

ELECTRIC FENCE CONTROLLER

Restore discipline to the farm or allotment with this new electric fence controller. It features higher output power and lower current drain than the previous design for use in rural areas.

(EA Dec '85, 85ef11)

Cat K85110 **$49.95**

AUDIO TEST UNIT

Just about everyone these days who has a stereo system also has a good cassette deck, but not many people are able to get the best performance from it. Our Audio Test Unit allows you to set your cassette recorder's bias for optimum frequency response for a given tape or alternatively, it allows you to find out which tape is best for your recorder.

(81AO10) (EA Oct '81)

Cat K81101 **$59.50**

VIDEO FADER CIRCUIT

Add a touch of professionalism to your video movies with this simple Video Fader Circuit. It enables you to fade a scene to black (and back again) without loss of picture lock (sync) or colour.

(EA Jan '86, 85ff10)

Cat K86010 Normally $24.95

Special only $19.95

LOW BATTERY VOLTAGE INDICATOR

Knowing your batteries are about to give up on you could save many an embarrassing situation. This simple low cost project will give your early warning of power failure, and makes a handy beginner's project.

(ETI 280, March '85)

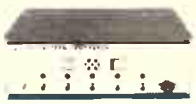
Cat K42800 **$9.95**

PARALLEL PRINTER SWITCH KIT

Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently, so that you can select one or the other at the flick of a switch.

(ETI 666, Feb '85)

Cat K46660 **$79.95**



CRYSTAL CONTROLLED TV PATTERN GENERATOR

Anyone wishing to obtain the maximum performance from a colour TV receiver needs a pattern generator. Why not build this superb unit which provides five separate patterns: dot, crosshatch, checker board, grey scale and white raster? **Note:** The RIE kit includes a large ABS type case!

(80pg6, EA June '80)

Cat K80033 **$99.95**

HUMIDITY METER

This project can be built to give a readout of relative humidity either on a LED dot-mode display or a conventional meter. In addition it can be used with another project as a controller to turn on and off a water mist spray in a hothouse, for example. (ETI May '81) ETI-256

(Includes humidity sensor $19.50)

Cat K42560 **$61.45**

STEREO ENHANCER

The best thing about stereo is that it sounds good! The greatest stereo hi-fi system loses its magnificence if the effect is so narrow you can't hear it. This project lets you cheat on being cheated and creates an 'enhanced stereo effect' with a small unit which attaches to your amp.

(ETI 1405, ETI, MAR '85)

Cat K54050 **$79.50**

THE BUSKER PORTABLE AMPLIFIER

This handy amplifier is completely portable and is capable of operating from either the mains or a 12V battery. Main features include guitar and high-level inputs, an inbuilt loudspeaker, and bass and treble controls. Its just the thing for busking or for guitar practice.

(EA Feb '85 85ba2)

Cat K85020 (excluding cabinet) **$99**

DELUXE CAR BURGLAR ALARM

Stop your car from being one of the 70,000+ stolen cars stolen each year with this "state of the art" car burglar alarm. Features include key switch operation, delayed entry and exit, automatic reset, and provision for an auxiliary battery. Further more, of the 10 most important features listed by NRMA, this EA Deluxe Car Alarm has 9 of them!

(84ba5, EA May '84)

Cat K84050 **$99.95**

MODEL ENGINE IGNITION SYSTEM

Get sure starts every time, without glow plug burnouts on your model engines.

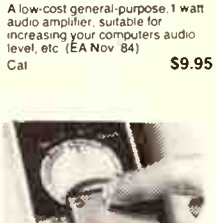
(ETI June '83) ETI 1516

Cat K55160 **$49.50**

1W AUDIO AMPLIFIER

A low-cost general-purpose 1 watt audio amplifier, suitable for increasing your computers audio level, etc. (EA Nov '84)

Cat **$9.95**



ZENER TESTER

A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes.

(ETI May '83) ETI 164

Cat. K41640 **$11.95**

PREAMP FOR PAGING AMP

A versatile preamp with separate bass, treble and volume. (ETI 1421)

Cat K54210 **$24.95**

FAIR DINKUM RS232 FOR MICROBEE

The Microbee, among other home computers, has a 'sort of' RS232 port in that it doesn't implement negative-going portion of its output signal (TxD). Most peripherals with an RS232 input can cope with that, but inevitably, there are those that can't. This project fixes that!

(ETI 676, ETI FEB '84)

Cat K46760 **$39.50**

PH METER KIT

Build this pH meter for use with swimming pools to fish tanks to gardening, this pH meter has many applications around the home. This unit features a large 3½ digit liquid crystal display and resolution to .01 pH units, making it suitable for use in the laboratory as well.

(EA Dec '82) 82PH12

Cat K82123 **$199**

GENERAL PURPOSE AMPLIFIER CLASS B

One of the handiest 'tools' for the electronics experimenter is a genuine purpose audio amp. This module will work from a wide range of supply voltages, has good sensitivity, is robust and reliable - easy to build too! (ETI 453)

(ETI April '80)

Cat K44530 **$16.95**

HEADPHONE AMPLIFIER

PRACTICE WITHOUT ANNOYING THE FAMILY!

If you play any type of electronic instrument, this headphone amplifier will surely interest you. It will let you practice for hours without upsetting the household, or you can use it to monitor your own instrument in the midst of a rowdy jam session. (EA Feb '84) 83MA11

Cat K84111 **$39.95**

EA AM STEREO DECODER

AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system.

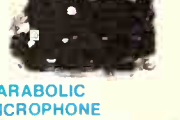
(EA Oct '84) 84MS10

Cat K84100 **$26.95**

CUDLIPP CRICKET

A fascinating Electronic Cricket with just two ICs. The Cudlipp can be used to bug your home, office etc! Great fun! (EA Feb '82) 82EG2

Cat K82022 **$12.95**



PARABOLIC MICROPHONE

Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of componenets for this project is around $15 including sales tax, but not the cost of batteries or headphones. (EA Nov '83) 83MA11

Cat K83110 **$14.95**

SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Superb Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,500 sold!

For those who haven't the time and want a quality hi-fi, we also sell the Series 5000 kits assembled and tested.

POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER

- 1% Metal Film resistors
- Al[illegible]

SPECIAL, ONLY $399
SAVE $50

[illegible] developed by [illegible] ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms (per channel)
POWER AMPLIFIER: 100W RMS into 8 ohms (+ −55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz +0 −0.4 dB 2.8Hz to 65KHz, +0 −3 dB. NOTE: These figures are determined solely by passive filters
INPUT SENSITIVITY: 1 V RMS for 100W ouput
HUM: 100 dB below full output (flat)
NOISE: 116 dB below full output (flat, 20KHz bandwidth)
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
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above).
INTERMODULATION DISTORTION: 0.003% at 100W (50Hz and 7KHz mixed 4:1)
STABILITY: Unconditional

Cat. K44771 ..... $449
Assembled and tested $599
packing and post $10

PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES [illegible] PREAMPLIFIER

- 1% Metal Fi[illegible]

SPECIAL, ONLY $359
SAVE $40

[illegible] believe that dollar for [illegible] commercial unit available that sounds as [illegible]

SPECIFICATIONS:
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

Cat. K44791 ..... $399
Assembled and tested $699
packing and postage $10

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands

SPECIAL, ONLY $209
SAVE $30

Cat. K44590 ..... 1 unit: $239
..... 2 units: $429
packing and postage $10

SERIES 4000 SPEAKERS

8 Speakers ..... only $549
8 Speakers with Crossovers ... $795
Speaker Cabinet Kit (complete) $395
(Please specify cabinet to suit 7" or 8" mid range woofer)
Crossover Kits $295
Complete kit of parts (speakers, crossovers, screws, innerband boxes.) $1,095
Assembled, tested and ready to hook up to your system ... $1,295
(Approximately 4 weeks delivery)

Errors and Ommissions Excepted

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**

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**

MULTI FUNCTION STEREO MIXER EQUALIZER

SPECIFICATIONS:
SENSITIVITY:
Phono: 3mV
Mic: 1mV
Line (tape or tuner): 150mV
SIGNAL/NOISE RATIO:
Phono: 55dB
Mic: 60dB
Line: 65dB
FREQUENCY:
Phono: 20Hz-20KHz (RIAA + 2dB)
Mic: 20Hz-20KHz + 3dB
Line: 20Hz-20KHz + 3dB
CHANNEL BALANCE: 0 5dB
T.H.D: Less than 0 03%
HEADPHONE IMPEDANCE: 4-16 ohms
OUTPUT: 0 775V
EQUALIZER:
Centre frequency: 60Hz, 250Hz, 1KHz, 4KHz, 12KHz
Control Gain: + −12dB
POWER SOURCE: 110V/60Hz or 220V/50Hz

Cat.A12016 ..... Normally $399
SPECIAL, ONLY $349

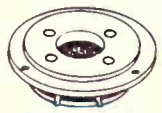
PHILIPS SPEAKERS

Description	Cat.No.	Price
AD01610T8 (C12030)		$24.95
AD02160SQ8 (C12040)		$69.95
AD80652W8 (C12042)		$69.95
AD070620M8 (C12045)		$69.95
AD12250W8 (C12050)		$129.00

WALL MOUNTING SPEAKER HOLDERS

Mount your speakers at ear level on your wall!!
Features....
- Holds speakers up to 260mm deep
- Left/Right adjustment
- Up/Down adjustment
- Includes mounting screws
- Nipping-screw pins hold speakers firmly in place
- Installation instructions

Cat.H28630 ..... **$89.95**



1" DOME TWEETER SPEAKER

Mylar diaphragm
SPECIFICATIONS:
Sensitivity: 96dB
Frequency Response: 2-20 kHz
Impedance: 8 ohms
Power RMS: 15 watts RMS
Magnet Weight: 5 4oz
Size: 96mm diameter

Cat C10234 ..... **$10.95**

8" WOOFER HIGH POWER SPEAKER

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

Cat C10226 ..... **$34.95**

2" HORN TWEETER SPEAKER

Mylar diaphragm, aluminium voice coil
SPECIFICATIONS:
Sensitivity: 95dB
Frequency Response: 1 5-20 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 2 5oz

Cat C10232 ..... **$8.95**

8" TWIN CONE FULL RANGE SPEAKER

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

Cat C10224 ..... **$23.95**

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

5" MIDRANGE SPEAKER

Sealed back, foam edge, black cone, silver dust cap
SPECIFICATIONS:
Sensitivity: 98dB
Frequency Response: 500-8 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 5 4oz

Cat C10230 ..... **$12.95**

6½" TWIN CONE FULL RANGE SPEAKER

Foam edge, black cone, black whizzer cone
SPECIFICATIONS:
Sensitivity: 89dB
Frequency Response: 60-15 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 5 3oz

Cat C10222 ..... **$14.95**

Rod Irving Electronics
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Phone (03) 663 6151
425 High St, NORTHCOTE
Phone (03) 489 8866
Mail Order and Correspondence
P.O. Box 620, CLAYTON 3168
Telex AA 151938

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LOCAL ORDERS & INQUIRIES
(03) 543 7877

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Errors and omissions excepted

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New Zealand's Plans for Optical Fibres

Alan Concannon

Optical fibres are making the same impression as a new technology as the zip code and sliced bread did many years ago. New Zealand, like many other countries, is now starting to realise the many advantages optical fibre has to offer. Besides introducing it into both New Zealand's plant and products, every avenue that can benefit from the introduction of fibre optic technology is now being scrutinised.

The fact that they have recently manufactured their first fibre optic cable, and installed the first external fibre optics cable in Australasia, makes it obvious that New Zealand like so many other countries is now starting to exploit this new technology to the full.

The First Cable

The first fibre optic cable is now being made by Austral Standard Cables Pty Ltd in Christchurch. At the end of last year, the company got a technical release and acceptance from the NZ Post Office for the first production-run fibre optic cable from its Hornby factory.

The cable is the result of three year's research and planning in a NZ$500,000 development programme. Importantly, the 2.6 kilometre cable represents a major advance for a New Zealand made product in the area of high technology. It will be installed between the New Plymouth Power Station and the Spotswood Telephone Exchange to provide speech and data circuits with improved safety and reliabilty.

An NZ First

The first external fibre optic cable in Australasia is in a power system between the NZ Electricity Division's Islington substation and the South Island system control centre. The 700 metre underground dual cable, was bought from NEC and has been in operation now for more than 18 months.

It carries information, both speech and data, sent between the control centre and the rest of the South Island network of power stations and substations. Microwave radio was impractical over the short distance involved and fibre optics provided a high-capacity alternative. In a built-up area, it was a low impact, safe solution.

Fibre optics is now seen as a possible alternative to existing techniques used by the electricity authorities to minimise interference. Mainly for shielding and where some sort of barrier system has to be used to provide isolation between points with different potentials.

NZ Railways

The NZ Railways Corporation recently let a contract for the design, installation and commissioning of the telecommunications systems for Stage One of their trunk electrification programme.

The system will extend from Palmerston North to Ohakune. It will be a digital optical fibre system between the control centres at Palmerston North and Taumarunui. A Westinghouse System Two dual

computer-based system will also be provided in the Palmerston North traction control centre for control and monitoring of the 16 remote traction power supply locations.

The operation will be from colour VDU stations equipped with light pens and a mimic design display. A Westinghouse System Two computer-based telephone system will afford secure voice communication to locations along the 185 km route.

The multi-million dollar contract for signalling has been awarded to Westinghouse-McKenzie-Holland Pty Ltd. Using the latest computer-aided design and project control techniques, WMH will progressively upgrade the entire signalling system from Palmerston North to Ohakune. This will provide for ac immune signalling to meet the stringent requirements imposed by the adoption of the 25 kV ac traction system.

The network has been designed to give automatic re-routing facilities in the event of a cable or equipment failture. These facilities are provided using digital switching techniques under microprocessor control. Computers located at the major control centres continually monitor the network and on receipt of a fault message will instruct the digital switches to re-route the affected circuits.

> ***Tasman 2 will provide 11 400 channels and 57 000 telephone conversations***

Tasman 2

The Tasman 2 project for a fibre-optic telecommunications cable to link Australia and New Zealand is now in its pre-contract phase. Tasman 2 is a joint effort by the NZPO and Australia's overseas telecommunications commission (OTC). At least three pairs of fibres will be used in the Tasman 2 cable providing 11,400 digital channels capable of carrying 57,000 simultaneous telephone conversations — or a mix of voice data and television signals in digital form. And this capacity should be sufficient until about 2010 AD. This project is only part of a NZ$1.5 billion fibre optic network which will eventually link Japan, Hong Kong, South Korea, Taiwan, the Philippines, and the United States.

General Areas

New Zealand has also designed and developed a sensor using optical glass fibres for a range of infra-red opeational products. These have been manufactured by Switch Enterprises in Auckland.

Fibre optic CATV trunk systems — for digital transmission and distribution of television and sound channels are also under development and are being keely researched. Though it appears that purpose-provided cable TV networks will, in the majority of cases, be restricted to the distribution of television signals alone.

Use of fibre optics overseas for cable TV has to date been experimental. Costs have been high compared with coaxial cable systems. It is likely to be some time before the required hardware is commercially readily available to New Zealand and at an economic price. Competitors are UHF TV, Satellite TV and of course, existing coaxial CTV technology.

Wideband Signals

The distribution of wideband signals is still under consideration for the New Zealand telecommunications network. Presently, the NZPO is building an integrated digital network (IDN). Such a network is made up of digital telephone exchanges linked together by digital tranmission systems. This IDN system will be developed into an integrated services digital network (ISDN) which will allow a full range of digital services to be extended to the subscriber, including all those futuristic services, often talked about, including full motion videoconferencing services.

Industrial Applications

The industrial applications of fibre optics are still few and have taken off not yet in New Zealand. But, the aspects of freedom to interference and the ability of fibre optics to carry a high volume of information are of primary concern to industry. It will therefore, only be a matter of time before fibre optics are extensively used in New Zealand industry. For fibre optic components to be used widely in industry, a reduction in the price of these components will be necessary — and this will be only a matter of time. ●

National networking, satellite-to-home broadcasting, Pay TV via multipoint distribution services, optical fibre cables and high capacity satellites, FM sub-carriers . . . These are some of the broadcasting developments Australians can expect in the next decade.

FUTURE BROADCASTING DIRECTIONS

***Liz Fell**

It is ten years since Mr Kerry Packer first persuaded the Fraser Government to focus attention on the broadcasting opportunities opened up by the Australian satellite system. Packer could see that satellite technology was ideally suited for multipoint distribution of TV and radio services.

National networking was the name of Packer's new game plan. But this raised delicate political questions about the ownership structure of the Australian media industry and the future of regional TV broadcasters. Some feared the power of the larger media owners, including Mr Packer, if they were allowed to extend their advertising and programme reach into virtually every Australian home.

Successive Australian governments delayed making decisions about the future structure of the broadcasting industry, and the years rolled on. Meanwhile the satellites were designed, constructed and even launched in the expectation that the TV and radio industry would become the largest user of satellite capacity.

Controversy

Anticipating future opportunities, some TV entrepreneurs signed up with Aussat without waiting for the government to decide on its policy. Finally, in June this year, legislation allowing the major TV owners to expand nationally was passed by Parliament.

The legislation proved extremely controversial. It allowed TV owners to extend their ownership reach up to 60 per cent of the Australian audience and paved the way for restructuring or "equalising" the original TV industry.

Eventually the three Sydney-based commercial TV networks will each have a terrestrial rebroadcasting outlet in regional Australia. The metropolitan owners may either buy the regional stations or sign them up as network affiliates. In the final outcome, most media analysts predict there will be a smaller number of TV owners.

Commenting on the Labor government's media policy and the new legislation, the former Coalition communications spokesman, Mr Ian Mcphee, said: "On every single issue relating to media ownership, Labor has sold its soul, its principle, its commitment. The Labor platform — which calls for diversity of ownership, reduced concentration of media ownership, choice and quality — is not worth the paper it is written on."

Aussat Struggles

Meanwhile Aussat struggled on after announcing an operating loss of $42.6 million in 1985-86. By the end of this year, when the third satellite should be up in the skies, Aussat hopes that 24 transponders — nearly two-thirds of its total capacity — will be used by the media industry.

The satellites will be used for radio and TV networking and programme interchange; remote area broadcasting; Video and Audio Entertainment and Information Services (VAEIS) such as Mr Alan Bond's Sky Channel; and occasional TV news gathering and videoconferencing.

Macquarie was the first commercial radio operator to take advantage of Aussat's multipoint capacity. Through its Macsat network it now distributes news/talk, sports, music, and advertising to its own stations or other stations interested in purchasing a satellite dish.

The two government-owned telecasters, ABC and SBS, are distributing and interchanging programmes via Aussat, as are the three major commercial TV networks on a more limited scale. In addition, Network Seven and Nine have full-time international satellite leases to receive programmes from Los Angeles and then rebroadcast these across Australia.

Even the commercial newsagency, Australian Associated Press, is now "broadcasting" its news text services across the country, and there are future plans to establish a satellite-delivered advertising network for suburban, country and metropolitan newspapers using standard sized advertisements.

Another rationale for Aussat was its ability to deliver Homestead and Community Broadcast Satellite Services (HA-CBSS) to people living in remote areas of Australia. The ABC is now Aussat's largest media user, and four new remote commercial TV services (RCTS) are either underway or planned.

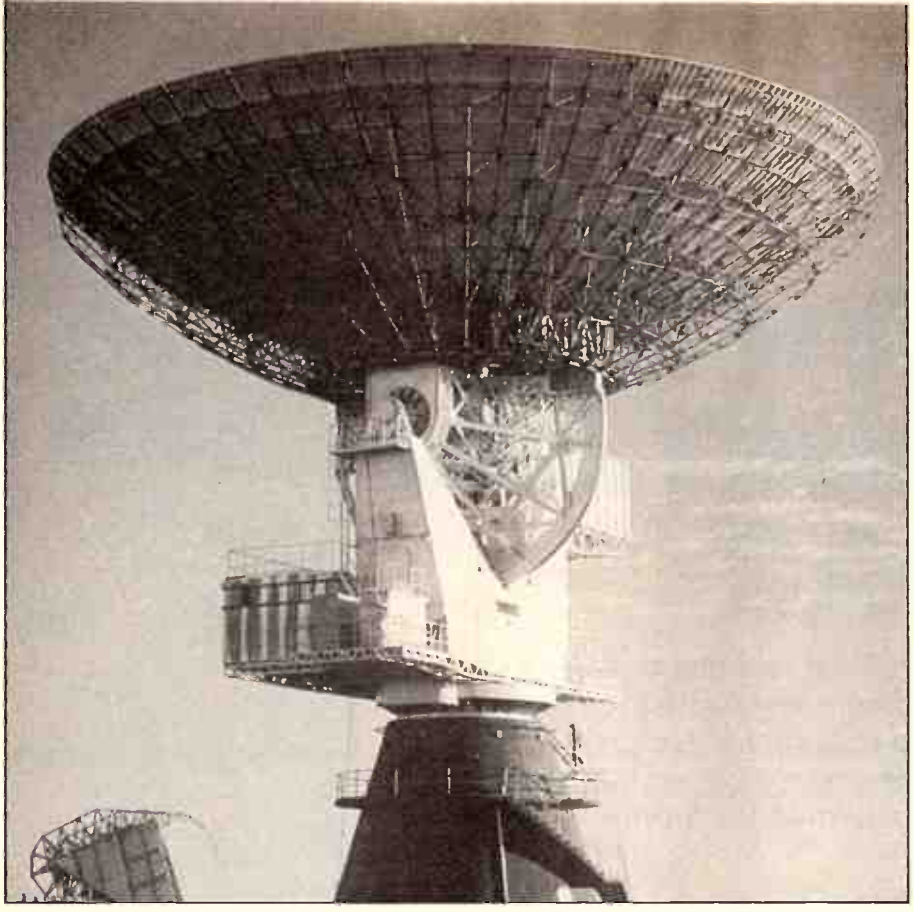
B-MAC

Remote broadcasters are required to use Scientific Atlanta's B-MAC technology which combines developments in digital audio (B) with Multiplexed Analogue Components (MAC) for satellite TV. This allows for the transmission of stereo TV with teletext, four high-speed (204 kbps) sound or data channels, and a low-speed (8 kbps) data stream to the same small TV receive only (TVRO) satellite dish.

B-MAC's full potential has not yet been fully realised. The RCTS licensees are currently exploring the possibility of using or leasing the high-speed channels for high fidelity radio broadcasting, while the low-speed channel may be used for one-way data-base broadcasts. The ABC is already transmitting two radio services, but it has been slow to find an application for its low capacity data channel.

All the remote broadcasters face the problem that the market for the 1.5 metre TVRO homestead satellite dishes has not taken off. The total market size is estimated at around 30,000, yet only 3000 TVRO's have been sold in the last eighteen months.

The dish suppliers believe a number of different factors are responsible for the



low response to direct satellite-to-home TV reception. Some regard the $2500 cost for each small dish as prohibitive; others lay the blame firmly with the government and its confused media policies.

In addition, many communities are receiving their remote TV signals via larger satellite earth stations and then retransmitting these terrestrially. This means viewers are watching normal PAL TV signals and the full range of B-MAC services are not available to each household.

It may be some years before the domestic TVRO market develops in Australia, though ironically, it is expanding offshore. Viewers in New Zealand and Papua New Guinea have discovered they can pick up Australian TV with a small dish and then redistribute it through a building or local community.

Further off-shore in the Southwest Pacific, other viewers are designing and constructing dishes to recieve US TV signals off Intelsat's Pacific satellite which operates in the C band at 4 GHz. Later this year, New Zealand plans to use Aussat's third satellite for TV broadcasting and distribution and this operates in the Ku band at 12 GHz.

The spill-over of satellite-delivered TV into other countries will not disappear. Some South Pacific countries are already talking about a campaign to educate consumers on the TV services available, and the need for a dual 4-12 GHz TVRO with a readily adjustable antenna to pick up signals off satellites in different orbital locations.

VAEIS

An innovative application of both B-MAC and Aussat's multipoint distribution capacity is the development of private Pay TV networks. Called Video and Audio Entertainment and Information Services (VAEIS), B-MAC is ideal for Pay TV since the signals are encoded and each receiver is individually addressable.

VAEIS are not actually regarded as "broadcasting" to the general public, so licenses are allocated under the Radiocommunications Act and ownership rules do not apply. They can be offered to subscribing pubs, clubs, racecourses, hotels, schools, hospitals, businesses, coaches, marine vessels, trains, aircraft — anywhere but a domestic home.

TV entrepreneurs such as Messrs Alan Bond, Robert Holmes a Court and Kerry Packer were quick to seize this new opportunity . . . they even leased satellite capacity before the government had developed a VAEIS policy. Mr Bond has since bought out the interests of his two major competitors and is now offering his Sky Channel TV service to 1000 pubs and clubs.

VAEIS can also be delivered via multipoint distribution services (MDS) using the 2 GHz microwave band, or via Telecom's terrestrial bearers. VAEIS/MDS licences are in high demand; by May this year, the Department of Communications had received 190 "expressions of interest" in licences, together with "up-front" licence fees worth about $1 million.

Some of the MDS/VAEIS applicants see these licences as a foothold into the domestic Pay TV market, though the Federal Government has placed a four year moratorium on this type of service. The Department now has too many MDS applications for the spectrum available — especially in capital cities.

A draft VAEIS Spectrum Plan issued in January indicates 15-19 channels at the most, depending on the type of service. Departmental planners are now trying to figure out the best way to allocate some of these channels — they are even considering an auction or a lottery with entry criteria.

Another long-term policy is to move TV stations onto UHF, clear Bond II frequencies, and expand radio broadcasting into regional areas using FM transmissions. At present there are 110 ABC, commercial and public radio services operating throughout Australia.

All these stations will soon have the opportunity to exploit the spectrum using their FM radio sub-carriers to transmit additional audio or data services. The metropolitan AM stations are also eager to transfer to FM, though, again, this is a question of available spectrum and how to allocate licences.

Cabling the Ground

Meanwhile Telecom is busy cabling the ground with high capacity optical fibres — ideal for TV distribution — and Aussat is planning to expand its TV and radio service base with the next two second generation satellites, due for launch in 1993 and 1994.

Each new Aussat satellite will have 19 high powered 54 MHz transponders which will be capable of carrying at least two TV signals. New Zealand has ordered eight transponders with a national beam performance of at least 50-55 EIRP (dBw) to provide direct broadcasting services.

In May, the Liberal Party communications spokesman, Mr Julian Beale, spelled out his vision for the future of Australian TV. "We wish to see a market . . . where there are no prohibitions on the development of cable and pay television, where there is a plethora of smaller stations giving specialised service to the Australian viewing public and finally, when that day comes, where there is a myriad of services arising from the use of satellites."

Beale did not elaborate on whether the Australian radio and TV industry had sufficient funds to actually produce the range of programmes required by all these distribution facilities. All the signs point to the importation of less expensive product from overseas via satellite — and this is not likely to help Australia's trade imbalance.●

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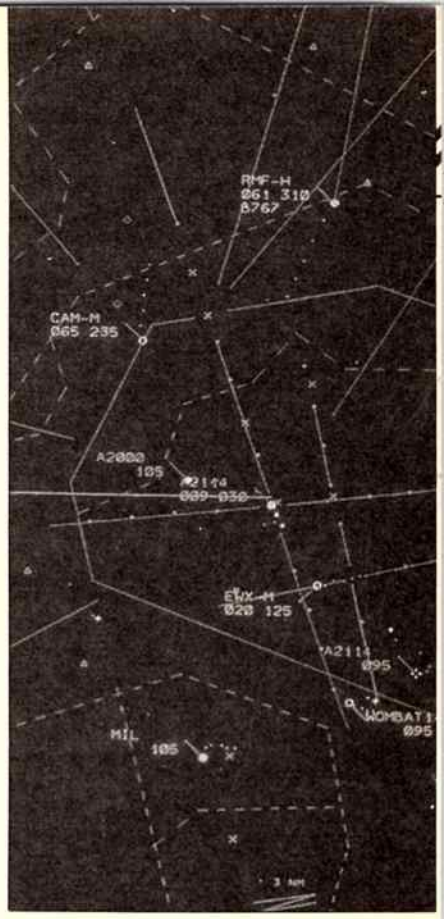
* *Liz Fell is a journalist and broadcaster who has specialised in communications and media politics.*

Part 1

A PRACTICAL INTRODUCTION TO RADAR



In this article the reader is introduced to some of the basic principles of radar. Two simple systems are briefly discussed along with the simple operational requirements of a ground-based radar capable of tracking aircraft. Later articles will develop the theory and practice further.

John Bell

Radar is the name given to a system which uses electromagnetic waves to locate, track, detect and perhaps identify objects. In everyday life radar is used by the police to determine the speed of cars, to estimate the height, position and speed of aircraft and as a navigational aid. Scientists have used radar to assist in plotting the surface of the moon while the Military use it for detecting hostile threats and directing the operations of weapons systems. Radar is an extension of human senses: it can do things which the eye cannot do (for instance to "see" in the dark) but it is unable to resolve fine detail and colour. There are several types of radar but they all effectively stem from the concepts involved in "Radio Detection And Ranging" from where the word was coined during World War II.

Early history

The pioneers of radio communication realised that radio waves were being reflected by certain classes of objects whose physical dimensions were comparable with, or greater than, the wavelength of the incident electromagnetic wave. Heinrich Hertz, the discoverer of radio waves, established in 1886 that radio waves have identical optical properties to those of light waves. In 1904, a German engineer, Christian Hulsmeyer, proposed a rudimentary collision avoidance system for ships at sea, whilst in 1922 Guglielmo Marconi proposed an angle-only system for the same purpose. However, in the absence of the appropriate technology to implement these ideas very little was done until pulsed radio waves were used to investigate the ionosphere in the UK and USA during the 1920s. In the 1930s the development of various forms of aircraft radio detection, location, ranging and navigation systems was spurred on by military interests in Germany, the UK and the USA. Indeed, by the end of 1938, Britain had a network of five Chain Home radar stations operating to detect aircraft in the SE approaches to London and the southern counties: on the other hand Germany entered the war with gun laying radar fitted to the battleship *Graf Spee* and navigational aids to assist their bombers to pinpoint their targets.

The conclusion of World War II saw the UK, the USA and other countries in possession of reasonably sophisticated radar systems developed for military applications. Furthermore, there had been a plethora of associated developments in radio communications, electronics, automatic control systems, components and so on which, in general, became available to post-war industry. Thus, since 1945, there have been significant developments in radar enabling it to support commercial interests including the navigation and control of ships and aircraft whilst the military have pursued its development especially in the fields of target detection and location and automatic weapons control.

Understanding radar systems

Radar systems are designed to meet specific civilian, commercial, scientific or military requirements. Most of the technologies involved are those commonly available from radio communication, electronics and electrical engineering. It is the application and operation of these technologies which sets radar apart as a different discipline. For instance the static antenna used in most communication networks may need to be replaced by a rotating multi-beam antenna or by a small dish carried by an aircraft or missile, which may look for and then lock-on to a specific target.

Radar thus requires knowledge of a wide range of supporting technologies. Indeed, several years of study could well be involved if in-depth knowledge is required. However, if we restrict ourselves to the basics and avoid too much technical detail, mathematics and explanations we can de-mystify the subject. In this and following articles some of the basic technologies involved will be considered and how these may be used to meet common-sense operational requirements. This practical approach will give an overall view of the technologies involved to meet real life requirements.

It is quite impractical to go into too much technical detail as whole books have been writing on specific building block and aspects of radar systems. After World War II The Massachusetts Institute of Technology were responsible for preparing The Radiation Laboratory Series of 28 volumes for publication by McGraw-Hill which summarised war-time developments. Many, many books have been written

since. In this series of articles it will be necessary to keep topics both simple and selective. For those would would like to pursue the subject further a bibliography will be provided at the conclusion of this series of articles.

Radar and human vision

The human eye is capable of resolving extremely fine detail in colour under favourable conditions and furthermore the brain is able to process the information in quite an extra-ordinary fashion. Together they identify much of the world around us, recognise which objects are moving or are still, where things are and what action, if necessary, needs to be taken by the person concerned. In short the eye-brain combination enable us to survive, navigate and exercise some sort of control resulting from events occurring around us. Under certain conditions such as insufficient light, the obscuration of the object(s) being observed, too many events taking place in too short a time, too great a range in relation to the object size, etc, the performance of the human eye-brain combination may be severely limited.

Radar is able to perform measurements and extract particular types of data from targets at greater distances than the unaided human eye and its performance is largely independent of light and weather conditions. If objects can be observed their positions and rates of change of position may be measured and displayed by electronic means or used to control some type of reactive system.

Because the wavelengths employed are typically in the range of 3 to 10cm a radar system is unable to resolve as fine a detail as the human eye. Although the wavelength of visible light lies within the range 4 to 7.5 x 10^{-7}m the resolving power of the eye is limited by the number of receptors on the retina; nevertheless its fundamental resolving power is many times greater than even the latest milli-metric radar. Note that these statements relate resolution to wavelength. Both the performance of the human eye and radar systems may be enhanced by using appropriate optical or other techniques which may favour one system over the other under given sets of conditions.

Basic types of radar

Broadly speaking radar systems may be divided into two categories, namely those which transmit a continuous carrier wave CW and those which transmit bursts of CW, the so-called pulse radar. As will be seen later most radars employ some form of modulation to their CW. For a start two straightforward examples will suffice to explain the principles.

CW radar

A simple version of CW radar is used by the Police to determine the speed of cars. This is based on the fact that if a source of oscillation moves towards or away from an observer there will be an apparent change in frequency. (This is the old steam-train whistle effect where the frequency of the whistle appears to be higher as the engine approaches the onlookers on a station platform, only to apparently drop in frequency as the engine races past.) This is the Doppler effect which is illustrated in Figure 1 for speed detecting radar. In this case a beam of known frequency is directed at the car (or aircraft) and the reflected frequency, which now includes a Doppler shift, is accepted by the receiver networks; the difference in frequency is then used to calculate the approach speed of the target relative to the observer using the relationship:

$$v = \frac{f_d c}{2f} \quad \text{..... (1)}$$

where c = speed of light (300,000,000 m/s)
v = target speed
f_d = shift in frequency Hz
f = transmitter frequency Hz

In a practical situation there will be an angle between the radar beam and the oncoming target: in this case the equation will need to be modified by dividing the result by the cosine of the angle. The two in the denominator occurs because there is a two way path of electromagnetic energy involved, that is, the transmitted energy is reflected back over the same disance so doubling the frequency change compared with the more simple steam train whistle effect. There are, of course, variation to the simple concept illustrated in Figure 1: there are many models of radar systems for detecting the speed of vehicles and the circuits must be designed to cater for the desired operational requirements.

Basic pulse radar

The very basic operation of a pulse radar

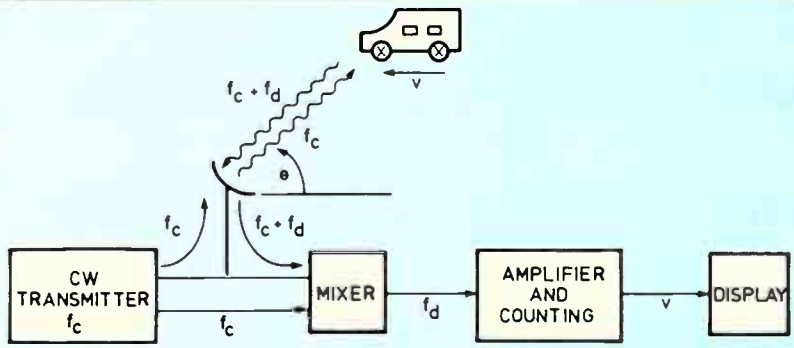


Figure 1. *Roadside radar uses the Doppler effect to measure the speed of vehicles. The effect of the on-coming vehicle is to increase the received frequency by f_d which allows the speed of the vehicle to be determined. The mixer removes the f_c term which leaves f_d, the Doppler shift which is then amplified, counted and processed to display 'v', the vehicle speed. If the vehicle were travelling away from the radar the returned frequency would be diminished by the Doppler shift. A correction factor must be applied to compensate for the radar-to-vehicle angle. With the simple circuit shown the mixer effectively removes the sign of f_d so that if the direction of vehicle travel is required a more complex mixer, which enables phase comparisons to be made,is normally used.*

is illustrated in Figure 2. As with most radars, a common antenna system is used for both transmit and receive modes with precautions being taken to ensure that unwanted transmitter energy is not injected into the receiver circuits.

The radar transmitter emits short bursts of carrier wave which are then reflected by the target. Under appropriate conditions the antenna receives enough reflected energy for in-built processing circuits to measure (and perhaps display) the time difference between the transmitted and received pulses.

The simple A-scope display shown in Figure 2 enables the time between the transmitted and received echo pulses to be measured: the distance from the radar antenna to the target is then known because electromagnetic waves travel at the speed of light. In an operational situation such a display would probably be calibrated in terms of range.

The range, in metres may be calculated from

$$R = \frac{ct}{2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where 't' is the time delay and 'c' is the speed of light. The factor 2 must be introduced because the pulse must travel out to the target and return over the same effective path. Radar engineers often use the following expression to calculate target range:

$$R\,(km) = 0.15t\,(\mu s) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

or use the fact that each one micro-second of round trip corresponds to 150m.

In the case where a rotating antenna is used the pointing angle can be synchronised with an appropriate oscillographic display to give aircraft direction and range. This is the plan position indicator (PPI) which is most useful when it is desired to monitor the position of multiple targets such as aircraft in the vicinity of an airport or ships near to, or in, harbour. Other display arrangemens are used according to the operational requirements; for instance, the A-scope presentation may be quite adequate where an aircraft is just equipped with forward looking radar.

The basic functions of a pulse radar system are outlined in Figure 2. The transmitter, which could use a Magnetron tuned to about 36 Hz, is pulsed at regular intervals at about 250 pulses per second (pps). Because the transmitted pulse would grossly overload the receiver circuits (and perhaps burn them out), a special transmit-receive (TR) cell is used, often called a duplexer, to prevent the transmitter pulse from entering the receiver system. The time of the transmitted pulse must be stored because it is the time difference between the out-going and received pulses which enables the target range to be calculated. Upon receipt of the echo pulse low-noise rf amplification is used prior to converting the signal down to an intermediate frequency (IF) using a local oscillator. This is the so-called first-detector of the normal superhetrodyne system. IF amplification is then followed by detection (the second detector) to obtain a video pulse which can then be displayed.

In practice the circuitry associated with even simple radar systems as described above can become quite complex. At this stage only the fundamental concepts have been outlined; other factors, some of which will now be discussed, will lead to more complex circuitry.

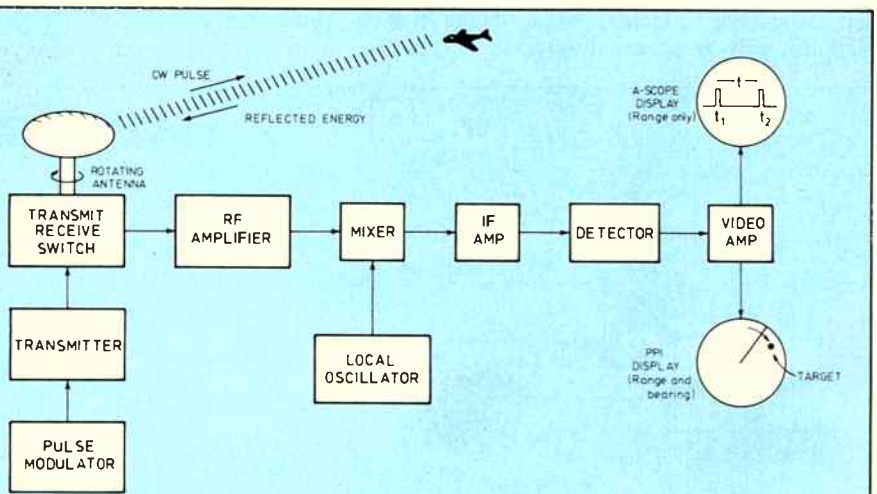


Figure 2. *The basic operation of a simple pulse radar is shown above. Bursts of electromagnetic energy are transmitted from a rotating antenna which, when pointing at the aircraft, will receive reflected pulses. The received pulses are processed in a wide-band superhetrodyne receiver. For any pair of received pulses the times t_1 and t_2 are known and thus, knowing light travels at 300,000,000 m/s, the time delay ($t_2 - t_1$) allows the range to be calculated. If the antenna pointing position is coupled into a CRO a Plan-position-indicator (PPI) display will give both target range and bearing.*

Comparison and requirements of systems

Let us now briefly compare the simple Doppler CW and Pulse CW systems described so far and then compare both with the requirements of the real world. It would also be useful to evaluate their performances in the three dimensional world; that is, in tracking aircraft.

For a start the simple Doppler system described only gives target speed and, with minor modification, the direction of travel: it does not give angular direction or range from the radar. On the other hand the simple pulse system described gives angular direction and range but not target speed. Neither system establishes aircraft height or identifies the aircraft uniquely. In short, both simple systems described are only able to perform a limited range of functions. Of course, in certain cases such as roadside radar, such elementary functions are quite acceptable but in more complex environments, typically associated with aircraft, ships, navigation and weapons systems more useable data is required.

Clutter

Because electromagnetic waves are reflected from most classes of objects the simple pulse radar system will pick up signals from stationary as well as moving targets. If a radar system is to be used as a mapping aid, as is done in certain types of aircraft navigation systems for instance, this is what is wanted. On the other hand, if the radar is being used to track moving targets such unwanted returns may well obscure the target(s) of interest. These unwanted returns are known as clutter and special techniques are used to avoid the problem.

In the next article radar systems will be discussed in a little more depth and some of the techniques used to realise practical systems will be explained. ●

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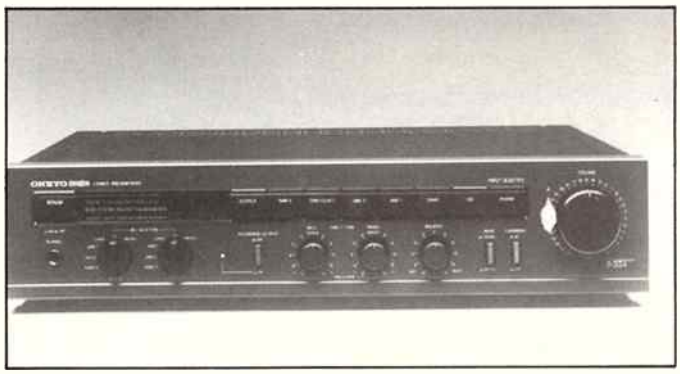
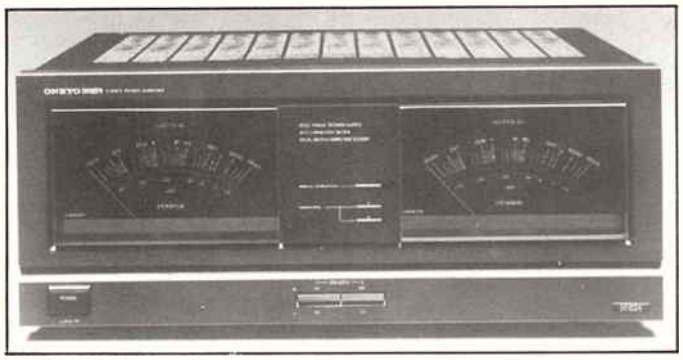


a. The P304 PRE AMP



b. The M504 Power AMP

P304 And M504 — New Separates From Onkyo

The P304 Pre-amp and the M504 Power Amp are the latest additions in the Onkyo Integra Range. These two new products are the successors to the P3033 and M5033 amplifiers and have been released in Australia by Hi-Phon Distributors Pty Ltd.

As members of the Integra family, the P304 and M504 have been designed with real phase circuitry. This includes an additional real phase transformer in the power supply circuits of both channels, resulting in enhanced sound reproduction especially when using high quality speaker systems. The design of the front panels has been upgraded, bringing them in line with all other Integra components.

In addition to the features of the P3033, the P304 offers a further line and tape input (bringing the total number of inputs up to 7) and an additional tape record selection switch.

The M504 offers an increase in output from 100 watts per channel to 165 watts and still has the ability to drive low impendance speaker loads right down to 2 Ohms. All other design features of the M3033 have been retained, including dual mono construction, linear switching for waveform linearity, high speed peak power meters and a four-way switching system for two pairs of speaker outputs.

Cesa Hi-Fi Grand Prix Awards

Entries are now open to all manufacturers and distributors of hi-fi audio products for the 4th Annual Australian Grand Prix Awards.

The Hi-fi Grand Prix Awards are convened by the hi-fi audio group of CESA (Consumer Electronics Suppliers Association) for the purpose of rewarding and promoting excellence in the design and performance of hi-fi products available to Australian consumers.

An independent panel of judges, experienced in hi-fi and the consumer electronics industry, will assess products in their respective categories and award the winner on its merit. In keeping with their independence, the judges also have the right to reject submitted products which in their opinion do not meet the standards of high fidelity; and if in the judges' opinion, there is no worthy product in a particular category, then no award will be given.

Tomorrow's Images

Pioneer have launched a 'comprehensive' range of laser disc players from the 'robust' LD-V2000 to the 'advanced' LD-V6000A.

Pioneer claim that the LD-V2000 is 'primarily designed for level 1 use'. It boasts high video clarity with 400 lines horizontal resolution. The next unit is the LD-V4200 with a RS-232C port interface. This attachment allows easy connection to a variety of computers and software. Finally there is the 'state-of-the-art' LD-V6000A. Pioneer claims that this machine is 'designed for the most sophisticated, industrial, multi-screen and simulation applications. This player can be purchased at $2,500.

Mr Moroshiro Sato

A New Director

National Panasonic has appointed a new managing director of its Australian Franchise a Mr Moroshiro Sato. Mr Sato comes from National's parent company Matsushita in Osaka.

NAD Amps

If you can describe yourself as a serious audiophile committed to the LP as a source of music then the NAD 1300 preamplifier is, apparently, The device for you.

The 1300 is built around a phono preamp that optimises reproduction of vinyl discs. Input capacitance is user adjustable, and input resistance is extremely high — a FET with exceptional rf immunity.

According to NAD this preamp delivers precise imaging and a 118 dB dynamic range. Added to this are a 'null' test mode, semi-parametric tone controls, and bass equalization. The 1300 also measures 10 to 15 dB quieter than many separate preamp units.

Trackmate

Amaray International, a worldwide leading manufacturer of protective systems for magnetic media, is exhibiting a supposedly state of the art cleaning systems at the Australian hi-fi show in Sydney. It's called Trackmate cleaners.

The new Trackmate cleaning systems are an advanced innovation of American Joe Fritsch. Mr Fritsch will visit Australia for the duration of the Show.

At the heart of Trackmate is the use of highly absorbent brushes for cleaning. Unlike felt or tape, brushes are ideally suited to clean irregular surfaces and grooves (whether your teeth or a cassette deck). Absorbent brush filaments carry solvent to the dirt, dissolve the dirt, and capillary action draws the contamination back into the brush. A second breakthrough was the development of a felt pen to apply cleaning solution. You no longer need to "overdose", target the drips, or shield the spray.

Trackmate has received strong endorsements from service managers and hardware distributors such as JVC, Selora, Mitsubishi, Toshiba, Telefunken, Phillips.

New Yamaha 'Heart'

Yamaha has released a new 4 channel amplifier which it claims has all the credentials to become the heart of a true entertainment system.

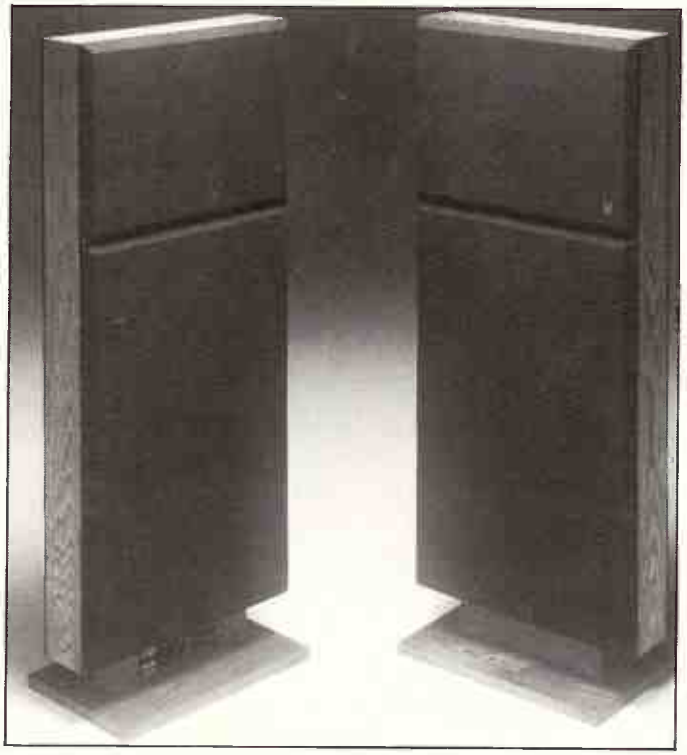
With a total of eight audio input sources and three video inputs, all controllable through a full function cordless remote control, the AVC-30 apparently allows 'a degree of multi-component integration only matched by expensive professional A/V mixing equipment'. The four channel drive of the AVC-30 allows both Dolby Surround and Yamaha Natural Surround.

Effectively, the AVC-30 functions like two amplifiers in one with 100W per channel RMS available to drive a primary front pair and a separate 20W per channel to drive a rear pair of speakers.

The AVC-30s multiple inputs are the key to its role as the 'heart' of a total entertainment system. The three inputs can, for example, allow two hi-fi stereo VCRs and a video disc player to be connected.

The eight audio inputs mean that a CD player, turntable, two tape decks, a tuner, and another VCR or video disc player can be accessed at the push of a pad on the RS-AVC30 infra red remote control. Even volume can be controlled, with the volume control actually moving remotely, while an LED display allows you to see the setting from across the room.

If nothing else, the Yamaha will have armchair appeal to less energetic enthusiasts!

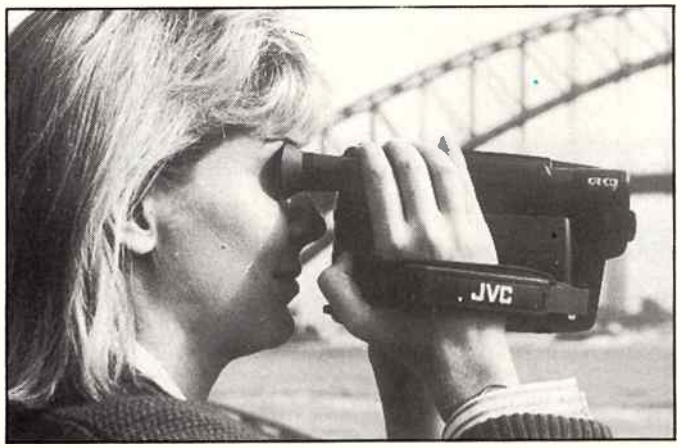


BES Hemispherics

The Odyl Group have become the exclusive distributors for the products of Bertagni Electroacoustics Systems (BES) of America.

BES produce a wide range of equipment for both commercial and domestic use. In the former category is the range of BES Omnidirectional Ceiling speakers. One of the most prominent of these is the C70D. This unit has a frequency response of 40 Hz — 19 kHz (± 3 dB). Its sensitivity is 92 dB SPL at 1 metre with a one watt input, and 70 dB SPL at 15 feet. The dispersion of the C70D is 180 degrees horizontal and vertical.

In the domestic field the main BES range consists of the SM 300, the SM 280, SM 275, SM 255 Mk 11 sM 100, SM 80 and SM 90. The most striking thing about these particular speakers is that one of them is more than 48 cm wide. The drivers attach directly to a polymer diaphram stretched over the frame of the speakers. The effective area of the speakers is thus measured in square metres rather than square cms as with conventional speakers. They also disperse sound front and back. BES claim that this design is 'more efficient' than other types. According to their research 'greater moving surface means greater ability to turn electrical impulses from the amplifer into sound waves'. Whatever the truth of this claim the BES range is certainly unique.



Advancing Video

JVC claim to have produced the "smallest VHS recorder in the world". Known as the GR-C9EA the new unit retails at $2099. As with all VHS recorders JVC claim that this unit is 'stylish' in design and is ideal 'for amateurs and professionals'.

JVC claims a number of 'unique features for its unit including a 10-Lux low light sensitivity', a 'unique battery grip and single switch operation of lens shutter and power'. R.I. 120

Scan Kits

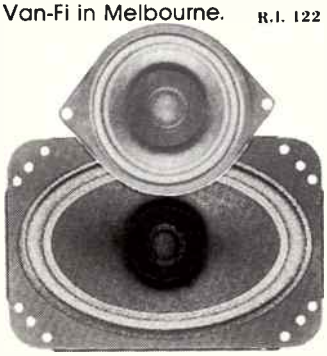
Scan speakers have produced two new kit speakers the Scanspeak 200 and the Scanspeak 300. The first is priced to sell at $800 and the second $1399. You will also need a good soldering iron.

The 200 provides a frequency response of 50 Hz to 20 kHz plus or minus 3 dB. The sensitivity is set at 89 dB for one metre from an input of 1 watt. The crossover network is designed simply with 12 dB cutoff slopes. The cabinets have a 40 metre capacity which makes for a big set of speakers. R.I. 121

Jensen Developments

Jensen of the US, "spurred by the growing demand for the JXL line of car stereo receivers" had released four new speakers onto the market.

These are the 6' x 9' JXL 693 Triax, 6.5' JXL 653 Triax, 4.5' JXL 452 Coax and 4' JXL 401. Top of the range is the JXL 693 which offers a frequency response of 40 Hz to 26 kHz, sensitivity of 93 dB SPL and impedience of 4 Ohms. The JXL 401 on the other hand will give the enthusiast a frequency response of 70 Hz to 21 kHz, a sensitivity of 93 dB SPL and impediance of 4 Ohms. Jensen tell us that all of these units are compact disc ready. These products can be obtained through Van-Fi in Melbourne. R.I. 122



Domestic Disc Jockey

The CDP-10 is the name Sony Australia has given to its new compact disc player. It is a development of its Disc Jockey technology in which the player was mounted in the boot of a car. Sony claims that 'the release of this unit graphically illustrates the nature of CD technology and its seemingly endless applications'.

The new unit has a built-in changer for the 10 compact disc magazine. When loaded the magazine and changer will give 10 hours of CD music. The device will sell for $1,599.00

Japanese Recognise Audio Excellence From Tannoy

Tannoy, a British manufacturer of speaker systems, has been awarded the Japanese Golden Sound Award for a second time. Tannoy is the only manufacturer to have won the prestigious award from the Japanese audio industry more than once.

The award, initiated in 1982, is judged by a panel of independent reviewers throughout Japan. Tannoy first won the award in 1982 with its Westminster speaker and was honoured again with the 1986 award for its RHR SPECIAL loudspeaker. Norman Crocker, Tannoy Chairman, recently reviewed the award at a presentation ceremony held in Tokyo.

Tannoy have been successfully exporting high quality products to Japan for 25 years and are the largest European importer of domestic hi-fi loudspeakers to Japan. Tannoy are also noted for their public address systems which they export worldwide.

Norman Crocker, the chairman of Tannoy, receives the Golden Sound award.

READER INFO No. 15

New Tape

Some time ago TDK set its engineers the goal of producing a high density recording tape that possessed both 'high coercivity and a high resistance to wear'. The results of their labours led to the recent release of a new range of audio tapes called the SF range. It includes two metal, three High position or type II and three Normal position or type I tapes.

The new tapes make extensive use of Avilyn which consists of a combination of ferric oxide with cobalt. The SF tapes are claimed to be extremely quiet. TDK claim a bias noise figure of 61 dB'.

Jansson of Denmark

This Danish company claims that it is introducing "The New Standard Units Hi-Fidelity Sound". It offers a range of systems from the Jansson Concerto 2000, which features a 100 watt RMS amplifier, a digitally synthesised AM/FM stereo tuner and a host of other features, to the Jansson Concerto 3000 which offers even more.

The amplifier is rated at 200 watts RMS, the cassette deck has Dolby C and D as well as metal tape facility, and the tumtable comes with the Ortophon OMP 30 cartridge as standard. There is even a spare cartridge for non critical listening such as at parties. Compact disc players and graphic equalisers are optional.

The world's greatest electronic show happens but once a year

It's on again in Perth

THE ANNUAL Perth International Electronics Show occupies a curious place in the pantheon of such consumer electronic marketing affairs.

Its organisers, the West Australian Consumer Electrical & Electronics Assoc Inc, bill the event at Perth's Claremont Showgrounds as the biggest electronics show in the country.

Definitions

Certainly with 218 companies represented at the last show and just short of 94,000 visitors, including both consumers and trade representatives, the show is a big event on any electronic-buff's calendar.

The organisers also say that similar shows organised in the east have failed to get off the ground.

The IREECON show in Sydney is thought to be larger, but it is different being more concerned with radio and TV products.

As the Perth show is a mixture of consumer and trade, with a number of peripheral products like cameras tacked on, the organisers lay claim to the show being the biggest "consumer electronics and homeware exhibition Australia and South East Asia has ever seen".

In fact,the show is usually placed about fourth in the electronics show line up.

This year the show, to run from July 29 to August 2, has the usual mix of trade and consumer products — the main emphasis being on the consumer products — with the stands covering about 10,000 square metres of exhibition space over 10 pavilions.

One of the major traditional exhibitors at the show is Yamaha, and with 1987 being the Japanese electronic giant's centenary year the company has booked one of the biggest stands to show only a few selected products.

Although the much-awaited Digital Audio Tapes are not among the selected products, there will still be plenty to keep the audio buff happy.

Digital Processors

The most unusual of the offerings will be the Digital Sound Field Processor (DSP-1). Released only this year the $1500 (recommended retail) unit has been designed to re-create the sound and feeling of a live venue.

Connected to an existing hi-fi system through a four-channel amplifier, the DSP-1 generates the acoustic pattern of reverberation and echo felt at live performances.

Yamaha's engineers went to a great deal of trouble digitally recording the acoustic performance of a series of auditoriums, ranging from major European concert halls to intimate jazz clubs and large rock concerts.

Using powerful computers they analysed the results to design the DSP-1. The unit has 16 standard venues, although almost any variation can be programmed.

Ideally it should be used with six speakers (two main and four "presence" speakers) but it can use four.

Another new release to find its way onto the Perth show's stands is the AVC-30 Natural Sound Stereo Amplifier, which can handle both audio and video imputs.

Yamaha's press blurb says the four-channel AVC-30 makes a normal VCR sound like a Hi Fi VCR and a normal mono TV perform like a stereo TV, while stereo sound from either a VCR or a TV receiver can be further improved.

Hype aside, the unit functions like two amplifiers in one with 100 watts per channel RMS available to drive a primary front pair of speakers, and a separate 20 watts per channel to drive a rear pair.

But more importantly, the AVC-30 has eight audio input sources and three video inputs, which can be controlled through a cordless remote control. These eight inputs mean that a CD player, turntable, two tape decks, a tuner and another VCR or video disc player can be accessed through the unit at the push of a remote-control button.

The unit has a recommended retail price of around $900.

Apart from those two unis, the show-

piece of the Yamaha stand will be the company's 1000 series products, including the CX-1000 Digital Control Amplifier, the MX-1000 Power Amplifier, CDX-1000 Compact Disc Player, and the NSX-1000 speaker system.

Sony's Display

Another big exhibitor, although with a reduced presence from last year, is another Japanese electronics giant, Sony.

This year, Sony has several new products to offer the gadget-hungry, with the most interesting to the audio buff being a compact disc unit for cars. The CDX-J10, which can be combined with the XT-10 Tuner system to make a complete radio-CD unit, is reportedly vibration and heat-proof. As a result, says a Sony spokesman, the unit can be used in buses, boats, or even airplanes.

A major feature of the unit is a magazine that can hold up to 10 CDs (one magazine is provided with each unit but more can be bought), and due to the usual sophisticated electronics the user can randomly select any track on any disc. The unit can also be programmed to play a selection chosen from any of the discs in the magazine.

Another feature of the CDX-J10 is that all components such as the power amplifier, tuner and the main unit can be mounted in the trunk and controlled through a small, remote commander unit, mounted on the dash.

Among the other, now almost endless, CD player offerings is Sony's portable CD player, or Discman. Just short of two centimetres thick and weighing only 430 grams, the Discman has most of the features of a regular CD plus rechargable batteries and a key-hold switch that ensures the function keys are not affected by an accidental bump or jar.

Other Sony products to be display include the CCD-V30 hand-held video recorder, the Watchcam security system and its Trinitron flatter TV screen.

Western Australian Electronics

Apart from Sony and Yamaha most of the other overseas distributors are represented at the show, with Akai, JVC, and Panasonic all major exhibitors.

However, the Australian electronics firms, including a surprisingly active WA electronics manufacturing industry, will also be at the show in force.

The main focus for the local industry is the Electronics Industry Association of WA (EIA), which this year has taken a pavilion just inside the main entrance to the showground. A complete pavilion, featuring 17 companies exhibiting anything from satellite communication equipment to energy management control systems, is a major step forward for the association.

Last year a corporate sponsor, Parry Corporation, helped out by occupying the centre stalls. This year Parry Corporation is still represented but only through its associated company ICOM, which specialises in satellite communication gear.

Apart from displays by some local trade manufacturers including Jemal Products, which specialises in printed circuits and assembly work, there are some innovative consumer products to be found in the WA EIA pavilion.

One such on the Beaver Corp stand is a digital diary, a device designed to log mileage from a car speedo cable. The user can indicate whether the trip is business or private and the result is a log of the car's mileage which can be sent to the taxation department.

Among its trade products, Jemal has a membrane touch switch, which has been on the market for about 18 months.

The surface layer is polycarbonate material which is reverse printed with the various touch switches required. Those switches are separated from the second set of electrical contacts by a specially-designed polyester spacer layer.

That spacer layer keeps the two outer layers separate normally, but it is also thin and porous enough so that when the outer layer is pressed, an electrical contact is created.

Among the other local exhibitors are W. J. Moncrieff, Professional Technology and Perth Communications.

Overall, the EIA pavilion has rather more trade exhibitors than the rest of the show, but still has the attractive blend of trade and consumer products that characterises Perth's annual function — the same blend that has attracted enough visitors to the show in recent years to ensure it remains extremely successful.

Mark Lawson

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Telecom Australia

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BUYERS GUIDE TO CELLULAR RADIO

Cellular radio has now reached most cities in Australia. Telecom claims that the new service is the greatest thing since Alexander Bell spilled acid on his trousers. By now most of us are aware how the new system works and its immense flexibility. What we may not know, however, is the cost of the new machines. Therefore, true to its tradition of turning night into day, ETI gives you the most comprehensive buyers guide to cellular telephones published anywhere in the world.

Manufacturer	*Model*	*Country of origin*	*Distributor*	*Price*	*Warranty*	*Size*	*Weight*	*rf power (watts)*	*Sensitivity*	*Portable*	*Hands Free*	*Digits on Display*	*Keys on Pad*	*Lock*	*Call Charging*	*Memories*	*Horn Alarm*	*Scratch Pad*	*Date Facility*	*Battery Life*
Audiovox	BC 40	USA	Pulon Holdin	3250	36	30 x 200 x 160	1.6	3	-116	n	Y	10	18	Y	Y	30	n	n	n	na
General	CF 1000	USA	Nomad	3070	12	20 x 228 x 40	2.2	3	-116	Y	Y	8	18	Y	n	10	n	n	n	na
Mitsubishi	mobile	Japan	Mitsubishi	4000	12	80 x 200 x 80	3	3	-115	Y	Y	32	23	Y	Y	100	Y	Y	Y	24
Mobiltronics	Walkabout PX 105A	Japan	Telecom	4250	12	83 x 209 x 34	0.87	0.	-116	Y	Y	10	20	Y	Y	30	n	n	n	8
NEC	Attache	UK	Mobiltronics	5500	12	30 x 185 x 75	5.3	3	-69	Y	Y	32	20	Y	Y	99	n	n	n	6
NEC	Neccel 2E	Japan	Telecom	3600	12	60 x 225 x 240	2	3	-116	Y	Y	16	21	Y	Y	16	Y	Y	Y	10
Novatel	390	Canada	NEC	2880	12	57 x 188 x 231	2.3	3	-116	n	Y	10	18	Y	Y	16	Y	Y	Y	na
Philips	Traveller	Australia	Air Int'n'l	3652	36	51 x 160 x 178	1.87	3	-116	Y	Y	24	21	Y	Y	50	Y	Y	Y	6
Racal	CAL 300	Japan	Telecom	2950	12			3	-116	n	Y	16	18	Y	Y	60	Y	Y	Y	
Racal	CDL 450	Japan	Advanced Com	5500	12	46 x 191 x 83	7.5	3	-116	Y	n	10		Y	Y	1	n	n	n	7
Racal	CDL 410	Japan	Advanced Com	4700	36	90 x 479 x 350	1.4	3	-116	Y	Y	14	18	Y	Y	1	Y	Y	Y	7
Racal	CDL440	Japan	Advanced Com	3500	36	55 x 210 x 70		3	-116	Y	Y	14	18	Y	n	100	Y	Y	Y	7
		Japan	Advanced Com	4600	36	250 x 295 x 110	1.4	3	-116	Y	Y	14	18	Y	Y	100	Y	Y	Y	7

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Thai Airways International 747

Siam Bayshore Resort Hotel is on the farthest tip of South Pattaya's beachfront, close to Pattaya village. Tennis lessons are available, as well as many watersports. With three restaurants, two bars and a nightclub, the Siam Bayshore Resort Hotel has all the charm and hospitality you could wish for.

Mandarin Hotel is a first class hotel conveniently located in the city centre, with beautifully appointed rooms decorated in Thai silk and cottons. There are three bars and nightspots to suit your mood. An excellent restaurant, 24 hour coffee shop, pool with sundeck and 24 hour room service.

The Grand Palace, Bangkok. Former Royal residence unequalled in the world for its ornate architecture. ". . . One of the most beautiful places on earth and home of the most revered Emerald Buddha — carved from a solid piece of jade."

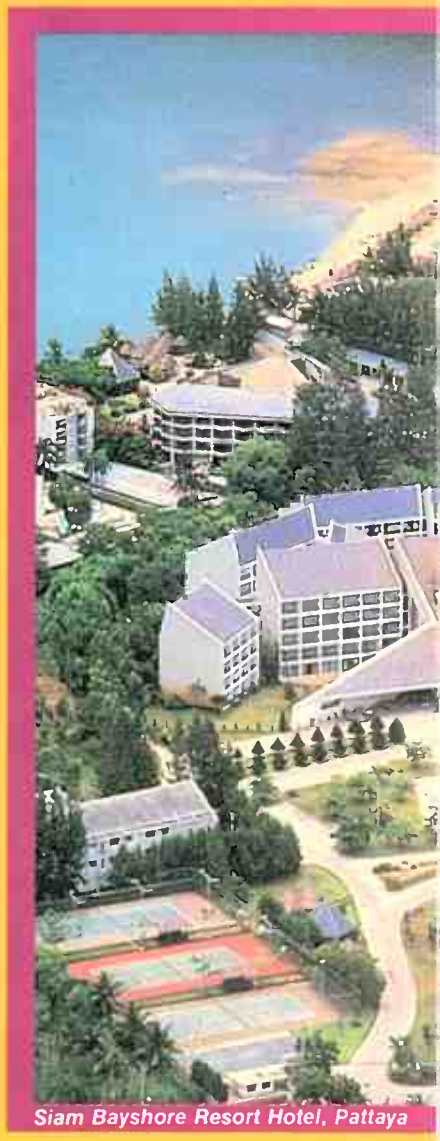
Thai food — a spicy tale. You must try Thai food. It will be on the menu in at least one of the restaurants in your hotel. Enormous amounts of time, patience and talent go into the preparation of traditional Thai dishes.

Shopping — a pleasant surprise. The shopping is really great, and excellent value. You can have clothes made to measure, or pick up sophisticated fashions in some of the ultra-modern department stores, boutiques and shopping squares.

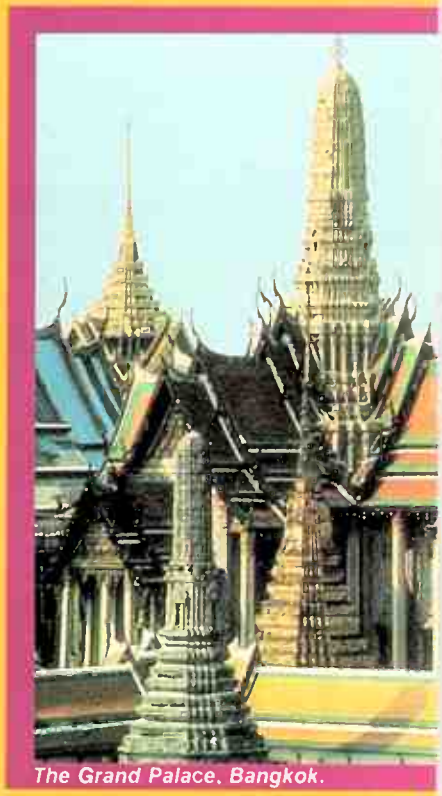
There's a promise of marvellous food inflight, including some taste-tingling Thai delicacies, free drinks, free stereo headsets, first run moves and individual attention to your comfort and enjoyment. The Thai people consider friendliness, good manners, courtesy and hospitality essential to their daily lives. And nowhere are the unique characteristics of a country more evident than on Thai, the National Airline of Thailand.

The Chao Phya River is Thailand's lifeline. It's worth an hour or so just to watch the endless procession of water traffic — heavily laden barges, the ubiquitous long-tail boats, commuter boats and pleasure craft. Across the river is the Temple of Dawn, with its intricate mosaics of antique Chinese porcelain. And one of the most enjoyable features of a visit to Thailand is the genuine friendliness of the Thai people. No wonder they call it the Land of Smiles.

Transfers on your trip will be courtesy of World Travel Service



Siam Bayshore Resort Hotel, Pattaya



The Grand Palace, Bangkok.

The Grill Room, Mandarin Hotel, Bangkok.

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Thai

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The Floating Markets

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2. South Australian residents need not purchase a subscription to enter, but may enter once only by submitting their name, address and hand-drawn facsimile of the subscription coupon to The Federal Publishing Company, PO Box 227, Waterloo, NSW 2017.
3. Prizes are not transferable or exchangeable and may not be converted into cash.
4. The judges decision is final and no correspondence will be entered into.
5. Description of the competition and instructions on how to enter, form a part of the competition conditions.
6. The Competition commences on July 1, 1987, and closes on August 31, 1987. The draw will take place in Sydney on September 3, 1987 and the winner will be notified by telephone and letter. The winner will also be announced in The Australian on September 7, 1987, and a later issue of this magazine.
7. The prize is: A return trip for two people flying Thai Airlines economy class Bangkok with 8 days and 6 nights accommodation. Breakfast, one set of transfers to and from the International Airport in Bangkok and your hotel are included.
8. Passports, visas, insurance, departure taxes, transportation between any other destination, immmigration formalities, transfers to the nearest Thai Airlines International departure Airport, are the responsiblity of the winner. The promoter accepts no responsiblity for any delay, cancellation, accident, personal or property damage arising from and/or in connection with the travel prize.
9. Entrants under the age of 18 years will be required to nominate a guardian to accompany them on the journey should they win.
10. The winner and their companion agree to abide by the booking conditions as laid out in the Royal Orchid Holiday Brochure. All travel must be completed by September 3, 1988.
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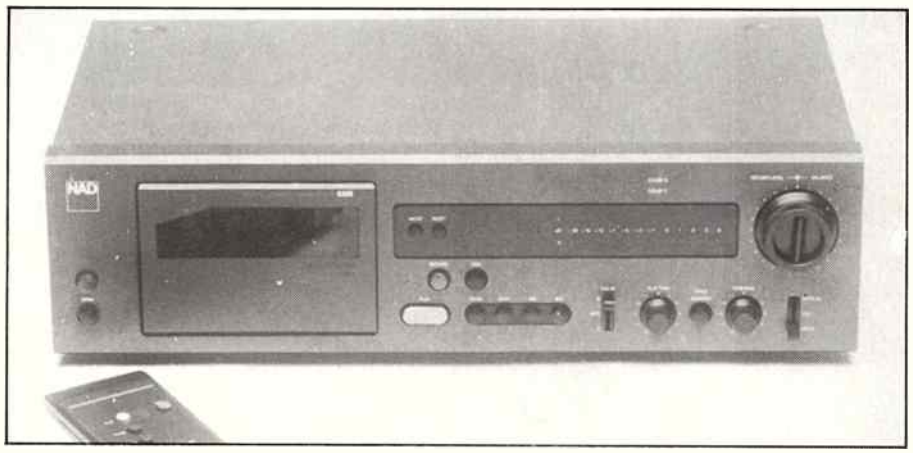
FREE BONUS GIFT!

This leatherette TRAVEL ALARM CLOCK is the ideal companion for any traveller. The LCD readout gives the time and date, along with an effective alarm. Lightweight and compact, the alarm folds away for use in a briefcase or handbag. The gold-colour corner trim and face give a stylish finish.

(Free gift is forwarded under separate cover.)

Louis Challis looks at the NAD 6300, and finds it fancy, but not flash.

Five features in a good box



SINCE THIS BRITISH company was founded NAD had tended to assume a low marketing profile. However over the last year, I and other reviewers, have noted a change in their marketing philosophy. Nowhere is this more evident than in the underlying design philosophy of their latest compact cassete recorder, the NAD 6300.

At a time when most of the other manufacturers are tneding to stress operational simplicity and brash visual impact, NAD are stressing visual simplicity and operational complexity. The NAD 6300 comes with some revolutionary design advances, all of which have been developed by other companies in America, Denmark, Norway and Japan.

Compensated Automobile Reproduction (or CAR for short) is the most interesting design feature of this cassette recorder.

This is a circuit that provides both conventional dynamic compression characteristics and supplements these by a low level 'loudness boost'. This solves one of the most obvious problems when attempting to listen to pre-recorded programme content in a car, bus or commercial vehicle — which is that soft passages and bass notes disappear into the mud.

The second attractive feature of the NAD 6300 is the incorporation of the *play trim circuit* which was developed by Dolby Laboratories in the USA in collaboration with NAD. The advantage of the 'Play Trim Circuit' is that it provides a simple means of adjusting frequency response so as to compensate for variations in record head azimuth and high frequency losses due to tape saturation. Had this circuitry been incorporated in the playback recorder after the Dolby circuit the result would have been hardly worth the trouble as the Dolby circuitry would have nullified any perceived advantage. Dolby Laboratories realised this and consequently have incorporated the 'Play Trim Circuit' in front of the Dolby noise reduction decoder circuit. The location provides a simple means of 'audibly' adjusting the high frequency equalisation in the octave bands centred on 8 and 16 kHz to ensure optimal sound quality.

The third attractive feature of the NAD 6300 is its incorporation of the HX pro *head room extension* circuit which originated in the Bang & Olufsen Laboratores in Denmark. This particular circuit eliminates the need to have fixed levels of bias, with its consequent risk of 'under bias' or 'over bias' of the signal. The HX Pro-head Room circuit constantly monitors signal level and frequency content during recording. It varies the level of the ultra-sonic bias signal so as to optimise the bias level to suit the presence of the dominant low frequency or dominant high frequency content, whichever is the more significant. Unlike the variable bias controls or adjustment circuits contained in most other notable top of the line cassette recorders like the Nakamichi 'Dragon', the HX Pro Head Room Extension circuit is fully automatic and minimises the need for you to carry out any special function or take any specific precautions.

The fourth interesting feature of the 6300 is its incorporation of the *dyneq* circuitry which was developed by Tanberg of Norway, where dyneq stands for Dynamic Equalisation.

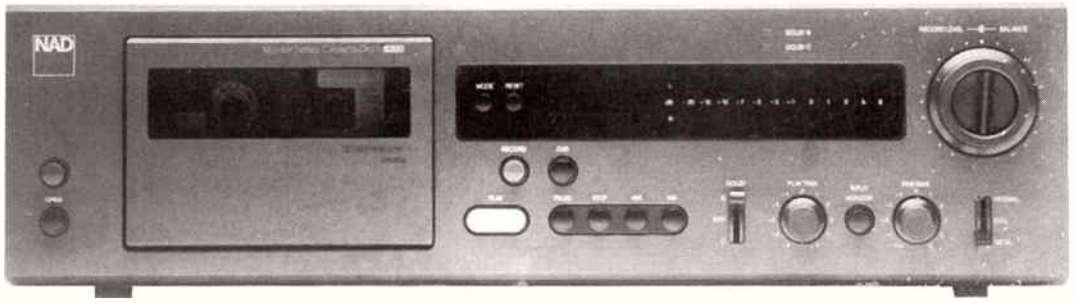
Most circuit designers, as well as many of the purchasers of their equipment, have been disturbed by the strident treble that most cassette recorders produce. It seldom sounds precisely the same as the original recording. Tanberg, the major Norwegian manufacturer of tape recorders overcame this problem by varying the level of equalisation so that at low signal levels the equalisation signal is increased to improve the quality of the recorded high frequency signals, whilst at high signal levels the circuitry reduces the level of equalisation to avoid saturating the signal. The dyneq circuit is also automatic, only operates during the recording process and once again requires no user adjustments.

The fifth feature of the 6300 cassette recorder is its use of a 'non symmetrical dispersed resonance dual capstan tape transport system', which Nakamichi developed in the mid 70's. It's had a dramatic impact on audible wow and flutter since that time. The advantage of this system is that there is no common capstan rotational speed which can give rise to inter-drive resonances, which are so readily converted into an unwanted wow modulation component in your music.

The sixth and best feature is the incorporation of the other five 'avante garde'; features in an inordinantly 'Plain Jane' gray wrapper which is now the hallmark of NAD equipment.

The Box

The front panel of the NAD 6300 fea-



tures a green power ON/OFF button at the left hand end of the panel, immediately above a black OPEN button, which opens up the cassette well. This is an ergonomic mistake. A far greater separation between these two buttons, or better still, an illumination of the power ON/OFF switch would have been far more sensible.

Immediately to the right is the cassette well cover, which incorporates a sensible clear window in the cover through which the tape condition may be viewed. At the right centre of the front panel is a rear illuminated escutcheon with two switches to the left labelled MODE and RESET. MODE toggles the counter between a lapsed time counter mode and a tape and counter mode. The RESET button resets the counter to zero or the time elapsed counter to zero, without affecting the other timing functions.

The counter utilises large and easily read LEDS with 10 mm high numerals, whilst the recording level display incorporates a series of green rectangular bars covering the range −20VU +1VU and amber light emitting diodes for the range +3, and +5VU. The last light emitting diode at +8VU is red and provides suitable warning of potential over modulation. Above the recording display are two recessed light emitting diodes in the front panel, one green to indicate selection of Dolby B, and one amber to indicate the selection of Dolby C. At the right hand end of the front panel is a large recording level control with a cleverly designed recessed balance control neatly protected within the confines of the outer knob. At the centre of the front panel, below the clear escutcheon, is a red RECORDing button and the CAR control. The first in the line of controls below is on elongated white PLAY button together with four small and inconvenient black buttons for PAUSE, FAST FORWARD and FAST REWIND. These controls should really have been colour coded or provided with a slightly wider seperation. The five remaining controls are a toggle switch for DOLBY B, DOLBY C and OFF, a PLAY TRIM control with centre indent and calibration points of +5 to −5, an INPUT MONITOR switch, which allows you to monitor from signal or from tape at the output terminals on the rear of the recorder, a FINE BIAS control with settings of +5 and a tape selector switch for normal, CrO_2 and metal tapes.

The rear of the cabinet has two pairs of colour coded input and output RCA coaxial sockets for left and right channels, a multiplex filter switch which rejects signals above 15 kHz and which would adversely affect the Dolby noise reduction process if recording from an fm receiver or tuner. Much to my surprise this cassette recorder, unlike the other imported cassette recorders on the market, sensibly incorporates an unswitched ac accessory output socket. This would not be unusual in itself if it were not for the fact that this is one of the first pieces of imported equipment which has the socket designed to accept Australian standard mains plugs.

The inside of the unit is rather impressive with one large phenolic mother board at the base of the chassis, six other printed circuit boards of varying sizes, and with appropriate inter-connections by ribbon cable supplemented by a reasonable amount of conventional wiring harnesses to boot. The number of large scale and specially integrated circuits was rather intriguing, one of which, I noted, was unlabelled. Although the printed circuits are phenolic, the masking and protection of the back of each of these boards has been executed to full professional standards and the quality control and finish is by no means cheap. The tape drive in particular is solidly manufactured with a preponderance of metal components to achieve rugged rigidity and durability. The electrical connections of the unit have also been manufactured to comply with the lastest SAA requirements and I gained the impression that this unit has been laid out to achieve simple maintenance or adjustment, as and when required.

Objective Tests

The objective testing was relatively straightforward even though this unit incorporates a large number of unusual circuits. The replay frequency response

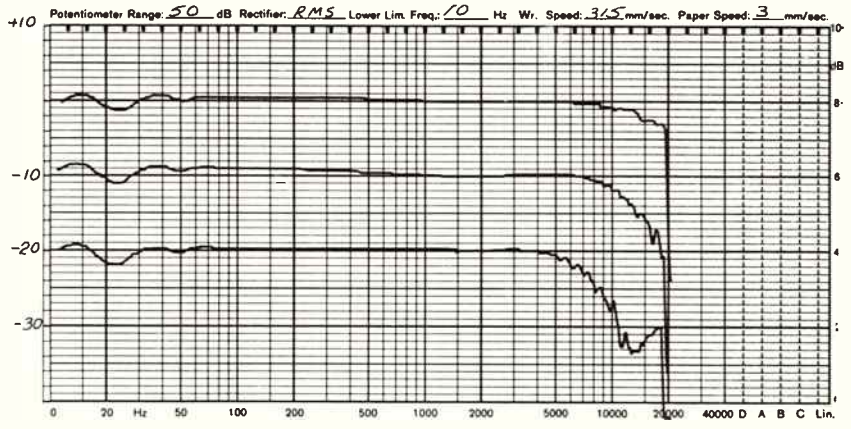


Figure 1: Frequency response. Top is Type 1 reference tape (Maxwell UDXL), centre is Type II (TDK SA) and bottom is Type IV (TDK WA). The traces are offset by 10 dB for the sake of clarity.

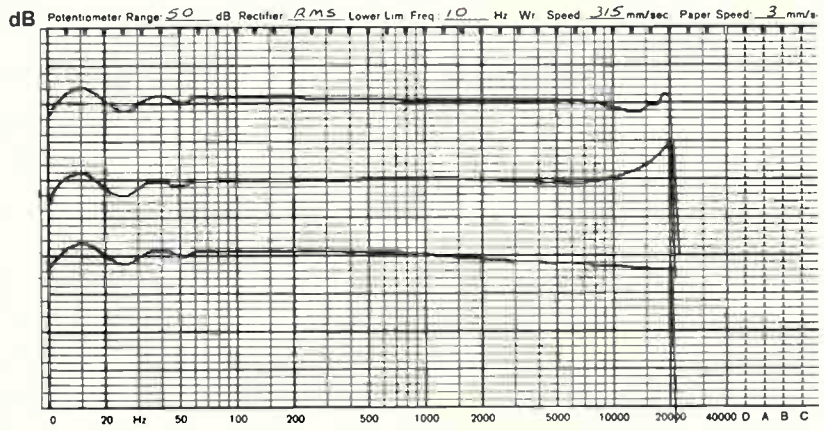


Figure 2: Record to replay reponse at −20 VU. All the traces are displaced for clarity. Top is a Sony HF-S90 (Type I) with Dolby B. Middle is a Denon DX8/60 with normal bias and no Dolby. At the bottom is a Teknics RT 60MK, also with no Dolby and normal bias.

chracteristics of the unit exhibited extremely smooth and unusually flat replay response for all tape types (see figure 1). The drooping high frequency response of the type II and IV tapes are the result of minor differences in azimuth alignment between the original recorders used for the reference tapes and that provided by this cassette recorder. By contrast the record to reply frequency responses at −20VU provided by examples of type I, type II and type IV tapes, without any special adjustment of the controls, are particularly impressive. As you will note from the results these responses are almost ruler flat between 50 Hz and 10 kHz with acceptable equalisation bumps below and meritorious responses above. This particular set of record/replay frequency responses display show the benefits of the Dolby HX Pro and the Dyneq circuitry which shows up to great and unquestioned advantage.

The effects of adjusting the bias control are quite significant and with bias set at centre (normal) and + 5 settings with type I and type II tapes results in fairly substantial differences in recorded linearity, particularly with the maximum bias which results in a rather unhealthy high frequency boost. By contrast reducing the bias to minimum tends to linearise the frequency response at the high frequency end and the typical 2 to 4 dB droop is neither disturbing, nor do I believe unacceptable. The 'Play Trim Circuit' provides a very convenient and effective means of adjusting your high frequency equalisation with typical adjustments amounting to as much as 3 dB over the critical 5 to 12 kHz region, although you have to have good hearing to be able to make full use of its potential.

A one third octave analysis of background noise reveals that the A-weighted

NAD 6300 STEREO CASSETTE RECORDER

Dimensions: 435 mm wide x 120 mm high x 250 mm deep
Weight: 5.9 kilograms
Manufactured by: NAD Electronics in Japan
R.R.P.: $1,299.

signal to noise ratio with Dolby B is 64.5 dB (A) with respect to 0VU and 67.5 with respect to the 3% third harmonic distrotion (at +3VU). The A-weighted signal to noise ratio with Dolby C is a very healthy 72 dB (with respect to 0VU) and is 75 dB(A) with respect to 3% third harmonic distortion level.

The channel separation is 75 dB at 1 kHz which is unusually high (and good) and which then smoothly drops to a figure of −46 dB at 20 kHz.

An unusual and most interesting set of curves is provided by the family of curves produced by the recording of swept frequency signals between 10 Hz and 20 kHz at level settings corresponding to 10 dB steps from 0 to −60 dB with the CAR switch activated during the recording phase (see figure 3). As you will note from the level recordings this results in a set of curves with an unusual mid band compression characteristic for signals lying

MEASURED PERFORMANCE OF NAD
MODEL 6300 CASSETTE RECORDER

Serial No. 70301285B

RECORD TO REPLAY FREQUENCY RESPONSE AT −20VU:

Tape	Dolby	Lower −3 dB Point	Max. Point and Frequency		Upper −3 dB Point
Sony HF-90 "B"	IN	Below 10Hz	+1dB	15Hz	Above 20kHz
Denon DX8/60	OUT	Below 10Hz	+4.5dB*	20kHz	Above 20kHz
Technics RT-60MX	OUT	Below 10Hz	+1,5dB	15Hz	Above 20kHz

* Can be reduced with bias adjustment

SPEED ACCURACY +10%

WOW AND FLUTTER

WOW	Average Less than	0.1% P-P
FLUTTER	Unweighted	0.06% RMS
	Weighted	0.02% RMS

HARMONIC DISTORTION

TAPE: SONY HF-S90

		100Hz	1kHz	6.3kHz
OVU:	2nd	34.6	40.5	546.1
	3rd	40.3	49.7	37.5
	4th	57.4	—	52.5
	5th	—	—	—
	THD	2.1%	1.0%	1.36%
−6VU	2nd	39.1	−50.0	—
	3rd	55.9	−67.3	−49.2
	4th	—	—	−54.2
	5th	—	—	—
	THD	1.12%	0.32%	0.40%

MAXIMUM INPUT LEVEL
(for 3% third harmonic distortion at 333 Hz)

TAPE	SONY HF-S90	+3 VU (INDICATED)
	TECHNICS RT-60MX	+3

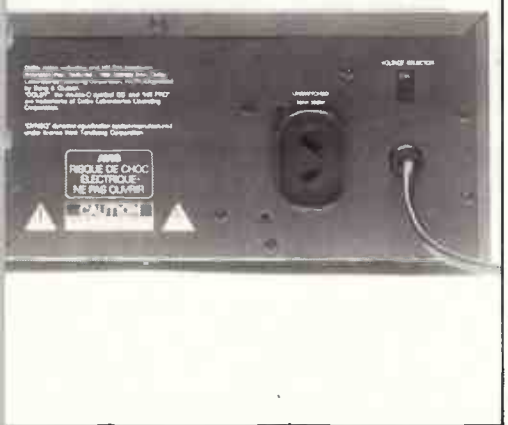
DYNAMIC RANGE

TAPE SONY HF-S90

Dolby Out	55.0dB(Lin)	59.0dB(A)
Dolby In (B)	60.0dB(Lin)	67.5dB(A)
Dolby In (C)	61.0dB(Lin)	75.0dB(A)

ERASURE RATIO
(for 333 Hz signal recorded at 0VU)

TAPE SONY HF-S90	−83.7dB
TAPE TECHNICS RT-60MX	−76.7dB



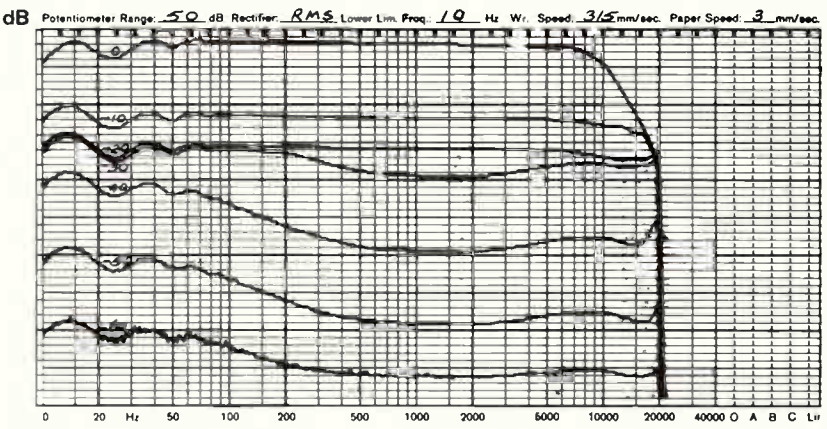


Figure 3: Swept frequency signals on NF S90 tape using the CAR circuit in 10dB steps.

in the range −20 to −30 dB. At levels below −30 dB the superimposed loudness contour type response is far more acceptable and desirable.

The wow and flutter characteristics are relatively good and both the weighted and unweighted flutter figures are first class and confirm the merits of the diffused resonance tape transport system.

The speed accuracy of the unit is 1% high and the erasure ratio with both type I and type IV tapes is exemplary.

In practical use the NAD 6300 deck cassette recorder is extremely easy to use, requires no special use of controls or settings and yet provides first class performance, almost without trying.

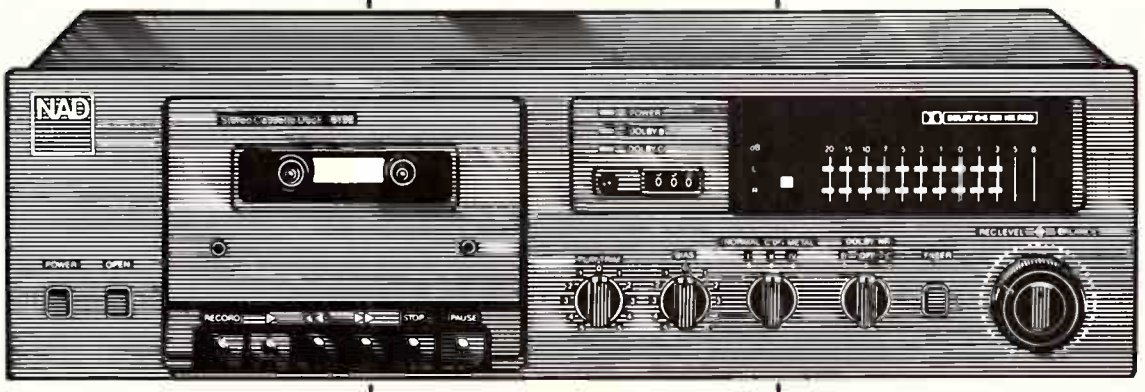
Subjective Tests

I played a number of pre-recorded tapes, many of which had been recorded on a Nakamichi 'Dragon' recorder and which sounded every bit as good on the NAD 6300. I then proceeded to record a number of tapes with the NAD 6300 for audible assessment by referencing them against the original programme content. I was suitably impressed by the extended high frequency response, by the adequacy of the signal to noise ratio, particularly with Dolby B and Dolby C encoding and the relative lack of stridency which many cassette recorders display.

From a technical standpoint the incorporation of the CAR facility is one of the most important features that this recorder provides. I recorded two demonstration tapes to evaluate in my own car. They confirm my existing belief that it is essential to reduce the dynamic range of one's programme content if one intends to listen to it in a noisy enviroment. With the windows open to maximise intrusive noise, a tape recorder with the characteristics open afforded by the CAR circuit sound far more natural than the same programme content recorded without it. It should also be noted that the degree of naturalness of that sound can and does change appreciably when compared with the original programme content.

The NAD 6300 recorder is unquestionably the best cassette recorder that NAD have yet produced. It offers a performance which is truly 'avante garde' and in the top league for cassette recorders in the under $2000 bracket. Its attributes are many and apart from the ergonomic features which I have criticised, it has no perceived vices. This is one cassette recorder that I would not be scared to buy nor to recommend to anybody in the market for a new recorder. ●

The PlayTrim™ Difference.



The new NAD 6155 semi-professional cassette deck is one of the few decks available at any price that can make a virtually perfect copy of today's most demanding source — the compact disc. This is achieved with the use of a brand new circuitry... PlayTrim™

PlayTrim™ was developed in collaboration by NAD and Dolby Laboratories, to deal with the variations in high frequency response that often occur in cassette recordings — especially in tapes that were recorded on one machine and are being played on another. Thanks to PlayTrim™, the NAD 6155 is the only cassette deck that can bring your old tapes back to life.

As your cassette deck specialist we invite you to audition the NAD 6155 today and experience the PlayTrim™ difference.

NAD

AN UNCOMMON COMPANY.

FALK ELECTROSOUND GROUP
BOX 234 ROCKDALE 2216 PHONE (02) 597 1111

READER INFO No. 22

A rundown of stereo TV sound production and how it differs from mono.

The extraction of hi-fi stereo TV sound

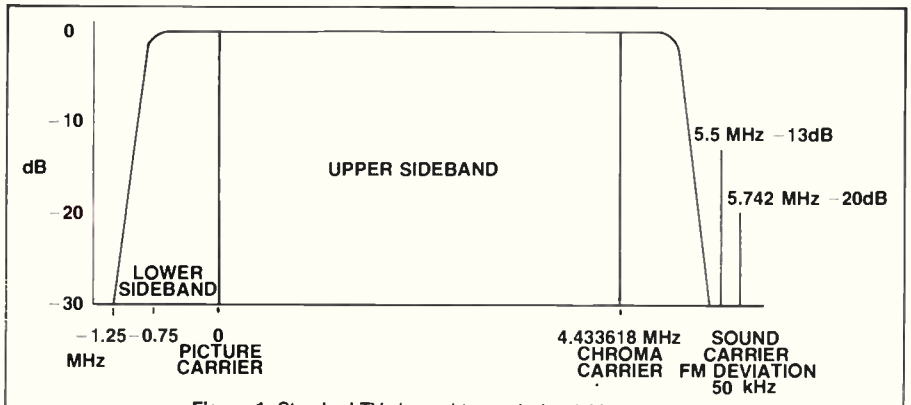


Figure 1. Standard TV channel transmission 7 MHz wide.

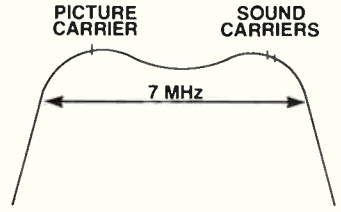


Figure 2. Typical tuner rf characteristic curve.

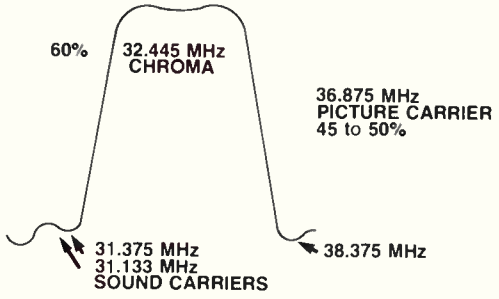


Figure 3. Typical IF characteristic curve.

NORMAL MONO TV sound, as used in Australia for many years, employs common demodulation of the picture and sound intermediate frequencies (IFs). This requires that the second sound IF be superimposed over the picture information and separated by a filter being final processing (intercarrier sound).

The system is prone to unwanted intermodulation, or carrier buzz, between the video, sound, chroma and other carriers. The effects can be reduced by the use of synchronous detectors but this technique limits the picture bandwidth and is dependent on fine tuning. Figure 1 shows the standard TV channel; Figures 2 and 3 show typical TV tuner and IF characteristic curves. Figure 4 shows the basic TV tuner/IF and demodulator in block diagram form.

One way of improving TV sound would be to transmit a completely separate sound signal. This would require the development of very high quality tuners and a change in broadcasting standards. However, an alternative and more immediate system has been developed called quasi-split sound. In this system, the intercarrier process is employed, but the IF carriers are separated at the tuner output. This allows the picture and sound filters to be arranged separately, improving both. Figure 5 shows typical filter characteristics for picture and sound IFs.

Some of the advantages of this system can be enumerated as follows:

1. Less is demanded of the tuner in relation to oscillator stability and accuracy of tuning.
2. The sound/picture carrier ratio is no longer critical.
3. There is improved suppression of unwanted video content in the sound channel.
4. There is improved sound-signal-to-noise ratio with weak signal input.
5. Attenuation of the sound carriers in the video channel is achieved eliminating interference especially to the chroma signal.
6. There is improved video bandwidth benefiting the reception of teletext and improving picture definition.

Beginning at the first sound IF filter, we can take a closer look at stereo sound circuits. The IF filter is a double bass filter arranged to pass the picture and the two sound carriers, attenuating much of the video carrier lower sideband (see Figure 6). It is important that the video carrier upper and lower sidebands have equal amplitude characteristics and that sound carriers are no longer attenuated.

The sound IF filter is followed by a suitable quasi-split sound IF amplifier chip such as a TDA2545. This IC also includes a synchronous detector and internal IF age control. Its output is the two sound IF carriers at 5.5 MHz and 5.742 MHz, frequency modulated with the stereo audio information.

The 5.5 MHz carrier is modulated with ½(left + right) information. This is the audio signal reproduced by normal mono sound receivers. The 5.742 MHz carrier is modulated with right information only. It

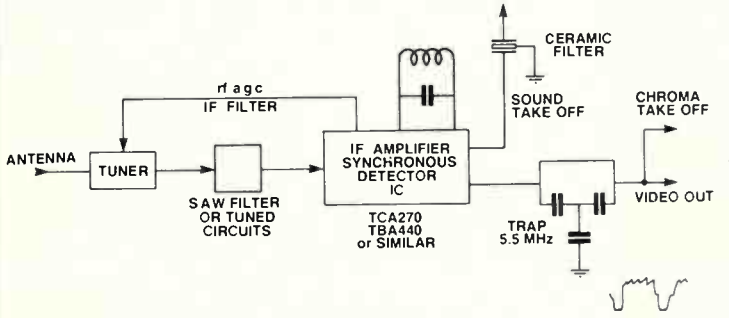


Figure 4. Typical TV tuner/IF block diagram.

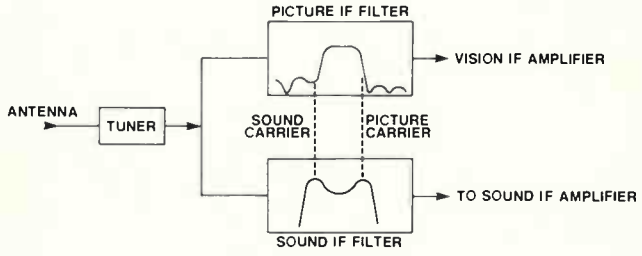


Figure 5. Comparison of picture and sound IF filter characteristics.

also contains a 54 kHz carrier, amplitude modulated with tones according to the mode of transmission. In a mono transmission it is unmodulated, in stereo transmissions it is modulated at 117 Hz (during bilingual transmissions at 274 Hz). These tones can be used to effect electronic switching of the decoder outputs.

The carriers are separated by ceramic filters (see Figure 7) and are then limited and demodulated by sound IF demodulator ICs such as TBA120U. The output from these stages is in one case ½(L+R) audio, and the other is R audio. There are now ICs available which perform all of these functions in one package.

The ½(L+R) are R signals are matrixed (as shown in Figure 8) to produce separate left and right stereo outputs. The positive input of the matrix IC is arranged to have a gain of 2 and is fed with ½(L+R) information. The negative input has a gain of −1, and is fed with R information only. Thus the output is:
2((L+R)/2)−R = left.

The output from the matrix IC is fed to the left output when stereo is transmitted. The R information is fed directly to the right output in this system. When mono is transmitted the L+R signal is directed to both outputs. When bilingual programs are transmitted, the operator can choose which channel is directed to which outputs. The only requirement is a suitable hi-fi stereo power amplifier and speakers to enjoy high quality stereo TV sound. ●

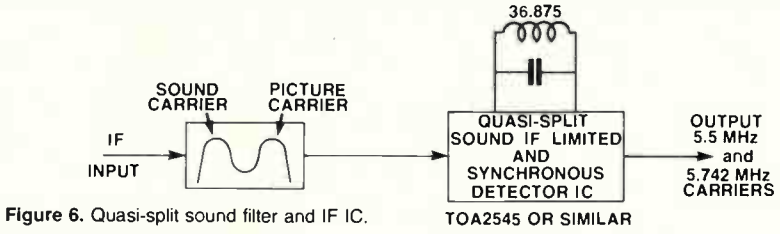


Figure 6. Quasi-split sound filter and IF IC.

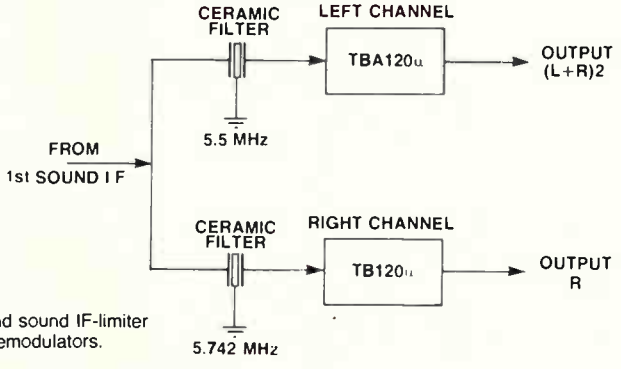


Figure 7. Second sound IF-limiter and demodulators.

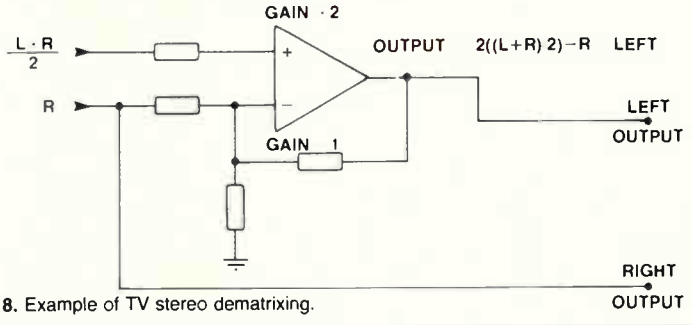


Figure 8. Example of TV stereo dematrixing.

Reviews

Artist — Tom Verlaine
Title — Flash light
Label — Fontana (Polygram)
Cat# — 830 861 2
Format — AAD

Tom Verlaine was the singer, writer and guitarist in the late '70s' New York New Wave band 'Television'. Although building a large cult following 'Television' never really cracked it for commercial success.

Flash Light is Verlaine's fifth release and is an excellent example of this hip New Yorker's style. Right from the opening track "Cry Mercy Judge" you become aware that you're listening to an original talent. Drums mixed way up front, dirge-like guitar and a unique vocal style combine with a solid rock beat to indicate what's to come.

Verlaine is a more than accomplished guitarist who tends to underplay initially and then build to swirling crescendos of rhythm and lead. He is also a stimulating lyricist of varied styles, from the existential — "Song" to the downright quirky — "Say A Prayer".

Best tracks are "Song", great drums and swirling guitar, "The Scientist Writes A Letter", a soaring guitar synth concept piece, "Bomb", full of well tensioned chords and chants over a doomsday musical feel and "The Funniest Thing (work of art)", a strong upbeat song with country rock overtones.

Flash Light is a thoroughly enjoyable contemporary rock release and well worth a listen if you like your rock tough, loud and intelligent.

ARTIST — David Bowie
TITLE — Never Let Me Down
LABEL — EMI
CAT# — CDP7466772
FORMAT — ADD

David Bowie really needs no introduction and with this release, his fifteenth, he proves yet again what an innovative and durable artist he is. With a veritable pot pourri of styles Bowie talks, croons, rocks and pouts his way through 11 masterfully produced tracks.

Musical assistance comes from long time Bowie stalwart Carlos Alomar and Peter Frampton (guitars) and excellent drumming is provided by Erdal Kizilcay.

Stand out tracks are "Beat Of Your Drum" a big production number with soaring vocals and strong drumming; "Never Let Me Down" a funkier softer tune featuring harmonica; "Zeroes" a quasi Ziggy revival song with blistering guitar and a Beatlesque fadeout; "New York's In Love" a basic solid rock song with a strong chorus.

Production credits go to Bowie and David Richards.

Love him or hate him — this release commands a listen.

ARTIST — The Robert Cray Band
TITLE — Strong Persuader
LABEL — Mercury/Polygram
CAT# — 830 568 2
FORMAT — AAD

With recent musical and commercial focus returning to the guitar it seemed almost inevitable we would witness the emergence of a great new blues artist Robert Cray (although not exactly new) could be that artist.

This is Cray's first major label release and is consistent with an artist who, I feel, is destined to become one of the great names of blues.

His guitar playing is exceptionally fluid and his vocal style has an easy listening quality that doesn't forsake the emotional depth required from the idiom. His lyrical observations pay both witty and poignant attention to contemporary blues situations. A very capable rhythm section, complimented by the Memphis Horns, complete the picture and assist in making this release a fresh and powerful blues statement.

Best tracks are "Smoking Gun" with gutsy vocals and biting guitar; "I Guess I Showed Her" a traditional blues vocal lament with strong brass backing; "Right Next Door" a great guitar song with a moving lyrical storyline; "Still Around" a starker, moodier blues song.

There are 10 tracks in total and the producers are listed as Bruce Bromberg and Dennis Walker. For those interested he is touring Australia and New Zealand this month.

If you purchase only one blues artist this year make sure it's Robert Cray.

ARTIST — Fleetwood Mac
TITLE — Tango in the Night
LABEL — Warner Brothers
CAT# — 925 471 2
FORMAT — ADD

This marks Fleetwood Mac's 6th release (with their present lineup) and although it appears their halcyon days are over it is nonetheless a consistent offering.

Here are 12 well produced and played songs that have that familiar Mac sound. From the rhythmic "Big Love" and "Isn't it Midnight" to the seductive "When I See You Again" and "Mystified" you are treated to a very polished studio performance from artists that know their craft very well.

Stand out tracks are "Family Man" with tasteful classical guitar soloing; "Tango In The Night" which has interesting verse and chorus tempo changing; and "Isn't It Midnight" a punchier rock song with a great guitar solo and strong harmonies.

Production credits go to Lindsay Buckingham and Richard Dashut.

If you are a fan it's a Macmust.

— Mark Lewis

Artist — Seattle Symphony Orchestra and Gerard Schwarz
Label — Delos
Cat# — D3051
Format — D/CD

More than any other composer, Stravinsky changed the style of his music to suit the theme on which he had been working. The marked contrast in style often be-

Compact Discs reviewed on this page supplied by Angel Compact Discs. Phone (02) 253-3690.

wildered and sometimes even baffled his audiences. Stravinsky's inventiveness and his superb mastery of timing unquestionably mark him as one of the greatest musical masters since Beethoven.

The Firebird

Igor Stravinsky's "The Firebird" is one of the most dynamic, enthralling and explosive pieces of classical Russian ballet music. It is these features that have made such an impact on the medium of CD recording, for it had to await the development of CD discs with their extremely wide dynamic range in order to provide a medium compatible with the full range from the quiet opening passages to the base drum with its 110 dB level.

The fairytale from which the theme of "The Firebird" was derived is just as magical as is its music, which has the ability to conjure up musical images few other classical works do.

It is the dynamic characteristics of this particular piece of music, rather than its melodic qualities which impose such unusual demands on your amplifier and loudspeakers (as they will readily attest). "The Firebird" starts with an unusually quiet passage, and as the label on the front of the disc warns, the level of the music soon increases to exhibit its full and extremely wide dynamic range — SO BEWARE.

The Seattle Orchestra performing in the Seattle Opera House have produced all of the eerie magical mood that Stravinsky set out to create for the audience. The muted cellos and double basses provide a beautiful unifying thread with pizzicato chromatic motives which are exciting and truely spine tingling. Stravinsky's music is opulent, graphical and in this disc particularly well recorded.

This combined rendition of "The Firebird" with the lesser known "The Song of the Nightingale" offers far better value than many other versions available, the majority of which only offer "The Firebird" without any supplementary content.

Music quality	★ ★ ★ ★ ★
Realism	★ ★ ★ ★
Recording technique	★ ★ ★ ★ ★

Song of the Nightingale

Stravinsky commenced work on "The Song of the Nightingale", which is the minor (fill in) piece on this disc, early in 1909 before he was given the task of writing "The Firebird" by the impressario Diaghilev. When he initiated the work it was intended to be an opera, when he finished it 4 years later he converted it in to a symphonic poem, which once again bears little similarity to his other works. The story behind the symphonic poem is a delightful tale about a Chinese emperor and his involvement with (of all things) a Japanese mechanical nightingale and a real nightingale. The emperor's tryst with the Angel of Death and the sweet sounds that the nightingale uses to save the emperor's life would have formed the basis for a wonderful opera or exciting ballet.

The music is sweet, lyrical, but not quite as exciting or as moving as that of the firebird. As a fill in piece at the end of the disc it is as sweet and as suitable as the 'sweets' at the end of an otherwise sumptuous feast.

Music quality	★ ★ ★ ★
Realism	★ ★ ★ ★
Recording technique	★ ★ ★ ★ ★

Louis A. Challis

Who said Men don't cry ?

To say that men don't cry is to say that men don't have emotion. It is to say that man is not moved by the birth of a child; by the visual splendour of nature, or the sensitivity of a song.

It was the emotional desire of Saul Marantz which set him on the mission of establishing standards in the science of sound reproduction that were to surpass laboratory levels of excellence and become the statement in technical superiority.

For 35 years Marantz has maintained that proud tradition whilst elevating the concept of sound reproduction to an art form.

The PM94 Stereo Amplifier, the latest in a line of new era Marantz audiophile components, has won Australia's highest award for excellence, the CESA Hi Fi Grand Prix, and is consistently winning acclaim from internationally prestigious publications like "Hi Fi News and Record Review" of the U.K.

So listen with your heart and experience the expression of emotion through the science of sound: Marantz.

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For your nearest Marantz Audiophile Dealer and a brochure, phone Marantz on (02) 939 1900.

READER INFO No. 24

Flash

FLASH is a program which allows you to implement flashing characters on your MicroBee. After the program is run, any inverse (or underline) text is converted to flashing text. The program works by altering the keyboard scan vector, and making the computer call the flash subroutine each time the keyboard is scanned. The subroutine increments a counter, and when it reaches a predetermined value, say 1000, the entire pcg is inverted and the process starts again ad infinitum.

The flash rate may be changed by altering the numbers underlined in the basic listing. The FLASH subroutine may be aborted by typing IN#ØOFF:POKE 194,233:POKE 195,163:IN#Ø.

To reinitialize the program, you must enter USR(28672).

S. Machin
Lismore Heights, NSW

```
00100 REM *** BASIC loader for FLASH program ***
00110 REM ***      By Sean Machin 18/4/86      ***
00120 CLS:RESTORE:NORMAL
00130 FORI=28672 TO 28732:READD:POKE I,D:NEXTI
00140 DATA 33,15,112,34,194,0,33,232,3,34,13,112,201,106,2,205,233,163,197,229,2
45,42,13,112,43,34,13,112
00150 DATA 42,13,112,124,181,32,9,205,48,112,33,232,3,34,13,112,241,225,193,201,
33,0,248,126,47,119,35,124,254,0,32,247,201
00160 U=USR(28672):REM Initialize routine
00170 CURS 17,4:PRINT"This text should seem quite normal..."
00180 CURS 14,8:INVERSE:PRINT"Whereas this text should appear to flash!!!"\\
00190 NORMAL
00200 END
```

```
ADDP   CODE   LINE   LABEL  MNEM   OPERAND     COMMENTS


               00100 ;FLASH, a program which converts inverse chars to flashing
characters
               00110 ;By Sean Machin 18/4/86
               00120
7000           00130          ORG    28672          ;START PROGRAM AT 28672 DEC
               00140
00C2           00150 KEYVEC   EQU    0C2H           ;KEYBOARD INPUT VECTOR
A3E9           00160 SCAN     EQU    0A3E9H         ;NORMAL VALUE IN (KEYVEC)
F800           00170 PCG      EQU    0F800H         ;START OF PCG
03E8           00180 DELAY    EQU    1000           ;DELAY BETWEEN FLASHES
               00190
               00200
7000 210F70    00210 INIT     LD     HL,FLASH       ;LOAD KEYBOARD INPUT VECTOR
7003 22C200    00220          LD     (KEYVEC),HL    ;WITH NEW FLASH SUBROUTINE
7006 21E803    00230          LD     HL,DELAY       ;AND GENERALLY INITIALIZE
7009 220D70    00240          LD     (DLYVAL),HL    ;THE PROGRAM AND,
700C C9        00250          RET                   ;RETURN TO BASIC
0002           00260 DLYVAL   DEFS   2              ;2 BYTES FOR SCRATCHPAD
700F CDE9A3    00270 FLASH    CALL   SCAN           ;CALL ORIGIONAL ROUTINE
7012 C5        00280          PUSH   BC             ;SAVE ALL REGISTERS
7013 E5        00290          PUSH   HL
7014 F5        00300          PUSH   AF
7015 2A0D70    00310          LD     HL,(DLYVAL)    ;LOAD HL WITH DELAY VALUE
7018 2B        00320          DEC    HL             ;DECREMENT IT
7019 220D70    00330          LD     (DLYVAL),HL    ;AND STORE IT
701C 2A0D70    00340          LD     HL,(DLYVAL)    ;LOAD AGAIN
701F 7C        00350          LD     A,H            ;AND SEE IF THE DELAY VALUE
7020 B5        00360          OR     L              ;IS ZERO IE FINISHED
7021 2009      00370          JR     NZ,RETURN      ;NO, RETURN TO BASIC
7023 CD3070    00380          CALL   INVERT         ;YES, INVERT PCG CHARACTERS
7026 21E803    00390          LD     HL,DELAY       ;AND RESTORE
7029 220D70    00400          LD     (DLYVAL),HL    ;THE ORIGIONAL DELAY VALUE
702C F1        00410 RETURN   POP    AF             ;RESTORE ALL REGISTERS
702D E1        00420          POP    HL
702E C1        00430          POP    BC
702F C9        00440          RET                   ;AND RETURN TO BASIC
7030 2100F8    00450 INVERT   LD     HL,PCG         ;LOAD HL WITH START OF PCG
7033 7E        00460 LOOP1    LD     A,(HL)         ;GET BYTE
7034 2F        00470          CPL                   ;INVERT IT
7035 77        00480          LD     (HL),A         ;AND STORE IT
7036 23        00490          INC    HL             ;INCREMENT POINTER
7037 7C        00500          LD     A,H            ;AND SEE IF
7038 FE00      00510          CP     0              ;END OF PCGRAM IS REACHED
703A 20F7      00520          JR     NZ,LOOP1       ;NO, CONTINUE INVERTING
703C C9        00530          RET                   ;ELSE RETURN FROM INVERT
7033           00540          END                   ;THE END!!!
00000 Total errors

LOOP1   7033    INVERT  7030    RETURN  702C    DLYVAL  700D
FLASH   700F    INIT    7000    DELAY   03E8    PCG     F800
SCAN    A3E9    KEYVEC  00C2
```

```
10 REM **********************
20 REM *                      *
30 REM *    BACK-A-TAPE       *
40 REM *                      *
50 REM * MARTIN.P.KALITIS.    *
60 REM *                      *
70 REM **********************
80 PRINT"[CLS][WHT]LOADING DATA,PLEASE WAIT.....*
90 I=49664
100 READ A:IF A=256 THEN GOTO130
110 T=T+A
120 POKE I,A:I=I+1:GOTO 100
130 IFT<>46850THENPRINT"ERROR IN DATA PLEASE CHECK":END
140 SYS49664
150 DATA 169,0,162,225,141,138,2,141
160 DATA 40,3,32,58,194,32,215,194
170 DATA 32,47,195,32,55,195,32,58
180 DATA 194,32,79,195,32,47,195,32
190 DATA 134,195,76,10,194,169,7,162
200 DATA 2,160,0,141,134,2,142,32
210 DATA 208,140,33,208,169,147,32,210
220 DATA 255,96,32,37,194,24,162,2
230 DATA 160,9,32,240,255,162,0,189
240 DATA 143,194,32,210,255,232,224,20
250 DATA 208,245,24,162,4,160,18,32
260 DATA 240,255,169,66,32,210,255,169
270 DATA 89,32,210,255,24,162,6,160
280 DATA 11,32,240,255,162,0,189,163
290 DATA 194,32,210,255,232,224,16,208
300 DATA 245,24,162,24,160,2,32,240
310 DATA 255,162,0,189,179,194,32,210
320 DATA 255,232,224,36,208,245,96,42
330 DATA 42,42,42,66,65,67,75,45
340 DATA 65,45,84,65,80,69,42,42
350 DATA 42,42,32,77,65,82,84,73
360 DATA 78,46,80,46,75,65,76,73
370 DATA 84,73,83,65,32,67,79,77
380 DATA 80,76,69,84,69,32,84,65
390 DATA 80,69,32,67,79,80,89,32
400 DATA 83,89,83,84,69,77,32,45
410 DATA 49,57,56,55,45,32,32,24
420 DATA 162,11,160,6,32,240,255,162
430 DATA 0,189,2,195,32,210,255,232
440 DATA 224,21,208,245,24,162,13,160
450 DATA 10,32,240,255,162,0,189,23
460 DATA 195,32,210,255,232,224,24,208
470 DATA 245,96,80,76,65,67,69,32
480 DATA 5,79,82,73,71,73,78,65
490 DATA 76,158,32,84,65,80,69,73
500 DATA 78,32,68,69,67,75,32,65
510 DATA 78,68,32,80,82,69,83,83
520 DATA 32,82,69,84,85,82,78,32
530 DATA 207,255,201,13,208,249,96,169
540 DATA 1,162,1,160,1,32,186,255
550 DATA 169,0,162,65,160,3,32,189
560 DATA 255,169,0,32,213,255,96,24
570 DATA 162,11,160,7,32,240,255,162
580 DATA 0,189,114,195,32,210,255,232
590 DATA 224,20,208,245,24,162,13,160
600 DATA 11,32,240,255,162,0,32,246
610 DATA 194,96,80,76,65,67,69,32
620 DATA 150,66,65,67,75,45,85,80
630 DATA 158,32,84,65,80,69,169,32
640 DATA 162,1,160,255,32,186,255,169
650 DATA 16,162,65,160,3,32,249,253
660 DATA 173,61,3,133,251,173,62,3
670 DATA 133,252,169,251,174,63,3,172
680 DATA 64,3,32,221,245,96,0,256
```

Back-a-Tape

THIS program is for the Commodore 64 and a C2n Datasette.

The program pokes the data into the computers memory and then transfers operation to the machine code program.

Back-a-tape copies most types of files from one tape to another thus making a back-up of all your important tape programs.

After you have typed it in save a copy on tape and then run the program. This program detects errors automatically so there is very little room for error.

M. P. Kalitis
Winston Hills, NSW

Errata ETI-1533

THE following errors have been discovered in the 1533 switcher featured in December and November 1986:

1. C18 appeared on the overlay diagram but not the part list or the circuit diagram. It is connected between pin 2 of IC3 and ground. It should be put on board with a value of 1nF.
2. C14 (1nF) goes between pin 3 of IC3 and ground.
3. On the overlay diagram, R30 should be R22 (100R) and R32 (connected to M1) should be R30 (390K).
4. There are two R3's on the overlay. The one next to R5 is R23.
5. Indeed Tr2 does need four connections! Most transformers with two windings do! Each winding is made up of 3 turns with a total of 6 turns needed.
6. The overlay diagram shows two R18s. A quick match with the circuit will show that the one which connects to RV2 (as shown in the circuit diagram) is in fact, R33 with a value of 10R.
7. Diode D9 (1N914) on the overlay and circuit diagram should be D6. On the overlay diagram, D7 and D6 should be replaced by ZD2 and ZD1 respectively. The correct values for ZD1 and ZD2 should be 18V and 4V7 respectively.
8. R28 on the circuit diagram is labelled R26. Note that there are two R26's. R28 is 100k, R26 is 30k.

Minimart

WANTED: NIKKO TRM-210 or TRM-610 amplifier. Preferably working but this is not vital. Contact Mathew Moddock P.O.Box 259 Narrandera, NSW, Ph: (069) 59-2972 AH.

FOR SALE: Old Teletype Printer. Comes with case, keyboard power supply (240v). Paper ribbons, running in perfect condition, includes interface to any computer with Atari Joystick Port (9 pin). Price a slab of Vic Bitter or $30. Ring Adrian (03) 555-5167 AH.

FOR SALE. 16 mm Projector. $200. Contact Mark (02) 693 9704 BH.

8 to 32 bit I/O expander

DOES your computer have an 8 bit I/O port, but you want more? If so, then the following circuit is for you.

The 8 bit I/O port from the computer is connected as D0-D7. The 32 output bits are labelled OUT0-OUT31.

The circuit consists of a 74HC138 and 8*74HC175 latches. Pullup resistors are also needed on the 8 Data In lines if the output port is incapable of driving CMOS loads. LS devices may be used instead of HC without the resistors. The choice of HC devices has many advantages however, as HC devices give a better output (lower impedance and larger voltage swings) than LS devices.

The circuit operation is fairly simple, with each out-

Computer Driven Multiplexed Display

THE circuit to be described allows a digital display to be connected to a microprocessor with the minimum of circuitry. Each of the four digits and decimal points may be accessed by the computer through the ports 7CH to 7FH, this is easily expandable to any number of digits. Most of the hard work of updating information during each multiplex cycle and decimal to seven segment conversion is done by the software. An algorithm to output data for one multiplex cycle might be as follows:

1. Get nth decimal digit of display (n=0,1,2,3)
2. Convert decimal data to seven segment display data (see note 5 for conversion chart)
3. Output data to port

This cycle is repeated at some regular frequency for each digit, so that a coherent display results. A multiplex frequency of 40 Hz/digit proved sufficient, so the computer services the display 160 times per second. Operating occurs during interrupts and it takes only tens of microseconds, so plenty of time remains for the micro to continue its number crunching.

The display was designed to operate with a Z80 or 8080 microprocessor. IC2 decodes the input/output request, while IC3 decodes the digit to which the data is being outputted. IC's 4 and 5 latches the most recent data to the relevent display digit, so that this one digit remains illuminated until the next byte of data is outputted.

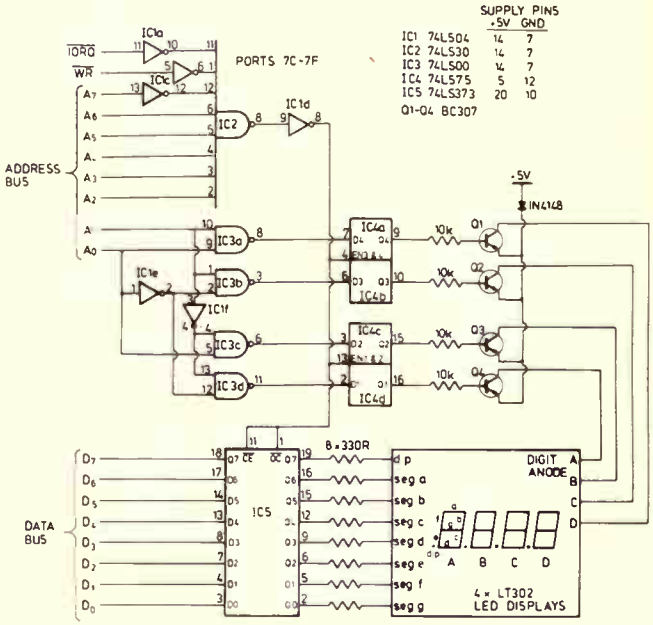
The display is cost effective in that the need for multiple external latches and/or a multiplexing chip, as well as seven segment decoders is eliminated. Expansion to alphanumeric or graphic displays is also easily realisable.

Notes:

1. Power consumption — 31mA with no display; 70mA with 4 digits (8888)
2. Connected to ports 7C (digit A) to 7F (digit D)
3. IC5 may be either 74LS373 or 74LS374 — pin configuration is identical
4. Segment is lit when data bit is 0
5. Bytes of data corresponding to each digit is as follows (in Hex).

Digit	Data (Hex)
0	81
1	CF
2	92
3	86
4	CC
5	A4
6	A0
7	8F
8	80
9	84

J. J. Schutz
Camden Park, SA



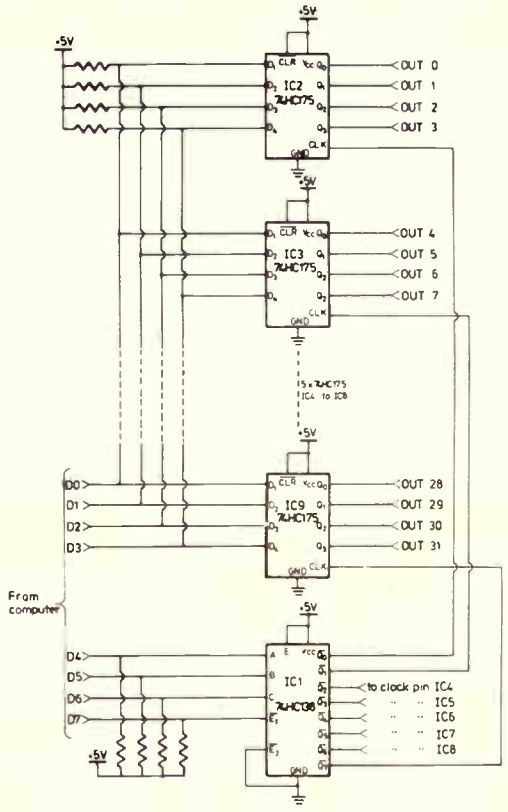
put of the 74HC138 driving the CLOCK pin of each latch. Operation is then as follows:

The computer places 4 bits of data on D0-D3, which are intended to go onto the 4 output lines of the latch chosen by the 74HC138. Its address inputs are connected to D4-D6. Thus the computer places the address of the pseudo 4 bit output port on D4-D6. D7 is then pulsed low, causing the appropriate output of the 74HC138 to pulse low, and latch D0-D3 on the rising edge. If the I/O port has a STROBE output, that can be used as the enable and D7 can be used as another address, to make a 64 bit output!

That may sound complicated, but it isn't really. Following is an example BASIC program to output a byte to a consecutive pair of 4 bit outputs (to treat it as 4 8 bit ports, rather than 8 4 bit ports). As there are no GOTO or GOSUB statements, line numbers are not critical.

```
100 REM Send data D to
    virtual 8 bit port A
110 REM 0<=D<=255 , 0<=A
    <=3
120 REM assumes memory
    mapped port, address PA
130 DH=INT(D/16) :REM Upper
    4 bits of D
140 DL=D-16*DH :REM Lower
    4 bits of D
150 PD=DL+32*A :REM
    Data+address to go to
    the port.
160 POKE PA,PD
170 POKE PA,PD+128 :REM
    Retum D7 high
180 PD=DH+32*A+16 :REM
    Now do high order bits.
190 POKE PA,PD
200 POKE PA,PD+128
210 RETURN
```

A. Conway
Doncaster, Vic.



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

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

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

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

'Idea of the month' contest

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

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

PRIZE WORTH $191

RULES

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

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

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

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

COUPON

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

"I agree to the above terms and grant *Electronics Today International* all rights to publish my idea/program in ETI Magazine or other publications produced by it. I declare that the attached idea/program is my own original material, that it has not previously been published and that its publication does not violate any other copyright."*

* Breach of copyright is now a criminal offence.

Title of idea/program .....

Signature ..... **Date** .....

Name .....

Address .....

..... **Postcode** .....

LeCROY enhances 9400

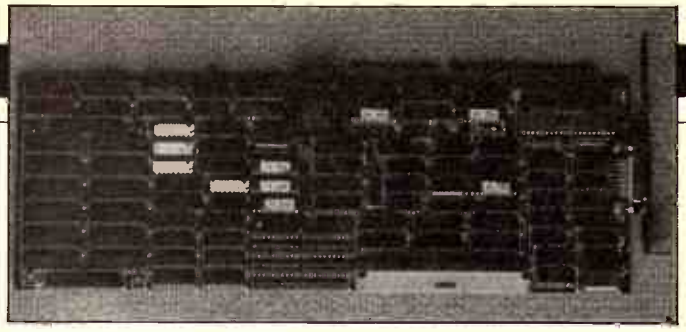
The LeCroy Corporation has launched the Model MS01 Mass Storage Package for the WP01 time and WP02 frequency domain signal processing packages for its 9400 digital oscilloscope. The package utilizes an IBM-convertible PC with IEEE-488 interface and dual 3½ inch floppy disk drives for storage of waveforms and oscilloscope front-panel settings.

The MS01 provides a system for storage of both waveforms and oscilloscope front-panel settings. File names are automatically supplied by the package, but the user can also choose his own file names, with auto sequence numbering. Time stamps including date, hour, etc. are generated with any stored signal. An automated series of oscilloscope measurements followed by waveform storage can be carried out by loading successively different front-panel settings onto the 9400.

The 9400 gives dual channel signal acquisition into deep 32K memories at 100 megasamples/sec for transients and 5 gigasamples/sec for repetitive signals. Vertical resolution is 8 bits, total waveform memory is up to 19K, dc accuracy +/–1% and it is fully programmable over GPIB and RS-232.

For further details, please contact: Fred Blake, ETP-Oxford, 31 Hope Street, Ermington, NSW 2115. (02) 858 5122.

R.I. 101



Boosts Drawing Speed

A new range of microcomputer graphics monitors which can pan, zoom and redraw images up to 20 times faster than comparable screens has been launched on the Australian PC market by Comprador Business Systems of Sydney.

The range, called Xcellerator, is the world's first graphics system for micros to incorporate the third-generation Texas Instruments graphics processor chip, the TI34010.

Comprador Business Systems, a Sydney-based supplier of CAD/CAM, manufacturing and desktop publishing software for personal computers, has been appointed the exclusive Australian distributor by the manufacturer, Cambridge Computer Graphics, of Cambridge, England. The system comprises two 19-inch high-resolution display monitors — a grey scale with eight shades of grey version, and a 256-colour version — and three graphics controller cards.

Up until now, graphics controllers have had to rely on the PC central processor and memory to perform functions such as pan, zoom and character font generation.

The effect has been to slow down important microcomputer applications such as computer aided design and desktop publishing.

The Xcellerator range had overcome these problems by using a processor chip that was not only dedicated to graphics production, but was more powerful than its PC host.

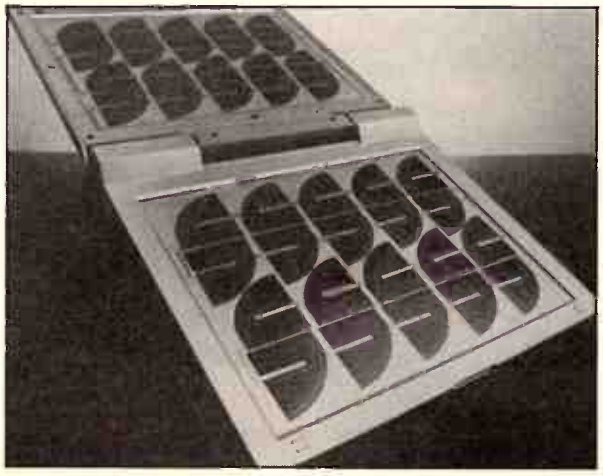
The TI34010 graphics chip is a programmable 32-bit device which executes commands at six million instructions a second, and is capable of filling and clearing a 1024 x 768 pixel screen 10 times a second.

Xcellerator software drivers are available for most standard CAD and graphics packages including AutoCAD, MS Windows, Campaint and Personal Designer. In addition to these screen drivers, Comprador can provide software tool kits which enable users to develop their own.

A typical Xcellerator colour screen with 1Mb of memory will cost around $14,000.

For more information contact Arthur Inglis on (02) 681 4000.

R.I. 102



Solar Generator

The Victorian Solar Energy Council has released a new portable solar electric generator. It comprises 20 solar cells linked to provide a 3 volt, 6 volt, 9 volt or 12 volt dc supply.

The box is being manufactured by Amtex Electronics, and is designed to be easily portable into remote locations. Power output is suitable to lighting, radios, TV and other domestic appliances.

R.I. 103

Intelligent Edit Suite Audio Mixer

The ESAM 608 mixer is designed specifically for television editing and in order to provide the operator interface for their intended purpose, the appearance and layout is quite different from that of conventional audio consoles.

Source section allows independent selection of the sources that will be active at the To and From edit points and preview functions. the selections may be made indendently for channels 1 and 2. Each input is also provided with a fader to control the level of that source.

The crossfade section controls transitions between the From sources and the To sources during an edit. Transitions are independent for channels 1 and 2 and may be performed manually or automatically from the control panel.

The Editor Control section is used to enable or disable the edit system's control over various functions of the mixer.

Edit system control is the single most powerful feature of the 608. When Editor control is enabled, commands may be sent directly to the mixer from an edit decision list, separately from the video if desired. each input may be assigned to channel 1 or 2 of either the preset or program bus. Transition durations may be assigned and transitions started. Selections on the preview switcher are also controllable from the edit system.

Edit system interfacing is identical to that which is used in 612-616 and is designed to operate with Ampex ACE, CMX, Calaway, convergence, Grass Valley Group and other editing systems capable of operating a production switcher. A direct interface allows control of mixer functions through edit system GPI or other contact closure methods.

All operating functions of the Model 608 mixers are accessible through manual control. It's designed and manufactured by Graham-Pattern Systems, Grass Valley and distributed by Mastatek, PO Box 1561, Northgate Hornsby, NSW 2077. R.I. 104

Baby Scanner

A new, moving beam bar code scanner is claimed to be the smallest fixed mount unit in the world.

The new Microscan MS-1000 Scanner, just released in Australia by Intermec, is small enough to fit in the palm of the hand and measures 102 x 137 x 58 mm.

Yet when coupled with special decoder boards, the MS-1000 can read and decode 400 labels a second in real time.

The compactness of the new unit is a major feature which permits easy placement on products or production lines, even under the most stringent space limitation.

The MS-1000 can be tailored to the specific needs of an application with variable optical characteristics, speed and scanning flexibility.

Extended range optics on the units are capable of reading low density codes up to 40 inches away with a depth of field of up to 24 inches.

Standard optics have an adjustable centre of focus from 0 to 10 inches.

A wide field of view permits the placement of labels 3.75 inches long as close as 2 inches from the scan head.

The MS-1000's scan rate can be varied from 50 to 400 scans a second and with the optional right angle mirror, the beam can be redirected 90 degrees up or down allowing the scanner to be mounted in nearly any position.

Further information on the new Microscan MS-1000 can be obtained from Intermec Pty Ltd, Unit 7, 9 Foamcrest Avenue, Newport Beach, NSW 2106, or by telephoning (02) 997 1223. R.I. 105

Enhanced Graphics Adaptor

Data Cable Pty is distributing the M-20E Enhanced Graphics Adaptor, which can be used with IBM PC, XT, AT and compatible computers. It has monochrome, colour and enhanced colour modes, the latter able to support 64 colours.

Features of the new M-20E are a 256K dynamic RAM screen buffer on board, light pen interface, feature connector and video jack support. It has a recommended retail price of $586.67 (including tax). R.I. 106

Epson Laser

Epson Australia is making it's debut in the laser printer market with a compact model — the GQ-3500.

It comes equipped with 640K of memory — expandable to 1.5MB — to handle text and graphics functions. A second generation engine design allows for a smaller, more compact machine than lasers using first generation engines and offers user-replaceable consumables which result in easy servicing and low per page operating costs.

Epson's laser printer boasts an unusually fast warm-up time — 45 seconds, and first page printing time of between 22 and 25 seconds; overall speed is claimed to be six pages per minute. Users have access to seven built-in fonts available simply by pushing a button on a control panel.

The printers standard 470K of user memory provides the ability to print a half page of graphics at 300 dots per inch (dpi). An optional 1.5 megabyte expansion board allows users to print a full page of graphics at 300 dpi.

It includes a new page printer language which is a further extension of ESC/P with added features allowing users functions such as high level graphic primitives, forms overlay and formatting.

The GQ-3500 has two built-in, user accessible IC card slots located on the right side of the machine for identity and/or fontcard usage. In addition to three resident modes IC cards enable the GQ-3500 to emulate printer protocols like HP LaserJet Plus and Diablo 630. R.I. 107

20 MHz DAC

TRW have released the TDC 1012 bipolar monolithic digital to analogue converter which can operate up to 20 MHz. Typical settling time is 30 ns, which can be optimized by designing the DAC to operate into low impedance loads. The complementary 40 mA current outputs can produce 1 V full scale output into a 50 ohm load. R.I. 108

New XT and AT

AJ Distributors are distributing the Banksia Information Technology (BIT) range of PC XT and AT compatibles. BIT is owned by David Hartley, an Australian now living in Hong Kong. He has established a relationship with a Hong Kong manufacturer to produce a range of PC XT/AT compatible boards which Banksia individually configures and then subjects to extensive quality assurance tests prior to shipment.

The BIT units are supplied complete with an original DOS package and a quality manual written in what is claimed to be real English.

An extensive software library is available for the control of PC industrial interfaces, stand-alone and PC based PROM programmers and programs such as CUPL for compiling code to download to PLD's.

For more information contact: John Williams, AJ Distributors, 44 Prospect Road, Prospect, SA 5082. (08) 269 1244.

R.I. 109

Power opamp

The UA77000 is a high performance monolithic operational amplifier constructed using the Fairchild planar epitaxial process. The amplifier provides 250 mA output current and features small characteristics better than the UA741. The amplifier is designed to operate from a single or dual power supply and the input common mode range includes the negative supply.

The UA77000 employs internal current limiting, thermal shutdown and safe-area compensation making it essentially indestructable. It is intended for a wide range of applications including voltage regulators, audio amplifiers, servo amplifiers and power drivers.

R.I. 110

Termination Panels

The DVME-691 is a screw termination panel specifically designed for direct connection of input and output analogue signal wires to the A/D and D/A channels of Datel's DVME-600 Series of VMEbus analogue I/O boards. It eliminates the need to bring special field cables directly to the I/O connectors of the VMEbus boards themselves. Field wiring is brought to terminal blocks on the DVME-691 which come etched directly to flat cable connectors.

One meter long flat cables with pin compatible connectors then run from the DVME-691 directly to the I/O boards. Using the DVME-691, the user's sensors, transducers, and actuators connect directly to terminal blocks on the panel for input to any of DATEL's I/O boards.

There are two versions of 691, the DVME-691A version which is designed to be used with Datel's analogue inputs boards and the DVME-691D version for output boards. The difference between the two is mainly in the placement and pinout of the flat ribbon cable connectors to the A/D and D/A boards. Both versions come complete with a transparent plexiglas safety shield, flat cables that directly connect to the appropriate channels and 3.5 inch high Retma 19 inch rack mounting hardware.

For more information, contact Elmeasco at 15 McDonald Street, Mortlake, NSW 2137. (02) 736 2888.

R.I. 111

Goldstar Semis

Penn Central Group has announced their appointment as Australian distributors for the Korean company Goldstar Semiconductor.

Product Manager, Mark Riley, commented that the addition of Goldstar to their product line offered a hedge against an impending US/Japan trade war on semiconductors.

Goldstar are a technology driven company as demonstrated by the impending release of a 1M DRAM later this year.

Goldstar's product range includes voltage regulators, memory, linear IC, 74LS/74S/74HC/4000/CMOS, microprocessors, CMOS gate arrays and transistors.

For further details, please contact: Mark Riley, Penn Central Group, 56 Silverwater Road, Auburn, NSW 2144. (02) 648 1661. R.I. 112

Fluke Current Clamp

Elmeasco Instruments has announced the release of the John Fluke model 801-1010 clamp-on current probe, an accessory for digital multimeters that measures ac current to 700 amps, and dc current up to 1000 amps. The probe clamps around a conductor and senses the magnetic field products by current flow, allowing safe, accurate measurements without breaking the circuit.

A unique feature of the 801-1010 is a thumbwheel zero control. This allows the user to compensate for residual core magetism in the clamp, and improve the accuracy of dc measurements down to 1 amp. R.I. 113

Sat coms

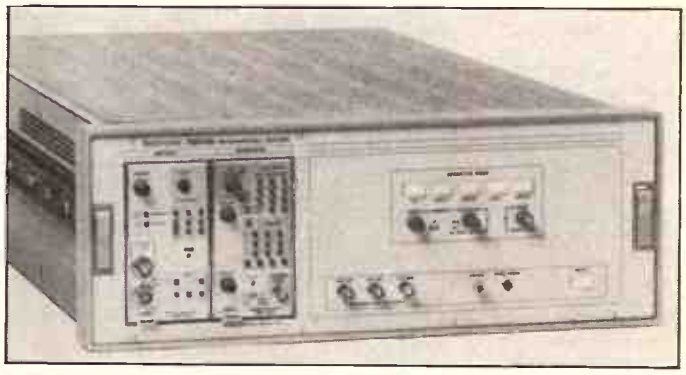
E.S. Rubin Marine has announced that is has become the Australian agent for Marconi's Oceanray satellite communication system. The Marconi Oceanray is a new generation light weight Inmarsat unit with the capability to handle telephone (including PABX), telex and fax communication. In addition the unit is compatible with the IBM PC and can be utilized for data transmission. This has significant implications for ship management systems and ship manning. R.I. 114

Digitiser

Tektronix has announced a transient digitiser that operates at 750 MHz with 10 ps time resolution for applications requiring the capture and analysis of fast, single shot events.

The Tektronix 7912HB Programmable Digitiser combines high bandwidth and timing resolution with fast data transfer capabilities for signal acquisition and analysis. The 7912HB is the third generation of digitisers based on Tektronix high frequency scan converter technology.

With 10 ps/point time resolution, the 7912HB performs at the equivalent of 100 Gigasamples per second. With a 750 MHz bandwidth, it captures signals with risetimes less than 525 ps long. R.I. 115



EGA MONITOR!!

INTRA 14" RGB HIGH RESOLUTION COLOUR MONITOR

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

INTRA 14" RGB COLOUR MONITOR

Resolution: 640 x 200 dots
Display Format: 80 x 25 characters
Display Colours: 16
Dot pitch: .39mm
Sync Horiz. Scan Freq: 15 75 KHz
Sync Vert. Scan Freq: 50Hz
Band Width: 18MHz
Cat X14520 **$695**

SAMSUNG TTL MONITOR

A quality 12" TTL monitor, with a high contrast, non-glare screen at a very reasonable price!
SPECIFICATIONS:
CRT: 12" diagonal 90° deflection, non-glare screen
Active Display Area: 216(H) x 160(V)mm
Display Characters: 2,000 (80 characters x 25 lines)

Description	Cat.No.	1-9	10+
Green	X14517	$189	$179
Amber	X14518	$189	$179

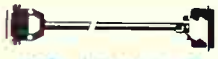
RITRON 2 MONITORS

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

BARGAIN!

PRINTER RIBBONS

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



PRINTER LEAD FOR IBM*

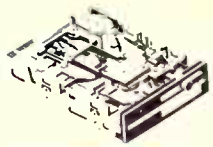
- Suits IBM* PC XT and compatibles
- 25 pin "D" plug (computer end) to Centronics 36 pin plug

Cat P19029 1 8 metres **$19.95**
Cat P19030 3 metres **$29.95**

CANON A-10 PRINTER

- Serial Impact Dot Matrix
- 140 C P S
- Near Letter Quality Mode
- 1 4K Buffer

Cat C20040 **$595**



NEC DISK DRIVES

3½" DISK DRIVE

- 1 M/Byte unformatted, (640K formatted).
- Double sided, double density.
- Access Time 3m sec

Cat **$265**

5¼" SLIMLINE

- Switchable 1 6 M/Byte to 1 M/Byte unformatted
  1 2 M/Byte to 720K formatted
- Double sided, double density.
- AT compatible

Cat C11906 **$295**

8" SLIMLINE

- Double sided, double density.
- 1 6 M/Byte unformatted

Cat C11908 **$795**

1 YEAR WARRANTY!

IBM* COMPATIBLE DISK DRIVES

Tired of paying out more for Japanese Disk Drives? These "direct import" Hong Kong disk drives are the solution! They feature Japanese mechanical components, yet cost only a fraction of the price!

Cat.No.	Description	Price
C11801	500K	Normally $199
	SPECIAL, ONLY $179	
C11803	1 M/Byte	$239
C11805	1 6 M/Byte	$259

PRICE BREAK THROUGH!

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

NEC drive with DTC controller card
Cat X20010 **WAS $995**
SPECIAL, ONLY $850
*IBM is a registered trade mark

2 & 4 WAY RS232 DATA TRANSFER SWITCHES

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

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

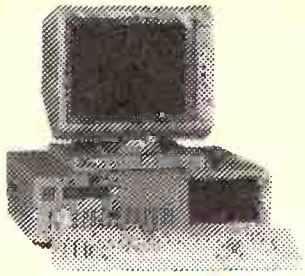
2 WAY Cat X19120 ~~$125~~ $95
4 WAY Cat X19125 ~~$145~~ $135

2 & 4 WAY CENTRONICS DATA TRANSFER SWITCHES

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

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

2 WAY Cat X19130 ~~$125~~ $95
4 WAY Cat X19135 ~~$145~~ $135



IBM* XT COMPATIBLE COMPUTERS from $795*

Check these features and our prices. We're sure you'll agree they're exceptional value for money!

- Assembled in Australia!
- Tested by us for 24 hours prior to delivery!
- 150W power supply
- AT style keyboard
- Operating manual
- 8 Slot motherboard
- 6 Months warranty!

(Japanese drives available for an extra $50 each)

*$795 COMPATIBLE COMPUTER

256K RAM Single Drive, Graphics and Disk Controller Card. $795

256K RAM COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 1 Parallel Port. (Includes Timer Disk) $1,095

640K RAM COMPATIBLE COMPUTER

2 x 360K Disk Drives, Multifunction Card, Colour Graphics, Disk Controller, 2 Serial, 1 Parallel Port. (Includes Timer Disk). $1,150

20 M/BYTE HARD DISK COMPATIBLE COMPUTER

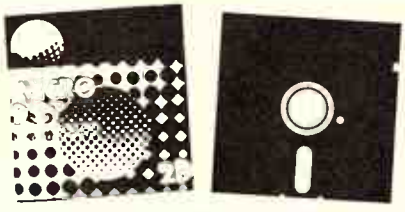
20 M/Byte Hard Disk, 360K Disk Drive(s), 640K RAM, Multifunction Card, Colour Graphics, Disk Controller, 2 Serial, 1 Parallel Port. (Includes Timer Disk)
Single 360K Floppy Disk Drive ..... only $1,850
Dual 360K Floppy Disk Drives ..... only $1,995

IBM* AT COMPATIBLE

Assembled & Tested in Australia!

- 1 M/Byte Main Board
- 1.2 M/Byte Floppy Disk Drive
- Colour Graphics Display Card
- Floppy & Hard Disk Controller
- Printer Card and RS232
- 200W Power Supply
- 6 Months Warranty
- 6 MHz
- 80286 CPU
- 8 Slots
- 20 M/Byte Hard Disk
- Keyboard
- Manual

..... only $2,975



Now you can buy top quality 5¼" disks that are also the cheapest in Australia! They even come with a 5 year guarantee, which indicates the quality of these disks. So why pay 2-3 times the price for the same quality?

MICRODOT 5¼" DISKS!

DESCRIPTION	1-9 BOXES	10+ BOXES
5¼" S/S D/D	$14.95	$13.95
5¼" D/S D/D	$15.95	$14.95

(SEND $2 FOR SAMPLE DISK!)

MICRODOT 5¼" HIGH DENSITY

1-9 BOXES	10+ BOXES	100+ BOXES
$49.95 (PER 10 DISKS)	$44.95 (PER 10 DISKS)	$39.95 (PER 10 DISKS)

5¼" D/S "NO FRILLS" DISKS FROM 90¢ EACH!!

Bulked packed, Microdot D S D D without boxes, or brand name, just their white card jacket!

10-99 DISKS	100+ DISKS	1,000+ DISKS
$1.20ea	$1.10ea	$0.90ea

(SEND $2 FOR SAMPLE DISK!)
(TAX EXEMPT PRICES LESS 20c PER DISK)

3½" "NO FRILLS" DISKS!

D S D/D disks with white boxes but no brand name. (These are a top name brand, but we can't tell you which.)

10-99 DISKS	100+ DISKS	1,000+ DISKS
$42.50 (PER 10 DISKS)	$39.95 (PER 10 DISKS)	$35.00 (PER 10 DISKS)

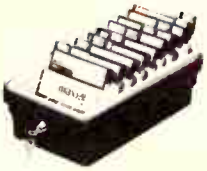
(SEND $5 FOR SAMPLE DISK!)
(TAX EXEMPT PRICES LESS 40c PER DISK)

VERBATIM DISK SPECIALS!

All prices 10 disk boxes!

Description	1-9	10+
5¼" S/S D/D	$27.95	$26.95
5¼" D/S D/D	$34.95	$32.95
5¼" High Density	$59.95	$49.95
3½" S/S D/D	$54.95	$49.95
3½" D/S D/D	$59.95	$55.95

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



JUMBO 5¼" DISK STORAGE

If you've got lots disks, you'll appreciate the extra capacity of this disk storage unit when it comes to locating "that" disk!
Features...

- 100 disk capacity
- Smoked plastic cover
- Lockable (2 keys supplied)
- 9 Dividers/spacers

C16020 **only $24.95**
C16027 (Hinged Lid) **$26.95**

5¼" DISK STORAGE

Efficient and practical. Protect your disks from being damaged or lost!
Features...

- 70 disk capacity
- Smoked plastic cover
- Lockable (2 keys supplied)
- Dividers/spacers

Cat C16025 **only $19.95**

COMPUTER PAPER

Quality paper at a low price! 2,000 sheets of 60 gsm bond paper
Cat C21003 11 x 9½" **$39.95**
Cat C21005 15 x 11" **$67.95**

PAPER TAMER

- Restores order to the top of your desk or work area
- Made of white plastic coated steel
- Stores up to 900 continuous sheets
- Allows perfect paper feed
- Allows easy examination of print out

C21050 (10") **only $49.95**
C21050 (15") **only $79.95**
(Printer and paper not included)

IBM* XT COMPATIBLE CARDS

NEW! NEW! NEW! NEW!

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

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

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

Floppy Disk Drive Controller Card (2 Drives, 16 Bit)
Cat. X18005 ..... $59

Floppy Disk Drive Controller Card (4 Drives, 16 Bit)
Cat. X18006 ..... $65

High Resolution Mono Card
Cat. X18007 ..... $199

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

768kB RAM Card (without memory)
Cat. X18012 ..... $89

Printer Card
Cat. X18017 ..... $34.95

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

XT Motherboard (without memory)
Cat. X18020 ..... $225

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

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

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

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

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

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

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

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

Enhanced Graphics Adaptor Card 256K RAM on board
Cat. X18070 ..... $295

64K Printer Buffer Card
Cat. X1807? $139

(AT COMPATIBLE)

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$500 plus		$12 50

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

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Errors and omissions excepted

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NICADS!

Size	Desc.	1-9	10+	100+
AA	0.5 A.H.	$2.95	$2.75	$2.25
C	1.2 A.H.	$7.95	$6.50	$6.25
D	1.2 A.H.	$7.95	$6.50	$6.25

CO-AXIAL SOCKETS LOW LOSS SPLITTER

Gives 2 standard co-axial outlets from one input

Cat L11036 (left) **$4.95**

Cat L11037 (right) **$4.95**

COMPUTER CABLE

CIC6 6 conductor computer interface cable Colour coded with braided shield (to IE422 specifications) Copper conductor 6 x 7/0 16mm

1-9 metres **$1.90/m** 10+ metres **$1.70/m**

CIC9.100 9 conductor computer interface cable Colour coded with mylar shielding 9 x 7/0 16mm

1-9 metres **$2.50/m** 10+ metres **$1.95/m**

CIC12 12 conductor computer interface cable Colour coded with mylar shielding 12 x 7/0 16mm

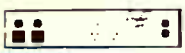
1-9 metres **$2.70/m** 10+ metres **$2.50/m**

CIC16 16 conductor computer interface cable Colour coded with mylar shielding 16 x 7/0 16mm

1-9 metres **$3.90/m** 10+ metres **$3.40/m**

CIC25 25 conductor computer interface cable Colour coded with mylar shielding 25 x 7/0 16mm

1-9 metres **$4.90/m** 10+ metres **$4.40/m**



MAINS MUFFLER

Sudden mains disturbances can seriously affect your computer equipment, and stored data. So why risk it when you can have a Mains Muffler, particularly when the cost of one failure is likely to be greater than the purchase price! So vanish those dangerous clicks and voltage spikes forever with the Mains Muffler!

SPECIFICATIONS:
Maximum total load 1000W 4 AMP 250V 50Hz
Outlet Sockets
Attenuation 150KHz - 47dB
500KHz - 68dB
10MHz - 66dB
Dual T Section:
VDR Transient suppression
Surge capacity 200 Amp 8 x 20uS

2 WAY Cat X10089 **$199**

4 WAY Cat X10090 **$299**

HIGH EFFICIENCY RADIAL FIN HEATSINK

Black anodised with a thick base plate, this radial fin heatsink can dissipate large amounts of heat for maximum efficiency. Designed by Rod Irving

105x30mm	Cat H10520	$ 3.50
105x75mm	Cat H10525	$ 3.50
105x100mm	Cat H10529	$ 4.90
105x140mm	Cat H10534	$ 6.50
105x150mm	Cat H10535	$ 6.75
105x170mm	Cat H10538	$ 7.95
105x195mm	Cat H10542	$ 9.90
105x200mm	Cat H10543	$ 9.90
105x225mm	Cat H10546	$10.50
105x300mm	Cat H10549	$12.00
105x600mm	Cat H10560	$24.95

SEMICONDUCTORS!

Always check our prices before you buy!

	1-9	10+	100+
2114	$2.95	$2.75	$2.50
2716	$9.95	$9.50	$8.95
2732	$8.95	$8.50	$7.95
2764	$7.95	$7.50	$6.95
27128	$9.95	$8.95	$7.95
27256	$11.50	$10.50	$10.00
27512	$19.50	$18.50	$17.50
4116	$3.95	$3.50	$2.95
4164	$3.95	$2.95	$2.75
41256	$7.95	$8.95	$5.95
555 8pin	$0.50	$0.40	$0.35
6116	$3.95	$3.75	$3.50
6264	$7.95	$6.95	$6.50
6802	$5.00	$4.00	$3.75
6821	$2.00	$1.80	$1.70
6845	$5.00	$4.00	$3.75
7406	$0.40	$0.30	$0.25
INS8250	$29.95	$27.95	

MEL9501

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

SPECIAL, ONLY $29.95

8087

Genuine Intel chips with manual and data sheets packed in boxes!

8087-3 (4.77MHz) **$269**
8087-2 (8MHz) **$385**
8087-1 (10MHz) **$585**
80287-6 (6MHz) **$475**
80287-7 (8MHz) **$679**

PUSH BUTTON DIALLERS

Tired of old fashion dialling and re-dialling engaged numbers? These convenient push button diallers include last number redial (up to 16 digits) and instructions for an easy changeover

Cat A12030 **Normally $19.95**

SPECIAL, ONLY $14.95

TV INTERFERENCE FILTER

Cuts CB/Ham signals interference

Cat L11048 **$5.95**

RS232 INLINE SWITCHING BOX

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

Cat X15662 **$32.95**

CENTRONICS GENDER CHANGERS

- Female to Female
- Saves modifying or replacing non-mating Centronics cables
- All 36 pins wired straight through

Cat. X15663 **Male to Male**

Cat X15661 **Male to Female**

Cat X15664 **Female to Female**

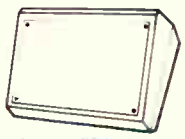
Normally $33.95.

Only $24.95

ECONOMY 19" RACK CASE

Save with this quality rack mount case complete with vents, handles and assembly screws. Tremendous value!
Dimensions 480 x 134 x 250mm

Cat. H10415 **$44.95**



SLOPING CASES

Plastic with metal front panel, available in two sizes:

Cat. H10450 190x120mm **$16.95**

Cat. H10455 256x185mm **$27.95**

(measurements are approx. only)

HORWOOD METAL INSTRUMENT CASES (ROUND HANDLES)

84/6/V
H10461 153 x 102 x 203mm **$18.95**
84/8/V
H10462 203 x 102 x 203mm **$19.50**
84/10/V
H10463 254 x 102 x 203mm **$19.95**
84/12/V
H10464 305 x 102 x 203mm **$22.95**

HORWOOD METAL INSTRUMENT CASES (SQUARE HANDLES)

93/6/V
H10467 153 x 76 x 228mm **$16.95**
93/8/V
H10465 203 x 76 x 228mm **$17.95**
93/10/V
H10466 254 x 76 x 228mm **$18.95**
93/12/V
H10468 305 x 76 x 228mm **$21.50**
93/17/V
H10470 430 x 76 x 228mm **$29.95**

TEXTOOL SOCKETS

P17016 16 pin **$14.95**
P17024 24 pin **$18.50**
P17028 28 pin **$24.95**
P17040 40 pin **$29.50**

SAVE $7

RS232 MINI TESTER

- Male to female connections
- All pin wired straight through
- Dual colour LED indicates activity and direction on 7 lines
- No batteries or power required

T D Transmit Data
D S R Data Set Ready
R D Receive Data
C D Carrier Detect
R T S Request to Send
D T R Data Terminal Ready
C T S Clear to Send

Cat X15656 Normally $39.95

Only $29.95

BRAND NEW FANS

Quality, new fans for use in power amps, computers, hotspot cooling etc. Anywhere you need plenty of air

240V 4⅝" Cat T12461 **$14.95**
115V 4⅝" Cat T12463 **$14.95**
240V 3½" Cat T12465 **$14.95**
115V 3½" Cat T12467 **$14.95**

10+ fans (mixed) only $10 each!

FAN GUARDS TO SUIT

4⅝" Cat T12471 **$3.95**
3½" Cat T12475 **$3.95**

MAIL ORDER HOTLINE
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(TOLL FREE)
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BELL WIRE

Red and white twisted
Conductors 2 x 1 strand 0.17mm
Sheath O.D 2 x 1.35mm
Cat W
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Economy knobs with elevated white pointer

Cat H10001 RED
Cat H10002 BLUE
Cat H10003 GREEN
Cat H10004 YELLOW

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SAVE $6

RS232 MINI JUMPER PATCH BOXES

- Interface RS232 devices
- 25 pin inputs
- 25 leads with tinned end supplied
- Complete with instructions

Cat X15653 **Male to Male**

Cat X15654 **Female to Male**

Cat X15655 **Female to Female**

Normally $25.95

Only $19.95

SAVE $8

RS232C NULL MODEM ADAPTOR

- Male to female connections
- Pins 2 and 3 reversed
- All 25 pins connected

Cat X15657 **Male to Male**

Cat X15658 **Male to Female**

Cat X15659 **Female to Female**

Normally $22.95

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- Digital readout (LED) for both tacho and speedo
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- In built light indicator for night illumination
- Designed for 12 volt negative earth electrical systems
- Speedo 0 - 199kph
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- Complete with mounting hardware

Cat A15064 **R.R.P. $89.95**

OUR PRICE $74.95

PIEZO SIREN

- 4 piezo units in a high impact plastic cabinet
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- Output 115dB at 1m, dual tone
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- Smart design suits interior use

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W12624	24 Way	$2.90
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W12634	34 Way	$3.90
W12636	36 Way	$3.90
W12640	40 Way	$4.90
W12650	50 Way	$5.90
W12660	60 Way	$6.90

RS232 WIRING ADAPTOR BOX

- Male to female
- 25 Detachable plug on leads
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- Ideal for experimenting or temporary connections

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- Saves modifying or replacing non-mating RS232 cables.
- All 25 pins wired straight through

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Cat X15651 **Male to Female**

Cat X15652 **Female to Female**

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Tunable: 76 - 81MHz
Field Strength:
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Receiver 15mV (100%)
Battery: Transmitter LR44 (1.5V)
Receiver 3 x UM4 (4.5V)
Instructions: Japanese (English not available!)

Cat A10520 **R.R.P. $199**

Our price, only $189

CRYSTAL LOCKED WIRELESS MICROPHONE AND RECIEVER

MICROPHONE SPECIFICATIONS:
Transmitting Frequency: 37.1MHz
Transmitting System: crystal oscillation
Microphone: Electret condenser
Power Supply: 9V battery
Range: 300 feet in open field
Dimensions: 185 x 27 x 38mm
Weight: 160 grams

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**

Our price, $99

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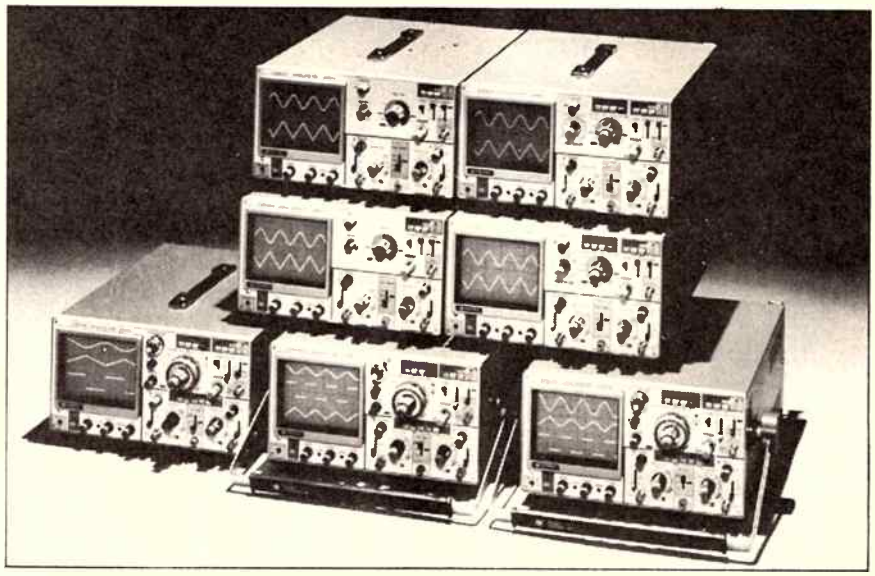
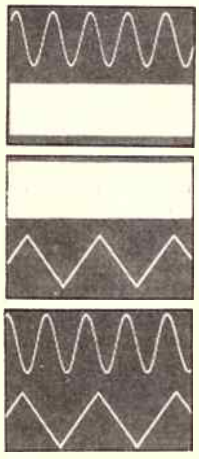


It's the standard features that make Kikusui CRO's exceptional.
The NEW COS-5000TM series offers standard features, normally only found on expensive, higher bandwidth scopes.
Consider:

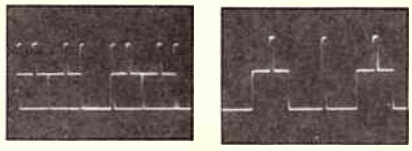
1 Bright and sharp signal traces with Automatic Linear Focus. This eliminates the need to readjust the focus during measurements between timebases. Even in high intensity, there are no blooming effects.

2 'Simultaneous' triggering of both CH1 and CH2. The VERT MODE displays both signals whether they are synchronised or not. An indispensable facility when troubleshooting between working and faulty boards.



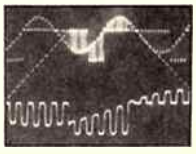
3 Auto setting of the optimum triggering level. In AUTO TRIG LEVEL LOCK, a peak to peak detector locks onto and tracks the trigger signal. There is no need to reset the trigger level between measurements.
The Manual Level Control provides superior triggering of complex waveforms or very low level signals.

4 Stable viewing of complex waveforms. The VARIABLE HOLDOFF control allows the easy viewing of waveforms such as uP or video signals with multiple triggering edges, caused by different frequency and level components.



NO HOLDOFF WITH HOLDOFF

5 Simultaneous display of original and magnified waveform. Kikusui's ALTERNATING SWEEP MODE allows both the original waveform and the selected magnified portion to be viewed simultaneously.



ORIGINAL
MAGNIFIED

6 Advanced new design using energy saving circuitry. The newly developed Dynamic Bias Circuit [PAT PEND] automatically controls the power consumption of the unit. Another feature in Kikusui's policy of continued innovation.

Features	5100TM	5060TM	5041TM	5021TM	5020TM
Bandwidth	100MHz	60MHz	40MHz	20MHz	20MHz
Channels	3	3	2	2	2
Vertical Sensitivity	1mV/DIV	1mV/DIV	1mV/DIV	1mV/DIV	1mV/DIV
Max Sweep Speed	2ns/DIV	5ns/DIV	20ns/DIV	20ns/DIV	20ns/DIV
Delayed Sweep	YES	YES	YES	YES	NO
Trigger Modes	CH1, CH2, VERT MODE, LINE, EXTERNAL.				
Alt Sweep	YES	YES	NO	NO	NO
Delay Line	YES	YES	YES	NO	NO
Accel Voltage	18kV	12kV	12kV	2.2kV	2.2kV
Warranty	2 YEAR WARRANTY ON PARTS AND LABOUR				
Probes	2 QUALITY SWITCHABLE PROBES INCLUDED				

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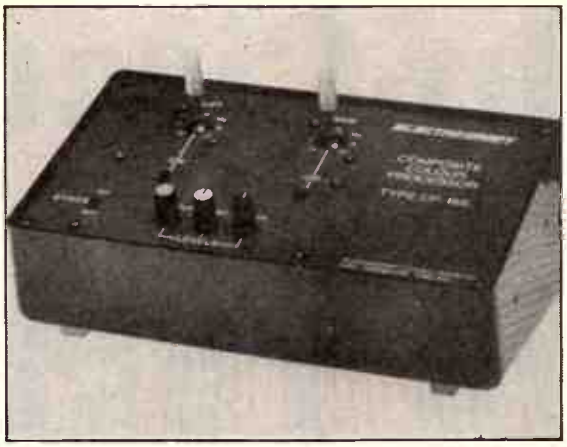
READER INFO No. 27

Colour processor



Electrocraft have released a colour processor. It is designed to correct colour balance problems in professional and semi professional situations. It can be used where the colour balance has been incorrectly set, or where a director want to match tape shot indoors and outdoors.

It can also be used to put a tone on footage. It does this by first removing the colour information to produce a monochrome image, and then colouring it appropriately. this facility can yield sepia for an old fashioned look, or convert shots taken during the day into night time shots with a blue tint, plus the use of black level and contrast.

According to the makers, signal degradation is unnoticeable. The machine has a bandwidth of 5 MHz, so it can be used with nearly all video sources. R.I. 116

Databridge Modems

Rosser Communications is distributing the Databridge DSP 2400 modem. Cost will be less than $1000 a unit. The DSP modems recently won an Australian Design Award for Databridge.

The 2400 does 2400 and 1200 baud in full duplex, auto-dial, auto-answer, auto-disconnect. It can be operated in dumb or smart mode. In dumb mode it operates as a manual modem, particularly useful in synchronous AT type functions. In smart mode it is fully Hayes and AT compatible. It operates on both pulse and tone dialling exchanges, has a built in dialling director, a password system and the ability to operate a leased line and the ability to switch between sync and async modes.

R.I. 117

In-Circuit Digital IC Tester

Yet another cheap, easy and useful test device from ETI.

THIS VERY SIMPLE project allows digital integrated circuits to be tested, whilst in circuit.

Using an ic test clip clamped over the device to be tested, a series of Light Emitting Diodes indicate whether the pins on the ic are going high, low, or switching. Working with a manual or data sheet for the particular ic, this LED indication will show how the ic is functioning.

The standard project uses a 16 pin test clip, allowing up to 18 pin devices to be checked. This can be done by applying the clip in two stages, so as to cover all the pins. The same method will allow you to check 40 pin devices using a 24 pin clip. Due to changes in ic width versus pin numbers, different size clips are necessary.

The project can be used on digital ic's from 5 Vdc to 22 Vdc (on the pins). The current rate is set at 3 mA for 5 Vdc, and 20 mA for 22 Vdc. Note: Inputs and outputs below 3 mA may not have sufficient current to light the LED — but if there is less than 3 mA going to the ic then it probably wouldn't trigger anyway.

Voltages below 1.8 Vdc are considered "lows", and greater than 2 Vdc are considered "highs". The trigger voltages for the LED's are provided by the ic pins switching high or low.

By using a data reference for the ic being checked (this can come from the circuit or a data manual) it is possible to establish if the ic is functioning correctly.

HOW TO USE

Clip the test clip onto the ic — making sure that pin 1 of the ic matches pin 1 of the clip.

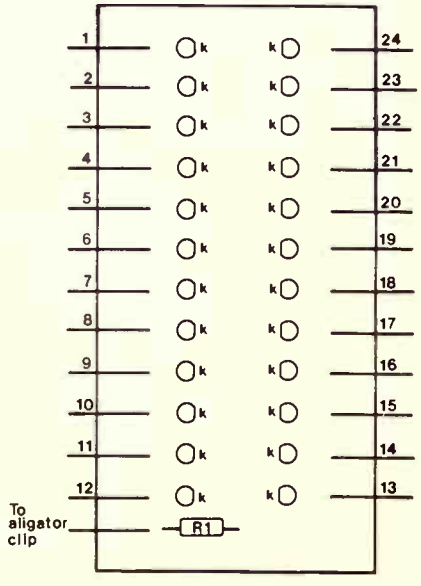
Any lit LED means that on that pin there is a high, unlit LED's infer a low, and flickering LED's indicate that the pin is switching high/low.

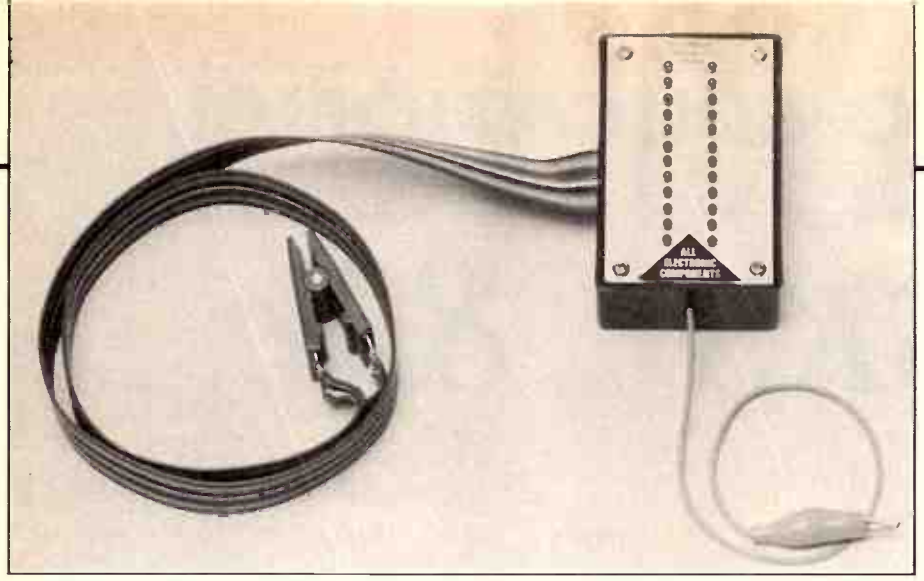
Ic's with the same body width as the test clip being used, but with a greater number of pins, require two stage checking. Follow the above procedure, and after testing the first 16 or 24 pins, remove the clip and re-clamp it onto the remaining pins.

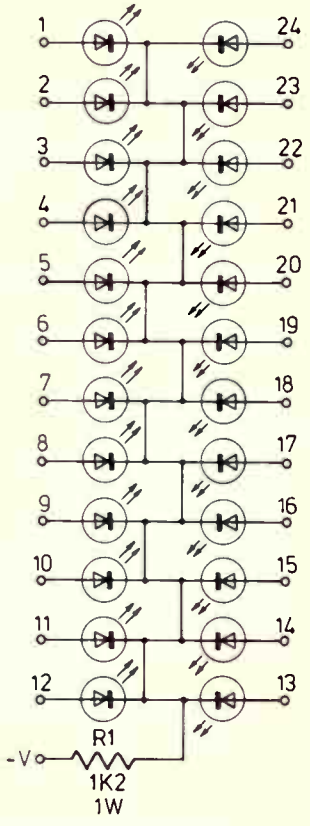
CONSTRUCTION

Construction is very simple, and has been made easier through the use of a Printed Circuit Board. Start by soldering R1 (1k2 1 Watt) onto the pc board. Next, place the LED's on the board but do not solder yet. Push the LED's into the panel (prepunched) ensuring that they have a firm, tight fit, and are all level. Wriggle the pc board down the LED leads as far as possible to the bases of the LED's. Now solder the LED's.

Cut a slot, or drill a hole in the side of the case to accept the rainbow cable. Then drill a small hole for the common flying







lead. On the lead, solder the alligator clip on one end, and the other end to the board.

Solder the rainbow cable to the test clip — we found it best to solder the first wire to pin 1 of the clip, and the second wire to the pin opposite pin 1, and so on. This avoids bending and twisting the cable. With a black marker pen or texta, mark pin 1 of the test clip for identification.

All that remains is to solder pin 1 of the test clip to the pc board on LED 1, and so on.

To check that the unit is functioning correctly, use a supply between 5 Vdc and 20 Vdc — a 9V battery will do. Clip the alligator clip to the negative terminal of the supply and check that the correct LED lights with the correct pin on the test clip, from the positive of the supply. ●

PARTS LIST
ETI-184

R1 1k2 1 watt 5% Resistor
LED1-24 3mm Red LED
PCB AEC 87-5-1 Single-sided tinned.
PANEL Silk-screened aluminium.
TC1 16 pin ic Test Clip.
CASE UB5
MISCELLANEOUS 1 metre 24 way Rainbow cable, 1 metre hook-up wire, Alligator clip, solder.

This project was designed by the technical staff at All Electronic Components.

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GPR3030

GPQ3020 GPQ3030

Model	GPR3030	GPQ3020	GPQ3030
Type	Single	Dual	Dual
Outputs	0 - 3V 0 - 3A	0 - 30V x2 0 - 2A x2 5V 1A 5V 3A	0 - 30V x2 0 - 3A x2 5V 1A 5V 3A
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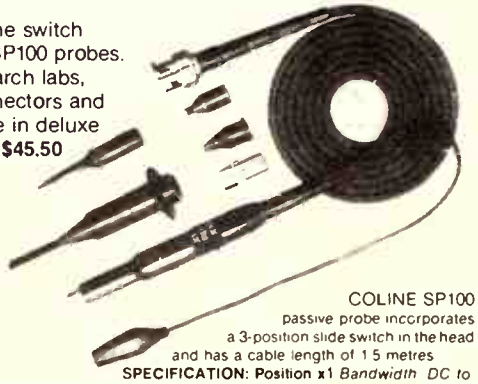

COLINE SP100
passive probe incorporates a 3-position slide switch in the head and has a cable length of 1.5 metres

SPECIFICATION: Position x1 *Bandwidth DC to 10MHz • Input R 1M (scope input) • Input C 40pF - scope cap. • Working Voltage 600Vdc (inc peak ac)*

Position Ref *Scope input grounded Probe tip grounded through 9M*

Position x10 *Bandwidth DC to 100MHz • Risetime 3.5nS • Input R 10M when used with scopes having 1M input (probe 9M - 1%) • Input C 11.5pF when used with scopes having 30pF input capacitance • Compensation Range 10-60pF • Working Voltage 600V dc (inc peak ac)*

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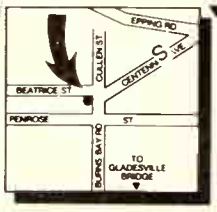

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Createc SC01

One of the more interesting instruments to come our way lately has been the SC07 from the West German firm Createc GmbH, located in West Berlin. Not only is it a miniature oscilloscope with an LCD screen, but it also functions as a volt and frequency meter and contains some impressive signal processing functions.

In its oscilloscope mode, the SC07 functions as a digital device with a sampling rate of 20 MHz, which leads to a theoretical bandwidth of 10 MHz at the Nyquist limit. The input amplifiers have a dc to 10 MHz bandwidth to suit this sampling frequency.

As with most digital oscilloscopes, this rather unimpressive bandwidth is offset by a host of very attractive digital features. It has nine non-volatile memories in which waveforms can be stored. It has complex triggering and one shot circuits that make it possible to capture difficult transients. Sophisticated signal processing allows multiplication, division and addition of signals and the display of a complex waveform. It is also possible to perform some quite detailed measurement on the signal: Volts (rms, average, peak-peak and zero-peak), period and frequency are all displayed in either the multimeter mode or across the screen in the oscilloscope mode.

What makes the SC01 unusual it is size; all these features are packed into a device no bigger than a large calculator. The secret is internal-clever circuitry, widespread integration and the use of surface mounting and other low volume components. In fact, there are two pc boards inside, one full of application specific ICs and the other full of surface mounted components. According to the leaflets supplied by Createc, the circuit consists of a two stage input amplifier feeding a 7 bit flash converter which turns the analogue input signals into digital data. From this point onward the system is totally digital. The master controller is a 80C31 processor with 64 k of ROM on the side. However, there are three other processors on board, one to look after the flash converter and its associated high speed memory, one for the keyboard and one for the display.

The display is a 128 by 128 pixel LCD. It's a bit mapped, and multiplexed to reduce drive requirements.

The matrix is purchased of the shelf in Japan, but the graphics processor is designed by Createc for this particular job. The LCD, as always, is a compromise between legibility and weight/power constraints. There is a screw adjustment at the bottom of the case so that one can optimize the LCD angle for the surroundings.

The keyboard is a fifty key device. It consists of a numeric pad with the normal arithmetic operators and then the control keys grouped in logical groups to make operation easier.

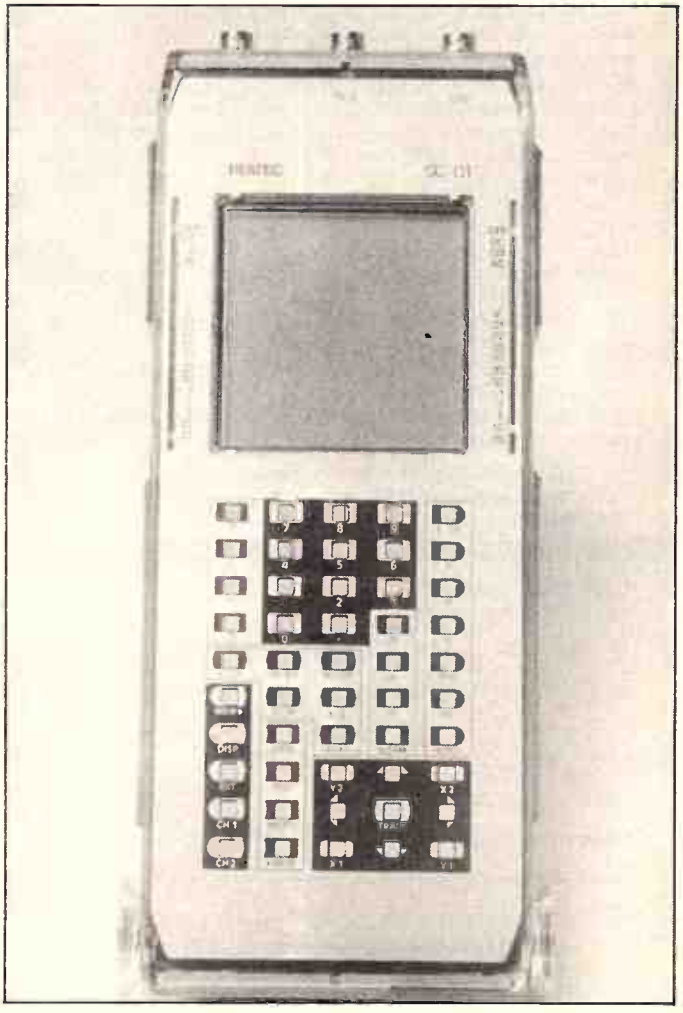
At one level operation of the device couldn't be more straightforward. The vertical scale is set by two large slide switches on either side of the device. The horizontal scale is set by two key strokes. The first defines the channel, the second is 'auto'. The 'auto' function sets the horizontal scale so that one and a half periods appear on the screen.

At a second level however, driving the Createc gets quite a bit more complex, and one needs to use the manual fairly carefully to derive full benefit from the machine. Putting it into any particular mode is achieved by operating the keys in a usually across the keyface from left to right. Initially, this seems to make life more complex. However, with a bit of experience it makes life easier since all the functions on the device are accesses in the same manner.

The SC01 was released in April 1986 at the Hannover industrial fair, and exports started happening around the end of the year. The company is particularly keen to attract export orders because, while 40% of the R and D on the device was covered by the West German government, local orders are not expected to be sufficient to account for the rest of the money. In Australia it is being distributed by Klaus Reimann of the Sydney based Electronic Developments and Service, and will sell for $2500 ex tax.

Is it worth it? Probably not for the run of the mill laboratory, where similar funds will buy very much more bandwidth for less money. However, there must be plenty of applications where advantages of portability, ruggedness and storage will more than outweigh the disadvantages of price. It is rather a pity that it requires mains for operation, especially given that its power consumption is only 3 Watts. There are a couple of other things wrong with it: I would have liked to see easier adjustment of the LCD viewing angle. The screen is difficult to see at the best of times, and making it difficult to adjust just compounds the problem. The slide switches on the side of the box are unnecessarily clumsy as well. Still, these are small quibbles for the technician confronted with the problem of lugging a conventional CRO up a mast to test recalcritant equipment.

— Jon Fairall



REVIEW

Scope Cordless Iron

Scope Laboratories, the Melbourne based soldering iron manufacturer, have just released a cordless iron. Cordless irons have been a growing trend overseas for the last few years, but this is the first cordless iron I have seen manufactured in Australia.

Its a 60 watt job, in a largish bright orange pistol grip shaped case carrying two 'D'cell NiCads rates at 2.5-2.7 watts. These are special devices available from Scope, each soldered in so they can't be removed on a whim. At the base of the pistol grip is a socket for the recharger, a small plug pak style unit that charges from the mains. It will deliver 400 mA in the charge mode. According to a spokesman at Scope, the NiCads will last in deep cycle mode for several years, and "innumerable" cycles. If they are cycled on a slow charger they will last even longer. There is also a 12 volt version available as an extra that charges from the cigarette lighter of a car. There is a detachable copper tip and several alternative tips for suiting to particular jobs.

When the equipment arrives, the NiCads are completely discharged, and require about 16 hours to charge up fully. The tip would melt solder after about an hour on the charger however. To operate, there is a trigger located on the pistol grip which takes about five seconds to heat the tip to a useable temperature. The blurb from Scope says that you can make about 100 connections before you need to recharge. I didn't test this, but I did use it for a whole day, and the figure does not seem seriously wrong.

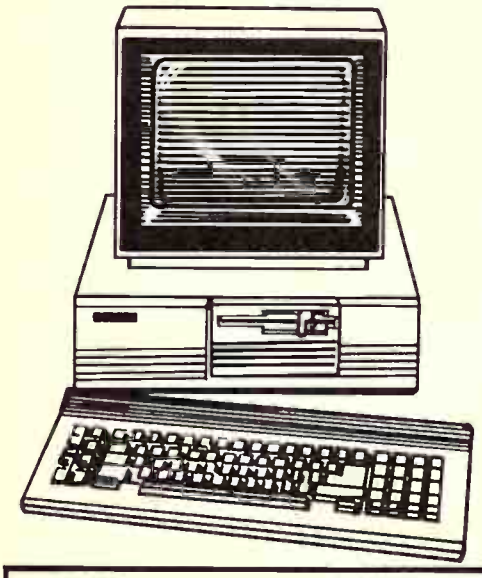
For someone who is used to handling an ordinary soldering iron, the pistol grip takes a bit of getting used to. However, after a few hours it becomes more natural. In any event, if you have a need to do soldering where power points are non-existent or difficult to find, as telephone technicians often do, its a great advance to find a practical cordless iron on the market at last.

It costs $83 ex tax from Scope Laboratories in Melbourne.

— Jon Fairall

DSE Multitech

All the best for less!!



Multitech PC500

The DSE Multitech PC-500 System 1 started the Affordable PC compatible revolution by being the first to break the $1000 price hurdle. It's still the leader when it comes to quality, versatility and value! With 256K memory (expandable to 512K), single 360K disk drive, 4.77MHz clock speed, CGA card, parallel and serial ports and MS-DOS — it's not hard to see why!
Does not include monitor.

Specifications:
- IBM PC standard 4.77MHz clock speed
- On-board memory 512K maximum (256K fitted)
- 8088 CPU chip
- CGA card, parallel and serial ports fitted
- 67W power supply
- Supplied with MS-DOS 2.11 plus software depending on model.

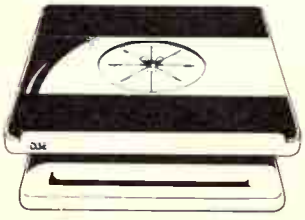
Cat X-8000

$995

Budget Swivel Base

Nylon slide assembly and non-skid feet for positive action. Allows full 360° rotation and 25° vertical adjustment. Suits all monitors (or even your home telly!) from 22cm to 35cm screen size. Cat X-1190

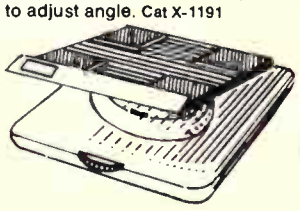
$24.95



Deluxe Swivel Base

Similar to budget model, offering same degree of rotation and angle, but this one has knurled knob for front locking or freeing monitor. If you want to turn the monitor frequently (eg for others to see screen) this is the one to choose, as the monitor does not have to be removed to adjust angle. Cat X-1191

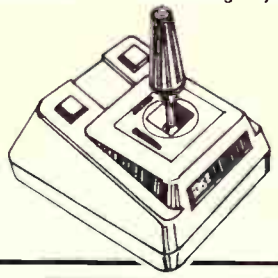
$34.95



IBM/Apple Joystick

Get the most from your computer games with this great value IBM/Apple Joystick! When the action is fast and furious you'll want the quickest response. Lightweight, comfortable and smooth action will give you the edge! Cat X-3570

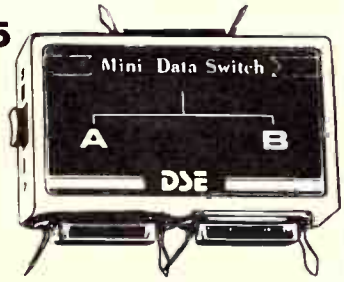
$59.95



Parallel Switch Box

This one can save you heaps! With the Parallel Switch Box you can now run one printer from two computers or even two printers from one computer. Saves that constant cable changing. Simply plug it into the parallel port and it does the rest! Cat X-3571

$59.95



Budget DSE Diskettes

Why pay more? Top quality computer media at a realistic price, made exclusively for Dick Smith Electronics by one of the world's leading disk manufacturers. They're so good we use them ourselves! Double sided disks, soft sectored, in 5¼" (13cm) standard size.

Single density: Box 10 disks	Double density: Box 10 disks
$27.50	$29.50
Cat X-3500	Cat X-3501

Serial Data Cable

2.35 metre serial cable with male DB25 plug one end, female DB25 socket the other. All 25 pins wired 1-1, etc. For serial printers, modems, computer/computer connection, and other data applications. Also ideal as extension lead for parallel printer cable (gives over 4m). Cat X-3564

$39

Parallel Printer Cable

Standard "Centronics" type printer cable with 36 pin Centronics plug (as used on 99% parallel printers) one end, 25 pin D socket the other. 1.7m long. Cat X-8614

$34.95

Female/Female Gender Bender

Adapts male serial cables without re-soldering or re-connecting. Simply plug in — twin female DB25 sockets with all 25 pins wired pin to pin. Cat X-3566

$15.95

Male/Male Gender Bender

As above, but twin male plugs permanently wired. Cat X-3565

$15.95

RS232 Breakout Box

Ideal for modems, other serial applications where connections need changing. DB25 male to DB25 female, pin 1 permanently wired, all others open with wire links supplied. Cat X-3568

$27.50

Permanent RS232 Jumper Box

Similar to above, but connections made internally and soldered for permanent applications. All 25 pins open. Wire links supplied ready for soldering. Cat X-3569

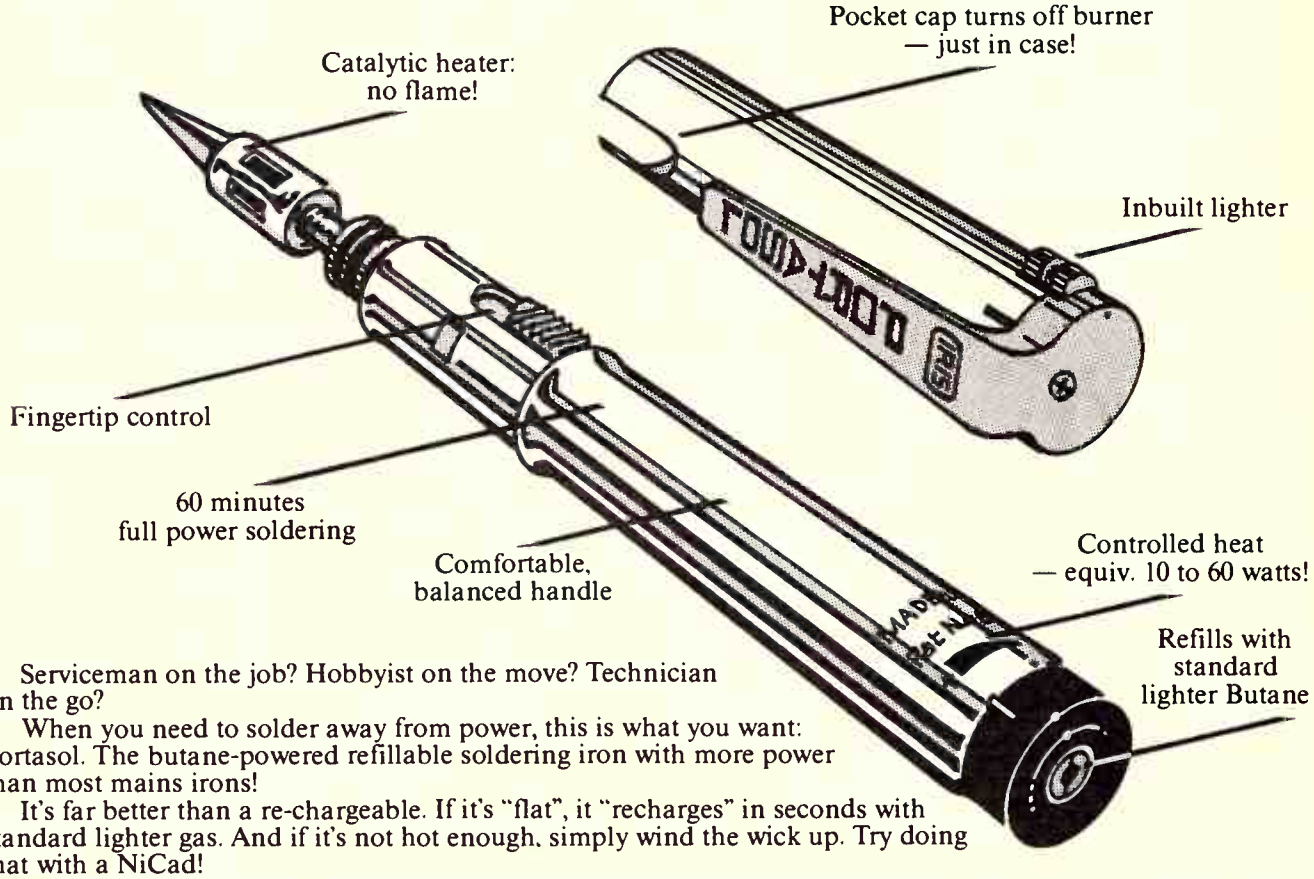
$17.50

DICK SMITH ELECTRONICS COMPUTERSTOP

Don't shop at DSE... Unless of course, you want the best value, largest range and professional service!

Want a Hot Tip?

PORTASOL won't let you down.



Serviceman on the job? Hobbyist on the move? Technician on the go?

When you need to solder away from power, this is what you want: Portasol. The butane-powered refillable soldering iron with more power than most mains irons!

It's far better than a re-chargeable. If it's "flat", it "recharges" in seconds with standard lighter gas. And if it's not hot enough, simply wind the wick up. Try doing that with a NiCad!

Perfect for all soldering applications — even those heavy jobs you'd normally want a "big gun" for. Yet it's small enough to slip into the shirt pocket (and in case you leave it on, the cap turns it off for you!)

Just think of the applications apart from electronics: Boat wiring and repairs. Auto electrics. Builders/electricians. Antenna installers. And so many more.

Portasol: it's a breakthrough in soldering. Throw away your old ideas about soldering. Get a Portasol and you'll get the difference. Cat T-1370

Spare tips including Catalytic Heater
$12.95
Cat T-1371

Only $59.95 at DICK SMITH ELECTRONICS PTY LTD

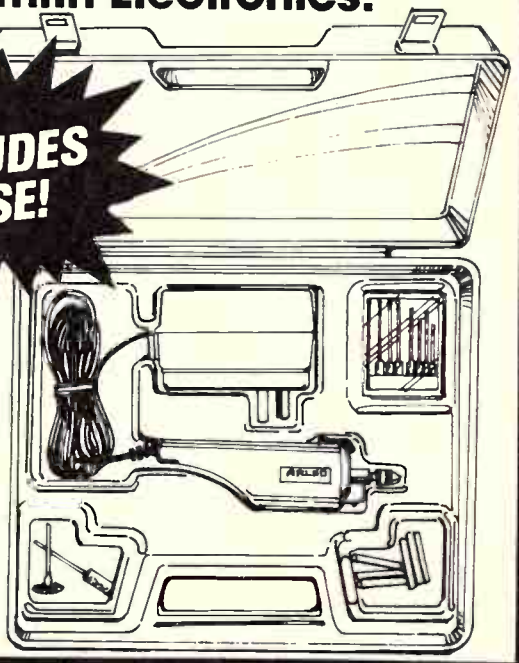
Available at all DSE stores . . . or phone DSXpress on (008) 22 6610 (Sydney 888 2105)

ARLEC

Famous Aussie brand from the famous Aussie stores: Dick Smith Electronics!

ARLEC'S FAMOUS
SUPERTOOL!

INCLUDES CASE!



What versatility! It sands. It polishes. It engraves. It mills. It's one of the handiest tools you can have in your arsenal! This fantastic hobby machine is a 10,000 RPM power head which does all of the above with the attachments supplied. And because it operates from low voltage (240V plugpack included!) it's safe. Includes the Supertool and plugpack, 2 milling cutters, 1 wire brush, 1 grinding wheel, 4 high speed drills, 5 chuck collets (0 to 4mm), eraser sticks and instructions. Cat T-4754

ONLY $59.95

Supertool: for • Hobbyists • Model Makers • Technicians • Gem & Lapidary • Antiques • You name it!

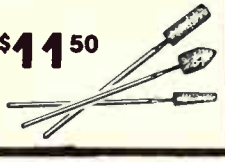
SUPERTOOL ACCESSORIES:

Cutting Discs
$11.95

Set of 6 mini cutting discs, with arbor, for cutting metal and plastic. Essential for the serious hobbyist. Cat T-4766

Grinding Bits
$11.50

Shape, sand and grind your projects to perfections. 3 piece, different shapes. Cat T-4758



Wire Brushes
Pack of 3 wire brushes for polishing, cleaning, etc. Cat T-4768

$15.95

Set 4 PCB Drills
Top quality high speed steel twist drills in all popular PBC sizes: 1.2, 1.0, 0.8, and 0.6mm. Cheaper than buyer singly! Cat T-4756

$7.95 set

Erasers
Make short work of rubbing out! Two different types to cover both ink and pencil!

Set 5 pencil Cat T-4762 $2.95

Set 5 ink Cat T-4760 $5.15

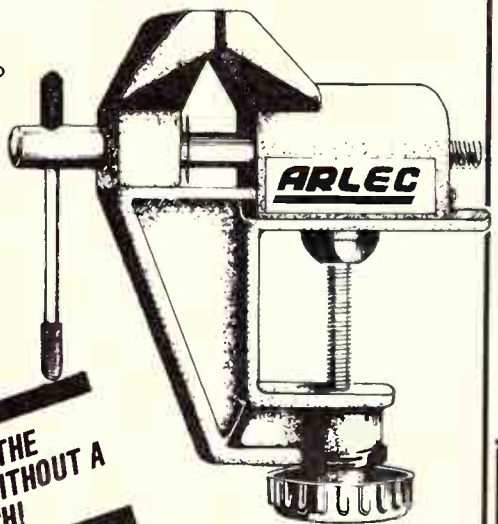
Engraving/Milling Bits
Set of three cutters designed to make short work of any engraving or milling job. Fine and medium hex head plus fine round head. Cat T-4764

$9.95

OTHER FINE ARLEC PRODUCTS...

ARLEC MINI VICE

Need a third hand? Here's one that won't let go! The mini vice from Arlec attaches to any table, desk, bench, etc. (up to about 40mm thick). 50mm wide jaws hold tight —opens up to around 60mm for those big jobs. More than strong enough for cutting, filing and other testing applications. Cat T-4748



A MUST FOR THE HOBBYIST WITHOUT A WORK BENCH!

ONLY $12.95

ARLEC NICAD CHARGERS

"D" Charger

Want to charge "D" NiCads? This one will handle two or four D size cells — even the heavy duty 4A types (the ones most chargers take forever doing!) Perfect for radio control cars, video cameras, etc — anything with a D size NiCad. Rated at 2x 3V, 400mA. Cat M-9400

$39.95

Multi Current Arlec Charger

In-situ charger for all NiCad types (AAA to 9V) with 4 different charging currents and 6 different connector types to suit all device sockets. Handles up to 10 NiCads at one time. Cat M-9510

$29.95

M-9521

Universal model accepts all types, automatically adjusts charging current to suit type. Includes battery tester. M-9521

$39.95

DICK SMITH ELECTRONICS

PTY LTD

When you need a third hand...

Cat Y-1073

To hold the light, that is! Don't strain your eyes with small pcb's, circuits, etc: use our nifty little headband light. You might look like a real goof — but you won't strain your eyes!

$4.95

Buy in bulk and $$$ave

Every hobbyist, every technician knows that a well- stocked "junk box" is one of life's biggest assets. You never know when you want a... and a good junk box should be able to yield one! Stock your junk box with DSE bulk bargain packs. Prices up to 50% and more off single prices!

¼ Watt Resistor Pack

300 computer selected carbon resistors, at huge savings. Cat R-7010 **$8.75**

Ceramic Pack

Over 60 ceramics of various values, with voltages as high as 630VW! Cat R-7050 **$6.25**

Metal Film Resistor Pack

300 1% tolerance metal films. A great buy! Cat R-7015 **$17.55**

Diode Pack

100 pieces signal diodes in both Ge and Si. From OA90 to 1N914's. Cat Z-3005 **$13.15**

Greencap Pack

60 greencaps from .001 to 0.22uF. All 100V types. Cat R-7040 **Around $22 worth $12.60**

LED Pack

100 premium quality (matched brightness & colour) LEDs in red, green & yellow Cat Z-3015 **$26.35**

Electro Pack

55 quality pcb mounting electros from 2.2 to 470uF. Cat R-7030 **Around $15 worth! $8.75**

Read all about it!

ARRL Handbook

The amateur's "bible". A fantastic reference source for those who have a licence or those who haven't. Cat B-2220

$49.95

1987 EDITION

ARRL Antenna Handbook

Everything you ever wanted to know about antennas — and then some! Highly valuable in any library. Cat B-2207

$29.95

Amateur Electronics and Study Guide

"Students own notes" format makes it so easy to understand. A must for the beginner — right through to full licence level. Cat B-2319

$16.95

VHF/UHF Manual

Recommended for "Z" calls and all others interested in working above DC! One of our most popular manuals. Cat B-2054

$29.95

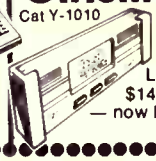
Near Half Price!

Great for computer buffs —or just as a gift! Computer shaped LCD desk clock now at a huge saving. Cat Y-1039

$6.95

One for the Girls...

Cat Y-1010



Big savings too on this travel alarm. It's pink, so it's just right for mum or sis! Last year sold for $14.95 — now look! **$6.95**

Value!

No, we don't know what they're from, but they're great! 240V AC motor, geared to 5RPM, with cam driving microswitch 3 times each rev. So you get the motor and microswitch for this crazy price! Cat J-1041

$1.50

"4000 Count" Bargraph Digital Shows Analog!

$249

The usual complaint with a digital multimeter is you can't see changes. Problem Solved: this new LCD gives you the best of both worlds: digital accuracy, with an analog indication AS WELL which shows both magnitude AND variation at the same time. But there's even more than that: this outstanding design counts to 4000, rivalling the accuracy of 4.5 digit meters, while keeping the price down to 3.5 digit types! 4000 counts means it has double the resolution of 2000 count meters. One of the best meters we've ever seen! Cat Q-1666

Magnavox is Back!

Famous Magnavox speakers are back in production, and back at DSE stores. Build your own speaker systems with these superb models:

80mm Tweeter

30W maximum rated, 8 ohms impedance. Frequency response to 18kHz. Cat C-2070 **$9.95**

100mm Midrange

Superb high quality speaker for smaller systems. 3W, 8 ohms. Ideal replacement speaker, too. Cat C-2062 **$9.95**

125mm Midrange

High power version: 30W rating, with 800 to 7000Hz. Smooth and precise. Cat C-2060 **$19.95**

200mm Woofer

Huge 80W rating with excellent bass response. Frequency response to 500Hz. Cat C-2054 **$29.95**

250mm Woofer

Similar to above, but slightly lower (65W) rating, lower resonant frequency. Cat C-2052 **$39.95**

300mm Woofer

The Big Gun! 80W rating, 30Hz resonant frequency. Also 8 ohms. When you want the best... Cat C-2050

$49.95

Bargain of the Century

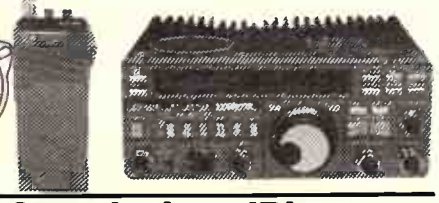
BUY AN FT757GX

Yaesu's superb all mode, all band HF transceiver with 100 watts out from the size of a (small) shoebox. Already one of the greatest buys in amateur radio. . . Cat D-2940

$1799 AND GET A HANDHELD FREE!!!

Yes while strictly limited stocks last, we'll also throw in a Yaesu FT203 2 metre hand-held. That's around FIVE HUNDRED DOLLARS saving! Yes, 500 big ones that the assets test, the taxation department, not even a Royal Commission can get you for!

HURRY! STRICTLY LIMITED STOCK!!! OFFER APPLIES ONLY WHILE CURRENT STORE STOCKS LAST.



Digital Capacitance Meter Too!

Few pF to 200uF range — very handy to sort through "unknowns" (saves you having to remember codes too!) Much more accurate than "combined" meters. A must for the lab or the service bench. Cat Q-1221

$99

At Last! DSE's Dipper

Budget priced dipper with 1.5 to 250MHz range (6 plug-in coils) for all those amateur and communication uses. Inbuilt xtal oscillator (1-15MHz), 2kHz sine wave modulation. Cat Q-1335

$129

Sennheiser 'Phones

Top quality Sennheisers — for when you want REAL quality.

HD40

The budget model. Lightweight and comfy, 22-18000Hz response. Complete with 6.5/3.5 multi-plug & cable. Cat C-4120 **$49.95**

HD410SL

The BEST! Superb sound reproduction, 20-18000Hz response and generous 3 metre cable. Highly comfortable, ideal for monitoring 'phones. Cat C-4115 **$74.95**

Checking Cables? It's E-Z!

The best device we've ever seen for checking cables and connections. The perfect roadie's friend. Handles RCA, BNC, Cannon, 6.5mm etc. Rugged, too. Cat Q-1532.

$59.95

Bench meter Bargains

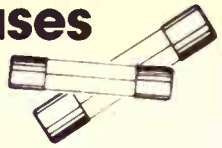
When you want high visibility and don't want to tie up a multimeter, try these. DCV and DCA, huge scale and two ranges. Ideal for techs, schools too.

0-1A, 0-10A DC Cat Q-2130

0-10V, 0-20V DC Cat Q-2140

EACH $29.95

Fuses



We've got the LOT!

Whatever your requirement in fuses, see DSE. You'll save! And if you buy in bulk, you'll save even more!

Fast Blow

3AG

100mA	S-4494
150mA	S-4451
250mA	S-4453
350mA	S-4455
500mA	S-4457
1A	S-4461
1.5A	S-4465
2A	S-4467
3A	S-4469
5A	S-4471
7.5A	S-4473
10A	S-4475
15A	S-4477
20A	S-4479
25A	S-4481
30A	S-4485
35A	S-4487

M-205 ALL

250mA	S-4412
500mA	S-4415
1A	S-4421
2A	S-4423
5A	S-4425

45¢ EACH

Slo Blo Fuses

3AG		M205	
250mA	S-4350	250mA	S-4300
500mA	S-4355	315mA	S-4305
1A	S-4360	500mA	S-4310
2A	S-4365	1A	S-4315
5A	S-4370	2A	S-4320

Auto (Blade Type) Fuses

ALL 50¢ each

5A	S-4505		
7.5A	S-4507	20A	S-4520
10A	S-4510	25A	S-4525
15A	S-4515	30A	S-4530

Mains Circuit Breakers

Plug-in replacements for "Federal" type fuses in your fuse box. Saves ever having to search for fuse wire again!

16A	P-5920	10A	P-5910
20A	P-5925	15A	P-5915

ALL $10.95 each

THE ROLLS-ROYCE OF HAND TOOLS: PIERGIACOMI

You asked for quality - you've got quality. Around the world, Piergiacomi tools are known for their outstanding performance and precision. Stainless steel, beautifully honed cutting edges - you owe it to yourself to try them!

Standard Cutter
Just feel the precision! 4mm blade opening. Cat T-3262 $16.95

Shears
Cut through metal, plastics, even RG213 coax! Cat T-3265 $22.95

Back Angled Cutter
Reverse to normal cut especially for fine pcb work. Cat T-3261 $16.95

Needle Nose Pliers
Really a needle! Ultra fine with flat blades. Cat T-3266 $17.95

Inclined frontal cut.
Full frontal! Leaves 1.5mm lead length for soldering. Cat T-3263 $19.95

Inclined cutter and bender
Bends pcb leads as well as cutting them. Clever! Cat T-3264 $18.95

Building Or Renovating?

Find the power cable or pipe before your drill or saw does! Hand held detector detects metal to several cm; a must for builders & handymen
Cat Y-1060
WAS $17.95 NOW $14.95

Assorted Metric Screw Pack

Over 200 pieces of the most popular small sizes: M2.5, 3 and 4 nuts and screws — cross, round and countersunk head. Plated finish.
$9.95 10 up $8.77

BOXES AND CASES FOR PROJECTS

No matter what your project, there's a DSE box just right for it. Professional finish, made to last. Here are just two styles from our large range:

Extruded Aluminium

High degree of RF shielding, close fitting ends. Extrusion size 76 x 102mm, supplied in three lengths:

76mm length	H-2420	$10.95
102mm length	H-2425	$12.95
153mm length	H-2430	$14.95

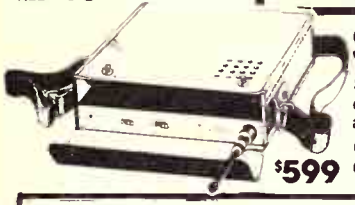
Plastic

As used by world-wide manufacturers. Three different styles of case, one to suit your requirements.

155 x 65 x 160mm	H-2508	$9.45
200 x 95 x 140mm	H-2506	$15.00
200 x 65 x 100mm (illustrated)	H-2505	$18.75

FROM $10.95

FROM $9.45



Slimline UHF CB: Royce

Slimline so we've given it a slim price! It's superb — electronic control, full 40 channels - and add the optional carry case for go-anywhere type. Cat D-1810

$599

Optional Carry Case (turns mobile CB portable)Cat D-1812 **$189.95**
Optional Tone Squelch (ideal for business use)Cat D-1808 **$129**

Less than $1 per piece!

Our T-4830 tool kit is outstanding value! 21 pieces including mini spanners, screwdrivers, spintights, etc etc. Handy plastic carry pack. Cat T-4830

$14.95

Stick it by Gum!

Glue nearly anything to anything with a hot melt glue gun. Easy to use, makes a really strong, tough bond. Great for the hobbyist, ideal for the serviceman.

Cat T-4840
$19.95

Own a Frog 8800?

Want wide band FM? Here's how to get it: fit an FM wide module. We ordered hundreds more than we needed so you save! Normally around $50, now almost half price! Cat D-2824 $29.95

Protect those Mags!

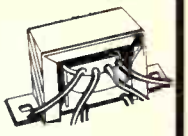
Electronics magazines are too expensive to throw away. And they make good reference too. So protect them with DSE's magazine binders. Holds up to 12 copies of your favourite mag (fit EA, ETI, AEM, AR, ARA, etc etc).Cat B-4045

VALUE! $6.95

NEEDA TRANSFORMA? SEE DSE

Our range will get you the voltage and power you want. All electricity authority approved, versatile, ready-to-go-to-work transformers just right for a hobby project or a commercial design - and anything in between!

DSE2851. Primary: 240V, 50Hz. Secondary voltage: 6.3-0-6.3V. Secondary current: 150mA. Terminations: Flying leads. Cat M-2851 $5.50
10 up $4.70



DSE2155. Primary: 240V, 50Hz. Secondary voltage: 6.3, 7.5, 8.5, 9.5, 12 & 15V. Secondary current: 1 amp. Terminations: Flying leads. Cat M-2155 $7.95
10 up $8.80

DSE6672. Primary: 240V AC. Tapped: 15, 17.5, 20, 24. Secondary voltages: 27.5 & 30V. Secondary current: 1amp. Terminations: Solder lugs. Cat M-6672 $11.95
10 up $10.95

DSE2000. Primary: 240V AC. Secondary: 18 volts @ 6A. Terminations: Flying leads. Cat M-2000 $29.50
10 up $28.35

DSE0144. Primary: 240V AC. Secondary: 28-0-28V. Secondary current: 2A. Cat M-0144 $29.50

DSE0153. Primary: 240V AC. Secondary voltage: 35-0-35V. Secondary current: 2.5A. Cat M-0153 $29.50

FERGUSON Low Profiles Too

Famous Ferguson low profile transformers offer low levels of flux leakage (very quiet!) as well as their small profile. All 20VA models, all with twin windings which can be paralleled or seriesed for greater current or voltage output.

2 x 6V@1.7A	M-3596
2 x 7.5V@1.3A	M-3597
2 x 9V@1.1A	M-3598
2 x 12V@.85A	M-3599
2 x 15V@.69A	M-3600
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ALL ONE PRICE! $24.75 EACH

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Plug packs make great sense. The bulky transformer is left on the power point while the whole of the case can be devoted to the circuitry! And your choice of AC or DC output - depending on application.

12V AC at 500mA
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The Perfect Answer At The Right Price!

Budget-Priced Answerer

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Our most affordable answering machine priced for the small business or home. But don't let the low price fool you... new technology offers a wealth of features. An amazing 'built-in' female synthesized voice allows the single tape to record more messages than other single tape answering machines. • 40 second recording time permits callers to deliver a full message. PLUS: 8 second VOX auto-off • 3 ring delayed trigger • Call screening and telephone monitor • Volume control • 'Power' and 'Auto Answer' LEDs. All this packed into a compact unit which uses standard size cassettes. Includes power adaptor and Telecom approved phone plug. Cat F-6125

Phone & Answer Machine

Telecom Authorised

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It's a full function push-button phone AND answering macnine. Takes up less space, doesn't need two phone sockets or double adaptors, yet gives all the features of both. Single tape unit uses standard audio cassettes, and you only need record your outgoing message once. Retrieve messages left from any phone — anywhere. Cat F-6140

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Call Forwarding 2 Tape Answering Machine

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You won't believe that an answering machine could offer so much — at such a low price. But then it's much, much more than an answering machine. Look at the incredible features this state-of-the-art machine has to offer:

- Call forwarding
- "Memo" function
- Emergency message sending
- Answer delay
- Total remote control
- Security coded

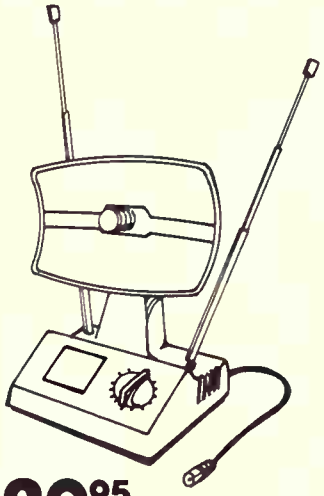
Plus all the "usual" answering machine features. Cat F-6145

16 Memory Hands-free Loudspeaking Phone

$179

The ideal office companion — even at home! It's the perfect telephone for busy people. Features 16 single touch memories so those important calls are always at your finger tips. Loudspeaking mode allows you to make or answer calls without interrupting your work. Features include adjustable speaker volume, mute switch, 16 single touch memories, handsfree operation, Hookflash for PABX use, adjustable ringer level, Tone/Pulse switchable, battery backup facility, desk or wall mountable and more! Cat F-5136

Deluxe 3 Band Indoor

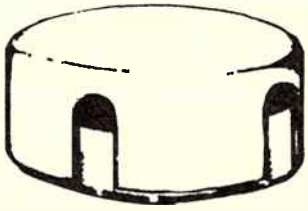


$29.95

Ideal for strong reception areas, you'll save heaps on complex outside systems with this quality UHF, FM, VHF indoor antenna. Colour, black and white and stereo, nothing's a worry for this one. Installed in seconds for the perfect picture. Cat L-4005

Get A Clear Picture!!

Indoor UHF/ VHF Diplexer



$9.95

Many TV sets and videos have only one antenna input: tough luck if you're running VHF and UHF antennas! Now there's a solutions — the Diplexer. Accepts lead-ins (75 ohm) from both antennas and combines them without the normal losses associated with couplers used at UHF. Then you can run one lead-in to the TV/Video. Cat L-4470

Go Anywhere FM/TV

$49.95

Here's a go anywhere TV/FM antenna that's small enough to be packed up and put in the camper or van. It even comes with a special 'gutter gripper' bracket for caravan use, plus a mini mast and 7 metres of 300 ohm ribbon. Single folded dipole for maximum performance over wide frequency range, suits horizontal or vertical mounting. Cat L-4026

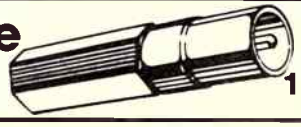
Even from your old set you can now get...

Stereo TV!

$199

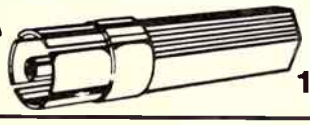
Your old telly can have the best qualities of the modern ones — without spending a thousand dollars or more on a new model! You can have full stereo sound from your existing set. Just plug in the DSE Stereo Sound Receiver and quality stereo is at your fingertips (and buzzing around the room as well). You can put it through your existing stereo amplifier and speakers for true hi-fi and the 6 preset stations make tuning a breeze. Its handsome design and compact size mean it'll be at home anywhere. 6 preset stations, video and audio output with termianls, mono/stereo mode selection, LED stereo indicator and more! Yes, it's fully compatible with Australian "two carrier" TV system. Comes complete with adaptor plug and connecting leads. Cat L-4905

Metal Line Plug Cat L-4508



$1.20 10 up 85¢

Metal Line Socket Cat L-4509



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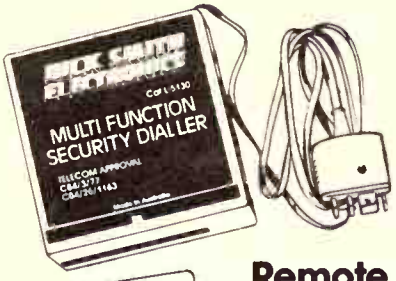
Install your own alarm system or second phone, etc, and save a fortune. Put your technical knowledge to work for you instead of someone else!

Control 444444444...!

The Affordable Professional System

The latest in electronic technology and concept, versatile enough for commercial use yet affordable for home use. The Control 4 is a complete 4 sector alarm panel with panic or emergency sector,with provision for a wide range of options which can turn it into a formidable and secure alarm package. Advanced features include adjustable entry, exit and alarm times, 4 inputs PLUS 2 end of line, allows connection to remote keyswitch or codepads for added security, monitors both mains power and standby battery against failure, emergency/panic button, allows silent access for authorised people, allows 24 hour circuits to be monitored (fire, medical, hold-up, freezers, etc), provision for 'At Home' Entry Guard feature, provision for dialler and just about every feature you're likely to ever want! Comes complete with DC adaptor. With Control 4 — you won't need any more! Cat L-5106

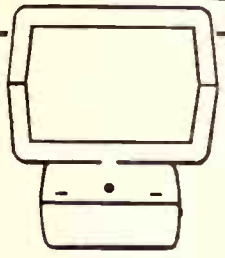
$299



Alarm Phone Dialler

Your home alarm can 'phone' you at work, phone a relative or friend to alert them. Telecom authorised, dial two numbers. Suitable for most alarm types. Cat L-5130

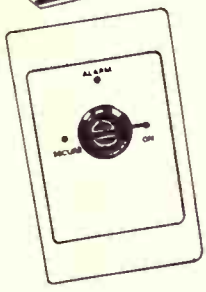
$249



Passive infrared detector

Wide angle protection of rooms, hallways, etc. Adjustable swivel head for precise line of detection. Convenient wall or ceiling mounting. Cat L-5009

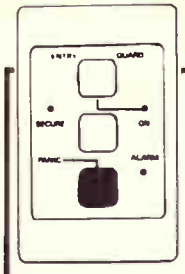
$89.95



Remote Keyswitch

Help eliminate accidentally setting off the alarm! The CP1 remote keyswitch can be mounted out of the surveillance field of your alarm sensors (eg. in the garage, garden, verandah) so you can arm and disarm your system remotely. With tamper switch and three LED status report. Cat L-5104

$79.95



Entry Guard

Designed for use in conjunction with the Control 4 security system Entry Guard allows you to use your alarm while you're at home. It allows you to monitor one or more sectors of the house (say the perimeter sensors) while others are ignored. Incorporates 24 hour panic button for emergency use. You can even activate an optional plug-in dialler! Cat L-5107

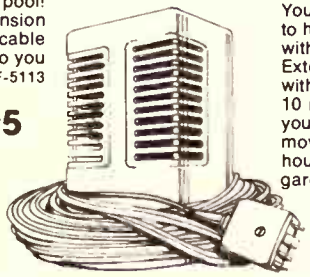
$79.95

15 metre Phone Extension!

Take the phone from room to room, or out to the patio or pool! With the Telephone Extension Reel you get 15 metres of cable on a retractable spool — so you can keep it tidy! Cat F-5113

$18.95

Is that the phone??

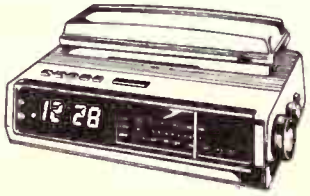


You won't have to strain to hear the phone ring with the Telephone Extension Bell. Comes with socket adaptor and 10 metres of lead. All you do is plug it in and move it anywhere in the house, workshop or garden, etc. Cat F-5119

$19.95

Hands-Free Telephone with Clock Radio!

Perfect for the bedside table! Alarm Clock Radio with all the features PLUS push-button Telephone with hands-free capability. Sure makes those early morning (or late night) calls easy! Cat F-5109



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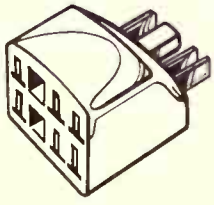
Economy Phone!

The economical way to a second phone or replace that clumsy old thing with a modern push button model. Features automatic last number redial, mute switch and ringer On/Off! Cat F-5185

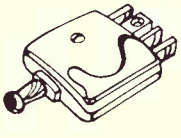
$19.95



Double Adaptor

Get away with it! Connect two phones or a phone and an answering machine without disconnecting and reconnecting. Cat F-5112

$7.95



Plugs/Sockets

DSE's phone plugs — identical to Telecom type 605 — as used in all phones, etc. Cat L-5117

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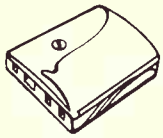

Our 610 phone sockets are designed to Telecom standard... and DSE's versatility. Cat F-5118

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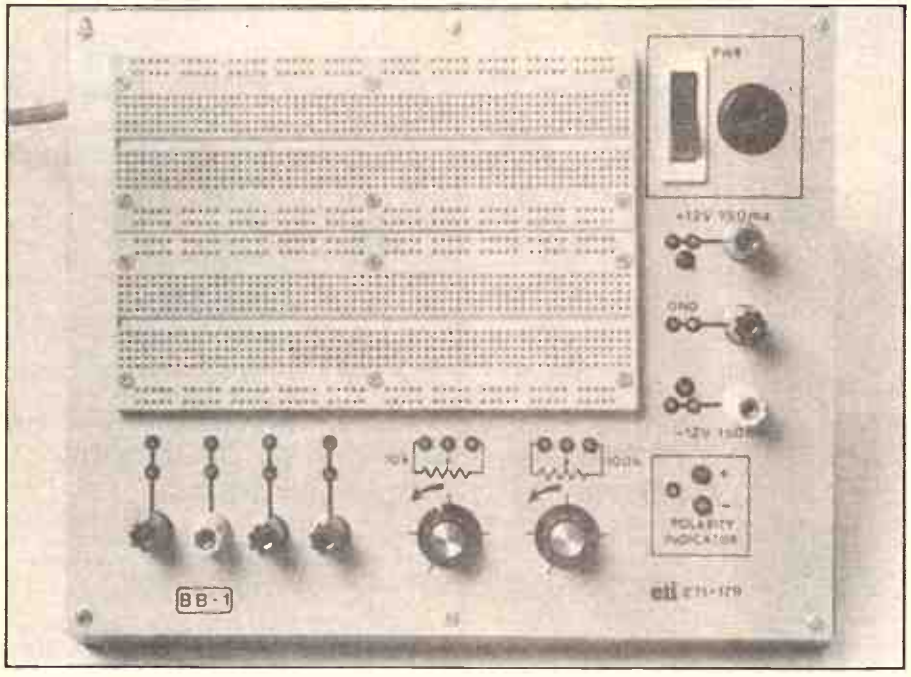
AN ANALOGUE BREADBOARD

A breadboarding socket on its own is useful, but it needs to be combined with an integral power supply, some hardware and support circuitry if a really versatile system is to be realised.

Peter Phillips



The top view. Front panel artwork for the ETI 179 was too big to fit in the magazine. If you require it, contact ETI readers services on (02) 693 6666.

THE BREADBOARD HAS traditionally been the developmental tool of circuit designers, as the ease of component replacement allows 'fine tuning' of the circuit before its eventual placement on a pcb. Educational institutions often use breadboarding systems for practical sessions of electronics, as component wastage is minimised. However, on its own, a breadboard is simply a means of interconnecting and supporting components. Any external attachments to the circuit, such as test equipment, potentionmeters, switches, the power supply, input signals etc, need to be arranged around the board and connected in whatever way possible. This can result in the traditional 'rats nest', resulting in confusion and circuit errors. More sophisticated circuit development systems offer a breadboard mounted on a box that contains external support for the board. It sound simple, and it is. The problem is; trying buying one that doesn't cost an arm and a leg. This article presents a design that includes all the pcb layouts and panel artwork to allow constructors to build their own, customised system. The design is intended for analogue applications, and features a dual polarity power supply and a sensitive voltage polarity indicator. A digital breadboarding system will be presented later and will include support circuitry peculiar to such a system.

The Circuit Principles

The circuitry of this project is relatively simple. One pcb design (PCB-1) contains the dual polarity power supply and the polarity indicator. PCB2 contains the hardware and the socket pins that enable interfacing between the breadboard and the power supply.PCB3 hold to two on-board potentionmeters and the connections to the outside world. The design is based

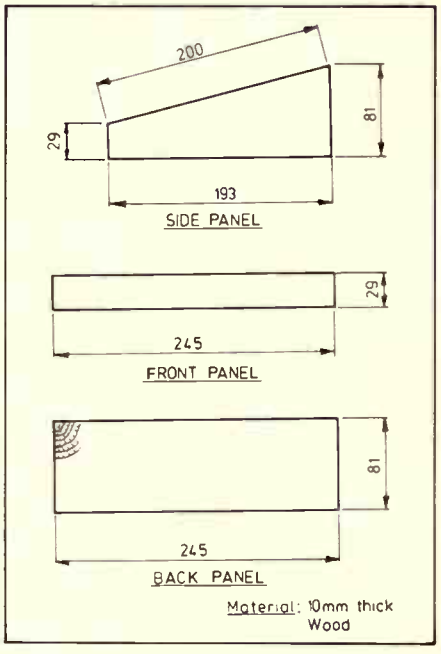


Figure 1: Cutting diagram for the box. This is only really necessary if you want to use a front panel like ours. Otherwise you can dimension the thing to please yourself.

upon my experience of the requirements for analogue circuit development. Cost has been minimised by using garden variety components, which perforce means a relatively basic, but still very versatile unit.

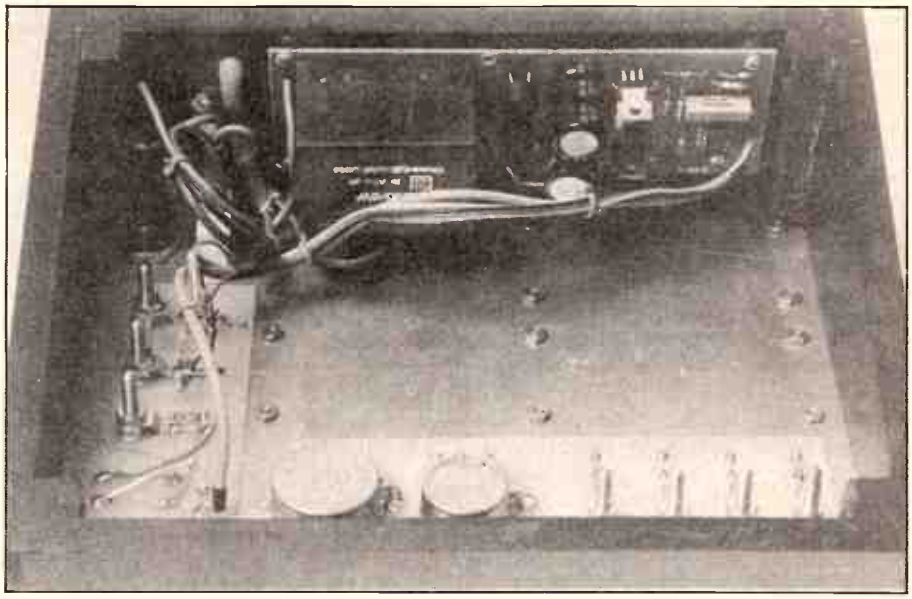
Naturally, readers can add, alter or delete sections as required. For example, PCB-3 could be used to mount switches instead of potentionmeters, or two of these boards could be used, one for the pots, the other with switches. The power supply will not handle currents greater than around 150 mA per side unless a higher VA rated transformer is used. However, in the unlikely event that higher currents are needed, an external power supply can be interfaced via the 4mm terminal posts provided. Heavy leads are connected to the terminals, which then connect to the breadboard via the associated socket pin(s) with 0.6mm wire.

Customising the Design

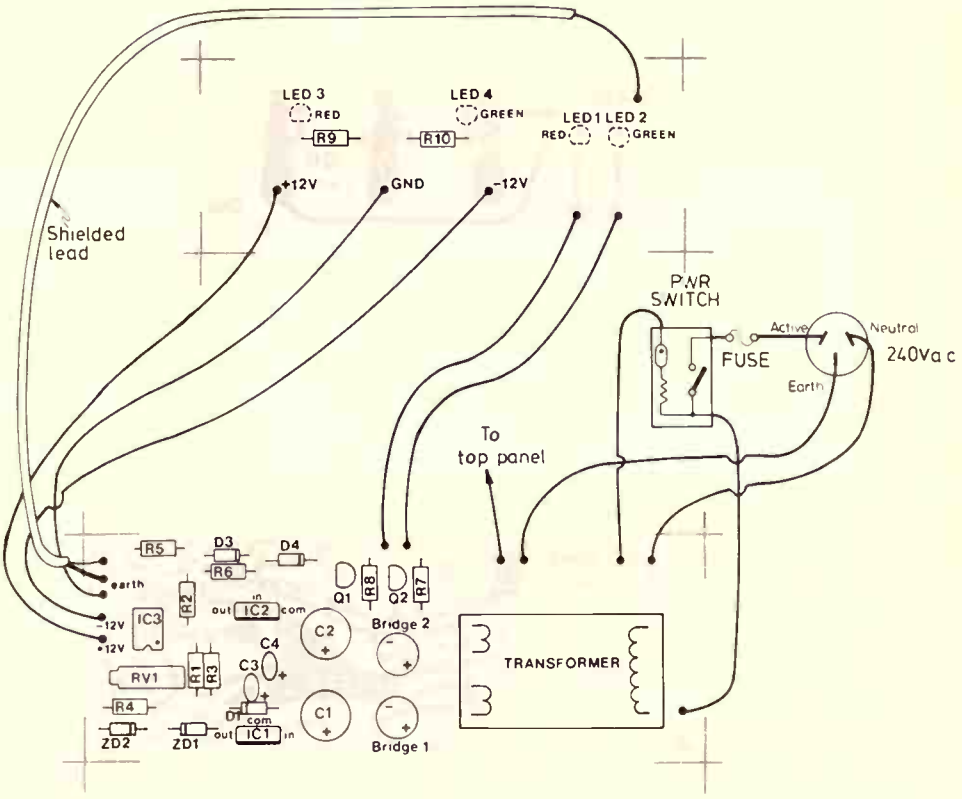
The mounting framework for the prototype, consisting of a wooden box fitted with an aluminium top may suit those with the necessary workshop facilities. However, any equivalent construction would do, although the metal top is recommended to act as a ground plane. A sloping top was incorporated to facilitate viewing the breadboards, but a simpler construction would result from a flat box. The power supply board (PCB-1) was mounted at the rear of the box in the prototype, but can be positioned anywhere it fits. I attached two breadboarding sockets (840 hole size), but one would probably be sufficient for most applications. A bottom cover of timber or metal should be added to the box, and rubber feet will provide stability. To further extend the versatility of the BB-1, mounting flanges for extra pots, switches and devices could also be attached to the unit.

If the supplied top panel artwork is to be used, the layout of the prototype is mandatory. Develop your own artwork and the sky's the limit. There are various methods of constructing the top panel. For example, the top could be made from one large pcb section (245mm x 200mm), etched using the supplied pcb layouts positioned accordingly. The component side could then be painted and screen printed using the supplied design. If screen printing facilities are not available, press-on lettering and hand drawn symbols and lines could be applied. This latter would require lacquering to protect the artwork.

Alternatively, an aluminium top with hand-painted artwork could be used. Treatment of the aluminium top should at least include coating with lacquer, perhaps preceded by polishing and dipping in caustic soda. This latter treatment should be done with some care, as irritating fumes are released during the process. Otherwise, the aluminium could be painted, after application of a suitable primer, and the artwork applied to the painted surface. The prototype was constructed using an aluminium top covered with a Scotcheal panel. The pcbs (2 and 3) were then laid to the underside of the top panel by drilling holes to allow mounting of the necessary hardware through the panel onto the pcbs. This method results in the pcbs being attached by the hardware, allowing trackside accessibility from underneath. An alternative approach is to make each pcb, and then mount the boards on top of the panel. This would require rectangular cutouts in the panel, and fixing with screws at each corner of the pcb. This 'modular' approach, with its inherent flex-



Bottom view, looking towards the back of the unit. PCBI holds the transformer, PCB 2 is to the left, and the pots carried by PCB 3 are almost obscured in the foreground. This view also shows how the box was built. Simple!



ibility would allow any arrangment sought, while still offering a good-looking end result.

Constructing the BB-1

Commence construction by building the box. Those with a flair for carpentry will probably build a box with mitred corners and a recess to hold the top panel. (The prototype wasn't; just a simple butt connection box, painted matt black, then sprayed with satin enamel lacquer).

The next step is to cut the top panel, trimmed in size to suit the box. The position of the holes and cutouts can be determined either from the artwork or by placing the pcbs and the breadboarding socket(s) into place, and cutting out accordingly. If a Scotchcal front panel or a screen print is being used, this could be applied first, and used as a reference for the various cutouts. Once the top panel has been completed, PCBs 2 and 3, the breadboarding socket(s) and the power switch (and fuse if used) can now be mounted in position. If the pcbs are mounted as in the prototype, that is, beneath the top panel, held by the hardware, it is likely hole alignment may not be exact. For this reason, you may prefer to drill the top panel according to the artwork, then drill the pcbs using the top plate as a template. Getting perfect alignment is impossible, but with care, good results can be obtained. This part of the construction is relatively time consuming and fiddly, as care must also be taken not to damage the top panel artwork, or to create any short-circuits between the panel and the components passing through it.

PCB-1 should now be built, as per the layout diagram, but should be fitted only after all wiring, testing and adjustments have been completed. This pcb was fitted to the prototype using spacers and self-tapping screws into the timber back. If a bigger transformer than the specified one is used, it should be mounted directly on the case, earthed and connnected with leads to PCB-1. If a power supply with increased power characteristics is used, heat-sinking the regulators will be necessary.

The choice of the power switch should be made with some care as it is likely this switch will get a lot of use, requiring a rugged switch if reliability is to be achieved. Use of a miniature switch is not recommended. The illuminated variety was employed as it provides a positive indication that the power is on.

Four LEDs are incorporated on PCB-2, two adjacent to the +12 and −12 termi-

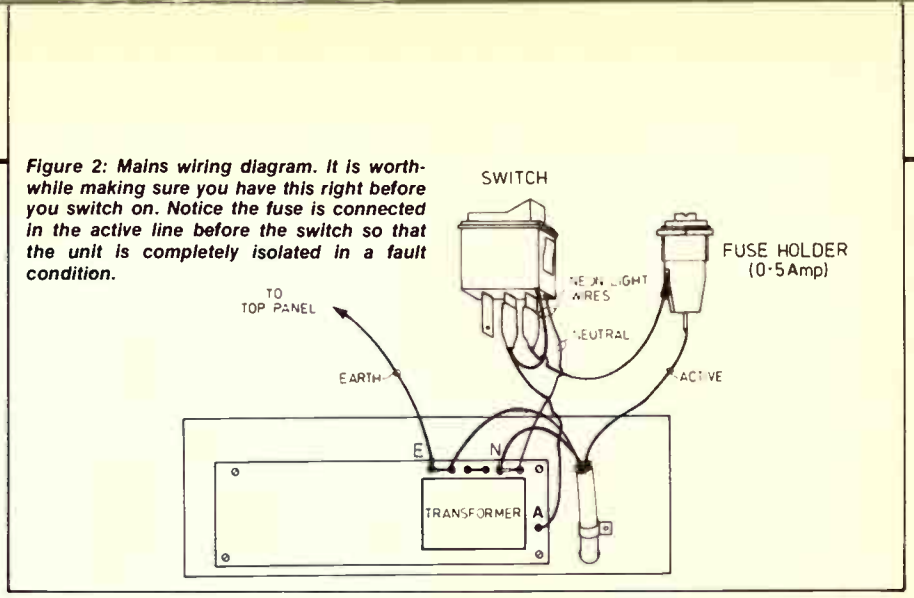


Figure 2: Mains wiring diagram. It is worthwhile making sure you have this right before you switch on. Notice the fuse is connected in the active line before the switch so that the unit is completely isolated in a fault condition.

nals, two more for the polarity indicator. Pin-point LEDs are specified; green for both negative voltage indicators, reds for the positive indicators. They mount directly onto the pcb, through a 5mm hole drilled in the top panel. A piece of 4mm black plastic tubing over the bottom of the LEDs will enhance their light output and protect the leads from shorting to the panel. Current limiting resistors R9 and R10 for LEDs 3 and 4 should be soldered on the track side of PCB-2. The 4mm terminal posts on both PCBs 2 and 3 should be soldered directly to the pcb track with their connecting lugs. If VCU style potentionmeters are used for PCB-3, they can be soldered to the pcb lands directly by forming the lugs to suit. The flat section will be incorrect to suit a screwed dial knob, requiring another flat to be filed onto the shafts. Metric style pots overcome this problem, but will require connection with wire to the pcb lands.

The earth wire from the mains is terminated on PCB-1, and is subsequently connected to the ground terminal post of the unit via the power supply wiring. However, a separate 7 amp rated wire should be connected to the aluminium top panel. This not only provides protection, but serves to ground any noise pickup. The pcb mount transformer is not earthed, as it is double insulated. However, if a conventional mount transformer is used, it should also be earthed.

Construction of the pcbs is straight forward; just follow the layout diagrams and watch component orientation when building them. The IC socket pins associated with PCBs 2 and 3 can be obtained either by sacrificing IC sockets, or by purchasing insulated IC socket strips. The gold insert, machined variety are recommended to stand up to the type of use envisaged. (Those used in the prototype were supplied by George Brown). Molex pins would work, but are unlikely to give reli-

PARTS LIST

RESISTORS — All ¼ watt 10% unless otherwise specified.
— all values in ohms.

R1, R2, R5, R6 ..... 10k
R3 ..... 220k
R4 ..... 68k
R5, R6, R7 .....
R8, R9, R10 ..... 1k

POTENTIONMETERS RV1 ... 10k, 10 turn trimpot
RV2 ..... 10k linear, panel mount
RV3 ..... 100k linear, panel mount

CAPACITORS
C1, C2 1000
C3, C4 ..... 2.2 tantalum.

SEMICONDUCTORS
Q1 ..... BC547 or similar
Q2 ..... BC557 or similar
D1, D2 ..... IN4004 or similar
D3, D4 ..... IN914 or similar
ZD1, ZD2 ..... 5V6 400mW Zener diode
IC1 ..... uA7812, T0220 voltage regulator
IC2 ..... uA7912, T0220 voltage regulator
IC3 ..... uA714
Bridge 1 and 2 ..... W04 or equiv.
LED 1 and 2 ..... Pinpoint red LED
LED 2 and 4 ..... Pinpoint green LED

SWITCHES
S1 ..... 240 volt mains switch (illuminated)

TRANSFORMER
T1 ..... PCB mount, PL30/5 VA or equiv.

MISCELLANEOUS
PCB or vero board; Scotchcal front panel; timber for case; light gauge aluminium sheet 220mm x 245mm; 7 x 4mm terminal posts; 20 insulated IC socket pins, gold insert, machined variety; 2 control knobs; 4 pcb supports, rainbow cable hook-up wire, 240 lead and plug; cable clamp; lugs, 840 pin breadboard socket(s); fuse holder; 0.5 amp fuse.

able long term service in this application. The socket pins solder directly to the pcbs, through a 3mm hole in the top panel. The interconnections between PCBs 1 and 2 are shown in figure 3. Note particularly that a shielded lead is required to connect the polarity indicator input on PCB-2 to its circuitry on PCB-1.

Commissioning

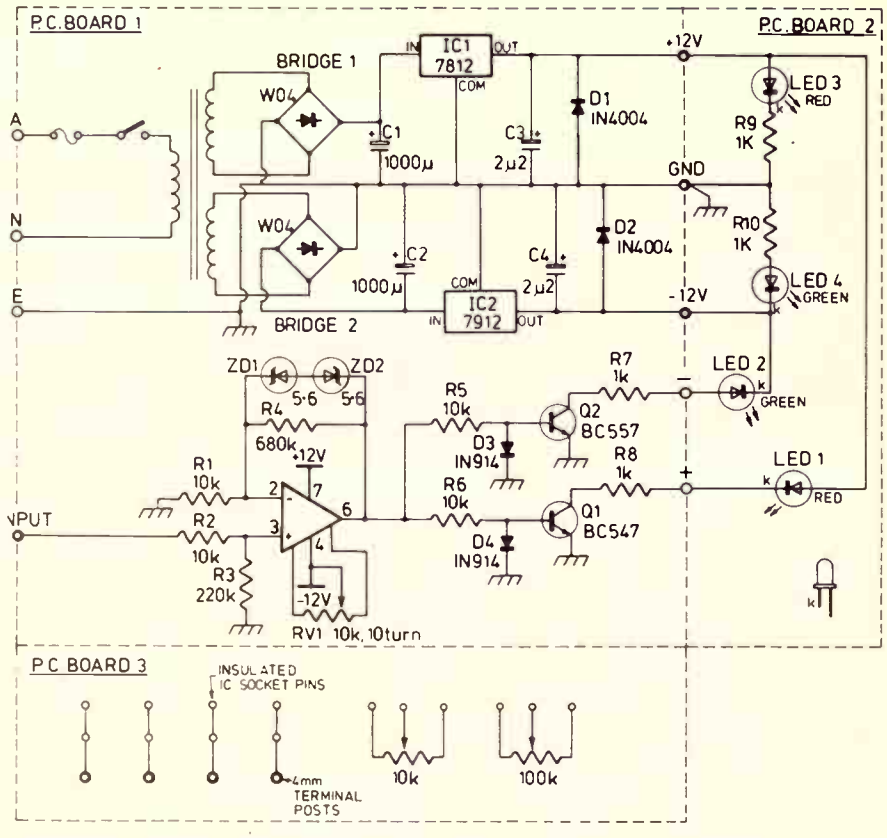
Once all wiring is complete, and final checks confirm that PCBs 1 and 2 have all components correctly polarised, apply power to the unit. The two voltage indicator LEDs should light to show the presence of the +12 and −12 volt rails. If not, determine if these voltages are in fact present. A likely problem is incorrect orientation of diodes D1 and D2, or of the regulators. Note that the 7800 series has different connections to the 7900 series, but that orientation on the pcb is the same for both devices. If voltage is present, check the LED orientation. If all is well, it remains to adjust the offset for the polarity indicator. This should ideally be done with a voltmeter connected to pin 6 of IC3 to measure the dc output voltage. Connect the polarity indicator's input terminal to ground, and adjust RV7 until the dc voltage at pin 6 is exactly 0 volts. Allow a few minutes for everything to stablise before performing this adjustment. Once this is complete, both LEDs associated with the indicator should be out. Applying a positive input voltage greater than 10mV should cause the red LED to turn on; similarly, the green LED should light for an equivalent negative input voltage. The maximum input voltage should not exceed 24 volts. Finally, install PCB-1 into position and tie the wiring neatly into looms.

Using the BB-1

The BB-1 is designed to facilitate the development of analogue circuitry, by providing the necessary support to the central object of the unit; the breadboarding area. Next month will provide some interesting practical op amp circuits for you to experiment with, but some important do's and don'ts are worth mentioning now. The breadboard sockets are the most expensive item of the unit, and require special treatment if they are to last. It is important to only ever insert leads and wires into the sockets that do not exceed around 8.7mm. Telephone wire is useful as interconnecting wire, and a range of colours is recommended in various lengths. Try to use wires that are the right length to keep the circuit neat and to prevent random noise pickup. Develop a colour code standard, e.g., red for positive rail, white for negative, black for ground, and only use wires with clean bared ends. Broken pieces of wire lodge in the breadboard, caused by re-using old wires, will quickly render the socket useless. Ideally, a pair of wire strippers should be on hand to bare the wire without causing a nick in the wire when it is stripped. Bare the wire to expose around 5 to 6 mm only; too

ETI-179 How It Works

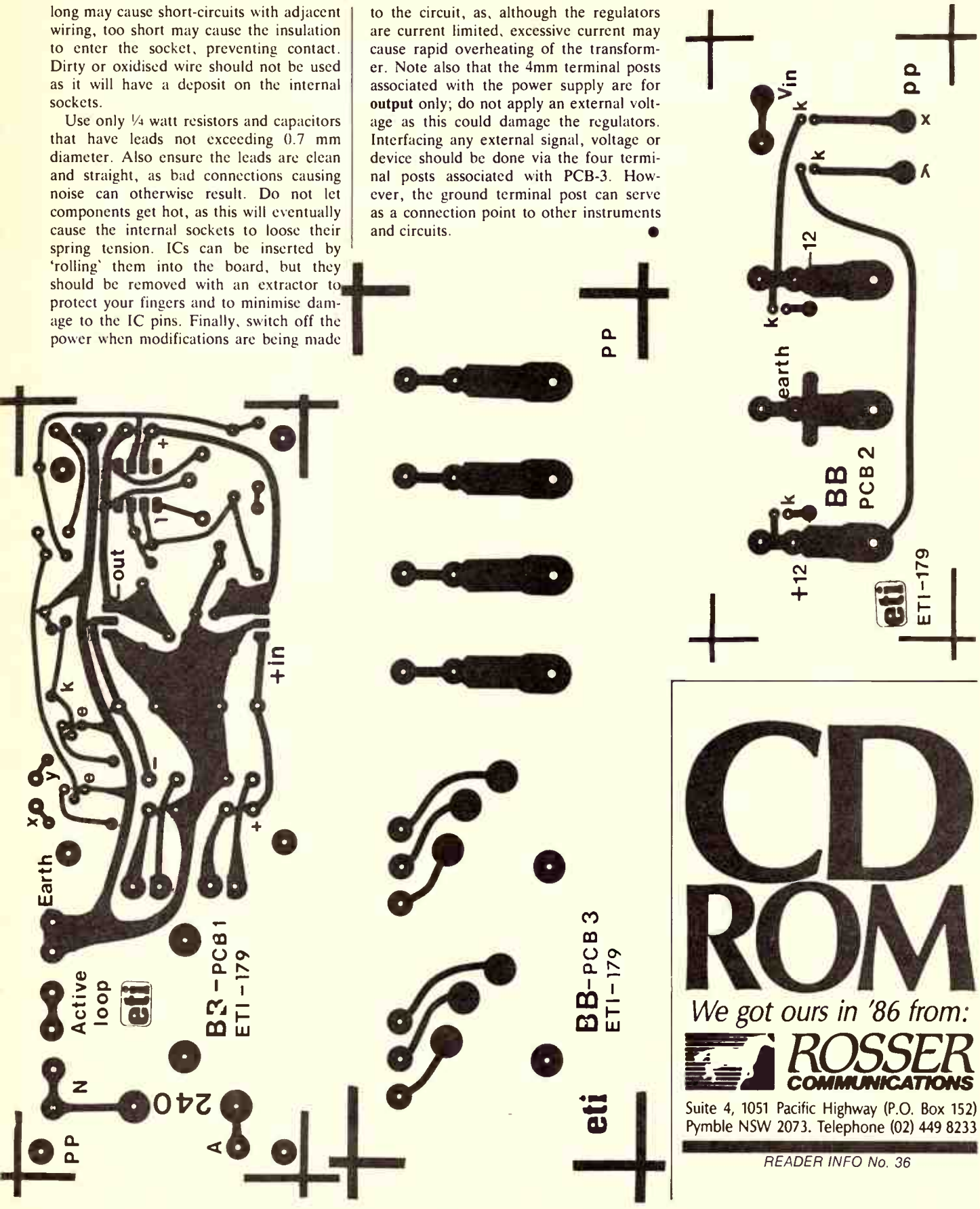
The electronics for this unit are mainly contained on PCB-1, although indicator LEDs and outputs/inputs are on PCB-2. The dual polarity power supply uses two 12V, three terminal regulators, supplied by two diode bridges in turn connected to the isolated secondary windings on the transformer. Capicators C7 and C2 filter the bridge outputs. Capacitors C3 and C4 improve the transient response of both regulators, and should be tantalums. The diodes D1 and D2 allow reliable start up of the regulators by eliminating any reverse voltages that may be present at the regulator outputs. The output voltages areestablished at +12 V and −12 V (within 5%) with respect to ground, and are applied to PCB-2 for subsequent connnection to the breadboard. The transformer secondary voltages are 15V ac each, and the suggested transformer has a rating of 5VA, limiting the available current per side to around 160mA. At this current, no heatsinking is needed for the regulators. Varying the output voltages by using different regulators would require a suitable transformer matched to the required voltages.



The polarity indicator is based on a 741 op amp, connected as a high gain, non-inverting amplifier. R1 and R4 set the gain at around 68, and ZD2 and ZD2 limit the output voltage of the 741 to plus or minus 6V. This prevents saturation problems, and minimises the effect of skew thereby allowing a quick response. The indicator LEDs 1 and 2 are driven by transistors Q1 and Q2 which operate when the output voltage of the op amp increases above 0.6 V. Q1 requires a positive voltage to operate, supplied when the input to the op amp exceeds +10 mV. Similarly, applying −10 mV or more to the input will cause Q2 to switch on. Diodes D3 and D4 protect the transistors against reverse conduction. The input resistance of the circuit is around 200k ohms, allowing the circuit to be used to monitor voltages in most applications. R3 is used to limit random noise pickup when the input is left open-circuit. The maximum input voltage is 24 V. Offset adjustment is provided by RV1 to ensure the output voltage of the 741 is zero volts when the input is connected to ground.

long may cause short-circuits with adjacent wiring, too short may cause the insulation to enter the socket, preventing contact. Dirty or oxidised wire should not be used as it will have a deposit on the internal sockets.

Use only ¼ watt resistors and capacitors that have leads not exceeding 0.7 mm diameter. Also ensure the leads are clean and straight, as bad connections causing noise can otherwise result. Do not let components get hot, as this will eventually cause the internal sockets to loose their spring tension. ICs can be inserted by 'rolling' them into the board, but they should be removed with an extractor to protect your fingers and to minimise damage to the IC pins. Finally, switch off the power when modifications are being made to the circuit, as, although the regulators are current limited, excessive current may cause rapid overheating of the transformer. Note also that the 4mm terminal posts associated with the power supply are for **output** only; do not apply an external voltage as this could damage the regulators. Interfacing any external signal, voltage or device should be done via the four terminal posts associated with PCB-3. However, the ground terminal post can serve as a connection point to other instruments and circuits.



MACHINE CODE

When you get right down to the nitty gritty, computer's aren't all that complex. Even the notoriously difficult art of machine code programming is quite simple once you get the hang of it.

Phil Cohen

All of the languages, packages, suites of software ever written for any machine all end up in just one format: machine code. Most people start programming by learning one of the 'high-level' languages like BASIC or FORTRAN, and are told again and again during that process that machine code is somehow beyond their comprehension and best left to the experts. It's only later when they have conquered their trepidation that they get around to machine code programming — and find it surprisingly easy.

Perhaps if programming was taught from machine code upwards, instead of from high level languages downwards, there would be less mystique in the subject.

Machine code

Machine code is what the processor uses to tell it what to pull out of memory, what to do with it, and where to put it when it's finished. Most processors have around 200 different codes that they can respond to, and all of the clever hardware design inside the processor chip itself is designed to do nothing but make it follow machine code instructions.

Here are a few typical machine code instructions (not for any particular processor):

Name	Mnemonic	Value (hex)	Meaning
Clear	CLR	10	Clear
Load	LD	12	Load the next byte
Increment	INC	14	Add 1
Print	PRI	16	print the value*

* Most processors do not have a direct print instruction, but we'll forget that here for the sake of simplicity.

The clear instruction clears the value stored in the processor, the increment causes the stored value to be increased by 1, the print instruction causes it to be printed. So to get the machine to print the value 1, we could put the values: 10, 14,16, into three successive memory locations, and then somehow get the processor to start 'executing' the program from the first of those locations. Let's say we put the instructions into memory locations 1, 2 and 2:

Location	Value
0	10
1	14
2	16

Remember that what we're talking about is putting voltages onto the lines going to the memory chips, to 'store' the values in these locations. And that when the processor 'reads' the values back out again, it also is putting the voltages on various pins to represent the locations 0, 1 and 2 and getting the values 10, 14 and 16 back the same way. Always remember that it's just simple electronics that's at the heart of any computer.

Somehow we get the processor to start working at location 0. First, it will set the memory address bus (see earlier articles) to the value of 0. At this, the memory chips will set the data bus to the value 10. The processor will notice this, and will clear itself. Having done that, it will automatically look at the instruction in the next location, do it, then look at the next, and so on until something stops it.

The Assembler

When people first started writing progams in machine code, they found it a pain in the neck to keep writing the hex codes for the instructions. So they invented a program called an 'assembler' that took the 'mnemonics' (CLR, INC, etc) and translated them into machine code. So the assembler might take the input:

```
CLR
INC
PRI
```

and translate it into:

```
10
14
16
```

That's all an assembler does. It translates easily-readable mnemonic codes for instructions (and for memory locations,

which we'll come to later) and turns them into machine code that can be run directly by the processor.

These three instructions, CLR, INC and PRI, are all 'single-byte instructions'. That is, they each take up just one memory location. But some instructions take up two or more bytes. In our example, LD (value 12) is a two-byte instruction: 12 01 would cause the processor to load the value 01, while 12 87 would cause it to load 87.

For the assembler, you would write the mnemonic of a two-byte instruction, followed by the value: LD 34 would be translated as 12 34.

So if we write a program to load the value 22, increment it, then print it, the assembler instructions would be:

```
LD 22
INC
PRI
```

and the machine code would be:

Location	Value
0	12
1	22
2	14
3	16

When the processor gets to the LD instruction at location 0, it loads the value from the next location (location 1 = 22), and then skips that location and does the

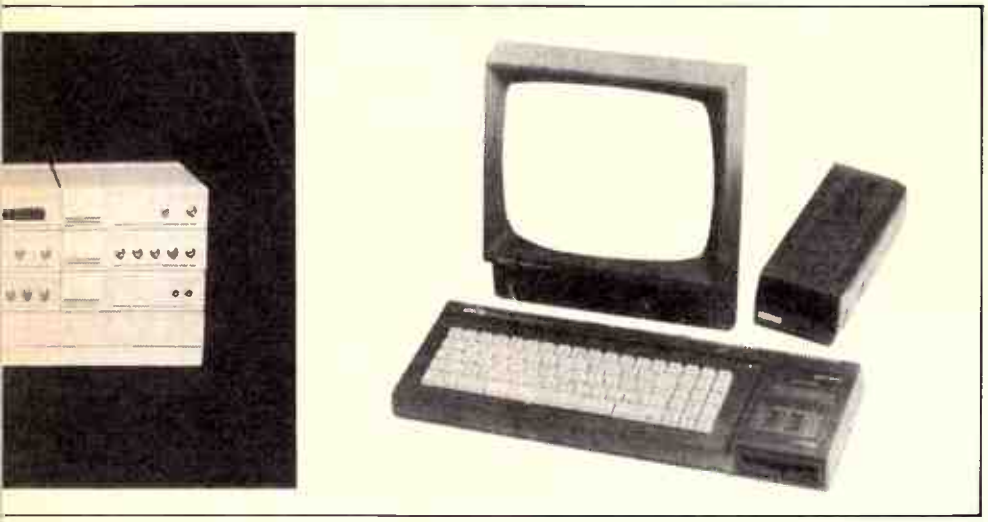
instruction at the next location after it — location 2.

Memory Location Names

Another thing that an assembler does is to keep track of the memory locations you are using. Let's invent a new instruction:

Mnemonic	Value (hex)	Meaning
PUT	18	Put the value into a particular memory location

PUT might be used like this: PUT 4



would mean 'put the value currently in the processor into memory location 4'. So the following program:

```
CLR
INC
PUT 4
```

Location	Value
0	10
1	14
2	18
3	04

would end up putting the value 1 into memory location 4. Now that's all very well, but what if we want to put a few more instructions into the program? Location 4 is no longer available to store the processor value. If we use up the first ten locations with the program, then changing location 4 is going to change the program itself. What we need to do is make the location we want to change the first one after the end of the program.

How about this:

```
CRL
INC
PUT A
HERE A
```

'HERE' is not an instruction, but an 'assembler directive'. The assembler takes HERE A as being 'call this location A'. When the assembler converts this program into machine code, it will first find out how long the program is:

0	CLR	10
1	INC	14
2	PUT	18
3	A	?

Then use this information to set A = 4 (the location that HERE would be at if it were an instruction). Then it can go through and fill in the value for 1 in the program itself: 10 14 18 04.

If you add another instruction to the program:

```
CLR
INC
INC
PUT A
HERE A
```

Then the final machine code will be different: 10, 14, 14,18, 05.

Assemblers allow you to 'label' particular memory locations in much the same way that BASIC keeps track of variables, by giving each one a name. Instead of A, we could have used COUNTER, or LOCATION 1, or any name that suited the purpose of the programmer.

Jumps

Moving from one location to the next is all very well, but what about when you want to jump from one part of the program to another? here's another instruction:

Name	Mnemonic	Value (hex)	Meaning
Jump	JMP	20	Jump to the location given

For example, JMP 6 will cause the processor to jump to the instruction at location number 6:

Location	Mnemonic	Value
0	INC	14
1	INC	14
2	JMP 6	20 06
4	INC	14
5	INC	14
6	PRI	16
7	CLR	10

(notice that because JMP 6 is a two-byte instruction, two values are shown in the 'Value' column, and location 3 (where the 06 goes) is not actually shown in the 'Location' column).

the processor would do instructions at locations 0 and 1, then read the JMP at location 2, read the value at location 3, then jump to location 6 and do the PRI next, continuing with the CLR.

JMP can be used with an assembler directive too, like this:

```
INC
INC
JMP B
INC
INC
HERE B
PRI
CLR
```

This would give an identical result to the above listing. ●

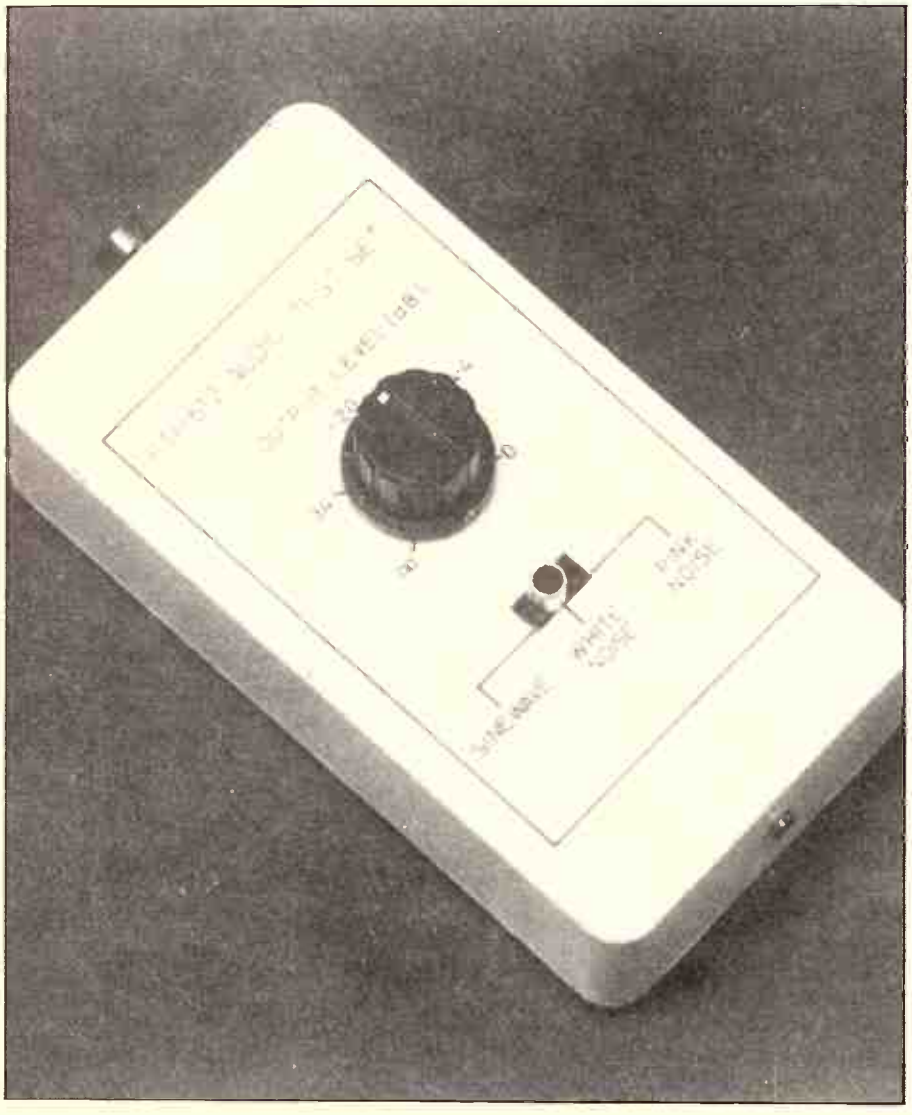
Glossary

Address lines: wires that carry address information between the processor and memory.
Assembler: a program that translates mnemonics into machine code.
Assembler directive: an instruction to the assembler that is not translated into machine code.
BASIC: a simple high-level language.
Data bus: wires that carry data beween the processor and memory.
Data lines: same as data bus.
Decrement: decrease a value by 1.
Execute: carry out a particular instruction.
FORTRAN: a high-level language.
Hex: hexadecimal code — an easy way of representing the state of sets of 8 wires on paper.
High-level language: a set of instructions that can be translated into mnemonics, and from there into machine code.
Increment: increase by 1.
Instruction: one step of a program.
Label: a name for a particular location in memory.
Location: a small area of memory capable of holding one byte.
Machine code: a series of numbers that, when stored in memory, the processor can follow as a program.
Mnemonic: a three- or four-letter code that represents an instruction.
Multiple-byte instruction: an instruction that takes up more than one location in memory.
Processor: the central chip in a computer, that controls all of the others.
Single-byte instruction: an instruction that takes up only one byte of memory.
Variable: a name allocated to a particular area of memory, in which values are stored by program.

ETI-612 AUDIO TEST SET

Tired of dragging half a tonne of test equipment, two power boards, and a suitcase full of connecting cables around to do some simple calibrations and signal testing on audio gear? We have the answer.

Glen Thurecht



THE IDEA BEHIND this project was to design a small, hand held, and battery operated test instrument that could be used to perform many of the tests usually done with bulky mains operated equipment. This test set consists of three signal sources. A low distortion, 1 KHz calibrated amplitude sinewave, white noise source, and a pink noise source.

Types of Noise

A noise source is a signal that varies randomly in amplitude. When a noise source is viewed on an oscilloscope it appears as an undifferentiated band across the screen. However if the noise is viewed in the frequency domain via a spectrum analyser it shows components of varying amplitudes across the whole of a given spectrum.

The amplitude of the noise with respect to frequency depends on the type of noise. White noise is a signal defined as having equal power or energy per frequency in-

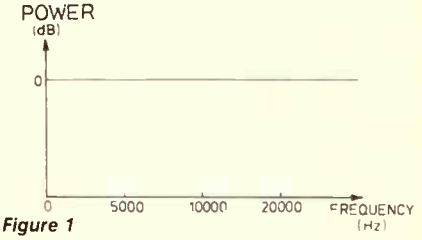


Figure 1

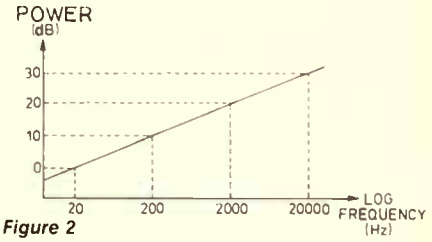


Figure 2

terval. For instance, the power in all the frequency components in the 10 to 20 Hz range is equal to the power in all the frequency components in the 1000-1010 Hz range. This is shown in the amplitude versus frequency graph of Figure 1. Note that this graph uses a linear scale on the frequency axis. The graph of Figure 2 shows the white noise plotted against a logarithmic frequency axis. The response now shows an increase in the power of 3 dB/octave as there is more energy/octave in the higher frequency range.

Pink noise, by contrast, is defined as having equal power or energy per octave. That is, the power in the 10 to 20 Hz frequency components is equal to the total power in all the 1000 to 2000 Hz frequency components. If pink noise is plotted against a logarithmic frequency scale, then the response of Figure 3 is gained.

The differences between Figure 3 and Figure 2 suggests a way of generating pink noise from white noise. All that is needed is to pass the white noise through a filter with a 3 dB/octave attenuation rate, and voila! Pink noise.

Applications

A 1 kHz sine wave is used in many audio measurements as a reference frequency. For instance the calibration of a VU meter requires a set input frequency (1 kHz) at a defined level. The very definition of the loudness level is based on a unit called a Phon. The loudness level of a sound, in Phons, is numerically equivalent to the intensity (in decibels) of a 1 kHz sine wave which is judged by a listener to be of equivalent loudness. In this way the intensity of a multi-toned signal can be expressed in terms of a single tone.

Noise may be used as a test signal in frequency response measurement systems.

Since the amplitude of white noise is independent of frequency, it is an excellent source for checking the frequency response of amplifiers and speakers. If the white noise is fed into an amplifier, a narrow band filter on the output should detect equal amplitude at all frequencies through the range of interest. Any deviation from this is due to the device under test.

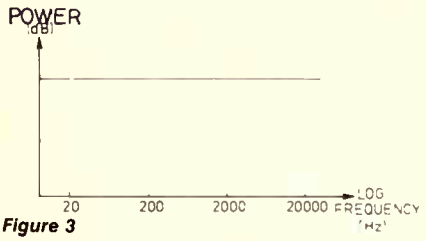
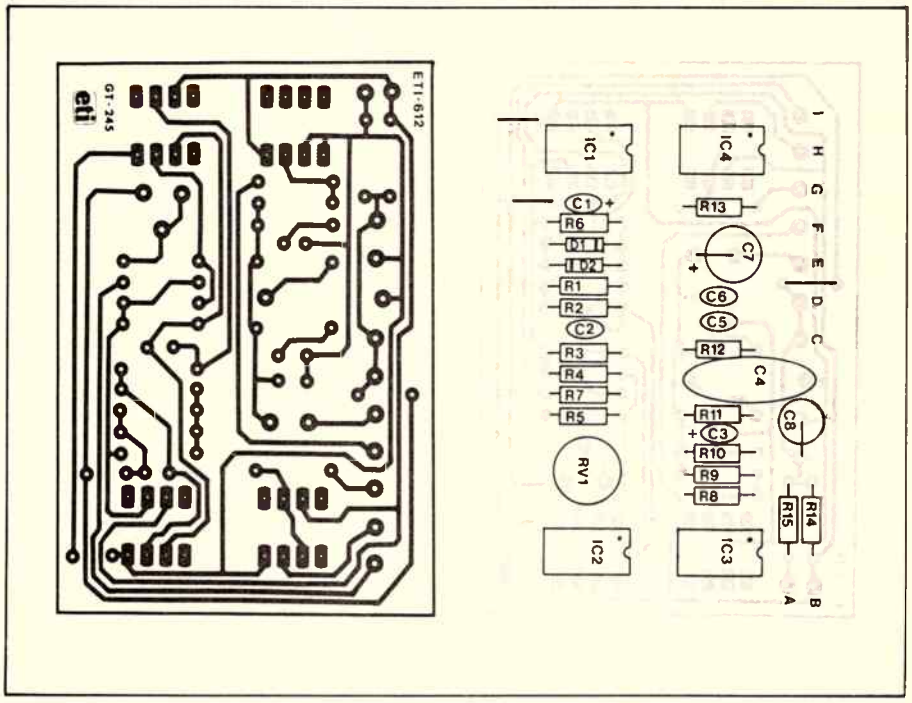


Figure 3



Pink noise is used when the measurement system uses filters with a constant fractional octave bandwidth. For instance a real time spectrum analyser uses a set of parallel filters with a constant octave of 1/3 octave between centre frequencies. If a pink noise source is injected into this filter bank it should give equal output for each frequency band.

An interesting application for the use of a pink noise is tuning a graphic equaliser in a sound system to compensate for the frequency response of the listening areas. Though this is the primary purpose for a graphic equaliser it is usually used as a glorified tone control since no objective way of adjusting it is readily available. All that is required is a pink noise generator, a microphone with a known frequency response and a VU. The VU meter is usually incorporated in the tape deck and best results are obtained with an analogue meter, not a digital one.

The test procedure is simple and best results are obtained if the following steps are followed:

1. Set first channel to maximum boost and all other channels to maximum cut;
2. Place the microphone in a central listening position;
3. Adjust the level of the pink noise until the VU meter indicates mide scale;
4. Without changing any levels on the VU meter or the pink noise source, repeat step number one for each band on the graphic equalizer, jotting down the output level in each case;
5. Compensate for the response of the microphone. This is best done by finding the difference between the amplitude of the centre frequency of each band and that of an arbitrary reference. Then add or subtract this from the result measured on the VU meter.
6. The graphic equaliser is then set up so that the response will be flat. For example if band 1 was +3 dB and band 2 +7 dB then set the graphic equaliser to, say, −3 dB on channel 1 and +4 dB on channel 2.

For optimum performance the combination of all the channels should be centered around 0 dB not all crowded in the boost or cut region. Also the left and the right channels may be done separately or together.

Design

The most novel aspect of this design is the sine wave generator. Traditionally there have been two main methods for the generation of a sine wave. These are the Wein Bridge and converting a triangular wave to a sine wave. The Wein Bridge is known for low distortion and simplicity. However when amplitude stabilization is inserted problems can arise. If a thermistor is used to stabilize the amplitude then amplitude bouncing occurs when the frequency is changed and the thermal time constant involved limits use at low frequencies.

On the other hand, FET stabilization

ADVERTISERS' INDEX

requires a more complex circuit, and distortion is large at high signal levels due to the channel resistance non linearities.

Triangle to sine wave converters have been used in high quality signal generators but do not produce the extremely low distortion required. Also the triangle to sine converter usually requires the use of two highly matched transistors in a differential configuration. These transistors must be thermically coupled to provide the best results.

This project uses a different, more simple approach. Figure 4 shows the block diagram of the oscillator. It consists of a bandpass filter and an amplitude limiter in a positive feedback loop. The band pass filter is a high-Q resonant L-R-C circuit in which the inductance is simulated with a gyrator. The Q of the gyrator can be made very high and hence the frequency selectivity can also be high. The amplitude limiter simply consists of two diodes limiting the positive and negative swings.

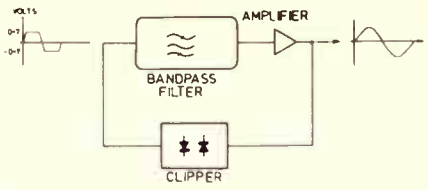


Figure 4

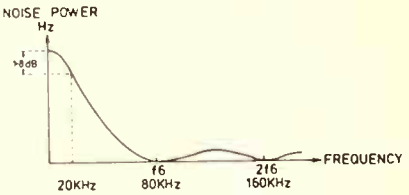
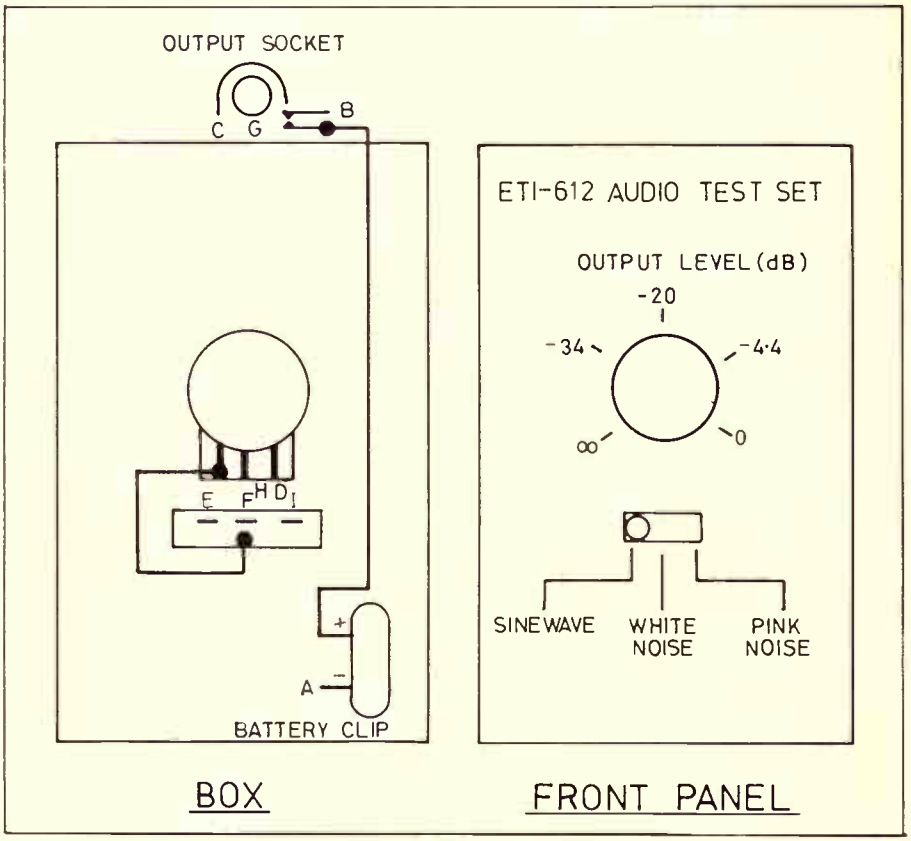


Figure 5

The total harmonic distortion generated by this circuit is approximately 0.05%. This could be reduced tremendously if a soft amplitude limiter were used instead of the hard clipper. A soft limiter works by reducing the amplitudes of the harmonics when the input signal is presented to the bandpass filter. However, for this portable test device the extra circuitry was not thought necessary for the reduction in the already low distortion.

The noise sources are generated with the help of a National Semiconductor MM5837 digital noise source. The generation of a digital noise source is extremely easy and produces a stable and predefined noise spectrum. Basically all that is involved is a string of shift registers with exclusive OR feedback arranged to produce a psuedo-random bit pattern. Inside the MM5837 is a 17-bit shift register and a clock generator running at 80 kHz. This



produces an output spectrum as shown in figure 5. The amplitudes of the components follow a sine squared function. At 20 kHz the amplitude of the frequency components is only down to 1.8 dB and hence is ideal for the generation of noise over the audio spectrum.

Since Figure 5 is a plot of amplitude versus frequency on a linear scale, it is apparent that the output in the audio range is classed as white noise. The 3 dB/octave filter used to convert it to pink noise is arranged as 3 phase-lag sections, cascaded to cover the 20 Hz to 20 kHz range.

Construction

Construction of this unit is relatively simple and should cause no problems. As always, check the pc board for any cracks or bridges between tracks. Begin by placing the board in the box, and using it as a template, mark and drill the mounting holes. Remove the board, and insert the three links. Next the 15 resistors and two diodes, taking care of the diodes polarities. The four IC's can now be soldered in place, make sure the pin number is in the correct position, and noting that all the IC's point in the same direction. Next the trim pot and finally the capacitors. Ensure that the correct polarity for the two tantalums and the two electrolitics is observed.

Now that the pc board is completed we can commence the preparation of the housing. The prototype was housed in a die cast aluminium box because it was intended for use in a harsh environment. These boxes are relatively expensive, but a plastic box may do in a gentler world. Before mounting the board, drill holes for the phono connector, potentiometer and battery clip. The slide switch requires a rectangular hole so mark the position, drill two starting holes and file to he marks.

After the paint work has dried mount the phono socket, potentiometer, switch and battery clip. We can now commence wiring. Use ribbon cable for the interconnections as this keeps things neat. Cut a piece of 8 way ribbon cable 10 cm long. Separate one of the end wires and snip the other seven wires so that it is approximately 3 cm longer than the rest. Strip and tie all eight wires and solder them into the PC board with the long one going to point 'B'. Now start making the connections to the phono socket, pot, and switch making wire lengths as short as possible. The battery clip is next with the negative (black) going to point A on the PC board and the positive (red) going to the switch on the phono socket. Finally the small wire from the pot to the switch is soldered.

Depending on the size of the box used, you may need to mount the PC board very close to the lid using a nut as a standoff. if this is the case it would be wise to insulate the lid with some electrical tape to prevent any shorts where the PC board is to be mounted.

PARTS LIST — ETI-612

Resistors	All ¼ Watt 2% metal film
R1	150k
R2, R3, R4, R14	10k
R15	10k
R5	560
R6, R11, R13	1k
R7	11k
R8	1M
R9	6.8k
R10	3k
R12	300
RV1	500 trimpot
RV2	100k log
Capacitors	
C1, C3	1µF tant.
C2	39nF greencap
C4	0.27µF polycarbonate
C5	100nF greencap
C6	33nF greencap
C7, C8	47µF electro
Semiconductors	
IC1, IC2, IC4	TL-071, LF356, etc.
IC3	MM5837
D1, D2	1N4148, 1N914, etc.
Miscellaneous	
SK1	6.5mm standard phono socket with switch
S1	3 position, single pole slide switch

1 knob; 1 diecast or zippy box; 1 9v battery clip; battery holder; PC board; nuts; bolts; washers; ribbon cable.

Testing

Power is applied to the circuit when there is a connector in the output socket. So in order to test the circuit you must insert a connector into the socket.

Probably the easiest way to test the circuit for operation, if you are not lucky enough to have an oscilloscope, is to connect the unit to your stereo system. In switch position one the sine wave is selected. You should hear a pure tone reasonably high in frequency. Switching to position 2 the white noise should sound like the noise that you hear inbetween FM stations. Position 3 is the pink noise and sounds like the white noise with a lot of the high frequency content removed. If all is not well at this stage don't panic! Simply follow the trouble shooting guide that follows.

Firstly, with power removed, check that the two diodes are correctly orientated. Note that they should be pointing in opposite directions. Make sure that the 4 IC's have been placed in the correct way. Then recheck all the wiring with the wiring diagram and ensure that the link between the switch and the potentiometer has been connected.

Next, apply power and check the power supplies with a dc voltmeter. Each rail should be in the range 3-4.8 volts and the magnitudes of the rails should be within 1 volt of each other.

If there is a larger difference between the two rails then something is drawing too much current on the rail with the lowest voltage, or there is a short to common (ground) on that rail.

If the sine wave generator is not working then make sure that all the components are the correct values and have been placed in the right places. Also look for any dry solder joints.

The noise source can be checked by connecting a multimeter set on AC volts onto pins 3 and 2 of IC3. This should read about 4.5 v ±1.5 volts. If it is not, then there is a problem with IC3.

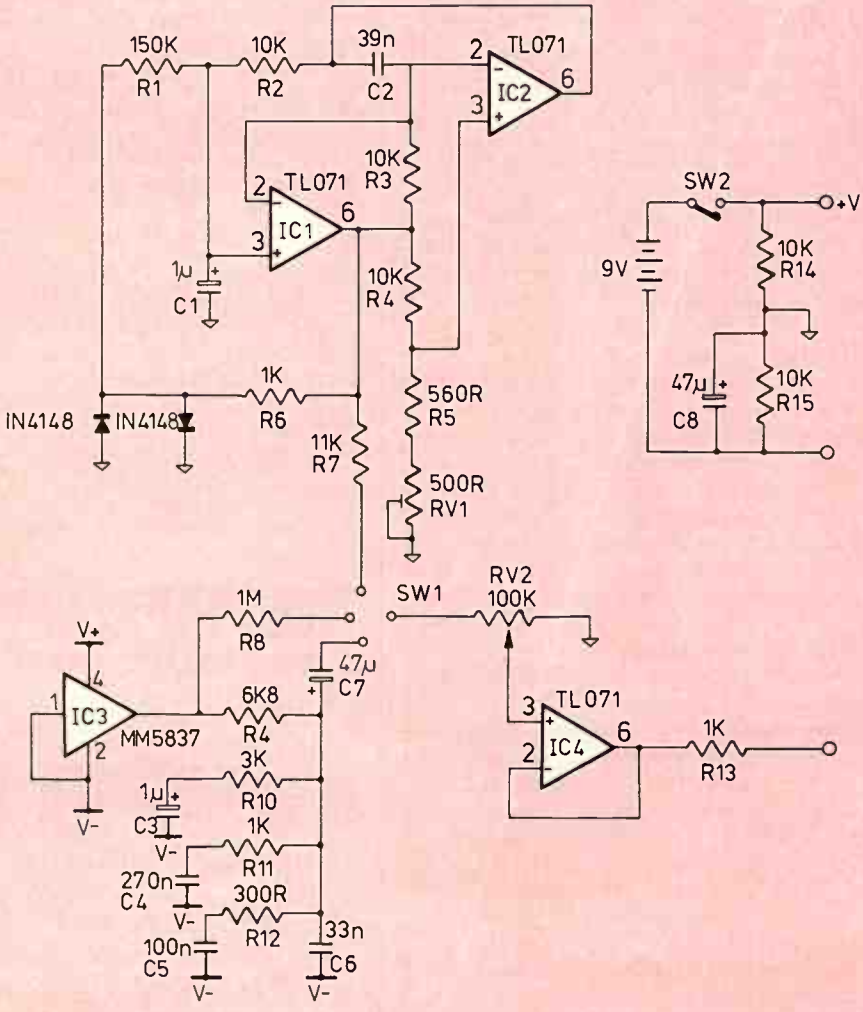
Calibration

There is only one adjustment that has to be made to calibrate this circuit. By varying RV1 both the frequency and the amplitude of the sine wave oscillator are varied. Hence there are two ways of calibrating; measurement of output amplitude, or measurement of output frequency.

If you have access to a frequency counter this will be the most accurate method of calibration. Simply measure the output frequency and adjust RV1 until 1 kHz is displayed on the counter. This will then give an output amplitude of 0 dB ±1.5% or ±0.13 dB when RV2 is rotated fully clockwise.

For those without a frequency counter the unit can also be accurately calibrated by measuring the output amplitude with an ac voltmeter. Simply adjust RV1 until the meter reads 0.775 volts when RV2 is rotated fully clockwise (ie, VRMS for 1mW into 600 Ω). This then will automatically give an output frequency of 1 kHz. The accuracy of the output frequency will be largely determined by the ac voltmeter error specification at 1 kHz.

Note that the calibration indications on the front panel are only as accurate as the logarithmic tapering on thepotentiometer itself. A typical error of ±10% is to be expected in a good pot. However, the indicator in the fully clockwise position is accurate to the tolerances given above. The indicators are only used for the sinewave output and the noise sources are not calibrated in this way. ●



HOW IT WORKS — ETI-612

The circuit may be divided into two main sections; the sine wave generator; and the noise source.

The sine wave is created by passing a square wave through a band pass filter. The filter is a R-L-C circuit which resonates at the sine wave frequency. R1 sets the Q of the circuit. The inductance, L, is simulated by the active, gyrator network framed by R2, R3, R4, R5 RV1, C2, IC1 and IC2. Hence the resonant frequency is determined by the gyrator and C1. A low impedence output from the resonant circuit is available at the output of IC1. The sine wave output is then passed through the clipper formed by R6, D1, D2 and then used as an input square wave to the reasonant circuit. Sustained oscillation is assured through the arrangement of positive feedback from input to output. R7 is used to set the maximum output to 0 dBm via the voltage divider, R7 and RV2.

The noise generator is all neatly found in one integrated circuit, IC3. This is a pseudo random bit pattern generator which has a white noise output power spectrum tha is flat within 1.8 dB from almost D.C. to 20 kHz. R8 is used to set the maximum output level of the white noise via the voltage divider R8, Rv2.

Pink noise is obtained by passing white noise through a low pass filter with a 3 dB/octave amplitude response. This filter is formed by R9, R10, R11, R12, C3, C4, C5. These components form three cascaded phase lag networks each spanning one decade to cover the complete audio spectrum. C6 is used to attenuated frequency componets above 20 kHz by 6 dB/octave. C7 AC couples the pink noise to the output level pot via S1.

IC4 is a voltage follower to buffer the source and provides a low impedance output. R13 is included to give some form of short circuit protection.

Power is supplied by a standard 9v battery. The operational amplifiers +V and −V supplies come directly from the battery terminals and a common or reference formed by R14, R15 and C8. Power is connected to the circuit when S2 is closed. This switch is part of the output phono socket and is closed when a phono plug is inserted.

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- 10 useful log/lin pots... 1.95
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- 2 1uFx4 greencaps on pcb 1.95
- 2 neon test screwdrivers 1.95

$1.95 EA PACK

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- 1 multimeter test leads. 1.95
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SOLDERING TOOL KIT

Includes heatsink, reamer, scraper, brush, tweezers and screwdriver. Was $7.95 Save $3 Cat 20-2456 $4.95

Miniature Side-Cutting PLIERS

Were $17.45 High quality, 115mm long, insulated handles, best for electronics assembly etc. SCOOP PURCHASE! $8 EA Cat 20-2320

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

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Radio control, single trans and receiver, programmable code, range 12-15 metres. Cat 01-0970 $89

DIGITAL REMOTE CONTROL

Wireless trans/rec remote switch 2x10 Amp outputs to lock/unlock car central locking systems. Programmable code, 12Vdc. LED indic. $149 Cat 01-0972

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Was $99 Heavy duty professional tool, ni-cad batteries, forward and reverse, 4 tips + charger incl Cat 20-2308 $55

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All wanted values 1 ohm to 10 Meg $2

Packs of 100 same value 0.5W or 0.25W Carbon film

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Qty 1-9 $2.50 ea Qty 10+ $2.20

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512K to modem $24.95
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(Imagewriter I, II or some others)
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Plus to printer $27.50
(Imagewriter I, II or some others)
Custom made to order here in Oz

Fuji 3.5" FLOPPY DISKS

BEST QUALITY DISK Boxes of Ten only.

SSDD..... $ 49 MF1DD Cat 50-1020
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Was $39.50 Negative ION Generator kit $29.50

Cat No ...11-1550

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(Based on AEM5501 Sept. 1985)

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.

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also modems, printers, terminals, etc.

CENTRONICS PARALLEL GENDER CHANGER

36 pin female to female Female socket each end, all pins wired $25 EA Cat 04-0763

No-Name Floppy Disks but 100% guaranteed!

Famous maker no label diskettes in plain white envelope, with write-on sticky labels.

5¼" DS:DD.....$16.95 Box of 10
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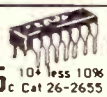
BEST QUALITY

LM3900

EQUIV RCA3401



HALF PRICE! 45c 10+ less 10% Cat 26-2655

C106 Popular SCR Buy 10, less 10%
50V 4A 26-7331 40c
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PILLOW SPEAKER

Slim-line 8 ohm speaker; place under your pillow for music before bed-time or repetitious learning while sleeping. Cat 19-6002

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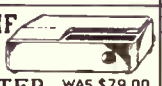
Build your own system at low cost! Has 22K end-of-line resistors, N.O/N.C. instant and delay, inbuilt siren, entry/exit delay, auto reset, 12Vdc oper. $25 ea Cat 01-0947

UHF to VHF TV SIGNAL DOWN CONVERTER



WAS $79.00 Save $40.00
Converts UHF output e.g. VCR, computer or TV game, to VHF signal, CH 1,3, or 4 12V dc or mains powered. $39 EA Cat 24-1020

41256-15 (150 nS)

Big name manufacturer!

Qty 1-9 $7.50 ea Qty 10+ $5.90 EA Qty 100+ $5.50 ea
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NE556 DUAL TIMER

Usually $1.40
Integrated Circuit 70c ea
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Ideal for internal car or home alarm siren Mini size 90mm diam Warbler sound effect Input 12Vdc 300mA Output 98dB at 1m Was $18, now $12 ea Cat 03-2013

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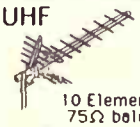


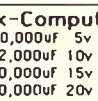
Cat 01-3003
10 Element + 75Ω balun $39
Add mixer/splitter box $4.95 to join VHF aerials (sorry, no mail orders)

PUSH-BUTTON TV TUNER PCBs

$4 EA
2 PCBs with 8 x DPDT push-button switches, similar to 1soslot, and 8 x 100K multi-turn trimpots, as used in AWA sets Cat 24-0001

MOTOROLA MRF-603 $6

Similar to 2N5590 Cat 26-1259



LM-376 VOLTAGE REGULATOR POSITIVE, ADJ Cat 26-0573

50c ea

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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

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1-19.....10c ea Cat 19-8000
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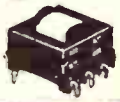
58mm (2.25") SPEAKER 8Ω 250mW

$1.50 ea
10+ $1.40 ea
Cat 19-6000
High efficiency ferrite magnet

10V 350mA PCB mtg POWER TRANSFORMER



0-110-220V input 10V AC 350mA output Cat 20-1020 $3.50 EA

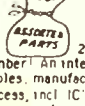
12V 2.6AH RECHARGEABLE SEALED LEAD ACID BATTERIES NOW $22 EA

Scoop buy - discontinued model but 100% g'teed. Ideal for alarms etc. Size 134x54x95mm(H) Were $41.50 Cat 02-1007

FM Wireless Microphone

Only $17 EA Cat 05-0394
Freq 88-108MHz, range up to 100m, Electret condenser 50Hz-14KHz resp

LUCKY DIP Offer



$13 24-0023

13-15 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!

WANTED TO BUY, SELL or EXCHANGE....

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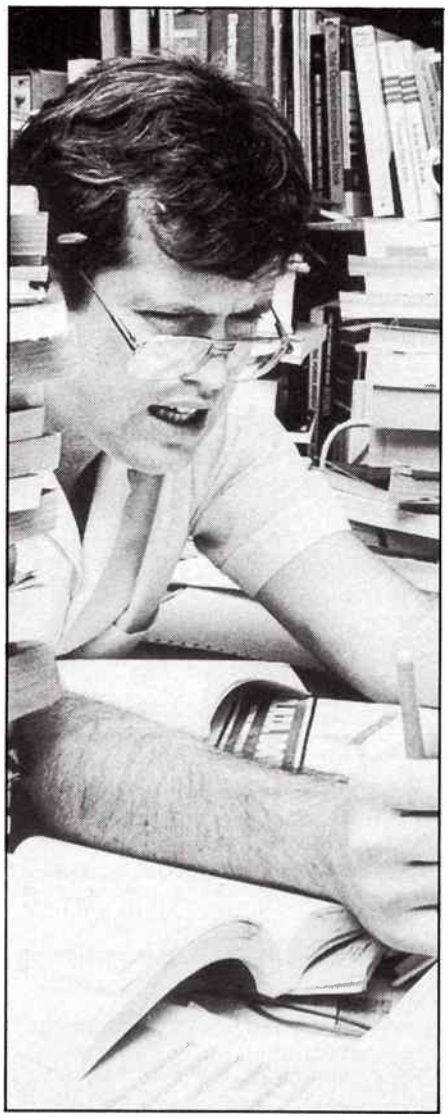
DREGS

Like all magazines, particularly those concerned with the electronics industry, ETI receives a number of letters from readers who are less than satisfied with some aspects of the way we do our job. The following, however, is far from typical.

Dear Sir,

RE your mouse trap project No. 1524 (ETI August 1984). It won't kill a mouse, not a Territory mouse anyway. In fact, two of these projects, refined to the highest peak of efficiency and sensitivity coupled together in parallel still will not kill a mouse (Territory).

The set-up will toss a mouse in a beautiful, graceful parabolic curve — sometimes a whole 24 inches can be obtained. Unfortunately the little bastard then gets up and runs away.



Designing the ultimate trap. Note the hairy arms vital to the inventor.

I am not attributing this disappointing result to Mr Ian Thomas' lack of knowledge of electronics, definitely not. It is his lack of knowledge of mice (Territory) that is the cause of the trap's failure.

I would suggest that if he wants delighted mouse trappers beating a path to his door that his first move be to have some discussion with someone knowledgeable in the construction of mice and then return to the drawing board. The matters which I believe it would profit him to investigage are as follows:

1. The insulating properties of the pads on mouse feet.
2. The fact that an arc prefers to travel along the top of the fur leaving the mouse safe and sound inside his coat.
3. Contact is made purely by the force of gravity and a mouse has not much mass.
4. A mouse's whiskers are not just attached to his face for decoration. He uses them very busily and effectively to feel the way. They are not very conductive but they do let a warning tickle through.

Mr Ian Thomas suggests that probably the quickest and easiest way of disposing of mice would be to just plainly electrocute them using the mouse as a bridge between the active and neutral of the 240 volt house supply. This, due to the nature, construction and insulating characteristics of mouse feet is very difficult as contact has to be made in two places without using the feet . . .

My efforts to construct an effective, humane mouse exterminator have not been inspired by a desire to bring the world to my door, to be a benefactor to mankind or to get an article printed in a magazine (*surely not! ed*).

The fact is that at this time of year, every year, I have to reset a four hole mouse trap four of five times a night (all four holes). Such a device is definitely not humane.

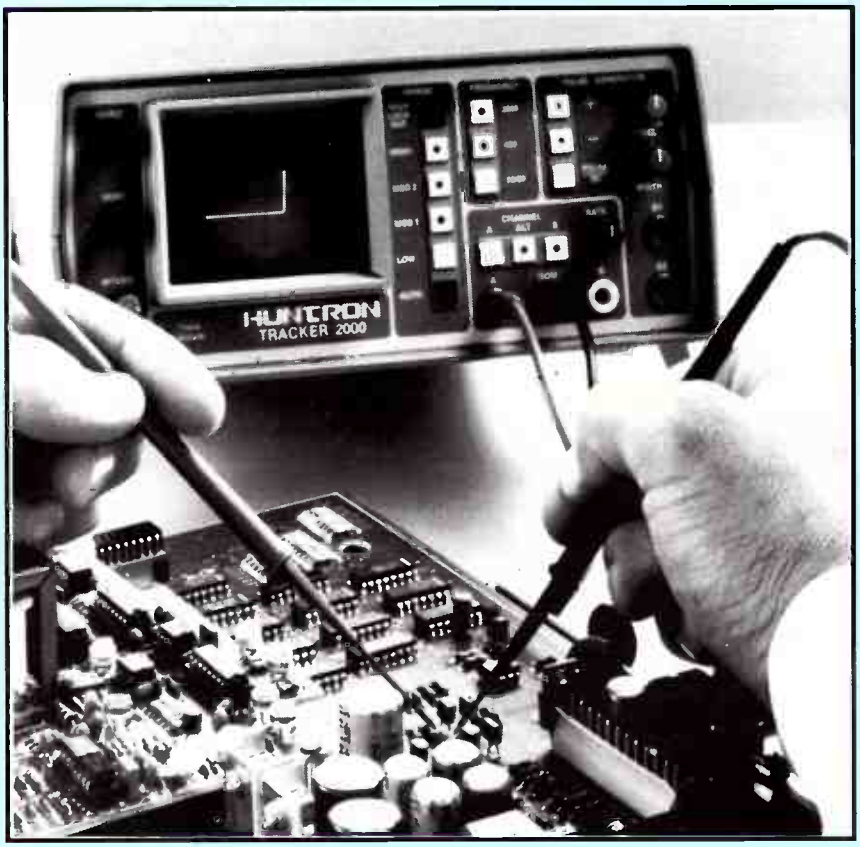
The expenditure of eighty odd dollars on something which does not work, not withstanding the definite, clear, incisive, decisive, forthright unequivocal promise contained in the preface of the project does not inspire faith in, or encourage the building of ETI projects.

If Mr Thomas feels like having another go he might be able to come up with something using the laser principle.

Yours Faithfully,
F. M. Bongers
Alice Springs

P.S. if you are short of mice let me know how many hundred and colour preference.

OVER 200 "HUNTRON TRACKER" USERS IN AUSTRALIA CAN'T BE WRONG!



With the Huntron Tracker you'll discover an entirely new way of troubleshooting — a method which challenges the belief that functional component testing is the most effective technique for isolating failures.

That's because Huntron Trackers test the actual P-N structure of a device, without system power. It's an unconventional testing strategy that complements a technician's intuitive troubleshooting skills.

The Tracker does so by showing you a picture of a component's overall health. With experience, you can determine the condition of a component simply by analyzing the Tracker's display. Without documentation or reference devices! Or you can compare the signature from a suspect component with a known good part. The Tracker works equally well with digital, analog and hybrid boards or components.

Some of our Huntron Tracker users include —

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THE HUNTRON TRACKER TESTS . . . DIODES, TRANSISTORS, LEDS, THYRISTORS, I.C.'S INCLUDING . . . CMOS, NMOS, PMOS, TTL & ANALOGUE. CAPACITORS, MEMORY COMPONENTS INCLUDING DRAMS, SRAMS, EPROMS, EEPROMS.

FOR FURTHER INFORMATION SEE US ON STAND 29 AT THE "WHAT'S NEW PRODUCT SHOW" IN SYDNEY ON THE 8TH AND 9TH JULY, OR CONTACT ONE OF OUR SALES STAFF ON ONE OF THE NUMBERS LISTED BELOW —

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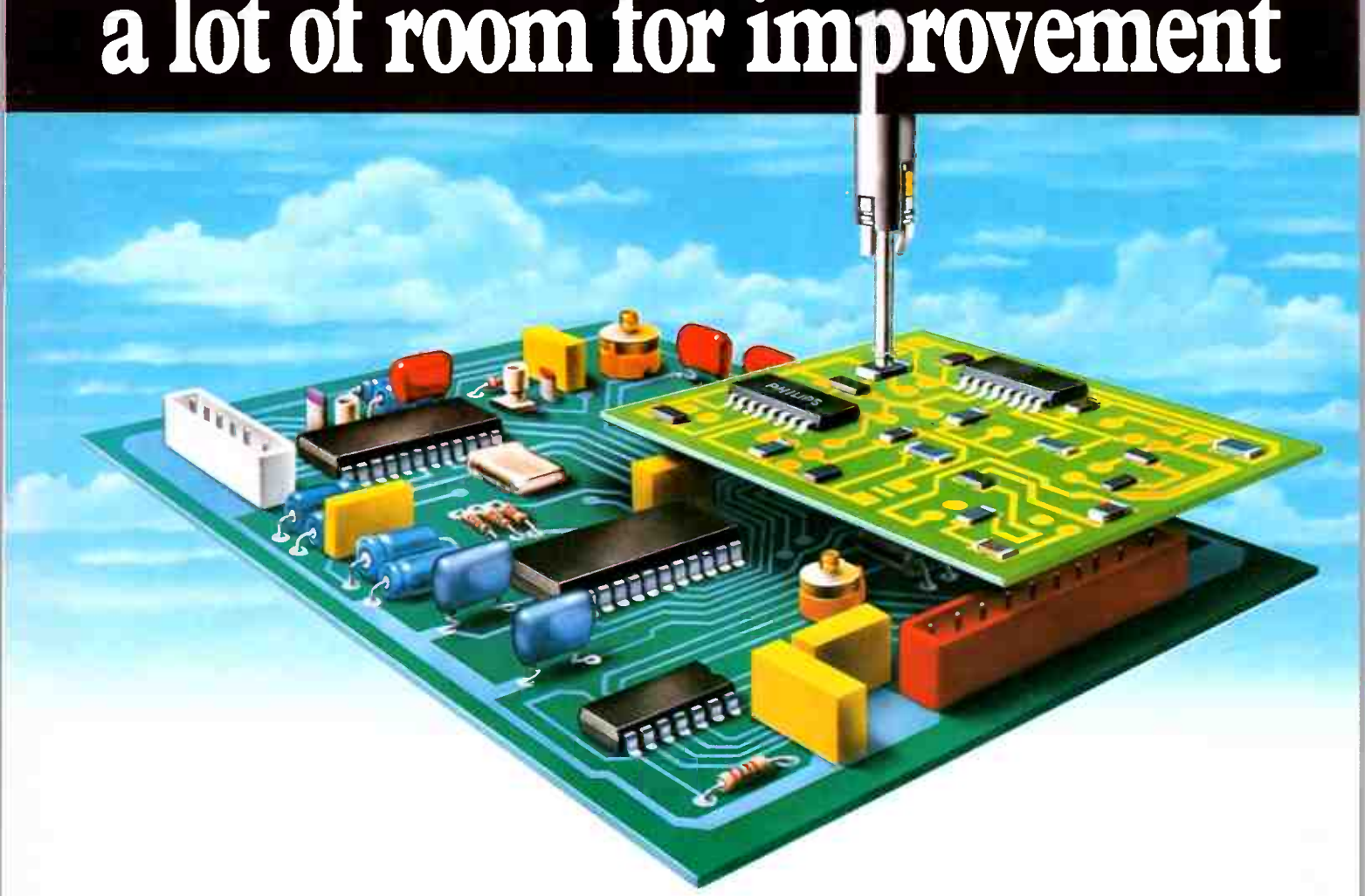
READER INFO No. 38

Philips SMDs offer a lot of room for improvement



Philips Surface Mounted Devices give you plenty of room to improve the design, manufacture and performance of your products.

Because they not only take miniaturisation a major step forward, but also make circuit boards less costly and dramatically more reliable.

Smaller boards, closer placement, and because the devices are mounted on, not through the board, the designer can use both sides of the PCB.

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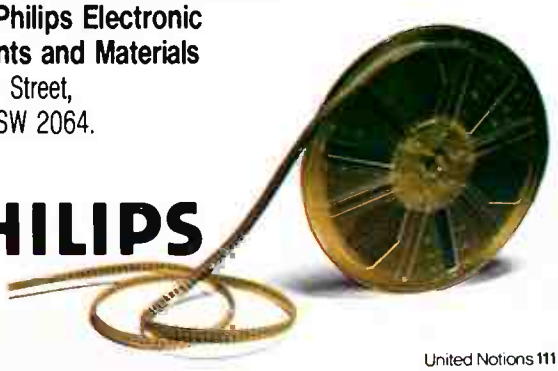

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