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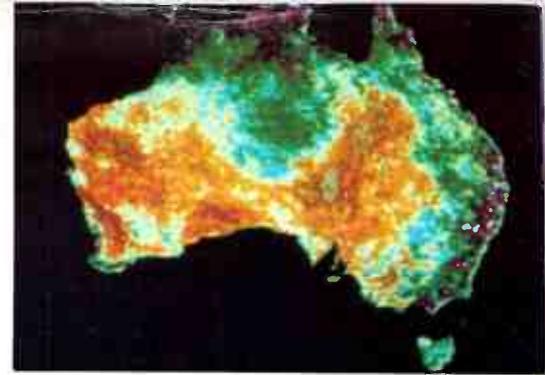
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COVER: Pioneer DAT player — Courtesy Pioneer.

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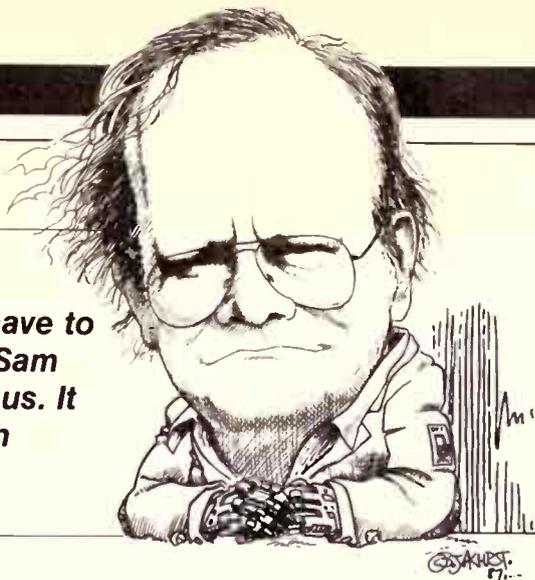
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“
**Sooner or later, we have to
 realize that Uncle Sam
 exacts a price from us. It
 may be too high**
 ”



The trade relationship between this country and the US is one of the main determinants of the long term future of the electronics industry in Australia. The industry depends to a very large extent on orders from government and large organisations, and in both cases face strong competition from overseas, especially the US.

In the light of this fact, Mr Bob Hawke's recent visit to the US is a matter of some interest. His basic message during many rounds of golf with US Secretary of State George Schultz was that we want a better deal for our primary industries. If we can't get that, the US can no longer take our relationship for granted.

That relationship has a number of different dimensions. But the common link between them all is that Australia has been prepared to deal with the US on the basis that we concede short term economic advantage in exchange for the protection and support of the US for our strategic goals in the world. It's an arrangement that could make a certain amount of sense, but a minimum requirement is that the US should understand where our strategic interests lie, and should be prepared to respect them. There is abundant evidence this is not the case.

The Prime Minister has told Schultz that unless he can wring some concessions from a protectionist minded Congress, then many in Australia will call into question the basis of our relationship. Hawke is perfectly correct in that, and indeed there had been a flurry of speculation on the future of the US spy bases (quaintly referred to in diplomatic argot as "joint facilities"). Of perhaps more long term consequence is its effect on other government purchasing, and the effect that could have on Australian industry.

Certainly in the defence area, a more independently minded purchasing policy could have quite spectacular results. The costs to Australia of supporting the US alliance have been heavy. The F18 contract, apart from being hugely and unnecessarily expensive, cost us the Fleet Air Arm. The Sikorski helicopter contract, apart from also being hugely expensive, cost us the helicopter industry that the British Westland company was prepared to establish here.

On a less spectacular, but still important level, many government and quasi government instrumentalities spend huge sums in the US every year on instrumentation, computers and other equipment. No one, least of all Mr Hawke himself, is suggesting that access to the Australian market is on the line, but the US might be surprised to learn how much trade is done in Australia simply because Australians like dealing with the Yanks.

More than between most countries, trade between the US and Australia is not solely an economic undertaking. It has a significant psychological component, and if that psychology changes, then much of value might be lost. The fastest way to change it would be if Australians started to feel that the US was treating us with contempt.

It will be argued that we can't do without the US, and there are many reports in our daily papers of inefficiency and ineptitude to hang such an argument on. The point will be made that there are too many things that Australians cannot do. The more important point to remember is that if we had to, we could. As things stand, we don't have to because there is always the easy option of going to Uncle Sam. Sooner or later, we have to realize the Uncle Sam exacts a price from us. It may be too high.

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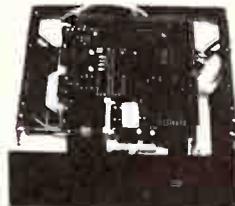
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TV Aggregation

Licensees in the four expanded regional commercial television markets, covering Queensland, New South Wales and Victoria, have elected to aggregate their service areas under the federal government's television equalisation plan. This outcome is an overwhelming endorsement by the stations of aggregation, which has always been the government's preferred approach to the equalisation of television services.

The move will bring more than four million Australians living in eastern mainland regions a step closer to gaining access to television programming comparable to that already enjoyed by viewers in Sydney and Melbourne.

It means most country country television viewer will gain access to three competitive commercial channels as well as the ABC, while retaining local programming, such as news, sport, weather and community announcements.

Today's announcement follows amendments to the Broadcasting Act 1942, passed by parliament earlier this year, and the release on August 26 of the indicative

plan and guidelines for the equalisation of regional commercial television services.

The government's equalisation timetable anticipates that the necessary broadcasting infrastructure will be in place to enable the southern NSW market to begin equalisation by 1989, followed by the Queensland market in 1990, the northern NSW market by 1991, and the Victorian market by 1992.

The government will not force aggregation on the smaller regional stations in Western Australia and South Australia because of the fears about the viability of three competitive services in those states.

It will shortly be taking up with the relevant licensees in WA and SA proposals for the provision of additional commercial services in those states.

The situation in Tasmania, where there is an existing commercial monopoly, is also being addressed, and the minister is trying to push through a second independent commercial service within the next two years.

These moves depend to a large extent on the existence of satellite reticulation tech-

nology which will make it possible to network large slices of the programming from capital cities. The corollary, of course, is that requirements for staff in the TV industry are likely to reduce dramatically. Industrial trouble among technical staff has already erupted at HSV7 in Melbourne, where staff were on strike for several weeks over job losses due to networking from the Sydney station ATN7.

The government is hoping that the creation of super networks across Australia will give them the financial muscle to resuscitate the film industry through a stronger commitment to Australian production. Currently the industry is reeling under the impact of reduced spending due to the ending of the 150 per cent tax concession.

In 1988 the government plans appear to have worked, with all channels well and truly meeting their commitment to Australian production. Whether this will last is another question. Imported programming sells for typically one tenth the cost of local production so the financial incentive to buy off shore (basically the US) is strong.

New Zealand And The Apocalypse

One of the most surprising results of any major nuclear conflict would be the emergence of New Zealand as a major power. It is estimated that at worst only 1000 New Zealanders would die from nuclear radiation. However a recent report commissioned by the New Zealand government predicts dire economic consequences for the tiny nation should the superpowers elect to destroy each other.

The report, by the New Zealand Planning Council, describes the way that the national economy would crumble once trade links with the devastated countries of the northern hemisphere were severed.

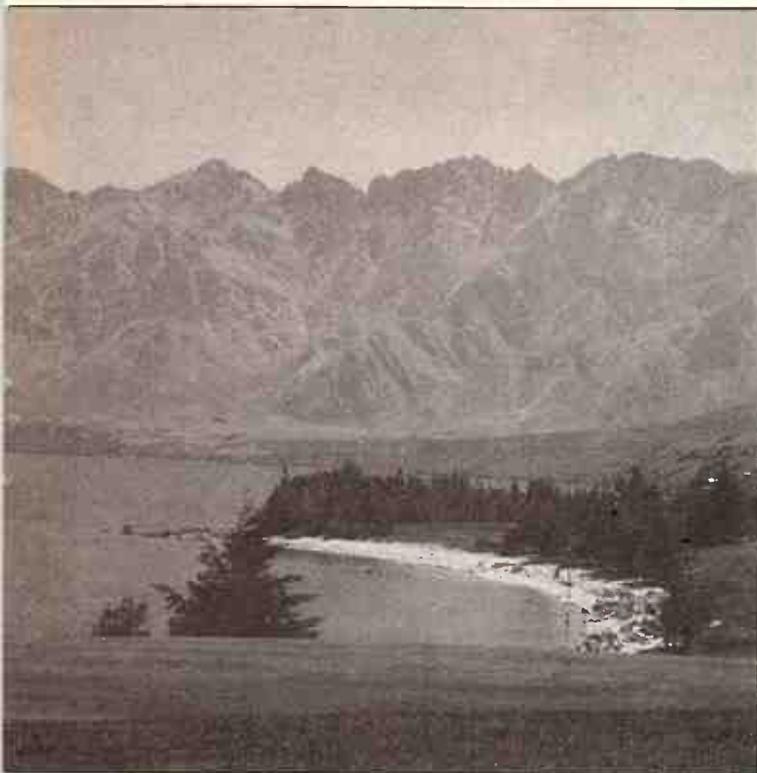
The council bases its advice on scenarios envisaged by the Scientific Committee on Problems of the Environment, known as SCOPE. The SCOPE report of 1985, compiled by more than 300 scientists from 30 countries, looked at the environmental consequences of a major nuclear exchange.

Woomera Hots Up

Woomera rocket range is moving into high gear, with both US and West German scientists using the range for observation of the Supernova 1987a.

The Minister for Science and Small Business, Mr Barry Jones, has signed an agreement which will permit the United States to launch and recover sounding rockets in Australia for scientific non-military, non-commercial purposes over the next 10 years. Mr Jones signed the agreement with the United States Ambassador, Mr Bill Lane, in Canberra.

The sounding rocket program will be conducted by the US National Aeronautics



One of the report's authors, Wren Green, was New Zealand's representative on SCOPE. According to Wren, even though New Zealand is unlikely to be a nuclear target (especially since implementing its anti-nuclear warship policy), industry would

eventually be crippled by the loss of imported machinery and spare parts. Transport would be disabled by a lack of imported lubricating oil and rubber. For a while, the country could survive on indigenous supplies of oil and petrol but, ultimately, the

country's sole refinery would grind to a halt through lack of spare parts.

Moreover, healthcare would disintegrate. New Zealand depends for almost all its medical supplies on the northern hemisphere. Within six months, says the report, suffering would be immense. Deaths from asthma, diabetes and epilepsy would multiply. Without anaesthetics, dentists would be forced to extract rather than treat infected teeth, a fearful prospect.

Of more concern to the authors than teeth is the loss of export markets because consumer markets in the northern hemisphere would disappear.

It predicts that unemployment would soar to 50 per cent of the population as export markets for dairy and meat products dry up. What would happen, it asks, if farmers who have 65 million sheep can sell produce from only 15 million animals?

New Zealand also fears that if an aggressor chooses to bomb Australia's three US military communication bases, electromagnetic pulses could arrest computers and electronic control equipment in the country. Banks, telephone, radio and television would be crippled immediately (although some

might see this as a blessing). So too would the country's electrical grid. This, in turn would disable New Zealand's oil refinery at Marsden Point, a plant for the manufacture of synthetic petrol, and pumping operations for natural gas.

Though engineers could ultimately repair the damage, perhaps within a few months, the devastation would reduce New Zealand within that time to an economy comparable with that of pre-industrial (and pre-nuclear) Europe.

The report also warns of catastrophic food shortages, mainly of wheat. Cautiously taking into account updated predictions since the 1985 SCOPE report of temperature drops in the southern hemisphere of up to 3°C, the report warns of reductions in rainfall that could suppress agricultural output in New Zealand.

The report also states misgivings about New Zealand's unwillingness to stockpile goods that could become unavailable, such as pharmaceuticals, rubber, fertilisers and compressed natural gas.

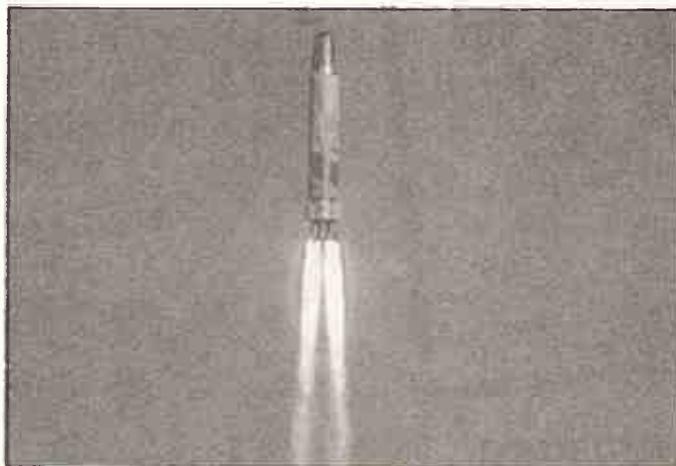
New Zealanders may therefore have to face the terrible choice, of either dying in a nuclear flash or surviving on nothing but mutton.

and Space Administration (NASA) and the Space Projects Branch of the Department of Industry, Technology and Commerce (DITAC). The Department of Defence will conduct the launches as DITAC's agent. NASA previously launched sounding rockets from Woomera between 1961 and 1977.

Meanwhile on August 25, British Aerospace celebrated the 30th anniversary of its upper atmosphere sounding rocket, by launching one from Woomera.

The launch provided astronomers and scientists with the opportunity to observe the supernova, some 155,000 light years distant in the Large Magellanic Cloud (LMC).

Customer for the launch was the German Aerospace Research Establishment



(DFVLR) which was responsible for procurement of the rocket and co-ordination of the launch. The *Max Planck-Institut* was responsible for procurement and manage-

ment of the payload experiment while funding was provided by the German Ministry of Research.

The Skylark's payload consisted of an X-ray telescope

and camera to provide astronomers with a colour X-ray image of the supernova. The results should provide scientists with valuable information about the matter expelled during the explosion of the star and increase understanding of the supernova remnant. After providing approximately five minutes of observation time the payload parachuted back to earth.

The first Skylark was launched from Woomera in support of the 1957 International Geophysical year, and since 1964, British Aerospace has supplied an entire family of Skylark rockets. The success of the Skylark programme is further reflected by continuing orders with 11 being ordered in 1986 and additional sales expected this year.

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NEWS DIGEST



Methane Sensing

Gold Coast laser manufacturer Laser Dynamics has supplied a laser to BHP for a new gas sensing system to protect its fleet of ocean going liquid natural gas (LNG) tankers. The \$30,000 LDL specialised Nd:Yag laser has been bought by BHP's Central Research Laboratories in Newcastle.

BHP Senior Research Scientist Dr Chris Scott said the LDL laser was a central element in a new system being developed to monitor methane gas concentrations on the company's LNG tankers. BHP

is taking delivery of new tankers to transport LNG from Australia's North West Shelf to Japan. Dr Scott said that methane levels are currently monitored by a multitude of localised sensors.

BHP Central Research Laboratories is developing a new semi-automatic system to measure methane levels over a wide area at pre-programmed intervals. The system could also have wide ranging applications in all LNG transport and storage situations, Dr Scott said.



A delighted Peter Hunt accepts the award of the BWD 50 MHz 821 Oscilloscope which he won in the ETI/Parameters competition in June. The award took place in Melbourne. From left to right, Peter Phan (regional sales manager, Parameters), Peter Hunt and Robert McPherson (general manager, BWD).

CUM/HQ4



Ford's New Robots

Machine Dynamics, the largest robot manufacturer in Australia, has just finished implementing an assembly line for the production of motor car doors at the Ford assembly plant in Melbourne.

Doors are produced at Ford on a small side arm of the main production process. Metal sheets need to be cut, pressed into shape, welded together to make the whole door assembly, and then presented to the main assembly line.

Naturally the jigs used to determine the exact shape of the doors are changed depending on the particular door: left front, left rear, right front, right rear and so on. So the line at Ford was arranged such that one shift was spent installing the jigs, and the next making one type of door. The line was divided into stations so that one person made a number of welds, another screwed in a number of bolts and then another did more welding and so on down the line. On the next shift all the doors were stacked in a corner of the factory, the jigs ripped out and replaced. Since the jigs are both expensive and delicate, this was a difficult and time consuming job.

Next day, the line would start making a different door. Since it would take about a week to make a complete set of doors, a week's supply had to be stacked on the plant so that there would always be an example of every door available at the main assembly line for installation in the body of the car.

This system is obviously inefficient, and Ford engineers had puzzled for years

over a better way of organizing things. Earlier this year, they got together with engineers from Machine Dynamics to sort out an efficient structure for the door assembly line, using a high degree of automation and avoiding the need to stack doors for long periods of time.

This brainstorming session came up with a highly flexible architecture for the new line. Separate jigs for all the doors are held on cubes which can be rotated so that any jig can be presented to the line. A single operator at the head of the line manually operates a magnetic gantry that lifts a sheet of metal and presents it to the first cube. He enters an instruction on a terminal which tells the line what type of door it is supposed to be, and the first cube orientates itself correctly to receive it.

From there on, the door is untouched by human hands. The line is operated by a number of robots that reproduce all the functions of the human operators. Sheets of metal are placed together, bent and welded. As the door passes from robot to robot, information on the door type is passed with it. The only thing that is still done by hand is placement of nuts and bolts. Automation of this step is still not cost effective according to the development team.

The design of the line also allows it to move doors faster than the main assembly line can move cars. This means that it is unnecessary to stockpile doors. They can be made in the quantities required when they are required.

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Managers, Promoters and anybody
interested in what goes into
today's music-making.

Plight Of The Microbee

Assiduous readers of ETI will have heard of the Australian computing firm Applied Technology. ETI in fact helped to launch this new enterprise way back in the early seventies when it featured a cat burglar alarm developed by one Owen Hill. The alarm could be obtained through the mail.

The orders flowed in and Hill set up Applied Technology as a consequence. For the next nine years the new company developed a range of products and kits based on the S100 buss. It in fact became one of the largest suppliers of microcomputer technology in the country.

In 1981 Hill and his company were invited by an engineer from the NSW Department of Education to manufacture a Z80 computer with 16K of memory with BASIC in ROM. The result of this request was the development of the Microbee which first appeared in the February edition of *Your Computer*. The new unit which met the requirements of the Department of Education in every respect cost \$399 and proved an instant winner. Not only was the new computer popular with the public but in April 1982 the NSW Education Department announced that Microbee and Apple had both been chosen to equip state schools.

Things seemed to be going well. Between 1982 and 1985 the company grew at the rate of 122 per cent per annum. Overseas orders began to pour in. Sweden alone bought something like \$3,000,000 worth of the new computer.

Unfortunately however despite its early promise the company began to run into trouble. Problems arose from two sources. First of all there was the question of capital. Not surprisingly Hill had not believed his success possible when he began making the Microbee and consequently his financial situation was somewhat rudimentary.

By 1985 Applied Technology owed \$1,000,000 to a local bank. The bank suggested that AT attract some equity and started to reduce its overdraft to \$500,000.

Adding to the problems of the company was the failure of the GAMMA PC. The new computer was based on the 2C256 chip and early tests seemed to indicate that the company was on to a winner. Unfortunately however further development was hampered by a phelthora of problems. Eventually after expenditure totalling a million dollars the project was abandoned, leaving a gaping hole in the company's finances. The Commerical Director of the company Harry Harvey blames the expense and delays of the Gamma project for the weakening of the company. Climbing interest rates and a decline in the currency also hindered the situation.

Things were getting somewhat desperate so in November 1985 Applied Technology became Microbee Systems and was floated on the stock exchange. For a while things did not improve however, and the company started to contract in order to reduce its overheads. For example, its branch office in Ryde was closed down. In the last few months however things have improved for the beleaguered company, Impact, a manufacturer of laser printers, has offered to become a joint partner with Microbee. Impact plans to manage a private placement of Microbee shares to raise the capital of which Impact would subscribe one to two million dollars. The company will acquire 45.8 per cent of Microbee's issued capital.

In the past Owen Hill and his company have been proud of their independence. However, the deal with Impact raises several possibilities for the company. First of all Microbee now has access to Impact's international distribution. This factor was especially important in view of the fact that Microbee's sales had declined before the merger. Impact has in fact recently signed an agreement with Gestetner

which has agreed to market its products in Europe and the US.

Then there is the matter of increased resources. Harvey attributes a lot of Microbee's problems with the 2C256 to a lack of adequate funds for research. Such funds should now be available when the two companies pool their financial resources.

The Quasar Beacon

The UK Schmidt Telescope at Siding Springs has been used to discover a quasar more distant than any other in the universe.

The quasar, known (unimaginatively) as 0000-2620 after its position in the sky, lies some 13 billion light years away. It is also one of the brightest quasars, as luminous as 10,000 ordinary galaxies.

Cyril Hazard, who located the first quasar back in 1963, discovered the latest record-breaker.

On an ordinary photograph, a quasar appears as a speck of light, just like a star. But the astronomers at the observatory routinely put a large thin prism over the front of the telescope. The prism breaks up the light of each object into a short spectrum. The spectrum of quasar looks very different from that of a star, so it is comparatively easy to pick out.

Hazard, of the University of Pittsburgh, and his team have been searching for distant quasars by looking for the characteristic ultraviolet emission from hydrogen, Lyman-alpha, shifted by the expansion of the Universe so that it appears at the red end of the spectrum.

The Royal Observatory in Edinburgh, which runs the Schmidt Telescope, stores all the plates from the telescope in a special library. In October Hazard went to Edinburgh to select photographs that his team could measure on a sophisticated machine in Cambridge. Hazard picked out a plate covering

the constellation Cetus. As he scanned it by eye, using a hand magnifier, Hazard noticed the spectrum of the bright new quasar and realised it was more distant than any previously known.

The exact distance to a quasar depends on the rate at which the Universe is expanding, which astronomers do not know precisely. So they refer to distances in terms of "red shift", the amount by which the wavelengths are stretched.

Until last year, there seemed to be a "barrier at a red shift about four. Then Hazard's team found a quasar with a red shift of 4.01. Earlier this summer, Maarten Schmidt at Caltech discovered a quasar with a red shift of 4.04, another with about the same red shift a few days ago.

When Hazard saw the spectrum of the new quasar, he knew immediately that it must have a red shift around 4.1. But he needed a precise measurement from a spectrograph on a large telescope to confirm the discovery. John Webb from the University of Leiden, along with Bob Carswell and Helen Parnell from Cambridge, were about to go to the Siding Springs. They took a spectrum that showed the red shift was 4.10, and showed a multitude of absorption lines.

The light from distant quasars can reveal what was happening in the Universe soon after the big bang. The light we observe from 0000-2620 left it when the Universe was less than one billion years old, and less than 20 per cent its present size. As the light has travelled towards us, it has passed through clouds of gas and through galaxies that are forming. These leave telltale sets of absorption lines.

Quasar 0000-2620 is particularly important because it is ten times more brilliant than the other quasars with a red shift around four. As a result, astronomers can study absorption lines in the spectrum much more easily. Hazard hopes that the spectrum of this quasar will help astronomers to understand how galaxies are born.

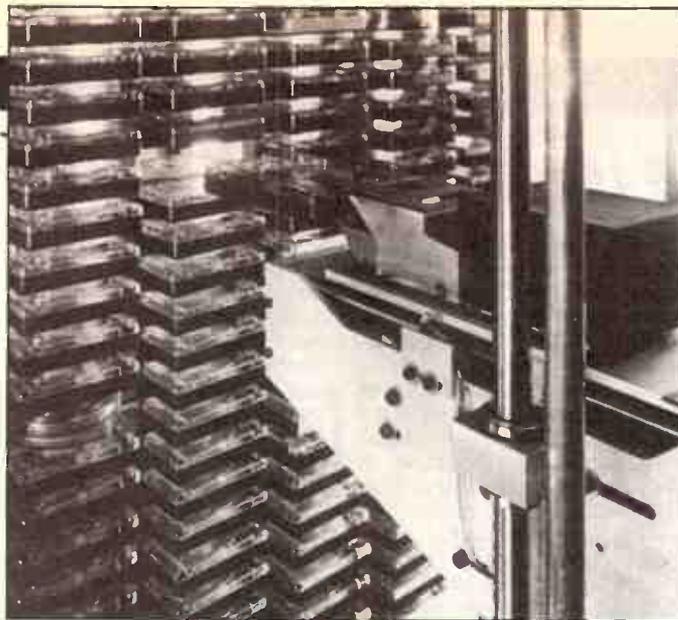
Tape

Hewlett-Packard and Sony have struck a deal which will put the power of 1000 floppy discs in a desk-top personal computer. HP and Sony hope to set an industry standard for DAT (Digital Audio Tape) as an even higher density erasable store at a tenth of the price of optical discs.

The DAT cassette is the size of a credit card and contains tape that is only 3.9 mm wide. This runs at 0.8 cm/s past a head-drum, similar to those used in video recorders, which rotates at 2000 rpm. For hi-fi, the stereo sound is converted into 16 bit digital code. For data storage, blocks of 8 bit bytes are recorded instead. This data streams on, and off, the tape at the very high rate of 170 kilobyte/s which is around 600 Mbytes/hour. So a two hour DAT cassette can store 1.2 gigabytes of data. This makes the tiny cassette equivalent to more than 1000 conventional floppy discs.

In addition to the error correction already provided by the DAT format for hi-fi, HP and Sony have agreed a second level of error correction which gives an extra ten per cent redundancy. This ensures that data recordings are virtually free from any errors.

The DAT data storage deck will be made the same size



as a conventional floppy disc drive, so that it can be built into the body of an IBM PC or clone. The cassette can either be used as a back up store or for loading large chunks of data into the computer's memory for rapid access.

A two-hour DAT cassette, storing 1.2 gigabytes of data, can be fully re-wound in 41 seconds. The average search time between sections of data along the tape is less than 20 seconds. HP and Sony plan to start volume production of DAT data drives by the end of 1988.

In the face of this challenge from Sony and HP a consortium of European companies has been formed to develop and market optical disc systems.

Optical discs produced for video and audio use can be recorded on once only. The industry is keen to produce discs that can be re-recorded on many times over in the way that magnetic discs used on computers can be. Optical discs have a much higher storage capacity than magnetic.

Rank Xerox and GEC from Britain and LETI, the French electricity board's research laboratory, are involved in the project. "We are talking about a market that will be worth billions of pounds in the 1990s," says Ted Williams, a PA technology consultant who recently toured 14 Japanese companies and concluded that they were well ahead of European efforts compared with his last visit

four years ago.

The catch-up exercise will cost over \$20 million for the next three to five years. This is the sort of sum the consortium will be seeking from the European Commission's Esprit programme of information technology research later this month.

With that kind of cash, the companies could set about producing an erasable magneto-optical disc, says Williams. This type of optical disc can be erased and written over many times over. Information is recorded on such a disc, usually made from applying a DC magnetic field and heat from a laser beam to a spot on the disc simultaneously. The magnetic field lines up dipoles in the material so that they are perpendicular to the disc. The bits are erased by heating up the spot again and reversing the field.

The question is can this be done quickly enough to approach the abilities of a magnetic disc which can move to and records a bit of information in 30 milli-seconds? Williams says the process of applying a magnetic field to erase information slows up the process, but it can be done in 100 milliseconds. This time might be reduced to 50 milliseconds at which point optical discs would be a viable alternative to fixed Winchester magnetic discs.

Unrepeatable

A few months ago the scientific community was agog with new developments in super conductors. It was claimed that with the right recipe, even highschool students could make the new family of liquid-nitrogen superconductors. However, the new materials seem to be much harder to keep than to make.

Researchers have been plagued with unrepeatable results, apparently because some materials can be unstable in the superconducting phase. Now a group from AT&T Bell Laboratories in Murray Hill, New Jersey, reports that the superconducting

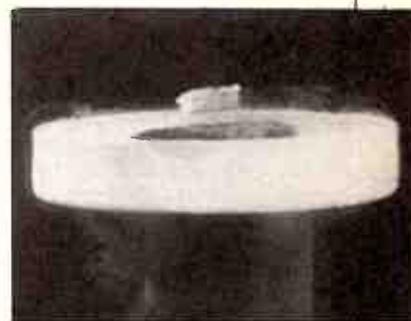
phase of yttrium-barium-copper oxide degrades when exposed to water.

Some scientists had suspected that the new superconductors might be sensitive to water. Some hints came from experience. Another reason is their composition: the best-known member of the family contains copper in an unusually high state of ionization, known as +3, which is less stable than the standard +1 or +2 states.

Quantitative measurements showing that the new ceramic superconductors react with water in the liquid state or humid air were reported in *Applied Physics*

Letters (August 17, p532). M. F. Yan, R. L. Bams, H. M. O'Bryan Jr., P. K. Gallagher, R. C. Sherwood, and S. Jin of Bell Labs found that $YBa_2Cu_3O_7$ reacted with water, forming cupric (copper +2) oxide, barium hydroxide, oxygen and Y_2BaCuO_5 . The compound did not have to be submerged in water to react with it. Its superconductivity was degraded when exposed to humid air.

The sensitivity to water should not prevent applications of the new materials. The Bell Labs group writes: "It should be possible to protect them with coatings of metal, glass or plastic." In fact, an



earlier paper in *Applied Physics Letters* (vol 51, p203) reported liquid-nitrogen superconductivity in wires of the new material clad with metal that could protect against ambient moisture.

Superconducting Lines Printed On Circuit Boards

The new superconducting materials which can be used at dramatically higher temperatures than the earlier superconductors have recently been much in the news. They are of major interest for high power applications, such as electromagnets which can produce very intense fields, for magnetic levitation, etc.

Work is being performed at the GEC Hirst Research Centre at Wembley, London, to investigate the possible applications of these new materials at much lower power. Their use as connecting lines on printed circuit boards is now being considered.

Bryan Barnard told us: "At our Engineering Research Laboratories in Stafford we have screenprinted the yttrium barium copper oxide high transition temperature

superconductor material as tracks on printed circuit boards. This black material offers the possibility of higher speed interconnects between integrated circuits on the board."

The bulk material behaves as a superconductor only if it is kept below its transition temperature. In the case of the currently available bulk material, this is about 92K (-181°C), but materials showing superconductivity at much higher temperatures — even up to room temperature — may well be developed.

The use of superconducting connecting lines of zero resistance on printed circuit boards would result in the time dispersion of pulses being reduced. Fast pulses entering a connection line would leave the line without

the pulse rise and fall times being degraded. This may improve the speed of operation of computers, etc. When asked about the possibility of the material being used for connections inside an inte-

grated circuit, Barnard indicated that a great deal of development work will be required before semiconductor and superconductor fabrication techniques are fully compatible.

Obituary

Mr Neville Frolley died on October 16. He was 50.

Frolley was widely known as the owner of All Electronics Components, the Melbourne based kti company, whose advertisements and projects have been appearing in ETI for many years.

He had 32 years experience in the electronics industry; servicing and designing radio and TV, industrial electronics and instrumentation. He then set up All Electronic

Components as a mecca for Melbourne electronic enthusiasts, claiming the biggest range and the best prices in the country. The real reason for this success however, was a reputation for reliability and integrity.

He is survived by his son Andrew, who has followed his father into the family business. Neville also has two other sons and a daughter. He will be sorely missed.

OTC Opens New Downstation

OTC has opened its first major city downstation on the East coast with a new facility at Oxford Falls, near the similar Aussat operation at Belrose. It's 17 km from the Sydney central business district, to which it will be linked by line of site microwave bearers on top of the Paddington and Broadway exchanges.

The total cost of the facility is \$26m, of which \$11m was paid out to local companies. This included the \$1.6m 18 metre dish and transmission power and control equipment.

Antenna at the station will include a 32 metre dish relocated from the Moree down station, the new 18 metre dish and a seven metre dish to carry advanced digital business services.

The Oxford Falls station will replace the Moree station that has been OTC's main access to the Pacific Ocean Intelsat satellite for the last twenty years. The move results from a better knowledge of interference patterns at C band frequencies.

The decision to locate at Moree was taken because of fear that the energy from major cities would interfere

with the satellite signals.

Modern communications theory has shown how to design downstations so this does not happen. As a result, it is possible to locate close to the city, thus avoiding the need for costly terrestrial microwave links. According to OTC the cost saving will eventually be passed on to consumers.

... and ups R and D effort

OTC's research and development budget passed \$3m for combined internal and external R and D during the last financial year, according to a recent report released by the overseas carrier as part of its annual report. The increase in funding is part of a move to take R and D funding to one per cent of turnover and represents a major change of thinking, given that three years ago OTC did almost no research at all.

The major spur has been the combined OTC/TCNZ interest in an optical fibre bearer between the two countries. It will be called Tasman 2 (see News Digest, February 1987) and it is the first step of a Pacific Basin fibre network that will link the

US and SE Asia, to Australia and New Zealand.

The technology to build an optical network on such a scale does not currently exist, and much of OTC's research effort has been to ensure that it does before the 1991 target date. This includes the development of operational components utilising 1550 nm because it is now becoming increasingly clear that Tasman 2 will be one of the first cables in the world to use the shorter wavelength.

R and D is being managed in two separate streams, one internal to the organisation and one external. The aim is to make both streams about equal in terms of costs. Internal R and D is devoted to keeping the company abreast of the latest technologies, to providing a capability for interfacing pieces of equipment into the network and the ability to develop equipment to specific OTC requirements where it is not available off the shelf.

The External Development section gives contracts to companies or groups of companies to develop products to OTC requirements. According to the report, the ra-

tionale for this type of development is the creation of an industry in Australia capable of supporting a large section of OTC needs for system hardware.

Among the current rash of projects: single mode couplers and laser stabilisation for optical fibre transmission systems by AOFR in Canberra; a computer model of a submarine fibre system which OTC is now using for the design of its systems developed by STC; and the development of new fibre cables by Olex and ASC for underwater use.

Notwithstanding this interest in fibre technology, OTC is also extremely active in the satellite area. Current projects include the development of new downstations. A consortium including Codan, South Australian Institute of Technology, CSIRO, the University of Sydney and Mitec in Queensland is currently developing a Ku band downstation that will be purchased by individual customers and used to gain access to the Intelsat Business System, or to Aussat services.

The Young Achievers



The five winners of the AMP Beyond 2000 Science awards have been announced. The awards totalling more than \$40,000 are intended to encourage NSW schoolchildren to come up with viable technological inventions.

Two of the most interesting devices were an anti-snatch handbag alarm developed by Tanya Conroy (14) and a remote control shop display invented by Eileen Etheridge (15). In view of the recent plague of bag snatching in Sydney, Conroy's device is particularly timely. The alarm is concealed in the bag and is activated by a chain attached to its owner. When the bag is "snatched" the chain activates the alarm thus (hopefully) discouraging the thief.

Eileen Etheridge's invention was inspired by a visit to a real estate agent whose shopwindow display rotated just before it could be read by any potential customer. Eileen's device consisted of a proximity switch placed inside the window. The switch is operated and the display is halted by customers placing their hand in front of the switch. Removing the hand reactivates the display. In order to make her invention more attractive to shopowners Eileen added a counter which allows owners to see what particular item has caught the most interest.



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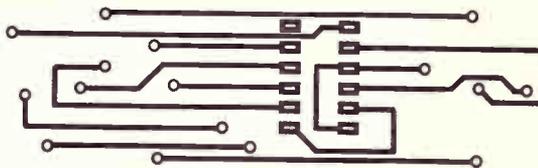
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Sandgropers succeed at IRECON

West Australian electronics manufacturers are negotiating more than \$2.7 million worth of sales following the IRECON exhibition. Seventeen Western Australian companies took part in the four-day exhibition in Sydney earlier this month and order worth \$150,000 have already been placed with several companies.

The West Australian Minister for Industry and Technology, Mal Bryce, said that it had been estimated that over the next 12 to 18 months Western Australian companies could expect sales worth \$14.8 million as a direct result of IRECON. "It is encouraging to see that companies in this industry are serious about developing overseas and in-

ternate markets and are achieving a high level of sales outside Western Australia," Mr Bryce said.

"It is the technology-based companies which are transforming the Western Australian economy."

Retail Smart Card

The first retail smart card outside of Europe has just been launched in New Zealand.

Backed by merchant bankers Fay and Richwhite, the new card, called "Asset", contains its own computer chip that enables it to provide an extensive range of financial services and store information about every transaction.

It can be used to make purchases in three ways. First, it works as a normal credit card giving shoppers up to 50 days interest free.

Second, purchases can be charged directly to an Asset working account. Cardholders also can make deposits into this account, which earns daily interest. Withdrawals can be made from the account, with daily interest charged when the balance drops below zero.

The third option is to charge purchases directly to the cardholders bank account at Postbank, which has the same effect as writing a check to that account.

The cardholder can select any of these options through the Asset Card at the point-of-sale when the purchase is made.

In addition, the Asset Card is licensed by MasterCard International. Chief Executive of MasterCard International, Russell E Hogg, said the chip card could revolutionise the way credit and debit cards operate internationally.

"It also will lead to a significant reduction in credit card fraud because the infor-

mation in the chip cannot be stolen in the way data can be skimmed from standard credit cards. And the smart card is almost impossible to duplicate."

The technology chosen for the Asset Card was based on the French Bull CP8 card. Bull, one of the largest computer manufacturers in Europe, made international news recently when it acquired a significant shareholding in Honeywell Information Systems. Bull CP8 is the world's largest supplier of smart cards and is the only company capable of delivering proven technology in the quantities required by Asset Card.

Asset has taken further steps forward in becoming the first major issuer in the world of the new ISO (International Standards Organisation) microcircuit chip. It was a move that will keep the company at the forefront of the technology and one which will meet with the

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standards recently published by MasterCard International.

The ISO position chip is located on the centre left of the card on either the front, or rear below the traditional magnetic stripe. The chip contact is also smaller in size to provide greater reliability and is now oblong in shape. It is anticipated that the majority of cards produced in the future will contain the ISO standard chip.

Asset Card Limited is providing a total service to retailers joining the system, which includes software development, network design, terminal selection and installation planning. These services are provided from Asset Card Limited's in-house staff of engineers and software developers, who have access to the latest development and testing tools for smart card encoding, personalisation, ROM burning and testing.

Initial installations of Asset will include over 550 termi-



nals at 185 L.D. Nathan locations throughout New Zealand. The terminals will be connected using Telecom's EFT X.25 Network. The Asset system has the ability to accept transactions on-line if certain card conditions prevail, or to poll terminals which have collected transactions in an off-line mode. Asset plans to adopt the Australian AS2805 standard as soon as it is available.

After an exhaustive study of available smart card terminals, Asset has recommended the French EF1822, supplied by CSEE through Unisys New Zealand. Selection was heavily influenced by the desire of major New Zealand retailers, including L.D. Nathan to have the ability to accept other banks magnetic stripe cards in addition to the Asset smart card.

The software for the terminal application has been developed entirely in New Zealand by Asset software engineers. Unisys provided software services for the terminal communications protocol. Asset fully expects to support a range of terminal devices in the future, meeting the application needs of a wide range of retailers. These devices will undoubtedly include portable terminals as well as fully integrated "Point of Sale" systems. The Asset terminals have a battery back up facility and sufficient memory to hold several thousand hot cards and up to 500 off-line transactions.

Michael Fay, chairman of Fay and Richwhite said: "At this stage we'll be introducing it as a credit/debit card only, but the card's security plus its versatility makes it suited to broader uses," he said.

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Ozone In Montreal

Several industrial nations met in Montreal in September and signed the world's first global treaty for the protection of the environment. The treaty is aimed at protecting the ozone layer. However, many scientists doubt whether the treaty will achieve the object.

Ozone in the atmosphere absorbs most of the ultraviolet light from the Sun. Life on Earth is damaged by even small increases in ultraviolet light. The concentration of ozone is governed by up to 50 chemical reactions involving several trace gases. Attention in recent years has focused on chlorine ions, which catalyse the breakdown of ozone.

Unnatural quantities of chlorine have been released into the stratosphere from chlorofluorocarbons (CFCs), chemicals used in aerosols, refrigerants and plastic foam. Ground-based measurements and satellite observations have shown that ozone in the stratosphere has decreased by up to 3 per cent over the past decade.

The uncertainty arises from disagreements over measuring techniques but, says Bob Watson, head of atmospheric research for NASA in the US, "there is no doubt that stratospheric ozone has diminished." He says that it is "virtually certain" that this decline is linked to chlorine from CFCs.

Hence, the negotiations for a treaty to protect ozone, which have been going on under the aegis of the UN Environment Programme for a decade, have centred on limiting the production of CFCs.

The limits are imposed in a complex formula that affects both production and international trade in CFCs. Their main purpose is to force an increase in the price of industrial CFCs now in use.

This price rise, says spokesmen for the companies that make the chemicals, will be necessary to induce companies to seek safer replacements that will not damage ozone. Last week, a spokesman for the British Depart-

ment of the Environment said that it is impossible to predict whether the limits being contemplated for agreement in Montreal will have the required effect on prices.

In September, the department published an independent scientific assessment of the relationship between ozone and CFCs. The review emphasised that "there is no significant trend detectable in measurements of the global average of ozone (in the atmosphere as a whole)."

This is because methane in the lower levels of the atmosphere is helping to increase concentrations of ozone there at nearly the same rate chlorine decreases it in the stratosphere. The department, in an announcement with the review, said that CFCs were "unlikely to lead to a reduction of the stratospheric ozone layer."

The effects of methane, given of especially by farting cattle and paddy fields, have maintained the total amount of ozone over our heads, so the ultra violet light hitting the Earth has not yet increased. But scientists at the department say that it is wrong "to rely on one form of pollution to offset the effects of another." Those who have ever stood close to a farting cow would agree. Moreover, the decrease of ozone in the stratosphere could change the heat balance in the upper atmosphere, destabilising weather.

The real question to be addressed in Montreal was not whether CFCs should be limited, but by how much, and when.

The Soviet Union and Japan have never committed themselves to a final position, but the British negotiators wanted looser restrictions than the US did. The US also wants to include halons, bromide-containing compounds used in fire extinguishers, in the limitations. Forty times more CFCs are released than halons, but halons are up to eight times better at depleting ozone as Britain did not want to include halons in the protocol.

In negotiations over the

past year, original, stringent proposals for limits on CFCs have been scaled down, mostly in the face to objections from the EEC, led by Britain. Agreement in principle has now been reached to freeze CFC emissions one or two years after the treaty comes into effect, which is likely to be one or two years after it is signed.

Agreement has also been reached in principle that this will be followed by a 20 per cent cut in CFC emissions, four to six years after the treaty comes into force.

Telecom's Australian Order

Pacific Dunlop Batteries Industrial has won a multi-million dollar contract to supply batteries for Telecom Australia. It is the biggest order for batteries ever placed in Australia so far.

The batteries, which will be made in Australia, will have a combined capability of delivering 10 MV.A for 10 minutes.

Telecom's national media officer, Ms Andrea Gash, said that it was Telecom's policy

to support Australian manufacturers and equipment suppliers wherever possible.

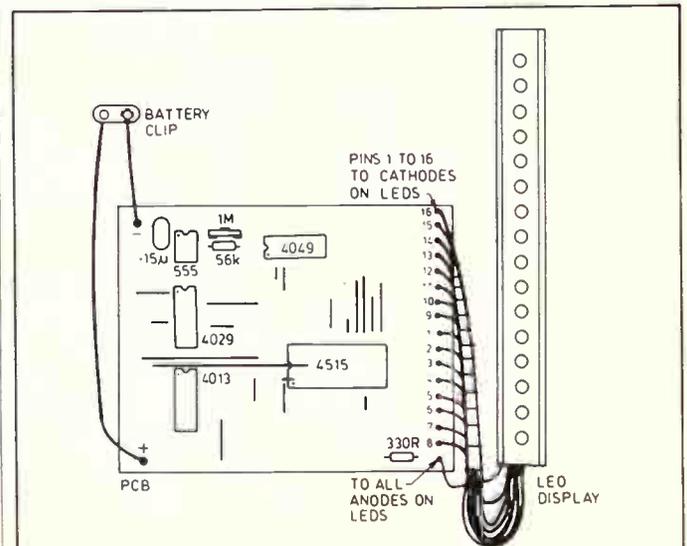
Ms Gash said, "From a technical point of view, placing this order with an Australian company has significant advantages. It means we can get replacements immediately if we need them, and it is important for us to have locally based technical product expertise.

"Telecom's special requirements meant we needed a company that could provide up-to-the-minute technology. The largest of the batteries will have to handle very high rates of discharge — an average of 1700 amperes," she said.

By way of comparison, the average home appliance draws 10 amperes, and even the giant batteries driving 20 tonne locomotives underground at Mount Isa Mines only draw 600 amperes.

Pacific Dunlop Batteries Industrial is a division of an all-Australian company, which has undertaken other large projects including the 230 tonne batteries installed within RAN submarines.

The equipment ordered will be supplied in five stages over more than two years.



ETI-287 Errata

Two links were inadvertently left off the overlay diagram of the ETI-287 in October. Both begin under the 4515 and go to the left, as shown in the new overlay diagram.

Light Tube for Soldiers

The Department of Defence has installed two fibre optic networks to provide better data communications be-

tween Defence sites in Canberra.

A one-kilometre optical fibre cable network, to be hosted by a HP3000/930 central computer, has been installed at the Russell Defence Complex. There are plans to extend the network to other Defence areas in Canberra. At the Campbell Park Defence complex, two lines of

optical fibre cable have been installed linking a Prime 2755 central computer with widely separated peripherals. The cables and associated multiplexers were supplied by Olex Cables in Melbourne and installed by Laurie Preller and Associates.

Amber Systems

David Hannay, managing Director of Amber Technology, has announced the formation of the Amber Systems Group.

The new division will offer installation and system design services.

COMING EVENTS

NOVEMBER

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

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

DECEMBER

The Australian Society for Computers in Learning in Tertiary Education is holding its annual conference in Sydney on November 30-December 2. Tel (02) 697 3175.

The Australian Urban and Regional Information Systems Association will hold its 15th annual conference UPRIS 15 in Hobart from December 2-4. For full details contact the conference secretariat (002) 34 1424.

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

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

FEBRUARY

Communications 88 — the third Australian International Electronic Communications and Information Technology Exhibition will be held at the new Sydney Conference and exhibition centre in Darling Harbour during February 7-10. All those interested in this

comprehensive exhibition should contact Australian Exhibition Services Pty Ltd, 424 St Kilda Road, Melbourne, Vic 3004. Tel (03) 267 4500.

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

MARCH

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

APRIL

Tekniikka 86 An international Specialised Exhibition of Automation in Industry will be held in Finland at the Jyvaskyla Exhibition centre over April 19-22. Contact the Jyvaskyla Fair chairman Mr Olli Patja, Exhibition Manager, PB 127, 40101 Jyvaskyla. Tel (9) 41 611 288 Finland.

MAY

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

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

JULY

COMDEX Australia's National and International Computer and Communications Exhibition and Conference will be held in the

Darling Harbour area of Sydney from July 26-28. Potential visitors and exhibitors should ring (02) 959 5555.

AUGUST

The 3rd Regional Convention of the Melbourne Audio Engineering Convention will be held in the exquisite surroundings of the Melbourne Hilton over August 16-18. The three day programme of papers and workshops will be accompanied by an extensive exhibition of audio products. Contact the Chairman Brian Horman, PO Box 131, GPO South Melbourne 3205. Tel (03) 329 162.

SEPTEMBER

The ANZAAS Centenary Congress will be held over September 2-6, 1988 at Sydney University. Enquiries should be addressed to Mr B. O'Bourke, Organising Secretary 1988 ANZAAS Centenary Congress, 118 Darlinghurst Road, University of Sydney, NSW 2006. Tel (02) 692 4356.

OCTOBER

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

NOVEMBER

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



Paul Budde describes how videotex is now being used for everything from training doctors to conducting surveys.

Videotex News

EVALUATION GUIDELINES

The US Videotex Industry Association's Direct Marketing/Advertising Committee has completed a report which recommends content evaluation guidelines for videotex system operators. The committee suggests that system operators compile statistics for each service provider on page accesses per day and month, sessions started by day and hour and average session length. The report also recommends that subscriber counts should be based on active subscribers and not the total numbers of customers who have signed up since the system's inception. Written subscriber surveys are recommended to gather user demographics and attitudes toward the system.

The VIA committee was spurred on by information providers and advertisers who are concerned that they receive noncomparable evaluations on their products from various system operators.

VIDEOTEX INTERWORKING PILOT TRIAL

The German and Dutch PTTs have started a pilot trial based on the new Videotex Interworking (VI) protocol. It will be the first such internetworking implementation and is surely a showcase in Europe. The Btx-Teletel gateway has been abandoned somewhat for technical as well as political reasons.

The French PTT recently made a call for tenders for VAPs to support either Prestel or the Videotex Interworking protocol, besides Teletel. Those in favour of VI in

France seem to count on this protocol becoming the new European standard and eventually hope to reduce the future adoption of CEPT 3 + 4 formats in other countries. However, even if the VI protocol is considered as the future real European standard, it will not reduce in any way the adoption of CEPT 3 + 4.

One could comment that in countries like the Netherlands, where the adoption of 3 + 4 has been decided upon already it cannot be otherwise; evidently, countries that have not decided in any official way to adopt CEPT 3 + 4 will probably opt for implementing VI only. If adopted, VI will be a gateway system for interconnecting European public networks, whether Prestel, Teletel, or CEPT. It will require additional investments and VI implementations in each public videotex network throughout Europe.

"VI is a very transparent and versatile system, and will integrate all 7 OSI layers and bring a European solution not only to the transparent conversion of existing standards but also to such technical aspects as billing, taxes, data protection, etc., all aspects which are absolutely necessary in any true interworking between public videotex services."

By 1990, (approximately) the West German Bildschirmtext (Btx) network will be based on the Videotex Interworking (VI) communications protocol (ODI level 6) replacing the current External Gateway network.

MINITEL IN AFRICA

The French PTT have been very busy on the Ivory Coast. Cooperation between the two countries dates back three years ago when Telesystemes, a subsidiary of the

French telecommunications holding Cogecom, supplied a packet switched network, known as Sytranpac. More recently, the French PTT have supplied a concentrator to link Sytranpac to the international packet switched service providing access to ASCII data bases worldwide.

In addition, the French PTT have just donated two first-generation videotex access points, connected to Sytranpac, that are currently under trial. This will give access to in-house as well as subscription Teletel services in France.

PROCESSIBLE DATA ON PRESTEL

Prestel is coordinating efforts with a working group, including terminal manufacturers and Service Providers, to implement the new Processible Data standard into existing videotex host computers and peripherals such as printers, terminals, and videodisc players).

Currently under test, Processible Data will be available with a printing option. It is mainly a means of sending customised data from host computers to intelligent terminals, printers and other peripheral equipment including videodisc players.

NIGHT IN NEW YORK

Video Billboard, a division of Billboard Information Systems Inc, is New York's first public access, Prestel based videotex service. Personal computer users are now able to access all the excitement of New York.

Anyone can log onto Video Billboard. Information on favourite restaurants, shows, nightclubs, concerts, art galleries and a host of other special events in the New York Metropolitan area,

is available.

Users are able to scan Billboard's business and professional services directories, and become privy to special discounts and free event days before they are announced to the general public.

ELECTRONIC SURVEYS

Due to requests by site hosts of the Bay Area (Canada) TeleGuide, Chronicle Videotex has conducted live, on-line surveys.

These surveys show that computerised polling on public terminals can be both entertaining and cost-effective. The electronic surveys can obtain more responses in a shorter time and is an easier way of identifying user feelings about public access terminals. The people who answer surveys on Teleguide are motivated and less self-conscious about responding as everything is user-directed and selected.

GASC

GASC, Graphic And Software Communication system, can be seen as an inexpensive yet much enhanced videotex system, or as a star-shaped simple minded local area network, or as a file-server handling a large number of intelligent work stations.

Typical user stations in a GASC system are intelligent terminals such as microcomputers. In many situations, intelligent videotex terminals or microcomputers with videotex capabilities are particularly well suited. This is due to their good yet inexpensive colour graphics capabilities and to the fact that they also permit access to arbitrary private or public videotex systems.

THE LLENTEX TOOLS

Digital is recognised in the international videotex world as a technical leader. The Digital VTX products however, missed the right interface to properly manage and market videotex services.

Greg Tremlow from Civil and Civic (a Lend Lease Division) developed, together with Paul Budde Communication, the so-called Llentex tools. These tools make proper database input possible, amongst a variety of other things.

The tools are now being checked by the Digital R & D Group in Boston — U.S. and there is a great chance that it will be marketed by Digital on an international scale.

LIVE WIRE UPDATES

Employees at Digital Equipment Corporation's Marlboro, Massachusetts facility don't have to go out and buy newspapers or magazines to find a daily stock market report or to hunt for articles informing them of the latest business news and information.

They have Live Wire, an electronic news source based on Digital's VAX VTX videotex software which can be accessed from their terminals through VAX accounts or at dedicated terminals located in lobbies and cafeterias. Live Wire is the largest private videotex service in the world with over 11,000 users.

TASS ON-LINE

DataSolve World Report on-line data base is the first one in the world to include news from the Russian TASS Bureau News Service. 70-80% of the

TASS news will be National Russian News.

ON-LINE EUROPE IS GROWING

The European on-line publishing market grew from \$US300 million in 1982 to \$US655 in 1985. The balance of payments between European and American information is also changing. At this stage the ratio is 17%: 83%, by 1990 this will be 21%: 79%.

VIENNA — MEDICAL COUNCIL STARTS PILOT PROJECT

The Viennese General Medical Council has run a six-month pilot project including 450 general practitioners in three districts of Vienna. This 600-page videotex service provides addresses, phone numbers, surgery times and specialist doctors. Users also have access to information about holiday periods, replacements during the holidays, weekend and night emergency services.

50 doctors are participating in a closed user group that provides confidential information about the General Medical Council, international events, further education etc. The program is expected to be extended throughout Vienna.

EDUCATING DOCTORS

A computer based medical education program developed by The Royal Australian College of General Practitioners Family Medicine Program (FMP) is available on Viatel.

The system is called CHECKUP (Computerised Home Evaluation of Clinical Knowledge Understanding and Problem Solving).

CHECKUP has two elements:

- ★ A bank of over 10,000 true/false questions used to identify areas of deficiency in a General Practitioners' existing knowledge base;
- ★ A problem bank which presents an outline of various patients symptoms and enables the doctor to interactively question the "patient", perform medical tests, etc. and so decide an appropriate diagnosis.

ON-LINE DATA BASES ON AUSTRALIA

Since its inception in 1963, Australian on-line data base users have been using CSIRONET to maintain and access their own private databases. In 1982 the first public access database was established.

An overview of public data bases now available through CSIRONET:

- ★ AUSSTATS — the ABS Service

The Australian Bureau of Statistics has a new service offering a large range of time series statistics on the Australia-wide computer network CSIRONET.

Called AUSSTATS, the new on-line service allows subscribers to store, retrieve and manipulate a wealth of social and economic statistics.

AUSSTATS will allow users anywhere in Australia to quickly and easily look at any of the 3,400 time series statistics on the service.

The time-series — which usually span between 10 and 20 years — cover the most important indicators of Australian social and economic conditions.

In the past these figures have been available on microfiche and on mag-

netic tape as well as in publications, but now AUSSTATS offers a faster more versatile tool for the users of these statistics.

Additionally, the figures can be downloaded to a micro or another computer, for modelling or spreadsheet analysis.

- ★ Duns Market Identifiers (available late 1986)

Contains information on 180,000 Australian business enterprises including details such as annual sales, number of employees, names and titles of senior executives, line of business and status of organisation.

- ★ 1981 Census of Population and Housing

Gives all the results of this census.

- ★ Australis

A scientific information service for anyone interested in current scientific research being undertaken in Australia. Currently consists of 13 databases and answers questions on topics as diverse as Marine Biology to Building Research.

- ★ Access to other public databases via CSIRONET

Can be used to access the Australian Bibliographic Network maintained by the National Library. Librarians searching for a particular book or periodical not in their own collection can find out which library in Australia has it. They can then get the publication through an inter-library loan.

- ★ Access to overseas databases is easy via CSIRONET and the OTC Midas network. Two of the most popular databases are Dialog in the US and ORBIT in the UK. Both carry a host of information ranging from scientific studies to business information and balance of payment statistics.



This month Arthur Cushen tells about the new radio schedules and New Zealand's unique radio museum.

Kilohertz Comment

AUSTRALIA LOOKS FOR OVERSEAS RELAY BASES

The annual report of the ABC indicates that Radio Australia is looking for overseas relay bases.

The ABC report states that "progress has been made towards possible future use of off-shore transmission facilities to improve reception in main target priority areas. Exploratory contacts have been made with Radio Tampa in Japan, and discussions are in progress with the BBC regarding use of their Singapore facilities to improve our service to the Indian sub-continent."

As well as the proposed use of existing stations overseas to better serve the Asian continent, Radio Australia is constructing a transmitter site in Queensland at Brandon where two 100 kw transmitters will be used to beam programmes to Papua New Guinea and the South Pacific, while a further two 10 kW transmitters are to be used as stand-by units.

NZ'S EXPERIENCE

The reverse situation prevails in New Zealand. Radio New Zealand International was established in September 1948 and is still using old AWA 7500 watt transmitters for its shortwave service to the South Pacific, Australia and Papua New Guinea. In the annual report of the Broadcasting Corporation of New Zealand reference was made to Radio New Zealand International as follows: "Once again a relay of the National Radio Network has been the main programme from Radio New Zealand's shortwave transmitters.

"Evening transmission on RNZ International was extended in August to include Australia, and captured a growing audience for the

Radio New Zealand 10 pm national and international news.

"An important part of the service offered to Pacific Island radio stations continues to be the dispatch of recordings of New Zealand programmes from the Transcription Service. There is no substitute, however, for a sustained and strong voice for New Zealand in the Pacific.

"In view of the ideological battle being fought out for influence in the region, it is of concern that yet another year has gone by without a clear indication of government policy and without a level of financial commitment being established to upgrade this vital presentation of New Zealand to the rest of the world."

Following its introduction in 1948 Radio New Zealand had special programmes of two hours and 45 minutes to the Pacific and this was repeated for listeners in Australia. The transmissions were closed down in 1976 between May 1 and June 5 when worldwide protest from listeners forced the resumption of shortwave broadcasting. The service continued with an evening programme to the South Pacific and Australia up until March 1982 when the Government withdrew their \$180,000 subsidy. Since then the cost of the relays have been carried by the Broadcasting Corporation of New Zealand.

INTERNAL RELAYS

Radio Australia was almost unknown to the domestic audience within Australia. However, since October 1 the ABC has relayed complete Radio Australia programmes from midnight to dawn.

As well as providing the entertainment for listeners throughout Australia it is an excellent public relations exercise as the taxpayer now has some idea of the excel-

lent programming which Radio Australia provides for its international audience. It had been noted that in other countries shortwave transmissions are relayed locally on FM so that not only tourists can be catered for with various language broadcasts, but the population in general gains some knowledge of what is being offered to overseas listeners. This is the case, for example, in Sweden and Finland.

The ABC 24-hour a day operation commenced in August with "Beyond Midnight" which is relayed from 3LO Melbourne and carried on metropolitan and regional stations. This has meant that medium wave listeners wishing to tune in to distant stations have found that almost all frequencies are now blocked from dusk to dawn. Only 909 and 1125 kHz are not used by any Australian or New Zealand medium wave station, while 1305 kHz is clear after 1200 UTC when 4XD Dunedin leaves this channel.

SHORTWAVES

DENMARK: Radio Demark, Copenhagen, has a transmission to Australia 1200-1252 UTC on 11845 kHz. An earlier transmission to the South Pacific 1100-1130 is on 15165 kHz. All broadcasts are in Danish but there is a short opening announcement in English.

GUAM: KTWR operated by Trans World Radio has restyled their programmes for shortwave listeners and it is now called "Pacific DX Magazine." The broadcast to Australia is on Friday 0945 UTC on 11805 kHz, to India on Saturday 1445 on 9780 kHz and to Japan on Sunday at 0845 on 11805 kHz. The programme includes contributions from DX organisations from Australia and New Zealand and on the fourth weekend of each



BBC World Service Newsreader Brian Empringham

month a contribution from the South Pacific Association of Radio Clubs. KTWR has recently celebrated its 10th anniversary and has also started using a new interval signal.

HONG KONG: The BBC's two 50 kW transmitters are now in regular operation with broadcasts to China, Japan and Korea. The first schedule to be put into operation is as follows: 0400-0845 on 15280, 0900-0945 on 7180 and 5995 kHz, 1100-1130 on 5995, 1300-1330, 1430-1515 on 7160 and 5995, 2115-2300 on 7160 and 5965 kHz, 2300-2345 on 5965.

INDIA: All India Radio announces that they are now carrying broadcasts of the United Nations Radio in three daily transmissions beamed to South East Asia. The United Nations Radio had to cancel its use of VDA transmitters due to budget problems and has offered transcription material to international broadcasters to carry UN Radio programmes.

ISRAEL: The Israel Broadcast-

ing Authority has recently re-timed its broadcasts due to the return to standard time and the transmissions which are identified as being for receptions in Australia in English are 0500-0515 on 11610 and 17620 and 1100-1130 on 15650, as well as many other frequencies, while the transmission 2000-2030 is on 7465, 9010, 9435 and 11610 kHz.

TURKEY: The Voice of Turkey broadcasts to Asia in English at 1230 UTC on 15145 kHz, to Europe at 2000 on 7215, at 2200 on 7135 9560 and to North America at 0300, 9560 and 17760.

USA: The Voice of America is continuing with its expansion project. Four transmitters construction companies are awaiting word of the order

from the Voice of America for some 50-100 500 kW transmitters. Transmitters from the four competing companies have been under test at the VOA transmitting site at Greenville. These have come from AEG, BBC Boveri, Continental and Marconi. There is also a major \$10,000,000 dollar renovation of the Voice of America studios in Washing-

ton now underway.

This item was contributed by Arthur Cushen, 212 Eam Street, Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 11 hours behind Australian Eastern Daylight Time.

HISTORIC VERIFICATIONS AND RECEIVERS FORM ARCHIVES COLLECTION

The history of radio communications is fast fading from memory. It is only through those far sighted pioneers of the early 1900s who preserved their equipment and their verifications and other printed material that we can learn the history of their achievements.

Throughout the radio world there is realisation that when many of the pioneers of broadcasting die there is often a tremendous amount of early equipment and material, which is destroyed.

New Zealand has a unique collection of verifications and printed material on the early days of radio which is stored in the Archive Section of Radio New Zealand in Timaru. Doubtless there are many collections being held privately in other parts of the world which trace the history of broadcasting since its infancy, but it would seem that the New Zealand Radio DX League is the first major club which has an archives section. When members pass on they are able to leave their radio history in the way of verifications and publica-

tions to be housed in a National Archive building.

For many years listeners had been disturbed by the destruction of some priceless verifications and so the Leagues Archives section was first housed in Oamaru where space was also made available for a collection of vintage radio receivers. The collection soon outgrew the space available and after consultation with Radio New Zealand, it was agreed that this material should form part of the national collection on radio.

Treasure Trove

The historic treasure trove at Timaru includes several hundred Edison cylinders; 60,000 78 rpm gramophone records; 5000 45 rpms and 5000 LP albums; historical material on disc 10,000; with a further 6000 items on tape. As well as holding this stock, informal arrangements exist with the BBC, ABC and National Library of Australia and others, who also hold sound recordings of New Zealand material.

The collection also features early

broadcasting equipment, including disc cutters, disc records, acetate discs, which were associated with the early recording industry.

As well the catalogue lists all the verifications material, publications and receivers which are part of the DX League collection.

Following Suit

Since New Zealand had pioneered this field of collecting equipment and printed material on the history of radio other countries have also seen the benefit of preservation. In the United States last year a group was formed under the Association of North American Radio Clubs to collect radio verifications. The group called itself the Committee to Preserve Radio Verifications.

The committee has made arrangements for archive material to be deposited with the Christian Science Monitor in Boston, who will house the material in their building.

International News Around The Clock

Shortwave listeners are in the unique position that when news breaks, they can tune to the source of the story and hear, not only from the area in which a disaster has occurred, but also reports from a wide variety of International stations.

This survey of world news covers over sixty countries and in the twenty-four hour period focuses on broadcasts in English which are audible in the South Pacific. The frequencies listed are not the only ones used by any International station but the ones regarded as giving the best service to this area. The fact that many International stations have news on the hour every hour has been taken into consideration and only the bulletins which are of prime importance or offer the best

reception have been noted. There are some countries in the Northern Hemisphere which change their schedule when they observe Daylight Time and these will be heard an hour earlier after March 26, 1988.

All frequencies are in kilohertz and times are in UTC (10 hours behind Australian Eastern Standard Time, or 11 hours behind Eastern Australian Daylight Time).

UTC	CITY & COUNTRY	FREQUENCIES
0000	London BBC UK	9570, 9915
	Melbourne Australia	15240, 17795
	Moscow USSR	9840, 15130, 15405
	Washington VOA USA	15185, 17740
	Wellington New Zealand	15150, 17705
0030	Brussels Belgium	5910, 9925
	Quito Ecuador	9870, 11910
0100	Buenos Aires Argentina	11710
	Los Angeles AFRTS USA	11730, 15345
	Melbourne Australia	15240, 17795

	Montreal Canada	5960, 9755
	Moscow USSR	9840, 15130, 15405
	Madrid Spain	6125, 9630
	Washington VOA USA	15205, 15375
0200	Brazilia Brazil	11745
	Bucharest Romania	9570, 11940
	Cairo Egypt	9475, 9675
	London BBC UK	9410, 9915, 15380
	Melbourne Australia	15240, 17795
	Paris France	9790, 9800
	Taipeh Taiwan	11740, 11860
	Washington VOA USA	9455, 11675
0230	Hilversum Holland	11730
	Karachi Pakistan	11570, 15115
0300	Ankara Turkey	9560, 17760
	Budapest Hungary	9835
	Cairo Egypt	9475, 9675
	London BBC UK	9915, 11955, 15380
0300	Havana Cuba	6090, 6140
	Managua Nicaragua	6100
	Melbourne Australia	15240, 15320
	Quito Ecuador	6230, 9870
	Prague, Czechoslovakia	7345, 9740
	Warsaw Poland	9525, 11815
0330	Dubai UAE	9640, 11940
	Paris France	9550, 9790
	Tirana Albania	9500

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READER INFO No. 10

Kilohertz Comment

0340	Athens Greece	9420	Ulan Bator Mongolia	9615, 12015	
0350	Rome Italy	9710, 11905	Washington VOA USA	6110, 11715	
0400	Berne Switzerland	9725, 9885	Wellington New Zealand	6100, 9630	
	Hilversum Holland	7175, 9895	1230	Ankara Turkey	15145
	Jerusalem Israel	9435, 11585		Berlin East Germany	21920, 21465
	London BBC UK	5975, 9410	1230	Cairo Egypt	17675
	Melbourne Australia	11910, 11945		Dhaka Bangladesh	12030, 15525
	Washington VOA USA	9670, 9770		Stockholm Sweden	15190, 17790
0430	Helsinki Finland	11715, 11755	1300	London BBC UK	9410, 15070
	Vienna Austria	5945, 6155		Melbourne Australia	5995, 7215
0440	Paris France	9550		Pyongyang North Korea	9325, 9345
0500	Cologne DW West Germany	5960, 9635		Washington VOA USA	6110, 11715
	Jerusalem Israel	11610, 17620	1330	Brussels Belgium	15590, 17600
	London BBC UK	5975, 9410		Delhi India	9545, 11810
	Melbourne Australia	11910, 11945		Hanoi Vietnam	9840, 15010
	Madrid Spain	6125, 9630		Manila Philippines	11850
	Moscow USSR	15130, 15145		Tashkent USSR	9600, 9715
0515	Montreal Canada-DT	9760	1400	Stockholm Sweden	11785, 15345
0530	Dubai UAE	15435, 17775		Tokyo Japan	7240, 9695
	Hilversum Holland	6165, 9590		Washington VOA USA	6110, 11715
	Kuwait Kuwait	15345	1430	Hilversum Holland	13770, 15560
0545	Montreal Canada	6050, 7155, 9760	1500	Cologne DW West Germany	7225, 9735
0600	Boston WCSM USA	7365		Los Angeles AFRTS USA	15330, 15430
	Kuala Lumpur Malaysia	15295		Melbourne Australia	6035, 7205
	London BBC UK	7150, 9640		Moscow USSR	9705, 11660
	Los Angeles AFRTS USA	6030, 15265		Tokyo Japan	5990, 9695
	Melbourne Australia	11910, 11945	1510	Vatican Vatican	7250, 9645
	Seoul Korea South	7275, 9570	1600	London BBC UK	9410, 9915
	Washington VOA USA	6035, 7200		Washington VOA USA	9645, 9760
	Wellington New Zealand	11780, 15150	1605	Paris France	6175, 9860, 11705
0615	Montreal Canada-ST	6050, 7155, 9760	1630	Hilversum Holland	6020, 9515
0620	Vatican Vatican	6245, 9645	1700	London BBC UK	9410, 9915
0630	Warsaw Poland	9675		Melbourne Australia	6035, 7205
0645	Bucharest Romania	11940, 15250	1700	Pyongyang North Korea	7290, 9325
0700	Boston WCSM USA	7365		Berne Switzerland	6165, 9535
	London BBC UK	9640, 15360	1800	Kuwait Kuwait	11665
	Los Angeles AFRTS USA	6030		London BBC UK	5975, 9410
	Melbourne Australia	9655, 11910		Madrid Spain	7275, 9765
	Pyongyang North Korea	13750, 15340		Washington VOA USA	6040, 9760
0730	Hilversum Holland	9630, 9715		Wellington New Zealand	11780, 15150
0800	Berlin East Germany	21540	1815	Dhaka Bangladesh	6240, 7505
	Brussels Belgium	5910, 17600	1830	Belgrade Yugoslavia	5980, 6100
	Kuala Lumpur Malaysia	15295	1900	Beijing China	9850, 11500
	London BBC UK	11955, 15360		Kabul Afghanistan	7310, 9665
	Los Angeles AFRTS USA	6030, 9530		Melbourne Australia	6035, 7205
0800	Melbourne Australia	9655, 11910		Montreal Canada	11945, 15325
	Moscow USSR	9780, 15130		Moscow USSR	7370, 13795
	Prague Czechoslovakia	11685, 17840	1930	Tehran Iran	9022, 9765
	Pyongyang North Korea	7550, 13670	1950	Quito Ecuador	11740, 15270
0830	Beijing China	9700, 11755	2000	Ankara Turkey	7215
	Berne Switzerland	9560, 11905		Baghdad Iraq	9875
	Helsinki Finland	15245, 15305		Belgrade Yugoslavia	5980, 6100
	Manila Philippines	11850, 15350		Boston WCSM USA	9465, 11695
	Vienna Austria	15410		Budapest Hungary	9835, 11910
0900	Cologne DW West Germany	9715, 15410		Jerusalem Israel	11610, 11655
	London BBC UK	11750, 15070		London BBC UK	7145, 9410, 9570
	Melbourne Australia	5995, 9655		Melbourne Australia	7215, 15240
	Moscow USSR	9760, 15130		Montreal Canada	11945
	Port Moresby PNG	4890		Pyongyang North Korea	6576, 9345
	Port Vila Vanuatu	3945, 7260		Washington VOA USA	9770, 11760
	Tokyo Japan	11840, 15235	2005	Damascus Syria	7455, 12085
0910	Majuro WSZO Marshall Isl.	4950	2030	Hilversum Holland	9895
0930	Beijing China	9700, 11755	2045	Delhi India	9910, 11715
	Montreal Canada	5960, 9755	2100	Berne Switzerland	9885, 12035
	Stockholm Sweden	15390		Cairo Egypt	9475, 15375
1000	Berne Switzerland	11905, 15570		Cologne DW West Germany	7130, 9765
	Delhi India	11920, 15320		Melbourne Australia	7215, 15240
	Hanoi Vietnam	9765, 12035		Montreal Canada	11945
	Los Angeles AFRTS USA	6030		Moscow USSR	9840, 9875
	Melbourne Australia	5995, 9645		Tokyo Japan	15195, 17755
	Moscow USSR	9780, 15130	2115	Belgrade Yugoslavia-DT	6100, 7240
	Oslo Norway (Sunday)	15170, 15175	2130	Montreal Canada	11945
	Quito Ecuador	6130	2145	Cairo Egypt	9670
1030	Bucharest Romania	11950, 15250	2200	Ankara Turkey	7135, 9560
	Colombo Sri Lanka	11835		Delhi India	9910, 11715
	Hilversum Holland	6020, 9650		Havana Cuba	7150, 9590
	Vienna Austria	15410		London BBC UK	9410, 9570
1100	Jerusalem Israel	15650		Melbourne Australia	15320, 15395
	Karachi Pakistan	15606, 17660		Montreal Canada	5960, 9755
	London BBC UK	11750, 15070		Taipei Taiwan	9455, 15370
	Los Angeles USA	6030		Vatican Vatican	6015, 9615, 11830
	Melbourne Australia	5995, 9645		Washington VOA USA	15185, 17740
	Seoul South Korea	15575	2215	Belgrade Yugoslavia	6100, 7240
	Tokyo Japan	7240, 17810	2300	London BBC UK	9410, 9570
	Washington VOA USA	6110, 15425		Melbourne Australia	15240, 15320
	Wellington New Zealand	6100, 9630		Montreal Canada	5960, 9755
1115	Berlin East Germany	21465, 21540		Stockholm Sweden	9695, 11705
	Paris France	9790, 11670		Washington VOA USA	15185, 17740
	Tehran Iran	11790			
1130	Hilversum Holland	15560, 17575			
1200	Helsinki Finland	11945, 15400			
	London BBC UK	11750, 15070			
	Melbourne Australia	5995, 7205			
	Montreal Canada	9625, 11955			
	Moscow USSR	9760			
	Tashkent USSR	9600, 9715			

DT = Daylight Time. These broadcasts are heard one hour later when Northern Hemisphere is observing Standard Time, last Sunday in September up to the last Sunday in March in most countries.
ST = Standard Time.

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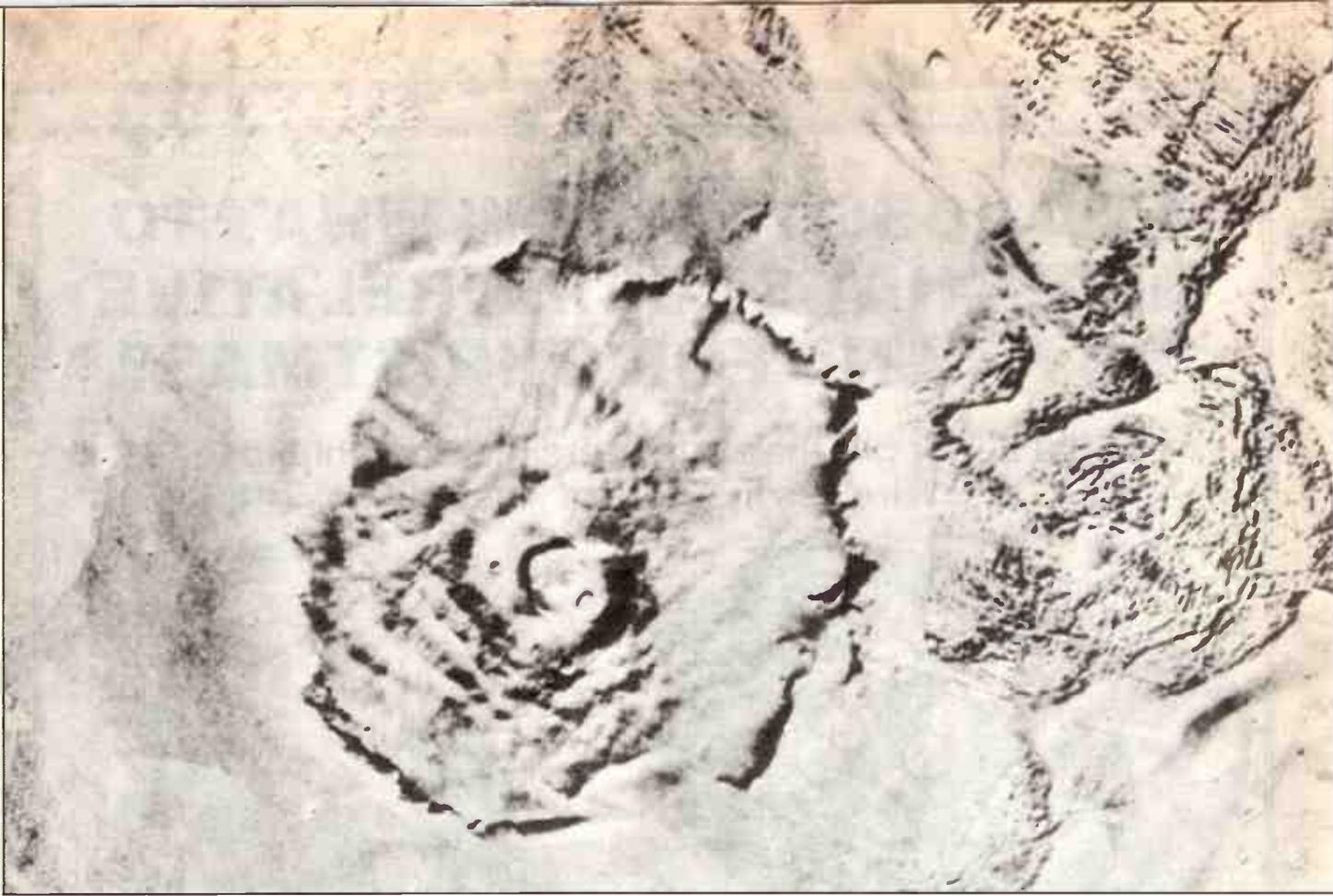
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NASA plans new strategies to take it into the 1990's

THE YEAR OF FLYING DANGEROUSLY

Kathryn Doolan

NASA promised 1986 to be "The Year of Space Science". Among the payloads of the 15 space shuttle flights promised for that year was the Hubble Space Telescope — a window to the universe, the Galileo probe to Jupiter and the Ulysses probe to study the sun. Among the less discussed payloads were experiments for the Strategic Defensive Initiative ("Star Wars"). All in all, 1986 was to be an exciting year in space and would help the beleaguered NASA regain some of its former glory.

January 28, 1986 dawned bright and clear at Cape Canaveral. That day was to see the launch of space shuttle "Challenger" with the first "civilian" in space aboard. At 11.39 am that morning, 73 sec-

onds after launch, "The Year of Space Science" was a bitter memory of a promise gone wrong.

Bitter Collapse

1986 saw the release of two divergent reports which highlighted the conflict between illusion and reality in the American space programme. "Pioneering the Space Frontier", was a blueprint for a glorious settlement in space for the next fifty years. This vision was sharply contrasted by the release of the "Report of the Presidential Commission Investigating the Shuttle Tragedy", a damning assessment of the current American space programme in which safety took second place to promoting the illusion of "routine spaceflight".

Currently, the American space pro-

gramme is at the crossroads. The beginning of the problems surrounding the shuttle stem right back to the beginning of the project. The original space shuttle "sold" to the Nixon administration was a product of compromise; its design had been dictated by a space hungry Pentagon and there were no active escape systems for a shuttle crew.

To fund the space shuttle, NASA insisted on an "all its eggs in one basket" policy. Space science projects were slashed to a bare minimum and American satellites were to be launched by the shuttle and not by cheap, expendable unmanned launch vehicles. NASA's premise was that if the shuttle made 24 flights a year, then the vehicle would pay for itself.



quirements are now NASA's priority; a strange goal for a civilian space agency whose charter bans all military space activity.

The Reagan administration is still expecting the shuttle to be the workhorse for its ambitious Strategic Defence Initiative programme. If the 1985 schedule of nine flights is used as a basis for setting up the SDI programme, then it will take a fleet of four space shuttles, barring accidents, 1500 flights over a 200 year period to accomplish this goal.

Lost Prestige

Some sanity for future long term plans has been provided by ex-Astronaut Dr Sally Ride whose final assignment for the space agency was to direct a study on NASA's long term plans. The study titled "Leadership and America's Future in Space", makes fascinating reading and, if implemented, will provide NASA with substantial long term goals to help America regain its lost prestige in space.

The four main initiatives recommended by Dr Ride are as follows:

1. Mission to Planet Earth.
2. Exploration of the Solar System.
3. An Outpost on the Moon.
4. Humans to visit Mars.

The "Mission to Planet Earth" calls for an extensive study from space of our home planet and the characterisation of Earth on a global scale. In the early 1970's, Skylab provided a new understanding of Earth. The "Mission to Planet Earth" proposes that a worldwide observational system be established which would predict global changes in areas such as the weather, natural forces and pollution control. A more extensive Remote Sensing System is suggested to help implement a thorough Earth watching system.

The "Exploration of the Solar System" would be a continuation of the already established tradition of solar system exploration carried out by the unmanned space probes of Viking and Voyager. The programme would help provide a greater understanding of the solar system and would significantly expand our knowledge of the universe.

Suggested initiatives include a mission to Saturn: the Comet Rendezvous, Asteroid Flyby (CRAF) mission to Comet Tempel Z and the sending of unmanned probes to retrieve samples from Mars. The mission to Saturn and the Asteroid Flyby would take place by 1995 and the Mars project would be completed by the year 2000.

Outpost on the Moon

The setting up of "An Outpost on the Moon" has been suggested previously. After the success of the Apollo programme, the scientific community were in-

cessed that moon exploration came to a halt. Dr Ride's report argues that a return trip to the Moon is a realistic goal, based on the considerable knowledge obtained by the various Apollo missions. The initial programme would consist of a robot mission to the moon in the 1990's to explore suggested landing sites for the establishment of long term settlements. Phase 2 would see the return of astronauts to the moon by 2005 and this would be followed by permanent manned settlements. By 2010, it is hoped that 30 people will live at one lunar base for eight to ten months at a time.

The most ambitious recommendation by Dr Ride is the "Mission to Mars". She believes that an Apollo type commitment can get an American crew to Mars by the year 2000. As with the lunar programme suggestion, a robot mission would initially be sent to Mars, to be followed by a manned mission when feasible. To cope with medical problems, the space station would be the base of operations and once medical and logistical problems were solved, a one year turnabout would be possible.

One of the more fascinating aspects of this report is the acceptance of the space shuttle's obsolescence and the need for an alternative launch system by the late 1990's. Suggested vehicles include an Orbiting Transfer Vehicle and the use of Expendable Launch Vehicles to get the crew into orbit.

The key to this report is the completion of an American space station. At present, this idea is a hot potato with Congress because of the amount of money involved. Initially, it was hoped that the station would be ready by 1992, however, the Challenger disaster has set the completion date back to 1996-97 at present.

From a political viewpoint, the National Commission's "Pioneering the Space Frontier" was a grandiose idea in view of NASA's dismal performance in 1986. Even though the Office of Management and Budget shelved Dr Ride's report for this year, NASA has indicated that this would be a reasonable path to follow in attempting to regain the credibility that blew apart with "Challenger" on a cold winter morning in January 1986.

In the meantime, as America recovers from "Challenger", the Russians, Europe, India and China are pursuing their own space programmes and threatening America's once unchallenged position as the leading power in space. ●

Encroachment

By the end of December 1985, 23 shuttle flights had been launched, a far cry from the optimistic launch schedule predicted by NASA ten years previously. Nine flights in 1985 had almost brought the system to breakneck capacity even with a schedule of 15 flights in 1986 and 19 in 1987, the shuttle was still the most expensive launch system in the world. As well, the Department of Defence was steadily encroaching into the civilian space agency's territory.

After a hiatus of over two years, 1988 will see the launch of STS-26. In June, the shuttle Discovery with a crew of five will be launched for a four day mission. The flight manifest shows that the Defence re-

Kathryn Doolan is with the space association of Australia.



Screened four nights a week this graphics card precedes the many hours of test transmissions from Australia's most sophisticated amateur television group.

SMILE . . . YOU'RE ON AMATEUR TV

Thomas E. King



Not all amateur ATVers are as devoted to the hobby as is Vic, VK2BTV, who uses these facilities for transmitting pictures to other amateurs on the Central Coast of New South Wales.

The amateur television scene in Australia began long before those first olympian efforts in 1956. In fact various forms of amateur television have been experimented with for the last half century.

High resolution fast scan television is a bit of a newcomer, however, and it has only been an important method of amateur transmission for the past 15 or so years. In the early days only a few experimenters could be found in scattered locations. These days fast scan ATV has developed a strong following in capital cities and major provincial centres alike.

ATV Range

ATV activity can be found to some degree or another in Canberra, South Hedland, WA; Brisbane where VK4RTV and the South East Queensland ATV Group is located; Townsville and Bendigo. In Melbourne during periods of favorable propagation two way contacts can be made between the Victorian capital and the north coast of Tasmania as well as the east part of South Australia. ATV has been a favourite with some South Australian amateurs for a number of years. VK5RTV and VK5RCN, and ATV repeaters in Adelaide, provide amateurs with a good means of improving signals from their low power TV transmitters.

In New South Wales ATV has followers in Wagga Wagga, Newcastle, the Blue Mountains, west of Sydney, where the Sydney ATV Group has a regular 147.300 MHz VHF net to coordinate enquiries and the Monday/Tuesday and Thursday transmissions, as well as the Central Coast region centred around Gosford. A resident north of Gosford, but a member of the Central Coast Amateur Radio Club, Vic, VK2BTV, began his involvement in amateur television in Sydney with the world's first PAL ATV transmission in



Professional quality standards and facilities assist Gladesville Amateur Radio Club President, John, VK2HA, one of two on-air personalities in his five three hour weekly program for Sydney amateurs.

1968. These days his transmissions (from a fully equipped ATV centre and a stack of four, 18 element yagis up to some 20 metres) can be received — when conditions are good — in Liverpool, Ryde and Bondi to the south, Newcastle to the north and the Blue Mountains to the west. As yet his 3.5 KW ERP signals have not crossed the Tasman to the east and thrilled New Zealand's growing number of ATV experimenters.

Despite the level of ATV interest seen in Australia no club or group is as committed or active as the suburban Sydney Gladesville Amateur Radio Club. The club's energy, in fact, is directed almost exclusively to television with a number of avenues open for member participation, including:

- ★ study and research of colour TV principles.
- ★ design and construction of UHF television transmitters, receivers and modulators.
- ★ experimentation with various UHF antenna designs.
- ★ exploration of the many applications of video techniques used by professional TV stations: downstream keying, wiping, fading, sync processing, switching, high resolution graphics, mixing and processing.
- ★ program development, film making and on-air presentation.
- ★ live to air studio and outside broadcast transmissions.
- ★ production of teaching material such as computer programming and control, elementary and advanced electronics, design and construction of antennas and feedlines, transmitters and receivers.

Gladesville TV

While this may seem like enough to fill a year's calendar, for the Gladesville Amateur Radio Club it's a several times a week event.

At precisely 7 p.m. local time each Wednesday a computer generated graphics card in full PAL format is transmitted:

VK2TVG

Gladesville Amateur Radio Club
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TEST

TRANSMISSION

Channel 35

This half hour period gives amateurs and non amateurs alike time to fine tune their conventional colour sets before the start of live test transmissions. (As the standards for amateur transmissions are identical to those used by commercial broadcasters any domestic TV receiver can be used for ATV purposes. However, as power levels are vastly different between amateur and commercial services a good UHF antenna will be needed. As well, some form of preamplification may be required as the signal radiated from Lane Cove has an ERP of about 60 W.)

Live test transmissions begin at 7.30 p.m. with a prearranged call to another ATV station by alternate on-air announcers John, VK2BUI or John, VK2HA, President of the Gladesville Amateur Radio Club. An hour long taped novice or full call lecture presented by Ron Bertrand, VK2DQ begins the three hours of education and information. Professionally produced short programs on topics as diverse as the Flying Doctor, antenna fundamentals, Chernobyl and hydraulic transmissions are interspersed with live studio presentations of GARC-related events, news from the Wireless Institute of Australia and a bulletin from the Australian National Amateur Radio Teleprinter Society. Occasionally a guest speaker is interviewed on a topic related to electronics or communications.

Several times during the 3 to 3½ hour test transmission which ends around 10 or 10.30 p.m. viewers are invited to make signal reports. Amateurs can use 146.925

or 28.375 MHz for signal reports while the public is encouraged to telephone (02) 427 0530.

An average night might draw a dozen or so responses. Nearly all of them are from amateurs. During a recent signal blackout of the SBS service in Sydney, however, the club's number ran hot as UHF 'channel switchers' wanted VK2TVG "to get off the TV and put the regular programs back to air!"

Teaching Body

The Gladesville Amateur Radio Club is recognised as the foremost teaching body for amateurs in Australia. This has been brought about by the high standard of instruction offered by Ron Bertrand over the past seven years. (The pass rate for his novice and full courses is around the 85 to 90 per cent mark.)

The club realised that Ron's efforts could be further utilised by video taping his lectures and making them available on loan to clubs and individuals around the country. Videotape amateur classes which began five years ago are about 15 weeks in length for the novice and about 22 weeks for the full call. Videotape requests now in excess of 300 have come from as far afield as Thursday Island. Coordinated by TAFE, 12 islanders who attended the taped course all passed their amateur exams. Videotape users pay a nominal fee and are requested to return their copy within two weeks to the GARC, P.O. Box 48, Gladesville, NSW 2111.

In an effort to expand their instructional services to the Sydney community at large the club began putting classes on ATV about 4½ years ago. At that time transmissions using a home video camera and a donated transmitter went to air from the Kenwood premises. Additional space was needed. Fortunately, one of the club members, Keith VK2ZZO, had more than just a passing interest in the challenges and rewards of ATV.

Now an ardent ATVer, Keith became involved with the activity some 3½ years ago. Just over a year ago regular GARC test transmissions began radiating from antennas atop his residence which now contains a studio and control room setup. These days three quality television cameras scan the set complete with 4 KW of track lighting sending signals to the adjoining control room. Here the pulses are processed, videotaped and sent live to the ATV transmitter which in conjunction with the 9 dB gain antenna has a coverage from Bondi to Pymble. Even the ATV experimenters in the Blue Mountains can view VK2TVG transmissions. It's estimated that around 200 ATV enthusiasts



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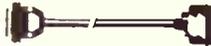
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32 — ETI December 1987

Amateur TV

(and an unknown number of home viewers) are within range of the UHF Channel 35 signal. (It's actually more like channel 35½ because the authorised ATV allocation in Australia is between the commercially allotted channels 35 and 36.)

Test transmissions are not limited to Wednesday nights as VK2TVG goes to air on Friday evening with its half hour test pattern at 6.30 p.m. followed by a repeat of the Wednesday transmissions. On Saturday the test pattern is often screened from noon with a 2½ hour computer course beginning at 7.30 p.m. The Sunday test pattern begins at 3 p.m. Material is then transmitted from 7.30 p.m. to 8.30 or 9 p.m.

ATV Challenges

All the test transmissions which are directed and produced by Keith are supported by a team of highly motivated club members. At least five ATV devotees are required for the live Wednesday night telecasts while six individuals are needed for taping the Thursday night classes offered by Ron Bertrand. (About 25 people from all over Sydney attend the weekly three hour amateur class also held in Keith's home.)

It's the willingness of members to become involved that's helped the club to reach its current high level of achievement," said Keith. "Some of the club members who come each week," he said, "are interested in learning about camera operation or the processes involved in television program production. Others enjoy building studio sets and props while still others find the technical challenges to be paramount."

One of the challenges before the group now is how to increase its ATV signal coverage. Such an effort would not only help increase ATV activity within the amateur population of Greater Sydney a stronger signal would be receivable by more of the general public who could make use of the educational and instructional transmissions. To meet the challenge investigations are taking place about using a 1.2 GHz or 10 GHz link between the Lane Cove studio to a transmitter site in Ryde.

The anticipated microwave link would provide a new outlet for those interested in experimenting on the frontiers of amateur technology. While fast scan amateur television is just one facet of an ever expanding hobby the Gladesville Amateur Radio Club intend to continue making its contribution to the development of ATV in the most professional manner possible.

Now you don't have to be bolted to your vehicle to keep in touch.



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READER INFO No. 17

TRANSIT SIGNS

A new twist to an old display problem

John Ulph

STC-Cannon of Moorabbin, Victoria, who are well known for their manufacture and distribution of Cannon Connectors around the world, have over recent years been also developing a business in an entirely different area; designing and building a large range of electronic signs.

Some of the major projects have been scoreboards at the QEII Stadium for the 1982 Commonwealth Games, the Sydney Showgrounds, and the SANFL Football Park in Adelaide. Of course, such projects are few and far between in Australia. The main target of the project has been the transportation industry where they are known as transit signs. They are designed to replace the long established roller blinds, used to display destination information and route numbers on buses, trains and trams.

Research & Development

STC-Cannon have spent over 60,000 man hours in research and development of various display systems. R&D financing comes from both a scheme that involves allocating a set percentage of turnover to a group fund, plus additional in house appropriations deciding on a year to year basis.

Major customers for the transit signs have so far been MTT in Western Australia and STA in South Australia. UTA of New South Wales has a pilot batch that they have been field testing. Sample units are also running in Queensland and the ACT.

Various sign configurations are available; however, up to now, a 96 x 16 indicator matrix has proved to be the most popular. A 16 indicator high sign allows two rows of 7 indicator high characters to be displayed simultaneously or, alternatively, a single row of 14 indicator high characters. The recently introduced 112 x 10 units will prove to be an excellent cost effective combination.

As much of the signs and control as possible are Australian made or assembled. Only parts not available in Australia are imported. Keypads are made in Adelaide, printed circuit boards, metalware and vacuum moulding, manufacture, assembly and test occur in Melbourne.

The equipment is in modular form for quick in field replacement.

The basic principle of attraction and repulsion is used to rotate a permanently magnetized disc.

An electrical pulse of 100 microseconds to 1 millisecond will set the magnetic core. It is the residual magnetism of this core that turns the dot and provides its memo-



ry. The pulse length is dependent on the type and size of the display.

Normally one side of the disc is black. A range of colours is available on the flip side, e.g. white, yellow, golden, green, orange and red. The two sizes of indicators used are nominally 10 mm and 15 mm square. (A comprehensive range of other sizes and modules is available for other types of signs.)

A solid state X-Y driving circuit pulses each indicator in turn, rotating each disc to display either its coloured or black side.

Advantages

The advantages of these signs are numerous.

- Visibility is excellent. Display characters are formed by the matrix of fluorescent coloured discs which reflect ambient light. Because the high contrast elements all lie in the same plane, the displays are highly visible over a wide range of ambient light conditions and viewing angles.
- At night the sign is illuminated by fluorescent tubes. A hexagonal shaped disc has recently been introduced which provides a larger reflective area than the current circular.
- Reliability is high, maintenance costs are low. The disc is the only moving part and is rated for a minimum of 100 million operations.
- Because the discs in the character modules are held in their required position by remanent magnetism, no power is dissipated in the indicator except at the instant of data change. This eliminates failure due to heating stress and greatly reduces the electronic controller complexity because no circuitry is needed to continuously operate each display element.
- The display boards are light in weight and are assembled from modular panels mounted on a lightweight frame.
- The operating power cost is low. Power is only required to change the information; for instance, a single sign requires less than 15 watts during updating and less than 6 watts at standby.
- Memory capacity . . . approximately 3500 separate pages of 32 characters (2 lines of 16).
- Revised destinations . . . messages can be added or changed by simply re-programming memory chips.
- Message access time . . . a message will be displayed less than 1 second after its selection.

New Control

Recently, an 80C39 microprocessor based keypad control unit has been added to the

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Transit Signs

original design. The control unit enables both the message selection and the route number to be entered from its keypad. It has been ergonomically designed for ease of operation and is normally mounted on the right hand side of the driver.

Data input is an interactive procedure between the control's LCD (2 lines of 16 characters) and the bus driver via the keypad. The data input sequence commences with a question appearing on the LCD display, enquiring the first display destination code. On entering this, the LCD makes further enquiries until the required display sequence is entered. Each re-programmed display display page set is allocated a unique destination code number which may be called up in any sequence. Each page set's data and destination code is stored on one of 16 64K EPROMS.

Control Operation

The keypad control stores two sets of messages ... 'A' destination, normally used



'The programmer also has the ability of being able to print out a "Look alike" picture of each page as well as a list of attribute data.'



for outward trips and 'B' destination for inward bound. Within each destination, 2 modes are available:

MESSAGE BUILD where up to 5 separate page sets can be linked together to form 2 sets of messages;

SECTION MESSAGES where up to 2 separate page sets can be linked together to form 5 sets of messages.

The Section Message mode is used where a route can be divided up into sections. Detailed information on each section can be stored and as the bus enters each section, the driver can select the pertinent message for that section. This is especially useful for city sightseeing buses.

Since each page set has a unique code number, it can be stored in any one of the memory chips. Thus, special function advertising chips can be added to the control for a short time. With the message building functions detailed above, the driver can intermingle information on the attractions such as the Bicentenary, Expo or Moomba with the normal destination display.

The route number can be either programmed as part of page data, on the

memory chips or separately entered by the bus driver when entering the page sets required for each message. In both cases both numbers and letters can be used.

Sign combinations vary from customer to customer. Some have just a front sign, other front, side and rear. The data to the signs is fed from the control in serial form via a five core cable. Side and rear signs clone all or part of the front sign. The control does have the potential through a sixth control line, to send completely different data to a second set of signs. This feature is useful when sign sizes have to be different, due to space availability in the bus.

Programming of Memory Chips

A small programmer is provided for assembly and storage of the display information. The programmer contains a small LCD screen which mimics the sign display. Two separate methods of page construction are provided.

The more simple and memory efficient is based on a character generator, where a selection of 3 different sets of characters maybe assembled and then stored as an ASCII string. One line of large characters or two lines of small characters are available in this mode.

The other is the graphic mode where, as well as being able to call on 3 character sets and place them anywhere on the screen, each individual indicator may be set, this enabling full graphic capability. In this case, the condition of each indicator in the display is separately stored.

Once a group of destinations is assembled, the page and attribute data, such as page set code number and scroll time, may then be dumped onto a memory chip.

The programmer also has the ability of being able to print out a "look alike" picture of each page as well as a list of attribute data.

Future Markets

The potential of these signs in dual language applications is currently being investigated as the graphics capability and the scrolling allows for alternate language and character display. It is felt that they could be useful in both our own local tourist industry and in countries that contain more than one large ethnic or language group.

To enhance the system and to use the economies gained, both in the design and local manufacture of the sign modules, an interface unit will shortly be made available. This will make it possible to link a standard computer, via an RS232C or 20 mA loop, to the sign and so provide a cost effective combination for many static applications.

John Ulph is engineering manager at STC Cannon

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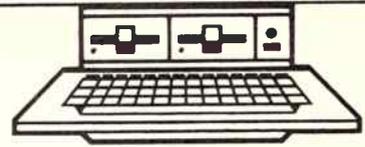


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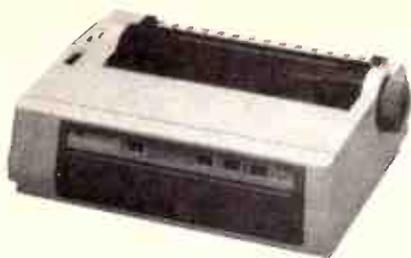
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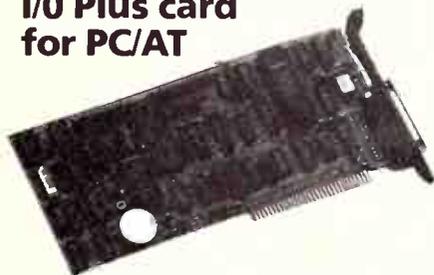


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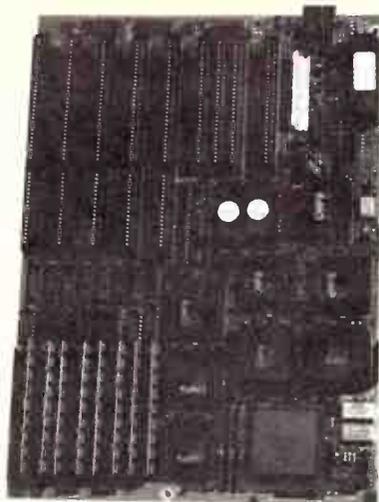
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\$4150 (16MHz)
\$4500 (20MHz)

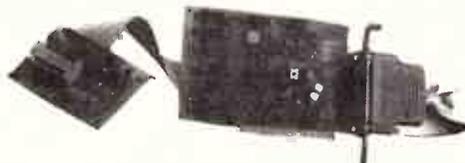
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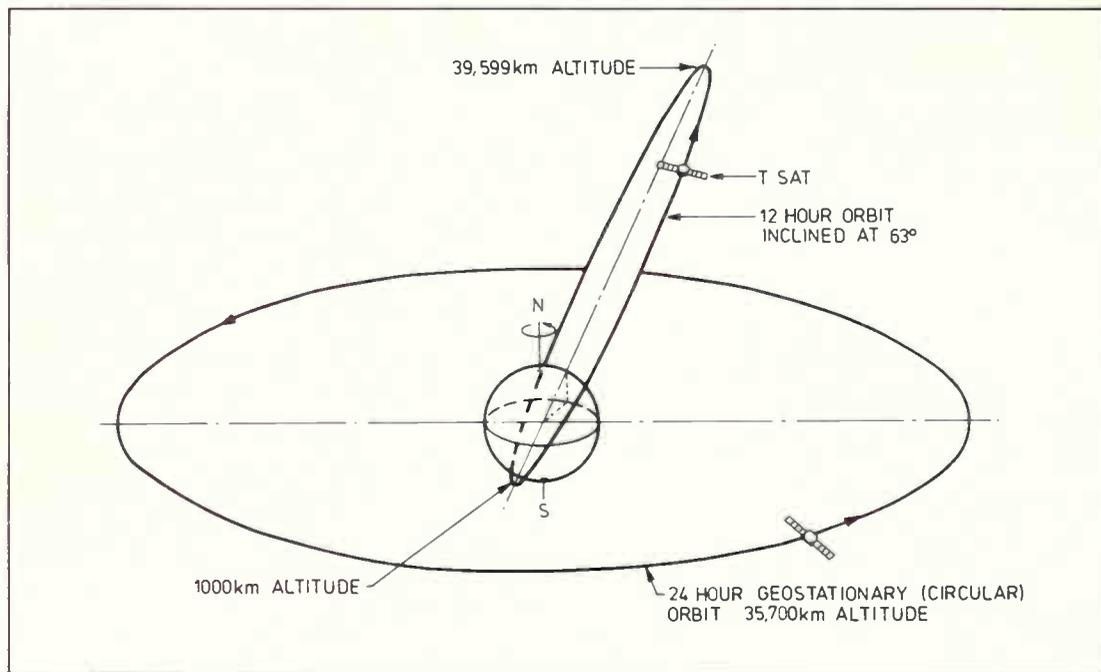
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MOBILE SATCOMS FOR THE FUTURE

We have come to regard the geostationary satellite as the norm whenever we discuss satellite communications. But its not the only way

John Norbury



The Molniya satellite orbit compared with the geostationary (circular) orbit.

Nearly all recent proposals for satellite communications systems to provide a service to mobile stations have common features. They include the use of geostationary satellites, operating at radio frequencies around 900 MHz or 1.5 GHz; either low-gain omnidirectional antennas or higher-gain steerable directional antennas for the mobile terminals; and communication on narrow frequency bands which permit only a single channel to be carried on each allocated frequency (known as single channel per carrier, or SPCP, access techniques, which means restriction of data transmission rates to the low figure of some 16 kilobit s⁻¹).

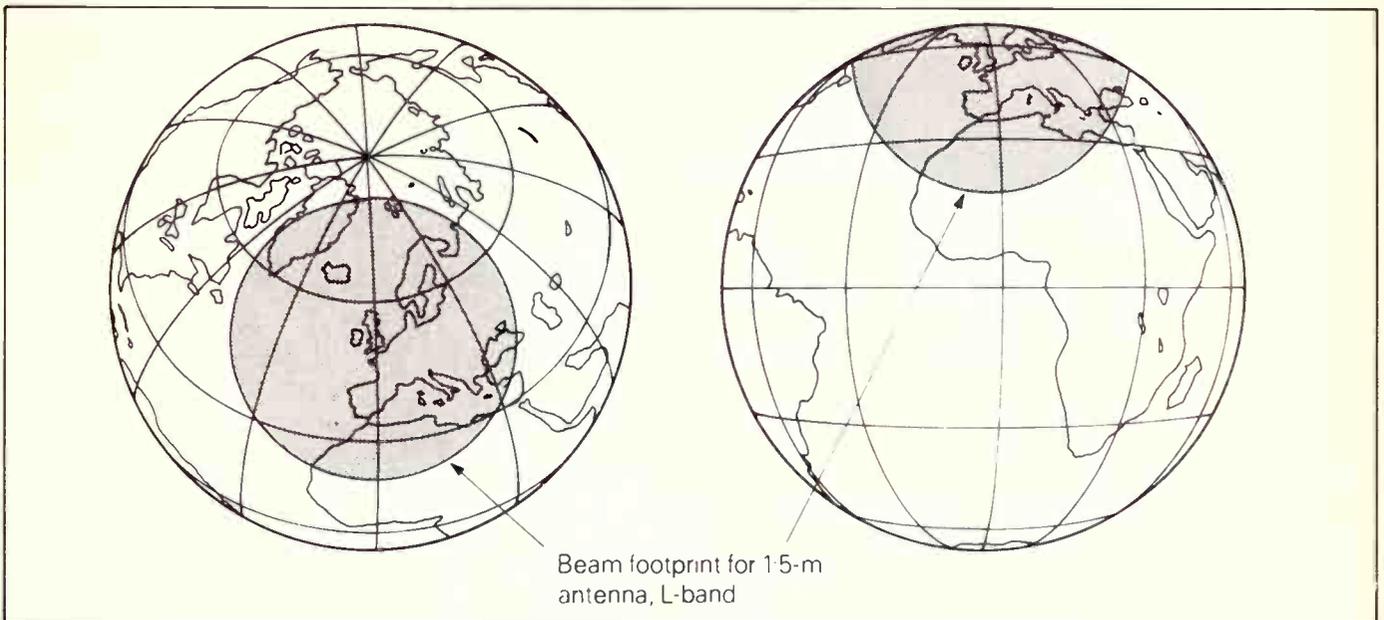
Communication *via* geostationary satellites give global coverage from a three-satellite constellation, which is ideal for most maritime and aeronautical applications, but it suffers from somewhat severe propagation problems when the line-of-sight path from the ground station to the satellite is at a moderate angle of elevation. This is especially so with land mobile satellite services (LMSS), where the low angle may lead to multipath propagation effects, attenuation by trees and blockage of the signal by buildings or uneven terrain. These factors place considerable constraints on the type of system that can be planned. For example, mobile stations in North America need a toler-

ance to fading of 30:1 (ISdB), to ensure a 90 per cent probability of acceptable speech communications. In Europe the figure is even greater.

Cost considerations of land mobile stations call for simple, low-cost antennas; that in turn means the satellite should have a very large effective transmitter power to provide a service of commercial standard. This criterion could be met by using high-power transmitters and large satellite antennas, but only at a considerable penalty to overall cost.

The Molniya Orbit

An alternative to the geostationary orbit is



Comparison of coverage by (left) a Molniya orbit and (right) a geostationary orbit.

the 12-hour Molniya orbit, used extensively by the Soviet Union and illustrated in the figure at left.

It is highly elliptical orbit which provides a satellite position giving angles near to that at zenith, when viewed from earth at moderate latitudes, for eight hours of its orbit time. On alternate orbits it provides a further eight hours for a region at the same latitude but 180 degrees different in longitude. Twenty-four hour coverage over one region means using three satellites in three orbital planes separated by 120 degrees. Obviously, any such constellation of satellites also gives coverage for a region of 180 degrees different in longitude from the

originally planned region.

Elevation angles for polar regions would be high, as is shown by the 'beam footprints' in the diagram above. The left-hand part of the diagram shows the view of Earth from a satellite in a Molniya-type orbit. To the right is the view from the equivalent geostationary position. Coverage of the polar region is seen to be excellent using the Molniya orbit, in contrast to that provided by geostationary orbit where the elevation angle to the satellite is zero at about 81 degrees North or South. This means that to provide complete polar coverage, even for fixed point-to-point communications service, satellites in non-geostationary orbits are needed.

Several satellite configurations are possible for LMSS, selected to reduce the overall power needed in the satellite and thereby, the overall system cost. Constellations of satellites in low orbits have been proposed in the USA, and Canadian scientists have studied 12 and 24-hour, elliptical orbits in detail. British studies have investigated application of Molniya orbits to provide UK coverage of LMSS.

Such systems have several advantages for Europe. The elevation angles are greater than 60 degrees and there is the possibility of using high-gain non-steerable antennas for the mobile stations. Furthermore, the reduction of multipath propagation with such an orbit adds to these factors to remove many of the constraints imposed by a geostationary orbit system. It means the fading margin that has to be tolerated is reduced to a few decibels, and the gain of

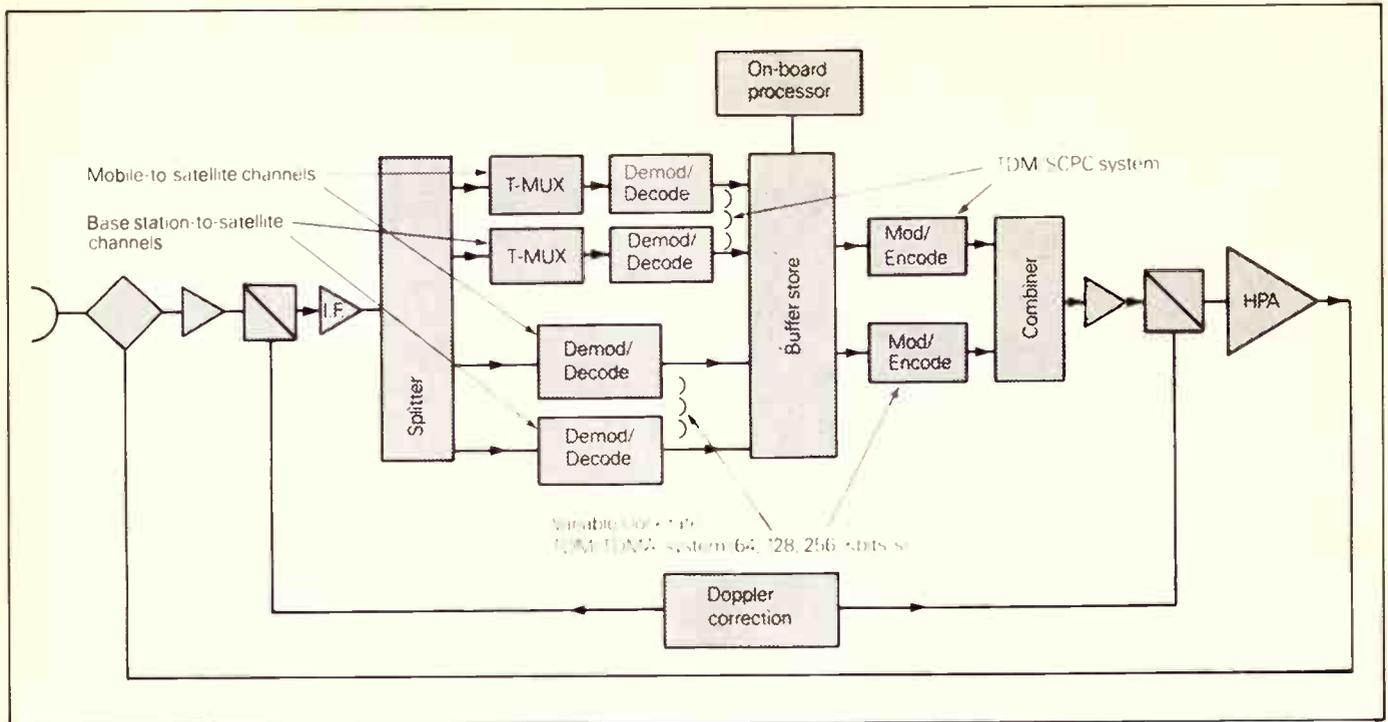
the mobile station antenna could be as high as 15 db, so the link can be engineered taking into account a starting advantage of some 100 times more antenna-to-antenna power being available, from base station to mobile, than in the geostationary system. And, although it is necessary to provide a three-satellite constellation for coverage over 24 hours the launch energy needed to place a satellite into a Molniya orbit is roughly half that for a geostationary equivalent.

The capital cost of a satellite system tends to be related directly to the amount of radio-frequency power needed for the link. So any configuration that reduces the power needed per voice channel, as in the case of the elliptical orbit satellite, makes the system a great deal more commercially attractive. The provider of a satellite mobile service would have the choice of an initial system of satellites working at relatively low radio-frequency power per voice channel, or have many more revenue-earning channels for the same capital cost as in a geostationary system.

Studies conducted recently in the UK favour a 12-hour elliptical orbit, because it would be the lowest cost option for a demonstration satellite. But the orbit passes through the Van Allen radiation belts, which could degrade electronics devices and solar panels. A so-called Tundra orbit, taking 24 hours, enables this high radiation environment to be avoided. When deciding on the best orbit for an operational system, it will be necessary to compare the three-satellite Molniya constellation, using a low

Members of a consortium of university-based and other laboratories taking part in the mobile payload study.

Member of consortium	Area of study
Bradford University	Mobile system/system design
King's College, London University	Microwave system
Surry University	On-board processor/system design
Loughborough University	Modulation/demodulation
Manchester University	Coding/decoding
Portsmouth Polytechnic	Doppler correction
Queen Mary College, London University	Antenna
Rutherford-Applet on Laboratory	Co-ordination/system concepts



Proposed scheme for the satellite-borne payload to be used for communication with mobile and base stations.

launch energy and small satellite antenna, with the two-satellite Tundra system where launch costs are higher, antennas are bigger but the radiation environment is better.

Payload Study

For several years a university consortium in the UK, whose members are listed in the accompanying table and whose activities are co-ordinated by Rutherford Appleton Laboratory, has been studying advanced ideas for satellite communications systems under the banner of Communications Engineering Research Satellite (CERS). Two ideas that have generated considerable interest are the use of on-board processing of signals in satellite systems and the application of the Molniya orbit. This group is now in the middle of a two-year project in which an electronic model of a mobile payload with full on-board processing is being built.

The design of the proposed payload is outlined in the final diagram. A simple reflector of 1.5 m diameter is planned for the antenna, the necessary steering to point to Earth in a Molniya orbit to be achieved by manoeuvring the satellite. Depending on the data rate, a transmitter power of between 10 W and 20 W will be needed.

Full demodulation and decoding of the received signals would be included, using a variety of schemes. There are several modulation schemes to be considered, including one in which the carrier is phase-shifted by the data keying process. Decoding would be possible for a variety of coding schemes. An on-board micro-processor would control an electronic buffer store to allow reformatting

of data and re-transmission using modulation and coding schemes that would be independent of the up-link channel.

Access schemes for communications with the satellite are, first, time division multiplexing (TDM) on the down-link to mobile stations with time division multiple access (TDMA) on the return path from mobile station to satellite; second, TDM on the down-link to mobiles, with SCPC on the up-link. The payload, by using dual channels for each system of access, allows full duplex (simultaneous two-way) operation. Both up and down channels would operate in the L-band (1.5 to 1.6 GHz), with data rates of 64, 128, 256 or 512 kilobit s⁻¹.

The motion of the satellite in the Molniya orbit causes a doppler shift in the transmitted and received signals. It is intended to compensate for this on board the satellite by controlling the frequencies of its local oscillators, using either an on-board control system or ground control.

Different types of traffic such as short, coded messages or voice of facsimile could be accommodated within the same time frame merely by varying the length of the time slot allocated to each individual service by the multiplexing system. The full capacity of the system, using 4.8 kilobit s⁻¹ voice coding would be about 50 voice channels.

For the mobile station, an antenna with an angle of ± 15 degrees could be used, mounted on the vehicle roof with its axis pointing vertically. Dimensions of less than one metre square are possible for this. The

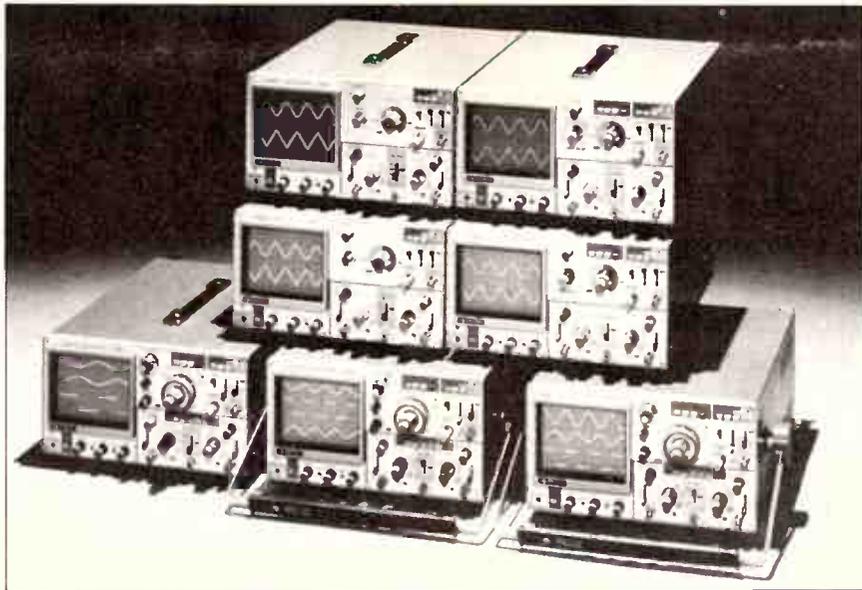
power of the mobile transmitter would need to be about 20 W. The only obstructions that may be expected to impair reception are overhead bridges or vegetation, or multipath scattering that might occur from very tall buildings. System coverage, in time and space, would be better than 99 per cent.

If the justification for satellite systems to provide communication with mobile stations is that they would fill in *all* the gaps not covered by a terrestrial-based cellular system, it might be questionable whether a geostationary service will be attractive enough commercially at such a level of coverage. An elliptical orbit system, although resorting to the complexity of operating a constellation of satellites, offers almost complete coverage even in urban areas and at greatly reduced signal strength requirement.

The technology could equally well be applied to both mobile and fixed service systems for the equatorial regions of the earth operating with a geostationary satellite. If this mobile satellite solution is commercially viable for Europe, then the cost of the transmitter-receiver, produced in quantity, would have to be comparable with those used in terrestrial mobile systems, namely of the order of \$2000. The potential for such technology, in regions where satellite systems offer the most practical way of providing mass communication, seems considerable.

Dr Norbury is with the Rutherford Appleton Laboratory, UK

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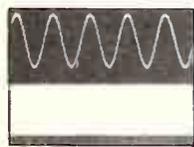
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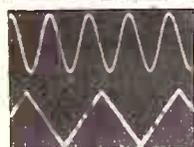
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CH2



CH1
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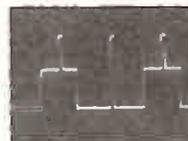
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Asterix IV is the most powerful laser of its type in the world. It will be a useful tool in the quest for fusion power.

THE BRIGHTEST IODINE LASER

Brian Dance



The most powerful iodine laser in the world, known as Asterix IV, is being prepared for operation at the Max-Planck-Institute for Quantum Optics, in West Germany. It is expected to produce 2 kJ pulses of 1 ns duration. Shorter pulses of about 200 ps duration should be obtainable at power levels of over 5 TW (5×10^{12} Watts). These pulses will be available every 20 minutes for experimentation into the holy grail of modern physics: atomic fusion.

The Institute for Quantum Optics was founded in January 1981 from the Laser Research Project Group under an agreement between the West German Federal Ministry for Research and Technology and the *Max-Planck-Gesellschaft*. Work with iodine laser systems started in 1972. According to Siegbert Witkowski, the project leader: "The first experiments with low power systems showed that iodine lasers

are promising candidates for systems which can produce the highest power levels for plasma experiments."

Today the Asterix work is the largest program in the institute. The five stage Asterix IV will be a successor to the four stage Asterix III iodine laser. The latter came into operation in 1977 to deliver 1 TW pulses (300 J in 300 ps) for plasma research. Asterix IV has improved xenon flash lamps which, with the addition of a preamplifier and a final amplifier, will enable the pulse energy to be increased by a factor of about seven times over that of Asterix III.

How It Works

The iodine laser employs an alkyl iodide C_3F_7I vapour in a quartz tube surrounded by flash lamps. Ultra-violet radiation from the flash lamps, peaking at about 275 nm, causes dissociation of the vapour to form

excited iodine atoms. Thus the population inversion required for lasing is produced. The iodine atoms decay to the ground state with a life time of about 1 ms (determined by collisions in the laser gas), but can undergo stimulated emission to produce 1315 nm radiation.

Most of the iodine atoms recombine with the C_3F_7 free radicals to reform the original compound. A small portion produce other compounds, including molecular iodine, which, even in small quantities, disturbs the laser process by allowing a premature radiationless transition. To combat this, a gas purification system was developed which circulates the laser gas after each shot and freezes out the impurities. The temperature of an alkyl iodide reservoir is adjusted in the -50°C to -20°C range to obtain the required vapour pressure.

The mode locked laser oscillator pro-

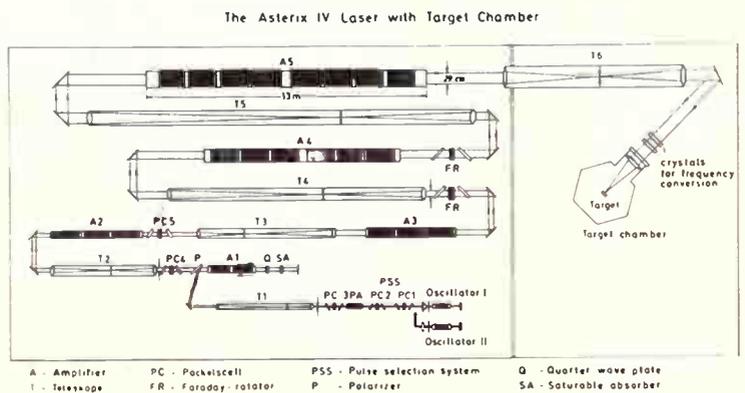
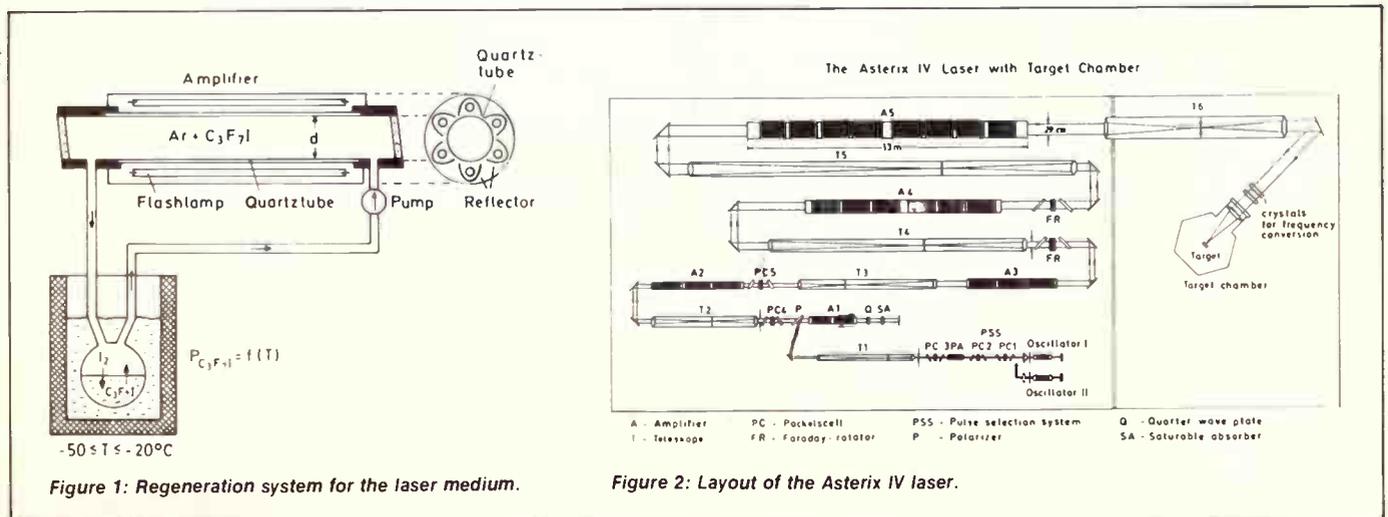
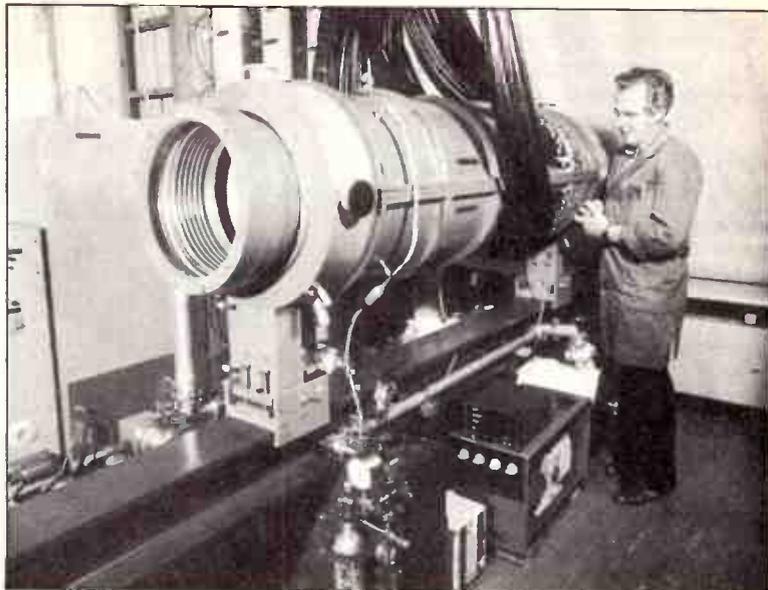




Figure 3: View of the Asterix IV laser (under construction)

Figure 4: Prototype of the final amplifier with only one section.



duces a train of some 20 pulses. A single pulse is selected by a double Pockels cell shutter for amplification by an overall factor of 10^5 to 10^6 . The oscillator is followed by a pre-amplifier with a diameter of a few mm. It intensifies the selected oscillator pulse to an energy of a few mJ. Argon at a pressure of 1-5 bar is added to the gas in the amplifier tubes, since it produces pressure broadening of the line widths. Variation of its pressure enables the gain of the amplifier stages to be controlled.

The beam traverses the first amplifier once in each direction, the forward and return beams being separated by a polarizer in combination with a quarter wave plate. The total path length is about 150 m. Optical shutters between the amplifiers of the chain provide a transmission gate for the amplified pulse for only a short time (about 10 ns) so that unwanted oscillation and feedback are avoided. These Pockels cell shutters employ crystals of potassium dideuterium phosphate (KD*P) which alter the polarization when an electric field is applied. Each shutter consists of a Pockels cell between two crossed polarizers.

Faraday rotators are used after the third and fourth amplifiers (where the beam diameter is large) to prevent feedback. Each is placed in a pulsed magnetic field between two polarizers oriented at 45° relative to one another. The magnetic field strength is adjusted so that the plane of polarization is rotated by 45° between the two polarizers. The return path is thus blocked. These Faraday rotators prevent the radiation from being returned through the amplifier chain and possibly destroying optical components in the initial stages of the chain.

Five telescopes are used between ampli-

fier stages to successively increase the beam diameter in order to avoid damage to the optical components from the intense radiation. The beam diameter increases from 2 mm at the oscillator output up to almost 300 mm in the final amplifier (which consists of eight sections and is 12 m in length). The telescopes also produce a more uniform distribution of the energy across the beam.

Optical Damage

One of the main problems in the development of an ultra-high power laser is the destructive effect of the high intensity radiation on the amplifier windows, on the Pockels cells, and on the polarizers. It is important that the energy is evenly distributed across the beam so that the beam diameter can be minimized without risk of damage to the optical components at points of maximum intensity.

The refractive index of material in the beam path does not remain constant at the high intensities involved. Accidental intensity peaks produce locally increased refractive indices leading to self focusing. This causes the intensity to rise still further in the regions concerned. Optical components can then be destroyed. The longer the light path, the greater is the chance of this damage occurring.

This effect considerably delayed the development of Nd:glass lasers. Witkowski points out that it is far smaller in the iodine laser, since the active medium is a gas which makes a much smaller contribution to the refractive index. In addition, the light paths in the glass components are much shorter in the iodine laser than in solid state types. Witkowski says that the beam divergence is constant at all power levels.

The fundamental 1315 nm wavelength, the 658 nm second harmonic, and the 488 nm third harmonic will be used for plasma research. The 329 nm fourth harmonic may also be employed. Witkowski says that the opportunity of changing the wavelength is as important as changing the pulse intensity and duration for studying the physics involved.

Flash Tubes

There is a significantly higher demand made on the iodine laser flash tubes than those used in Nd:glass lasers, since they must deliver a similar amount of energy in only one hundredth of the time. Dr. G. Brederlow, head of the Asterix group, says that the Xenon flash lamps developed at the Institute are not sealed, so impurities in the gas released from the walls and from the electrodes under high thermal loading can be removed after about every 50 flashes.

Up to 1.2 MJ of energy is supplied from the bank of capacitors, which are situated beneath the floor of the laser room. They are connected by coaxial cables to the flash tubes. The total number of flash tubes used in Asterix IV is 168. The tubes are exchanged after 32000 discharges, before the quartz becomes brittle. The tube lifetime is three times higher than at the start of the tube development program.

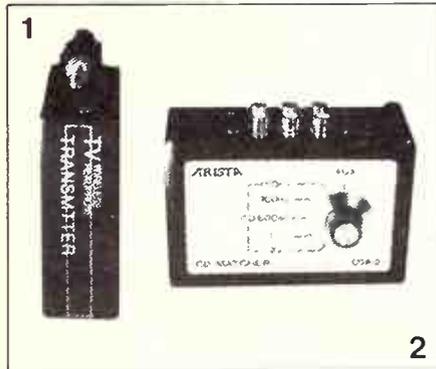
Asterix IV is housed in a laboratory about 30m x 15m with an ultra-stable floor. Clean room conditions are maintained to preserve the many optical surfaces in optimum conditions. The cost of the laser itself is about \$3.3 million and the cost of the whole building that includes also the laboratories and offices for the other division of the institute some \$19 million.

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READER INFO No. 19

Iodine Laser

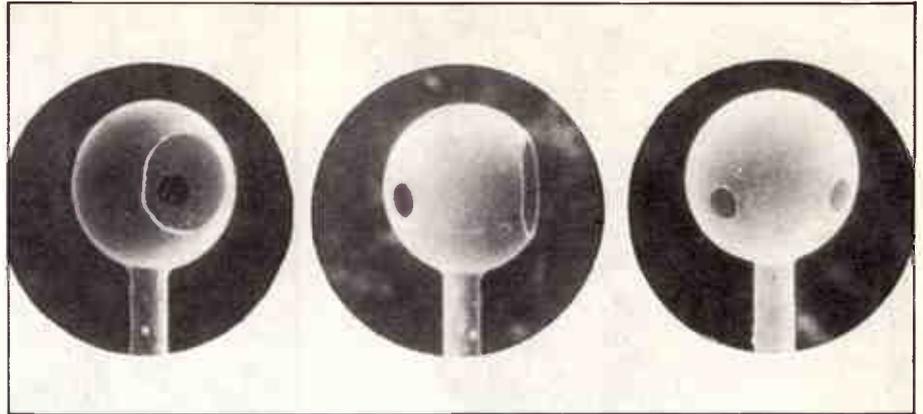


Figure 5: Three different views of a spherical gold cavity (diameter 280 μm , wall thickness 2 μm). The laser radiation is injected through the large hole. The radiation inside the cavity is observed through the two smaller diagnostic holes.

Laser Fusion Research

Fusion research has been one of the main applications for Asterix. Witkowski says: "There is no full scale laser fusion program in the Federal Republic of Germany. Our lasers are smaller than those used at the Lawrence Livermore Laboratory in the US, therefore we do not try to compete with them in setting up a record in the number of generated neutrons. Instead we attempt to study and understand the basic physics of fusion-relevant phenomena in detail."

"There are two ways to laser fusion. One involves the direct irradiation of fuel pellets from all sides, but laser radiation cannot do this fully homogeneously. The second is an indirect drive technique in which the fuel pellet is placed in an isotropic thermal radiation field or "radiation bath". For example, the pellet can be in a cavity which confines the radiation and causes the pellet to implode. In our program we study physics problems relevant to both, direct and indirect laser fusion.

"Recently we have concentrated our interest on the soft x-radiation of plasma. We investigated the spectra of plane targets and tried to create thermal soft x-radiation in empty gold spheres. Gold is used because the efficiency of transformation of the laser radiation into soft x-radiation is very high (sometimes over 50%) and radiation confinement is also best for materials of high atomic number."

The laser radiation enters the 250-1000 μm diameter spheres through small holes. The radiation temperature inside the spheres is measured through additional small holes using an x-ray spectrometer over the 1-50 nm region. Radiation temperatures of over one million degrees and a fairly good approach to black body radiation have already been reached.

Wave lengths as short as 0.44 μm are available by frequency multiplying the Asterix III output.

A considerable portion of activity at Max-Planck is devoted to the development of diagnostic methods. High speed shadow photography is used to observe the expansion of the sphere after the injection of the laser pulse. For comparison single frame x-ray shadowgrams can also be taken. Absolutely calibrated x-ray diodes monitor the total x-radiation emitted out of the diagnostic holes. Spatial and spectral resolution in the soft x-ray region is achieved by absolutely calibrated transmission grating spectrographs. An image converter camera was developed and is used in combination with the transmission gratings to observe the development of the spectrum inside the cavity with picosecond time resolution.

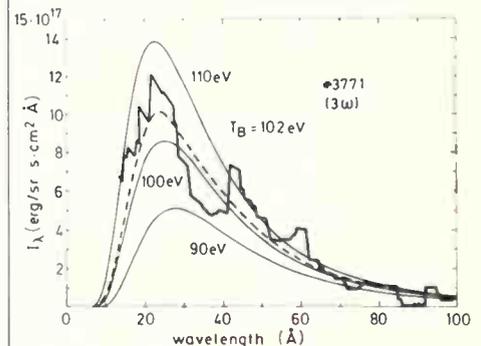


Figure 6: Measured spectrum of the radiation in the gold cavity is observed through a diagnostic hole. For comparison ideal Planckian spectra of different temperatures are shown. The dashed Planckian with a temperature of 102 eV fits the measured spectrum best.

No. 6

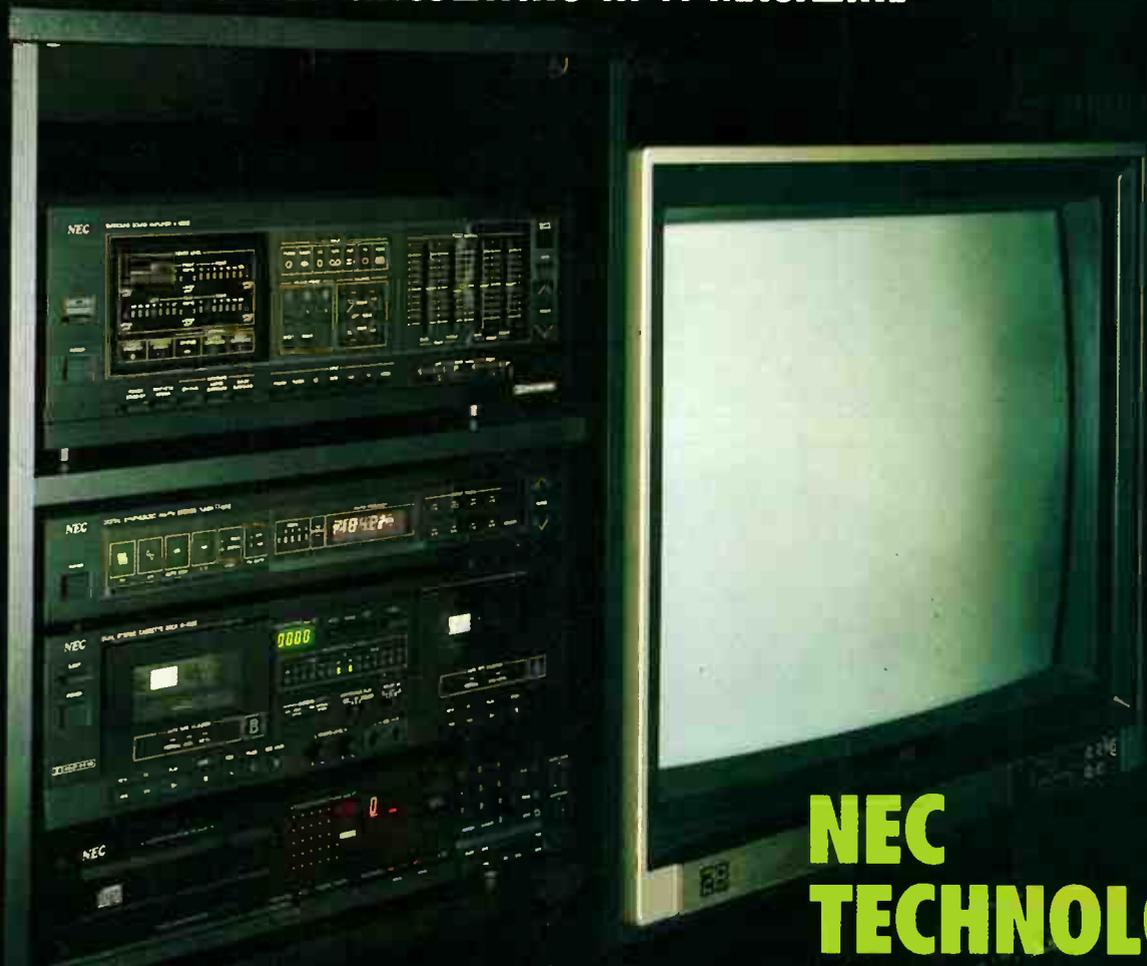
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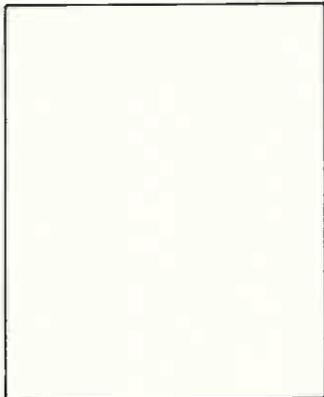
NEC
TECHNOLOGY
AT HOME

PIONEER DAT REVIEW

Sight and Sound News for December tells of Yamaha's centenary celebrations, the foundation of Ozfi and a host of new releases.

Sight and Sound News

Cover Shot



Surround Sound

The NEC Surround Sound components modify basic

stereo signals to create a 'fill-in' channel between the left and right channels. This slight front-to-rear delay produces a sense and depth of sound from behind, thus apparently creating the theatre experience.

NEC developed four types of Surround Sound effects:

- Dolby, which decodes the original Dolby sound track to create in the user's home the same sound effect applied in movie-theatres;
- Hall, which recreates the ambient sounds of a concert hall;
- Matrix, which allegedly creates the effect for the listener of being in the middle of a stadium or outdoor arena, and adds extra life to broadcasts of concerts or sporting events;

• Creation, which allows the user to custom design Surround Sound effects according to his or her own tastes.

NEC's Surround Sound component range consists of the AV-250 and AV-300 stereo amplifiers, the AVR-700 receiver and the AVD-700 decoder. Both amplifiers offer 30 watts power per channel and three Surround Sound processors — Dolby, Hall and Matrix.

The AVR-700 receiver delivers four power amplifiers with 70 watts per channel into rear speakers. It provides both Dolby and Matrix Surround Sound effects and AM/FM digital synthesiser tuner. The AVD-700 decoder offers 16-bit digital delay circuitry and all Surround

Sound effects. It features terminals for ten audio and five video systems.

NEC's audio-visual system combines the A-1300 Surround Sound amplifier, the T-601 digital synthesised AM/FM television set and a VCR.

This audio-visual package can be operated by NEC's unified remote control, which allows independent operation of the audio components, the television and the VCR. With it, the user can adjust both front and rear volume in the Surround Sound system, scan or give direct access to 16 memory presets on the AM/FM tuner and operate the numerous functions of the CD player, television and VCR.

READER INFO No. 120

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Eidetic Amp

Australian designer Greg Ball was in Sydney last October to launch a new power amp, the GB1b, developed by his firm Eidetic.

Reasonably fresh from the United States where he worked as a designer/consultant from Madrigal, Ball has been working on both this amp and a preamp which he plans to market in the new year. He has already aroused interest (and orders) from audio specialists and designers in this country and in the US for his power amp. In fact, Ball is reason-

ably confident about his export prospects. With contacts back in the US who already have worldwide dealerships and interest expressed by the *Absolute Sound* magazine, he is in a fairly happy position, made even more so by the cheap freight costs of his rather small, compact unit, weighing only 7 kg.

The GB1b power amp measures 425 x 140 x 160 mm and is styled rather like the Haffler unit with a chassis design of 35 per cent open upper area, and heatsinks out to the sides. All active heat

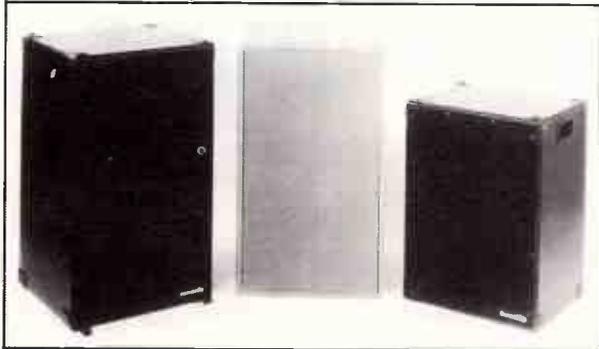
generating devices are mounted directly to the externally finned heatsinks to ensure minimal thermal lag, internal temperature rise and component ageing.

Ball's strong claim is that the GB1b will drive any loudspeaker from 1 to 8 ohms nominal impedance more accurately than any other amplifier at any price. The amp is rated at 150 to 300 watts with less than 0.002 per cent THD at 1 kHz 8 ohms, and less than 0.05 per cent THD at 1 ohm, 20 Hz to 20 kHz. Frequency response is 20 Hz to 20 kHz ± 0.1 dB, signal-to-noise ratio is over 100 dB(A) re 1 watt 8 ohms, and dynamic headroom is 2.2 dB at 8 ohms. Gain is 29 dB or 28.3 times.

The GB1b power amp retails at \$1500.

READER INFO No. 121

Eidetic
AUDIO RESEARCH PTY. LTD.



Taller, Deeper Speaker

Following on from the RS3251 loudspeaker, the US-based company Community Light and Sound, has released a slightly taller and deeper speaker, the RS3271. More significant is that the internal volume of the speaker is almost double its predecessor.

Using a three-way speaker system design, the RS3271 incorporates Community's M200 driver and exponential

pattern control for the 450 Hz to 3 kHz range. A pair of piezo electric drivers are mounted on a pattern control horn for frequencies above 3 kHz and low frequencies are channelled through a 15-inch driver attached to an exponential coupler. The bass loudspeaker is cooled and damped by magnetically conductive fluid.

READER INFO No. 122



New Eurovox Car Systems

Six new car systems have been released by Eurovox ranging in price from \$250 to \$1299.

Top of the range is the MCC 8280C, an FM stereo/AM stereo Digitalic Cassette Car System. It is a 20 watt x 4 channel unit with LCD dot matrix display, clock, station frequency and level meter readout. The auto-reverse cassette system is full logic motor driven, and has automatic music search. Individual front and rear LCD

bar graphs enable one to equalise front and rear.

Nearly all settings including volume level are programmable.

The ECD 1000E CD player offers such features as full computer logic sequential control, full disc or single track repeat, programme skip, fast forward/reverse, LCD display of track, elapsed time, remaining time, just to list a few.

READER INFO No. 123



New Professional Speakers

The US company Klipsch and Associates, has introduced a new line of professional loudspeakers which includes new models and extensively modified current models.

Top of the range of the new models is the KP-450, a high output system of sleek, clean style. Company specs are 104 dB SPL sensitivity, 129 dB SPL maximum output at maximum continuous power of 300 watts. Overall system response is 45 Hz to 20 kHz ± 4 dB.

The speaker is a three-driver, two-way design with two 15-inch woofers operating in unison. Separate cabinets for the low frequency and high frequency sections are provided and a "fully-featured" version offers an in-

terlocking device for the separate cabinet sections.

The KP-301 is a three-way system with a 15-inch woofer in a ported enclosure and a horn-loaded tweeter and midrange. Specs are 101 dB SPL sensitivity, 123 dB SPL maximum output at maximum, continuous power of 200 watts, and overall response of 45 Hz to 20 kHz ± 4 dB.

Compacts in the KP series are the KP-201, a high output three-way system and its more rugged and powerful brother, the KP-250. These speaker systems come with protective trim, recessed handles and a recessed socket for mounting to support stands.

READER INFO No. 124

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Check <input checked="" type="checkbox"/>	YES	NO	UNDECIDED
Are you totally familiar with the Brand?			
Is Service/back-up parts available?			
Will the player be compatible complementary to your existing system?			
Does it have the features you need?			
Has the product received favourable reviews from distinguished electronics writers?			

Check <input checked="" type="checkbox"/>	YES	NO	UNDECIDED
Will you be comparing the \$199 Player with the 'well known brands' players?			
Have you discussed the many variations of Compact Disc Players with trained Audio Consultants?			
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Was the answer satisfactory?			

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NOVEMBER '87

On the Multi-Play System . . .
"In Pohlmann Labs, the Pioneer demonstrated that convenience need not be achieved at the expense of audio quality. Many of the PDM-70s measured specifications were entirely comparable to single disc players".

. . . **DIGITAL AUDIO** JULY '87

On the Sound Quality . . .
"The linearity is excellent".
. . . **E.T.I. NOVEMBER '87**
ON PDM40

"In the listening room, I was pleased to encounter distinctively fine Pioneer Sound".
. . . **DIGITAL AUDIO**
JULY '87 ON PDM70

On the Craftsmanship . . .
"The heart of the system is the Multi-Play unit which is beautifully made from steel and plastic, and, subject to no abuse, should provide years of trouble free operation".

. . . **E.T.I. NOVEMBER '87**
ON PDM40

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Wireless "SR" remote control

With Pioneer CD players bearing the "SR" mark, you can operate most of the functions from the control of your chair. A numeric keypad is an extra convenience when accessing tracks directly or programming tracks. Moreover, using the "SR" (System Remote) controls for our receivers and amplifiers, you can operate our CD players as well.

Auto programme editing

This is a handy feature when dubbing from disc to tape. When you specify the length of a tape you're going to record on, the player automatically counts the numbers of tracks that can be recorded within the specified amount of time and shows the total playing time from the beginning of a disc on a selected track.

"Random Play"

Touch the RANDOM PLAY button, and a built-in microcomputer randomly selects the songs for you from among the six loaded discs in our multi-play CD Player - without repeating tracks! * or, press this key after you've programmed tracks, and the computer randomly selects songs from among those programmed.

Digital filter

Pioneer's high-tech digital filter uses a double normal sampling frequency (over-sampling) to ensure accurate sound with the lowest possible noise and phase distortion. This means extra clarity and razor-sharp sound definition.

Anti-resonance concept

To ensure superb disc tracking and great sound, we've come up with the "anti-resonance concept". This concept is expressed in three ways.

New Disc Stabiliser

We've come up with a new, better way to clamp the disc - Pioneer's New Disc Stabiliser. During play, the stabiliser clamps the disc magnetically. Since the stabiliser does not remain in contact with the rest of the mechanism during play, it does not pass vibration on to the pick-up. The result is surer and more accurate disc tracking which of course means better sound.

Honeycomb base

The base of our CD players are made using a ribbed honeycomb construction, which not only increases rigidity but also protects the pick-up and disc drive system inside from vibration.

Vibration-Resistant pick-up mechanism

With our vibration-resistant pick-up mechanism, the laser pick-up is mounted on a "ballast base" which is fully isolated from the main chassis by means of dampers composed of ceramics and rubber. The ballast lowers the centre of gravity of the pick-up chassis, thus improving stability. This reduces the chance of sound degradation due to vibration.

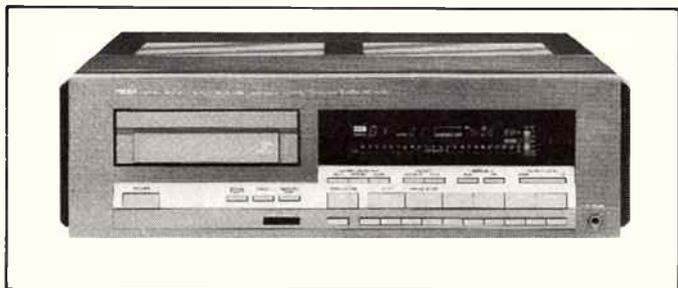
Add-on programmed play and direct-programming

Anytime during playback of tracks in normal order, you can switch to programmed play, programme as you listen to track, and the moment the track is over (or when you touch the PLAY button), the player switches to programmed play mode. Also you can programme tracks as you listen.

* Some tracks may repeat when a disc contains more than 100 tracks (PD-M90X and PD-M60) or 64 tracks (PD-M40 and PD-X77M).

PIONEER® Compact Disc Players

For more information and the name of your closest PIONEER Dealer please phone (03) 580 9911. Pioneer electronics Australia



Yamaha Turns 100

Yamaha turns 100 this year, and as a celebration and tribute to its engineers the company has used digital technology (and an engineer's free hand) to produce the "ultimate in audio performance" in the CX-10000 control amplifier, MX-10000 power amplifier and CDX-10000 compact disc player. Together with speakers and equaliser the units make up the "Limited Centennial Edition: 10000 Series" and represent the top of the line in audio quality.

The 'free hand' arrangement, as you might suspect, translates into an expensive component system. All up, with speakers and equaliser, the Limited Edition Series will cost a mighty \$46,000, but for \$15,000 you could buy the control amp separately, the power amp for \$12,000 and the CD player for \$5000.

However, interest in the system has taken the Japanese manufacturers by surprise. Not expecting to sell many, the show-piece line was originally hand-made; now Yamaha is having to cope with orders worldwide from aficionados and so it has ventured into moderate scale production. Already two CD players and a front end system have been sold in Australia. Yamaha expects to sell around 10 systems in total here.

The CX-10000 control amp with provision for four video inputs and two video monitor outputs, uses quadruple oversampling 18-bit DSP digital equalisation (even on analogue sources) and direct digital inputs and outputs. Two new DSP programs are included and 126 programs can be set in memory. The equaliser allows 1/6 octave adjustment at 61 centre fre-

quencies and both Q values and levels can be freely set. the sensitivity of each input can be set from 0 to -6 dB.

To achieve their ultimate in the control amp Yamaha engineers used a lot of proprietary circuitry. The voltage controlled amp used eight ICs with internal, super low noise transistors instead of a conventional volume plus amp. In an effort to avoid sound degradation, a discrete transistor switch is used to switch between input and output. Using a three-transformer power supply, the analogue, digital and video sections each have their own supply. The amp uses a two-box chassis system made of highly rigid non-magnetic extruded aluminium.

The MX-10000 power amp weighs a hefty 43 kg. It is a MOSFET quadra-push-pull design, delivering 250 watts per channel into 8 ohms. The amp provides class A power without switching and without cutoff for all loads from zero to infinity. A high performance predrive amplifier between the two-input terminals is used to achieve a 132 dB signal-to-noise ration and a 500 V/ μ s slew rate.

The CDX-10000 CD player features quadruple oversampling digital filter with 18-bit output, twin matching 18-bit DAC, hi-torque FG motor which provides, Yamaha claims, the fastest access time of any player in the world, and a 20-bit digital volume control which can advance the output in 0.4 db steps through 120 dB dynamic range. A digital terminal allows direct input of digital signal into the CX-10000 control amp.

READER INFO No. 125

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READER INFO No. 21



Matsushita RQ-MD-1

Portable DAT Developments In Japan

We mentioned last month that Sony is set to release the world's first portable DAT player in Japan in December. It looks like they will be beaten by Matsushita (Technics) which plans a November release in Japan for its RQ-MD1.

The unit measures 210x40x122 mm and weighs 1.45 kg with batteries. Features include a three-way power supply, search at what Matsushita claims is 60 times the normal speed, 32-programme random selection analogue and microphone inputs. Specs are 15 Hz to 22 kHz frequency response, and more than 90 dB dynamic range and signal-to-noise ratio.

The Sony TCD-D10 is just slightly larger than the Matsushita RQ-MD1. It measures 238x53.6x175 mm and features search function, backlit multifunctional display with clock, real time counter, and remaining recording time. Accessories include rechargeable battery and stereo microphone.

While there is no word on when such players might be released here, as we await the outcome of copyright de-

bate in the US, both Philips and Sony have indicated that they intend to start marketing DAT products in Europe. This may stir things along but there is still a way to go before prices become accessible. The Matsushita RQ-MD1 retails for the equivalent of \$2900 in Japan, and the Sony TCD-D10 for \$2410.

READER INFO No. 126

Japanese Adjust To Changes

For fiscal year 1986, the top 10 Japanese electronics companies showed sales down 2.4 per cent from the year before. In terms of profit of the top 100 companies, 75 suffered a profit drop. This was despite an appreciating Yen value which correspondingly slowed exports. The top 10 companies for sales were Matsushita Electric, Hitachi, Toshiba, NEC, Mitsubishi Electric, Fujitsu, Sony, Nippondenso, Sharp and Sanyo.

Recent friction over trade, the rising value of the Yen, as well as cheaper production costs, have prompted Japanese consumer electronics manufacturers to expand local production in Europe, the US and Asia.

Sony, which makes 8 mm video in West Germany and

CD software in Austria, will next year make audio tape in Italy. Toshiba, too, has investments in West Germany where it manufactures VCRs, and next year Fuji Photo Film will construct a tape plant there. Pioneer is producing CD players in France. In the US, Pioneer is expanding its facility for producing video disks.

Philips, which is presently mopping up operations in Australia, has made overtures to gain complete control of North American Philips in a move interpreted as reflecting the Japanese position.

However, it is in Asia where production costs are cheap that business is really brisk. Factories in Taiwan, Korea, Singapore and Malaysia supply most of the colour TVs and only recently Philips closed its Clayton plant in Victoria transferring production to its factory in Singapore. Also in Singapore is Kenwood which produces video products for the European market and plans to manufacture audio products for the US market.

Meanwhile Japanese manufacturers have not been slow to pick up on trends that would boost exports and profits. In Europe, the introduction of direct broadcast satellites should create a market for new receivers, tuners and antennas. Camcorders are still seen as novel items, with greater appeal than VCRs which, in turn, are nevertheless expected to experience higher demand due to S-VHS and ED Beta.

Hi-fi Guild Sealed

The inaugural meeting of the Australian Hi-Fi Manufacturers' Guild, Ozfi, went off to the apparent satisfaction of the founding members. Resolutions were passed to promote Australian products by advertising and by lobbying for government support for the organisation and for Australian products.

While endorsing each members products, Ozfi will also endorse certain hi-fi retailers it considers sells quality audio products. Setting it-

self up as such an arbiter, Ozfi will offer some guidance to the consumer and identify itself with good quality products. One of the problems Australian manufacturers have to overcome, the members believe, is a reluctance on the part of the Australian public to believe that Australian hi-fi wares are better than imports even though they are quite often cheaper. (One cynical solution expressed by a participant at the meeting was to simply raise the price of some goods).

The meeting and ensuing barbecue brought together representatives from Australian speaker, amplifier, and cable manufacturers and gave them an opportunity to view each other's products. New products they were particularly excited about are the Eidetec power amp (see separate item) and two new sets of speakers from Richter, one which incorporate a 5-inch driver from E-tone and another using a new 8-inch driver from Magnavox which designer Ralph Waters is over the moon about ("a first in terms of size and performance").

Manufacturers/designers Australia-wide, who are interested in joining Ozfi, should contact Ralph Waters on (02) 771-3550.

Warning For TV Equalisation

In a paper at last September's IREECON, Telecom engineer J. D. Hodgson outlined some restrictions that need to be taken into account by planners and manufacturers of broadcast antenna systems for the regional areas TV equalisation programme.

The government's equalisation scheme for four to six services requires broadband UHF arrays with effective radiated power (ERP) of 300 kW to 1 MW. Hodgson points out that while the use of common UHF transmission facilities at major sites is the most economic proposal, it requires very high gain antenna systems. Unfortunately

these are particularly sensitive to mechanical deflection, and in periods of high wind, might result in picture flutter. The problem is particularly accurate for the UHF band where 1mm of mechanical movement approximates 1 degree of electrical phase shift.

Hodgson suggests the use of wider cross section antennas using six sides, rather than the 32 wavelength, four-sided, narrow cross-section ones proposed, would allow more substantial steelwork to be introduced into the antenna support column.

(Papers delivered at IRECON are now available as a collection in book form from the Institute of Radio and Electronics Engineers, Australia, (02) 327-4822.

The Cut For CDs

As from December 1, Polygram follows WEA's lead in cutting the price of its CDs.

Prices will vary between \$18 and \$28, with the majority for sale at \$25. WEA cut the price of most of its discs last October to \$25, and also introduced a range of "mid-priced" discs of some old material to \$17.50. As a result CD prices are now beginning to approach the levels of two years ago when they were first introduced.

High Definition Broadcasting In Japan

Japan could become the first country to introduce high definition satellite broadcasting, if plans by the Japanese Ministry of Posts and Telecommunications are approved. Broadcasting would be through two transponders on the BS-3b satellite which is scheduled for launch in 1991.

The plans call for a body that would work in conjunc-

tion with NHK (Japan Broadcasting Corporation) and the private Japanese Satellite Broadcasting.

Anti-DAT Legislation

There has been little development in the seething recording industry war over DAT in the US, since legislation was introduced last March to the House of Representatives requiring all DATs to contain a copycode scanner chip to prevent home recording of compact discs.

The chip works by scanning a prerecorded compact disc, record or tape for a notch in the sound spectrum 300 Hz wide, 60 dB deep, centred around 3.84 kHz. This would cause it to turn off the DAT for 25 seconds and thus sabotage any unauthorised recording.

The legislation has been opposed on three main points: it restricts the rights of

the individual to free home taping; it defeats the purpose of DAT, ie, to record; and that no one wants a chunk of sound deleted from their music.

CBS records has developed a prototype of the copycode scanner system, and the House Energy and Commerce Consumer Protection Subcommittee, to which the legislation has been referred, has asked the National Bureau of Standards to test the system. This could delay action on the legislation for some months but in the meantime the subcommittee has recommended that the chip should be required for one year.

Meanwhile the two main lobbying groups, the Home Recording Rights Coalition representing foreign and American electronics manufacturers, importers, retailers and consumers, and the Recording Industry Association of America, representing the recording industry, are sparring with each other.

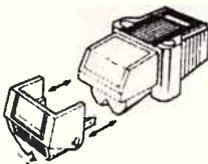
Stylus wear. By the time you hear it, it's too late.

If you haven't replaced your stylus (needle) in the past year, you may be permanently damaging every record you play.

Replacing your stylus is simple (see diagram). And selecting the proper stylus to replace it *with* is also easy. Make certain it's a genuine Shure stylus.

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Product Briefs



Denon Tapes And Floppies

Denon HD8 and CRO₂ position cassette tape is now available in C100 length at the same thickness at 90 minute tape. The HD8 is a high technochrome formulation based on metal powder and cobalt. New versions of the HDM and HD6 CRO₂ tape and a DX normal tape have also been released. Denon is also making 5.25-inch and 3.5-inch floppy disks.

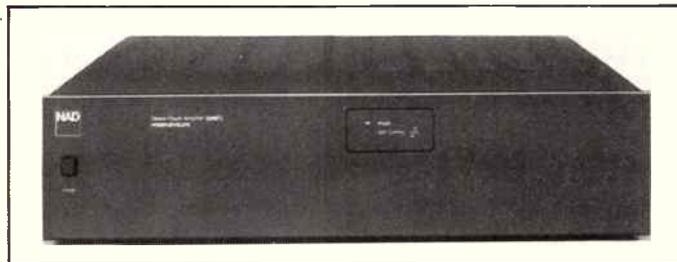
READER INFO No. 136



Sharp VCR Programming

The new Sharp 103 VCR comes with a Command Control VCR programmer which is usable anywhere in the house. A liquid crystal display shows the programmed input. The 103 also comes with a tamper-proof lock and sells for \$779.

READER INFO No. 137



NAD Amp

NAD has released a 40 watt stereo amp, the NAD 2240PE, to retail at \$499. Dynamic power is 160 W to 250 W, THD is 0.03 per cent, 20 Hz to 20 kHz, dynamic headroom +6 dB at 8 ohms, and clipping power 50 W, 1 kHz. The

amp features power envelope circuitry, high current output stage, an impedance selector, binding post speaker terminals and soft clipping circuitry.

READER INFO No. 138



Perreaux Professional Amps

Perreaux has a new range of professional amps at 180 W (3000B), 300 W (6000B/6200B) and 500 W (8000C/9000B) per channel into 8 ohms. Special features include the use of MOSFETs for soft clipping, in the 6000B/6200B and 8000C/9000B versions, specially designed capacitors capable of delivering 200 amps instantaneous current

are also important. They also include high powered fans as well as heatsinks to dissipate heat. The 6200B provides 650 watts into 2 ohms continuously and the 8000C is fitted with a variable reference meter to indicate actual power available with respect to voltage and local impedance.

READER INFO No. 139



Pioneer Range

Pioneer has released new ranges of practically everything from turntables to CD players, addressing all sections of the hi-fi market. At the top end is a new "PL" series of turntables, the "Reference Series" amplifiers, "A" series amps, "F" series tuners and "PD" series CD players. For

the middle section of the market the Pioneer "A" series amps extends down in price with six models from \$2700 to \$369. The Avante component system, too, comes in models of various sophistication and price as does new "CT" series tape decks.

READER INFO No. 140



Pioneer Car Graphic Equaliser

The Pioneer BP650 graphic equaliser for the car features 7-band equalisation, variable input gain, and fader control to provide 25 watts

per channel (or 6.5 watts per channel when using four speakers). The equaliser, with illuminated controls, retails for \$259. *READER INFO No. 141*

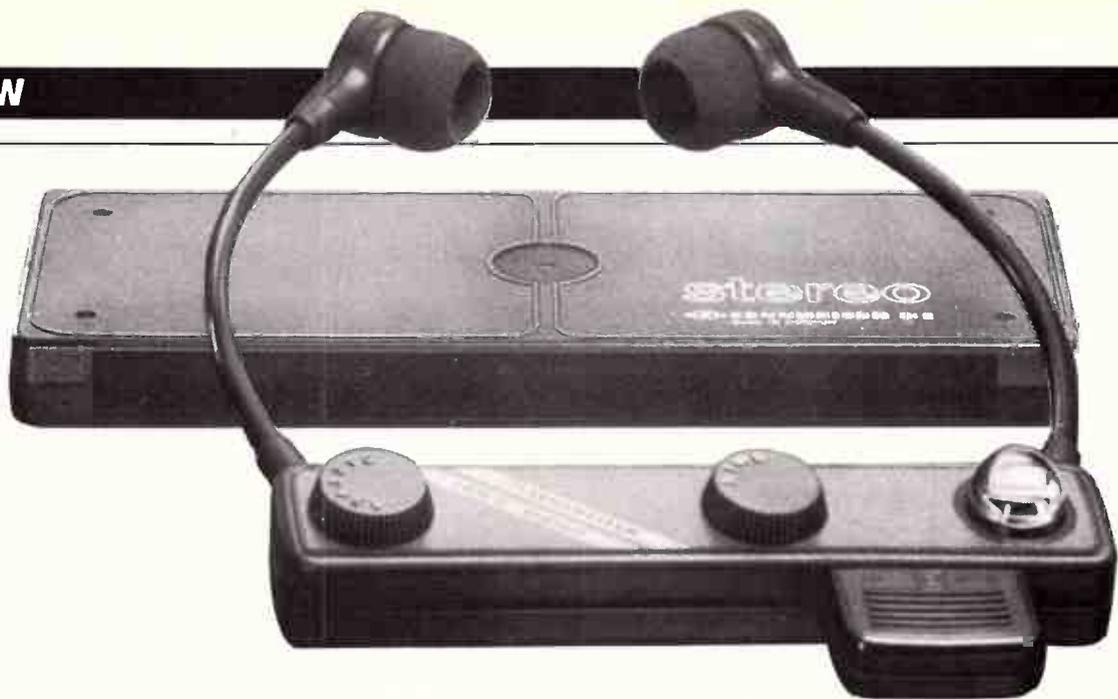


Philips Sound Machine

The D8958 Sound Machine is a portable dual cassette deck, FM stereo, AM/SW radio, with CD player. Philips claims amplifier circuitry and speakers have been

matched for superior CD reproduction. The package which comes in black and silver, sells for \$859.

READER INFO No. 142



Sennheiser Infra Red Headphones

Headphones have been taking a bit of a battering recently. However, new cordless techniques might be set to change all that.

Once the possession of headphones was the mark of the true audiophile. Now it seems they are no longer considered sexy. It's difficult to know whether this is just the result of fashion. Some would argue that 20 years ago, headphones provided the only way to get good sound at a reasonable price, given the quality of available speakers. Today, with improvements in speaker technology, this is no longer true.

Notwithstanding such esoteric factors however, headphones have some other advantages. For instance, they have a distinctive sound that some people find quite attractive. It is also the only way to listen to music without disturbing other people. If this is a problem for the hi-fi lover, it is even more so when TV is concerned.

However, headphones have a number of disadvantages, not the least of which is that one is limited in one's position by the cord. Generally, you must sit right next to the hi-fi unit, and in the case of a TV, some sort of extension is essential.

The obvious way around

this limitation is a wireless link, and experience proves the best way of doing that is via infra red. Transmissions at this frequency have the characteristic that they readily reflect off most of the materials used in a domestic environment, such as ceilings and walls.

The company to come up with goods is Sennheiser, well known as the maker of a wide range of high quality headphones. They have just released the HD1/S12 infra red units, especially tailored for the domestic hi-fi environment. The headphones come in a two piece unit. One plugs into the hi-fi via a 6.5mm coaxial jack, and

acts as the transmitter. The other section is an integrated headphone/receiver that hangs around your neck.

A bank of LEDs in the transmitter transmits two carrier frequencies at 95 kHz and 250 kHz. These are frequency modulated by the audio signal with a deviation of some 25 kHz. The signal to noise ratio under optimum conditions is claimed to be 58 dB.

The transmitter derives its power from the mains. The receiver is powered by a rechargeable battery pack. This is a rather cunning piece of design, since the battery pack is a tiny module that plugs into the bottom of the receiver, and then can also plug into the wall socket to recharge. At least that's the theory, and in Europe it probably works quite well. In Australia, however, with our differently shaped wall sockets, this is something of a problem, and drives the cunning reviewer to the creation of a death defying jury rig for recharging. The distributors, Consolidated Electronics will have to look at this before they sell too many.

Anyway, given that power is actually available, the unit

can be operated in in three different modes: stereo and two mono. It's designed to access two mono channels so that it can be used on the European multi lingual broadcasting system where TV might be accompanied by two distinct audio channels. In Australia, the stereo mode will be of most interest.

It actually works quite well. Sitting perhaps three metres from the TV set it produced excellent sound, with no objectionable hiss at all. The noise level rises slightly when someone interrupts the beam by walking in front of the viewer, but not unacceptably. The orientation of the transmitter and reviewer turn out to be quite uncritical. The best results, in fact, are to be had when the transmitter is pointing at the ceiling and the receiver uses the reflections for its source. The only disturbing aspect was that a bright neon light located near the set had to be kept off. The system appears quite sensitive to the flicker from this source.

The sound, while not exceptional, is certainly more than adequate for TV use, although not for hi-fi usage. Frequency response is limited by the transmitter at 50 Hz to 8000 kHz. An on-board volume control gives the user the ability to control the level to a comfortable loudness without leaving the chair.

READER INFO No. 118

Pioneer D1000 DAT Review

THERE HAS BEEN something of a competition between Japanese consumer electronics companies to see who can get the first DAT players into the country. With most of the principle players showing product in Japan, but no export versions being released until problems in the US are overcome (see September Sound Insights), local importers are being frustrated by events over which they have little control.

Aiwa won with a demonstration two months ago, but their product was in such demand that a review was impossible. The assembled media had to make do with a quick listen in the middle of a Grace Bros store, and apparently it was whisked back to Japan after a southern sojourn of only a few weeks.

Then Sony bought out a demonstration model. Unfortunately, local officials can't tell when they will be able to release it, so they allowed reviews only if the review was embargoed until the release date. It was only Pioneer who finally came to the party with the offer of a DAT player for one weekend. It was not long enough for a proper review with an investigation of all the objective performance specifications, but it certainly was enough time to find out how it works and make a subjective assessment.

Appearance

The D1000 is a reasonably attractive unit, with dark wood panelling on both sides, a well laid out front panel with a big display in the centre of it, and four silver feet for it to stand on. It's rather bigger (at 460mm by 390mm) than one would expect to see in a tape deck, but this reflects the immaturity of the technology rather than any intrinsic need for size. While there is a great deal of integration inside, there is little evidence of surface mounting as one sees in a typical CD player. This will come, no doubt, along with price reductions when the US market opens up.

Operation

Learning to drive the Pioneer was fraught with problems. There is no instruction manual, since the D1000 hasn't been released in any English speaking countries at this time. This also explains the fact that the device I took home required a 2:1 transformer to drive it from 240 Volts. It has the Japanese 110 V standard transformer inside. The matter is complicated

by the fact that some parts of it appear to work in rather strange ways.

However, getting a sound out is easy enough. The back panel contains analogue and digital inputs and outputs. The analogue I/O is conventionally laid out with RCA plugs. The digital I/O offers a choice of coaxial copper cabling or optical fibre.

Not having any other digital sound gear lying around the house I was unable to check the digital side of it, but the analogue I/O went straight into the back of my Series 5000 preamp.

Inserting the tape is quite simple if you've ever operated a VCR. The cassette, which is somewhat smaller than a conventional tape, drops into a pop up assembly. Push the cassette home and the unit pulls the cassette down and back into the front door: OPEN/CLOSE and EJECT. EJECT will bring the cassette out and up, ready for removal. OPEN/CLOSE slides the assembly out so you can look down at the cassette. Presumably this feature was added so that it's possible to check the state of the cassette. Interestingly, it is impossible to see while it's playing, unlike a conventional cassette.

Located above the basic controls are the MUSIC SEARCH, CUE and REVIEW

BUTTONS. CUE and REVIEW operate like fast forward and rewind functions except that the head stays in contact with the tape so you can hear it. Unlike a conventional cassette player, you don't simply hear a speeded up high pitched version of the original. In the process used here, the audio track is laid down in segments diagonally across the tape just as in a VCR. In the fast forward mode it sounds as if the head is reading one segment then skipping many before reading another one. The result is a stacato rendition of the track, but one with enough sound content to allow you to identify where you are on the tape.

MUSIC SEARCH takes you to the start of the next or the previous track ID mark. The track ID is an out-of-audio-band marker superimposed on the tape that allows the operator to electronically find any point on the tape. The function is operated by using three buttons that appear across the bottom of the recorder. ID MODE toggles through a selection of three options: start, skip and erase. Once a mode is selected, "enter" begins to flash in the console. Press ENTER, and an ID is put on the track. This ID track either identifies the start point of a track, a track to be skipped or clears a pre-existing ID.



depending on the status of the mode button.

There is no connection between the position of the IDs and the music tracks on the tape. Its perfectly feasible, as I did, to lay down IDs about ten seconds apart on the tape. However, its not possible to make the tracks much smaller than this, presumably because of the length of time the machine needs to read the ID on the tape.

To attach a number to the IDs so that they can be identified, the third button, RENUMBER is used. This will number all the IDs consecutively from the current position of the tape.

A facility like this only makes sense if there is a programme mode, so that you can summon tracks in some sort of prearranged order. Programming is done from a small keypad located just to the right of the display. The button labeled PROGRAM is pressed, followed by the number of the track, then PROGRAM is pressed again, and another track number, and so on, building up the tracks in the order in which you want them played.

The track information is displayed in the centre of the panel, on a screen that shows the track number, a tape counter, with a REMAIN function so that you can



see how much tape is left. The tape counter, I noticed, seemed somewhat inaccurate. After spooling through the tape a couple of times the position on the counter no longer corresponded to the music, which is a trifle disconcerting.

The display also has an indication of the ID mode, and a light that flashes when the machine is putting down an ID. The screen also carries signal level information on a couple of peak reading VU meters.

Recording

The recording process appears to be simplicity itself. There is only one control, INPUT LEVEL in the form of a long slider across the bottom of the unit. There is a REC MUTE and a REC PAUSE button as well to assist in cueing.

It's difficult to know, without the manual, exactly how the input level is supposed to work. I recorded directly off a Sony D50 CD player into the analogue inputs, and achieved breathtaking results with the level set almost at the top of the scale, and equally good ones with the level set to the bottom. One would expect some difference in the signal to noise ratio, and indeed there may well be some measurable difference, but I certainly couldn't hear it.

Subjective

The D1000 is impressive. According to the paper that Pioneer sent with the player, frequency response is 3 Hz-22 kHz (at 0.5 db) (yes, that really is three Hertz), dynamic range is 94 db and wow and flutter are within 0.0001 per cent. On the basis of my subjective test, I see no reason to doubt the figures.

Unfortunately, I only had two tapes, one from Pioneer, was a compilation of Top 40 type hits, presumably recorded under ideal conditions, and the other was a blank tape for us to practise on. The prerecorded tape exhibited extremely wide dynamic range, and certainly very wide frequency response. The high and lows

were all there, without being either too bright or too boomy. In fact, people who have a horror of CDs because of the way they accentuate the higher frequencies may well be happier with DAT technology for this reason, because while the high frequency are definitely all there, they are not over emphasised.

On the other hand, one thing that DAT definitely does share with CD is a complete lack of extraneous noise. Even if you stick your ear in the speakers you will not hear any tape noise with this device.

Frustrations

The special circumstances of this review were rather frustrating, not only because we didn't have the time to carry out objective testing, but more so because I would dearly have loved to test some of the other claims made for DAT. For instance, I would like to have tested the quality of the recording process by using two DATs to copy back and forth so as to create a few hundred generations of tape. On the basis of this review, I would guess that the claims made for DAT, which is that you couldn't tell the difference, are probably true.

It would also be interesting to see whether recording through the digital input would give any appreciable advantage over using the analogue input as I was forced to do. Aiwa were able to produce a digitally recorded tape at their preview, and there was no noticeable increase in quality. I would guess the same will hold true of the Pioneer.

Conclusion

Overall, I was left with the feeling that digital audio tape technology is going to be worth the wait. Of course, everything in domestic audio electronics has to be weighted against the cost. Pioneer will sell very few if they put them on the market at \$5000, which would be the extrapolation of the current Japanese price.

On the other hand, when the squabbles between the electronics and recording industries are sorted out, and DAT goes into the USA, as it surely must before too long, mass production will really begin to happen, and the price will fall through the floor. To make DAT really competitive with CD players Pioneer need to put themselves in a position where they can sell the D1000 for \$1500 or less.

I, for one, can't wait.

READER INFO No. 134



The KEF reference series Model 107 speaker is one of the most outstanding and unusual loudspeaker systems to be released in 1987.

Kef Reference Series 107 Speakers



THE INNOCUOUS FRONTAL appearance of these speakers really belies their potential. It uses an unusually tall main cabinet which is beautifully finished with thick walnut veneer. The main cabinet has a volume of 72 litres and utilises the same twin coupled cavity base loading system that KEF previously developed for their 104/2 series speakers (see ETI Dec '84).

The main attributes of this system are that it uses a pair of 250 mm diameter woofers operating in a push-pull unit. These drivers have a common rod interconnecting the two magnet systems so that the non-linear forces, which would otherwise be produced are effectively cancelled. This tried and proven system has been further refined since 1984. It ensures that the primary distortion components generated by each of the drivers are dramatically reduced when compared with most conventional ported cabinet systems. One major difference between the 107 series and the 104/2 has been the repositioning of the porting aperture of the low frequency driver to a new position right up at the top of the cabinet. This is a far more sensible position than on the face of the cabinet.

The cabinet design has received more than the usual amount of attention. You soon begin to appreciate how much internal bracing, damping and multi-laminate stiffeners has been applied judiciously and scientifically to minimise cabinet resonance. Of course KEF pioneered the experimental techniques by which these materials can be optimally positioned. Since then virtually all other major speaker manufacturers have copied their techniques so that they can isolate the small differences and special requirements needed for a new design.

The mid range and high frequency system is based on the KEF Model 105 system. That system was (and most probably still is) one of the best mid range high frequency systems yet developed. In the new 107 series however, the combined head assembly has been re-engineered to provide greater stiffness, marginal increases in cabinet volume and quiet significant im-

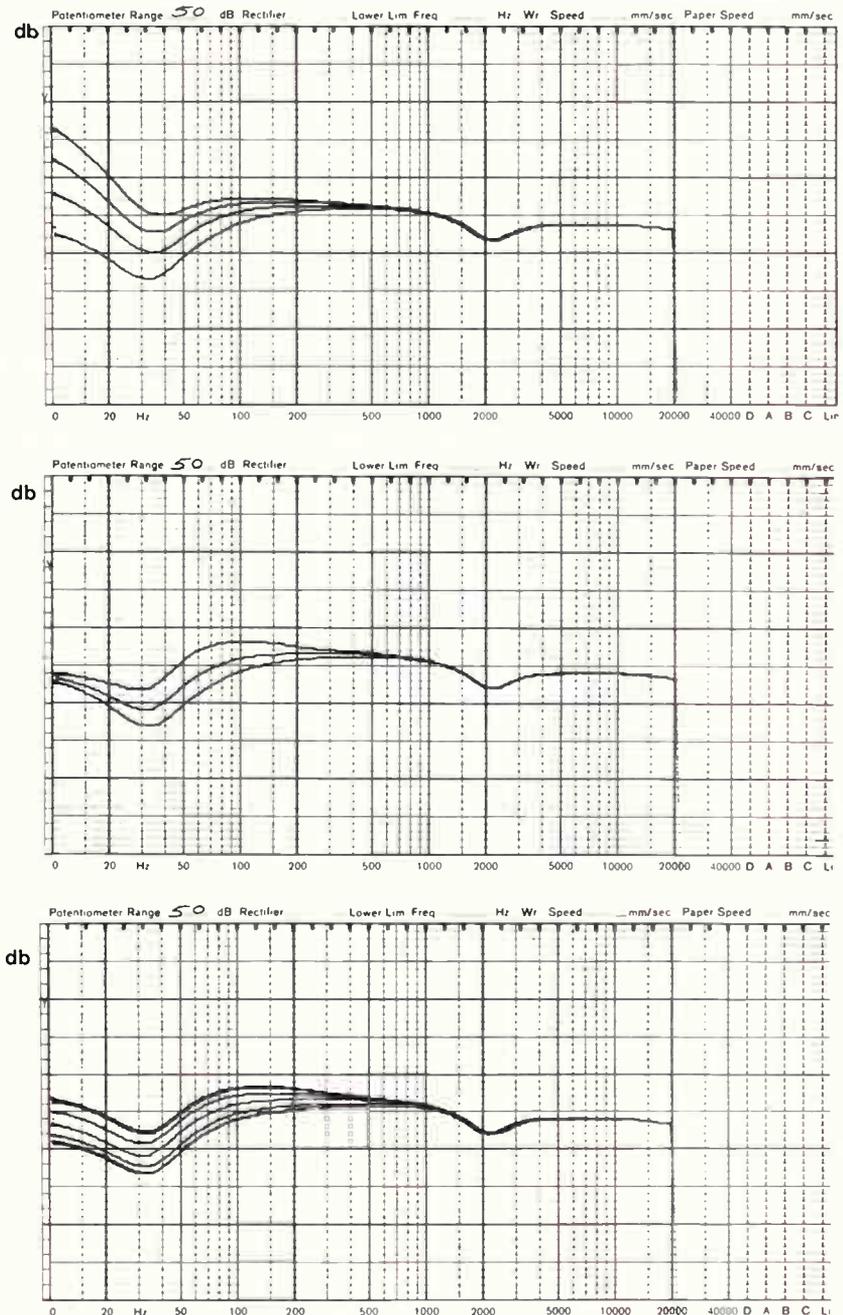
provements in damping as well. The acoustical performance of these items has been further enhanced by the use of new diaphragms, ferro-fluid damping in the tweeter air gaps and voice coils that can operate at significantly higher temperatures. All these factors naturally lend themselves to a significant increase in acoustical sensitivity.

Ultimate Performance

By providing the upward vented low frequency cabinet, that KEF describe as a 'coincident source' concept, KEF achieves what they describe as an 'optimised smooth dispersion sound field'. The sound emitted from this region is then propagated into the listening environment at just the right height. One inherent problem with the original 104/2 low frequency driver system was that it could not readily achieve the fully extended low frequency response which most users desired. As a result of user complaints, KEF decided to develop a supplementary system in order to achieve what they regarded as the 'ultimate' performance, i.e. a true 20 to 20 kHz band width capability.

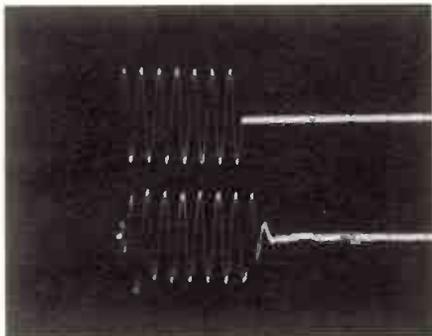
KEF's approach to this problem was to develop an active low level equaliser. This provides a series of adjustable fixed and variable low frequency equalisation contours to improve the limited low frequency response of the woofer system. The resulting filter unit is described as the *Kube*. This combines both active and passive networks in a small black box which is normally intended to be connected between the pre-amplifier output and the main amplifier input. As well as providing the low frequency equalisation, this unusual little box also provides KEF's now renowned 'conjugate load matching' system, which provides a simple, purely resistive six ohms load for optimum power transfer from the power amplifier to the speakers. It also allows you to connect

Dimensions: 1165 mm high x 330 mm wide x 448 mm deep.
Weight: 45 kilograms
R.R.P.: \$7500

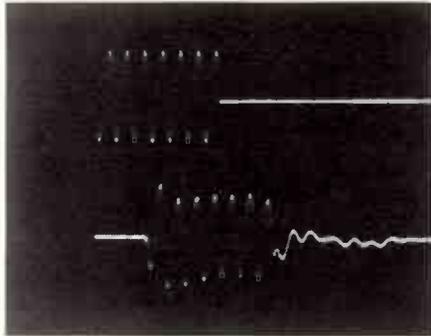


Performance of the Kube Low Frequency Equaliser. The top graph shows low end boost with $Q = 0.3$. The middle graph shows the effect of changing the Q and at bottom is a Q of 0.5 with differing contour settings.

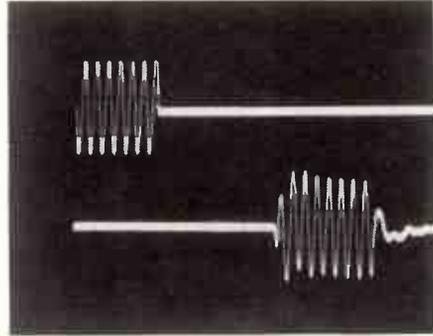
Upper trace is electrical input Lower trace is loudspeaker output



100 Hz (20 mS/div)



1 kHz (2 mS/div)



6.3 kHz (0.5 mS/div)

tape recorder inputs and outputs to avoid contouring effects.

Because the design engineers at KEF know that there is no such thing as a 'perfect room' they have incorporated a variable low frequency capability which allows you to vary the frequency characteristics with four variable low frequency cut-offs of 50, 35, 25 and 18 Hz. The filter unit modifies the response shape or Q of the boost circuit with values ranging from Q = 0.3 (overdamped), to 0.5 (critically damped) to 0.7 (flat). A third control allows the level of the low frequency boost to be set over a ± 3 dB range.

These specific features do not in any way emulate the base boost circuit of the amplifier. They are intended to tailor the characteristics of a speaker to match the limitations of the room in which they will be used.

Tests

The first series of tests were to assess the on-axis frequency response in our anechoic room.

This was conducted with the Kube controls set at the external 'I' position to assess the basic characteristics of the speakers without the addition of any sig-

nificant low frequency boost.

The performance is almost analogous to the measured performance that one would achieve with a KEF 104/2 series without the Kube. In this mode the measured frequency response from 120 Hz to 20 Hz is remarkably smooth; generally it's better than ± 3 dB on-axis. The results are nearly as good at 30° off the main axis. By providing the maximum low frequency boost characteristics from the Kube system, the low frequency end of the spectrum lifts up very nicely to provide a dramatic improvement in the 'low end response'. After looking at these preliminary

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6	31	56	81	106	131	156	181	206	231	256	281	306	331
7	32	57	82	107	132	157	182	207	232	257	282	307	332
8	33	58	83	108	133	158	183	208	233	258	283	308	333
9	34	59	84	109	134	159	184	209	234	259	284	309	334
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18	43	68	93	118	143	168	193	218	243	268	293	318	343
19	44	69	94	119	144	169	194	219	244	269	294	319	344
20	45	70	95	120	145	170	195	220	245	270	295	320	345
21	46	71	96	121	146	171	196	221	246	271	296	321	346
22	47	72	97	122	147	172	197	222	247	272	297	322	347
23	48	73	98	123	148	173	198	223	248	273	298	323	348
24	49	74	99	124	149	174	199	224	249	274	299	324	349
25	50	75	100	125	150	175	200	225	250	275	300	325	350

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results I decided to evaluate the frequency response characteristics of the KUBE system to find out how the individual controls actually modify the output spectrum. As you can see from the attached graphs, these operate in three different ways to achieve specific low frequency spectrum modification. The first of the graphs shows the ability to boost the low end response, particularly in the 10 Hz to 100 Hz region. The second graph shows the effects of varying the filter 'Q' over the frequency range 20 Hz to 200 Hz. The third graph shows how the three contour levels may be adjusted by ± 3 dB.

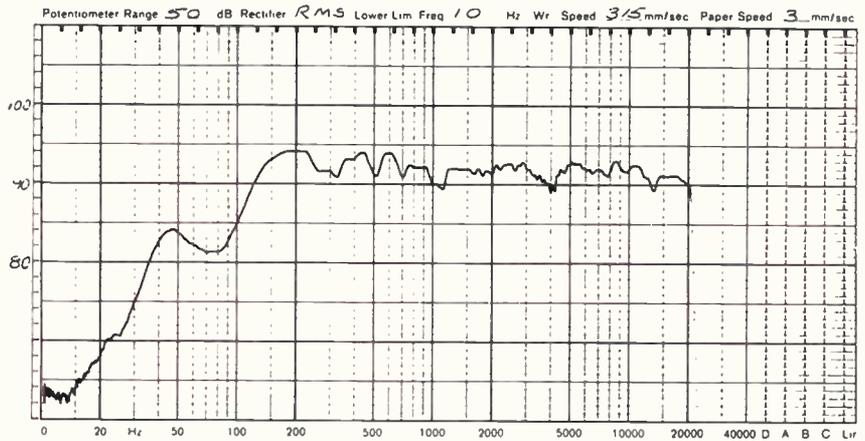
I went on to evaluate the phase response of the system which is exemplary. In fact, it is one of the smoothest I have yet seen. The speakers are phase aligned to produce a proper linear phase response by stepping back each of the drivers to achieve vertical source alignment.

The input impedance characteristics of the 107 series speaker are every bit as smooth as the 104 series whose characteristics they emulate. The nominal impedance of 6 ohms is maintained within ± 1 ohm all the way from 10 Hz to 12 kHz, only rising to 7.5 ohms at 20 kHz. By contrast, the tone burst evaluation of the

speakers reveals a little more jitter than I would have expected particularly around 1 kHz and this characteristic also showed up in the pink noise evaluation. The frequency characteristics around the 1 kHz region are not quite as smooth as they might be and this results in some measurable and audible colouration.

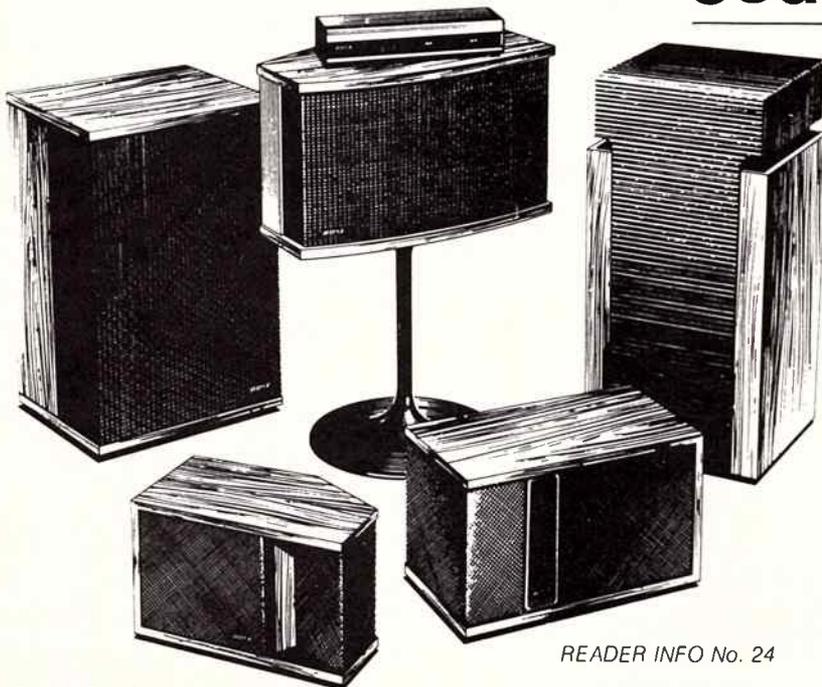
The decay response spectra of the 107 series speakers are exemplary. It features remarkably smooth response extending from 20 Hz to 20 kHz and useful performance extending out all the way beyond

25 kHz. The extent of natural cabinet or speaker resonance is remarkably low. Apart from a slight trace of colouration at 1 kHz the transient performance is quite exceptional. The polar plots measured at 1 kHz, 3 kHz, 6.3 kHz and 10 kHz are also exceptionally good with the bandwidth at 10 kHz being within ± 3 dB over a $\pm 30^\circ$ arc. Not surprisingly the distortion measurements provided by the system were exceptional at low frequency with only 0.7% distortion at 100 Hz for a 96 dB signal at 1 metre. By contrast the



Frequency response with controls set to mid position.

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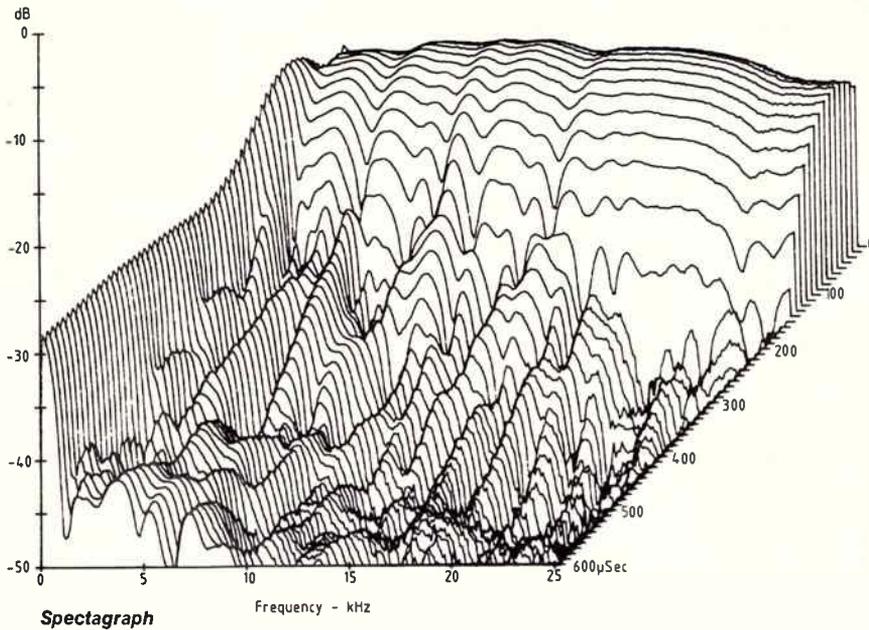
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KEF Speakers



distortion at 1 kHz was somewhat higher at 3.3% and again symptomatic of the colouration at that frequency. The high frequency distortion is quite low and the tweeter's performance is extremely good.

The system sensitivity is reasonably high providing 90 dB of output at 2 metres for a modest 6.6 watts of input power. The results of all of the primary objective tests revealed characteristics which should result in equally good subjective performance, if there is any correlation between the objective test procedures and our subjective assessment.

Subjective Pleasure

The listening tests on the KEF series 107's provided a number of evenings of true listening pleasure with the 107's providing a performance which few other loudspeaker systems can approach.

I listened to a very large number of pieces of classical music, pop music, rock music, organ music, tympany, violin, singing and orchestral music to evaluate the characteristics of these speakers at listening levels ranging between just audible and at sound pressure levels well in excess of 115 dB at my normal listening position.

For evaluation I used three exciting budget CD's from Virgin Records released under the IMP label which are really gems and well suited for this task.

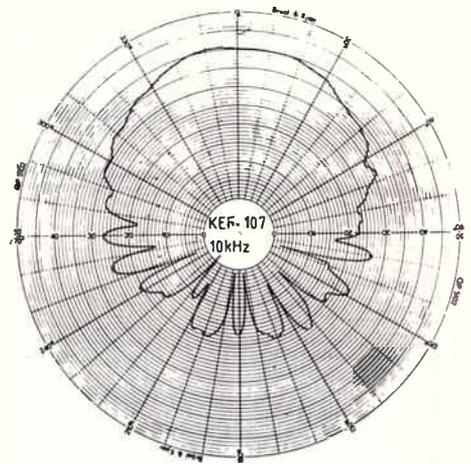
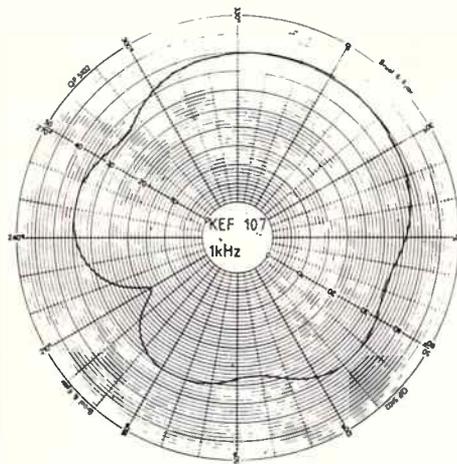
The first of these was "An Evening of Strauss" (PCD 856). Track 1 provides superlative high intensity bangs and pops in the "Champagne Polka". The speakers produced ear shattering sounds that were unbelievably realistic.

The second disc was Cristina Ortiz playing "French Impressionist Piano" pieces

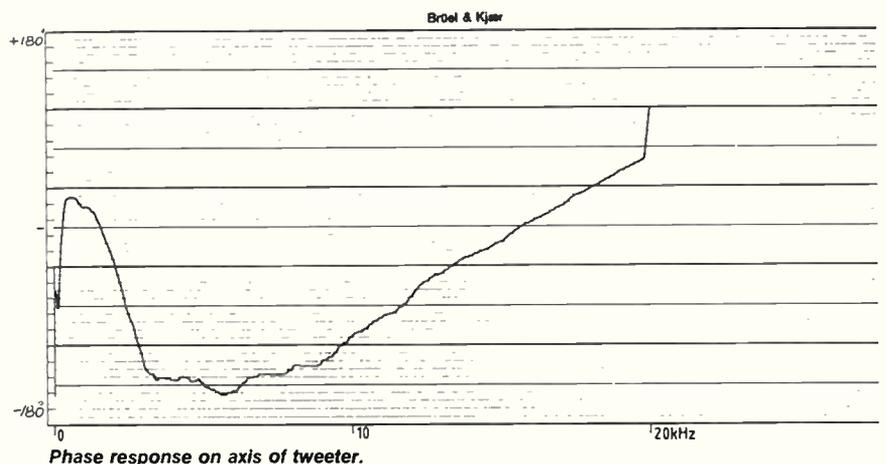
(PCD 846) which revealed the breadth and beauty of the KEF 107's classical capabilities. The third disc was the City of London Sinfonia playing "Mozart Clarinet Concerto and Flute & Harp Concerto" (PCD 852). This disc produced magnificent sound without any apparent trace of

MEASURED PERFORMANCE OF KEF MODEL 107

SERIAL No.	001789		
KUBE SERIAL No.	1783		
FREQUENCY RESPONSE:	20 Hz to 20 kHz		
CROSSOVER FREQUENCIES:	Not determined		
SENSITIVITY (for 90 dB average at 2m): 6.3 V r.m.s. = 6.6 Watts (nominal into 6 ohms)			
HARMONIC DISTORTION (for indicated level at 1m):	96 dB	96 dB	90 dB
	100 Hz	1 kHz	6.3 kHz
2nd	-45.6	-31.5	-55.3 dB
3rd	-46.9	-34.2	-53.2 dB
4th	—	-59.1	-60.0 dB
5th	-61.2	-51.9	—
THD	0.7%	3.3%	0.3%
INPUT IMPEADANCE			
100 Hz	5.6 ohms		
1 kHz	5.6 ohms		
6.3 kHz	6.2 ohms		
Min at 3 kHz	5.5 ohms		



Polar diagrams at 1 kHz (left) and 10 kHz (right).



Roland D50 Synthesiser Review



THE D50 IS a digital synthesiser. There's no ADSR, VCO, FM generators or any other analogue paraphernalia for that matter, in sight. I mention this point because some of the sounds produced by this synth have a warm analogue feel with a distinctive digital touch. So, how is it achieved?

According to Roland it's all done by LA Synthesis, which stands for Linear Arithmetic and is not related to Beverley Hills at all! The outcome of this technology — developed in a custom VLSI chip — is that the D50 is a sampler, analogue and digital synthesiser all in one keyboard.

Although the D50 can't actually sample anything, pre-recorded samples are stored digitally in the machine. These mainly

constitute the attack portion of various musical and percussion instruments and include some looped ones as well.

There are 100 PCM sampled waveforms in total of which number 1 to 47 are short percussive sounds such as marimba, vibraphone, harp, pianos and flutes. Numbers 48 to 76 consist of various looped samples and 77 to 100 are a combination of the previous samples in different configurations.

The theory behind this is that instead of synthesising the various waveforms, which takes a lot of complex processing, they have sampled the attack part of the waveforms only and synthesised the rest.

The D50 uses 20-bit digital to analogue

conversion which represents very high quality sound reproduction with low distortion and extremely wide dynamic range. Compact disc players currently only uses 16 bits. I'm not sure what sampling frequency was used but the samples sound crisp and convincing.

The PCM samples are stored in 4M bit of internal ROM and some of the samples are up to 256 milliseconds long.

Sophisticated software makes this machine very user-friendly. The overall result is that each parameter of a sound can be specified exactly and thus can be varied in a linear fashion. This is analogous to pushing sliders to vary an effect on a conventional synth. The sound generators, which

It's friendly, not wildly expensive and it sounds great. We're talking about Roland's D50 Linear Synthesiser. Our intrepid reviewer finds that this machine isn't perfect, but it's perfect for him . . . he actually bought one.

Terry Kee

can be either a PCM sample or synthesiser, are referred to as *Partials* and any two *Partials* can be combined in seven ways (*Structures*) with modulation to produce a sound, referred to as a *Tone*.

The dual mode, which uses two *Tones* or four *Partials*, is probably the most interesting as you can layer four sound generators to create a final sound that is rich in texture. Imagine . . . a breathy flute attack with a bell-like orchestral string! The individual parameters of the *Partials* can be varied. The synthesiser sections can be considered to have the conventional square, sawtooth and pulsed waveform generators, a filter section, envelope generators and an amplifier. The PCM section has an envelope generator and an amplifier but no filter.

Roland has opted to introduce their own jargon for the D50 — filters are referred to as Time Variant Filters (TVF) and amplifiers as Time variant Amplifiers (TVA). However, these can be visualised as the basic building blocks used in conventional analogue synths.

Facilities

The D50 has a 61-key, pressure and velocity sensitive keyboard with a programmable split point and four main keyboard modes. In the whole mode the upper *Tone* can be played with 16-note polyphony and in the dual mode both the upper and lower *Tones* are played in eight-note polyphony.

The split mode appeared to be quite attractive as the D50 performs as two separate synthesisers that can be accessed on two separate midi channels. The keyboard is divided into an upper and lower sections where the two *Tones* can be played separately in eight-note polyphony. This mode turned out to be rather disappointing as I got quite used to the full texture of the dual mode and a single *Tone* sounded thin in comparison. Various other monophonic keyboard modes are also possible.

Programmes to set up the sound parameters are stored on a memory card (about the size of a credit card) which is inserted into the card reader situated at the top left hand side of the panel. A maximum of 64 patches are available per card and there are a further 64 patches stored in 256k of RAM internally. This makes a grand total of 128 different voices

to be accessed at any one time.

Operation

So how easy is it to make all this wizardry come to life? On the front panel there are two rows of eight buttons labelled Patch Bank and Patch Number. On powering up the D50 for the first time, I found that the internal memory had the same 64 factory presets as on the card supplied with the machine. It was thus a simple matter of pressing the bank and patch buttons to select different voices.

Communication to us humans is via an 80-character LCD display that is sufficiently illuminated to operate even in the darkest corner. In the normal play mode the name of the patch, key mode, split point, volume balance between the two *Tones*, the names of the *Tones*, and the patch and bank number are conveyed. In addition, it informs us whether the patch is selected from card or internal memory.

Aftertouch is programmable and can be routed to pitch, vibrato, timbre and volume. A slider allows overall sensitivity to be adjusted.

Next we come to a button labelled Chase. When it is pressed the lower *Tone* is delayed relative to the upper *Tone* so it sounds like one *Tone* chasing the other, not unlike echoes in a digital delay line. Chase parameters are programmable and

this effect could be useful for hot solos that need echos at the right moment. A red LED lights when the button is activated.

On the back panel there is, of course, MIDI IN, Out and Thru.

Effects

Something which really separates the D50 from most of the competition in this price range are its on-board effects. Digital stereo reverb, chorus and 2-band parametric eq are all included and being digital don't detract from the sound quality.

However, the trade-off is that the effects cannot be accessed externally, so you cannot plug in a guitar to tap off some of the reverb. Having analogue-to-digital converters at the front end would probably raise the price of the machine dramatically.

All of the effect parameters need to be programmed along with the other sound parameters that make up a patch. It is a pity that bypass effect switches are not made accessible on the front panel. But it didn't take long to get to the reverb parameters and adjust the delayed to straight balance to get rid of the reverb. Selecting another patch will erase the adjustment though and you will have to repeat the procedure, unless you write the changes into memory.





The stereo reverb can be configured in four modes. By assigning reverb to a mixture of the two Tones with stereo outputs, having reverb on one channel only and the direct signal on the other or by having reverb on one of either two Tones only. There are 32 different types of reverb ranging from small halls to large caverns with cross-delays, gated reverb, delay and stereo panning effects thrown in. The sound quality is very good indeed.

There are eight basic chorus effects (including some flanging and tremolo). Rate, depth and balance are programmable. The 2-band equaliser allows adjustment of frequency, gain and width.

Editing

If you are familiar with analogue sound synthesis, you won't find editing the D50 difficult. The parameters are set out in pages that can be scrolled. The values are then altered by using the joystick for large changes, increment and decrement buttons for finer changes or the 10-key pad. There is a Compare facility.

The edited data will not automatically rewrite the previous data but the edited version will be erased when a different patch is selected or when the power is switched off. I found this extremely useful for mucking about with the parameters and not having them committed to memory. Any patch that you want to keep can be written into one of the 64 internal memories or onto a blank memory card which is available as an accessory.

Data cannot be written into the card supplied with the D50 as it is a read only card. The memory card can also store up to 16 different reverb types.

The PG 1000 programmer for the D50 is an optional item that is worth considering if you intend to do some serious programming. It is linked to the D50 via MIDI and makes parameters accessible directly on 56 faders. I counted them!

Making sound

Some patches on the PN-D50-00 card supplied with the D50 can only be described as being very impressive. Patches called

Fantasia and Future Pad had bell-like attack waveforms that sparkled with clarity and depth. It soon became obvious that the D50 could produce unique sounds. The percussive effect of the PCM samples and warmth of the synthesised section exhibited a good blend of digital and analogue.

It was also an easy matter to edit the sound to turn the D50 into an analogue synth. There are several string sounds that are very rich and warm in character, following in the tradition of most Roland string sounds. But the D50 goes further with more classical orientated orchestral strings such as Arco, Legato and Combie strings with various bowed and plucked attack PCM samples.

With the aftertouch keyboard orchestral strings with heaps of dynamics can be created. The LA principle also works particularly well with the breathy voices such as Flute, Bottle Blower and the brass sounds. In general the presets on this card produces patches that are atmospheric and ethereal and are particularly suited to soundtrack work. I would have liked to have more bass and piano type sounds.

My thirst for those very instruments was soon quenched after I received two more cards from Roland. The PN-D50-02 card comes armed with the decay type voices such as piano, harpsichord, bass, plucked, tuned percussive, percussive and sound effects. The PN-D50-01 card has the sustain group of sounds such as strings, brass, woodwind, organ, harmonica, sax and synthesiser.

Like most factory presets some of the sounds were stunning but there are a few that are unusable. Patch number 63 on the 02 card must be the worst snare drum I've ever heard! Some patches did exhibit some fizzy noise that seemed to follow the envelope of the waveform, but it is not obtrusive enough to be a problem. On the positive side most of the sounds are good and I was happy with the majority of them.

Conclusion

It won't be long before we start identifying D50 sounds on the charts, just because they sound so different. Top marks to Roland for that. And easy programming will no doubt encourage a new and exciting sound library. The D50 could definitely set a new standard in digital synthesisers.

RRP: D50 — \$2995
 PG-1000 Programmer\$695
 PN-D50-01 and 02 Memory
 Cards \$125
 Blank Memory Card \$125
 Distributed by Roland Corporation. ●

Reviews

Discs

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Title — Les Misérables
Artist — The London Cast
Producers —
Label — Festival
Cat No — 70255/6

Great Musicals seem to be the order of the day. First there was Webber's magnificent *Phantom of the Opera* and now we have the musical adaptation of Victor Hugo's *Les Misérables*. The score for this work was written by Alain Boubil and Claude Michel and the lyrics were translated by Herbert Kretzner and James Fenton.

As with the *Phantom*, *Les Misérables* presents the listener with both a superb story and excellent music. Based around the revolution of 1848 the musical concerns the life of the ex-convict Jean Valjean as he tries to introduce some humanity in his brutal surroundings. His personal tragedy is echoed in the catastrophe which overwhelms his divided country. The music Boubil and Michel have chosen to express the many complex events and emotions of Hugo's classic is both rich and varied. It ranges from the grim *Work Song* which opens the work to the more delicate and rich *On My Own* and *Empty Chairs*.

The cast does full justice to the work. Colm Wilson who plays Valjean sings with a voice

full of power and strength, he is a delight to hear as is Ian Tucker in the lesser role of Gavroche. All the cast display a refreshing degree of enthusiasm which is vital in such a project if the result is not to be a maudlin melodrama.

Simon O'Brien

Title — Famous Blue Raincoat
Artist — Jennifer Warnes
Producers — C. Roscoe Beck and Jennifer Warnes
Label — RCA

To appreciate *Famous Blue Raincoat* you had better like Leonard Cohen. He only actually appears once on this album but he wrote all the songs and his presence and style pervade the whole CD.

This is not to say that Jennifer Warnes does not bring her own interpretation to his works. The initial track *First We Take Manhattan* receives a spirited treatment from Warnes which has made it a minor hit. The other 8 tracks are considerably slower than this one and are more easily fitted in to the traditional Cohen style. Warnes demonstrates clearly her vocal skill and clarity on each. A particular highlight is *Song for Bernadette* whose lyrical rich-

ness is nothing short of remarkable.

Famous Blue Raincoat will appeal to those who like good singing, powerful lyrics and an easy listening style. Well worth a listen.

Simon O'Brien

Artist — Mick Jagger
Title — Primitive Cool
Producers — Mick Jagger, Dave Stewart, Keith Diamond

Mick Jagger's second major solo excursion, while no masterpiece, is consistent with what we have come to expect from this rock veteran of over 20 years.

Gone is the angry young man and in place is a sophisticated artist still doing what he knows best, making music.

With help from his friends Dave Stewart (Eurythmics) and Jeff Beck, Jagger has produced an album of basic guitar oriented rock tinged with some unusual influences. For instance, how many mainstream artists use original, not sampled, gamelan drums and uilleann pipes (Irish bagpipes) these days?

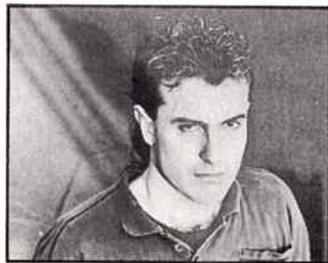


The better tracks are *Throwaway*, a classic rock track with a catchy chorus and subtle guitar phrasing, *Primitive Cool*, the most adventurous and interesting track with a funky bass line and nice use of brass and vibes, *Peace For The Wicked*, a fast paced more menacing song with a great bass and drum feel and *Say You Will*, a slower ballad style

number with tasteful classic guitar phrasing.

With this release Jagger confirms his status as a contender in a ring where, with his old band, he was once the champion.

One for the fans. Mark Lewis



Artist — James Reyne
Title — James Reyne
Producer — Davitt Sigerson
Label — Capitol/EMI
CDP 746941 2

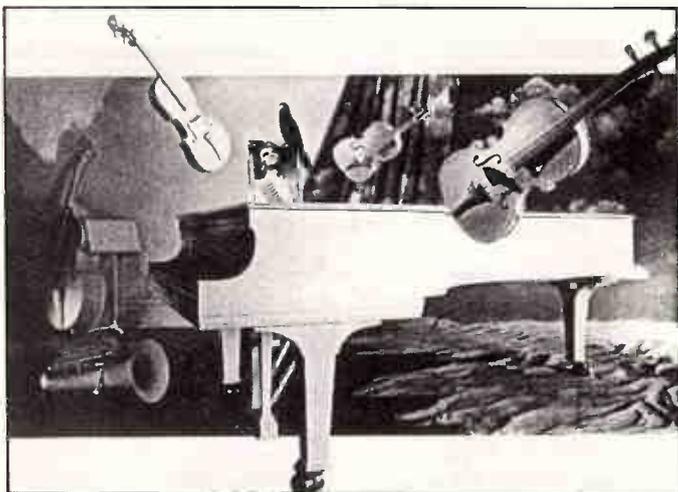
This self titled debut album from the former Australian Crawl frontman represents a quantum leap in sophistication from his work with that band.

He still retains his sardonic lyric style but with a wider, less parochial flavour. The music also has been tightened up and improved while still sounding similar to his old band. For any Aussie Crawl fan this release is a must. Even if you vaguely enjoyed any of their previous songs this release provides what they promised and for a variety of reasons failed to deliver.

The better songs are *Fall Of Rome*, a pacy guitar orientated rock number with an interesting lyric, *Always The Way* a well produced big ballad where Reyne really extends himself vocally. *Land Of Hope And Glory*, a fast boogie tune with great bass and guitar sounds, *Coin In A Plate*, a slower poignant ballad with tasteful synth effects.

Hopefully this release will push Reyne into a wider market and bring the success that this hard working performer justly deserves.

Recommended. Mark Lewis



Title — Elton John and the Melbourne Symphony Orchestra
Artist — Ditto
Producer — Gus Dudgeon
Label — Phonogram
Cat No — 832 470-2

Anyone who is a fan of Elton John and who follows his career closely will know that he regarded his 1986 Australian concerts as among the greatest highlights of his career. All in all he gave 27 performances and this recording is taken from the last given at the Sydney Entertainment centre on December 14, 1986.

Elton's voice is not at its best on this album but that is hardly surprising since he was recovering from a severe cold at the time. With that understood this is still a great disc and a must for all aficionados of Elton and his work. Each song is played and sung with the skill and professionalism that John never tires of producing.

The album is skillfully arranged with the quieter pieces at the beginning and the rockier numbers at the end. This has the air of leaving the listener with a feeling of hope rather than melancholy. Highlights are *Sixty Years On* with its mysterious lyrics, *Have Mercy on the Criminal* and *Take Me to the Pilot*.

The Melbourne Symphony Orchestra's accompaniment is extremely tasteful and definitely enhances rather than clutters the tracks. Both it and John can take credit for a job well done.

Simon O'Brien



Artist — Eric Clapton
Title — August
Producers — Eric Clapton, Tom Dowd, Phil Collins
Label — Warner Bros
Cat No — 925 476-2

It is heartening to see Ol' Slowhand still putting out quality albums and with all the guitar playing he has done over the years has not developed RSI or anything similar. This release begins a collaboration with Phil Collins who assists with both drumming and production duties. The partnership works admirably.

Clapton is absolutely in touch here, although do not expect a Clapton of the Cream dimension. What you can expect is a well produced album of lucid guitar orientated blues and rock music from a man who appears at ease with his life and talent.

All 12 tracks on this CD I found enjoyable. In particular, *It's In The Way That You Use It*, an infectious big production movie title song with keyboard assistance from Gary Brooker of Procul Harem fame, *Bad Influence*, a relaxed soft rock tune with a nice horn arrangement and a weaving guitar solo. *Miss You*, a terrific track with Clapton in full guitar and vocal flight, and *Holy Mother*, a slower spiritual style number dedicated to the late Richard Manuel (The Band) featuring a soaring blues guitar solo.

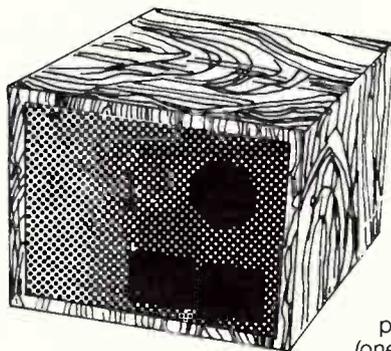
This ambiguously titled release aptly describes an artist who has experienced first hand the many ups and downs of today's popular music and emerged with his credibility and reputation intact.

Recommended. Mark Lewis

ADD A BASE OCTAVE OR TWO

A small 2-way speaker has many advantages over larger systems. Stereo imaging is often better because of the smaller front baffle. But lack of deep bass is the price you have to pay - but no longer!

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vifa

READER INFO No. 26



Title — The Name Of The Rose
Distributor — CEL
Length — 128 mins
Rating — M
Standard — ★★★★★

Your humble reviewer is something of a helot and I thoroughly enjoyed this offering. But, a mate of mine, who has read the book, said the film was not a patch on the literary offering. But, to be brutally frank, mine is the opinion that counts. This medieval thriller perfectly captures the cloistered atmosphere of the time and the intrigue does not let up for a moment. Sean Connery is perfectly cast as the Sherlock Holmes of the past, superbly

blending humour, horror and wit in the one role. F. Murray Abraham is the very personification of Tomas de Torquemada and his menacing presence pervades the film. Atmospheric, intriguing and fascinating, the film comes highly recommended.

Peter Brown

Title — Triplecross
Distributor — Crystal
Length — 97 minutes
Rating — PG
Standard — ★★

This offering can't seem to make up its mind whether it should imitate Moonlighting, that vapid tele-offering, Miami Vice or the Blues Brothers. In the end, it achieves nothing. This is a glossy plot of three ultra-rich ex-cops who seek out the toughest cases for the sheer thrill of it. Here we have a case involving the international art world, baseball, card tricks, old cars, Hollywood and a professional hit man. You would think that with all these ingredients, it would have to be a hit, but such is not the case. The dialogue is forced and inane, some of the stunts are passable and the alleged mystery of the plot is mindless in the extreme. Boring throughout. Stars Ted Wass, Markie Post, Gary Swanson and Barbara Horan.

Peter Brown

Title — Death Before Dishonor
Distributor — Roadshow
Length — 90 minutes
Rating — R
Standard — ★★

Let's get one thing straight. This movie will make a zillion at the video box office, despite being one of the worst examples of its kind yet seen by this reviewer. This is another of those Marine efforts where the boys in green massacre all and sundry in the name of Mom and Apple Pie. This time, the action takes place in

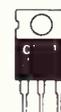
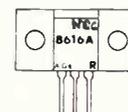
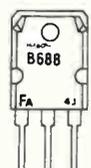
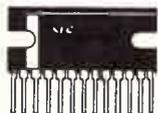
some anonymous Middle Eastern clime. The Arabs are predictably greasy, the Yanks are the good guys and democracy is saved for another day.

Buckets of gore, stunts aplenty and more explosions per film foot than one would have though possible. But, this sort of movie is dynamite on the video shelves and so, despite my less than enthusiastic ravings, this one is sure to be a winner. Warlike and predictable. Starring the eternally mumbling Brian Keith and a host of forgettables including Fredy Dryer, Joanna Pacula and Paul Winfield.

Peter Brown



JAPANESE SEMICONDUCTORS



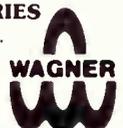
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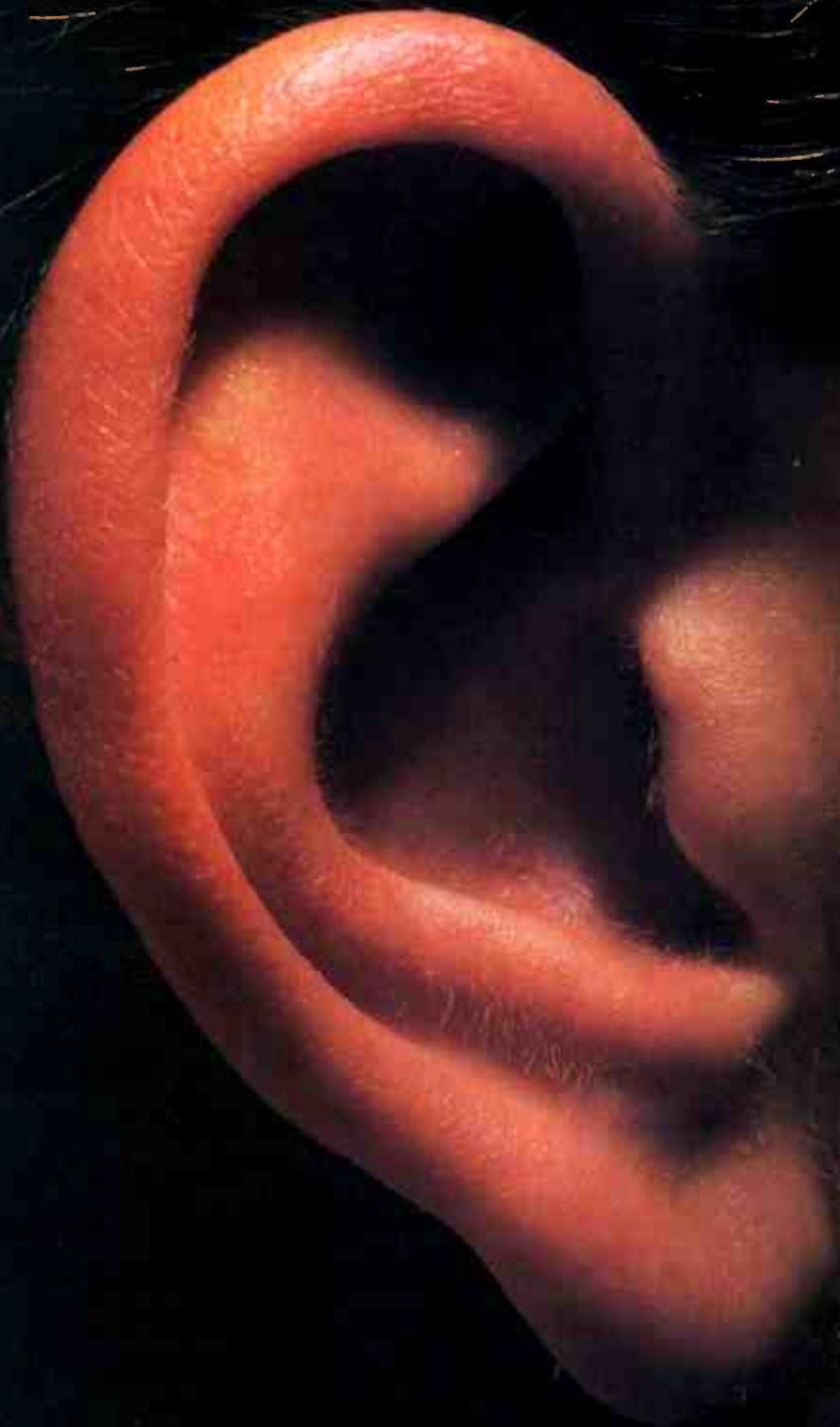
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READER INFO No. 27



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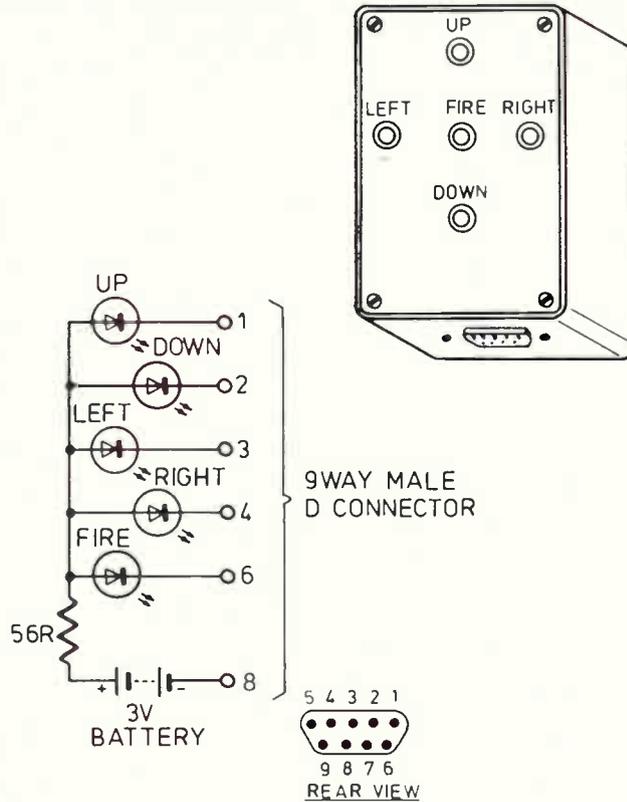
Joystick Tester for C64/128

Here is a handy device for C64/128 owners to test their suspect joysticks. This simple and easy to use tester will check for continuity of the plug and lead, also the operation of the directional switches and fire button can be tested.

Circuit operation relies on the switches in the joystick to direct current flow to the selected LED. Two AA 1.5V batteries power the circuit and the 56 ohm resistor limits the LED current to about 20 mA.

Construction is quite straightforward with all the components housed in a small Zippy box. The LED's are fixed to the front panel with clips or epoxy glue, in a pattern corresponding to the direction of joystick movement. The battery holder for the two AA batteries sits on the bottom of the box, held in place with foam blocks. I used a short length of colour coded ribbon cable for the interconnections between the LED's and the 9 pin male D connector. A battery clip with flying leads connects the batteries via the limiting resistor to the circuit.

As a bonus the joystick tester is small enough to



carry in your pocket to test those 'bargain' joysticks for sale at User Group meetings.

J. D. Glatter
Port Noarlunga South, SA

Idea of the Month

A "Minder" For Memory Backup NiCd Batteries

Here's a circuit that will keep tabs on an infrequently or little-used Nickel-Cadmium battery pack and maintain it in "topped-up" condition.

The circuit is intended for application where the battery is unused in the presence of "main" power. My specific application was to incorporate the circuit and battery into my Microbee computer as the RAM backup battery system. The top-up charging sequence is automatically initiated each time main power is applied.

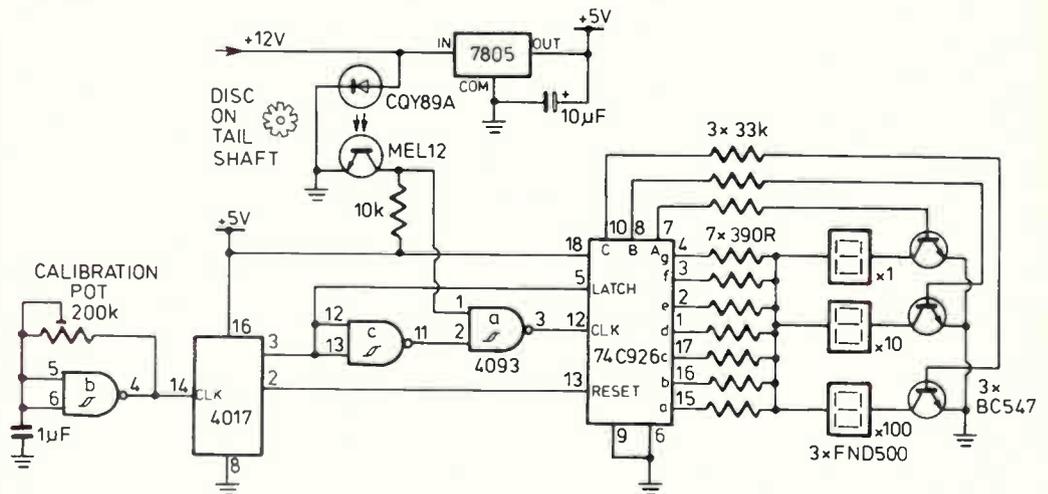
The circuit uses a 555 timer IC in a slightly different role than "normal" and uses a "variable zener" diode as an adjustable voltage reference. ICI, VR1 and R1 maintain the voltage at pin 5 of the 555 at a level determined by the setting of VR1, between 4 and 6 volts. The

Digital Car Speedo

This circuit centres around the 74C926 CMOS 4 digit counter, drive and multiplexer ic. The 74C926 counts sensor pulses from a sensor mounted on the tailshaft of the car over a given time period. The 4017 is being clocked by a Schmitt trigger NAND gate set up as an oscillator. The frequency is determined by the 200k calibration pot.

The tailshaft sensor that I used was an infra red LED and a photo transistor with a chopper disc mounted inbetween them. With the speedo calibrated at 60 km per hour, I found it to be accurate from 20 to 180 km per hour.

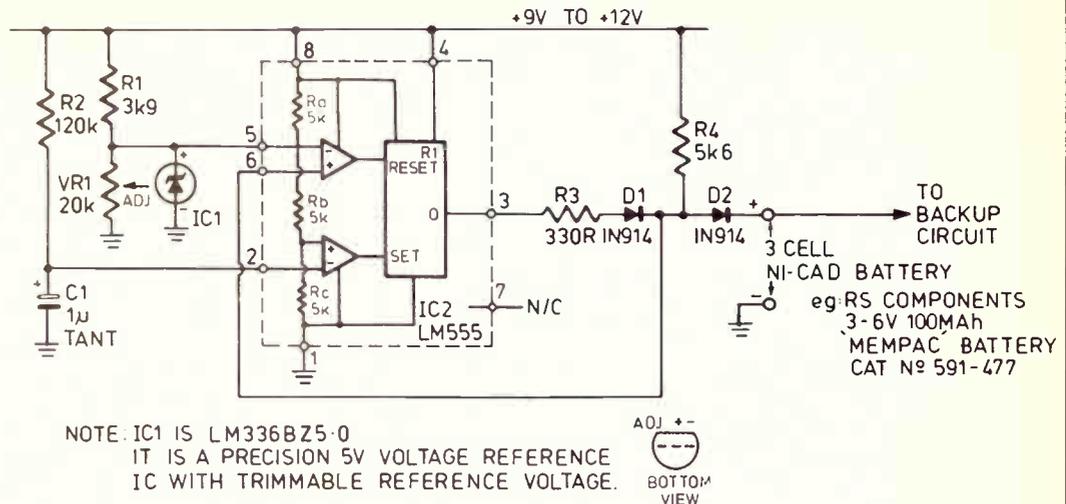
B. Harvey,
Southport,
QLD.



non-inverting input of the lower or "set" comparator is therefore held at half this value due to the voltage divider action of 555 internal resistors Rb and Rc.

At switch-on, R2 and C1 momentarily hold the inverting input of the "set" comparator (pin 2) at a low level (lower than half the reference set at pin 5) and cause a "set" pulse to be applied to the 555's flipflop stage, sending its output (pin 3) high and causing charging current to flow from pin 3 via R3 and isolating diodes D1 and D2 to the battery.

NiCd batteries exhibit a slight rise in terminal voltage as they approach the 100 per cent charged condition. The battery terminal voltage (plus the forward voltage drop across D2) is monitored and compared with the present reference voltage maintained at pin 5 of the 555. When the rise in terminal voltage is detected, indicating "Full charge", the "reset" comparator of the 555 sends a reset pulse to the flipflop, causing its output (pin 3) to



go low, turning off the main charge current. Trickle charging is then maintained via R4 and D2.

D2 prevents discharge of the battery through the charging circuit in the absence of "main power", and D1 prevents the R4/D2 junc-

tion from being pulled low by the low output state of the 555.

R3 and R4 are chosen to provide the desired "full" and "trickle" charge rates respectively.

Note that, in accordance with usual practice, the NiCd

battery should periodically be given a full discharge/charge cycle. Also note that IC1 is an LM336BZ5.0, not the more common LM336AZ22.5 type.

**R. J. Martindale,
Hill Park,
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:

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

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

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

'Idea of the month' contest

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

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



RULES

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

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

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

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

COUPON

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

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

Title of idea/program

Signature Date

Name

Address

Postcode

Letters to the Editor

Being a muso and a terminal junkie I would like to see more audio projects and effects units for guitars and more useful projects for the Commodore 64. A MIDI adaptor and/or Viatel/BBS Modem would be fantastic. Perhaps an audio project could be included in the Sound Insights section each month. Please also publish more 'ideas for experimenters'. Congrats on a great mag, keep up the good work!

Sean Rodden,
Sydney, NSW

I am happy to say that your magazine is the best and most comprehensive electronics magazine my money could buy.

I have but one complaint, I wish you had more competitions, eg, mathematical problems and electrical circuit ideas. I enjoy the new prod-

ucts section and like to build your circuits as a challenge.

Emmanuel Kopsaftis
Springvale, Vic

Please maintain a higher standard of project design and higher number of projects per edition. Most people do not like to buy magazines from O/S just to get a decent circuit or project. We have the capability here to produce these.

Michael Kyrannis,
St Albans,
Vic.

More of the same please and could you supply information for backyard inventors on getting their inventions off the ground. Such info might include patenting information, financial assistance and marketing.

Mark Walpole
Wilston, Qld

Re. Marketing I believe many would appreciate an extra discount on subscriptions rather than the cheap gimmicks offered as inducement. How about offering an option on gimmick version discount?

M. Blake,
Karratha, WA

We are the Bundaberg Commodore Computer User Group (BCCUG) and we meet on the first Sunday of the month in the library at Bundaberg West State School between 10 am and 2.30 pm. For information, contact Jan Kretschmer on (071) 72 7098 or Marion Cheshire on (071) 72 7794.

Marion Cheshire
Secretary,

I am writing to inform you of the Tumut & District Amateur Radio Club. The club meets

each Wednesday at 7.30 pm at the Tumut High School and is open to all ages and all levels of experience.

Club President is B. Minogue VK2DPZ.

The club expects to have its VHF Repeater in operation in the next few weeks Rx 146.800 Tx 146.200 please give us a call if you are in the area.

Butch Champman
VK2BYS (Publicity Officer)

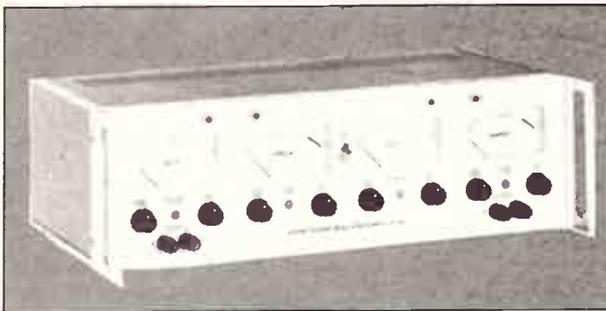
Minimart

FOR SALE: Vectorscope and Waveform monitor, matched pair, excellent professional model made by Systems Video in England. \$3850 for both. Phone Ross on (07) 801-1321.

LABORATORY POWER SUPPLIES

APLAB offer a complete range of regulated DC bench rack power supplies combining high precision and regulation capabilities with continuously adjustable outputs.

Designed with single, dual and multiple outputs, these power supplies can be used in either constant voltage or constant current mode of operation.



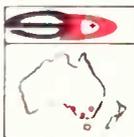
Standard models include:

SINGLE OUTPUT

OUTPUT: Output VOLTAGE: Current
0-30V 0-1A to 30A
0-70V 0-2A to 10A

DUAL OUTPUT
0-30V 0-1A to 2A

MULTIPLE OUTPUT
0-30V 0-2A to 5A



SCIENTIFIC DEVICES AUSTRALIA PTY. LTD.

VIC 2 JACKS RD. SOUTH OAKLEIGH 3167

PHONE (03) 579 3622 TELEX AA32742

NSW 559A WILLOUGHBY RD., WILLOUGHBY 2068

PHONE (02) 958-8064 TELEX AA22978

S A 31 HALSEY RD., ELIZABETH EAST 5112

PHONE (08) 255 6575 TELEX AA88125

**EX
STOCK**

High-Performance Cache Controller

Austek Microsystems has announced production of the A38152 Microcache, designed to dramatically boost the processing speed of Intel's 80386 microprocessor.

The Microcache is suitable for use in high-end personal computers and accelerator cards employing Intel's 80386 microprocessor. It is also suitable for use in other 80386-based systems, such as engineering workstations, network servers and standard bus processor cards (eg Multibus and VME).

The A38152 is Austek Microsystem's first major commercial release of a mainstream

microprocessor peripheral chip. Until now, the company has concentrated on producing very large scale integrated circuits (VLSI) in small batches for specific clients.

Major features of the A38152 include total control of a 32 K-byte capacity cache control memory, operation at speeds of 16 and 20 MHz (with 25 MHz version planned), a direct interface to the 80386 microprocessor, a direct interface to 4 8 K-bit x 8 bit static RAM chips, full 32 bit addressability for 4 G-byte memory support and cache coherency support.

READER INFO No. 112



Olex release Multiplexer

Olex Optical Networks has released its own Australian designed and manufactured optical fibre multiplexer.

The multiplexer comes in two models, the FOM 2400 and the FOM 4800, which have 24 and 48 channels respectively. It provides high speed data communication of up to 19,200 bits per second for 48 channels over distances up to 3 kilometres.

The FOM 4800 can accept up to 48 connections and channel the asynchronous data into a single stream for

fibre optic transmission.

The optical fibre multiplexer system has applications for joining computer terminals and printers at a distance from a host computer. It provides the backbone for local area networks.

Typical cost for a 48 channel system, including cable connection and a pair of FOM 4800 multiplexers installed over a distance of between 500 metres and one kilometre, is around \$200 per channel.

READER INFO No. 113



New Portable Oscilloscopes

Parameters have just revealed their own new range of oscilloscopes for 1987. This new family of Parameters scopes covers the main general purpose market from 15 MHz to 40 MHz.

The Parameters range starts with the PA 615S 15 MHz "super portable" dual trace oscilloscope. This instrument offers 2 mV sensitivity up to 15 MHz, automatic selection of chopped or alternative modes, plus automatic selection of TV line or frame display. Built into this 5.5 kg package is the choice of ac, external ac (11 V-30 V) or built-in Ni CAD battery operation. Complete with handbook, 2 x 10:1-1:1 probes and 12 months warranty, the PA 615S is meant for "field" maintenance applications.

The Parameters 5502 20 MHz 2-channel oscilloscope provides 1 mV sensitivity, built-in component tester, CH 1 output for use with a frequency counter, and variable trigger hold-off for observation of waveforms with complex trigger points. In addition, TV line and TV frame trigger is standard. The 5502 has a very effective low cost/high performance aspect and is supplied with handbook, 2 x 10:1-1:1 probes and a full 12 months warranty.

Next in the Parameters range is the 5504 40 MHz 2-channel, dual timebase oscilloscope. This scope offers maximum features at a minimum cost. Some features include 1 mV sensitivity, channel 1 output, variable hold-off, delayed time base, single sweep operation and scale illumination. The 5504 com-

plements the maintenance engineers working in telecommunications, computers, TV and the industrial control field. As with all Parameters oscilloscopes, the 5504 is supplied with handbook, probes and a full 12 months warranty.

READER INFO No. 114

CRT Monitor

Mitsubishi has announced the release of a new CRT monitor claimed to be the world's largest.

"The 37-inch (94cm) intelligent display monitor could signal the end of dedicated-application monitors," said John Spence, Manager, Electronic Components for Mitsubishi Electric.

With autotracking between 15.0 and 31.5 kHz horizontal and 40-75 Hz vertical, the monitor will automatically maximise display size. Further, a wide range of inputs (PAL, composite video, RGB analogue and RGB TTL) means a broad range of applications is possible.

The large monitor series, the XC3720, is equipped with a built-in audio amplifier and loud speakers, and can run off a camera, VCR, video disk or television tuner (receiver), as well as computer terminals, word processors, etc ... all providing big screen visibility.

The monitors have already been released in several major world markets and are in use in locations such as the London Stock Exchange, by the Bureaux de Change at Singapore Airport for display of foreign exchange

rates and other financial information, and also in one of the world's largest shopping centres in California.

READER INFO No. 115

For more information on a product circle the reader information number as quoted at the end of the news item on the reader information card and forward the card to ETI Reader Information Service, PO Box 227, Waterloo, NSW 2017.

A Compatible Flash

The ADC-304 is an 8-bit, 20 MHz analogue-to-digital flash converter, it is claimed to offer many performance features not obtainable from other flash A/Ds.

Key features of the unit include a low-power dissipation of 360 mW and TTL compatible outputs. A wide ana-

logue input bandwidth of 8 MHz (-3 dB) allows operation without the need of a sample-hold. Also, single +5V supply operation is obtainable with an input range of +3 to +5V, eliminating the need for an additional power supply. A 0 to -2V input range is available with ±5V supply operation.

Another apparently novel feature of the ADC-304 is the output coding is user-selectable. The MINV and LINV pins allow selection of Binary, Complementary Two's Complement, Complementary Binary and Two's Complement coding.

READER INFO No. 116

ALIAS/1

ALIAS/1 is a potential 3-dimensional image simulator, a sketch pad, illustration studio, and model shop all contained within a fast, flexible computer package.

This new generation computer system combines 3-D geometry, powerful image, computing and ALIAS/1 software to meet the needs of the designers, all interfaced to the world of CAD/CAM.

ALIAS International Sales Vice-President Dave McCreae says, "When developing ALIAS/1 computer hardware and software experts collaborated to develop a 3-D design and animation system that knew how designers really worked, instead of having to turn designers into computer programmers. Because ALIAS/1 was created for people who trained visually, the time it takes for a designer to become productive is minimal. From its first day of use the system encourages the creative process".

ALIAS/1 produces a wire frame environment visually based on interactive SPLINE technology, and a visual environment which allows unlimited viewing angles and

choices of perspective. Working with ALIAS/1 is like developing an abstract photo taken by your mind's camera.

Commenting on the recent news release that ALIAS/1 system has been selected by the Space Telescope Science Institute of America to visualise in 3-D the data received from NASA's Hubble Space Telescope, ALIAS President and co-founder, Stephen Bingham, said, "Our product was chosen for this project because it is so easy to visualise in three dimensions. Even those with no prior computer graphic programming experience can use the ALIAS/1 to visualise data transmitted back to earth by the Space Telescope. Data, generated as pictures is transmitted back to earth by the Space Telescope. Data, generated as pictures is stored and can be used to reproduce your work in the form of video, slides, print or film.

READER INFO No. 143

DATA MODEMS IN KITS OR FULLY ASSEMBLED AND TESTED

Build yourself a MODEM from our new range of kits in just an afternoon and be talking via computer to your BBS across town, or across the world. All kits have been designed to meet stringent Telecom specifications and come complete with every component down to the last nut and bolt.

Check these features: Double-sided plated-through fibreglass PCB
Soldermask on both sides
Screen printed component legend
Assembly and test manual

M300 \$129.00 T.P.

300 BPS
ANS/ORIG
CCITT/BELL
LOOPBACK TEST
PH/DATA RELAY
POWER PAK

M1200 \$189.00 T.P.

300/1200/75 BPS
ANS/ORIG
CCITT/BELL
LOOPBACK TEST
BAUDRATE CONVERTER
ADAPTIVE EQUALISER
PH/DATA RELAY
POWER PAK

M1212 \$169.00 T.P.

1200/1200 BPS
ANS/ORIG
CCITT/BELL
LOOPBACK TEST
SYNC/ASYNC
ADAPTIVE EQUALISER
PH/DATA RELAY
POWER PAK

Please deliver _____ M _____ Data Modem/s at \$ _____ each, plus \$7.50 for delivery. Add \$50.00 per modem for full assembled and tested unit/s. I enclose \$ _____ for total payment by, Cheque/Money Order/Credit Card: Bankcard/Mastercard. (Cross out what is not applicable.)

CARD NUMBER: _____ SIGNATURE _____

NAME _____

ADDRESS _____

POSTCODE _____

Mail Coupon to:
DATACOM COMPUTERS
Private Bag 39, BAYSWATER
VICTORIA 3153

Telephone orders:
ring (03) 221 7119.

READER INFO No 31

ETI December 1987 — 75

MERRY CHRISTMAS FROM



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	\$6.95	\$5.95
555 8 pin	\$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	
NE5534AN	\$1.95	\$1.85	\$1.75
AMEF7910	\$19.95	\$18.95	
MEL9501	\$29.95	\$27.95	
SC141D	\$1.75	\$1.50	
SC151D	\$2.50	\$2.25	
555	\$0.40	\$0.38	
741	\$0.50	\$0.45	

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

METEX M-3650 MULTIMETER

20A, 3 1/2 digit frequency counter multimeter with capacitance meter and transistor tester.

This spectacular rugged and compact DMM has a bright yellow high impact plastic case. It features a frequency counter (to 200kHz) diode and transistor test, continuity (with buzzer), capacitance meter up to 20 amp current measurement and comprehensive AC/DC voltage, current and resistance ranges.

CHECK THESE FEATURES...

- Push button ON/OFF switch
- Audible continuity test
- Single function 30 position easy to use rotary switch for FUNCTION and RANGE selection
- Transistor test
- Diode test
- Quality probes
- 1/2" High contrast LCD
- Full overload protection
- 20 Amp
- Built in lifting bail
- Capacitance meter
- Instruction manual

SPECIFICATIONS:

DC VOLTAGE:

Range: 200mV 2V 20V 200V 1000V

Resolution: 100uV 1mV 10mV 100mV 1V

Accuracy: 200mV 1000V - 0.3% - 1 digit

AC VOLTAGE:

Range: 200mV 2V 20V 200V 750V

Resolution: 100uV 1mV 10mV 100mV 1V

Accuracy: 200mV 200V - 0.8% rdg - 3 digits

750V - 1.2% rdg - 3 digits

Input Impedance: 10M ohm

DC CURRENT:

Range: 200uA 2mA 20mA 200mA 20A

Resolution: 100nA 1nA 10uA 100uA 10mA

Accuracy: 200uA - 20mA - 0.5% rdg - 1 digit

200mA - 1.2% rdg - 1 digit

10A - 2% rdg - 5 digits (10A range unfused)

Max. IP Amps: 10A (20A up to 60 seconds)

AC CURRENT:

Range: 2mA 20mA 200mA 10A

Resolution: 1uA 10uA 100uA 10mA

Accuracy: 2mA - 20mA - 1% rdg - 3 digits

200mA - 1.8% rdg - 3 digits

10A - 3% rdg - 7 digits (10A range unfused)

RESISTANCE:

Range: 200 2k 20k 200k 2M 20M ohms

Resolution: 0.1 1 10 100 1k 10k ohms

Accuracy: 200 ohm - 0.5% rdg - 3 digits

2k ohm - 2M ohm - 0.5% rdg - 1 digit

20M ohm - 0.5% rdg - 2 digits

Overload: 200 ohm 250V DC AC rms 2k-20M ohm 500V

Protection: DC AC rms

CAPACITANCE:

Range: 200nF 2uF 20uF

Resolution: 100pF 1nF 10nF

Accuracy: 200nF uF - 3% - 5 digits

FREQUENCY RANGE: 0.20kHz - 0.200kHz

Cat. Q91550



RS232 BREAK OUT BOX

A simple way of monitoring RS232 interface lead activity. Interface powered, pocket size for circuit testing, monitoring and patching 10 signal powered LED's and 2 spares. 24 switches enables you to break out circuits or reconfigure and patch any or all the 24 active positions.

SPECIFICATIONS:
Connectors: DB25 plug on 80mm ribbon cable and DB25 socket
Indicators: Tricolour LED's for TD RD RTS CTS DSR CD TC RC DTR (E)TC
Jumper Wires: 20 tinned end pieces
Power: Interface power
Enclosure: Black high impact plastic
Dimensions: 85 x 95 x 30mm
X15700 \$94.95



ROTATING LIGHT

Motor driven rotating reflecting mirror with a flash rate of about 150 per minute. Large lens fit right to base, making unit weatherproof. Spare globe included.

SPECIFICATIONS:
• Available in Blue or Orange
• 150 Revolutions per minute (approximately)
• Shock absorbing rubber mounting legs
• Connecting wires fitted through base
• 12V DC 750mA
• Base diameter 102mm
• Height 140mm
A15042 Blue \$42.95
A15043 Orange \$42.95



COMPACT DISC STORAGE UNITS

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

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



FREE STANDING, FOLD UP MAGNIFIER

An economically priced "hands free" magnifier lets you take care of all those tricky fine detailed jobs so many often encountered in electronics or any of many other practical uses such as home work hobbies etc.

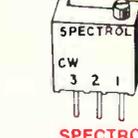
Cat T10020 Normally \$14.95
SPECIAL, ONLY \$12.95



RS232 FAST CABLER

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

SPECIFICATIONS:
Connector: DB25 plug on 100mm cable and DB25 socket on 100mm cable
Indicators: Tricolour LED's for pins 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DSR), 20(DTR)
Switches: 3 Slide switches to swap leads
Power: Interface power
Enclosure: Black, high impact plastic
Dimensions: 85 x 95 x 30mm
X15710 \$145



SPECTROL 64Y MULTI TURN TRIMPOTS

Cat No	Description	1-9	10+
R14700	10R	\$3.50	\$3.20
R14710	20R	\$3.50	\$3.20
R14720	50R	\$3.50	\$3.20
R14730	100R	\$3.50	\$3.20
R14740	200R	\$3.50	\$3.20
R14750	500R	\$3.50	\$3.20
R14760	1K	\$3.50	\$3.20
R14770	2K	\$3.50	\$3.20
R14780	5K	\$3.50	\$3.20
R14790	10K	\$3.50	\$3.20
R14800	20K	\$3.50	\$3.20
R14810	50K	\$3.50	\$3.20
R14820	100K	\$3.50	\$3.20
R14830	200K	\$3.50	\$3.20
R14840	500K	\$3.50	\$3.20
R14850	1M	\$3.50	\$3.20



CENTRONICS PLUG SPECIAL!

36 WAY MALE (P12200)	1-9	10+	100+
	\$3.95	\$3.50	\$3.00

METEX 4500H MULTIMETER

10A, 4 1/2 digit multimeter with digital hold, transistor tester and audible continuity tester.

The Metex 4500H is perfect for the technician, engineer or enthusiast who requires the higher accuracy of a 4 1/2 digit multimeter. This meter is exceptionally accurate (just look at the specifications) and yet still retains an exceptionally low price!

The Metex 4500H features digital hold which is normally only found on very expensive multimeters. This enables you to take a reading and hold that reading on display even after you have removed the probes simply by pressing the hold button.

CHECK THESE FEATURES...

- Readout hold
- Transistor Tester
- 4 1/2 digit x 1 1/2 (H) LCD
- Audible continuity tester
- Push-button ON/OFF switch
- Quality set of probes
- Single function 30 position easy to use rotary switch for FUNCTION and RANGE selection
- Built in lifting bail
- Instruction manual
- Full overload protection
- HFE test
- Battery and Spare test
- Diode Tester
- Vinyl case

SPECIFICATIONS:

DC VOLTAGE:

Range: 200mV 2V 20V 100V

Resolution: 10uV 100uV 1mV 10mV 100mV

Accuracy: 200mV 1000V - 0.05% rdg - 3 digits

Input Impedance: 10M ohms

AC VOLTAGE:

Range: 200mV 2V 20V 200V 750V

Resolution: 10uV 100uV 1mV 10mV 100mV

Accuracy: 200mV 200V - 0.5% rdg - 10 digits

750V - 0.8% rdg - 15 digits

Input Impedance: 10M ohm

DC CURRENT:

Range: 200uA 2mA 20mA 200mA 2A 10A

Resolution: 10nA 100nA 1uA 10uA 100uA 1mA

Accuracy: 200uA - 20mA - 0.5% rdg - 3 digits

200mA - 2A - 0.5% rdg - 3 digits

10A - 1% rdg - 5 digits (10A range unfused)

Max. IP Amps: 10A (20A up to 60 seconds)

AC CURRENT:

Range: 200uA 2mA 20mA 200mA 2A 10A

Resolution: 1nA 10nA 1uA 10uA 100uA 1mA

Accuracy: 200uA - 20mA - 0.8% rdg - 10 digits

200mA - 2A - 1% rdg - 10 digits

10A - 1.5% - 5 digits (10A range unfused)

Max. IP Amp: 10A (20A up to 60 seconds)

RESISTANCE:

Range: 200 2k 20k 200k 2M 20M ohms

Resolution: 10m ohm 100m ohm 1 10 100 1k ohms

Accuracy: 200 ohm - 0.2% rdg - 5 digits

2k ohm - 2M ohm - 0.1% rdg - 3 digits

20M ohm - 0.5% rdg - 5 digits

OVERLOAD PROTECTION: 200 ohm 250V DC AC rms 2k-20M ohm 500V

DC AC rms

Cat. Q91560



CORDLESS RECHARGEABLE SOLDERING IRON

- Built in solder point illumination
- Easy replacement of solder tip
- Protective stand which also functions as charging unit
- Sponge pad attach to stand
- Plug pack power adaptor
- Includes Nicad battery
- Instruction manual
- 12 months warranty

Cat T12480 Normally \$79.95
SPECIAL, \$69.95



UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety in about 40 minutes (less for less chips). Features include:

- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures EPROMs are thoroughly erased
- Engineered to prevent UV exposure
- Dimensions 217 x 80 x 68mm

WITHOUT TIMER

Cat X14950 Normally \$119

SPECIAL, \$99

WITH BUILT-IN TIMER

Cat X14955 Normally \$139

SPECIAL, \$119



METEX 3800 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3 1/2 digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, for testing Audible continuity and transistor hFE. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...

- Push-button ON/OFF power switch
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection
- 1/2" high contrast LCD
- Automatic over-range indication with the 1" displayed
- Automatic polarity indication on DC ranges
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001"
- High Surge Voltage protection 1.5KV-3KV
- Diode testing with 1 mA fixed current
- Audible Continuity Test
- Transistor hFE Test

SPECIFICATIONS:

Maximum Display: 1999 counts

3 1/2 digit type with automatic polarity indication

Indication Method: LCD display

Measuring Method: Dual-slope in A-D converter system

Over-range Indication: 1" Figure only in the display

Temperature Ranges: Operating 0°C to +40°C

Power Supply: one 9 volt battery (1006P or FC-1 type of equivalent)

Cat Q91530 Normally \$109

SPECIAL \$79



METEX 3530 MULTIMETER

This instrument is a compact, rugged, battery operated, hand held 3 1/2 digit multimeter for measuring DC and AC voltage, DC and AC current, Resistance and Diode, Capacitance, Transistor hFE and Continuity Test. The Dual-slope A-D Converter uses C-MOS technology for auto-zeroing, polarity selection and over-range indication. Full overload is provided. It is an ideal instrument for use in the field, laboratory, workshop, hobby and home applications.

Features...

- Push-button ON/OFF power switch
- Single 30 position easy to use rotary switch for FUNCTION and RANGE selection
- 1/2" high contrast LCD
- Automatic over-range indication with the 1" displayed
- Automatic polarity indication on DC ranges
- All ranges fully protected plus Automatic "ZERO" of all ranges without short circuit except 200 ohm Range which shows "000 or 001"
- High Surge Voltage protection 1.5KV-3KV
- Capacitance measurements to 1pF
- Diode testing with 1 mA fixed current
- Audible Continuity Test
- Transistor hFE Test

SPECIFICATIONS:

Maximum Display: 1999 counts

3 1/2 digit type with automatic polarity indication

Indication Method: LCD display

Measuring Method: Dual-slope in A-D converter system

Over-range Indication: 1" Figure only in the display

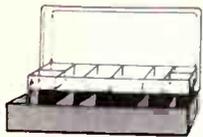
Temperature Ranges: Operating 0°C to +40°C

Power Supply: one 9 volt battery (1006P or FC-1 type of equivalent)

Cat Q91540 Normally \$139

SPECIAL \$109

ROD IRVING ELECTRONICS!!



MINI PARTS CASE
Features a clear plastic lid for easy identification of contents. Up to five adjustable lower compartments, plus a self elevating upper tray for smaller items.
Dimensions 110 x 210 x 43mm
Cat. H10087 \$9.95



COMMODORE EDGE CONNECTOR
156" spacing, 12/24 contacts
Cat No. 1-9 10-
P10973 \$5.95 \$4.95



2 1/4" MINI SPEAKERS (57mm)
Cat. No. 1-9 10-
C10610 \$1.95 \$1.75



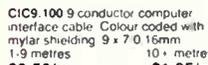
KEY SWITCHES
Cat. S12500 1-9 10-
Normally \$7.95
1-9 10- 25-
\$4.95ea \$4.25ea \$3.95ea



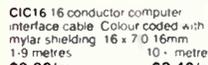
CANNON TYPE CONNECTORS SPECIALS
Cat. No. Description Price
P10960 3 pin line male
Was \$3.90 **NOW \$2.90**
P10962 3 pin chassis male
Was \$3.00 **NOW \$2.40**
P10964 3 pin line female
Was \$4.50 **NOW \$3.25**
P10966 3 pin chassis female
Was \$4.95 **NOW \$3.45**



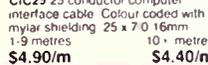
COMPUTER CABLE
CIC6 6 conductor computer interface cable. Colour coded with braided shield (to IE422 specifications). Copper conductor 6 x 7.0 16mm
1-9 metres 10- metres
\$1.90/m \$1.70/m



CIC9 10/9 conductor computer interface cable. Colour coded with mylar shielding 9 x 7.0 16mm
1-9 metres 10- metres
\$2.50/m \$1.95/m



CIC12 12 conductor computer interface cable. Colour coded with mylar shielding 12 x 7.0 16mm
1-9 metres 10- metres
\$2.70/m \$2.50/m



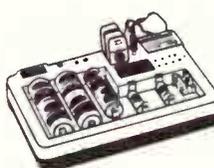
CIC25 25 conductor computer interface cable. Colour coded with mylar shielding 25 x 7.0 16mm
1-9 metres 10- metres
\$4.90/m \$4.40/m



NICADS!
Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!
Size Desc. 1-9 10- 100-
AA 450 mA H \$2.95 \$2.75 \$2.50
C 12 A H \$9.95 \$9.50 \$8.95
D 12 A H \$9.95 \$9.50 \$8.95



UNIVERSAL BATTERY CHARGER AND TESTER
Save money on expensive batteries with this universal battery charger. Features include meter tester and provisions for up to 8 pieces of any size (D C AA or AAA type batteries) at once - plus positions for a button and cell battery. Two times 9V and one times N type batteries. Recharging lead with alligator clips 9V clip and 4-way universal. Select currents from 2.5-3V 150mA 1.2-1.5V 80mA 1.2-1.5V 25mA 6-3V 14mA 1.2V 50mA. Includes detailed instructions.
Cat. M23533 \$29.95



DELUXE UNIVERSAL BATTERY CHARGER AND TESTER
Save money on expensive batteries with this universal battery charger. Features include meter tester and provisions for up to 8 pieces of any size (D C AA or AAA type batteries) at once - plus positions for a button and cell battery. Two times 9V and one times N type batteries. Recharging lead with alligator clips 9V clip and 4-way universal. Select currents from 2.5-3V 150mA 1.2-1.5V 80mA 1.2-1.5V 25mA 6-3V 14mA 1.2V 50mA. Includes detailed instructions.
Cat. M23535 \$49.95



SURGE BUSTER!
6 PROTECTED POWER OUTLETS!
Protect your valuable electronic equipment from damaging power surges. Ideal for protecting personal computers, video equipment, colour TVs, amplifiers, tuners, graphic equalisers, CD players etc.

SPECIFICATIONS:
Electrical rating, 240V AC 50/60Hz 10A. Complies with Australian Standards.
Approval number N10084
3 x Metal Oxide Varistors (MOV). Surge Spike Rating (each MOV) 4 500 amps (8x 20us)
Energy Absorption Factor each MOV 75 joules (10 x 1000us)
Maximum Clamping Voltage each MOV 710 volts at 50 amps.
Response time. Less than 25 Nanoseconds
X10086
Normally \$69.95
Introductory price \$47.95



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
H10520 105 x 30mm \$ 3.50
H10525 105 x 75mm \$ 4.95
H10529 105 x 100mm \$ 5.50
H10534 105 x 140mm \$ 7.90
H10535 105 x 150mm \$ 8.90
H10538 105 x 170mm \$ 9.95
H10542 105 x 195mm \$10.95
H10543 105 x 200mm \$11.95
H10546 105 x 225mm \$10.95
H10549 105 x 300mm \$12.95
H10560 105 x 600mm \$26.95



WELLER WTCPN SOLDERING STATION
The WTCPN Features:
• Power Limit 240 V AC
• Temperature controlled iron, 24 V AC
• Flexible silicon lead for ease of use
• Can be left on without fear of damaged tips
The best is always worth having
Cat. T12500 R.R.P. \$149
SPECIAL, ONLY \$129



QUALITY 3mm LEDs
Cat. No. Col. 1-9 10- 100-
Z10140 Red \$0.15 \$0.12 \$0.10
Z10141 Grn \$0.20 \$0.15 \$0.12
Z10143 Yw \$0.20 \$0.15 \$0.12
Z10145 Ora \$0.20 \$0.15 \$0.12



QUALITY 5mm LEDs
Cat. No. Col. 1-9 10- 100-
Z10150 Red \$0.10 \$0.09 \$0.08
Z10151 Grn \$0.15 \$0.12 \$0.10
Z10152 Yw \$0.15 \$0.12 \$0.10



CLICK AUTOMATIC NIGHTLIGHT
For safety and security around the home and at work, this clever little Australian made nightlight can't be beaten. The light sensitive sensor cell automatically switches on at dusk and off at dawn (or whenever the ambient light level is very low). And Click's nightlight costs less than 1 cent per day to operate!
A15058 \$19.95



4/6 WAY POWER OUTLETS
With overload protection!
4 Way (P18040) \$14.95 \$7.95
6 Way (P18042) \$19.95 \$12.95



ARLEC SUPER TOOL
A versatile 12V electric tool for:
• Sanding
• Engraving
• Grinding
• Polishing
• Cutting
• Drilling
• Milling
• Erasing etc.
Features:
Operates on safe, low 12 volts from mains electricity via AC adaptor (supplied). Light and easy to handle with touch switch and lock for continuous running. High torque motor. 10 000 R P M. Can drill 2mm holes in steel. 2 year guarantee.
Contents:
• 12V Super Tool
• Plugpack, AC adaptor
• 1 spherical milling cutter
• 1 wire brush
• 1 grinding wheel
• 4 drill bits, 0.6 0.8 1.0 1.2mm
• Set of 5 chuck collets
• 6 eraser sticks
• Instruction sheets
Cat. T12300 \$59.95



ANTISTATIC SOLDER SUCKER
• Light weight
• Sturdy construction
• Easy to remove tip
• Excellent value for money!
Cat. T11281 \$13.95



DB25 CONNECTOR SPECIALS!
We have just imported 50 000. So you get to save a small fortune!
DB25 MALE (P10900)
1-9 10- 100-
\$1.00 \$0.90 \$0.80
DB25 FEMALE (P10901)
1-9 10- 100-
\$1.20 \$1.00 \$0.90



VOLTAGE REGULATORS BARGAINS
Description 1-9 10-
7805UC \$0.50 \$0.45
7812UC \$0.50 \$0.45
7815UC \$0.50 \$0.45
905UC \$0.60 \$0.55
912UC \$0.60 \$0.55
915UC \$0.60 \$0.55
810s \$0.45 \$0.40
7812 \$0.45 \$0.40
LM324 \$1.00 \$0.90
555 \$0.40 \$0.38
741 \$0.50 \$0.45



PHILIPS SPEAKERS
Unfortunately we cannot always guarantee Philips speakers to be in stock due to availability problems nor can we guarantee the exact models listed. However, Philips equivalent or better will be supplied.
- Rod
Description Cat. No. Price
AD0161078 (C12030) \$24.95
AD02160508 (C12040) \$69.95
AD80652W8 (C12042) \$69.95
AD0706208 (C12045) \$69.95
AD12250W8 (C12050) \$129.00



20% OFF THE PRICE OF SPECTROL MULTIDIALS
MODEL 15-1-11
Number of turns: 10
Minor Scale Division: 1 500 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 25.4 x 44.45mm (1 x 1 3/4")
Depth: 25.4mm (1")
Weight: 45.4g (1.6oz)
Cat. R14405 \$45.95
SPECIAL, \$35.95



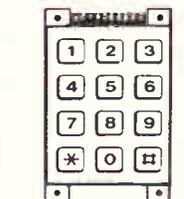
MODEL 16-1-11
Number of turns: 15
Minor Scale Division: 1 500 turn
Shaft Bore: 6.35mm (1/4")
Finish: Satin Chrome
Body Size: 46.04mm diameter (1 3/4")
Depth: 25.4mm (1")
Weight: 85g (3oz)
Cat. R14410 \$46.95
SPECIAL, \$37.50



10 TURN WIRE WOUND POTENTIOMETER
Spectrol Model 534
1/4" shaft.
Equip. 180urns 35-50 Beckman 7256)
Dials to suit 16 111 18 111 21 111
R14050 50R R14100 5K
R14055 100R R14110 10K
R14060 200R R14120 20K
R14070 400R R14130 50K
R14080 1K R14140 100K
R14090 2K
1-9 10-
\$9.95 \$9.50



10 AMP RELAY
SPD 1 12V DC 240V (S14111)
1-9 10- 100-
\$4.95 \$3.95 \$3.75



NUMERIC KEYPAD
Unencoded keypad. 10 digit keys plus two utility keys. Light grey in colour.
OUTPUT ARRANGEMENT:
Output Pin No. Symbol
1 N/A
2 Shield plate
3 Column 2
4 Row 4
5 Column 3
6 Row 1
7 Column 1
8 Row 2
9 Row 3
10 N/A
Cat. C19030
1-9 10- 100-
\$2.95 \$2.50 \$1.95



TOGGLE SWITCHES
Cat No. Description 1-9 10-
S11010 S P D T \$0.50 \$0.80
S11020 D P D T \$1.10 \$1.00



3M DYNAMARK PHOTOSENSITIVE (EX STOCK ONLY)
All prices per box and include tax
8007 REVERSAL FILM
250 x 300mm (10 sheets) \$39.95
300 x 600mm (5 sheets) \$54.95
8005 BLACK ALUMINIUM
250 x 300mm (10 sheets) \$69.95
300 x 600mm (5 sheets) \$79.95
8009 BLUE ALUMINIUM
250 x 300mm (10 sheets) \$69.95
300 x 600mm (5 sheets) \$79.95
8011 RED WHITE
250 x 300mm (10 sheets) \$64.95
300 x 600mm (5 sheets) \$74.95
8013 BLACK YELLOW
250 x 300mm (10 sheets) \$64.95
300 x 600mm (5 sheets) \$74.95
8015 BLACK WHITE
250 x 300mm (10 sheets) \$64.95
300 x 600mm (5 sheets) \$74.95
8016 BLUE WHITE
250 x 300mm (10 sheets) \$64.95
300 x 600mm (5 sheets) \$74.95
8018 GREEN WHITE
250 x 300mm (10 sheets) \$64.95
300 x 600mm (5 sheets) \$74.95



Rod Irving Electronics
48 A Beckett St. MELBOURNE
Phone (03) 663 6151
425 High St. NORTHCOLE
Phone (03) 489 8866
Mail Order and Correspondence
P.O. Box 620, CLAYTON 3168
Telex: AA 151938
Fax: (03) 543 2648



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

LOCAL ORDERS & INQUIRIES (03) 543 7877

POSTAGE RATES
\$1 \$9.99 \$2.00
\$10 \$24.99 \$3.00
\$25 \$49.99 \$4.00
\$50 \$99.99 \$5.00
\$100 \$199 \$7.50
\$200 \$499 \$10.00
\$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.
All sales tax exempt orders and wholesale enquiries to RITRONICS WHOLESALE, 56 Renner Rd, Clayton Ph. (03) 543 2166 (3 lines)

Errors and omissions accepted.
With PC, ST, AT, etc. equipment.
All prices include postage and handling.
Minimum: Apply to a minimum order.
(Maximum quantity is 100 units per item)



SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HI-FI SYSTEM!

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

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



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

- 1% Metal Film resistors

SPECIAL, ONLY \$399
SAVE \$50

Developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms (per channel)
POWER AMPLIFIER: 100W RMS into 8 ohms (-55V Supply)
FREQUENCY RESPONSE: 8Hz to 20KHz -0.04 dB 20KHz to 65KHz -0.3 dB NOTE: These figures are determined solely by passive filters
INPUT SENSITIVITY: 1 V RMS for 100W output
HUM: 100 dB below full output (flat)
NOISE: 116 dB below full output (flat 20KHz bandwidth)
2nd HARMONIC DISTORTION: 0.001% at 1KHz (0.002% on Prototypes) at 100W output using a -56V SUPPLY rated at 4A continuous -0.003% 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 (50KHz and 7KHz mixed 4:1)
STABILITY: Unconditional

Cat K44771 **\$449**
Assembled and tested \$599
packing and post \$10



PREAMPLIFIER
THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER

- 1% Metal Film resistors

SPECIAL, ONLY \$359
SAVE \$40

Believe that dollar for dollar commercial unit available that sounds as good as this!

SPECIFICATIONS:
FREQUENCY RESPONSE: High level input 15Hz - 130KHz -0.1 dB
Low level input conforms to RIAA equalisation -0.2 dB
DISTORTION: 1KHz -0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
SN 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 500ms source resistance connected -86dB flat 92dB A-weighted MC input master full with respect to full output (1.2V) and 200V input signal 71dB flat 75dB A-weighted

Cat K44791 **\$399**
Assembled and tested \$699
packing and postage \$10



THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 2R

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, interband boxes) \$1,095
Assembled, tested and ready to hook up to your system \$1,295
(Approximately 4 weeks delivery)

Errors and Omissions Excepted



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 components for this project is around \$15 including sales tax but not the cost of batteries or headphones (EA Nov 83) 83MA11
Cat K83310 **\$14.95**



1W AUDIO AMPLIFIER
A low-cost general-purpose 1 watt audio amplifier suitable for increasing your computers audio level etc (EA Nov 84)
Cat K83310 **\$9.95**



EA AM STEREO DECODER
AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola CQUAM system (EA Oct 84) 84MS10
Cat K84100 **\$26.95**



PLAYMASTER 300 WATT AMPLIFIER
This module will deliver up to 200 watts into an 8 ohm load and up to 300 watts into a 4 ohm load. Comprehensive protection is included and a printer circuit board brings it all together in a rugged, easy-to-build module. It can be built in either fully-complementary or quasi-complementary versions so output transistor shortages should be no problem at all (80PAP) (EA July 80)
Cat K83080 Normally \$109
SPECIAL, ONLY \$99
(Heatsink not included)

SERIES 4000 STEREO PREAMP
This high performance project is designed to complement ETI's 60 watt low distortion amplifier module and forms part of a complete stereo system the Series 4000 project (ETI 471) (Top Projects Vol 6)
Cat K44710 **\$59.95**

GENERAL PURPOSE PREAMPLIFIER
A general purpose stereo preamplifier using a single LM382 IC which can be tailored for use with magnetic pickups, tape recorders or microphones by changing a few components (ETI 445) (ETI July 76)
Cat K44490 **\$9.95**

OP AMP TESTER
The Op Amp Tester which could save you hours in agonising whether that old op amp that's been sitting in the draw for the last year (ETI April 85) ETI 183)
Cat K41830 Normally \$26.50
SPECIAL, \$21.50

150W MOSFET POWER AMPLIFIER
Here's a high power general purpose 150W Mosfet Power Amp Module! Suitable for guitar and P A applications and employing rugged reliable Mosfets in the output stage (ETI 499) (ETI March 82)
Cat K44990 **\$97.50**
(Heatsink not included) plus transformer **\$49.50**



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

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

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

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

D19 TWEETER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 2.5 - 20KHz
Free Air Resonance: 1.700KHz
Sensitivity 1W at 1m: 89dB
Nominal Power: 80 Watts (to 5,000Hz 120B oct)
Voice Coil Diameter: 19mm
Voice Coil Resistance: 6.2 ohms
Moving Mass: 0.2 grams
Weight: 0.28kg
Cat C10301 **\$38**

C20 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 35 - 6,000Hz
Resonance Frequency: 39Hz
Sensitivity 1W at 1m: 90dB (120B oct)
Voice Coil Diameter: 25mm
Voice Coil Resistance: 5.5 ohms
Moving Mass: 15 grams
Cat C10322 **\$89**
Cat K86092 (speakers only) **\$379**
Cat K86091 (complete kit) **\$449**



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 you early warning of power failure, and makes a handy beginner's project (ETI 280, March 85)
Cat K42800 **\$9.95**



MICROBEE SERIAL-TO-PARALLEL INTERFACE
Most microcomputers worth owning have an RS232 connector or port, through which serial communications (input/output) is conducted. It's a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel Centronics interface printers. Save money by building this interface (ETI Jan 84) ETI 675
Cat K46750 **\$49.50**



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**



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**

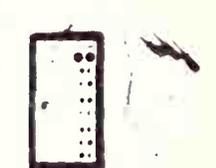


MULTI SECTOR ALARM STATION
Protect your home and possessions from burglars with this up to the minute burglar alarm system. It's easy to build, costs less than equivalent commercial units, and features eight separate inputs, individual sector control, battery back up and self-test facility.

Specifications:

- Eight sectors with LED status indication
- Two delayed entry sectors
- Vanable exit, entry and alarm time settings, entry delay vanable between 10 and 75 seconds, exit delay vanable between 5 and 45 seconds, alarm time vanable 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 gel battery! Unbeatable VALUE! K85900 complete kit only \$159 K85901 without battery backup \$134



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) 83T78
Cat K83080 **\$18.95**



ELECTRIC FENCE CONTROLLER
Hestore dispense 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 85E11)
Cat K85110 **\$49.95**



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

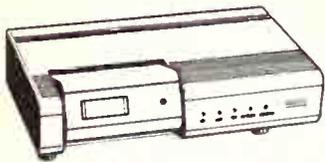


COMPUTER DRIVEN RADIO-TELETYPE TRANSCEIVER KIT
Here's what you've been asking for a full transmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The 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 **\$135**



Don't let your Christmas be spoilt!

Safeguard your home and valuables with our wide range of security products. We've got everything you need from control panels through to accessories!



**P.I.R. SENTRY
(HA-25)**

FEATURES:

- 7 LED indicators
- Passive Infra-red detection radium
- Built-in piezo siren
- Rechargeable 12V battery
- Built-in automatic battery charging system
- External siren connections
- Exit/Entry system
- Terminals for external detection devices
- Separate digital panel and main unit
- 3 Function Switch: delay off/instant
- 3 Adjustable timers
- 24 Hour loop included
- Built-in tamper switch
- Adjustable detection angle
- LED monitor for walk test
- R.F. Protection design

S \$175



**EXTERNAL SIREN &
FLASHING LIGHT**

Housed in a waterproof, metal case, with tamper switch.

SPECIFICATIONS:

- Siren:**
DC 12V 450 mA
Impedance 8 ohm
S.P.L. (dB/W) 110
Dimensions: 135 x 150mm
- Flashing Light:**
DC 12V
100 flashes per minute
Dimensions: 82 x 100mm

S \$89.50



**PASSIVE INFRA-RED
DETECTOR
(WP-800)**

FEATURES:

- Walk test LED indicator
- Wall/corner/ceiling mount
- Micro switch tamper proof protection
- 24 detection beams in 3 different ranges
- N.C. silent S.P.S.T. dry relay contact output
- Alarm auto reset approximately 3 seconds after triggered
- Superior RFI immunity protection
- Extremely low power consumption
- Adjustable mounting bracket
- Easy installation, easy adjustment
- Dual element, low noise, high signal to noise ratio pyroelectric
- Detection degree indicator
- D.C. 8-16V power operating

S15079 \$89.95



PIR FLOODLIGHT

A perfect all night security device with dual element Passive Infra Red sensor. All weather outdoor operation. Features off, automatic, test and manual on at your wall switch. Complete with wall mounting bracket, cable terminations and instructions.

SPECIFICATIONS:

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

A15597 \$185



BIG MOUTH CAR ALARM

FEATURES:

- Easy installation
- Automatic on/off
- Loud alarm signal
- Auto reset
- Low Price!

SPECIFICATIONS:

- Power:** DC 12V battery
Current Consumption: 10mA at 12V DC
Dimensions: 139 x 165 x 136mm
Exit Delay: 60 seconds approximately
Entry Delay: 12 seconds approximately
Auto reset: 90 Seconds approximately

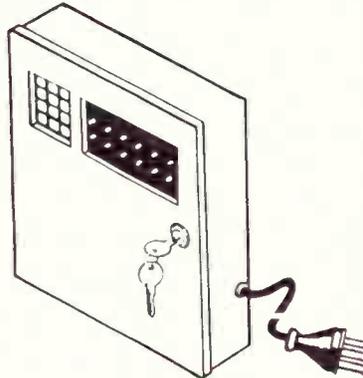
S15048 \$39.95



PIN SWITCHES

- Sell tapping and adjustable
- Suitable for car doors, hoods, trunks
- Single lead hook up
- Easy to use, easy to install
- Length 45mm
- Pack of 2 pins

S12522 \$2.95



**BURGLAR ALARM
CONTROL PANEL**

A complete six sector alarm control panel suitable for both commercial and residential use. Has all the features of larger units in a compact tamper proof metal cabinet. Inbuilt 240V - 50Hz power supply.

- Armed and Disarmed with digital keypad
- Six independent supervised zone inputs
- Will accept N/O or N/C sensors
- Each is supervised with end of line resistor
- LED indicator for each sector plus LED indicators for zone violation
- May be either delayed or instant zones.
- Separate zones may be disabled for service etc
- Two 24 hour zones. One is N/O for panic or fire alarm, the other is N/C for motion detector or siren box. Both are supervised with end of line resistors.
- Built-in Anti tamper switches
- N/C tamper switch on front and rear
- Audible alarm status indicator
- Internal buzzer sounds for exit/entry delays
- Internal buzzer for low battery and testing.
- Built-in siren driver output circuit
- External horns have wire cut protection
- Relay outputs.
- Timing relay - dry contact output (SPDT)
- Timing relay - 12V DC output
- Latching relay - 12V DC output, 500mA
- Regulated 12V DC output (1 amp maximum) for passive or active detectors. Short circuit protection
- Backup battery circuit
- Automatically charges backup battery.
- Built in test switch enables the sensors etc. to be tested without causing the sirens to go off.
- Phase II continual protection except for 24 hour zone
- LED indication of mains failure
- Dimensions 300 x 270 x 80mm

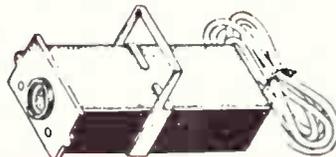
S13013 \$269



10W HORN SPEAKERS

White durable plastic, 8 ohms
Cat. C12010

1-9 \$11.95
10+ \$9.95



**ULTRASONIC BURGLAR
ALARM SYSTEM**

Complete alarm unit with in-built single lens ultrasonic detector. Compact body allows easy installation in small offices, cars, caravans, boats

- Exit delay to 30 seconds
- Entry delay to 10 seconds
- Auto reset time 3 minutes
- LED indicators for power on and motion detector
- 12V DC 1A output for siren/strobe etc
- Power supply 12V DC negative earth
- Dimensions 33(W) x 76(L) x 19(H)mm

Cat. S12055 \$69.95



CODE KEY PAD

- Telephone type digital keypad
- Four digit, changeable code.
- Over 5000 possible combinations
- Power consumption: 5mA standby, 50mA alarm
- Two sector LED and 1 arm LED
- Wrong number lockout
- 12V DC operation
- Relay output.
- Panic button
- Normally open tamper switch
- Dimensions: 145 x 100 x 37mm
- ACP3 compatible.

Cat. A13014 \$69.95

ROD IRVING ELECTRONICS

MELBOURNE: 48 A Beckett St
Phone (03) 663 6151

NORTHCOLE: 425 High St
Phone (03) 489 8866

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Quinto

Solid State DIGITAL AUDIO



- 5 minutes record time
- Multiple message store
- Satellite interface
- Random access of 99 events
- Battery back-up
- In-built noise reducer
- No maintenance required

Quinto Communications Pty. Ltd.

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Technology—Leading you into the future...

READER INFO No. 32



SCHEMA II: Schematic Capture Software for Engineering Professionals

FREE DEMONSTRATION PACK! New Release Version 2.01

Speed ease of use and power made SCHEMA the schematic software package for thousands of engineering professionals the world over. Now, SCHEMA II sets a new standard for all schematic capture programs to follow, regardless of price.

Use SCHEMA II to draw schematics (and other technical drawings) and automatically generate related design documentation such as bills of materials, net/pin/wire lists, component usage reports, design rule error checking reports, and more. SCHEMA II can help turn a good design into a great product because consistent design information is accurately transferred through the entire design cycle.

SCHEMA II runs on IBM PC/XT/AT/386/compatible personal computers and supports most popular graphics adapters, printers, plotters and mouses.

SCHEMA II is produced by Omaton Inc of Richardson Texas U.S.A. Abram Computers are the Sole Australian distributors. SCHEMA II is \$985 Plus \$10.00 freight plus tax if applicable.

Your satisfaction is Guaranteed . . . or your Money Back. Abram Computers guarantee your satisfaction with SCHEMA II. Try it for 30 days. If for any reason, you feel SCHEMA II does not meet your needs, return the package for a full refund.

Abram Computers

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 Parramatta NSW 2150.

READER INFO No. 33

NEW PRODUCTS

Sub-Audible Encoder/ Decoder

The GSA2320 is a sophisticated processor based signalling device. Model GSA2320 is a CTCSS encoder and decoder which can simultaneously decode one-of-38 EIA tones whilst generating another. This may be the same as the decode frequency or programmed for a different frequency. A different programme field is provided for encode and decode.

Two filters are provided. One serves as a high-pass filter to reduce Sub-Audible tone feeding through to the receiver audio amplifier.

A low pass filter minimises harmonic distortion of the CTCSS tone to the transmitter modulator.

Trouble free operation is apparently assured by the on-board voltage supervisor. This monitors the supply line voltage and resets the micro-processor if any voltage irregularity is detected. This means that any power disturbance cannot put the processor into an unknown state. Other features include repeater squelch tail suppression and a Time Out Timer (TOT).

READER INFO No. 105



Fast PC

Compaq has launched a 20 Megahertz, second generation version of its Deskpro 386 and announced the first 80386-based portable.

The Compaq Deskpro 386/20 combines the Intel 20 MHz 80386 microprocessor with advanced system architecture, utilising the new Intel 82385 Cache Memory Controller, to make it the fastest and most powerful personal computer available. It is claimed to be the first PC to incorporate the new Intel 82385 Cache Memory Controller.

This design provides fast retrieval of frequently accessed data stored in the

main memory, and when combined with the Compaq Deskpro 386/20's 20 MHz speed, the system's performance is up to 50 per cent better than most 16MHz 386-based PCs.

The Compaq Deskpro 386/20 provides up to 300 megabytes of high performance shock-mounted fixed disk storage and up to 18 megabytes of high speed 32-bit Random Access Memory.

It will run all popular software, hardware add-ons and peripheral devices designed for today's industry-standard 286 and 386 Personal Computers.

READER INFO No. 106



New Vigil RX Radar

AWA Marine has announced the Australian release of a new radar from Vigil. The Vigil RX Radar employs the latest technology in a lightweight radome which is claimed to have an extended 24nm range. Incorporated is the vigil remote keyboard which is a clearly laid out infrared remote operation, powerful enough to control all of the radar's functions and light

enough to slip into a jacket pocket.

Combine all this with a 9" high resolution daylight screen and bright, clear on screen graphics that clearly display necessary information, which is instantly readable. Combined with its two variable range markers and two electronic bearing markers the Vigil RX is a valuable navigation aid.

READER INFO No. 107

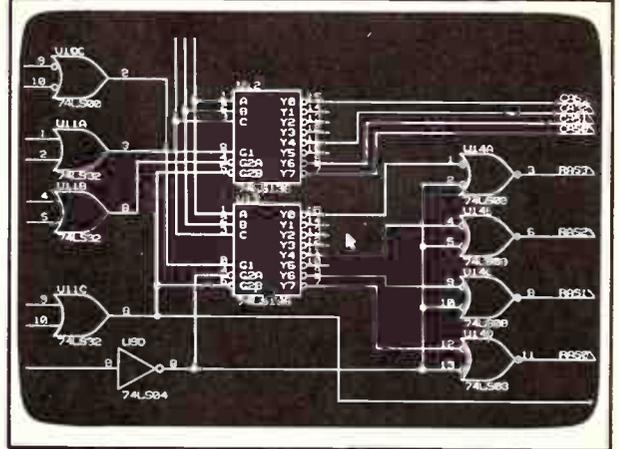
NHP Switches

NHP has made available a brand new range of small Load Break switches from LK. These switches are a mini version of the already popular Q-Line series, and as such are called the QM range. The switches are four sizes from 25 amps to 100 amps, and have motor switching (AC 23) ratings of 11 kilowatts to 37 kilowatts.

The switches have a high strength moulding complete with tunnel terminals which are finger touch proof. The contact system gives an excellent quick make and quick break switching action.

Also available are a range of enclosures with these switches pre-fitted, again with a choice of handles. Enclosure types can either be a PVC economy type or a high quality steel Enclosure.

READER INFO No. 108



Now it's easy to design schematics with your computer

Simply use OrCAD/SDT, the easy to use, totally flexible and affordable schematic design tool (software) - for use with IBM PC/XT/AT or compatible computers.

Easy schematic design

OrCAD/SDT makes the placement of graphic symbols, interconnections, components, and text both fast and easy. Parts can be selected by the keyboard or from a pop-up directory (and moved or rotated to where you choose).

Fast graphical editing

With powerful editing commands, single objects or groups of objects are easily moved, replicated or deleted. And if an object is accidentally removed, it can be immediately recovered with an "undo" command.

OrCAD/SDT Features:

- Unique parts library • Rubberbands wires/buses
- Automatic pan • Levels of hierarchy • Graphics options
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Please send me a FREE demo disk and literature.

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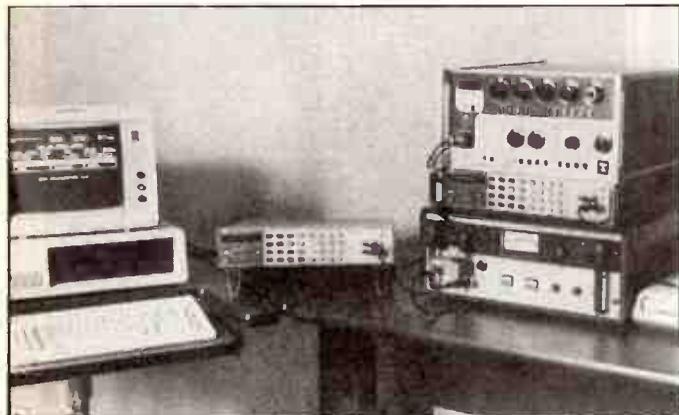
Prometheus Software Developments Pty Ltd.

191 Riversdale Road Hawthorn Vic. 3122.

Telephone: 819 6088 Fax: 819 6085

READER INFO No. 34

NEW PRODUCTS



PC-based Workstation Calibrates Multimeters

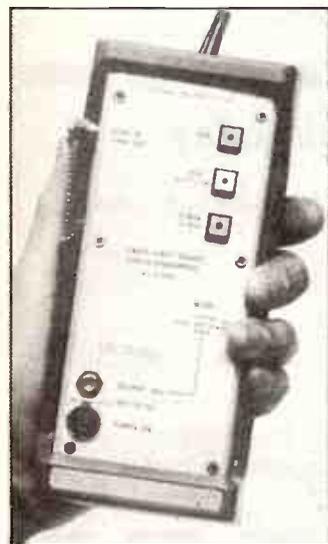
Engineers can create customised test procedures for calibrating all types of multimeters with the Ballantine Model 4050E Computest automated multimeter-calibration system. The instrument is based on a 256kB IBM PC with dual floppy drives, an IEEE488 interface card, a 384kB RAM disk, a 33cm high resolution colour monitor, an 80-column printer, and Ballantine's model 1620A trans-conductance amplifier (a wide-range AC/DC current source).

The Model 4050E's automated test procedures and menu-driven displays dramatically decrease calibration time over manual methods, while providing

documented disk or printed records or results. Calibration sequences can be edited to generate a library of procedures for a variety of instruments, and all sequences can be stored and recalled at any time. Special software utility functions provide for general disk maintenance. A password security system is available.

System software accommodates a wide variety of calibration sources, including: Fluke 5200A, 5205A, 5215A; Rotek 610 and 710; Datron 4000A, 4200 and 47000A; and Valhalla 2701 and 2724 instruments. Ballantine will provide coding for other IEEE488-bus-programmable sources on request.

READER INFO No. 101



Stablised Light Source

A new stabilised laser light source has been released into the market place by Kingfisher International. The new unit has several special features such as dc to 300 MHz analogue modulation capability. Thus it can act as an electro-optic converter for a variety of uses.

The light output level can be adjusted from the front panel for minor adjustments to the measurement set-up.

READER INFO No. 102



Sifam Fuseholders

Sifam Limited, has announced its range of panel mounting fuseholders is now approved by SEMKO — the Swedish testing authority internationally acknowledged as the approval body for such products.

New to the company's range of panel components a few months ago, the fuseholders are said to be highly

competitive in price, yet fully compatible with established fitting and performance requirements.

The modular design offers low or high profile front-of-panel options in a finely textured matt-black finish to blend with the style and texture of the company's other panelware such as meters and control knobs.

READER INFO No. 104

Hand Tachometers

Jaquet has just released two hand tachometers: the DHR906, an optical, non contact instrument for speeds from 10 to 100,000 rpm; and the DHR903, a mechanical contact instrument that can measure from 10 to 20,000 rpm or linear speeds from 1.0 to 2,000 m/min using the appropriate snap on driver.

Each instrument has three measuring ranges with automatic selection. Indication is provided of measurements above and below range and of low battery power. Battery life is approximately 120 hours. The instruments feature one button operation with automatic switch off after one minute. A self tester is incorporated and the last reading remains stored until the next measurement is made even when the instrument is switched off. Gate time is 0.7 sec for speeds of 100 rpm and above.

These instruments have a sturdy metal body for protection against mechanical stress and electrostatic interference. A carrying case is supplied which holds the instrument and accessories.

Electromark Pty Ltd, PO Box 184, Mordialtie 2223. Fax: (02) 57 5128. Phone (02) 570 7287.



READER INFO No. 103

PRE-PAK electronics - a major distributor for Arista products

• Catalogue numbers are in alphabetical and numerical order • Most items ex-stock! • 24 hour mail order service

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832	88	\$6.30	AW3	24	\$91.77	CAS13	53	\$13.10	CR2430	20	\$8.64	ECM130	97	\$42.21	GTS	57	\$81.25	J08A	7	\$1.55
2560	93	\$424.85	AXR311	8	\$5.25	CAS15	93	\$83.26	CR5	40	\$7.75	ECM141	97	\$33.81	GT8	57	\$69.95	JK10	25	\$4.70
346 BOX	18	\$16.40	AXR312	8	\$4.80	CAS16	93	\$89.66	CR5406	40	\$9.90	ECM1603	97	\$26.25	HCW40	44	\$23.80	JK5	25	\$3.90
346 SBP	18	\$2.10	AXR331	8	\$6.40	CAS18	92	\$79.15	CR55	40	\$8.45	ECM2110	96	\$53.97	HCW60	44	\$37.30	JL2	89	\$8.82
3C2Y	22	\$49.03	AXR332	8	\$4.20	CAS19	92	\$104.30	CR5507	40	\$11.50	ECM300	97	\$50.50	HCW80	44	\$58.50	JL3	6	\$2.60
3SB BOX	18	\$67.41	AXR411	8	\$11.45	CAS4	91	\$13.35	CR56	40	\$10.30	ECM450	99	\$15.64	HD1	87	\$11.55	JM4	6	\$2.60
3SB SBP	18	\$9.12	AXR412	8	\$5.40	CAS5	91	\$24.70	CS100	31	\$15.85	ECM5020	96	\$50.29	HO1000	85	\$43.45	JP3F	100	\$8.97
4LR44	20	\$4.76	AXR431	8	\$10.90	CAS6	91	\$19.90	CS200	31	\$8.90	ECM510	99	\$20.80	HO82	83	\$12.85	JP3M	100	\$7.20
4SR44	20	\$12.24	AXR432	8	\$4.50	CAS7	91	\$23.05	CS300	31	\$5.05	ECM541	99	\$28.17	HO86Y	83	\$14.88	JS25	4	\$0.55
5C2Y	22	\$71.29	AXRT5	8	\$4.10	CAS8	92	\$12.45	CS300A	31	\$5.70	ECM550	99	\$29.50	HP550	82	\$4.50	JS35	4	\$1.40
5C2Y200	22	\$14.75	BA1	102	\$22.50	CAS9	92	\$12.75	CS35	5	\$1.10	EP1	108	\$135.27	HP620	83	\$8.80	JS65	4	\$1.60
SCAS	22	\$61.42	BA125	60	\$499.46	CBA1	53	\$2.25	CS4	12	\$0.50	EP135	81	\$1.05	HR225	26	\$5.98	JS65C	4	\$1.70
A0144	33	\$0.00	BA2	102	\$20.95	CBA12	41	\$89.00	CS400	31	\$7.50	EP2	108	\$71.00	HS10	81	\$8.86	KE117	49	\$29.98
A2000	33	\$0.00	BC120	64	\$11.25	CBA14	41	\$149.00	CS65	5	\$1.10	EP25L	81	\$2.10	HS20	81	\$0.00	KE630	49	\$42.48
A2155	33	\$8.75	BC300	64	\$11.85	CBA2	41	\$3.20	CS65M	5	\$2.20	EP5	108	\$111.35	HS30	81	\$8.52	KE720	49	\$56.80
A2156	33	\$14.90	BC450	64	\$13.96	CBA20	41	\$199.75	CT10	18	\$1.10	EP35	81	\$2.10	HS114	25	\$5.40	KL1700	35	\$0.00
A2840	33	\$5.40	BC600	21	\$9.90	CBA4	41	\$12.50	CT110	18	\$2.50	EP35C	81	\$3.30	HT10	30	\$4.15	L12	13	\$0.40
A2851	33	\$6.10	BH21	15	\$1.50	CBA6	41	\$59.50	CT120	18	\$2.50	EP350	82	\$6.45	HT105	53	\$35.60	L6	13	\$0.40
A6672	33	\$14.90	BH22	15	\$1.20	CBA8	41	\$38.25	CT130	18	\$5.52	EP35L	81	\$3.40	HT11	30	\$5.90	LA1	45	\$6.76
AA1	70	\$39.40	BH23	15	\$0.45	CC1	102	\$2.50	CT140	18	\$7.92	EP4	108	\$230.94	HT12	31	\$6.25	LA2	45	\$6.76
AA10	70	\$36.26	BH41	15	\$1.55	CC103	18	\$5.82	CT20	18	\$1.10	EP5	109	\$71.00	HT13	31	\$6.60	LA3	45	\$13.55
AA4	70	\$78.50	BH410	15	\$4.55	CC106	18	\$6.84	CT30	18	\$1.50	EP6	109	\$94.05	HT14	31	\$5.85	LA4	45	\$23.30
AA2	73	\$123.55	BH411	15	\$1.90	CC107	18	\$7.08	CT40	18	\$1.80	EP8	109	\$139.15	HT15	31	\$5.80	LA5	45	\$16.40
AB1	61	\$3.70	BH42	15	\$1.40	CC108	18	\$10.20	CT81	18	\$3.40	EP9	109	\$101.70	HT17	30	\$15.45	LA6	45	\$12.20
AB2	61	\$4.25	BH43	15	\$0.75	CC3	18	\$1.10	CT8102	18	\$24.32	EP5100	84	\$21.50	HT18	30	\$19.20	LAB12	64	\$23.20
AB3	61	\$8.50	BH43L	15	\$0.75	CC6	18	\$1.80	CT82	18	\$4.45	EP550	82	\$5.05	HT19	29	\$8.75	LAB27	64	\$37.45
AB5	61	\$19.45	BH63	15	\$1.00	CC7	18	\$1.90	CTC15	89	\$2.15	ES1	29	\$1.85	HT2	29	\$2.65	LAB45	64	\$51.20
AC26	12	\$0.35	BH83	15	\$1.50	CC8	18	\$2.30	CTC20	89	\$2.20	ES2	29	\$2.65	HTC	29	\$2.44	LC223	26	\$5.98
AC32	12	\$0.40	BK51	62	\$7.95	CC10	86	\$9.95	CW1	29	\$0.00	F11	9	\$0.80	HTC12	29	\$2.64	LMT1	56	\$7.87
AC34	12	\$0.45	BK52	62	\$8.50	CC2	86	\$15.40	CW2	29	\$4.68	F56	9	\$0.50	HTC23	32	\$13.60	LMT10	56	\$15.64
AC55	12	\$0.80	BK53	62	\$11.45	CC20	86	\$19.10	DA1	81	\$4.70	F59	9	\$0.50	HT24	32	\$10.20	LMT11	56	\$29.40
AC65	12	\$0.45	BK54	62	\$9.65	CC3	86	\$5.45	DA2	81	\$4.35	F59T	69	\$1.60	HT25	32	\$3.30	LMT12	56	\$43.78
ACA1	38	\$26.52	BK55	62	\$8.30	CC4	86	\$7.60	DA3	81	\$4.00	F61	9	\$0.80	HT26	32	\$5.50	LMT2	56	\$9.76
ACA2	38	\$37.24	BK56	62	\$5.35	CC5	86	\$18.89	DA4	81	\$4.90	F619	9	\$0.80	HT3	29	\$24.50	LMT3	56	\$24.36
ACA3	38	\$35.30	BMC1	10	\$1.95	CC6	86	\$33.60	DA5	81	\$3.80	FD1	89	\$5.46	HT34	28	\$24.90	LMT4	56	\$13.75
ACP2	65	\$162.54	BMC15T	10	\$2.35	CC616	85	\$33.60	DB15L	11	\$1.70	FD3	89	\$5.46	HT35	28	\$35.95	LMT6	56	\$11.86
ACP3	65	\$252.00	BMC1TT	10	\$2.80	CC617	85	\$55.75	DB15S	11	\$2.15	FE1	82	\$2.52	HT37	28	\$56.20	LMT7A	56	\$16.59
ACS1	62	\$2.70	BMC2	10	\$1.75	CC6406	47	\$247.55	DB25L	11	\$1.70	FE2	82	\$2.52	HT37B	28	\$21.12	LMT8A	56	\$21.10
AL100	79	\$4.65	BMC3	10	\$5.60	CC6606	47	\$450.55	DB25P	11	\$2.25	FE3	82	\$2.76	HT37C	28	\$0.65	LNE11	8	\$9.72
AL100L	79	\$7.05	BMC4	10	\$3.75	CC6806	47	\$588.90	DB25S	11	\$2.50	FH001	13	\$1.75	HT37T	28	\$8.88	LNE12	8	\$9.98
AL101	79	\$5.40	BP2	12	\$0.65	CIC12	24	\$200.97	DB25SW	91	\$9.55	FH002	13	\$1.15	HT37T	28	\$8.88	LNE31	8	\$7.05
AL102	79	\$5.70	BP4	12	\$0.60	CIC16	24	\$233.20	DB25SW2	91	\$12.70	FH003	13	\$1.10	HT4	28	\$8.95	LNE32	8	\$6.75
AL102L	79	\$6.30	BP4L	12	\$0.80	CIC25	24	\$103.95	DB89L	11	\$1.70	FH004	13	\$0.70	HT5	28	\$24.90	LR1120	20	\$2.48
AL103	79	\$5.70	BP4M	12	\$1.75	CIC25L	24	\$350.07	DB89P	11	\$1.70	FH005	13	\$1.10	HT6	30	\$3.80	LR1130	20	\$2.08
AL103L	79	\$9.70	BS2	12	\$0.00	CIC6	24	\$94.18	DB89P	11	\$1.70	FH010	13	\$0.40	HT7	30	\$5.15	LR43	20	\$2.30
AL104	79	\$5.65	BS216	15	\$0.25	CIC9	24	\$41.79	DB89S	11	\$1.70	FH240	13	\$3.78	HT8	30	\$5.35	LR44	20	\$2.24
AL105	79	\$8.20	BS216A	15	\$0.35	CIC9L	24	\$128.10	DB89SW	91	\$8.12	FH241	13	\$2.00	HT8A	43	\$7.85	LTC20	89	\$1.46
AL105A	79	\$7.55	BS216B	15	\$0.25	CJ10	17	\$2.20	DC10	6	\$0.70	FL1	68	\$3.65	HT9	30	\$5.15	M205 BOX	18	\$18.90
AL106	79	\$4.45	BS216C	15	\$0.40	CJ103	17	\$19.33	DC13	6	\$0.70	FL2	68	\$3.65	HUW1	25	\$5.88	M205 SBP	18	\$2.50
AL107	79	\$3.35	BS4	12	\$0.45	CJ107	17	\$0.00	DC16	6	\$0.70	FL21	68	\$5.50	HUW2	25	\$12.07	M358	9	\$6.10
AL108	79	\$2.30	BS4A	12	\$0.65	CJ107	17	\$26.46	DC21	6	\$0.60	FL22	68	\$7.10	HUW3	25	\$17.22	M8135	15	\$2.78
AL111	79	\$3.30	BS4M	12	\$0.80	CJ108	17	\$26.46	DC25	6	\$0.60	FL23	68	\$8.75	IC510	23	\$136.60	M8136	15	\$2.30
AL116	79	\$2.45	BSC2	23	\$31.60	CJ11	17	\$2.30	DC31	6	\$0.90	FL3	68	\$5.33	ICD10	11	\$2.56	M8E1	89	\$29.90
AL116L	79	\$3.30	BSC3	23	\$47.88	CJ110	17	\$12.84	DCA10	6	\$2.00	FL4	68	\$4.95	ICD16	11	\$3.12	ME2	61	\$21.30
AL118	80	\$2.55	BT300	78	\$11.80	CJ111	17	\$13.56	DCA12	6	\$2.00	FL5	68	\$4.95	ICD25P	11	\$12.96	ME3	61	\$13.86
AL129	80	\$3.30	BW2	25	\$19.95	CJ112	17	\$14.28	DCA14	6	\$2.00	FL6	68	\$8.45	ICD25S	11	\$12.96	ME4	61	\$21.50
AL130	80	\$3.80	C25	5	\$0.70	CJ12	17	\$2.40	DCA2	6	\$2.00	FL7	68	\$8.45	ICD26	11	\$4.56	ME5	61	\$0.00
AL131	80	\$3.80	C35	5	\$0.70	CJ2	17	\$2.70	DCA4	6	\$2.00	FL8	68	\$4.45	ICD34	11	\$5.76	ME6	61	\$0.00
AL132	80	\$3.80	C65	5	\$0.95	CJ5	17	\$0.00	DCA6	6	\$2.00	FL9	68	\$5.98	ICD36CP	11	\$11.04	ME7	32	\$6.30
AL133	80	\$3.35	CG5M	5	\$2.20	CJ7	17	\$3.75	DCAB	6	\$2.00	FMA1	70	\$2.95	ICD36CS	11	\$11.40	ME8	32	\$9.65
AL134	80	\$3.35	CA1	38	\$6.59	CJ8	17	\$3.75	DF332	69	\$4.96	FMA10	71	\$63.40	ICD40	11	\$7.32	MH1	101	\$2.45
AL137	80	\$3.60	CA10	38	\$10.95	CKP2	64	\$78.00	DF334	69	\$6.95	FMA2	71	\$20.15	ICD41	11	\$9.00	MH2	101	\$3.75
AL141	80	\$2.75	CA11	39	\$29.85	CL10	90	\$19.45	DF772	69	\$5.96	FMA3	70	\$7.75	ICD64	11	\$12.36	MH3	101	\$4.75
AL142	80	\$3.75	CA12	39	\$34.50	CL11	90	\$23.10	DF774	69	\$7.90	FMA4	71	\$46.40	IL2	13	\$3.20	MH4	101	\$0.00
AL142L																				

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MS8 SBP	18	\$9.12	PD5A	7	\$0.80	RCA2S	5	\$0.75	SM100	103	\$36.95	ST13	17	\$1.95	TEL2	50	\$7.20	YOK2	77	\$17.55
MT2	100	\$24.15	PD5B	7	\$0.80	RCA3	5	\$0.60	SM20	14	\$3.65	ST130	17	\$9.60	TEL2C	50	\$7.95	YOK3	77	\$26.22
MT4	100	\$25.50	PD5M	7	\$4.40	RCA32	5	\$0.70	SM200	103	\$80.90	ST131	17	\$9.60	TEL3	50	\$12.39	YOK4	77	\$33.43
MT6	100	\$15.75	PD6	7	\$0.95	RCA34	5	\$1.25	SM300	103	\$93.45	ST14	17	\$2.00	TEL4	50	\$7.20	YOS1	63	\$7.65
MV1	32	\$4.20	PD7	7	\$1.05	RCA36	5	\$1.80	SM400	103	\$139.15	ST140	17	\$11.16	TEL5	50	\$7.56	YOS2	63	\$6.95
PDx1	105	\$189.50	PD8	7	\$1.25	RCA38	5	\$2.75	SM82	48	\$67.45	ST140F	17	\$14.28	TEL6	50	\$10.98	YH310	78	\$11.80
PDx2	105	\$410.20	PD8A	7	\$1.25	RCA3G	5	\$1.50	SM1	23	\$77.91	ST141	17	\$11.64	TEL7	50	\$7.92	YJ8	10	\$6.25
PDx3	106	\$634.45	PDM3	7	\$2.20	RCA3G8	5	\$2.90	SM2	23	\$96.49	ST141F	17	\$14.28	TEL8	50	\$5.88	YL1	75	\$7.40
N21	10	\$5.30	PDM4	7	\$2.30	RCA3I	5	\$0.80	SM3	23	\$111.40	ST145	17	\$14.28	TEL9	51	\$6.24	YL10	75	\$5.20
N24	10	\$3.90	PDM5	7	\$2.40	RCA3L	5	\$1.50	SM4	23	\$149.10	ST146	17	\$14.64	THD33	87	\$16.60	YL3	75	\$8.95
N26	10	\$5.30	PDM6	7	\$2.50	RCB1	87	\$7.80	SM0239	9	\$1.95	ST15	17	\$3.05	TLC2	24	\$130.20	YL5	75	\$6.55
NBC1	21	\$29.50	PDM7	7	\$2.60	RCB2	87	\$7.80	SPI	55	\$36.60	ST150	17	\$10.44	TLC15	24	\$178.71	YL15L	75	\$9.10
NBC2	21	\$19.80	PDM8	7	\$2.70	RCB3	87	\$4.25	SPI0	39	\$21.00	ST151	17	\$10.92	TLC2	24	\$24.57	YL16	75	\$5.55
NC3	21	\$47.25	PDM11	8	\$12.50	RC51	29	\$1.80	SPI00	42	\$30.00	ST154	17	\$14.28	TLC3	24	\$37.90	YL17	75	\$6.15
NC3FX	8	\$5.85	PDN12	8	\$11.70	RC52	29	\$7.65	SPI030	43	\$51.30	ST155	17	\$14.28	TLC4	24	\$48.09	YL19	75	\$17.55
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NCUM1	21	\$21.45	PDN32	8	\$9.65	RC213	53	\$272.97	SPI230	43	\$66.20	ST158	17	\$10.20	TLC8	24	\$97.24	YL2	75	\$7.55
NCUM1E	21	\$12.23	PER2	64	\$118.10	RG58	22	\$49.77	SPI2HP	44	\$86.96	ST16	17	\$3.40	TL51	26	\$2.90	YL22	75	\$16.40
NCUM2	21	\$12.54	PHS1	44	\$12.70	RG58CU	22	\$66.67	SPI5	42	\$15.80	ST160	17	\$11.64	TL52	26	\$2.75	YL23	76	\$15.80
NCUM2E	21	\$11.88	PHS2	44	\$12.90	RG59U	22	\$55.23	SPI7	42	\$4.70	ST120	17	\$1.95	TL53	26	\$4.65	YL24	76	\$13.90
NCUM3	21	\$8.74	PHS3	44	\$11.20	RG8U	22	\$340.41	SP2	55	\$57.10	ST21	17	\$1.95	TL54	26	\$14.20	YL3	75	\$7.55
NCUM4	21	\$9.00	PHS4	44	\$32.10	RN1158	15	\$0.80	SP24	42	\$5.50	ST23	17	\$1.95	TM1	59	\$113.39	YL4	75	\$5.50
NCUM5	21	\$9.00	PIR12	63	\$107.20	RN99A	15	\$2.10	SP4	43	\$12.50	ST231	14	\$5.32	TMC1	10	\$2.50	YL5	75	\$3.65
NJ3FP	8	\$8.75	PIR2	63	\$135.90	RN99C	15	\$1.25	SP40	42	\$9.65	ST233	40	\$2.60	TMC3	10	\$1.95	YL5L	75	\$5.05
NL222	26	\$5.98	PIR25	63	\$107.20	RN99D	15	\$1.00	SP45LT	55	\$177.20	ST235	40	\$4.20	TMC5	10	\$1.95	YL6	75	\$5.55
NM4	21	\$5.56	PL1	16	\$5.50	RN99F	15	\$0.80	SP4F	45	\$21.40	ST24	17	\$1.95	TMC7	10	\$2.50	YL6L	75	\$6.95
NM5	21	\$5.56	PL12	16	\$4.55	RPP1000	35	\$41.40	SP50	42	\$12.50	ST29F	17	\$2.00	TMC9	10	\$4.95	YL7	75	\$3.65
NP2C	8	\$6.20	PL13	16	\$8.50	RPP2000	35	\$56.60	SP55G	53	\$26.64	ST30	17	\$2.00	TML2	61	\$33.65	YL7L	75	\$4.80
NP3C	8	\$8.75	PL2	16	\$5.50	RPP250	34	\$24.20	SP6	43	\$14.30	ST305	14	\$1.50	TML2	61	\$33.65	YL9	75	\$4.95
NS221	26	\$5.98	PL25B	9	\$2.40	RPP500	34	\$30.80	SP65	42	\$15.45	ST307	14	\$1.95	TML2	61	\$33.65	YOM1	27	\$16.75
P25	2	\$0.45	PL259	9	\$2.40	RT1	28	\$5.88	SP6W	53	\$26.40	ST308	14	\$3.50	TML2	61	\$33.65	YOM2	27	\$33.70
P35	2	\$0.45	PL259ST	9	\$2.40	RT15	28	\$5.88	SP8	43	\$21.50	ST31	17	\$2.00	TML2	61	\$33.65	YOM3	27	\$84.00
P35M	4	\$1.10	PL3	16	\$5.50	RT3	28	\$5.88	SP80	42	\$18.25	ST40	17	\$2.25	TML2	61	\$33.65	YOM4	27	\$59.90
P35P	4	\$0.60	PL4	16	\$5.50	RX300	9	\$1.20	SPB20	43	\$29.90	ST40F	17	\$2.50	TML2	61	\$33.65	YP10	10	\$12.20
P3F	8	\$5.10	PL6	16	\$9.95	RX310	9	\$1.20	SPB3G	55	\$47.45	ST41	17	\$2.25	TML2	61	\$33.65	YP14	10	\$10.60
P3M	8	\$4.60	PL7	16	\$11.50	RZ10	9	\$1.05	SPB3LT	55	\$18.60	ST41F	17	\$2.50	TML2	61	\$33.65	YP21	10	\$3.20
P65	4	\$0.75	PL8	53	\$10.20	RZ11	9	\$1.10	SPB5LT	55	\$24.65	ST45	17	\$2.50	TML2	61	\$33.65	YPB	10	\$5.80
P65M	4	\$1.40	PH3	6	\$2.70	RZ12	9	\$0.80	SPC1	23	\$16.27	ST46	17	\$2.50	TML2	61	\$33.65	YR200	52	\$12.85
P65MA	4	\$1.50	PH4	6	\$2.90	RZ14	9	\$1.40	SPC1/20	23	\$3.72	ST50	17	\$2.20	TML2	61	\$33.65	YS10	10	\$12.20
P65MP	4	\$1.50	PH3A	15	\$1.35	RZ15	9	\$1.40	SPC1/500	23	\$76.23	ST51	17	\$2.30	TML2	61	\$33.65	YS14	10	\$10.60
P65MRA	4	\$1.10	PH3B	15	\$0.98	RZ16T	69	\$1.41	SPC2	23	\$21.63	ST54	17	\$2.50	TML2	61	\$33.65	YS400	73	\$68.70
P65HS	4	\$8.50	PH3C	15	\$0.86	RZ20	9	\$0.80	SPC25	23	\$21.52	ST55	17	\$2.50	TML2	61	\$33.65	YS500	74	\$115.00
P65P	4	\$0.80	PH3D	15	\$0.75	RZ20M	9	\$1.45	SPC3	23	\$60.16	ST57	17	\$2.00	TML2	61	\$33.65	YS600	73	\$41.25
PA10	81	\$1.74	PP1000	35	\$33.25	RZ20T	69	\$1.85	SPC4	23	\$113.61	ST58	17	\$2.20	TML2	61	\$33.65	YS8	10	\$7.30
PA100	81	\$1.89	PP1000M	34	\$27.75	RZ21	9	\$0.90	SPC6	23	\$285.60	ST60	17	\$2.30	TML2	61	\$33.65	YS800	73	\$96.20
PA110	81	\$2.03	PP1001	34	\$9.90	RZ21M	9	\$1.50	SPC7	23	\$240.24	ST602	14	\$1.20	TML2	61	\$33.65	YSK1	78	\$9.45
PA120	81	\$2.03	PP1006	34	\$9.90	RZ320	9	\$2.00	SPG1	55	\$3.40	ST603	14	\$2.25	TML2	61	\$33.65	YR25	74	\$79.85
PA1202	107	\$595.00	PP1009	34	\$9.90	RZ40	22	\$1.15	SPG2	55	\$7.30	ST61	6	\$1.90	TML2	61	\$33.65	YUC2	73	\$87.35
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ETI-1617:1616 Disk Drive

Part 2

Paul Berger

IN THE LAST article we covered the 1616 Disk Co-processor Card (SSDCC) hardware and low level communication between the 1616 and the SSDCC. This month we'll discuss the software that makes it all hang together.

Device Drivers:

The function of a device driver is to allow the implementation of 1616/OS, a standard high level method of communicating with input/output devices. 1616/OS allows the use of installable device drivers for both block oriented devices such as floppy disks, hard disks and RAM disks, etc, and character devices such as the keyboard, serial ports, etc.

To read (or write) data from a block device, you must pass the following information to the 1616/OS block read/block write system calls:

block number
block device number
starting memory address for the transfer

For example: From the above diagram, you can follow the path of communication between 1616/OS and a block device, such as the RAM disk. 1616/OS "asks" the RD/ block device driver to read (or write) a block. It is the function of RD/ driver to act on this instruction and forward the appropriate block from (or to) the RAM disk. On completion, the driver returns either a 0 (indicating everything is alright) or an error code.

A number of standard device drivers are located within the 1616's motherboard ROMs. Most drivers communication with the physical device directly. The floppy disk driver is slightly different in that it communicates with the software contained

in the SSDCC's ROM which in turn deals with the actual disk drive.

For example: 1616/OS "asks" to read a block from the floppy disk (drive zero or drive one). The F0/ (F1/) driver tells the SSDCC ROM to get the block. The SSDCC gets the block (returning an error message if there was a problem) and passes the block to the F0/ driver. It in turn places the block in the appropriate memory location (as defined in the 1616/OS system call). In this way, the 68000 processor is relieved of the tasks of retrieving or writing information; these tasks are off loaded to the Z80 processor.

Using 1616/OS with multiple block devices:

1616/OS is designed to support multiple block devices. Up to now the only block device has been the RAM disk, so the problem of specifying separate devices has not arisen. You now have available three different block devices:

RD/ **The RAM disk**
F0/ **Floppy drive 0**
F1/ **Floppy drive 1**

The concept of a filename is extended to include a specification of the block device upon which the file is saved. This is done by pre-pending the block device driver's name onto the normal filename. For example:

F0/myfile **is a pathname for a file on floppy 0.**
rd/MF2 **is a pathname for a file on the RAM disk.**

You may specify a pathname of this type wherever a normal filename is expected. Files whose names are given without a block device identifier are assumed to reside on the currently logged device.

The currently logged device is identified in the 1616/OS command line prompt. Initially this is the RAM disk (RD/). You can change the default block device by typing its identifier. For example, typing 'RD/' logs onto the RAM disk, 'F1/' logs onto floppy disk drive 1, etc. Floppies may be changed without any need to inform the system. Swapping floppies when files are still open will have predictably disastrous results.

Interprocessor Communication:

The interprocessor communication commands are detailed below. In this description data going from the Z80 to the 1616 is represented in angled brackets: <>.

Block read command: 01 unit, blockhigh, blocklow, <errorcode or 0> <1024 bytes>

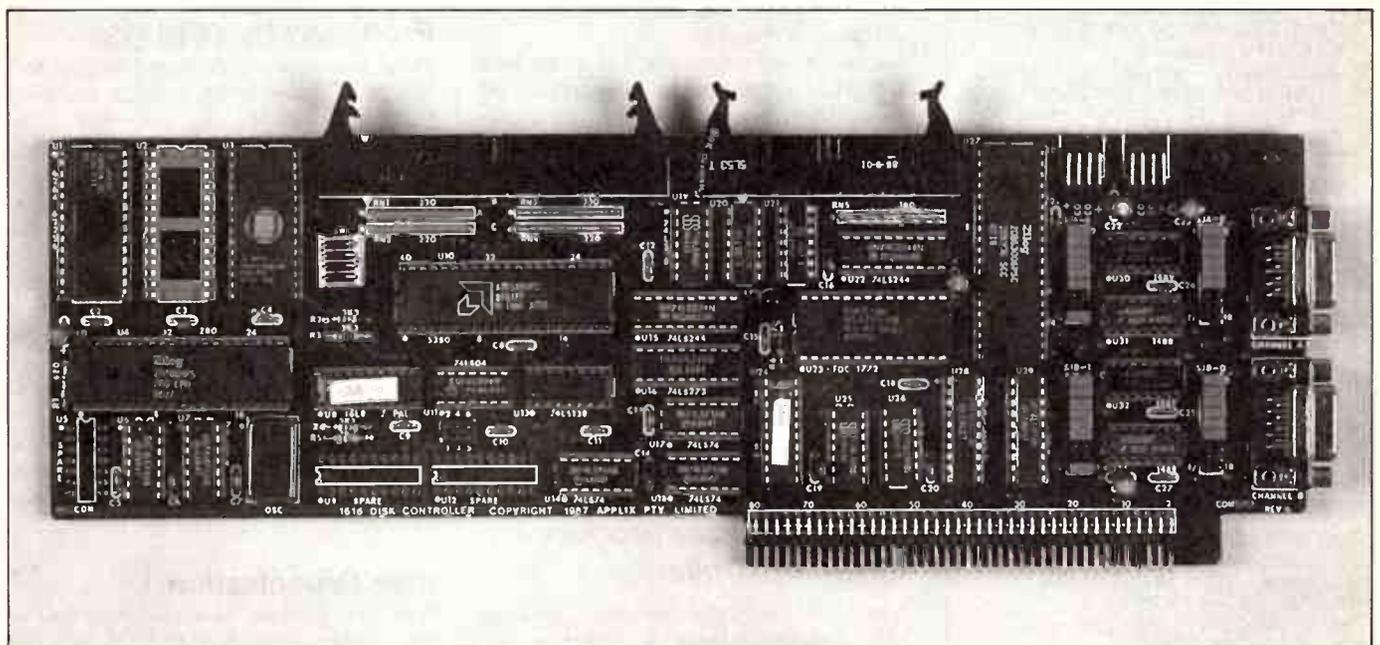
The 1616 writes a \$01 to the command port after which it writes the following bytes to the data port: The unit number (0 for drive 0, 1 for drive 1), the block number (high byte first). After this is the physical read is performed by the Z80 and an error code is returned to the 1616. If the errorcode is zero the 1616 may read out the 1024 bytes of data.

A non-zero error code indicates that something went astray; an interpretation of the error code may be obtained with command 3 (see below).

Block write command: 02 unit, blockhigh, blocklow, data <errorcode or 0>

Similar to the block read command, except that the 1024 data bytes are sent to the Z80 and then the 1616 must wait for the physical write to complete before an error code is returned.

Error message command: 03 errorcode <



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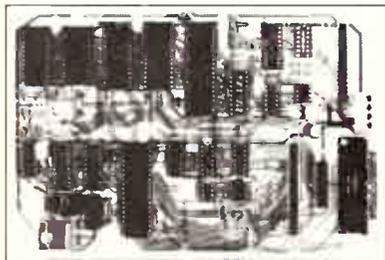
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ETI-1617

string> <0>

The Z80 is sent the error code byte. The Z80 then sends down a string for human interpretation, terminated by a zero byte. The various strings have differing lengths.

Format command: 04 \$B5 \$7E unit ntracks skewtable <errorcode or 0>

To physically format a disk, the 1616 selects command 4 and writes the values \$B5 and then \$7E to the data latch as a check against accidental issuing of format commands. After this send the unit number (0 or 1), the number of tracks on the disk (usually 80 or 40), then the 10 byte sector skew table. Wait for an error code.

The sector skew table consists of two consecutive 5 byte tables. The first is for side 0 of the disk, the second for side 1. All sectors receive the same interleave pattern with this format command. The Z80 driver code expects sectors to be numbered from 1, not from 0. The skew table sent by the SSDDUTIL.EXEC utility program is:

Side 0 1,4,2,5,3
Side 1 3,1,4,2,5

Format type 2 command: 05

This format command permits interactive track-by-track formatting and sector skewing. Its use is not documented at this stage.

Read Z80 RAM command: 07 Z80addrh, Z80addrli, lengthh, lengthl <data>

This command permits the 1616 to read 'LENGTH' bytes of the Z80's memory, starting from the specified Z80 address.

Write Z80 RAM command: 08 Z80addrh, Z80addrli, lengthh, lengthl, data

This command permits the 1616 to write 'LENGTH' bytes to the Z80's memory, starting at the specified Z80 address.

Call a Z80 program command: 09 Z80addrh, Z80addrli

This command causes the Z80 to perform a 'CALL' instruction to the supplied address. Upon return from the called program the Z80 resumes normal operation.

Read Z80 ROM version command: 0A < ROM version>

The Z80 returns a version byte for its current ROM.

Set floppy disk step rate command: 0C unit, rate

This command is used to change the floppy disk(s) head step rate as follows:

Value	Step rate used
0	2 ms.
1	3 ms.
2	6 ms. (default)
3	12 ms.

Error messages produced by the controller:

The disk controller software produces various error messages. Some are first de-

tected by the 1616's processor and the error messages for these are produced by the 1616/OS disk driver. Other errors are detected by the Z80 and are reported to the 1616 by means of an error code; when the 1616 encounters such an error code it fetches an English language interpretation of the error code from the Z80 and displays it.

Error Messages Produced By The Z80:

These refer to disk I/O failures of various forms.

Seek failure: A particular cylinder cannot be found; possibly because the disk drive has the incorrect number of tracks, or the disk is incorrectly formatted or poorly calibrated.

Drive busy(1), Drive busy(2): The WD1772 is permanently busy and cannot be interrupted out.

Write error(n): NN, Read error(n): NN
 These refer to errors detected during physical reading and writing. The second number NN is a copy of the WD1772 status register at the time of detection of the error.

Format error: The WD1772 reported an error during disk formatting.

No RDY signal: The /RDY signal from the disk drive (pin 34 of the 34 way signal cable) does not go low. This may be due to a cabling problem, incorrect disk drive strap setting or the absence of the selected drive.

Bad error number: This is the message string which the Z80 returns when asked to interpret an unimplemented error code.

Error Messages Produced By 1616/OS:

These messages are produced by that section of 1616/OS which handles the communication with the disk controller — the F0/ and F1/ block device drivers. They generally indicate that something untoward has happened in the communication between the two processors, such as the Z80 coming unstuck.

Disk controller timeout: This means that the Z80 failed to respond in any way to a command which was sent to it.

No TXRDY: Command = \$NN
 When attempting to send the command NN to the controller's command port the 1616 could not detect a true level on the STXRDY handshake signal, meaning that the Z80 is probably ignoring its command port.

Disk Organisation:

Note that a 'block' is a 1024 byte unit of data. Earlier versions of 1616/OS (versions

1.X) had 512 byte blocks.

The Root Block:

The organisation of data on 1616/OS block device volumes such as the RAM disk and the floppies is determined by fields in the device's block zero, referred to as the 'root block'. The root block contains seven significant 16 bit words organised as follows:

Offset	Name	Value for 800k disk	Usage
0	nblocks	800	Number of 1024 bytes blocks on the device.
2	ssosver	\$24	Version of 1616/OS under which the disk was initialised (ver 2.4).
4	bitmap	\$01	The block where the device bitmap exists.
6	dirstart	\$03	The block where the disk directory starts.
8	ndirblocks	\$07	The number of blocks allocated for directory space.
10	removable	\$01	Non-zero if the device has removable media.
12	bootblock	\$02	The block to be loaded into memory and executed at reset time.

The Bitmap:

The bitmap is a table of up to 8192 bits (per block allocated to the bit map), each of which indicates whether or not the corresponding block is currently used. Bit 7 of byte 0 corresponds to block 0, etc.

The Bootblock:

The 'bootblock' field indicates whether or not the disk contains a boot block to be loaded at reset time and, if so, what block it is. Whenever the 1616 is reset (by powering on, pressing the reset switch or by ALT-control-R) the operating system performs all initialisation and then goes through all the block drivers in order (RD/ first, then F0/ then F1/ then any others) looking for a device with its 'bootblock' field in the root block non-zero. When such a device is found the indicated block is loaded into memory and executed at address \$3C00 in the 1616.

The current level of the reset (0, 1 or 2) and the block driver number from which the system is booting is passed on the stack at 4(sp) and 8(sp) respectively. This allows the boot code to perform whatever level of initialisation is needed.

Note that the RAM disk may be used in this manner. Block 3 is reserved for booting, however it is not normally used. To use it, read in the root block, set the 'bootblock' field to 3, write out the root block again and then put your boot code in block 3.

If the disk in drive 0 (F0/) does not contain a boot program then the system will attempt to boot from disk 1 (F1/). If there is no second disk or if the second drive has no disk in it then the attempt to read from the second disk will fail, taking a few seconds to time out. It is preferable when disks are formatted that the standard do-nothing boot program 'boot' (supplied on

disk with the controller kit) be written out on the boot block.

The 1616 Disk Drive Utility Program:

The program 'SSDUTIL.EXEC' is supplied on disk with your disk controller kit. It performs the functions of disk formatting, directory initialisation (as described

above) and setting up or removing a disk's boot program.

There are three levels of disk preparation available with this program. The most basic level is to simply alter the disk's boot sector program; you enter the name of the new boot program and this is written onto the disk. If no boot program is written onto the disk then the disk is skipped in the booting sequence.

In the next level of disk preparation you may 'initialise' a disk. This recreates the disks root block, bitmap and directory. All files are lost. The boot block must be rewritten after this. The next level of disk preparation involves a physical format of the disk, followed by initialisation, followed by the boot code setup.

The Directory:

The directory lies from the block indicated by 'dirstart' up to 'dirstart + ndirblocks - 1'. The 64 byte directory entry is as follows:

Offset	Data type	Usage
0-31	chars	Null terminated file name (see below).
32-39	bytes	File creation data (yy/mm/dd/hh/mm/ss).
40-41	short	Type of file (see below).
42-45	long	File load address.
46-49	long	File size in bytes.
50-51	short	When the file is altered this field is zeroed.
52-53	short	Block number of file block map.
54-63	unused	Reserved by Applix.

The structure of directory entries is upward compatible with earlier versions of 1616/OS. The only differences are:

The 'file name' field has changed slightly. Filenames may only contain the following characters:

./0-9@A-Z

This is only enforced upon creation of the file (in the 'create' and 'rename' system calls) so that any files existing files which do not conform to this standard may be read, copied, executed or renamed.

Earlier versions of 1616/OS deleted files by putting a zero at the start of the 'file name' field (to indicate an unused directory entry) and freeing up the blocks used by that file in the bit map block. 1616/OS version 2.0 and greater now copies the first character of the file name to byte 31 (which is normally not used or zero if the file's name is the maximum length) before zeroing it. This allows utility programs to undelete the file, as long as the blocks that were allocated to that file had not already been reallocated.

The 'file type' field (bytes 40-41) are no longer required. At present this field is zeroed and reserved. For compatibility reasons a 'dummy' file type must still be passed to the 'creat' system call.

The 'backed up' field (bytes 50-51) have a slightly different use. When a file is altered this field is zeroed. Disk archiving utilities may set this bit to indicate that the file has been backed up. Backed up files are indicated by an 'A' appearing in the first column of a directory listing.

Zsystem:

One of the major reasons for basing the SSDCC around the Z80 CPU was to one day allow the 1616 to run the CP/M operating system. Well, this day has happened! We currently have a CP/M replacement (ZSYSTEM/ZC-PR3) up and running. It makes use of the 1616's memory for RAM disk and printer spooling whilst running CP/M, and the 1616 handles the video, keyboard, etc. It really screams along! Due to the large number of ex-Microbee owners who have switched to the 1616, we have made the disk format under CP/M compatible with the Microbee's.

Zsystem is written entirely in Z80 as-

sembly language (CP/M is 8080 code only) and offers many benefits over CP/M including fixing bugs in CP/M 2.2 itself. Zsystem takes full advantage of the Z80 instruction set and is downward compatible with all CP/M software. The Zsystem will be discussed further in a future article. Suffice to say, Zsystem has significantly greater utility and functionality than MS-DOS or plain CP/M 2.2

THYRISTOR LINE OUTPUT STAGES

Another in an occasional series on understanding and repairing TV sets. This month we look at a common output stage.

Gerry Nicholson

The Thyristor Line Output (LOP) stage was first developed by RCA in the US, and later employed by many European colour TV manufacturers. Only one company, (HMV), in Australia employed it in their first set before reverting to a transistorised stage in their second model. National also released at least one model which used Thyristors.

Functions

The most obvious purpose of a TV LOP stage is to deflect the electron beam across the screen and back every 64 μ sec. The scan period must be 52 μ s and the retrace 12 μ s. This represents a line frequency of 15625 Hz.

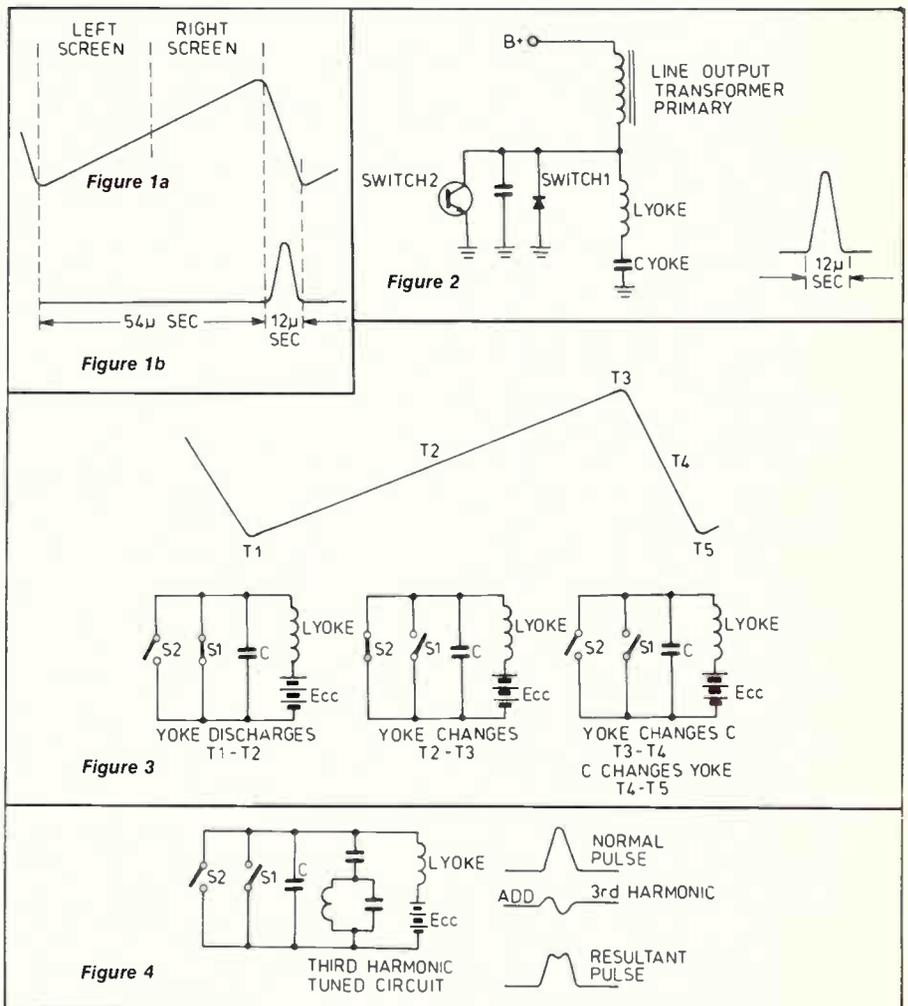
To achieve this, the current through the yoke must be a sawtooth as shown in Fig. 1a. Fig. 1b shows the voltage wave shape across the yoke. The high voltage pulse occurs when the line output switch (usually a transistor, valve or thyristor) switches off at the end of the scan, and the line output transformer primary discharges at a frequency determined by its inductance and the value of its tuning capacitor (see Fig. 2.) added to internal capacitance.

A basic horizontal deflection circuit can be represented by 2 switches, a yoke, a capacitor and a power supply (see Fig. 3).

When the beam is at the left of the screen (T1), yoke current (previously established) is at a maximum negative value. S1 is closed and S2 open. Energy stored in the yoke causes current to flow via S1 in a positive direction, deflecting the beam to centre screen (T2). (S1 is usually a diode). At this time the yoke current is zero, S1 is opened and S2 closed and current now flows from the power supply via S2 and into the yoke, deflecting the beam to the right of the screen (T3). Then S2 is opened and energy stored in the yoke dis-

charges into C since both switches are open) at a rate determined by the resonant circuit Ly and C. (This is the start of retrace). Once all the energy stored in the yoke has been transferred to C (T4) the yoke current reverses as C now discharges through the yoke into the power supply.

Once C is fully discharged (T5), the yoke current is again at a maximum negative value, the beam is at left screen, and the cycle is repeated. The retrace pulse is a half sinewave and the retrace period can be calculated by the following formulae $Tr = \pi\sqrt{LyC}$.



The voltages involved are very large. As a rule of thumb, the maximum induced voltages across C, S1 and S2 will be 8 to 10 times the supply voltage. It is usual to add 10% to 15% for mains variations and increases in horizontal frequency.

However we can decrease the voltages across these devices, by adding another tuned circuit, tuned to the third harmonic of the yoke circuit. This circuit introduces a third harmonic component when excited by the retrace pulse which reduces this pulse by as much as 20% (see Fig. 4). In actual fact third harmonic tuning is achieved by winding the line transformer so that the leakage inductance and internal capacitance form the circuit. As a result you won't see it on the schematic.

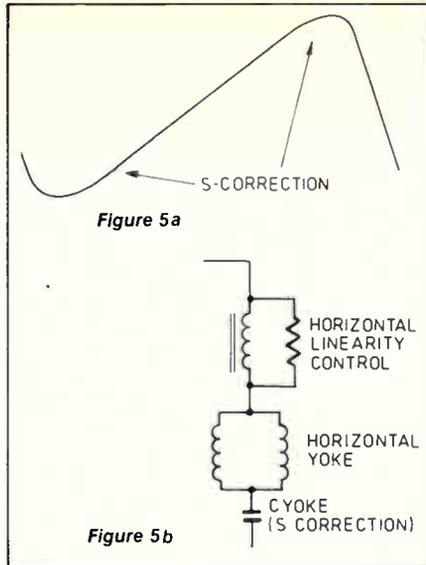
As mentioned earlier the main purpose of the line output stage is to deflect the beam across the screen, however it normally performs a number of other functions as well:

1. Generation of the high voltage pulses (8.3 kV) to drive the tripler which in turn produces the 25 kV for the tube ultor and about 6 kV for the focus voltage.
2. 400 to 600 V for picture tube screens.
3. High voltage regulation.
4. Scan linearity correction (S correction) and raster correction. If this is not done, distortion of the raster pattern also called pincushion distortion, will result.
5. Convergence waveforms.
6. Automatic gain control gating pulse.
7. Automatic frequency control pulses for horizontal synchronization.
8. Low voltage supplies for other sections of the set.
9. Burst gating pulses.
10. Retrace blanking.

Referring back to scan correction. Since the curvature of the picture tube face forms part of a large sphere, but does not have its centre at the centre of deflection, the beam needs to be slowed at each end of the scan for linear deflection. To achieve this a capacitor is employed in series with the yoke, and resonates with the yoke inductance at about 10 kHz, this makes the yoke current wave shaped as shown in Fig. 5a, and is called S correction. Usually further linearity correction in the form of a variable inductance shunted by a resistor is added in series with the yoke (Fig. 5b)

Operation

Now that we have familiarised ourselves with the basic line deflection circuit, we can have a closer look at the thyristor line output stage. In this case, 2 bipolar switches are employed, 1 for trace, 1 for retrace. Each switch consists of a thyristor and a high voltage fast switching diode. The Siemens thyristors BSTCC0146H/R have the diode and the thyristor in the



same package, as do the Phillips BT128 and BT129 devices.

A basic thyristor line deflection circuit is shown in Fig. 6. The trace diode (DF) and the trace thyristor (SCRt) control the yoke current during trace while the commutating diode (Dc) and the commutating thyristor SCRC start retrace and control the yoke current during this time.

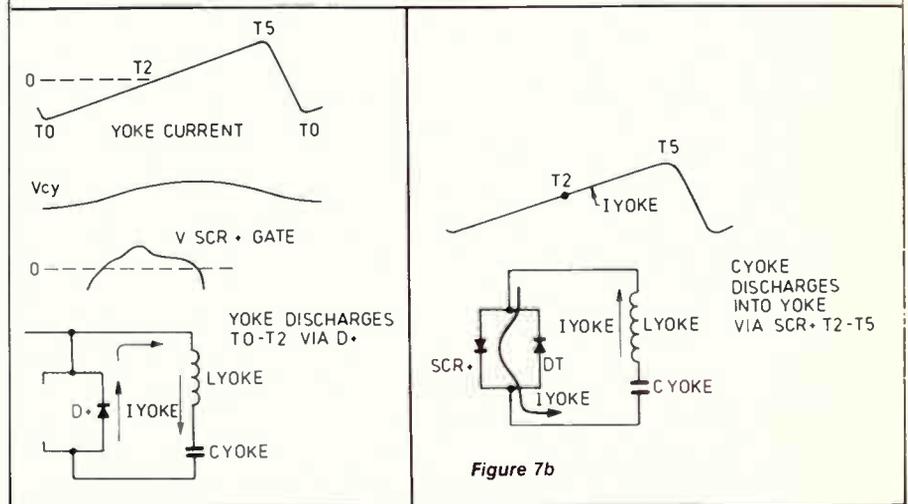
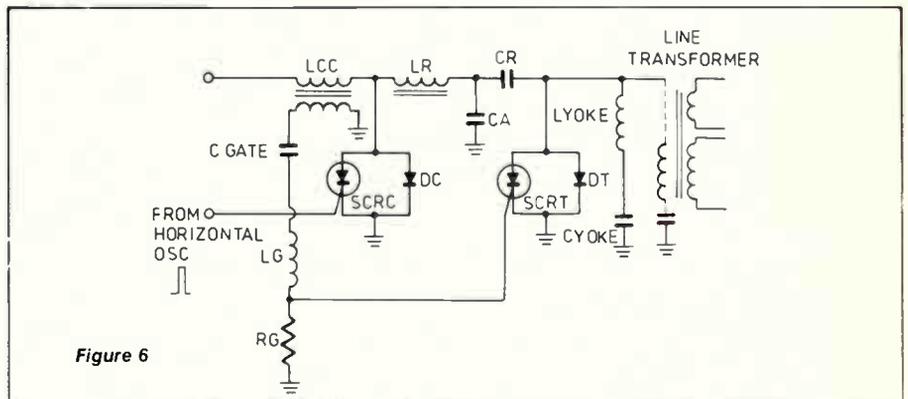
The inductor LR and capacitors CR, CA and CY provide the energy, storage and timing. Inductor Lcc provides a charge

path for CR, so that the circuit can be recharged from B+. The secondary of this inductor supplies the gating pulse for SCRT.

Capacitor CR and inductor LR form a series resonant circuit to set optimum retrace period. Neglecting CA and the line output transformer at present, and referring to Fig. 7a, at the beginning of trace (T) the yoke has been charged by the preceding retrace current, and the yoke current now discharges from a maximum negative value to zero at T2. This current charges Cy to a positive voltage via Dt and deflects the beam to centre screen.

Just prior to T2, the gate of SCRt is made positive, but this device will not conduct until its anode becomes positive. As mentioned above, at time T2 the yoke has completely discharged its energy into Cy and the yoke current is zero. Referring to Fig. 7b, Cy now begins to discharge via the yoke, Dt is reverse biased and SCRt now conducts, (since the current has reversed direction and its gate is positive). This action continues until T5 when retrace is initiated. The beam is now at the right of the screen.

Figure 7c captures the circuit at time T3 just prior to the end of the scan. SCRC is turned on by a positive gate pulse from the horizontal oscillator. Cr now discharges through Lr and SCRC. Lr and Cr form a series resonant circuit and a half sine wave pulse is set up. The yoke current



Thyristor Line Output Stages

now divides between SCR and SCRC. Once the current through SCRC exceeds the yoke current (at T4). Dt becomes forward biased and shunts the excess commutating current around the yoke and SCRT. SCRT is thus switched off and will not conduct until a positive gate pulse is reapplied during the next scan period.

Referring to Fig. 7d, at time T5, the

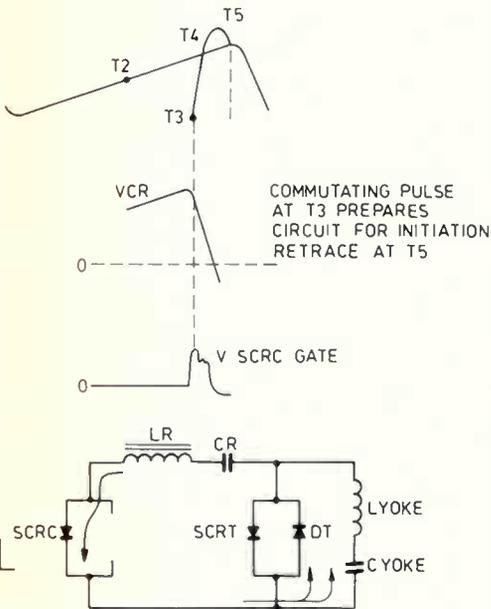


Figure 7c

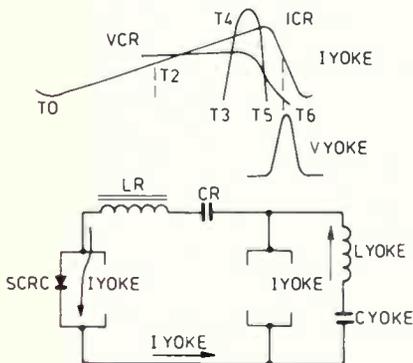


Figure 7d

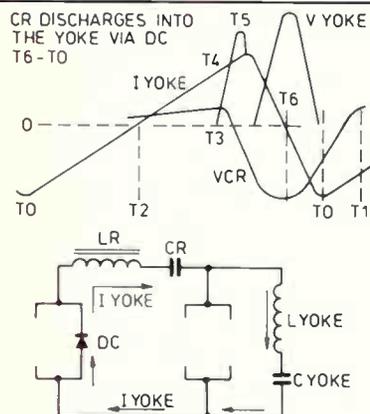


Figure 7e

commutating pulse current is no longer greater than the yoke current and Dt ceases to conduct. Cy Ly Cr Lr and SCRC now form a high frequency resonant circuit, (about 72 kHz). The energy stored in the yoke now causes a half sinewave of current to flow in this loop charging Cr to a maximum voltage of opposite polarity at time T6. At this time the yoke has fully discharged and Cr now discharges into the yoke (see Fig. 7e). Dc now conducts and SCRC is turned off and will remain off until its gate is made positive during the next scan period.

Meanwhile Cr continues to discharge into the yoke until T2 when the yoke current again reverses, forward biasing Dt beginning another trace cycle.

During the trace Cr is recharged via Lcc and Lr from the B+ rail, and stores energy for the next retrace cycle, by varying the inductance of Lcc.

Returning to CA in Fig. 6, Ca provides additional energy storage capability, lengthens the turn of the retrace voltage across SCRT (see Fig. 8a). In normal practice Ca is arranged as shown in Fig. 8b and this capacitor is sometimes varied to effect width control.

Although we ignored the line output transformer for ease of explanation, in practical circuits the yoke is usually driven by a secondary winding on the line output transformer. The transformer primary then becomes Ly in our basic circuit, and its inductance will affect our circuit calculations. A typical TV yoke has an inductance of about 80 μ h. The high voltage (25 kV) is produced, as in most line output stages, by stepping up the retrace pulse to approximately 8.3 kV and applying this to a high voltage tripler.

As mentioned earlier one can regulate a thyristor LOP stage against mains input variations and load variations. The basic circuit in Fig. 9 shows how this is achieved.

LINE OUTPUT STAGES

Advantages

1. Since this type of stage is self regulating it can operate with an unregulated supply.
2. Most other DC voltages can be scan rectified making only one voltage input necessary.
3. Pincushion correction etc can be passive and simple.
4. High current low voltage windings are employed on the Line output transformer making construction easier.
5. Fault location is simplified if one is familiar with the circuit operation.

Disadvantages

1. The thyristors can radiate spikes at switch on.
2. One must guard against increased

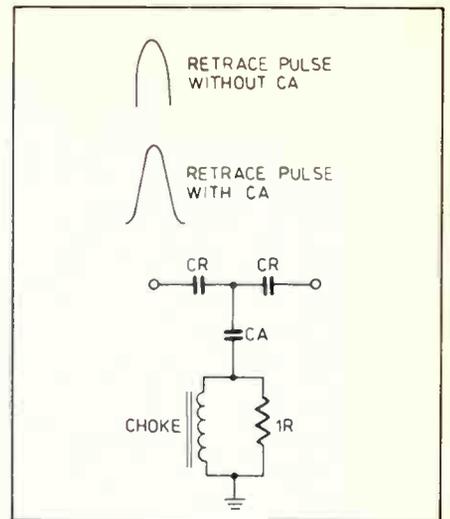


Figure 8

A pulse is rectified from a secondary on the line output transformer and fed via a zener to the base of a transistor which drives the primary of a saturable inductor. The secondary of this inductor shunts LCC, and affects the amount of energy stored in LCC while SCRC is conducting, and thus the energy transferred to Cr during trace.

If the input pulse increases and exceeds the zener voltage the transistor conducts. This saturates the core of the inductor, decreasing the inductance of the load winding which limits the energy stored and thus limits the high voltage output.

For a situation where the input voltage (B+) decreases, the saturable inductor adds to LCC and more energy is stored even though the input voltage has decreased.

The diode across the control winding protects the regulating transistor against induced spikes, etc.

Pincushion correction is fairly simple with a thyristor LOP stage. Referring to Fig. 10, a winding on the LOP trans-

line frequency which will destroy SCRT due to an increased retrace pulse across this device.

3. If the yoke circuit is open SCRT will again be destroyed due to the excessively fast rise time of the retrace pulse. (Removing the yoke plug must also remove the B+ supply).

4. If SCRT is open circuit or not gated on the commutating wave shape will be applied to the transformer primary, excessively increasing EHT and all other voltages derived from the LOP stage and could cause a great deal of damage if not guarded against by some kind of protection circuit.

5. High voltage high current capacitors are required and they are expensive.

former has the load winding of a saturable inductor across it, with a diode in series, so only the positive retrace pulse is affected. The control winding of this inductor is fed with a vertical sawtooth (preferably parabolic in shape) thus the horizontal scan is decreased at either end of the vertical scan and corrects the pincushion distortion.

Since thyristors are high current devices one can derive a number of low voltage supplies by rectifying the wave shapes from secondary windings on the LOP transformer. Since the line output frequency is high (15625 Hz) filtering is a breeze, although fast turn-off diodes must be used ie: Byx55 or similar (see Fig. 11a).

One can also derive supplies from secondaries on the input choke (Lcc) as in Fig. 11b.

Servicing

Many technicians profess they don't like thyristor LOP stages, however this is most likely because they are not as familiar with the operation as they might be.

One thyristor LOP stage which I have repaired on a number of occasions is that in the HMV C211, and I will now describe the steps I take to locate and eliminate any faults. This procedure also relates to LOP stages found in many of the European sets sold in this country. The HMV C211 scan module can be unplugged from the chassis. I have made up a set of leads, one end with pins on and the other with sockets so I can sit the board out on the bench. You will need a multimeter and an oscilloscope.

The first thing you need to do is solder all around the horizontal oscillator (IC210). Be sure you don't create any shorts. Next connect the plug lead which joins sockets 201 to 214 to the set and switch the set on. Leave the other lead off for now. With the oscilloscope time base set on 10 or 20 μ s per div. check the wave shape at the base of the TR202. Check if you can vary the duration above and below 64 μ s using RU201 10 k. If not try replacing C211 or C212 or both and also check whether the pulse seems to be jittering. Replace C204 if it is but note that this cap will also affect the frequency range. Two more caps which will affect this stage are the tantalum C213 and C214. The green cap C210 is also sometimes suspect.

If you have no waveshape at all check the IC after making sure there is 11 volts at Pin 1. If this waveshape is OK check that at Pin 24 on the other end of the board. It will be cleaner than that shown on the schematic, since Tr204 is not connected. Next turn the set off, connect a heavy duty clip lead from the junction of

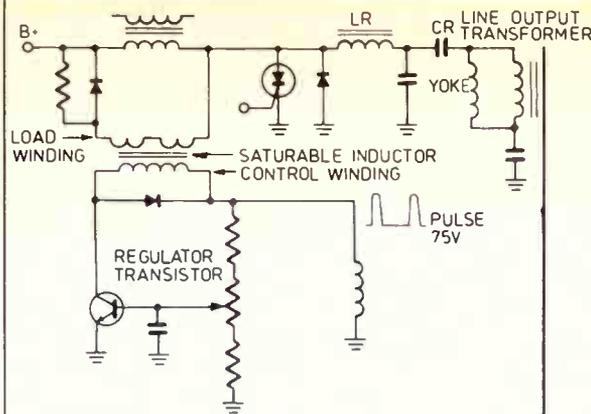


Figure 9

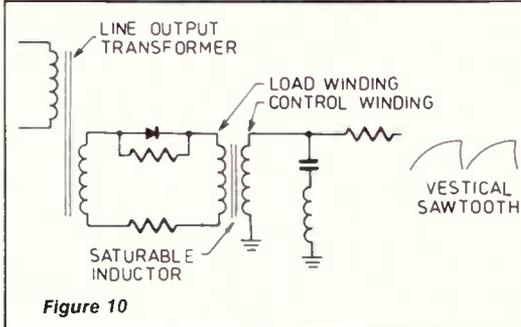


Figure 10

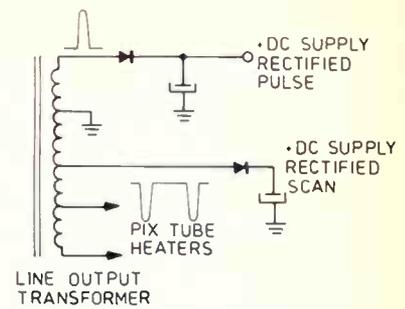


Figure 11a

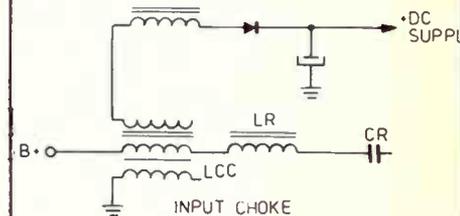


Figure 11b

C224 and C227 to earth and connect the other plug lead to connector sockets 215 to 224 to the set.

Before you turn on again, check R233, R203, C229 and check R230 180 ohm 10 w is not open circuit. If it is, check C223 is not shorted. This fault will cause the commutating wave shape to ring causing a very jagged picture. Also check Tr 204 — it should give an ohms reading one way due to the integral diode. Next with a ten-to-one CRO probe and the time base set to 20 μ sec/div and sensitivity at least 5 v/cm, turn the set on and check the wave shape at the anode of Tr204. This wave shape will not be exactly as shown on the schematic, since part of the circuit is shorted to ground. If there is no wave shape, check C244 or T201, the commutating transducer, for a cracked or broken core. Also check for dry joints. If all is well, check at Pin 221 for the trace SCR gate wave shape. If it is missing check back at Pin 6 on T201. If it is there, check C225 (there is sometimes a 68 ohm in series with this cap). Also check L204. If the gate drive is missing the trace thyristor will not come on and the commutating wave shape will destroy C238 which cost more than \$12. You will also notice arcing from the bottom of the transformer over-wind (Pin 14 on the LOP transformer). If all is well so far, turn off and move the shorting lead to the anode of Tr208 (check this device and C228 first) and switch on again. Now check the wave shape across C226. (remember Ca in our basic circuit earlier). If all is well, turn the set off again and make a few checks before you continue.

First check C230, and C239, the yoke

coupler. Also check that C237 is not shorted, and check there is continuity through the linearity control via Pin 215 through the yoke, via Pin 217, back to Pin 13 on the LOP transformer. If this circuit is open you will destroy Tr205 (Scan Thyristor). Since the sockets 215, 216, 217 and 223 invariably overheat and arc it is advisable to solder heavy leads to each and solder them to the pins at the back of the chassis. I usually gouge out any burns and fill them with araldite. Finally if you have a shorted turns tester put it across the over wind and check the transformer for shorted turns. Now switch on again and you should hear the 8.3 kV hissing, if all is well. Check the wave shape at Tr205 anode. Next switch off, reconnect the tripler input lead and turn on. If the LOP stage dies, of course, suspect the tripler. If all is well but still there is no picture, check D208 or the fuse in series with it. These are next to the tripler behind the board. For low brightness and lack of height, check R243 244 and 245.

Also check the 60 V at Pin 207 is as it should be. This is the vertical output supply. Check C241 — 2000 μ f/63 V and R248 75/10 w, if there is any doubt.

Finally check the regulating circuit, assuming you now have a picture. Varying Ru202 should vary the picture width in and out. If nothing happens check D206, L205 (which is usually a 1 ohm resistor) D205, Tr206, C232 (.22 μ f) and the saturable inductor Td201 (the primary sometimes goes open). The only trouble I've had with the pincushion circuit is the transducer whistling. Sometimes a bit of selastic will stop it. In other cases replace it, and check the whole board. ●

ETI-289 Watch Alarm Timer

Do you hate early mornings? Are you the type who gets out of bed at the very last minute, rushes through breakfast and arrives at work last? Or are you the organised type who gets up in plenty of time and relates to some music over a leisurely breakfast? We have designed two variations on a theme so we can suit all sorts.

James Twomey

THE ETI-289 IS DESIGNED around that most ubiquitous of modern objects, the soft drink can. It can be made to look aesthetically pleasing on any modern bedside. The idea is that one can use the output from a watch alarm to trigger a bedside radio or any other electrical device your imagination can come up with. You can't use the alarm from a digital watch because it is not loud enough, and doesn't last long enough to reliably wake somebody up.

The bottom of the can holds a piezo electric transducer. The soft drink can is placed on top of a digital watch so that the piezo transducer is close enough to detect the sound of the watch alarm. When the unit triggers, a relay closes which applies the power to any device you choose.

There is also a reset switch, a timer en-

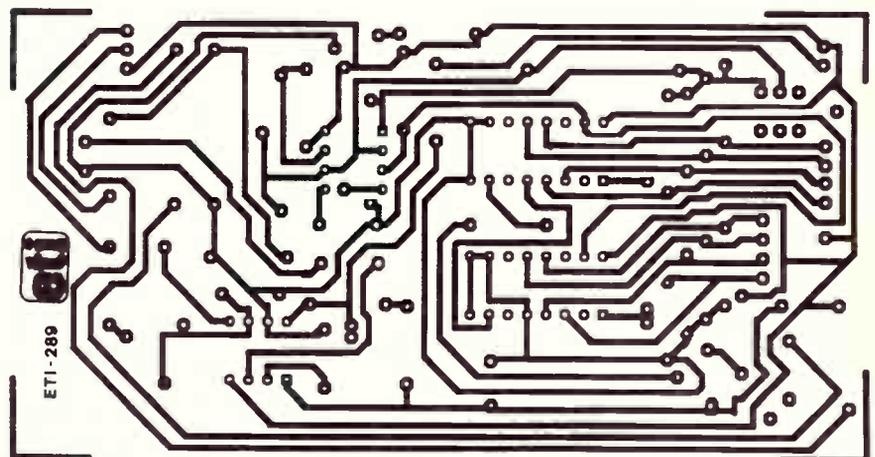
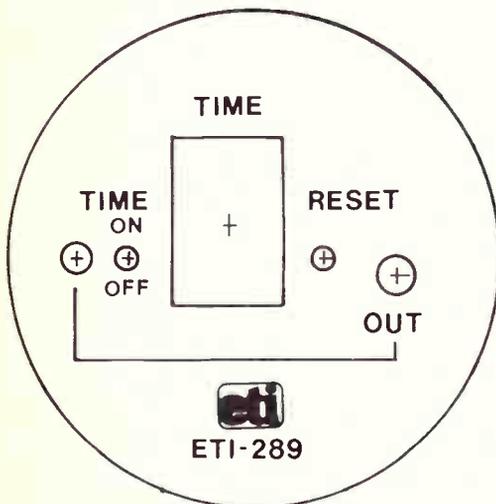
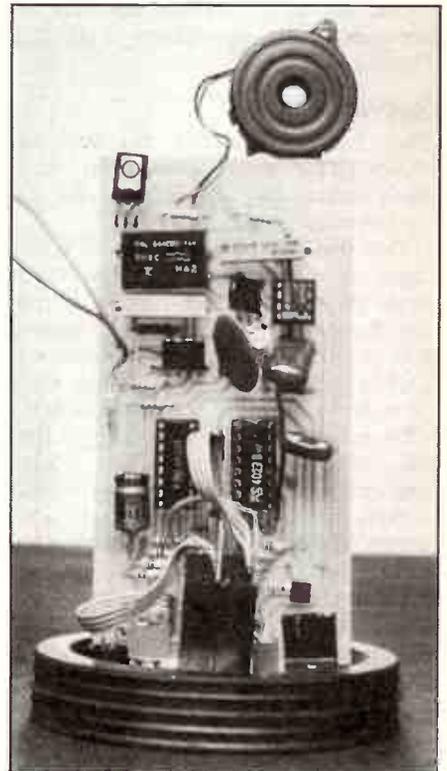
able switch, a jack plug socket and an indicator LED. The timer enable/disable switch allows the radio to be switched on for a pre-programmed time period or until the reset switch is pressed.

The timer has a range from zero to 99 time intervals. The duration of each interval may be varied during construction or by resetting a pot on the board.

The unit is powered by plugpack at the side. It is possible to run from batteries, but power consumption is rather high and will run the battery down in a few days.

Construction

Pour the coke into a glass and wash the can. Use a hacksaw to neatly cut away the inner-bottom section of the can. File any rough edges. Remove the rubber tyres from



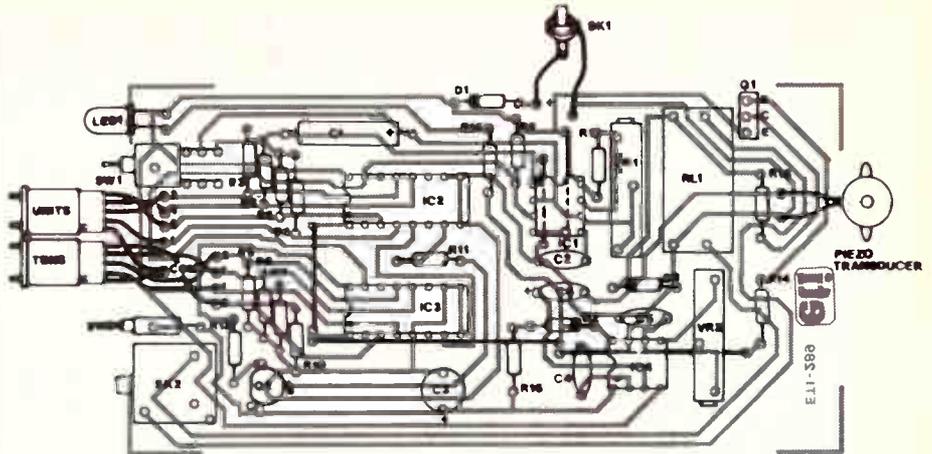
Watch Alarm Timer

the two plastic wheels. Place one of these around the top of the can and hold in position with some superglue. Put the can to one side.

Check the pc board for any track breaks or short circuits. If it is an undrilled board, drill where indicated by the component pads. As this project can be divided into 3 fundamental sections it is of advantage to construct and test each section separately. Begin by mounting D1, solder on a ground and +V lead. Put the links onto the board. Mount R1, VR1, C1, C2, SW1 and IC1. Check the polarity of C1. Power up the board.

Adjust VR1 to give a short time delay on pin 1. VR1 set to 4k2 gives a time delay of approximately a second. This delay can be measured by placing a multimeter between pin 3 of IC1 and ground.

When SW1 is on IC1 should cease oscillations. Set SW1 to the off position. The delay can be increased later but since long delays make testing counter circuits a slow process, keep it short.



Adjust VR1 to approximately 6k2. Mount IC4, C4, C6, C5, VR2, C3, LED1, R15 and R16. Check the polarity of C6 and LED1. Attach the piezo transducer. Use long leads to do this. Power up the board and place a digital watch over the transducer. Activate the alarm. Adjust VR2 until

LED1 is illuminated in synchronism with the alarm sound.

Attach D2, SW2, R14, Q1, R13, D3 and RL1. Once again power up the board, press SW2 and activate the alarm. LED1 should illuminate and remain illuminated. RL1 should switch on. Check this with a mul-

ETI-289 How it works

The circuit can be divided into three parts: a timer, a counter and a tone decoder. The timer is built around an LM 555 timer in astable mode. C1 is charged and discharged between 1/3 and minus 1/3 Vcc through R1 + R2 and R1 respectively. The total period is given by $T = 0.693(R1 + 2VR1)C1$.

When SW1 is closed C1 is shorted to ground and the timer is disabled. The output from the LM555 is taken from pin 3. This is used as a clock input to two 4029 counters via pull up resistor R2.

The two 4029 chips are configured as decade down counters and are cascaded using parallel clocks. This means that they count down from a maximum of 99 to zero in decimal. Pins 9 and 10 are tied to logic zero to achieve this.

The carry out of IC3 (pin 7) becomes the carry in of IC2 (pin 5). Both devices receive the same clock signal (pin 15).

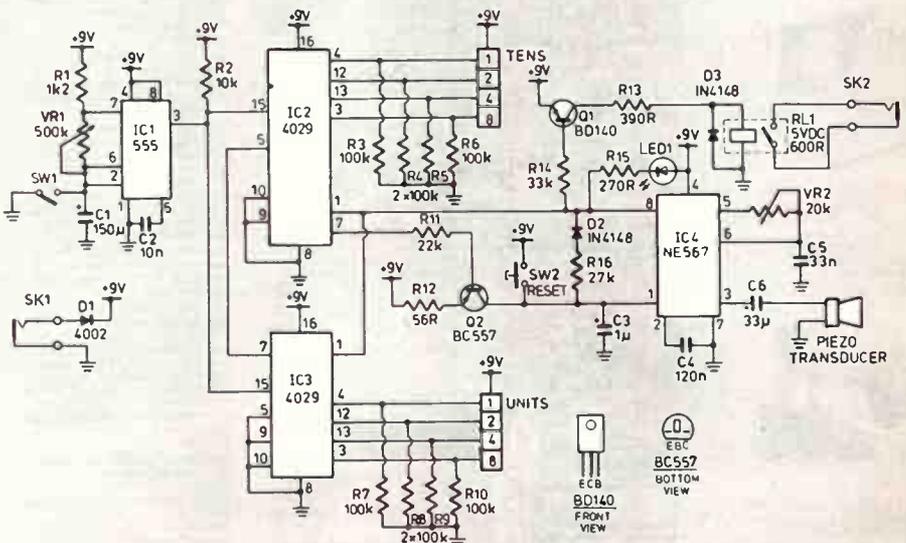
Pins 4, 12, 13 and 3 are called the jam inputs. The counter is loaded with these values (the jam inputs are set from the thumb-wheel switch values) when Present Enable (pin 1) is at a logical 1. If Present Enable is brought to logical 0 the counter is decreased with each positive going edge of the clock. This continues until Present Enable is brought high again.

Most of the time the carry out of IC2 (pin 7) is at logical 1. When the counter value reaches 00 it goes low, resetting the complete unit via R11 and Q2.

The whole process is initiated when the Tone Decoder NE567 chip receives the correct frequency signal at its input (pin 3). The tone decoder then takes its output (pin 8) low. Pin 8 is latched low by R16 and D2. It can be unlatched by taking pin 1 high. This can happen in one of two ways. Either SW2 is pressed or Q2 is switched on. A number of things happen when pin 8 goes low. LED1 is illuminated. Q1 is switched on and the relay is activated. Present enable on both counters is taken to logical 0 and the counters decrease in value on each clock signal.

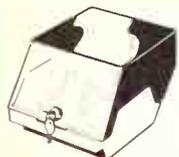
When both counters reach 90, carry out (pin 7) of IC2 goes low, Q2 is switched on, pin 1 of IC4 is brought high to unlatch the output of IC4, LED1 switches off, Q1 and the relay are deactivated and Present Enable on the counters goes high again. When Present Enable is high the counters are preset to the value on their jam inputs (the thumb wheel values) and do not advance on the clock signals.

R13 is a current limiting resistor for Q1. D3 protects Q1 when the relay is switching. VR2 sets the centre frequency of the tone decoder.

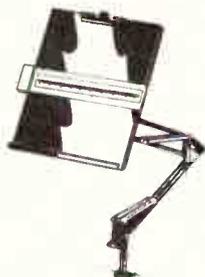


Rod Irving Electronics

The cheaper alternative...



5 1/4" DISK STORAGE (DD50-L)
Efficient and practical. Protect your disks from being damaged or lost!
Features...
• 50 x 5 1/4" disk capacity
• Smoked plastic hinged lid
• Lockable (2 keys supplied)
• Contemporary Design
Cat C16025 **only \$14.95**



COPY HOLDER (YU-H32)
• Adjustable arms allows easy positioning
• Copy area 9 1/2" x 11"
• Sliding line guide
• Clamp mounting
C21062 **\$39.95**



PANASONIC KX-P1081 DOT MATRIX PRINTER
• 120 C P S
• Pica or Elite character set
• Print Modes: NLO, Dot Graphics
• Proportional Font, Draft
• Proportional Printing
• Reliable and Compact
• Proportional Printing
• Logic Seeking
• 1K Printer Buffer
Cat C20035 **only \$595**



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 **only \$59**
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DB9 GENDER CHANGERS
• Saves modifying or replacing non-mating DB9 connections
• All 9 pins wired straight through
X15640: Male to male
X15641: Male to Female
X15642: Female to Female
..... **only \$14.95**



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 **\$17.95**
Cat.P19030 3 metres **\$22.95**



SEMICONDUCTORS!
Always check our prices before you buy!

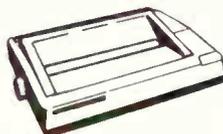
	1-9	10-	100+
V-20 8MHz	\$19.95	\$17.95	
V-30	\$39.95	\$34.95	
TEA2000	\$11.95	\$10.95	\$9.95
ZN429	\$9.95	\$8.95	\$7.95
ZNA234	\$39.50	\$37.50	\$36.50
SAB6456...P.O.A.			
2114	\$2.95	\$2.75	\$2.50
2716	\$9.95	\$9.50	\$8.95
2732	\$8.95	\$7.50	\$7.95
2764	\$7.95	\$7.50	\$6.95
27128	\$9.95	\$8.95	\$7.95
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	\$6.95	\$5.95
555 8 pin	\$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	
NE5534AN	\$1.95	\$1.85	\$1.75
AMEF7910	\$19.95	\$18.95	
MEL9501	\$29.95	\$27.95	
SC1410	\$1.75	\$1.50	
SC1510	\$2.50	\$2.25	
555	\$0.40	\$0.38	
741	\$0.50	\$0.45	



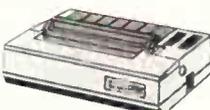
5 1/4" DISK STORAGE (DD100-L)
Efficient and practical. Protect your disks from being damaged or lost!
Features...
• 100 x 5 1/4" disk capacity
• Smoked plastic hinged lid
• Lockable (2 keys supplied)
• High impact ABS plastic base
• Contemporary design
C16020 **only \$19.95**



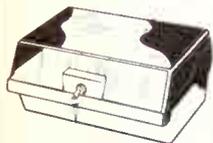
COPY HOLDER (YU-H33)
• Copy area 9 1/2" x 11"
• Sliding line guide
• Flat metal base
C21060 **\$39.95**



CPA-80 DOT MATRIX PRINTER
• 100 C P S
only \$375



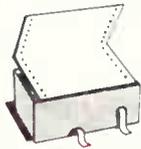
CANON A-50 PRINTER
• Serial Impact Dot Matrix
• 180 C P S
• Near Letter Quality Mode
• 1.4K Buffer
Cat C20045 **\$595**



JUMBO 5 1/4" DISK STORAGE (DD120-L)
If you have lots of disks, you'll appreciate the extra capacity of this disk storage unit when it comes to locating a particular disk.
Features...
• 120 x 5 1/4" disk capacity
• Smoked plastic hinged lid
• Lockable (2 keys supplied)
• High impact plastic base
C16028 **only \$24.95**



DUST COVER
Keep your computer and accessories free of dust and grime while not in use.
XT* Cover Set (C21066) **\$14.95**
AT* Cover Set (C21068) **\$16.95**



COMPUTER PAPER
Quality paper at a low price! 2 500 sheets of 60 gsm bond paper
Cat C21003 11 x 9 1/2" **\$49.95**
Cat C21005 15 x 11" **\$67.95**



VERBATIM DATALIFE DISK DRIVE ANALYZER
Automatically tests 4 critical areas of drive performance

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

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

Tests 4 critical areas...
In just minutes, the Datalife Disk Analyzer tests your drives' radial alignment, speed, write/read ability and clamping accuracy. And for each of these areas, it analyzes whether your disk drive is in good condition, fair condition or might need service.

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

No technical knowledge or special tools needed...
Everything you need is in this package. All you do is place the preprogrammed Disk Drive Analyzer in the drive to be tested, and select from the display screen menu the test or tests you want. And you can perform each test separately or have them all run automatically in just minutes.

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

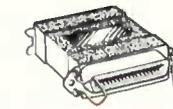
With the Datalife Disk Analyzer, that's a quick and easy task. If you value your data, you can't afford to be without it.
C12525 IBM PC/XT **\$59.95**
C12530 Apple **\$59.95**



DB15 GENDER CHANGERS
• Saves modifying or replacing non-mating DB15 connections
• All 15 pins wired straight through
X15645: Male to male
X15646: Male to Female
X15647: Female to Female
..... **only \$14.95**



RS232 GENDER CHANGERS
• Saves modifying or replacing non-mating RS232 cables
• All 25 pins wired straight through
Cat X15650 Male to Male
Cat X15651 Male to Female
Cat X15652 Female to Female
Normally \$14.95 each
Only \$9.95



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

8087
Genuine Intel chips with manual and data sheets packed in boxes!
8087-3 (4 77MHz) **\$269**
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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**



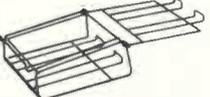
CPF CONTINUOUS POWER FILTER SPIKE ARRESTER
The Fortron CPF Filtered Electronic Spike Protector provides a protective electronic barrier for microcomputers, printers, telephone systems and modern electronic typewriters, audio and stereo systems and other sensitive electronic equipment.
The CPF provides protection from dangerous electrical spikes that can cause anything from obnoxious damage (like immediate equipment failure) to less obvious harm that can drastically shorten a system's life.
CPF's superior circuitry design and semiconducting technology responds instantly to any potentially damaging over-voltage, ensuring safe trouble free operation.
Additionally, CPF's filtering capability helps eliminate troublesome and annoying interference, general hash created by small motors, fluorescent lamps, and the like that threaten the performance and shorten equipment life of unprotected electronic components.
SPECIFICATIONS:
Electrical rating: 220-260 volts (AC) 50Hz 10 Amp
Spike/RFI Protection: 4 500 amps for 20ms second pulses
Maximum clamping voltage: 275V differential mode
Cat.X10088 **\$69.95**



3 1/2" DISK STORAGE (DD80-L)
• Holds up to 80 x 3 1/2" diskettes
• Smoked plastic hinged lid
• Lockable (2 keys supplied)
• High impact plastic base
• Contemporary design
Cat C16038 **only \$24.95**



KEYBOARD DUST COVER & COPY HOLDER
• Combines two functions in one set
• Flexible clamp can be attached to most brands of keyboards
• Made of clear acrylic plastic
• Overall size: 449 x 180mm
C21064 **\$29.95**



PRINTER STANDS
• Restores order to your work area
• Conveniently stacks paper printout in document tray automatically
• Made of black plastic coated steel
• Suitable for most printers
• Excellent value at these prices!
C21054 (80 column) **\$29.95**
C21056 (132 column) **\$39.95**



DELUXE PRINTER STAND
• Restores order to your work area without occupying extra space
• Feeds and refolds paper under the printer automatically
• Adjustable paper deflectors ensure smooth flow of paper
• Made of moulded plastic
• Suitable for most printers
C21058 (80 column) **\$69.95**

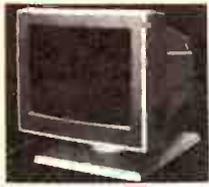


DISK NOTCHER
Converts 5 1/4" single-sided floppy disks to double-sided by placing an appropriate notch in the floppy disk jacket.
C21070 **\$9.95**



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

PRINTER RIBBONS TO SUIT EPSON MODELS...
MX100, FX100, RX100 (Cat. C22002) **\$19.95**
MX70.80, FX70.80, RX70.80 (Cat. C22031) **\$10.95**



SAMSUNG 12" FLAT SCREEN COMPOSITE MONITOR

FEATURES....
 ● Flat, high contrast, non-glare screen
 ● High resolution, 80 or 40 character display
 ● Tilt/swivel base
 ● Compatible with Apple[®] and IBM[®] colour composite signal

SPECIFICATIONS....
 Picture tube: 12" diagonal and 90° deflection
 Phosphor: Available in Green or Amber
 Video input signal: Composite Signal
 Polarity: Negative Sync
 Level: 0.5-2.0Vp-p
 Impedance: 75ohm
 Scanning frequency:
 Horizontal: 15.734 KHz ± 0.1%
 Vertical: 50-60Hz
 Video bandwidth: 20MHz
 Active display area:
 216(H) x 160(V)mm
 Display character:
 80 character x 24 rows
 Input terminal: RCA Phono Jack
 Controls:
 Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size
 Inside: H-Width, H-V linearity, H-V linearity Focus
 Power supply: 110/120V 60Hz, 220/240V 50Hz
 Dimensions:
 310(W) x 307(H) x 300(L)mm
 Weight: 8.1 Kg
 Shipping weight: 9.6 Kg

Cat No	Description	Price
X14510	(GREEN)	\$189
X14512	(AMBER)	\$189



SAMSUNG 12" TTL/COMPOSITE MONITOR

FEATURES....
 ● At least a monitor with both TTL and Composite modes¹
 ● High contrast, non-glare screen
 ● High resolution, 80 or 40 character display
 ● Swivel/Tilt base

SPECIFICATIONS....
 Picture tube: 12" diagonal and 90° deflection
 Phosphor: Green (P42)
 Video input signal: Composite/TTL
 Synchronisable
 Polarity: Negative/Positive
 Level: 0.5-2.0Vp-p 4.0-1.5Vp-p
 Impedance: 75ohm more than 6.8K ohm
 Scanning frequency:
 Horizontal: 15.75 KHz ± 0.1%
 Vertical: 47-63Hz
 Video bandwidth: 20MHz
 Active display area:
 Composite 206(H) x 160(V)mm
 TTL 216(H) x 160(V)mm
 Display character:
 80 characters x 25 rows
 Input terminal: Phono Pin Jack
 9 pin D-Sub Connector
 Controls:
 Outside: Power Switch, Contrast, Brightness, Signal Select, V-Hold, V-Size
 Inside: H-Width, H-V linearity, Focus, H-V Shift
 Power supply: 110/120V 60Hz, 220/240V 50Hz
 Dimensions:
 308(W) x 297(H) x 307(L)mm
 Weight: 7.3 Kg
 Shipping weight: 8.3 Kg

Cat No	Description	Price
X14509	(GREEN)	\$179



SWIVEL BASE

Make life easier with these quality swivel and tilt bases, complete with rubber fittings¹
 Cat D11100 Special, \$19.95



SAMSUNG 12" 20MHz COMPOSITE MONITOR ONLY \$149

FEATURES....
 ● High contrast, non-glare screen
 ● High resolution, 80 or 40 character display

SPECIFICATIONS....
 Picture tube: 12" diagonal and 90° deflection
 Phosphor: Available in Green (P39) or Amber
 Video input signal: Composite Signal
 Polarity: Negative Sync
 Level: 0.5V-2.0Vp-p
 Scanning frequency:
 Horizontal: 15.734 KHz ± 0.1%
 Vertical: 60Hz
 Video bandwidth: 20MHz
 Active display area:
 216(H) x 160(V)mm
 Display character:
 80 characters x 25 rows
 Input terminal: RCA Phono Jack
 Controls:
 Outside: Power Switch, Contrast, Brightness, H-Shift, V-Size
 Inside: H-Width, H-V hold, H-V linearity, Focus
 Power supply: 110/120V 60Hz, 220/240V 50Hz
 Dimensions:
 308(W) x 307(H) x 297(L)mm
 Weight: 7.3 Kg
 Shipping weight: 8.3 Kg

Cat No	Description	Price
X14514	(GREEN)	\$149
X14516	(AMBER)	\$149



SAMSUNG TTL 12" MONITOR

● High contrast, non-glare screen
 ● Excellent value for money¹

SPECIFICATIONS....
 Picture tube: 12" diagonal 90° deflection
 Mode: TTL
 TTL input signal:
 Polarity: TTL Positive
 Level: 4V p-p ± 1.5V
 Impedance: 75ohm
 Video bandwidth: 16MHz (± 3dB)
 Scanning frequency:
 Horizontal: 18.432 ± 0.1KHz
 Vertical: 50Hz ± 0.5%
 Active display area:
 216(H) x 160(V)mm
 Display characters:
 80 characters x 25 lines
 Input connector: 9 pin connector
 Controls:
 Front: Power ON/OFF, Contrast Rear: V-Hold, V-Size, Brightness Internal: Vertical Linearity, Horizontal Linearity, Horizontal Width, Focus
 Power supply: 110/120V 60Hz, 220/240V 50Hz
 Dimensions:
 308(W) x 297(H) x 307(L)mm
 Weight: 7.3Kg
 Shipping weight: 8.3Kg

Cat No	Description	Price
X14500	(GREEN)	\$189
X14502	(AMBER)	\$189



SENDATA DIRECT CONNECT MODEM

● CCITT V21 300 baud full duplex
 ● CITT V23 1200/75
 ● Bell 103 300 Full duplex
 ● Bell 202 1200 Half duplex
 ● Auto answer
 ● LED display for Power, TX, RX, CD
 ● AC power adaptor included
 ● DB25 pin connector
 ● Telecom Approval¹ C83/37.1045
 Cat. X19120 \$295
 (SOFTWARE FOR VIA TEL \$95)



VERBATIM DISK SPECIALS!

All prices 10 disk boxes

Description	1-9 boxes	10+ boxes
5 1/4" 1S/2D	\$24.95	\$22.50
5 1/4" 2S/2D	\$29.95	\$28.50
5 1/4" 2S/4D	\$75.00	\$70.00
5 1/4" 2S/HD	\$44.95	\$42.95
3 1/2" 1S/2D	\$47.50	\$46.50
3 1/2" 2S/2D	\$49.50	\$48.50



SAKATA 13" RGB COLOUR MONITOR

High quality IBM[®] compatible monitors, great with VCR's too!
SPECIFICATIONS:
 CRT: 13", 90° deflection colour
 Input Signal:
 Video Signal: Separate video signal
 Video: Positive
 Sync: Positive
 Input Level: TTL Level
 Scanning Frequency:
 Horizontal: 15.75KHz
 Vertical: 60Hz
 Display Size: 245(H) x 182(V)mm
 Resolution:
 Horizontal: 640 dots
 Vertical: 200 lines
 Size: 343(H) x 362(W) x 421(D)mm
 Weight: 11.8kg
 Cat. X14530 \$695



5 1/4" DISK STORAGE

Efficient and practical. Protect your disks from being damaged or lost!
Features....
 ● 70 disk capacity
 ● Smoked plastic cover
 ● Lockable (2 keys supplied)
 ● Dividers/spacers
 Cat. C16025 only \$14.95



3 1/2" DISK STORAGE UNIT

● Holds up to 40 x 3 1/2" diskettes
 ● Lockable (2 keys supplied)
 ● High impact plastic lid and base
 Cat. C16035 only \$14.95



APPLE[®] COMPATIBLE SLIMLINE DISK DRIVE

Compatible with Apple 2 -
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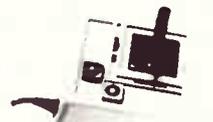
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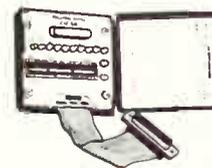
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ETI-289 PARTS LIST

Semiconductors

IC3, IC2.....	4029 up down counter
IC1.....	NE555 Timer
Q1.....	BD140
Q2.....	BC557
D1.....	4002
D2, D3.....	1N4148
LED1.....	green
IC4.....	NE567 Tone Decoder/PLL

Resistors

R1.....	1k2
R2.....	10K
R3-10.....	100K
R11.....	22K
R12.....	56R
R13.....	390R
R14.....	33K
R15.....	270R

R16.....	27K
VR1.....	500k multiturn
VR2.....	20k multiturn

Capacitors

C1.....	47µF electrolytic 16v
C2.....	10n greencap
C3.....	1µF electrolytic 16v
C4.....	120n greencap
C5.....	33n greencap

Miscellaneous

Piezo transducer, 2 Thumb wheel BCD switches, 20 cm Ribbon cable 9-way, RLY1 5 V DC 600R, SW1 single/double pole switch, PCB mount, SW2 Push to make, PCB mount, SK1 3.5 mm PCB socket, SK2 3.5 mm socket, 2 black and white plastic wheel with rubber tyres, 8 mm diameter 6.5 mm inner diameter.

timer. Push SW2. This should reset IC4 and turn off LED1.

Mount resistors R2 to R10. Separate the thumb wheel switches, solder 5 strands of ribbon cable onto one and 4 onto the other. Join the common terminals on the thumb wheel switches to each other. Mount the thumb wheel switches onto the front panel. Solder the open end of the ribbon cable onto the pc board making sure that each strand goes to the correct position as on the circuit diagram. Mount IC2 and IC3. Set the

thumb wheel switches to 55. Power up the board, press SW2. Pins 4 and 13 on IC's 2 and 3 should be logical 1. Pins 12 and 3 should be logical 0. If this is not so check the ribbon cable connections. Set the thumb wheel switches to 05. Place a multimeter between pin 7 and ground of IC2.

Activate the alarm. Pin 7 should go low after approximately 5 seconds and remain so for 1 second. If you suspect that the counters are not counting correctly, pin 6 of IC3 should oscillate at 1/2 the clock frequen-

cy. If this is not so check that the IC's have been inserted correctly. Insert R12, R11 and Q2. Power up, press SW2 and activate the alarm. LED1 should illuminate and relay 1 be activated. The system should reset itself after a time delay corresponding to the value of the thumb wheel switches. Adjust VR1 to a new time interval if required.

Now connect the 3.5 mm socket to the power and ground leads. Mount SK2 and SW1. Place the front panel on the top end of the pc board so that the LED, socket and switches are aligned with their respective positions. Stick down the front panel. Put on any locking nuts to hold the components together. Place the piezo transducer in the can and attach it to the closed end with some tape. Drill a small hole on the side of the can and mount the 3.5 mm power socket to it. Place the board inside the can so that the front panel fits snugly over the open end. Put the tyre on top of this and secure with superglue. Plug in a 9 V power-pack and a small battery powered radio with RLY1 in series with the on/off switch to the unit. Place it on top of your digital watch. The piezo transducer should be directly over the watch.

Get yourself a drink (remember the glass of coke . . . well its probably flat by now so get some orange juice) and go to sleep. ●

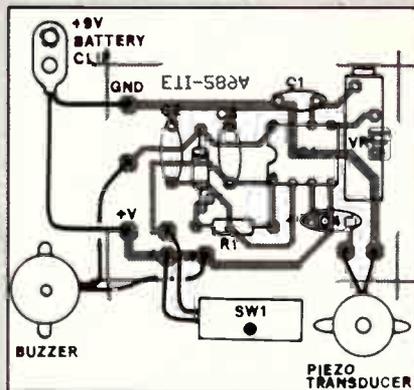
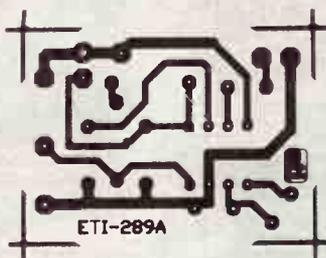
ETI-289A

This is a cheap variation of the main circuit. It's for use by people who are particularly nasty when they wake up in the morning.

You are sleeping comfortably when this loud and particularly horrid buzzer sound interrupts your dream. Your first instinct is to grab the alarm and throw it against the wall . . . Well, with this variation you can do just that.

The specification for such an alarm are that it should be battery operated, emits a loud irritating sound and be small enough to be built into a football or similar protective case. It should also switch off when subject to sudden deceleration.

The ETI-289A meets these requirements. It operates from a single 9 V battery. It is reset via a vibration switch and it is activated by the alarm tone of a digital watch.



ETI-289 How it works

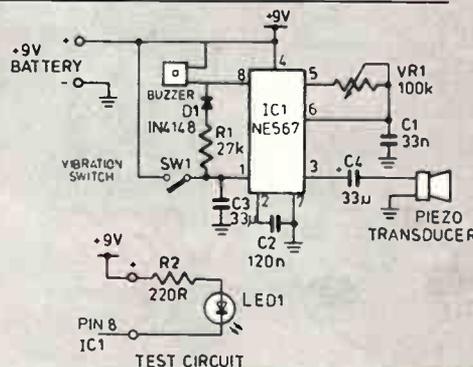
Most of the hard work is done by the NE 567 tone decoder chip.

The input from the transducer is fed via capacitor C4 to pin 3 of the 567. Pin 3 is the input to a phase locked loop. A signal presented to pin 3 whose frequency is within the detection band of the PLL will cause a logical zero state on the output (Pin 8).

A logical zero on the output energises the buzzer, which then has nine volts across it. The output is latched on

by the feedback resistor R1 and diode D1.

The output is unlatched (alarm turned off) by pulling up pin 1. This happens when the vibration switch is closed. The internal oscillator centre frequency is set by VR1. The centre frequency is given by $f_0 = 1.1/R1C1$. The bandwidth is given by $V1/f_0C2$, where V1 is the input signal amplitude and f_0 is the centre frequency. During construction the centre frequency is turned to the watch's alarm frequency.



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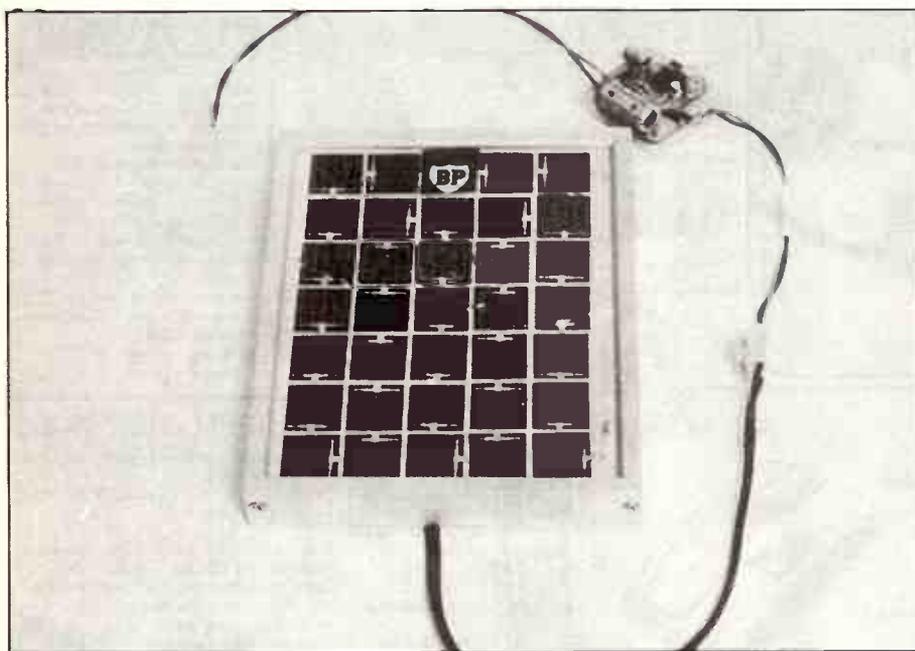
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ETI-569: SOLAR GENERATOR

SK Hui

With advances in solar cell technology, falls in price and higher efficiency, solar cells have finally begun to be practical sources of power.

This is a cheap, no fuss way to trickle charge a battery.



THE ETI-569 Solar Charger is designed to charge any standard 12 V lead acid car battery in any area where mains power is unavailable. It is ideal for remote data acquisition stations, caravans and boats.

Of course there are other solar chargers around, but these are extremely expensive. With the ETI-569 the emphasis is on simplicity and cheapness.

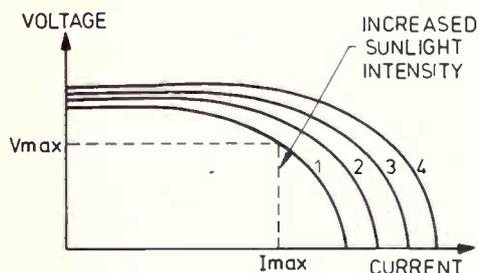


Figure 1: Voltage and current output at various light intensities.

Design Problems

The major difficulty in using solar cells for charging is the fact that their output voltage and current vary immensely with the intensity of the sun's rays. Another problem is that discharge from the lead acid battery into the solar charger must be avoided during night time. Furthermore, overcharging the lead acid battery must be automatically prevented.

The simplest way to re-charge a lead acid battery is to maintain a 15 volt current across the terminals with a series resistor to program the charging current. The problem here as regards solar charging is obvious, for how is this current to be maintained constantly with varying weather conditions. For any given light intensity, maximum power can only be obtained if the charger draws the right amount of current. Taking too much current from the solar charger will lead to a drop in terminal voltage and it will thus take a very long time to charge the lead

acid battery. As explained in figure 1, the circuit input impedance has to be continually re-adjusted to ensure that maximum power is drawn from the solar battery.

Ideally, the charging circuit has to have the ability to detect the right amount of current and at the same time, keep 14 V across the lead acid battery regardless of the fluctuations on the solar battery. Sound easy?? It would be easier if we had a stable power supply for the circuitry. However the whole idea behind the ETI-569 is to build a maintenance free system without using any man-made source of power. It seems vaguely ludicrous for a solar charging circuit to be powered by something else like a dry cell battery.

Clearly the design task is not easy if the solar circuit has to tackle the above problems and yet be simple enough to be constructed by the hobbyist. In fact it is well nigh impossible but a compromised circuit is quite feasible.

Design Solutions

Most modestly cheap solar panels are made

ETI-569 PARTS LIST

Resistors

All 0.25W, 5% tol.)
 RR1 1K
 R2, R5 10K
 R3 56K
 R4 1K8

Capacitors

C1 33 μ F 25V (Elec)
 C2 47nF (Green or Ceramic)
 C3 47 μ F 63V (Elec)
 C4 220 μ F 35V (Elec, axial lead)

Semiconductors

IC1 CMOS version of 555 timer
 Q1 BC547
 D1, D2, D3 1N4002 or 1N4004
 ZD1, ZD2 1N5352 (5W, 15V zener diode)

Miscellaneous

A single sided printed circuit board. Terminal connectors for connecting the solar panel and the battery to the circuit. I believe most of the major kit suppliers will not include the solar panel and the potting epoxy in the kit.

up of a chain of solar cells. During cloudy day-time hours, the solar battery output voltage is low (less than 12 V), so one of the first things we need is a voltage doubler to increase the voltage from the solar battery. This device raises the problem of overcharging the lead acid battery.

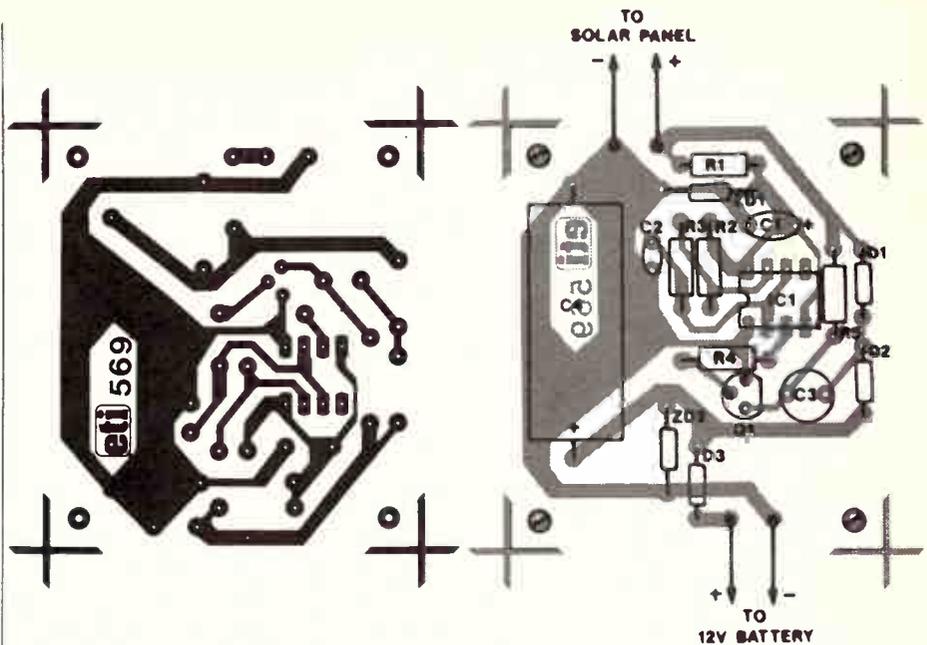
The answer to this problem is some kind of artificial load which automatically switches in to take up the charging current when the battery is full and switches itself off when the battery is being charged. An excellent artificial load can be constructed with a constant 15 V voltage zener diode and a 1N4002 rectifying diode connected across the lead acid battery. As the battery approaches full capacity, its terminal voltage gradually rises and starts to turn on the zener. From then on, any more current will be absorbed by the zener diode.

Referring back to figure 1 again, you will see that a different amount of current at a different intensity of light will have to be drawn in order to maximize the output energy from the solar battery. The zener diode automatically ensures this. Consider the case when the sun light increases, the voltage from the solar cell rises, resulting in more volts across the lead acid battery. Ohm's law says the battery will soak up more current as a consequence. This extra burden on the solar battery will lower its output voltage as indicated by the curve shown in figure 1. Consequently, voltage across the lead acid battery drops as well, resulting in a smaller current flow. Automatically, this process comes to rest on a point where the products of voltage and current give a maximum value. The settling point is constantly re-adjusted according to the changing sun light intensity.

When there is little sun light around, the voltage output of the solar battery is very low. Even with the help of the voltage doubler, the output voltage may not be enough to charge the lead acid battery. At night everything stops except the diode in series with the lead acid battery which prevents the battery from discharging. The charging process will resume automatically on the next sunny day providing a maintenance-free charging operation.

The voltage doubler itself is made up of an oscillator. I decided to use a CMOS 555 timer, since it draws minimal current allowing every drop of juice from the solar panel to be used for charging the battery.

Because of the hostile environment in which the unit will spend its life, it is strongly recommended that you put the circuit in epoxy for permanent use (after the testing). After all, the whole circuit is cheap enough to throw away and replace if it should stop performing.



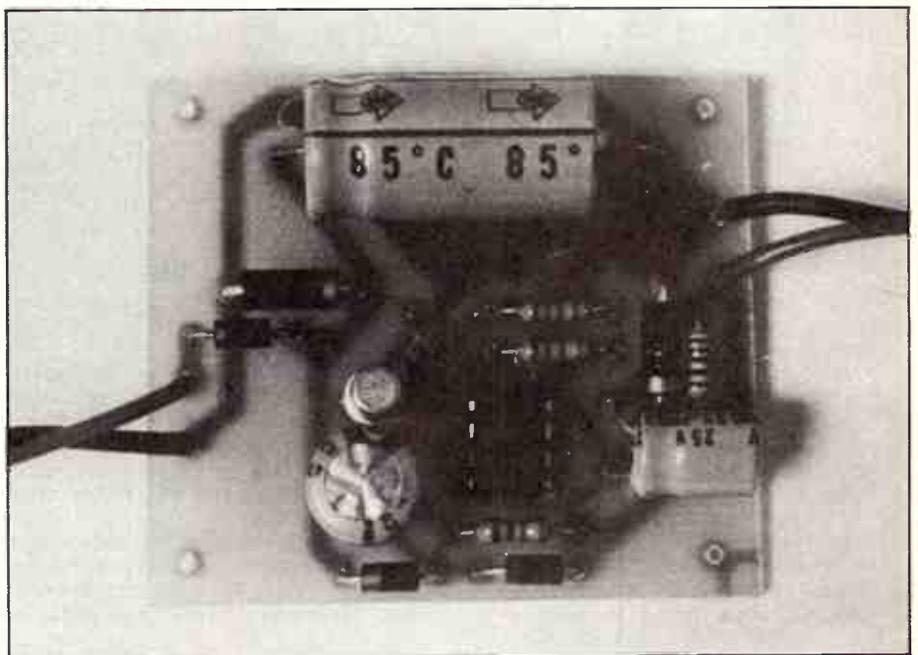
Construction And Testing

The type of solar panel used is not very critical in the unit. Almost any unit will do the job. Typically no more power than 6 W is required with an output voltage of 12 to 20 V. If you want to shorten the charging time by hooking up to solar panels in parallel, the power rating of ZD2 has to be higher than 5 W. This is because when the battery is fully charged, the output power from the solar panels has to be fully absorbed by the zener

diode ZD2. When the light intensity is at its peak (1000 W/square metre), the zener diode ZD2 has to buffer a fair bit of power from two or three solar panels in parallel.

There are only a few components on board so assembly of it should take no more than 20 minutes. No tuning and adjustment is required. However, be careful with the polarity of diodes, transistor and capacitors. Before you pop the circuit into an epoxy brick, it is necessary to test the circuit first.

The tools required to test the circuit are



very simple, two multi-meters, an uncharged lead acid 12 V battery (or a 220 R load resistor if you don't have a spare battery) and the sun. First connect the testing arrangement as shown in figure 2. One meter is configured as a current and the other one as a voltage meter. The polarity of the meters's probes have to be correct so that a positive reading is obtained when the current or voltage is in the right direction. Orient the solar panel towards the sun and you should get POSITIVE readings on the current meter. On a typical sunny Sydney winter morning you can expect 100 mA (assuming one solar panel is used). The voltmeter should read something like 15 V. Tilt the solar panel slightly to affect the amount of light falling upon it and you should ob-

serve either a drop or increase in meter readings.

There are two things you must check. No matter how you tilt the panel, even on a hot summer day, the voltmeter should never read more than 16 V (under no load condition). If it does, ZD2 has probably failed. If you cover the solar cell with a dark piece of cloth, the current polarity shown in the meter should be negative and the reading be either nil or extremely small. If the NEGATIVE reading on the current meter is significant while there is no sun, diode D3 is probably malfunctioning.

I would suggest that you leave the set-up as it is in figure 2 outdoors for a week or so, depending on the capacity of the battery to be charged. Start off with a completely dis-

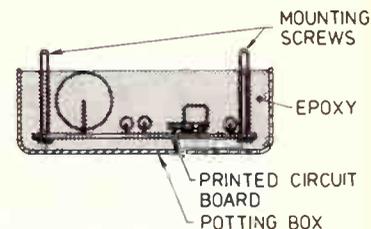


Figure 3: Schematic diagram of the potted box.

charged battery and see if it charges at all during a week.

The two meters are only temporary fixtures. They are there purely for the convenience of checking the charging conditions any time you wish.

After the circuit is proven, you can pot it into an epoxy brick. If you want to mount the brick onto something with screws, this can be done quite easily. As you realize there are four mounting holes on the four corners of the pc board. Mount four screws on the board as show in figure 3. Make sure the depth of the potting box is not higher than the length of the screws. Once the epoxy dries, you have got an epoxy brick with four screws sticking out on the bottom ready for mounting.

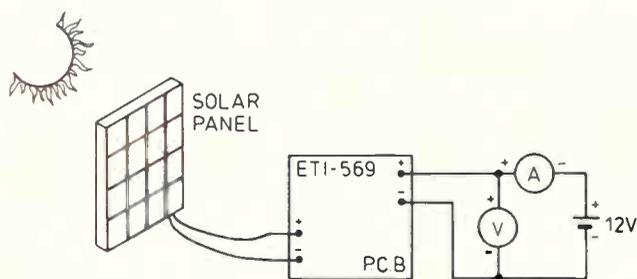
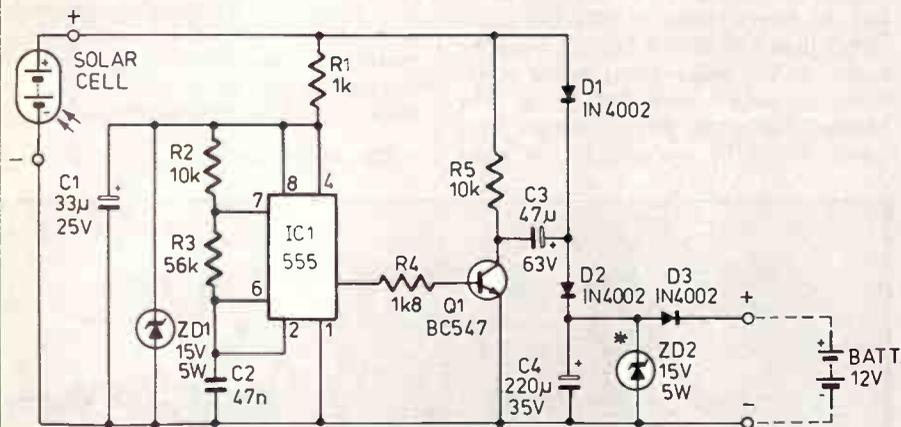


Figure 2: Test set up for the ETI-469.

ETI-569 How it works



* SEE TEXT

When the solar cell is creating a voltage much greater than the battery, the typical charge-type situation, then the circuit may be considered to consist merely of the solar cell and the battery. Current will flow from the solar cell into the battery. All the other components are present solely because this situation does not always pertain.

For instance, it may well be that, because of night or cloud, the solar cell is actually not developing sufficient energy to charge. In this situation, the biggest danger is that the battery will

discharge through the circuit or the solar cell. D3 protects against this situation.

At the opposite extreme, the battery might already be fully charged. It is necessary to have some form of voltage clamp to ensure that the battery is not damaged. This is achieved by ZD2, which effectively stops the battery ever going over 15 V.

A third problem is to ensure that when the solar cell voltage is below the battery voltage, but not a zero, the unit will still charge. The rest of the circuit is

designed to cover this eventuality. The heart of the circuit is a voltage doubler built around the 555 and the two capacitors C3 and C4. To see how it works, consider the situation with pin 3, IC1 at Vcc, so that the collector of Q1, and thus the negative plate of C3 is effectively at ground. Then current will flow from the solar cell, through D1 onto the positive plate of C3. D2 is reverse biased by the battery.

When pin 3 IC1 goes low, the collector of Q1 goes high, pushing the positive plate of the battery up to Vcc. But C3 has Vcc impressed across it already, so the new voltage is 2Vcc. This switches off D1 and turns on D2. Current now flows into C4.

When IC1, once again, causes the positive plate of C3 to drop to Vcc, D2 reverse biases, thus providing C4 with only one discharge path, through the battery. In this way it is possible to provide a charging current even though the solar cell has less potential across it than the battery.

Note that this is strictly true only if 2Vcc is less than 15 V, because of the operation of ZD2.

R2, R3 and C2 set up the frequency of operation of IC1. ZD1 is designed to protect the 555 from an over voltage situation, and R1 and C1 to stabilize the operating voltage of the oscillator.

ETI-180 SOLID STATE VOLTMETER **Part 1**

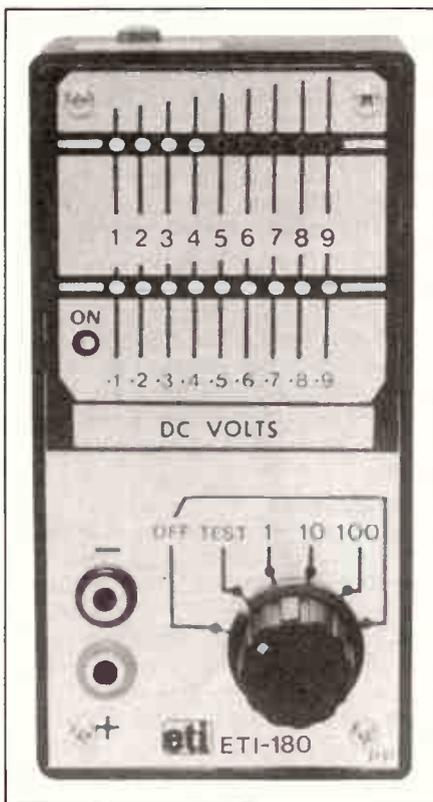
Here is a completely solid state, portable, small, high resolution dc voltmeter for around \$30. Impossible you say — what's the catch? We prove it can be done, and present a unique device that has numerous features, is easy to build and competes with a DVM.

Peter Phillips

WHEN THIS SERIES was planned, it was decided to base it on analogue electronics in a range of inexpensive, integrated projects primarily consisting of items of test equipment. So far all projects have conformed to this brief, and digital hasn't reared its head at all. But, after 10 parts, ideas were becoming scarce. It's either been done before, or can be better achieved with digital technology. Inspiration comes in strange ways, and in this case the concept was preceded by a means of achieving it.

A solid state voltmeter is not new; the bargraph is more commonly employed than the DVM, particularly as a level indicator. Also, marriage of a moving coil meter to analogue circuitry is simple in concept, as demonstrated by part 10 of this series. But a meter employing two bargraphs, one resolving 10% of full scale, the other 1% was sought. My spare time was occupied thinking about this idea, with the ultimate dismissal of many possible schemes as being impracticable. Who was it who reckoned on a mix of 1% inspiration and 99% perspiration? The perspiration continued, and first steps taken with the LM3914 bargraph driver IC. Finally, after consultation with a well worn 1978 National Linear Data book a basic voltmeter using one bargraph was operating on the breadboard. Big deal; now what? At 10 pm, it seemed a good idea to retire for the night, and end the series.

Then the whole thing crystallised. By 1 pm that night a complete prototype was operational. Simplicity itself, the whole concept opens up new possibilities for many applications. So we present, at last, a completely solid state analogue voltmeter.



Why this meter

The DVM is an accepted technology, and only diehards use moving coil multimeters. Or so the story goes. As one who grew up with valves (and who holds the view that a valve amp is best), my support for an analogue meter will no doubt draw cries of 'old fashioned' from readers convinced of the merits of the DVM. The strong points

of the DVM are its resolution, sensitivity and readability. Although resolution is an important feature, one has to relate this to the accuracy of the device. Most DVMs have an accuracy on the dc volts scale of around 2% to 3% (plus or minus one digit), which means a 10 V reading could be an actual value of anywhere between 10.2 to 9.8 V, suggesting the 10.00 reading is overkill. However, the high resolution allows ready comparison between voltages. The features of a moving coil voltmeter include its simplicity and ability to show a varying value, such as the voltage across a charging capacitor. Also, the voltage is obtained immediately, as no sampling time is required as in the DVM.

The analogue meter being presented in this and a following article encompasses the advantages of both technologies. It has a high resolution readout that even allows its evaluation in the dark, readily follows a varying voltage, and is user serviceable. Best of all, it's rugged. No delicate meter movement is required, and servicing is a matter of calibration or IC replacement. This meter would suit anyone who requires a cheap voltmeter, but finds a scale and pointer combination unsuitable, and its characteristics make it ideal as a backup for a DVM.

Description Of The Voltmeter

The term 'creeping specifications' refers to starting out with the intention of designing a mousetrap and ending up with an atomic bomb. To be truly effective, I considered the project should offer all the advantages of cost effectiveness, size, portability and usefulness. The first three criteria tend to constrain the fourth, but I didn't want an

atomic bomb, just a better mousetrap. The meter in its present form has three ranges comprising 1 V, 10 V and 100 V, for dc only. It also has over-range indication and a battery test feature. Input impedance is around 2M ohm, and resolution is to 1% of the full scale value. Accuracy is largely a matter of calibration, but is capable of 2%, which equates to plus or minus one low order LED indication. This unit is not intended as a high accuracy device, hence the \$30 price tag, and like many DVMs, the resolution may exceed the accuracy. The unit is powered by 4 size AA batteries, and rechargeables are suggested, though not mandatory as standby current is around 20 mA. The case is the second smallest sized jiffy box, and one pcb holds everything, including the range switch. This allows the unit to be used as a panel meter if needed, perhaps in a power supply.

The circuit is based on two LM3914s, and one μ A324 quad op amp. Two rows of 9 LEDs form the readout, and operate in conjunction to give 1% resolution. Figure 1 shows a simplified block diagram of the circuit. The 10% bargraph is driven directly by the dc input voltage, and a staircase output signal is generated as each LED is activated. The input and the staircase voltages are both applied to a differential amplifier, which produces an output equal to the difference between the staircase level and the input voltage. For example, if the input voltage is exactly 5 V, then assuming a 1 V step height, a 5 V staircase output level results as LEDs 1 to 5 are on. The output of the differential amplifier is then 0 V. If the input voltage rises to 5.4 V, the differential amplifier outputs 0.4 V, causing the 1% bargraph to light its 4th LED.

Each bargraph has 9 LEDs, and over-range indication occurs when the unused 10th LED of the 10% graph is activated. Thus, the 1 V scale actually only indicates up to 0.99 V, and on an input of 1 V, the 10% graph flashes, inviting range changing. The remaining scales behave the same way, but at 10 V and 100 V inputs. The 10% graph operates in bar mode; necessary to produce the staircase waveform. The 1% graph displays its value in dot mode, up to the ninth LED, when the output enters bar mode. This prevents any ambiguity in the reading which could result if the input voltage is close to a whole value. Otherwise, an input of say 9.95 V would display 9 V, as the unused tenth LED of the 1% bargraph would be on, and all others off.

A self-test feature is included, in which the voltmeter displays its own supply voltage. This voltage can vary by up to 15%

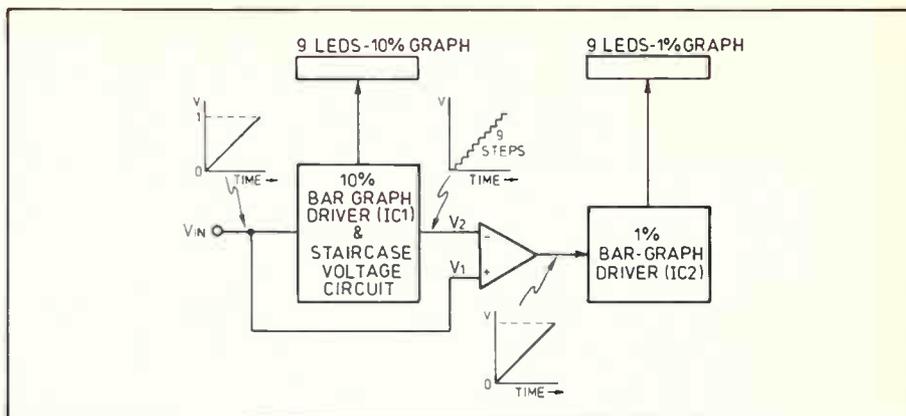


Figure 1: ETI 180 block diagram.

before accuracy is affected, and battery voltages as low as 4.5 V can operate the meter. The input impedance is approximately 2M ohms, constant for all ranges, and input protection is provided. This compares favourably with a 10 μ A moving coil voltmeter, which has input impedances of 100k ohms for its 1 V range, 1M for 10 V, and 10M ohm for 100 V, usually with no input protection. A DVM, however, usually has an input impedance around 10 M ohm.

Consistent with the educational aim of this series, first a look at the LM3914 bargraph driver, the heart of the whole project, then a brief discussion of the differential amplifier configuration that features prominently in the design. Full constructional details and all artwork for the project will be presented next month, and a circuit description is provided within this article.

The LM3914

This IC was introduced by National in 1977, in three varieties; the 3914, 3915 and 3916. The '14 and '15 types differ in that the '14 is linear, the '15 logarithmic. The 3916 is a complete 10 LED bargraph-IC package, constructed on a small pc board. Basically, the 3914 consists of 10 comparators driving 10 LEDs. A reference voltage of around 1.2 V is developed within the IC, and bar-dot mode can be selected by applying a specified voltage to the 'mode' pin. The feature that made this project possible is that all LEDs are operated by constant current sources. The value of the current is set by an external resistor, and each LED therefore has the same current, regardless of LED characteristics and how many are on at a time. The staircase voltage referred to previously is produced by sensing the voltage drop across a resistor in series with the supply and the LED anodes, and each step has the same height as the current increments

equally as each LED is turned on.

Figure 3 shows a simplified diagram of the device. Each comparator has descending values of V_{REF} applied to the non-inverting inputs, and the input voltage being monitored is applied, via the buffer, to the inverting input of all comparators. When the input voltage exceeds the voltage at the non-inverting input of a comparator, the LED driven by that comparator will light. The resistance from pin 7 to ground determines the LED current, and the reference voltage can be varied by using the circuit shown in figure 2, which also shows two equations relating the resistor values. If V_{cc} is applied to the 'mode' terminal (pin 9), the display is in bar mode. If the voltage at the mode terminal is 200 mV lower than V_{cc} dot mode is selected. If dot mode is required continuously, pin 9 is connected to pin 11, otherwise to pin 3.

A feature which caused some problems in the design of this project is the 'overlap' between segments. This causes one LED to fade out when the next turns on, rather than the required snap action to produce a definite, fast change in the generated staircase. As described in the circuit's operation, positive feedback between the two LM3914s was required to minimise the possibility of incorrect displays occurring as each step in the staircase occurred. A manifestation of this might give a display of, say, 3.9 V for an input approaching 3.0 V, occurring when the voltage reaches a value to just fade in LED 3 of the 10% scale. Until this LED is fully on, the step height cannot reach its final value and extinguish the 1% graph. However, tests have shown that, due to the applied feedback, this occurrence is unlikely. If suspected, change the range, and return to the original range.

Space limitations prevent a full examination of the 3914, which has considerable

versatility; demonstrated adequately by the National Data book.

The Differential Amplifier — Op Amp Version

A differential amplifier of any type produces an output proportional to the difference voltage between its input terminals. The op amp itself is actually a high gain differential amplifier. If one input of a differential amp is connected to ground, the circuit behaves as a conventional amplifier, as the input signal is then applied to the other input, giving the difference signal. Thus, a differential amp has two inputs, and, for discrete component circuits, can have two outputs. Because only the difference is amplified, a voltage present equally on both inputs, known as the common mode voltage, will produce an output of 0 V. Thus, the ideal differential amplifier has a common mode gain of 0, and a differential gain as set by the component values. Figure 4 shows the basic differential amplifier circuit using an op amp.

If all resistors have the same value, then applying 1 V to both inputs will cause the voltages at the non-inverting input to equal 0.5 V, caused by the potential divider of R3 and R4. The current flowing

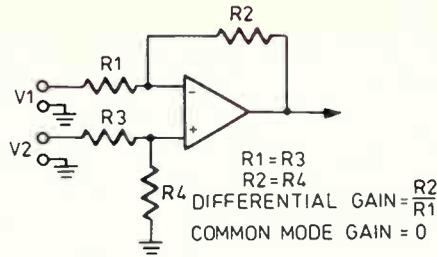


Figure 4: Differential amplifier implemented with an op-amp.

in R1 will equal the current in R2, as none flows into the op amp, and, as $R1 = R2$, the voltage across R2 will also equal 0.5 V. This means the output of the amplifier will be 0 V, as 0.5 V is already present at one end, showing that the output is 0 V when the input voltages are equal.

If the input voltage V1 is increased to 1.1 V, the output will be -0.1 V, as the voltage drop across R1 will become 0.6 V ($V1 - 0.5$). For the reasons already described, the voltage across R2 must equal that across R1, requiring the output to become negative by 0.1 V. Similarly, increasing V2 to 1.1 V, while V1 is 1V, causes the output to become +0.1 V. This shows that the circuit of figure 4 has a

gain of 1. The gain of the circuit can be increased by raising the values of R2 and R4, and the gain then equals the ratio of R2 to R1.

It is important that R1 equals R3, and that R2 equals R4, if a common mode gain of zero is to be obtained. The degree of matching of these components determines the common mode gain, and a specification known as the Common Mode Rejection Ratio is often used to describe the amplifier's ability to reject the common mode component.

In the circuit diagram of the meter, two differential amplifiers are used, and the common mode gain is adjusted to a minimum using variable resistors. This is a characteristic of most differential amplifiers, and the adjustment to obtain a zero output voltage needs to be performed when the inputs are joined together ensuring an equal common mode signal. In practice, varying the common mode signal will produce a slight variation in the output, an effect that can only be minimised by using accurately matched components throughout, including those in the op amp's internal circuit. Special instrumentation amplifiers are used where common mode rejection must be extremely high. ●

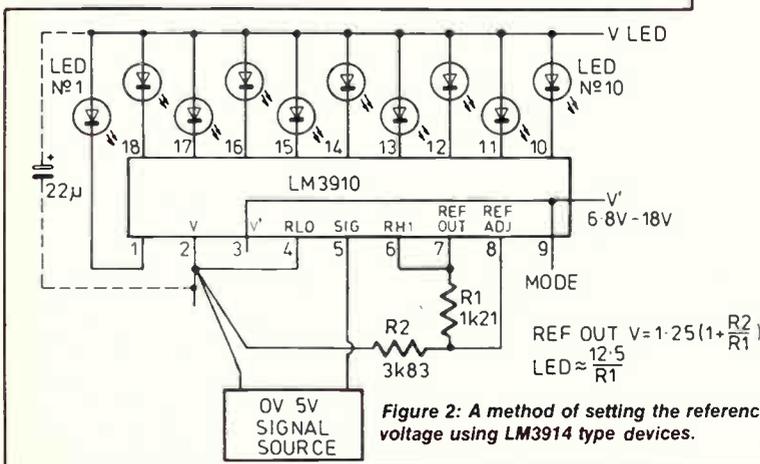
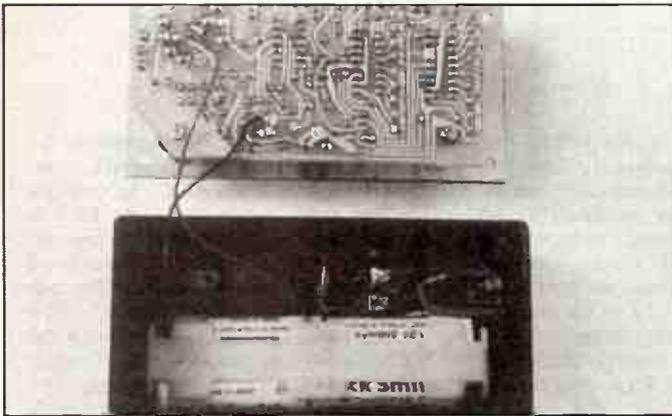


Figure 2: A method of setting the reference voltage using LM3914 type devices.

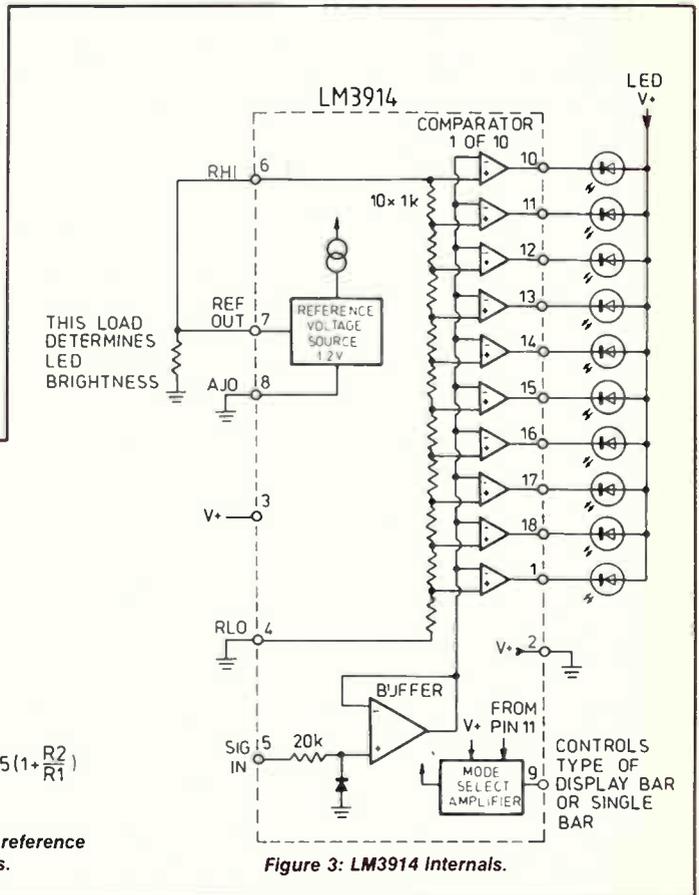
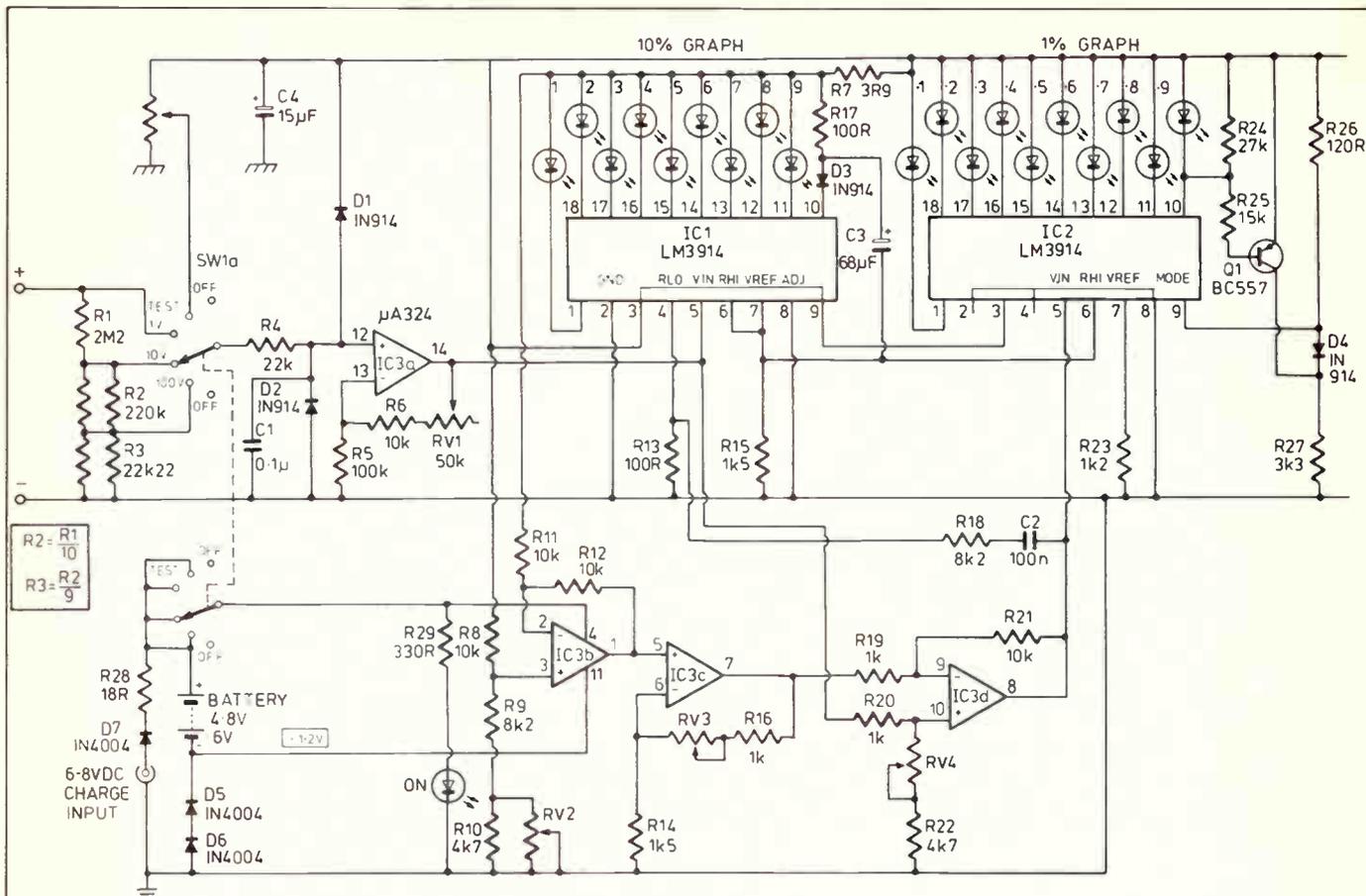


Figure 3: LM3914 Internals.



ETI-180 HOW IT WORKS

Range selection is provided by the potential divider of R1 to R3, and input protection is achieved by R4, D1 and D2. C1 averages an input voltage with a 50 Hz to 100 Hz ac component, providing a reasonable interpretation of the average (dc), rather than the peak value. IC3a acts as a buffer to the input voltage, and has an adjustable gain to calibrate the 10% graph. IC1 is the 10% bargraph driver, and the 9 LEDs comprising the bargraph are connected to Vcc through R7. The reference voltage, generated within the IC is applied directly to its internal voltage divider, and is also connected to the voltage divider within IC2, which is the driver for the 1% bargraph. Thus, the adjustment of the gain of IC3a is related to the reference voltage of IC1, and because the same reference is used for IC2, further gain adjustments within the chain are unnecessary.

IC3b is connected as a differential amplifier with a gain of 1, established by the resistors R9 to R12 and RV2. The amplifier senses the voltage drop across R7, which increments equally as each LED in the 10% bargraph lights because each LED is driven by

a constant current source within the IC. This current is determined by the value of R15. RV2 balances the amplifier to ensure a high common mode rejection, and correct adjustment should give a zero output voltage when the input terminals of the meter are short-circuited. R10 is in parallel with RV2 to allow an accurate setting.

IC3c is a non-inverting amplifier, with the gain set by RV3, and amplifies the output of IC3b. The output voltage of IC3c should equal the output of IC3a for each whole value of the input voltage. The outputs IC3a and IC3c are coupled to both inputs of the differential amplifier IC3d which supplies the input voltage to IC2. The gain of IC3d is set to 10 by resistors R19 to R22 and RV4, which adjusts the common mode gain to zero. The output of IC3d is the amplified difference of its inputs, and ranges from 0 V to 90% of V_{ref} . Thus, the input voltage to IC2 varies over these limits each time the input voltage changes by 10%, starting from any whole value.

The network comprising R17, D3 and C3 causes the 10% bargraph to flash when the input voltage to pin 5 of IC1 equals V_{ref} , at a rate determined

by the value of C3. The transistor Q1 and its associated components operate on the mode pin of IC2 to activate the bar mode when the ninth LED is turned on. This is needed to prevent possible ambiguity in the readout, as the tenth LED is not used. If the bar mode was not activated, then all LEDs of the 1% graph could extinguish for voltages slightly below a whole value, giving a 10% error in the reading. The bar mode holds all LEDs on for both the ninth and the unused tenth LED.

Positive feedback is applied from the output of IC3d to IC1 with a connection to the low end of the internal voltage divider of the IC. This causes a more definite change of the output indication of IC1 when the 1% graph reaches full scale. Without this network, the possibility of the 10% graph incrementing before the 1% graph has extinguished is likely. The diodes D5 and D6 provide a negative supply to IC3. This is achieved by making the common line 1.2 V positive with respect to the negative end of the battery. Although this IC can operate with a single supply, better linearity is obtained with a dual supply, even though the supply voltages are not equal.



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ERRATA AND OTHERS

As several readers have kindly pointed out there were a number of glitches in the last issue of ETI. In the Queensland Spaceport story for example Milton Byrch should have read Milan Brich and the phrase in our article about the Disc Drive for the Applix 1616 should have read "disk controller into the buffer" and not "into the bugger".

It is always embarrassing to read such vivid blunders but at least we here at ETI can take comfort in the fact that we fall short of the following litany of errors which were compiled by Steven Pile in his *Book of Heroic Failures* published by Future.

THE LEAST ACCURATE NEWSPAPER REPORT

Newspaper reporters make mistakes, of course, but few have been more innovative than the one who contributed a personality profile of a local man called 'Harris' to the *Wiltshire Times and Chippenham News* in 1963. The following week the paper carried a magnificent apology.

Mr Harris, it said, has asked us to point out a number of inaccuracies in our story. After returning from India, he served in Ireland for four years and not six months as stated; he never farmed at Heddington; particularly not at Coate Road Farm as stated; he has never counted cycling or walking among his hobbies; he is not a member of 54 hunts; and he did not have an eye removed at Chippenham Hospital after an air raid on Calne.

"My only disappointment when interviewing him," wrote the reporter in his original article, "was that I could not spare more time with this raconteur."

THE FULLEST ERRATA LIST

A booklet entitled *The History of Cornish Pubs* gained extreme popularity in 1978 on account of its impressive errata list.

It contained 140 corrections to a 70-page survey. High spots include:

Page 3, line 1, for 'assuming' read 'unassuming'.

Page 8, line 4, for 'White Hart' read 'White Horse'.

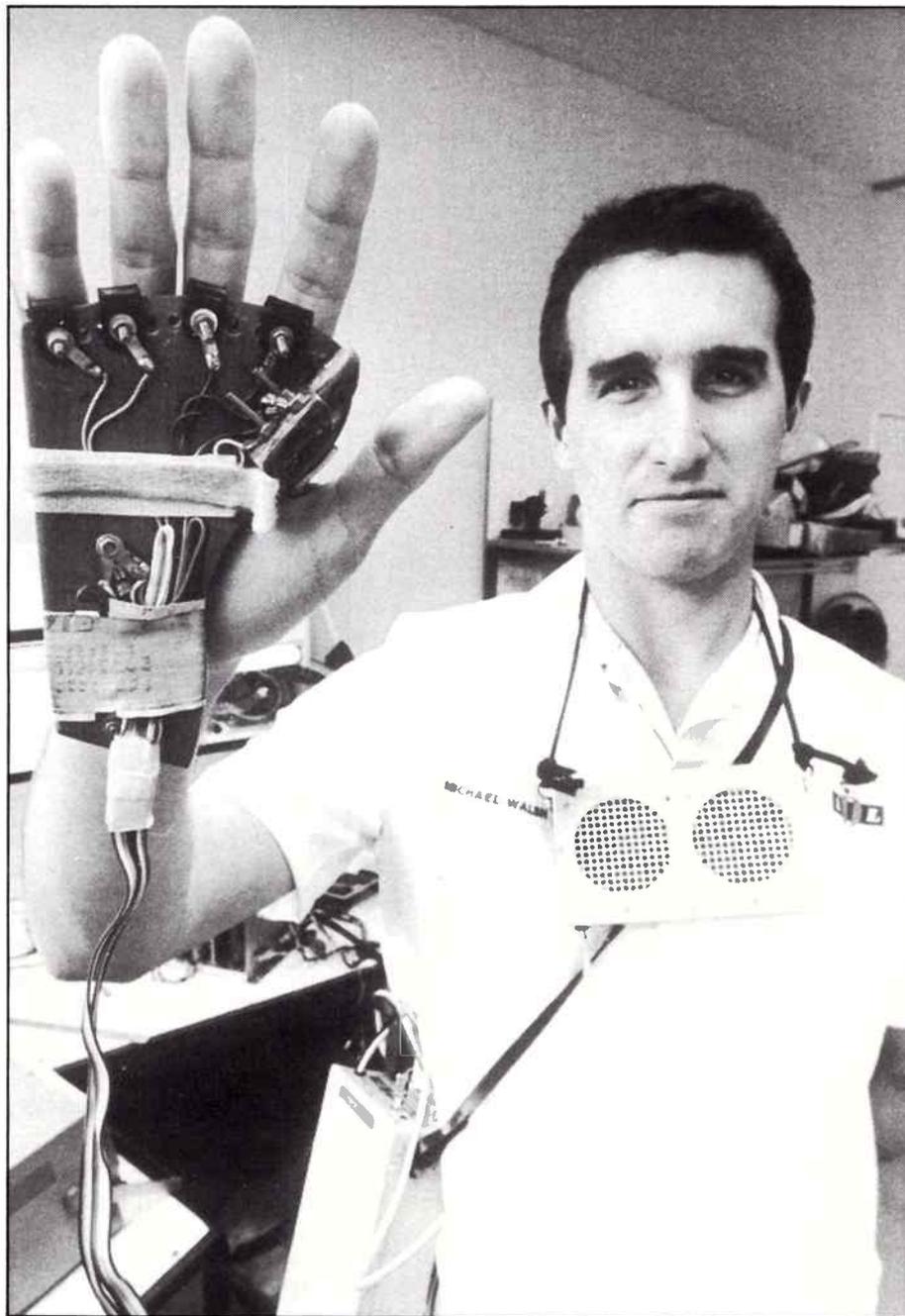
Page 13, line 49, for 'major' read 'minor'.

Page 32, line 19, for 'Mews' read 'mess'.

Page 63, line 6, for 'Queen's Arms' read 'Queen's Head'.

Page 73, Moulded ceilings line 5 delete ship. Fowey line 6 for Batallick read Botallack. Pannelling line 2 for Bosliwick read Boslowick.

In the book, sub-titled 'pubs with a storey to tell', the engagingly modest editor says, "We must apologise for the



Inspired by the film *Robocop* ETI engineers have come up with their version of the plastic policeman

minor mistakes which have cropped up between correcting the proof and printing. Some are my fault, others, like a car one takes in to have repaired, the fault is repaired but others occur! A few we have not corrected, especially punctuations! It should be easy to insert these in the text."

THE MOST MISPRINTS IN A NEWSPAPER

This record is claimed for a page in *The Times* of London on 15 March 1978; it

contains 78 misprints.

One story starts 'Sir Harold Wilson's action in making a public oss' and goes on to deal with a broadcast involving the governm and comprahle pay claims.

These errors were caused by an industrial dispute and do not, in any case, have the sheer style of the *Guardian* which can do this sort of thing quite unaided. Among its most famous misprints was a review of the opera *Doris Gudenov*. ●



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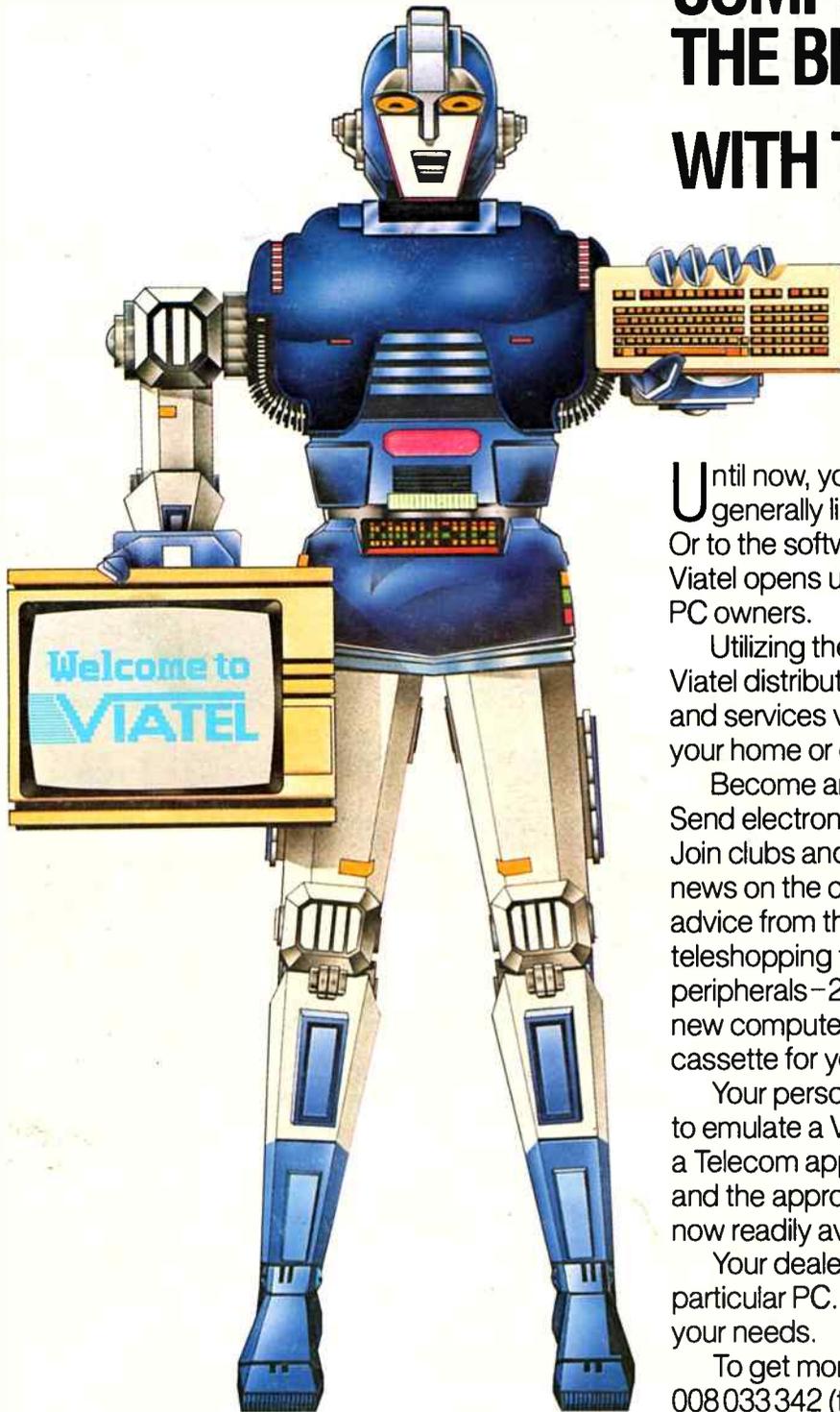
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