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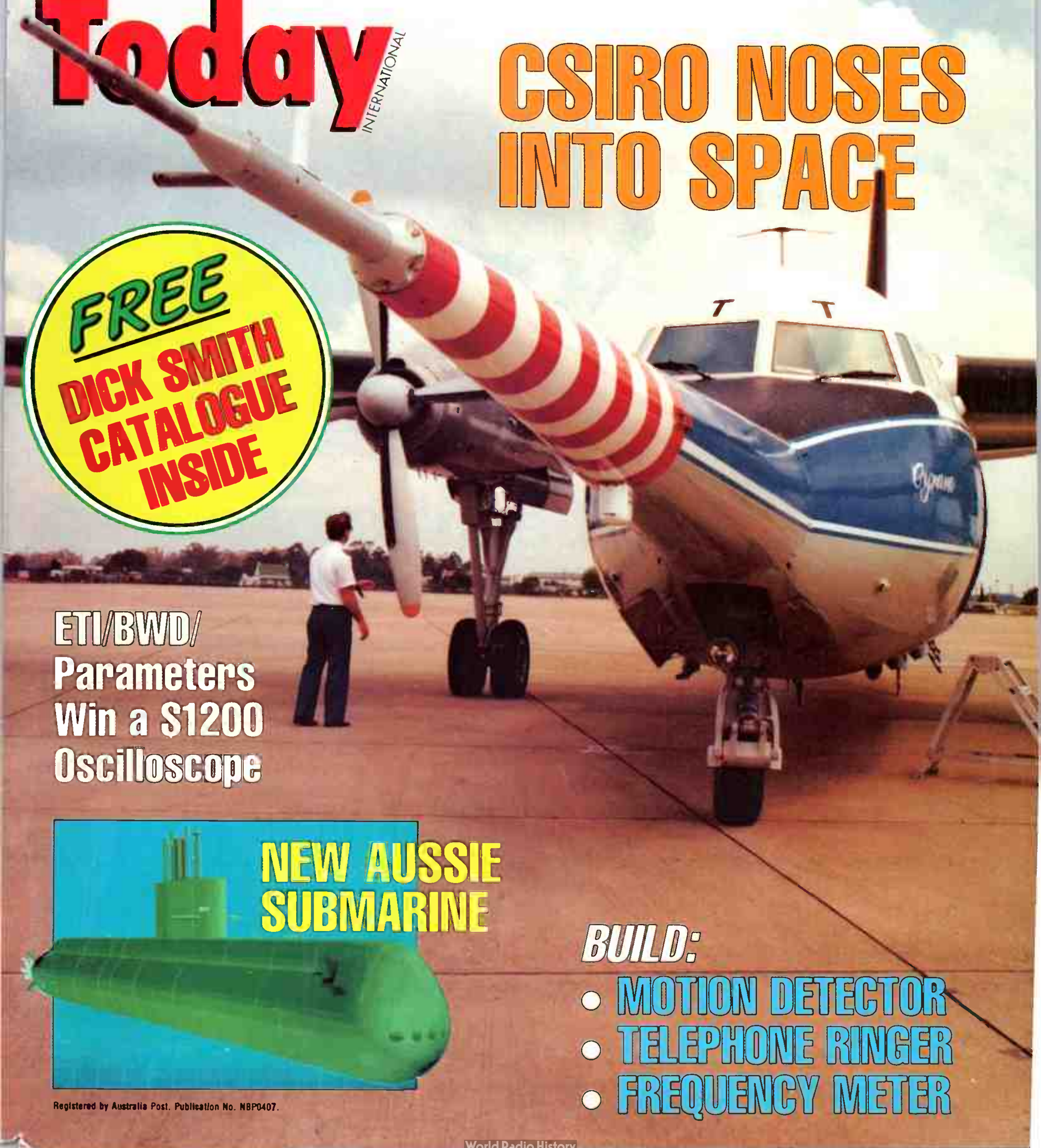

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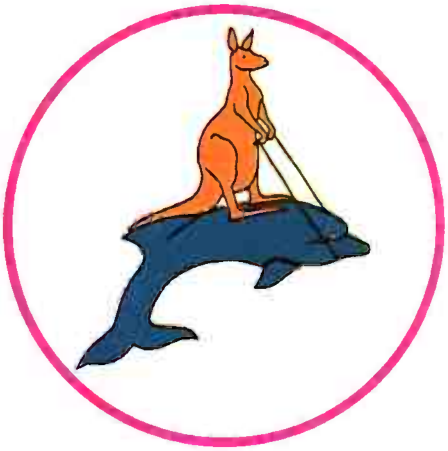

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Frequency

Undergrads and the nation are badly served by researchers masquerading as teachers

Underlying much of the discussion about the malaise gripping the electronics industry in this country is the view that research at universities and the CSIRO is not tied in closely enough with the needs of the industry. This is one reason why good ideas continue to be exported and why businessmen with investment cash continue to invest overseas. Now federal goverment agencies are taking a number of steps to improve the relationship between research and the market economy.

A report currently before parliament from ASTEC the Australian Science and Technology Council has recommended that the government should establish an Australian Research Council (ARC) that would provide a channel for university research funding separate from the day to day funding of universities.

As things now stand, money is channeled through the Commonwealth Tertiary Education Commission (CTEC) to individual universities who are free to allocate the money as they think fit. Thus research stands in line with capital costs, wages, teaching and so on for the tertiary education dollar. The main thrust of the ASTEC report is that this system is not the best way of ensuring that outstanding projects get funded. CTEC funds are allocated on the basis of student numbers which leads to a wide, flat distribution of funds across all departments in all universities. The ASTEC report says that the best way of getting results from our research funding would be to force specialisation on the universities. University funding should now come from two sources, CTEC and the ARC. They envisage that the ARC would allocate fund for specific types of research within specific departments at specific universities.

This scheme appears excellent. It would be a mechanism for channeling funds into productive areas of universities, and away from the more parasitic ones. It would be surprising if engineering and physics schools did not do well out of such a system, and this is as it should be, but there are problems nevertheless.

Perhaps the hardest problem to solve stems from the observation that a seat on the ARC will be seen, rightly, as a reward for a life in science well spent. Unfortunately, the type of science this country needs, the revolutions, the breakthroughs in fundamental processes, will be the preserve of the young. However, the ARC is organised, we must be sure that yesterdays men, no matter how well intentioned, do not try to place yesterdays solutions on today's problems.

This argument is just a subset of the more general argument that is difficult or impossible to select "winners" ahead of time in the technological stakes. This need not to be too much of a problem providing that the ARC is not involved in approving specific research projects. The ARC should merely decide which schools will get research funds, and then leave it to the schools to decide what research to support.

The second objection has been raised at length by the academics trade union, FAUSA (the Federation of Australian University Staff Associations). They argue that taking money from one group of academics to give to another group will not benefit the country in the long run. FAUSA want to see any extra money available spent on the research infrastructure such as libraries and equipment, and thus made available to the community at large.

The answer to FAUSA's objection is that the time is ripe to restructure careers in academia. Anyone who has suffered through some of the appalling lecturing that passes for teaching in our universities will be attracted to the need for a greater division between teaching and research. For the research scientist, teaching is an annoying distraction; meanwhile the undergrads, and the nation, are badly served by researchers masquerading as teachers.

We know that the concept of Centres of Excellence works. It has given Australia world level competence in certain medical sciences like *in-vitro* fertilization, and in radio astronomy. An extention could help other areas of endeavour.

Jon Fairall
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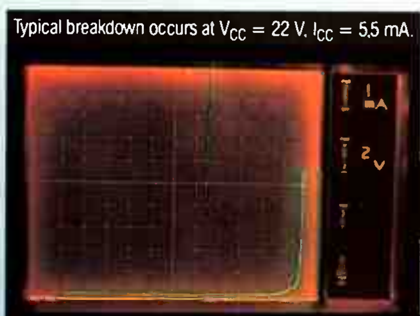
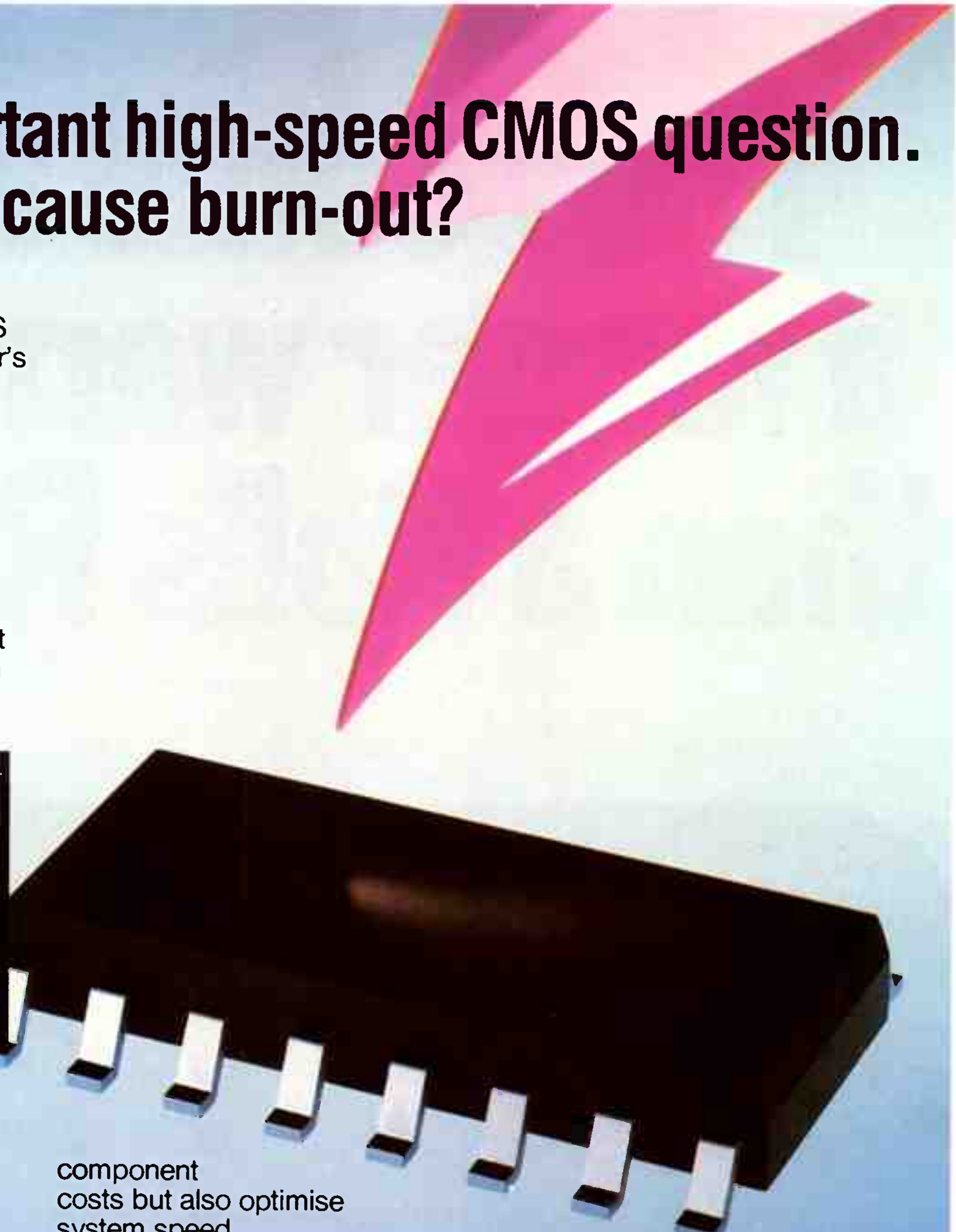
The all-important high-speed CMOS question. Will latch-up cause burn-out?

With Philips high-speed CMOS (HCMOS) logic ICs, the answer's no. Because they're free from latch-up.

What causes latch-up?
Latch-up occurs when SCRs (formed by parasitic bipolar transistors found in all CMOS structures) are triggered by current transients arising from over-voltage at the input, output or supply pins, or by ringing on the signal pins. The resulting



Curve tracer display from latch-up test with excess supply voltage. At no time did latch-up occur in the Philips HCMOS IC, since the supply voltage snaps back to 13V.



short-circuit across the supply rails causes excessive current and inevitably destructive power dissipation.

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We prevent any current injection into the SCR structures by growing an epitaxial layer on a very low-resistivity substrate. And by using unique design and process parameters to minimize the gain of the parasitic transistors, we achieved complete latch-up immunity. No burn-out.

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ADVERTISING INFO No. 4

Saatchi YAM 010

AWA; getting smaller

John Hooke

AWA has at last announced long awaited moves to revamp its microelectronics fabrication line. New equipment to be installed by 1988 will allow the company to fabricated Application Specific Integrate Circuits (ASICs) to two micron design rules.

The move was announced by Mr John Hooke, the managing director of AWA who said that it was a joint venture with British Aerospace Australia and the New South Wales government. BAeA is a wholly owned Adelaide based subsidiary of its UK based parent, but in this country its interests have mainly been in electronic contacting for the defence forces. It's movie into the fabrication of ASICs is seen as complementary to the rest of its business. The New South Wales government is hoping that the new fab line will become a centre piece for the technology park now being constructed in the swamps of Homebush Bay in Western Sydney.

For many years there has been pressure from local ASIC designers on the company to improve the performance of its fabrication line. Since the new line will be able to make semiconductors with only 2 microns between features, designers will be able to include far more circuitry on the same area of silicon. As the functioning of integrated circuits becomes more complex the ability to include more features without increasing the amount of silicon thus becomes more and more desirable.

As the only production facility in the country, AWA's facility is of considerable importance to defence contractors and in the government's quest for more local content in manufactured products. Staff on the existing line have been able to push the limits of the equipment from the design rated 10 microns down to 5 by dint of much imaginative work. However this has not been able to satisfy demand, and, according to Bob Mcclusky, who heads the microelectronics section of AWA, they have been forced to watch 75% of the ACIS design work originating in Australia leave the country.

The volume of that work has increased rapidly. World wide, the market for ASICs is now a significant fraction of the total market for integrated circuits. Driving this increase are two forces, one the increasing cheapness of design and testing because of Computer Aided DEsign, and secondly the growing expense of manufacturing discrete designs. Increasingly, integration is becoming a desirable option.

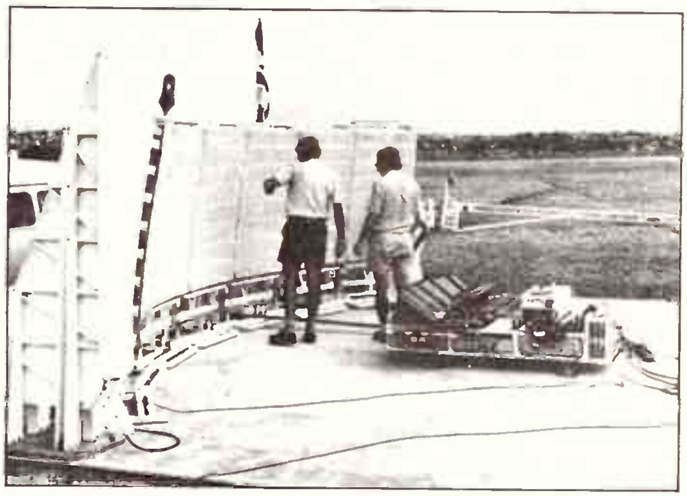
The move will put AWA on a par with most other fab houses internationally. According to Bob Mcclusky, not many places around the world can do much better than 2 micron work reliably.

A few are able to work to sub-micron precision on an experimental basis. Less are able to do so for production runs. Mcclusky says he will try to push the fab line to sub micron levels as soon as the demand warrants. Looking at the way local industry has taken to ASICs that does not seem to far in the future.

Serving Innovation

According to a number of manufacturing companies in Australia one of the greatest problems they face is finding new inventions and products to use and produce. In answer to this an new company has been set up called, appropriately enough the Australian Innovation Sourcing Service (AISS). It will be managed by the Innovation Centre of NSW.

The AISS has been called into being by the National Industry Extension Service (NIES) and is supported by Federal and State Governments, as well as industry groups. It uses the CSIRONET detabase which gives AIS Australia-wide access. The way the system will work is relatively simple. A list will be considered from the inspired genius working in his garage to the most prestigious scientific institution in the country. Each entry contains details relating to its legal status. A direct contact is provided for manufacturers and marketers to pursue if they wish to obtain the rights to the product. It will cost $65 to list a product with AISS with a special discount for volume registration. It now only remains to come up with the inventions.



Interscan, once an Australian invention, now an American industry.

Tickle Talkers

The Federal Minster for Industry, Technology and Commerce, Senator John Button has recently had the courage to announce that the government will support research and development into the 'Tickle Talker'. Apparently this unusually named device is an electrotactile hearing aid for the profoundly deaf.

The 'Tickle Talker' prototype was developed by the astonishingly named department of Otolaryngology at Melbourne University. It has produced speech perception results for electrotactile stimulation (feeling speech through electrical stimulation of the nerves of the fingers) that are, reportedly, the best in the world.

Supernova

The Parkes radio telescope has been linked to the NASA Deep Space Network facility in Tidbinbilla near Canberra to observe the radio emissions from the supernova 1987a. 1987a is the first supernova to explode in our neighbourhood of the galaxy since the advent of telescopes.

The link between the two telescopes was first established for the Uranus encounter by Voyager 2 in January 1986. The link was crucial to Voyager imaging. It was paid for by the NASA in return for free time on the Parkes radio telescope. One of the prime justifications for donating the time to NASA was the improvement to the sensitivity and the resolution of the telescope that would result from the link.

Early optical readings from the supernova indicate a particle emission velocity of 6200 miles per second, about a 30th of the speed of light. The star explosion was first detected by astronomers on February 24.

The supernova, located in the Large Magellani Cloud about 160,000 light years away, is at a declination of 69 degrees South and be observed in the Southern Hemisphere.

By joining the two instruments together astronomers create an interferometer, a device which can differentiate between the phase angle of the incident emissions, and so make very accurate measurements of position in the sky. By using one on 1987a, astronomers hope to be able to understand better the extact processes at work in a supernova. it is believed that the remaining core of the star will become an extremely dense object called a pulsar, while the outer clouds of dust and gas will spread out to become a nebulae, fertilising the intergallactic medium with heavy elements.

Tethered Satellites

NASA has selected five American principle investigators whose experiments will try to make use of the Tethered Satellite System (TSS-1). The TSS-1 is basically a deployable subsatellite which will be tethered to the shuttle via a retractable cable.

The TSS-1 project is a joint US-Italian venture with NASA on one side and Piano Spaziale Nationale (PSN) on the other. The Italians will build the satellite while the US will contruct the deployment mechanism and fly the complete payload aboard the shuttle.

The five investigators will concentrate their efforts on measuring and understanding the electrical interaction between the satellite with the electrically-conducting tehter and the natural space plasma enviroment. Apparently this movement is caused by solar ionisation of the Earth's upper atmosphere through which the Shuttle flies in its operational altitude range.

NASA News

Nasa has begun tests on the five instruments which will be carried on board the Hubble Space Telescope (HST). One of the goals of the test is to carry out approximately 39 hours or 28 simulated HST science operation using all five instruments.

Using a mock science program the HS Operations Control centre at Goddard is transmitting commands over telephone lines to the spacecraft, which is assembled in a room at Lockheed Missiles and Space Company. Sunnyvale, California. So far all is going well, on the ground. Nasa's problems, however, occur in a more ethereal area.

Assuming that HST gets into orbit (and judging by the present record that seems rather an ambitious assumption) the scientific data is requires will be transmitted back to the Goddard Space Fight Center by satellite and then relayed to the Space Telescope Institute at John Hopkins University, Baltimore, Maryland. At present the HST is scheduled to be carried into space on the Space shuttle Atlantis on November 7, 1988

Laying it on the line

The new managing director of the Texas Instrument Co's Australian subsidiary Mr Stuart Macnair gave a forthright speech on the value of artificial intelligence in Australian Technology when addressing Texas Instruments first media lunch on March 11. Macnair is the first native Australian to be placed in charge of Texas Instruments' Australia operations. A fact he noted with some pride.

McNair and his company are very taken by artificial intelligence. Citing examples from the Campbell's soup company in the US and a French Cancer centre McNair foresaw a bright future for mankind if the opportunities provided by artificial intelligence technology were explored thoroughly. Macnair expressed particular satifaction with the interest shown in A1 states "there is a very heavy emphasis on information technology at govemment level and certainly a very active involvement with ariticial intelligence. Macnair acontrasted this with the situation in Australia where 'there appears to be little, if any, interest in Artificial intelligence'.

Australian symbols

Technical Imports Australia has just released two very extensive symbol libraries to increase the popular acceptance of the 2D CAD package, Prodesign II.

The new symbols were produced in Australia to suit the specific requirements of local Engineers. The first library provides a comprehensive list of over 100 objects comprising electronics, electrical wave forms, PLC and some miscellaneous ones. The second library covers the Hydralic and Pneumatic Engineering industry and apparently all the objects were built in accordance with the SAA standard. Over 150 objects and catalogued using the SAA reference number, description and illustration.

Prodesign II is a full 2D CAD package that runs on 'industry compatible' PCs with all the functionally (in 2D) of software that costs well over $4,000. Prodesign II cost only $550. The libraries cost $121 for the Electrical version and $137 for the Hyd./Pneumatic.

On The Right Track

An order from the State Raile Authority of New South Wales, Australia, for electric equipment for 450 railcars, which feature such state-of-the-art technologies as electric propulsion equipment with gate turn-off (GTO) thyristors, has been won by Mitsubishi Electric corp. UK.

They will supply the entire electric equipment incorporating high technologies such as power electronics for a four-quadrant chopper-control system with GTO thyristors for energy savings, microelectronics for destination display and speed control using 16-bit micro computers, and opto-electronics in train management systems.

It is hoped that the motor technology and peripheral equipment will be transferred to several Australian manufacturers so that they can be produced locally.

Artificial Intelligence

The Minister for Science has announced plans to update the successful publication 'Handbook of Research and Researchers in Artificial Intelligence in Australia' which was first published in October 1986.

Mr Jones said that Artificial Intelligence research and its applications, which include expert systems, robotics and speech recognition, were making an important contribution to modern society, and in particular to the world economy.

"The Government has recognised its obligation to ensure that the Australian community does not miss out on the major benefits to be gained from a successful application of the results of research in artifical intelligence.

"An important aspect of maintaining Australia's world standing in artifical intelligence is to ensure that members of Australia's artifical intelligence community are kept adequately informed about current trends.

"My Department has made a major contribution by producing the Handbook of Research and Researchers in Artifical Intelligence in Australia. The handbook provides a ready reference to who's who in Australia AI, in industry, government laboratories and academia, what their research interests are, and how to contact them.

"If Australia is to take full advantage of the many benefits artifical intelligence has to offer our society, Australian researchers must work together to stay abreast of the latest developments. This means that important publications such as the AI Handbook must be constantly updated and expanded to provide a vital service to Artifical Intelligence researchers'. We hope Mr McNair was in the audience.

Philip Hinkins (right) newly appointed Technical Support Manager for Webster Computer Corporation's North American operations, pictured with Ludwig Croy, Director of Customer Engineering for all Webster Local and international markets.

The Expanding Web

The American branch of the Webster Computer Corporation has just signed up three major resellers on the American east coast in one year contracts totalling $US400,000. Particular Webster products involved in the deal are computer boards designed for its own DEC-compatible Spectrum minicomputer range and subsystems for the Australian market.

One of the biggest companies to sign up is Pioneer Technologies of Maryland which apparently has turn over of $US90 million annually. Pioneer are particularly interested in Webster's cache Qbus ESDI and SMD disc controllers which both emulate DEC's Mass Storage control Protocol (MSCP), and an SMD Unibus version of these controllers which was launched internationally this month.

These sales and contacts have boosted the intake of Webster' American plant to around $(Aust) 400,000 a month with the US market accounting for 40% of the Australian company's total turnover.

COMING EVENTS

JUNE

Ninth Australian Personal Computer show will be held in the Royal Exhibition Building in Melbourne from 31 May-3 June. Contact Ms Mary Young Australian Exhibition Services Ltd, Illoura Plaza, 424 St Kilda Rd, Melbourne 3004.

Communications '87, the Australian International Office Technology Exhibition, is on 1 to 4 June at the Royal Exhibition Building, Melbourne. Contact Australian Exhibition Services on (03) 267-4500.

PC87, the Ninth Australian Personal Computer Show is on 1 to 4 June at the Royal Exhibition Building, Melbourne. Contact Australian Exhibition Services on (03)$ 267-4500.

Office Technology '87 will be held 1 to 4 June in Melbourne. Contact Australian Exhibition Services on (03) 267-4500.

The 1987 Computing Systems Conference will be held 17 to 19 June in Brisbane. Contact the Institute of Engineers, Australia, 11 National Circ, Barton, ACT 2600. (062) 73-3633.

Laser 87 Opto-Electronics Microwaves will be held in Munich over June 22-26. This is the eighth international congress and trade fair. Contact German-Australian Chamber of Industry and Commerce, 2nd Floor, 47 York Street, Sydney 2000.

Videotex '87 Exhibition & Conference is on in Melbourne over three days in June. Contact Riddell Exhibitions on (03) 429-6088.

The Centre for Industrial Microelectronics Applications is conducting a seminar entitled 'Advancing with Electronic Technology' on June 25 Management House, St Kilda. Ph. Dianne Hunt (03) 660-5103.

The Australian Hi-fi Show Shows '87 will be held Sydney 19-21 June at the Airport Hilton; Brisbane 3-5 July at the Gold Coast International Hotel; Melbourne 17-19 July at the Dallas Brooks Hall; Adelaide 24-26 July at the Adelaide Hilton.

Videotex '87 to be held 30 June to 2 July at the Sheraton Hotel, Auckland. Contact the Secretariat on (649) 68-6955.

The Third National Space Engineering Symposium will be held 30 June to 2 July at the Australian Defence Academy in Canberra. Contact the Conference Manager on (062) 73-3633.

JULY

Automach '87, an exposition on automated manufacturing and sponsored by the SME, is scheduled for 7 to 10 July in Sydney. Contact Adolph Greco on (02) 875-2377.

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

AUGUST

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

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

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

SEPTEMBER

Australian Computer Exhibition and Conference will be held in the Royal Exhibition building in Melbourne 8-10 September. Ph Riddell House Promotions (03) 429-6088.

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

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

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

Labex '87 international laboratory equipment and products exhibition is on 21 to 24 September at the Royal exhibition Bulding, Melbourne. Contact BPI Exhibitions on (02) 266-9799 or (03) 699-9151.

Are you Donald Duck, or Superman

West German computer hackers have been caught invading a computer at a Japanese government laboratory. It is believed to be the first time that foreigners have gained secret access to a Japanese computer.

The computer, a Vax 11.750 belongs to the National Institute for High Energy Physics in Tsukuba. It is connected to a network through which around 300 physicists at affiliated institutes exchange data.

According to *New Scientist*, the British science journal, the invasions began in May 1985 and continued for about a month. Initially, the hackers were entering the computer only briefly. By the time the invasion came to light, however, they were staying online for several hours at a time.

The interlopers were discovered when one of the institute's scientists noticed that a suspiciously large number of users were logged onto the computer in the middle of the night. An investigation revealed that unauthorised entrants were using an identity code whose real owner seldom accessed the computer.

Before changing the computer's password, the laboratory monitored the interlops and recorded some of their conversations. These were in German and one of them included the number of a particular terminal which the Japanese traced to West Berlin's Technical University.

The Japanese believe that up to 20 hackers at several other German universities, including Hamburg, Frankfurt and Munich, were involved. It appears that they secured the number of the computer from a list published in West Germany. Coamputers at several other institutes, including on at CERN, Europe's centre for research into particle physics, are believed to have been penetrated at around the same time using this list.

Because the institute publishes all its results openly, mischief seems to have been the hackers' only motive. Their individual identities are not know. When asked who they were, one responded Donald Duck, another Superman.

Believe it or not

Most people have heard of solar-powered calculators — but a water-powered one? It sounds incredible, but the latest news from the Hong Kong Trade Development Board is that a Hong Kong based firm has developed a revolutionary "hydropowered" LCD calculator.

The water-resistant calculator was developed by engineers of Swank International Electronic early last year and a decision to manufacture taken last August. Patents have already been secured in the UK and USA, which Swank sees as its main markets.

"The actual operation is quite simple," says Swank's general manager, Mr T. M. Lee.

"The calculator is immersed in water, which enters the calculator body through special holes, even though the general body is water-resistant.

"This water is then used to power the calculator through a specially-designed water generator which keeps the calculator going for three months, after which it simply has to be immersed in water to renew the power source," Mr Lee explained. Mr Lee failed to mention whether the water needed to be salty or fresh.

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ETI Magazine December 1986

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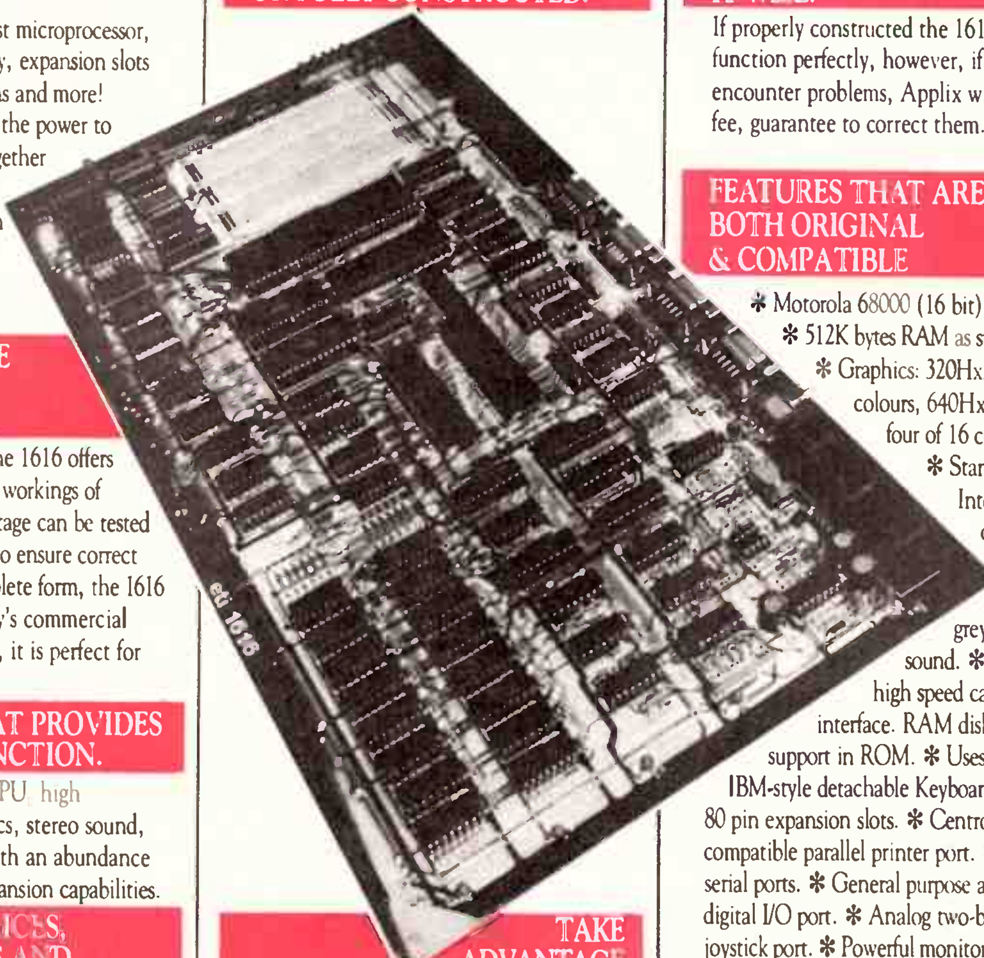

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TRADE

As the US trade deficit with Japan widens, the world waits for the clash of the Titans. Will it be good news or bad news for Australia?

Simon O'Brien

Phrases like "Pearl Harbour" and "blood on the ground" are not usually associated with the world of commerce and international trade but the recent spat between the US and Japan over the question of microchips has led to high feelings on both sides of the Pacific.

The first verbal shots in the conflict came from the US when President Reagan announced that from 17 April he will impose a 100 per cent tariff on a wide range of Japanese goods. Reagan said that the new measures were meant to chastise the Japanese for not abiding by an eight month agreement on semiconductors. Under this treaty the Japanese government agreed to increase Japan's intake of American goods and to refrain from 'dumping' microchips on the world market.

Despite the treaty it has been revealed that last year, 1986, Japanese microchip producers led the world in chip production and overtook the US for the first time. It is estimated that Japan's microchip domination cost the US more than 1 billion dollars and some 60,000 chip makers jobs. Such statistics frighten Presidents and Congressmen looking for re-election so the decision to impose the high tariff was extremely popular. It is believed that these new measures, if instituted, will double the price of Japanese goods imported into the US.

Blood on the Floor

American manufacturers are unrepentent over this attack on free enterprise. One manufacturer, mindfull of the low state of US-Japan relations in the years 1941-5 claimed that there would be "blood on the ground" (he did not specify whose) over the issue whilst another reckoned there was "trench warfare" in existence between the two states.

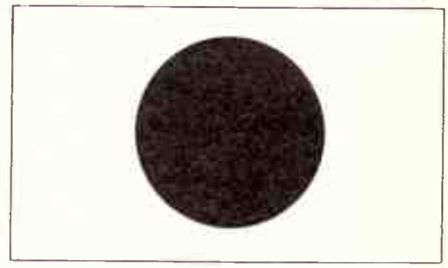
The response of the Japanese government has been conciliatory, but it is rumoured that the US is not the most popular nation in Japanese eyes at the moment. For one thing the Japanese claim that they have abided by the semiconductor treaty and another their national economy seems to be experiencing something like a recession. The American measures, the strongest applied since World War II, have come at an especially difficult time for the Japanese. Unemployment has reached 3 per cent and the Yen has appreciated by no less than 43 per cent over the last two years drastically increasing the price of Japanese exports. In fact Japanese wages and costs are now amoung the highest in the world, a fact which has caused many Japanese firms to move some of their biggest operations overseas. Even the cherished ideal of lifetime employment seems to be coming under attack in the land of the Rising Sun.

Chip Dumping

The Americans accuse the Japanese of 'dumping' chips on world markets. In order to support their case for protection some US manufacturers have displayed receipts they obtained in Hong Kong for such goods as 256K dynamic RAM (Random Access Memory) chip. These receipts show that the Japanese to have sold these goods for $1.89 each even though they had agreed to abide by a minimum price of $2.50.

Faced with all this the American response seems to be reasonable, or at least understandable. The Japanese do not agree. For one thing the American response seems as much based on emotion as evidence. Congressmen were apparently greatly irritated by the report that Japan's Vice Minister of Trade, Mr Makoto Kuroda had said that US supercomputer companies were "wasting their time"

WARS



attempting to sell their products to various Japanese institutions such as universities or government departments. Mr Makoto has denied making such an inflammatory comment and indeed claims that he was deliberately misquoted as part of a "dirty tricks" campaign waged by the US government.

Quite apart from what Mr Makoto is said to have said there is also the question of the statistical proof used by the US to advance its case. For whilst it looks as if Japan's trade surplus is increasing this is at least partially offset by the decline in the value of the US dollar and the strong growth of the Yen. Thus, in terms of Yen, it may seem as if the Japanese have cut their imports but in fact this is not the case. Over the last year while the Yen value of Japan's imports fell 30.7 per cent the actual volume of the nation's imports have risen by 12.5 per cent. The Yen has appreciated against the dollar by 43 per cent.

> ***"The response of the Japanese government has been conciliatory, but it is rumoured that the US is not the most popular nation in Japanese eyes at the moment."***

Increasing Imports

Even in terms of manufactured goods, the area which gives the US the most pain, Japan has increased its imports by no less than 31.4 per cent. These figures do not mean that Japan has become a major importer. It still retains a healthy surplus with most of the nations with whom it has to deal. It does mean however that Japan has not been secretly subverting agreements with the US to increase its imports. The Japanese themselves claim that part of the reason that they have not imported as much as the US would like concerns the particular nature of their domestic market. Like shoppers everywhere, only to a greater degree, the Japanese consumer likes to buy the home product in preference to that from the outside. They also set great store by such things as after-sales service and quality. In fact in Japan these things matter almost as much as the price of the object.

What does all this mean for Australia? As an importer rather than manufacturer of microchips we presumably do not have the same problems that the US is facing. Informed opinion on Australia's position in the conflict is not consistent, a fact that will surprise nobody. Senior Australian trade officials say the fact that Japan will need to increase its imports to pacify Uncle Sam means that Japan will, of necessity cut back on Australian imports, especially in beef and other areas. The Minister of Trade, Mr Dawkins has expressed concern at the possibility of increased chip prices on the domestic market. The official Japanese line seems to be that Japan will seek to appease the world rather than the US alone, and as a result the volume of Australia's exports could rise.

A Question of Principle

Beyond the question of self interest however, lies a far greater one of principle. Japan more than any other nation in the world owes its economic success to the quality of its people and their desire to resurect their country after a disasterous war. In fact Japan has the type of economy the US would like to have. Given this it is hard to see the present US attitude as stemming from anything except good old fashioned national rivalry and greed. This impression is reinforced by the fact that some Congressmen in Washington are apparently ready to submit a bill which would penalise any country which runs a consistent trade surplus with the US. It seems that the US economy has been a model of success for so long that the Americans have come to believe that its position is part of the natural order of things. ●

REVIEW

THE NEW ROM

A new storage medium is looming over the horizon. It will completely change computing, but no one in Australia is taking any notice.

Stewart Fist

The CD-ROM (Compact Disc — Read Only Memory) scene in Australia appears to be remarkably quiet when compared to the frenetic activity surrounding the medium in Europe and America.

I've just been to the second International CD-ROM conference in Seattle, and it is apparent that the major international hardware and software companies are all racing to get in on this market. There's also a whole new breed of electronic publishers entering the computer field from the world of print.

Australia's distributors and publishers hardly appear to have noticed that CD-ROM exists, or that it is now supported by world-wide logical and retrieval formats.

Vapourware

In an industry where 'vapourware' announcements are made a couple of years before products hit the streets, it is strange to find a major product that has advanced so far ahead of its hype. It would be fairly safe to predict a CD-ROM player alongside every personal computer within a couple of years.

Standardisation is the key. The High-Sierra Group — virtually a Who's Who of the top companies in the computing world — recently finalised its recommendations on CD-ROM standards and these have been accepted and passed by European and American standards associations. CD-ROM now only awaits the formality of ISO approval to become an official world standard.

The problems that CD-ROM has faced in the last year have largely arisen through confusion with the parallel development of CD-I (CD Interactive). Philips, who take the lead in the development of all CD-type optical disk formats, made the mistake of announcing CD-I before the dust had settled over CD-ROM. Confusion reigned supreme.

The CD-ROM

To clarify the difference: CD-ROM is the name now given exclusively to the use of compact audio-type 12cm disks for the storage of computerised data. The system was primarily designed to hold enormous amounts of textual data — 660 megabytes, or the equivalent of a couple of thousand floppies or a few hundred books.

CD-ROM can now also hold photographic still images and digitised graphics, and it can replay audio, data or still images with equal alacrity. It won't be long before dual-format CD-ROM players are on the market which can play your CD hi-fi audio disks or feed your computer/TV/monitor.

CD-I is a domestic appliance standard that has taken the CD-ROM technology a stage further, but which has not made it obsolete. Philips and Sony are designing the CD-I player to be a domestic appliance that doesn't require a computer — it will just plug into your TV set, and you'll control it with a mouse or joystick.

> “***Australia's distributors and publishers hardly appear to have noticed that CD-ROM exists.***”

CD-I can also handle sound, data, graphics and still images, but it has the additional capability of replaying a limited amount of full-motion video — usually occupying less than half the screen area.

Both of these systems are fully 'interactive' — which means that you can stop, replay, jump from one part to another almost instantaneously, etc. They are not aimed at 'linear' or entertainment markets.

CD-ROM is for the mass storage of information in serious business, educational and scientific applications where a computer can be used to manipulate the information; CD-I is a domestic self-contained unit for home education, information, and possibly some simulation-type game playing. At the present moment CD-I is still at least a year away from release, while CD-ROM is up and running.

Electronic Bookshelf

Microsoft's release of *Electronic Bookshelf* at the Seattle Conference is a good indication of what we can expect from CD-ROM. In the US this disk sells for US$295 on its own, or for just over US$1000 when packaged with a CD-ROM player.

For this outlay you get a complex writing support program and 10 major databases. Microsoft developed one of the databases, and the remainder were licensed from publishers already bringing out the information in book form.

The idea behind *Bookshelf* is that you have the retrieval program in the background behind your word processor — and it will work with almost all of the major MS-DOS word processors. Anytime you want to check a fact, or the spelling of a word, or the context of a word, etcetera, you simply hit a command key on the side of the PC keyboard, and jump instantly into the universe of information contained on the spinning CD disk.

The Bookshelf disk contains the *American Heritage Dictionary, The New Thesaurus, Bartlett's Familiar Quotations, Chicago Manual of Style, Business Information Sources,* the *US Zip Code Directory, 1987 World Almanac and Book of Facts.* Microsoft's standard set of *Forms & Letters,* a *Spelling Checker & Corrector,* and *Usage Alert* (which checks for clumsy writing style).

These 10 volumes would occupy a reasonable length of shelving in book form, but on the CD-ROM disk they take up less than a third of the available space — and this is in a fully indexed form. Every important word in the almanacs, thesaurus and quotations are indexed.

The retrieval program used by Bookshelf is quite sophisticated, and the indexing is extensive and complex. For instance, *Spelling Checker* can find words that are incorrectly spelled in the first few letters since it has a phonetic default mode for finding words. If you had spelt psychiatrist as "siciatrist" it would flag the misspelled word and then directly insert the corrected spelling into your document.

With the *US Zip Code Directory* you only need to type the address, city and state, and the directory will automatically find and insert the correct zip code. It is the same with finding facts using the Almanac; point to the relevant keywords (or type them in), initiate the Almanac, and you should jump directly to the statistic or factual information you need.

The software underlying Bookshelf was developed by Microsoft and runs under the Windows operating environment. This icon-plus-mouse approach to controlling your computer becomes almost a necessity when you start dealing with the sheer amount of information that can be stored on a CD-ROM disk. With Bookshelf you simply point-and-clock on keywords, then pull down a menu to select the Almanac, Dictionary, Spelling Checker, etc. It is so easy, and almost instantaneous.

A more traditional approach to handling large amounts of information on CD-ROM can be found in Parts-Master, a two-disk set published by the US National Standards Association. Parts-Master has its retrieval software on a standard IBM floppy, and with this you can locate and retrieve critical information on over 12 million parts and products used by the US Government. This CD-ROM system was designed originally for the defence forces, but is now widely used by commercial and government enterprises across America.

You can search the disks by item-name, National Stock Number, manufacturer's part number, company name, etc. and then move to quickly identify the items, find the sources of supply, locate the names and addresses of the manufacturer/s, and check the government stock item prices. It sounds complicated, but the system is so simple that anyone can learn to use it in a few minutes.

Parts-Master

Parts-Master costs US$5250 a year if you aren't part of the US government establishment, but for this amount you'll get a regular disk update as information changes. This subscription system with regular disk updates seems to be the way a lot of CD-ROM publishing will go. Nowadays a few thousand CD-ROM disks can be produced in a day and at an ex-factory cost of only a couple of dollars. In fact, CD-ROM is cheaper and simpler than reprinting paper directories or information lists.

A number of the old on-line information retrieval systems like Dialog and Orbit are now releasing their major databases on CD-ROM. You can get ERIC (educational resources), LISA (library abstracts), AGRICOLA (agriculture) and many other scientific and business databases on CD-ROM, usually with a bi-annual updating subscription.

Another quite different approach to using the storage capacity of the CD disk is in the area of graphic arts. Inhouse Graphics Services is a 'clip-art' CD-ROM disk for the Macintosh being offered by Multi-Ad Services of Illinois. Subscribers can receive over 900 pieces of atmospheric art, headings and logos on a disk.

The images are stored as high-quality vectored art (rather than the normal form of bit-mapped graphics), and the disks contain full desktop publishing software for page layout: an 80,000 word dictionary and spelling checker; automatic hyphenation system with both automatic and manual kerning; and horizontal text scaling. The output can be either to a stand- ▶

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ard laser printer or to a high quality Linotronic 300 Imagesetter for magazine reproduction.

Online Computer System's GATE (Global Approach to Technical Education) series, are technical training programs that utilise the interactive nature of CD-ROM. Responsive technical training courseware has been available before on the old LaserVision videodisc players, but CD-ROM has now taken the simple approach of video and sound and developed it into a full multi-media system with computer control.

The GATE programs are a family of integrated courses designed for self-paced learning. They've got college level courses in Electronics Technology, Automation Technology, Instrumentation Technology, Telecommunications, and Biomedical Equipment.

Online Systems have integrated a videodisc player with the personal computer and CD-ROM player, so that full motion video can be added to the CD-based program of instruction.

Versatility and Flexibility

One of the beauties of CD-ROM is its versatility and flexibility. Microsoft are thinking of releasing ALL their current PC programs on one disk. You only pay for those programs you use; the other's are locked away until you get a special password/access number from Microsoft — and you only get this when you pay your money. Developments of this kind could upset the whole system of software retailing and distribution.

CD-ROM will make an impact in other areas also. Where processing speed is not important, CD-ROM can give a microcomputer the ability to handle complex programs of the type only previously available on the largest of the mainframes.

Hewlett-Packard is developing a complex vehicle maintenance/analysis program for the Ford Motor Co. CD-ROM is used here to handle the exponential progression of possible pathways leading from the basic diagnostic information to possible multiple causes of problems. The CD-ROM disk will also double as an Electronic Manual for all current Ford vehicle models.

The more you think about CD-ROM, the more possibilities you can visualise. Optical disks are not (yet) the whole answer to computer storage problems because they are read-only systems — but so are books and that didn't inhibit their usefulness over the last few hundred years.

Just to whet your appetite, here are some other ideas which are still in the beta-test stages with various companies:

— a full-text dictionary with large-print for the visually handicapped. It has phonetic pronounciation and illustrations that can be scaled up for viewing.
— a geographic database of the US which allows you to point-and-click on any part of the country and see a customised map with user-selected features (such as political boundaries, hydrography, highways, etc) displayed. Details down to the local streets for the entire US will be included in the final release.
— a disk containing all of the NASA pictures from unmanned space probes over the years.
— a database of mass-spectra of elements and compounds (used for scientific analysis).
— mail-order shopping catalogues.

If you are involved in 'information', then the above may read like a list of flavours in a chocolate factory. All we have here is a taste of things to come.

I would predict that CD-ROM will come into its own when it is coupled with the expert systems. With this much storage capacity, the old forms of information retrieval software are not adequate for the task in many cases.

Expert systems provide a way of accessing complex branching information trees, and CD-ROM provides a cheap and compact way of storing the data required. The two together should make a formidable combination. ●

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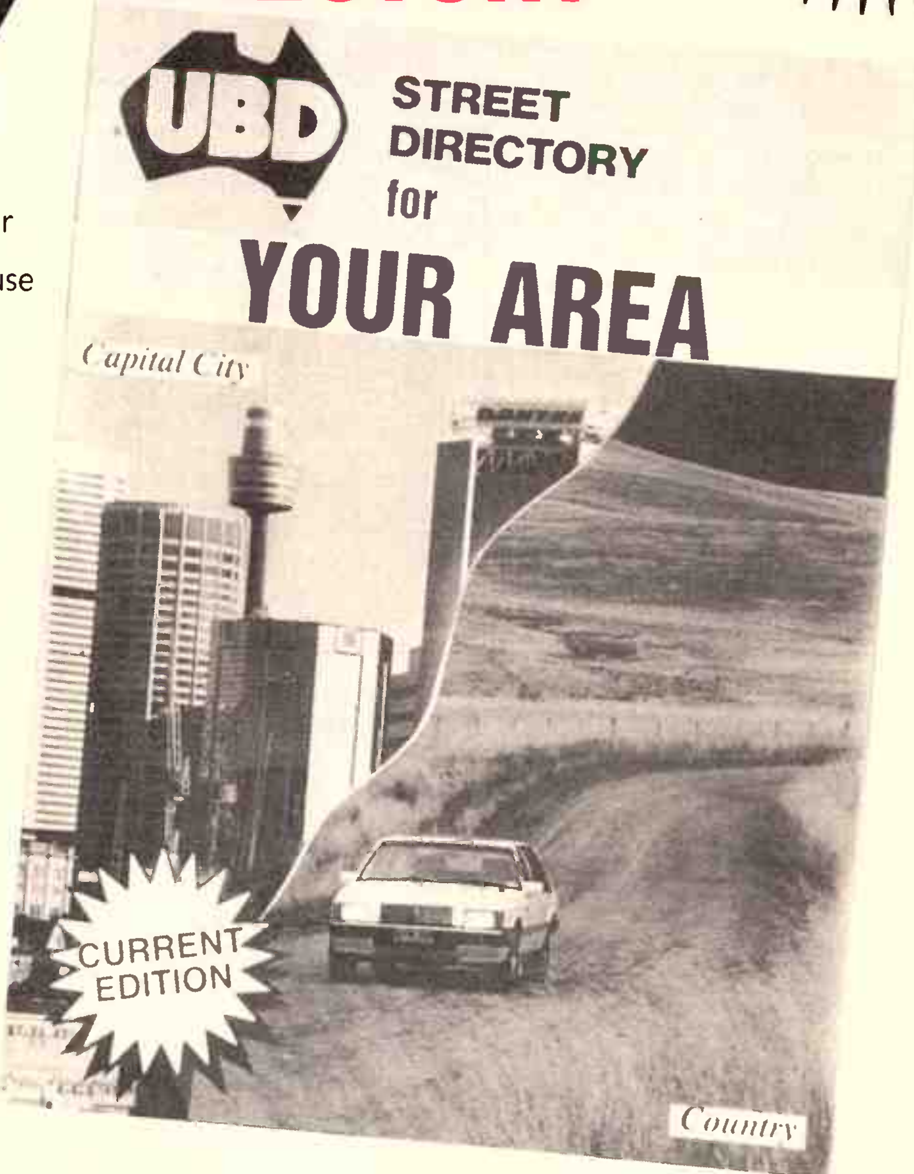

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The New Fleet

The Royal Australian Navy will soon start building its new submarines. They represent a multi million dollar opportunity for local industry.

Simon O'Brien

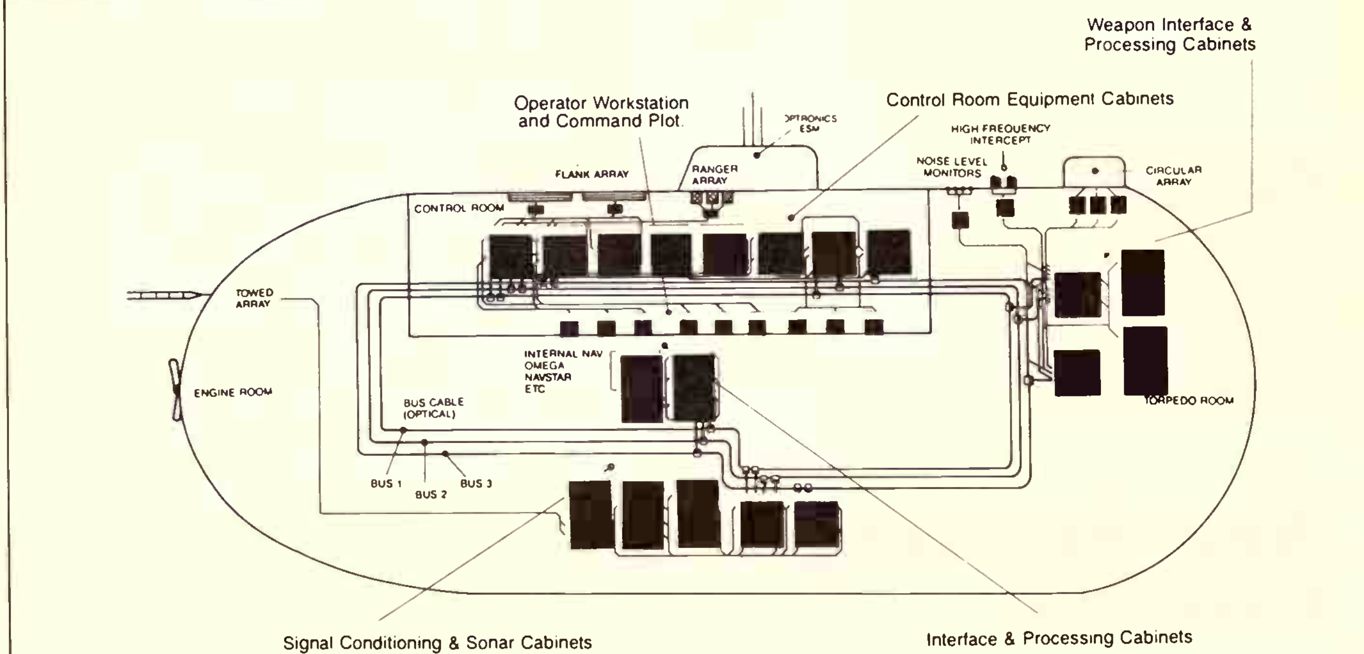
Over the 76 years of its existence the Australian navy has been renowned for the skill of its crews, its valour in battle and an unfortunate propensity to sink its own ships. Despite this latter quality the Australian navy plays a pivotal role in the national defence, as benefits an island nation. Recognising this the Federal government has decided to increase the power of the navy by replacing its aging squadron of Oberon class submarines with 6 or 8 new vessels.

It is intended that the new submarines will answer Australia's underwater defence needs well into the twenty-first century. They will belong to the new generation of diesel-electric powered boats with improved range and underwater speed. Tenders have been called and a number of foreign companies have been competing for the 3.5 to 4 billion dollars which the defence department is prepared to spend on the project.

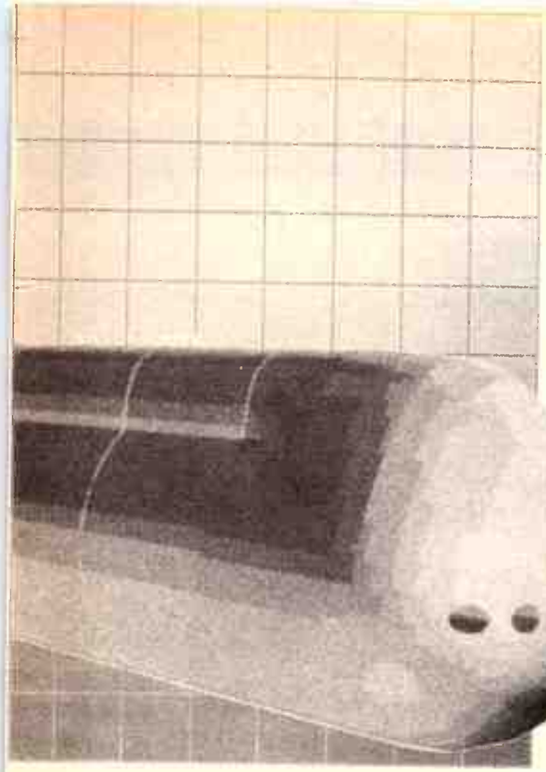
Although foreign consortiums will have a great deal of input into the programme they have attached themselves to smaller Australian companies because of the government's insistance that the subs be built in Australia by Australians. This factor alone makes the submarine project almost unique in the annals of Australia's defence equipment. It will give the RAN a unique submarine, tailored specifically to our operational requirements.

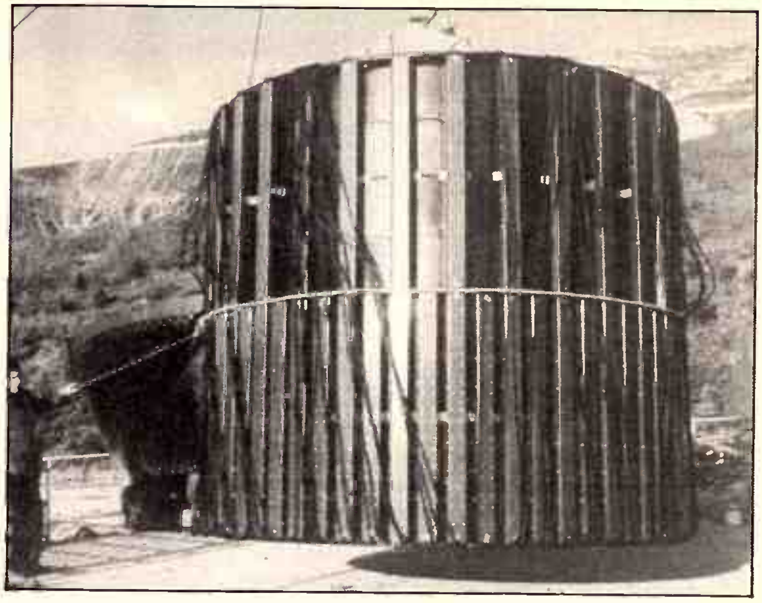
Two Main Features

Submarine construction has two main features. First of all there is the hull and the engines which power it, and secondly there is the *platform*, which refers to the electrical equipment which the sub uses to navigate and fight. Ther are two main contenders in the competition to build the hulls and engines of the Australian submarines; one German and one Swedish. The German concern consists of two companies: Howaldtswerke Deutsche Werft (HDW) and Ingenieurkontor Lubeck (IKL). HDW is the engineering side of this partnership while IKL is the designer. Both are well known West German companies and have had considerable experience in building subs for othre navies. Indeed this experience has been the source of some embarrassment as it has recently emerged that an official of the Indian government resigned after receiving a 30 million dollar payment over the sale ot four HDW-IKL subs to the Indian navy. It



Signaal's combat system situated throughout the submarine.





Above: Thomson Sintra's Search Attack array which is part of the integrated Sonar system. **Left:** the Kockum's design.

seems that HDW-IKL were also implicated in the illegal sale of submarine technology to South Africa. The Australian side of the German companies is known as Australian Marine Systems. Fortunately it has no interest in either the Indian or South African navies.

The Swedish rival to HDW-IKL is known as Kockums. At this stage Kockums seems to have the edge on its German rivals. It's been manufacturing both warships and merchant vessels for about a hundred years, including all the submarines currenly in service with the Swedish navy. The Australian bid marks the first time that Kockums has sought to enter the foreign market. It operates in Australia with the Australian Submarine Corporation which has been set up specifically to cater for the submarine project.

Both designs are believed to meet navy specifications in terms of performance and costs. According to Kockums their type 471 subs are characterised by silent running and the ability to withstand shock, as shown in the Swedes successful shadowing of Russian vessels in the Skagerrak.

Building a Platform

The central part of any submarine of course is its weapons and navigation systems. The Australian project has seen two consortiums bidding to secure the contract to build the platforms; namely the Dutch firm Hollandse Signaalapparaten known as Signaal, and the American firm Rockwell International.

The Signaal group also consists of Thorn EMI Electronics Australia (which will supply the Command plot), Signaal's parent company Philips, AWA (which will provide the optical fibre network), the Australian company C3 (which will design the principal software for the combat system) and a number of other companies such as the famous Krupp Atlas of West Germany which will design the very important mine avoidance system and Kollmorgan of the USA which will make the search and attack periscopes.

The Signaal group claim many advantages for their design, however, they lay particular emphasis on MILNET, a high capacity LAN which uses a fibre-optic based network consisting of multiple path data busses with self-healing, redundancy and fall back capabilities which, they claim, will ensure reliable operation, even after battle damage. Another aspect of the design Signaal and their partners are keen to emphasise is the integrated nature of various systems which they will supply.

The Rockwell bid is also a consortium consisting of Rockwell, Thomas Sintra Activities Sous-Marines of France which will design the sonar system, Computer Sciences of Australia which will handle the software side of the project, Scientific Management Associates which will provide logistic support and the Singer Company's Librascope Division of the United States which will be in charge of the weapons system.

Rockwell and its partners also claim many accolades for their expertise around the world. Rockwell states that it has 460 manufacturing, research and sales and service facilities on five continents. The consortium believes itself to be particularly strong in the area of systems integration and state that their data multiplex system gives them "the leading edge of shipboard information management". Thomas Sintra also claims to have an edge in sonar systems. The company is particularly proud of the ELADONE Sonar system which it designed. It apparently gives a submarine the ability "to hear without being heard".

Dockyards

A raging debate has been proceeding over the construction site for the new submarine force. After a year of rivalty, New South Wales and South Australia have emerged as the finalists.

At the time of going to press it seemed as if South Australia's dockyards were to be selected over those in New South Wales. This, of course, means a several billion dollar boost for the South Australian economy and a continual influx of federal funds thereafter, as the docks which construct the subs will presumably be charged with their maintenance.

South Australia will get the dockyards but Australia will gain a whole new generation of marine engineers. One of the conditions of the federal contract is that Australian expertise as well as Australian muscle must be used in the submarine construction. At present there are only about 30 people concerned in the project but the number will grow as the construction project begins in earnest. A large number of key personnel will be trained overseas so they can receive maximum experience. In fact, it is expected the total domestic expenditure on the platform will rival the bill for the hull and engines. Clearly therefore the human resources this project will generate are almost as important to the country as the submarines themselves, which it is officially hoped will eventually be scrapped without them ever firing a shot in anger. ●

Pocket Computers

The Sharp Corporation has just released five new pocket computers: the PC-1360, PC-1460, PC-1500A, and the PC-1600. With such an array it seems that Sharp hopes to capture the pocket computer market in Australia.

The PC-1360 features a RAM card and comes with a standard 8K memory although this is expandable to 64K. The 1460's memory can only be expanded to 32K though it features a powerful "Built in Matrix".

The 1500A is described by Sharp as "feature laden". this delightfully quaint term is Sharp's way of referring to such things as, increased Basic Language commands and a program lock function.

The 1600 is next and Sharp entitles this the "ultimate Pocket Computer". By "Ultimate Pocket Computer" Sharp means a machine that contains 16K of memory which can .be easily increased to 80K, a 96K ROM containing enhanced BASIC and a high speed CPU.

Sharp has also introduced the PC-2500. This is described as a "Ready-to-Go Business Tool". It contains a colour printer, Function keys, Serial I/O port, a graph search function and many other similar developments. 101

Dunlop's Developments

Pacific Dunlop's Industrial division has just released an Australian made battery meant to cope with local conditions. Known as the "Exide Safeguard" the new battery is said to be a significant advance on its competitors.

Pacific Dunlop claim that using the RE principle has allowed them to produce a "no fuss battery, light in weight and offering a low watt-hour cost". The new unit holds all its electrolyte captive in seperators between plates and needs no topping up and no maintenance. The Oxygen generated in recharging is immediately recombined internally, eliminating gassing or any other form of emission. Pacific claims that this battery "remains as clean and mess-free as a new dry cell".

Unfortunately the only model available initially is a 2 volt Model 2v220, though the range will soon also include the 12 volt model 12v38. Testing has shown that the new model 2v220 provides (under constant current discharge to 1.70 volts per cell at 25C) 11 amperes for 20 hours, 145 amperes for one hour or 720 amperes for one minute. 102

New Scope

The Scope company of Melbourne have developed a fast new heating iron (150W) which will operate from anywhere within 6 metres of a 12 volt vehicle battery. The new unit has been designed to provide the operator with the utmost flexibility.

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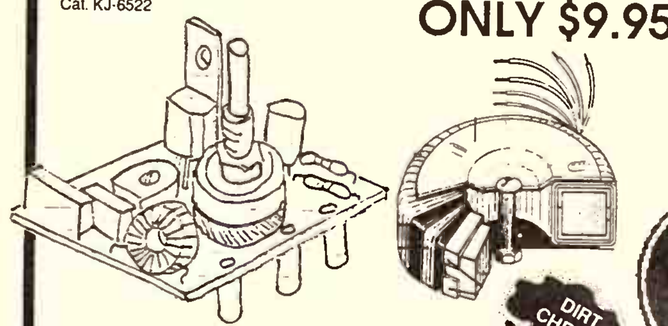

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FLOPPY DISK DRIVES

This article presents an overview of a floppy disk drive system with an emphasis on the electronic hardware. This storage medium has become so common that its operation warrants some explanation.

GLEN THURECHT

Floppy Disk systems have become increasingly popular in small to medium computer systems. This popularity has been due, in main, to the niche which the floppy disk fills in the present spectrum of memory storage options. The combination of system which gives bulk storage and fast access (in human response times) at a relatively low cost has made it a winner in the market place. The disks provide a non-volatile (data is retained when power has been removed) storage medium that can be removed from the drive so that large files or libraries can be set up. Once the initial cost of a disk drive has been outlayed the additional expense involved in expanding the memory capacity is minimal.

Another characteristic of this memory system is its ability to provide direct access to the required data. Unlike tape systems, which have to sequentially run through all the information blocks before accessing the required data, floppy disks can have certain blocks directly addressed and read. "Direct access" however is not the same thing as "random access" as found in semiconductor memory. Random access refers to the ability to directly access an individual data item without having to read a complete information block. Thus floppy disk storage provides a good compromise between tape recording and semiconductor memory systems.

Floppy disk formats

The aim of this article is to describe the electronic hardware involved in a floppy disk system but before we can explain that we must first look at the structure of the various disk formats.

There is a bewildering array of disk formats and it can be confusing when first exposed to them. The available formats can be broken into the following catagories:

1. Floppy disk size: 8", 5¼", 3½";
2. Hard or soft sectored; describes the way in which the address information is encoded onto the disk;
3. Single or double density; relates to the format used to record the data onto disk and hence the maximum amount of information that can be encoded; and,
4. Single or double sided: disks may be recorded on one or two sides hence a double sided disk will store twice the information of a single sided one, provided both are recorded in the same format.

Many combinations of the options in these categories may be combined to give a disk format. For instance — 8", hard sectored double density, double sided; 5¼", soft sectored double density, double sided . . .

The problem with all this great variety is that a disk of one format is not compatible with that of another. There have been no international standards agreed upon for the storage of information on a floppy disk.

Originally the floppy disk data storage system was created by IBM. This was called the IBM 3740 data entry system and consisted of a 8" soft sectored, single density, single sided format. This original 3740 system was accepted as the standard by industry and thus allowed the transfer of data from computer to computer and with other than IBM equipment. The problem of disk formatting arose because incompatability with the IBM format allowed much larger amounts of data to be stored on the same disk. Individual disk drive manufacturers developed their own methods and formats and rival systems competed on the market with no clear victor.

Disk structure

An 8" floppy disk is a 7.88" (200.1 mm) diameter Mylar disk. It is usually housed in an 8" square jacket. When inserted into the disk drive, the jacket is held stationary and the disk rotated.

In order to help with the addressing of information recorded onto the disk, it is divided into regions called sectors. This idea is shown in Figure 1. It is the method by which the sectors are identified that distinguishes between hard and soft sectoring. Figure 1(a) is a hard sectored disk in

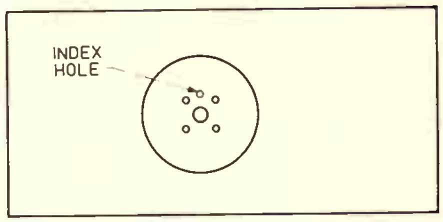


Fig. 1 (a). A lord disc.

which the sector positions are identified by the location of index holes. When the disk is rotated, an optical sensor detects when a sector hole is passing thus indicating which sector is currently under the read/write head. Figure 1(b) illustrates a soft sectored disk. This disk has no sector holes but relies on an ID header that is re-

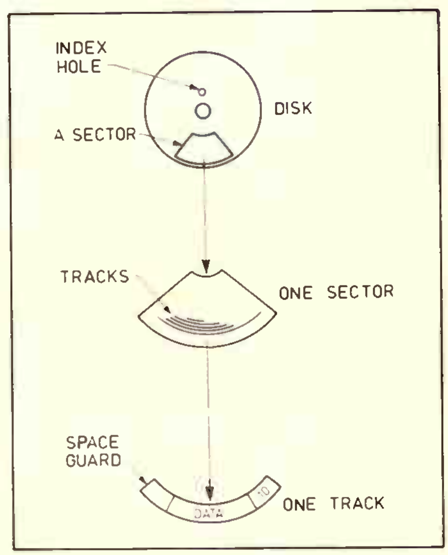


Fig. 1 (b). Floppy disc positioning.

corded at the starting location of each sector. As the disk is rotated, the read/write head reads the header and it is interpreted by the disk/controller to give the sector number.

As well as sector information, an index hole is placed on each disk and this identifies the sector number one position. This provides a physical reference point on the disk.

The method of hard sectoring allows more user data to be encoded onto the disk since there is no need to waste space recording the sector identification at the start of each sector. However, soft sectoring provides greater flexibility in the way the disk is formatted. In some applications the user is able to format the disk in a way which is much more suitable to the application at hand.

The electronics

The electronics hardware of a floppy disk system is broken into two sections:
1. The floppy disk controller; and
2. The floppy disk drive (FDD).

The controller handles all the tasks associated with the data transfer between the microcomputer system and the disk. It accepts data, converts it into a form ready for recording, and co-ordinates the location at which it will be stored. The controller also receives the 'raw' data that is read from the disk and converts it back into a form that can be used by the microcomputer. The controller is physically located in the microcomputer system itself and not in the FDD.

The FDD also contains a good deal of electronics that is directly associated with the rotating of the disk and control of the read/write head. The division between these two sections is illustrated in Figure 2. The FDD transmits flags to the controller which then gives commands in response. Data is transferred to and from the FDD in a serial form.

The floppy disk drive

The electronics contained internally in the FDD system can be roughly broken into the following groups:
1. Line drivers and line receivers to exchange signals with the host system;
2. drive selection circuit;
3. index hole detection circuit (and sector hole detection for a hard sectored FDD system;
4. stepping motor control for head positioning;

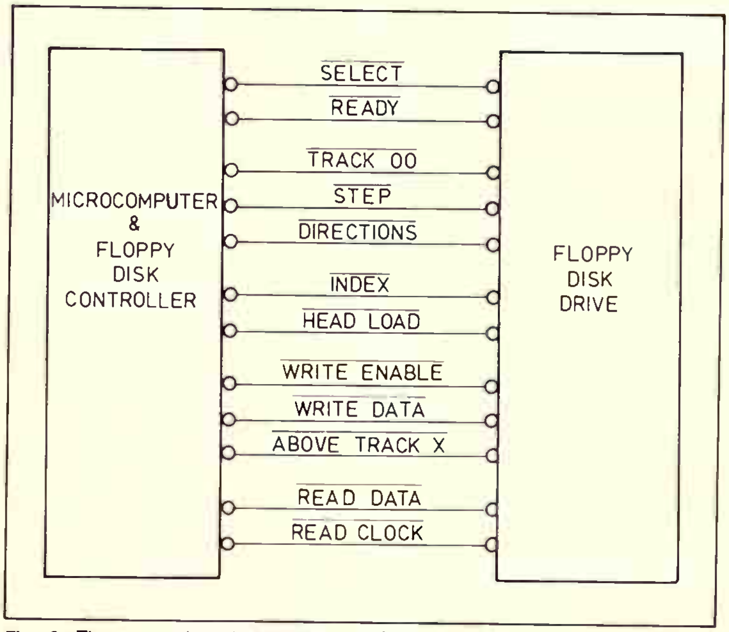


Fig. 2. The connections between the FDC and FDD.

5. read/write head amplifier;
6. head loading solenoid drive circuit;
7. write protect circuit;
8. track 00 detection circuit;
9. drive ready detection circuit;
10. head select circuit (for double sided disk drives); and
11. motor control for the rotating disk.

These requirements of a FDD are quite separate from the data co-ordination that is the disk controller's job. All these circuits account for the large amount of on board electronics that is found on the FDD. A typical FDD system consists of an array of sensors and detectors and two motors. One motor is the drive which rotates the disk at a constant rate, the other is a stepping motor to accurately position the read/write head on the correct track.

The line drivers and receivers are used to buffer the signals to and from the FDD. This allows the data to be sent over longer cables and reduces the possibility of errors caused by problems such as large line capacities which can slow down the leading and trailing edges of a data bit stream.

The drive selection circuit is used to allow multi-drive systems. The FDD is only selected when it is called on by the floppy disk controller. In this way a number of disk drives may be used on a bus structure or by being daisy-chained.

Index hole detection is achieved by using an optical sensor. A light source (LED) is positioned on one side of the disk and a photo transistor or photo diode placed directly under it. The floppy disk rotates between the two elements and when the index hole passes, the sensor detects the light, amplifies it and transmits the pulse to the controller.

When data is recorded onto the disk it is located on concentric rings called tracks. The track number along with the sector number then combine to give the complete address of a data block. The head is positioned above the desired track and as the disk is rotated the required sector eventually passes under the read/write head. The positioning of the read/write head has to be done accurately. Accuracy is obtained with the use of a stepping motor. Inside the stepping motor are a number of coils. When these coils are pulsed in a particular way they cause the motor shaft to move by a predefined angle. The shaft is then attached to a steel band that converts the rotational movement of the stepping motor into the linear motion required by the read/write head. It is the job of the stepping motor controller to drive the motor coils in the correct phase upon the receipt of a STEP command from the floppy disk controller.

The read/write head is usually made of ▶

SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Superb Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,500 sold!
For those who haven't the time and want a quality hi-fi, we also sell the Series 5000 kits assembled and tested.

POWER AMPLIFIER

WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER
• 1% Metal Film resistors

SPECIAL, ONLY $399
SAVE $50

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

SPECIFICATIONS: 150 W RMS into 4 ohms (per channel)
POWER AMPLIFIER: 100W RMS into 8 ohms (+ – 55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz +0 – 0.4 dB 2.8Hz to 65KHz, +0 – 3 dB. NOTE: These figures are determined solely by passive filters
INPUT SENSITIVITY: 1 V RMS for 100W ouput
HUM: 100 dB below full output (flat)
NOISE: 116 dB below full output (flat, 20KHz bandwidth)
2nd HARMONIC DISTORTION: 0.001% at 1 KHz (0.0007% on Prototypes) at 100W ouput using a + – 56V SUPPLY rated at 4A continues 0.0003% for all frequencies less than 10KHz and all powers below clipping
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above).
INTERMODULATION DISTORTION: 0.003% at 100W (50Hz and 7KHz mixed 4:1)
STABILITY: Unconditional

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

PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER
• 1% Metal Film ...

SPECIAL, ONLY $359
SAVE $40

... believe that dollar for ... commercial unit available that sounds as ...

SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input 15Hz – 130KHz, +0 – 1dB Low-Level input-conforms to RIAA equalisation + – 0.2dB
DISTORTION: 1KHz 0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation)
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1.2V) 92dB flat 100dB A-weighted, MM input, master full, with respect to full output (1.2V) at 5 mV input 50ohms source resistance connected 86dB flat/92dB A-weighted MC input, master full, with respect to full output (1.2V) and 200uV input signal 71dB flat 75dB A-weighted

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

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands ...

SPECIAL, ONLY $209
SAVE $30

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

SERIES 4000 SPEAKERS

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

Errors and Ommissions Excepted

VIFA/AEM 3 WAY SPEAKER KIT!

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

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

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

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

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

P25 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 25 - 3,000Hz
Free Air Resonance: 25Hz
Operating Power: 5 watts
Sensitivity (1W at 1m): 89dB
Nominal Power: 60 Watts
Music Power: 100 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.7ohms
Moving Mass (incl. air): 44 grams
Thiele/Small Parameters:
Qm: 3.15
Qe: 0.46
Qt: 0.40
Vas: 180 1
Weight: 1.95kg

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

VIFA/AEM 2 WAY SPEAKER KIT!

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

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

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

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

P21 WOOFER SPECIFICATIONS:
Nominal Impedance: 8 ohms
Frequency Range: 26 - 4,000Hz
Free Air Resonance: 33Hz
Operating Power: 2.5 watts
Sensitivity (1W at 1m): 92dB
Nominal Power: 60 Watts
Voice Coil Diameter: 40mm
Voice Coil Resistance: 5.8ohms
Moving Mass: 20 grams
Thiele/Small Parameters: Qm 2.4
Qe 0.41
Qt 0.35
Vas 80 1

Weight: 1.65kg

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

NEW!! DIRECT IMPORT!!

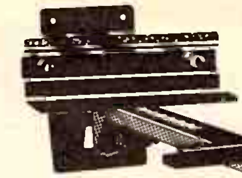
MULTI FUNCTION STEREO MIXER EQUALIZER

SPECIFICATIONS:
SENSITIVITY:
Phono: 3mV
Mic: 1mV
Line (tape or tuner): 150mV
SIGNAL/NOISE RATIO:
Phono: 55dB
Mic: 60dB
Line: 65dB
FREQUENCY:
Phono: 20Hz-20KHz (RIAA + – 2dB)
Mic: 20Hz-20KHz + – 3dB
Line: 20Hz-20KHz + – 3dB
CHANNEL BALANCE: 0.5dB
T.H.D: Less than 0.03%
HEADPHONE IMPEDANCE: 4-16 ohms
OUTPUT: 0.775V
EQUALIZER:
Centre frequency: 60Hz, 250Hz, 1KHz, 4KHz, 12KHz
Control Gain: + – 12dB
POWER SOURCE: 110V/60Hz or 220V/50Hz

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

PHILIPS SPEAKERS

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



NEW!!

WALL MOUNTING SPEAKER HOLDERS

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

Cat. $89.95

1" DOME TWEETER SPEAKER

Mylar diaphragm
SPECIFICATIONS:
Sensitivity: 96dB
Frequency Response: 2-20 kHz
Impedance: 8 ohms
Power RMS: 15 watts RMS
Magnet Weight: 5.4oz
Size: 96mm diameter
Cat C10234 .... $10.95

8" WOOFER HIGH POWER SPEAKER

Cloth edge, dark grey cone, rubber mounting seal, cloth dust cap
SPECIFICATIONS:
Sensitivity: 90dB
Frequency Response: 60-4 kHz
Impedance: 8 ohms
Power RMS: 50 watts RMS
Magnet Weight: 20oz
Cat C10226 .... $34.95

2" HORN TWEETER SPEAKER

Mylar diaphragm, aluminium voice coil
SPECIFICATIONS:
Sensitivity: 95dB
Frequency Response: 1.5-20 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 2.5oz
Cat C10232 .... $8.95

8" TWIN CONE FULL RANGE SPEAKER

Foam edge, black cone, black whizzer cone
SPECIFICATIONS:
Sensitivity: 98dB
Frequency Response: 45-16 kHz
Impedance: 8 ohms
Power RMS: 30 watts RMS
Magnet Weight: 13oz
Cat C10224 .... $23.95

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

5" MIDRANGE SPEAKER

Sealed back, foam edge, black cone, silver dust cap
SPECIFICATIONS:
Sensitivity: 98dB
Frequency Response: 500-8 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 5.4oz
Cat C10230 .... $12.95

6½" TWIN CONE FULL RANGE SPEAKER

Foam edge, black cone, black whizzer cone
SPECIFICATIONS:
Sensitivity: 89dB
Frequency Response: 60-15 kHz
Impedance: 8 ohms
Power RMS: 10 watts RMS
Magnet Weight: 5.3oz
Cat C10222 .... $14.95

rie

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425 High St, NORTHCOTE
Phone (03) 489 8866
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$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.

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56 Renver Rd, Clayton.
Ph. (03) 543 2166 (3 lines)

Errors and omissions excepted

008 335757 TOLL FREE MAILORDER HOTLINE FOR CREDIT CARD ORDERS! LOCAL ORDERS & INQUIRIES CALL (03) 543 7877

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N°1 FOR COMPONENT SPECIALS!

TAG TANTALUM CAPACITORS SPECIALS!

Cat.No.	Description	Price
R16124	16V 4.7uF	$0.48
R16125	16V 10uF	$0.52
R16126	16V 15uF	$0.75
R16128	16V 22uF	$0.85
R16216	25V 2.2uF	$0.40
R16220	25V 4.7uF	$0.70
R16222	25V 6.8uF	$0.70
R16224	25V 10uF	$0.60
R16228	25V 22uF	$2.40
R16300	35V 0.1uF	$0.30
R16302	35V 0.15uF	$0.30
R16304	35V 0.22uF	$0.30
R16306	35V 0.33uF	$0.30
R16308	35V 0.47uF	$0.30
R16310	35V 0.68uF	$0.35
R16311	35V 0.82uF	$0.35
R16312	35V 1.0uF	$0.30
R16314	35V 1.5uF	$0.50
R16316	35V 2.2uF	$0.50
R16318	35V 3.3uF	$0.35
R16320	35V 4.7uF	$0.70
R16322	35V 6.8uF	$0.80
R16324	35V 10uF	$0.80
R16326	35V 15uF	$1.40
R16328	35V 22uF	$3.50

ECONOMY TRANSFORMERS

	1-9	10+
2155 240V 6-15V 1A Cat. M12155	$9.95	$8.95
2156 240V 6-15V 2A Cat. M12156	$14.95	$13.95
2840 240V 9V CT Cat. M12840	$5.95	$4.95
2851 240V 12-6V CT 150mA Cat. M12851	$5.95	$5.50
2860 240V 15V CT 250mA Cat. M12860	$5.95	$4.95
6672 240V 15-30V 1A tapped Cat. M16672	$14.95	$13.95

QUALITY LEDS

Cat. No.	Description	Price
Z10140	3mm Red	$0.15
Z10141	3mm Green	$0.20
Z10143	3mm Yellow	$0.20
Z10145	3mm Orange	$0.20
Z10150	5mm Red	$0.15
Z10151	5mm Green	$0.20
Z10152	5mm Yellow	$0.20

HIGH INTENSITY RED LED BAR GRAPH

Dimensions:
Overall: 63mm across, 5mm high
LEDs: 10 x 5mm x 1mm

Cat No	1-9	10+
Z10180	$2.95	$2.75

½" HIGH INTENSITY RED LED DISPLAYS
(Available in Common Cathode and Common Anode)

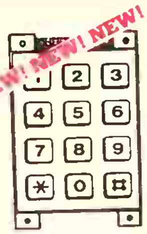
Dimensions:
Overall: 12.7mm across, 19mm high
Display: 12.7mm(H) x 7.3mm(W)
Segment Width: 1.2mm
Brightness: 3400 ucd I_F = 10mA

COMMON CATHODE:
Pin 1 Segment E Pin 6 Segment B
Pin 2 Segment D Pin 7 Segment A
Pin 3 CC Pin 8 CC
Pin 4 Segment C Pin 9 Segment F
Pin 5 Segment Dp Pin 10 Segment G

Cat No	1-9	10+	100+
Z10190	$1.95	$1.75	$1.50

COMMON ANODE:
Pin 1 Segment E Pin 6 Segment B
Pin 2 Segment D Pin 7 Segment A
Pin 3 CA Pin 8 CA
Pin 4 Segment C Pin 9 Segment F
Pin 5 Segment Dp Pin 10 Segment G

Cat.No	1-9	10+	100+
Z10191	$1.95	$1.75	$1.50



NEW! NEW! NEW!

NUMERIC KEYPAD

Unencoded keypad, 10 digit keys plus two utility keys. Light grey in colour.

OUTPUT ARRANGEMENT:

Output Pin N°	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

6.35mm STEREO PLUGS

UNBELIEVABLE PRICES!!
P10121 (plastic plug) Normally $1.00

1-9	10+	100+
$0.50	$0.45	$0.40

ELECTROLYTICS (PCB MOUNTING)

16 VOLT

Cat.No.	Description	1-9	10+
R15461	10uF	$0.25	$0.20
R15481	22uF	$0.25	$0.20
R15511	33uF	$0.25	$0.20
R15521	47uF	$0.25	$0.20
R15531	100uF	$0.30	$0.25
R15541	220uF	$0.60	$0.50
R15551	330uF	$0.75	$0.65
R15561	470uF	$0.75	$0.65
R15571	640uF	$0.90	$0.80
R15581	1000uF	$0.90	$0.80
R15601	2200/2500uF	$1.20	$1.10

25 VOLT

Cat.No.	Description	1-9	10+
R15422	2.2uF	$0.25	$0.20
R15432	3.3uF	$0.25	$0.20
R15442	4.7uF	$0.25	$0.20
R15462	10uF	$0.25	$0.20
R15502	25uF	$0.30	$0.25
R15512	33uF	$0.30	$0.25
R15522	47uF	$0.30	$0.25
R15532	100uF	$0.40	$0.35
R15542	220uF	$0.70	$0.65
R15552	330uF	$0.75	$0.65
R15562	470uF	$0.75	$0.65
R15582	1000uF	$1.00	$0.90
R15602	2200/2500uF	$1.40	$1.20

35 VOLT

Cat.No.	Description	1-9	10+
R15443	4.7uF	$0.30	$0.25
R15463	10uF	$0.30	$0.25
R15483	22uF	$0.30	$0.25
R15513	33uF	$0.40	$0.35
R15523	47uF	$0.40	$0.35
R15533	100uF	$0.60	$0.55
R15543	220uF	$0.60	$0.55
R15563	470uF	$0.70	$0.60
R15583	1000uF	$1.20	$1.10
R15593	2200/2500uF	$1.50	$1.30

50 VOLT

Cat.No.	Description	1-9	10+
R15404	0.47uF	$0.25	$0.22
R15414	1uF	$0.25	$0.22
R15424	2.2uF	$0.30	$0.25
R15434	3.3uF	$0.30	$0.25
R15444	4.7uF	$0.40	$0.35
R15464	10uF	$0.40	$0.35
R15484	22uF	$0.40	$0.35
R15514	33uF	$0.40	$0.35
R15524	47uF	$0.50	$0.45
R15534	100uF	$0.60	$0.55
R15544	220uF	$0.90	$0.80
R15564	470uF	$1.00	$0.90

63 VOLT

Cat.No.	Description	1-9	10+
R15405	0.47uF	$0.30	$0.25
R15415	1uF	$0.30	$0.25
R15425	2.2uF	$0.30	$0.25
R15435	3.3uF	$0.30	$0.25
R15445	4.7uF	$0.30	$0.25
R15465	10uF	$0.40	$0.35
R15505	25uF	$0.50	$0.45
R15525	47uF	$0.50	$0.45
R15535	100uF	$0.60	$0.55
R15545	220uF	$0.90	$0.80
R15555	330uF	$1.20	$1.10
R15565	470uF	$1.40	$1.20

CRYSTALS SPECIALS!

Description	Cat.No.	1-9	10+
1MHz	Y11000	$7.50	$7.00
4.433618MHz	Y11023	$2.95	$2.75
8.867238MHz	Y11055	$2.95	$2.75
12MHz	Y11070	$2.95	$2.75
14.31818MHz	Y11072	$2.95	$2.75

CHROME LED BEZELS

9mm hole, available 3 colours

Cat.No	Description	Price
S14030	Red	$1.20
S14032	Green	$1.45
S14034	Yellow	$1.45

5 PIN DIN PLUG

UNBELIEVABLE PRICE!
Cat. P10157 Normally $1.00

1-9	10+	100+
$0.50	$0.45	$0.40

ULTRASONIC TRANSDUCERS

Designed to transmit at 40kHz (L19990) and receive at 40kHz (L19991) with up to 20V I/P on the transmitter. These units can't be heard and so are ideal for TV remote controls, water level detectors, burglar alarms, motion detectors and information carriers as they can be either pulsed or used in the continuous wave mode.
Full specifications below for design purposes.
Maximum Input Voltage: 20V rms
Centre Frequency (kHz): 40 ± 1.0
Sound Pressure Level 10V RMS: 110dB min.
Sensitivity (dB/V/ubar) min.: 65 min
Bandwidth (kHz):
Transmit 4.0 (at 100dB)
Receiver 5.0 (at −73dB)
Impedance:
Transmit 500
Receiver 5000

Cat. L19990 (Transmitter) $4.75
Cat. L19991 (Receiver) $4.75

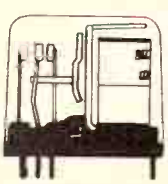
MINI JUMPERS

- Contact terminal: Phospor bronze
- Material: P.B.T. 94V-0
- Gold plated

Qty	Cat. No	Price
10	P12053	$2.95
25	P12055	$4.95
100	P12057	$21.95

TRIGGER TRANSFORMERS

Cat. M10104 $1.45



10 AMP RELAY

S.P.D.T. 12V Coil, 240V (S14114)

1-9	10+	100+
$4.95	$3.95	$3.75

CENTRONICS PLUG SPECIAL!

36 WAY MALE (P12200)

1-9	10+	100+
$3.95	$3.50	$3.00

DB STAND OFFS

At incredible prices! No need to pay absurd prices because we import them direct and pass on the savings to you!

2 Pack P10930	$1.00
10 Pack P10932	$3.95
100 Pack P10934	$20.00

U.V. TUBES

Fits into standard 15W flouro holder. Suitable for Scotchcal, Eprom erasing etc. As used in ETI Eprom Erasing Kit.
WARNING: Do not look directly into UV Tubes.
Cat. H28600 $24.95
*If ordering by mail please include an extra $2 for "special" packing.

SPECTROL MULTIDIALS

MODEL 15-1-11
Number of turns: 10
Minor Scale Division: 1/500 turn
Shaft Bore: 6.35mm (¼")
Finish: Satin Chrome
Body Size: 25.4 x 44.45mm (1 x 1¾")
Depth: 25.4mm (1")
Weight: 45.4g (1.6oz.)
Cat.R14405 $45.95

MODEL 16-1-11
Number of turns: 15
Minor Scale Division: 1/50 turn
Shaft Bore: 6.35mm (¼")
Finish: Clear Anodize
Body Size: 22.2mm diameter (.875")
Depth: 22.2mm (.875")
Weight: 19.8g (0.7oz.)
Cat.R14400 $26.95

MODEL 21-1-11
Number of turns: 15
Minor Scale Division: 1/100 turn
Shaft Bore: 6.35mm (¼")
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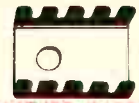

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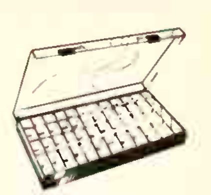

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MnZn magnetic ferrite. The head contains three ferrite cores — one in the centre for read/write and one on each side of this for erasing. The erase cones are used to erase a space between tracks when recording. This type of recording is called a tunnel erase, and is done because the magnetic field of the read/write head creates a track that is larger than required, so the erase cores squeeze the track to the needed size. If this were not done the track density would have to be made much smaller or data from one track would overflow into that of another.

Data is recorded onto the disk when the head is placed in contact with the surface and current passed through it. The current sets up a magnetic field which changes direction depending upon the direction that the current flows through the head. The magnetic field flux changes are then recorded onto the surface of the disk in a form much like a series of small magnets. These magnets have their poles pointing in a particular direction depending on the direction of the current when it passes through the head.

Because of the high bit densities on a floppy disk a problem called bit shifting is sometimes encountered. This is caused by the interraction between the small "magnets" that are recorded on the tracks. The poles of these magnets tend to repel or attract the magnet on either side of them. The amount of repelling or attraction is a function of the bit stream and is not a constant. This can cause errors in the recovery process if not taken into account. There are three methods commonly used to overcome this problem.

1. Since the bit shifting is higher for greater bit densities, reduce the flux density of the read/write head on the inner tracks where the bit density is greatest;
2. Adjust the window during which bits are detected to compensate for the shifting; and,
3. Compensate during the writing processes so that bits are recorded away from their normal position but then pushed back by the bit shifting process.

The greater the bit density, the greater the problem, hence for double density recording all three techniques are used. The first techniques is achieved by simply reducing the flux levels used for the recording on the inner tracks. On an 8" disk, tracks 0 to 43 are recorded at normal levels and the flux reduced on tracks 44 to 76. The third technique described is sometimes called time precompensation. It can be accomplished by passing the data to be recorded through a serial buffer and detecting patterns that will lead to bit shifting. When an offending pattern is found the corresponding bits are then delayed or written early.

When reading data off a disk the head is placed on the surface at the desired point. As the disk is rotated the "magnets" induce a voltage in the head windings that is a function of the speed of the transition past the head and the magnitude of the magnetic field when the recording was made. This creates a differential signal from the head that is passed onto the floppy disk read amplifier system. Figure 3 shows a typical monolithic read amplifier system. The head is attached to two pins and the output produced is a digital pulse corresponding to each peak of the input signal. The analog head signal is processed by amplifying, filtering and differentiating. It is then coupled to a comparitor/logic circuit to detect zero crossing and reject noise in the differntial read signal.

Because a floppy disk is not rotating fast enough the head must be placed as close as possible to the magnetic surface with the recorded information. In this way larger voltages can be induced into the head. In a floppy disk system the head is in actual contact with the surface of the disk. This of course can create wear on the disk and therefore floppy disks are not as reliable as the floating head arrangements found on other, much more expensive magnetic storage systems. A typical specification for the media life of a 5¼" disk is a rotational life of 3.5 x 16^6 passes/-track.

In order to keep the head and media wear to a minimum, the head is only put in contact with the surface when a read or write operation is to be performed. This then means that the head is held off the surface while the desired track is found and then placed in contact by the activation of the head solenoid. The FDD has on-board drivers that control this solenoid. Lifting the head off the surface also greatly increases the head life which has a typical specification of 10,000 hours of head to disk contact.

The FDD must also detect the write protect notch in the side of the disk. If the disk has been protected, a signal is sent to the controller which then inhibits the writing of data onto the disk. The detection of the write protect is again accomplished with an optical LED and photo transistor arrangement. When the writen enable tab has been removed, the writing is inhibited.

The track 00 signal is generated by another optical switch and is then transmitted to the controller. The signal indicates that the read/write head is positioned on track 00 and further outward stepping is inhibited. Also when power is first switched on, the read/write head can be stepped out until the track 00 position is detected. This gives the controller a reference position and further changes to track position may be attained by counting from one position to the next.

The drive ready detection circuit tells the controller that a disk is correctly inserted, the door is closed, and that a number of index pulses have been detected. All three of these conditions are logically ANDed and sent to the controller as the READY signal. The disk in and door closed are detected with mirco switches.

If the FDD is capable of using double sided disks then there will be two read/write heads, one for each side. There is only one line going to the floppy disk

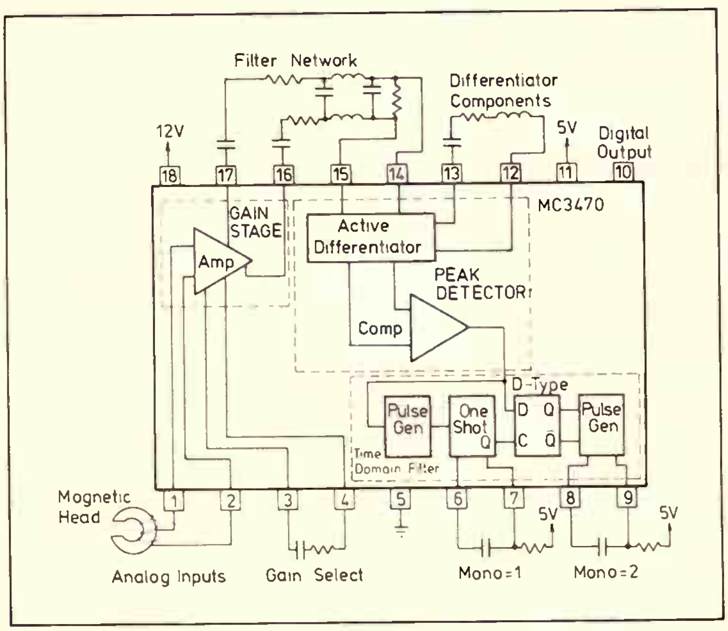


Fig. 3. A typical monolithic read amplifier.

controller for the READ DATA and only one from it for WRITE DATA. If two sides are to be recorded onto them there needs to be internal circuitry for multiplexing the heads into the read and write amplifiers. The multiplexer is switched by a line called HEAD SELECT sent by the controller.

The last of the circuit blocks of the FDD is the drive motor control for rotating of the disk. This can be an AC or DC motor that must rotate at a fixed rate. The speed of the motor must be kept constant to within about ±2.5%. Since the data is recorded onto the disk along with the clock information some variance in speed will not cause problems in the recovery of the data. The motor can sometimes be constant enough in speed to need no control whatsoever, its only requirement being the application of power. Some manufacturers use brushless DC motors as the drive mechanism which increases the reliability and gives maintenance free service.

Recording methods

Before we look at what is required for the disk controller we must look at the methods that the data is encoded for recording onto the disk.

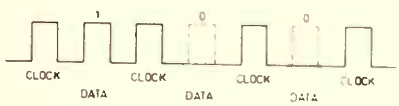


Fig. 4 (a). Informal IBM disc recording known as Manchester encoding.

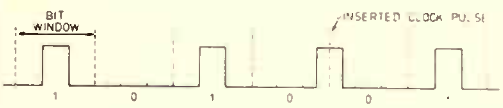


Fig. 4 (b). Modified FM encoding assigns 'bit windows'.

For single density systems the informal IBM standard for disk recording has been Manchester encoding (sometimes called FM, or frequency modulation). This is a simple system and the idea is shown in Figure 4(a). Here the clock is inserted at regular intervals and used for synchronisation. The data is inserted midway through two clock pulses where '1' is represented by a flux change and an '0' as the absence of a flux change.

This system only achieves around 50⅓ efficiency and hence other systems had to be developed to increase data densities. For double density recording there is no informal standard and different manufacturers use different techniques. This then means that there is much less interchangeability of disk at recording densities higher than single density.

One method of double density recording is MFM or modified FM. This method

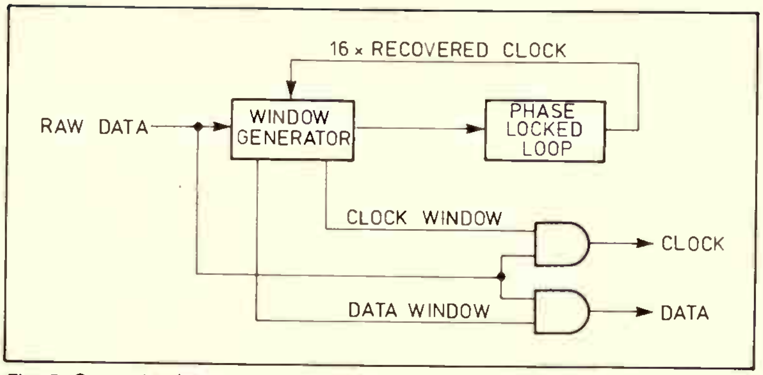


Fig. 5. Composite data is broken in to clock and data information.

assigns a "window" into which each bit of the data stream should be recorded. Figure 4(b) shows that '1's are recorded as flux transitions and '0's as no transition. In order to maintain synchronisation, clocking information must be encoded as well, since if a long series of '0's are recorded the controller may not be sure where the '0's should lie. This problem is solved by inserting a flux transition between any two adjacent '0's.

Another double density method is group-code recording (GCR) in which a group of four data bits can be encoded as a five bit code. The five bit code is selected so that flux transitions in a continuous encoded bit stream are spaced fairly evenly and therefore synchronisation is maintained. This method of coding can achieve about 80⅓ efficiency.

Controller hardware

The hardware involved in the floppy disk controller is centered around an LSI controller chip that can handle most of the disk interfacing functions. As well as this chip some systems require data separators, phase-locked loops, and timing precompensation circuits. The controller chips are available from a number of manufacturers including Western Digital, Motorola, Intel and NEC.

The data separator circuit is used to take the "raw" data from the FDD data separator. The phase locked loop is used to break the composite data and clock (raw) input into the separate data and clock signals. The phase locked loop generates a window during which the data bit is expected to fall and the data is then gated through an AND gate. The window then changes to the clock window and the clock signal is gated through another AND gate to produce the clock signal.

The phase locked loop that is used in this circuit is not the normal analogue variety with built in voltage controlled oscillator and phase comparator. This type of phase locked loop tends to compensate incorrectly when bit shifting is encountered. Instead the circuit of Figure 6 is used which is a simple digital phase locked loop that re-synchronises as each new bit enters. This re-synchronisation is achieved by reloading the 4-bit counter whenever a received bit is observed.

A double density bit separator is more complex since the problems of bit shifting are much greater. In addition it is also necessary to pre-compensate the data which is to be written onto disk. LSI chips are available that handle both the precompensation and the data separation for double density systems. These chips are usually used instead of going to the trouble of doing the job discretely, as with the single density controllers. ●

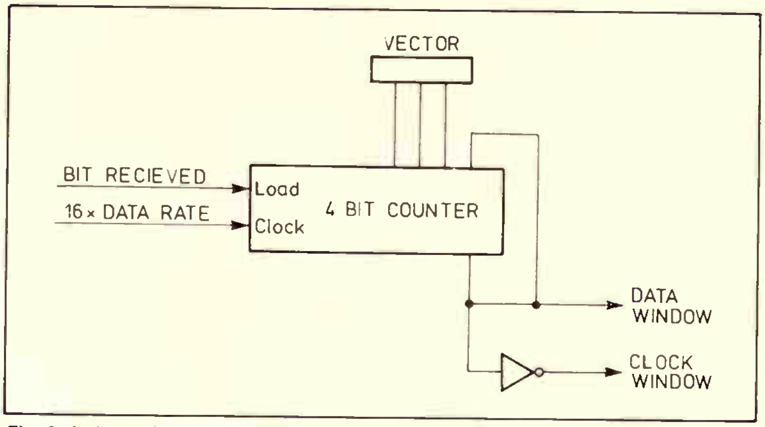


Fig. 6: A simple digital PLL for resyncronising.

THE PROBLEM WITH DIGITAL

High speed analogue to digital conversion is the most intractible bottleneck in most real world computer systems. However, good techniques can reduce many of the problems.

S. K. Hui

With the versatility and enormous manipulating power given us by computers and the latest advances in digital electronics, it's easy to see why everything is going digital!! Digital signals are easier to store, process and transmit than equivalent analogue information. Unfortunately, we live in an analogue world, so at the heart of every digital system, there has to be a converter if we need to take the signals outside the box or bring them into it.

In the last few years there has been tremendous progress. Today, much of the best sound and video equipment uses digital processing. Just a few years ago designers had to be content with analogue processing if they wanted any kind of quality. The change has been due to the existance of good high speed (higher than 1 MHz conversion rate) analogue to digital converters (ADC).

Unfortunately, the move has not come cheap. ADCs are now the most expensive form of integrated circuit in general use. To catch up with the speed and the wider word size of today's computers, the operating speed and accuracy of ADC have to be increased correspondingly. This is the reason for the horrendous price tag on many of the latest ADC chip.

The intention in this article is to give a brief overall view of some of the considerations in choosing ADCs, based on an understanding of the figures and jargon quoted in the specifications. What are the hidden traps? How much will the device deviate from its claimed specification when it is being used under a different environment? Is the resolution of the ADC too low or too high for the application?

Methods of conversion

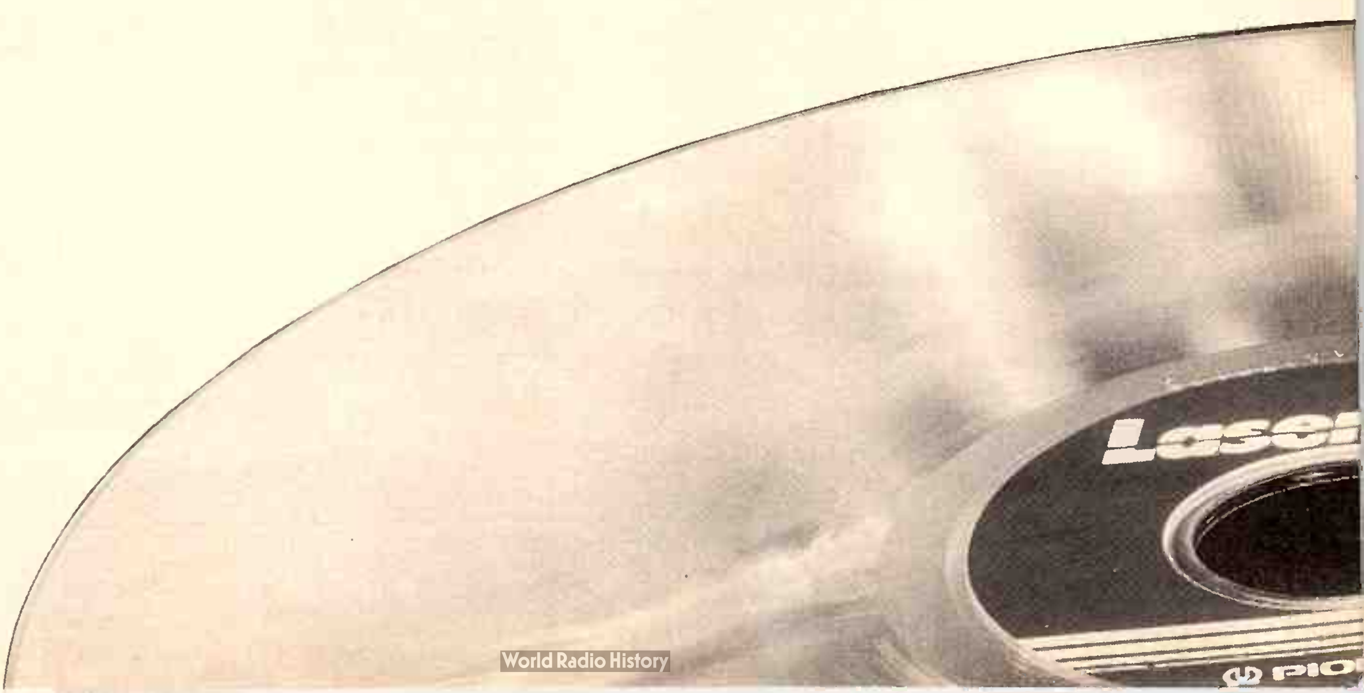
The most important single parameter in conversion is accuracy. How closely does the digital value relate to the analogue one? There are many contributing factors to the accuracy of conversion, but one of the most important is the method of conversion. Each method has its own advantages and disadvantages.

Successive Approximation is usually employed in cost effective circuits for moderate resolution with medium speed. For higher resolution, integration techniques are used. The most expensive method is flash conversion, which is capable of delivering extremely high speed and resolution.

Like a chemist's balance with binary weights (2, 4, 8, etc), the successive-approximation converter compares the unknown inputs with sums of accurately known binary weights. It starts with the heaviest and works its way down to the least significant bit.

Integration types count pulses for a period of time proportional to the analogue input voltage. The most frequently used integration technique is called dual slope integration. It eliminates drift by storing errors in the first integration and subtracting them in the second round. A sophistication of this is the quad-slope converter which goes through two dual-slope conversion process to obtain an extremely precise value. It does the dual slope integration twice, once with zero input and once with the analogue input to be measured.

A flash converter consists of many high speed precision comparators and is by far the fastest conversion technique available without trading precision for speed. In



flash conversion, the analogue signal is compared against stable voltage levels, using as many comparators as there are levels. The binary output of the comparator is processed by a priority encoder into a binary (or Gray code) form. This means the conversion process occurs in parallel, which is the secret of its high speed.

The Specifications

The fidelity of an analogue audio or video signal can easily be lost if the ADC is not properly used. There are five features of a specifications that need special attention:

(a) Accuracy in dc.
(b) Analogue Input Frequency Response.
(c) Linearity — Differential, Integral and Monotonicity.
(d) Quantization Noise.
(e) Aperture Time.

Accuracy

The error of an ADC at a given output code is the difference between the theoretical and the actual analogue input signal required to produce that code. Accuracy is a measure of the strength of this error. It can be divided into two categories; absolute and relative.

Absolute error is composed of gain error, zero error, non-linearity and quantising noise. Relative error is the deviation of the analogue value at any code relative to the full analogue range of the ADC's transfer characteristic from its theoretical value relative to the same range. It's usually expressed in % ppm (part per million) or fractions of a least significant bit.

> 66
> ***The fidelity of an anlogue audio signal can be lost if the ADC is not properly used.***
> 99

Generally, ADC manufacturers specify accuracy as a relative specification, since the absolute value reveals only half the story. A high speed ADC is an instrument which is capable of converting wide band analogue signals into a digitized form of that signal, so dc conditions give only a small part of the true accuracy story. The dc accuracy performance should, of course, be specified. But it often presents an erroneous view that the ADC is an ideal encoder, if other ac characteristics of the device are not mentioned at the the same time.

The testing setup shown in figure 1 is normally used to determine the absolute accuracy and dc linearity of the ADC. Assuming the error introduced by the DAC is not significant compared to that of the ADC (which is always the case), the difference amplifier output indicates the amount of quantization error on a slow ramping input.

In fact, quantization noise seems to be the major limiting factor to the accuracy of the ADC, at least as far as dc is concerned. As the frequency of the input signal goes up, other problems become more significant.

Linearity

A digital output code should correspond to a quantum of analogue input values exactly one LSB in width. Any deviation ▶

of the "measured" step from the ideal width is called Differential Nonlinearity. It is important because a differential nonlinearity error greater than one LSB can lead to non-monotonic behaviour of a DAC, ie: one analogue value can correspond to more than one digital value.

Referring to figure 2, the horizontal bars represents the measured DAC output values corresponding to the six adjacent codes. In figure 2a, the DAC output is linear because the quantizing levels (1, 2, to 5) of the DAC are equally spaced one analogue unit apart. The DAC output in figure 2b is non-linear, in that the quantum level 3 is 2.5 units above quantum level 2 and quantum level 4 is 0.5 units short. The differential linearity error, the difference between the actual quantum width and the ideal width (1 unit) is +1.5 unit for level 3 and −0.5 unit for level 4.

Employing such a DAC in a successive approximation type ADC will lead to missed code. An analogue input signal slightly larger than the value of X100 will be converted to X100 and if slightly smaller, be converted to X010. The code X011 will never exist.

While differential nonlinearity deals with errors in step size, integral nonlinearity has to do with the deviation of overall conversion shape from perfect linearity. As can be seen above, differential error only affects the Successive Approximation ADCs which employs a DAC internally, integral non-linearity affects all types of ADCs.

The integral non-linearity comes from the frequency response of the input stage of the ADC (as mentioned previously). The 3-dB bandwidth of the input roll off should be at least three times the Nyquist frequency. Circuits that roll off the input bandwidth will distort the high frequencies in the input, causing intermodulation products within the converter. When this accurs, watch for the monotonic curvature of the transfer function — which causes even harmonics, the symmetrical clipping or compression near the full scale positive or negative (causing odd harmonics) as in figure 3.

Quantization Noise

For an N bit ADC, the analogue continuum is partitioned into 2^n discreet ranges. All analogue values within any two quantized levels will be represented by the same digital code, usually assigned to the nominal midrange value. There is therefore, an inherent noise due to quantizing, with the maximum error of +−0.5 LSB. The combined effect of quantizing and aperture errors is reflected as signal to noise ratio in the manufacturer's specification sheet.

Aperture Time

This is the delay time after the issue of the HOLD command to a trade/hold circuit before the switch actually opens. In other words, it is the time uncertainty of the exact instant that the sample is taken at the analogue input. Obviously, the smaller the aperture time delay, the better the dynamic performance of the ADC. The total aperture time consists of two components. The first is the delay of the solid state switch. The resistance of the switch does not change from zero (open) to infinite (close) instantly. The delay time is usually a constant for a given switch and could be compensated by an advanced HOLD command, provided the delay time is known.

The second component of the total aperture delay is the jitter. The delay caused by jitter is much harder to solve. It is caused by random noise, 50 Hz mains frequency or any other noise sources nearby phase modulating the encoded signal. The delay time as a result of jitter is thus pretty random, unlike the former, which is merely a constant for a given switch.

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Q10538	MU65 0-50uA	12.50	11.35	10.90
Q10540	MU65 0-1mA	12.50	11.35	10.90
Q10550	MU65 0-100uA	12.50	11.35	10.90
Q10560	MU650 0-20v	12.50	11.35	10.90

Plus 20% tax where applicable

TRANSISTORS

Desc.	10+	100+	Desc.	10+	100+
2SJ49	5.50	4.95	2SK134	5.50	4.95
PN2222A	.10	.08	PN2907A	.10	.08
PN3463	.15	.13	PN3565	.12	.11
PN3566	.15	.13	PN3567	.10	.08
PN3569	.18	.16	PN3639	.18	.16
PN3640	.18	.16	PN3641	.10	.08
PN3642	.10	.08	PN3643	.10	.08
PN3644	.15	.13	PN3645	.15	.13
PN4250A	.15	.13	PN4355	.16	.14
PN4356	.16	.14	MPSA42	.23	.20
MPSA43	.23	.20	MPSA55	.15	.14
MPSA56	.15	.14	MPSA92	.22	.20
MPSA93	.22	.20	SC1410	.85	.75
BU126	1.50	1.25	BUX80	2.75	2.55
BU208	2.50	2.20	2SD350	3.75	3.40
BU326	1.75	1.60	BC547	.07	.06
BC548	.07	.06	BC549	.07	.06
BC557	.07	.06	BC558	.07	.06
BC559	.07	.06			

Plus 30% tax where applicable

DIODES

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

Plus 20% tax where applicable

COMPUTER CONNECTORS

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

Plus 20% tax where applicable

CANNON TYPE ADUIO CONNECTORS

We've sold 1000's because of their great value!

Cat.No.	Desc.	1-9	10+
P10960	Pin Line Male	2.50	2.00
P10962	Pin Chasis Male	2.30	1.90
P10964	Pin Line Female	2.95	2.75
P10966	Pin Chasis Female	3.10	2.90

Plus 20% Sales Tax where applicable

GREY FLAT RIBBON CABLE IN 100 FOOT ROLLS

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

LARGER QUANTITIES NEGOTIABLE!

Plus 20% tax where applicable

MICRODOT 5 1/4" FLOPPY DISKS

Have a look at these prices!
These are 100% certified, prime spec. disks in labelled jackets.
(not like our oppositions)

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

Plus 20% tax where applicable

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

500K DISK DRIVE FOR IBM*

12 months warranty!

1-9	10+	100+
$145	$135	$125

Plus 20% tax where applicable
*(*IBM is a registered trademark)*

TANTALUM CAPACITORS

Cat.No.	Description	10+	100+
R16124	4.7uF 16V	$0.24	$0.18
R16125	10uF 16V	$0.25	$0.23
R16126	15uF 16V	$0.38	$0.36
R16128	22uF 16V	$0.42	$0.40
R16132	47uF 16V	$1.55	$1.20
R16134	68uF 16V	$1.80	$1.50
R16220	4.7uF 16V	$0.35	$0.33
R16224	10uF 16V	$0.38	$0.37
R16228	22uF 16V	$1.20	$1.00
R16300	0.1uF 35V	$0.13	$0.12
R16302	0.15uF 35V	$0.13	$0.12
R16304	0.22uF 35V	$0.15	$0.12
R16306	0.33uF 35V	$0.15	$0.14
R16308	0.47uF 35V	$0.15	$0.14
R16310	0.68uF 35V	$0.16	$0.15
R16311	0.82uF 35V	$0.18	$0.15
R16312	1uF 35V	$0.15	$0.12
R16314	1.5uF 35V	$0.24	$0.20
R16316	2.2uF 35V	$0.24	$0.23
R16318	3.3uF 35V	$0.29	$0.27
R16320	4.7uF 35V	$0.35	$0.33

30% Sales tax where applicable

PRINTER RIBBONS

To suit CP80, BX80, DP80 etc.

Cat.No.	3+	25+	100+
C22036	8.00	7.50	6.50

Plus 20% tax where applicable

LEDS 5mm STANDARD

Desc.	10+	100+	1000+	10,000+
Red	$0.10	$0.09	$0.08	$0.07
Green	$0.15	$0.10	$0.09	$0.08
Yellow	$0.15	$0.10	$0.09	$0.08

Plus 20% tax where applicable

TRANSFORMERS

Cat.No. & Desc.	1-99	100+	1000+
M12851 2851 240V 12-6V CT 150mA	3.50	3.30	2.90
M12155 2155 240V 6-15V 1A tapped	6.00	5.75	5.50
M12156 2156 240V 6-15V 2A tapped	9.00	8.75	8.50
M12840 2840 240V to 9V C.T. at 150mA	3.50	3.30	3.10
M12860 2860 240V to 15V C.T. at 250mA	3.50	3.30	3.10
M16672 6672 240V 15-30V 1A tapped	8.95	8.75	8.40

Plus 20% tax where applicable

HARD DISK DRIVE FOR IBM*

- 20 M/Byte
- Seagate hard disk
- Hard disk controller by Xebec

Cat. X20010 .... $695

Plus 20% tax where applicable

12V SEALED LEAD ACID BATTERIES

Description/Cat.No.		1-9	10+
1.2 AH	S15029	$12.50	$11.75
2.6 AH	S15031	$17.70	$16.50
4.5 AH	S15033	$23.40	$22.00

Plus 20% tax where applicable

POLYESTER 100V "GREENCAP" TYPE

Cat No.	Description	1-99	100+	1000+
R15131	.001uF	0.06	0.04	.03
R15137	.0012uF	0.06	0.04	.03
R15138	.0015uF	0.06	0.04	.03
R15140	.0022uF	0.06	0.04	.03
R15142	.0033uF	0.06	0.04	.03
R15143	.0039uF	0.06	0.04	.03
R15145	.0047uF	0.06	0.04	.03
R15146	.0056uF	0.06	0.04	.03
R15147	.0082uF	0.06	0.04	.03
R15148	.01uF	0.07	0.05	.04
R15150	.015uF	0.07	0.05	.04
R15152	.022uF	0.07	0.05	.04
R15154	.033uF	0.07	0.05	.04
R15155	.039uF	0.07	0.05	.04
R15156	.047uF	0.08	0.06	.05
R15157	.056uF	0.08	0.06	.05
R15158	.068uF	0.08	0.06	.05
R15159	.082uF	0.08	0.07	.05
R15160	.1uF	0.09	0.08	.07
R15162	.15uF	0.11	0.10	.09
R15164	.22uF	0.15	0.14	.13
R15165	.27uF	0.16	0.15	.14
R15172	1uF	0.70	0.55	0.50
R15176	2.2u	1.20	1.10	1.00
R15178	3.3uF	1.50	1.20	

Plus 30% tax where applicable

SUPER DISCOUNT 5 1/4" FLOPPY DISKS IN BULK PACKS!

Attention schools, clubs, software houses etc! These are 100% certified, prime spec. D/S D/D disks with a 5 year warranty and made by a leading manufacturer, only without labels or brand names! But have a look at the price! Sensational value to say the least!

Descript	10+	100+	1,000+	10,000+
D/S D/D	$1.10	$1.00	$0.90	$0.80

Plus 20% tax where applicable

FREE sample disk available on request!
(Please send $2 to cover postage)

DISK DRIVE FOR APPLE* (6502 SYSTEM)

1-9	10-24	25+
$175	$165	$155

Plus 20% tax where applicable
*(*Apple is a registered trademark)*

NICADS

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

Plus 20% tax where applicable

HORN SPEAKERS

Cat No.		1-9	10+
C12010	5" Plastic 10W Max	6.00	5.80
C12015	5" Metal 10W Max	6.00	5.80
C12012	12V Siren	9.90	9.60

Plus 20% tax where applicable

FANS

Cat.No.	Descript.	1-9	10+	100+
T12461	240V 4 1/2"	11.00	10.00	9.00
T12465	240V 3 1/2"	11.00	10.00	9.50
T12463	115V 4 1/2"	11.00	10.00	9.00
T12467	115V 3 1/2"	11.00	10.00	9.50

(Fan guards to suit also available)

Plus 20% tax where applicable

Letters to the Editor

One of the Lucky Ones

I am a student studying Industrial Electronics at Gymea Technical College in Sydney. I am one of the lucky ones who gained a place in this course, unlike many others whose names went on a waiting list. However, my good fortune is apparently to be short lived. The second stage of this course is unlikely to be offered at this college because no technician is employed to support the course in maintenance and construction of necessary equipment. Currently students and teachers fulfill this role; showing dedication borne of necessity.

I previously read with interest your article 'A Career In Electronics' (ETI Oct, 1986) although I felt TAFE was poorly represented. However, I must now agree that TAFE seems to ignore the needs of students who wish to train in electronics. Why is it that government support is lacking concerning because it is the only college within my reach. I am doing this course to simply protect my job, as being merely an electrician is now no longer enough.

I suggest that post trade training in electronics is essential both to individuals concerned with their job prospects as well as to the country. Without trained personnel, industry cannot function, and we all suffer. I am one of over 50 students enrolled in this course at Gymea, and we all face the prospects of being on the 'scrap heap' because of government ceilings on employment within the public service prevent the course being offered in its entirety. Surely this is government cost cutting in its worst form; akin to severing the artery that feeds the nation to save a few dollars.

Larry Mahoney
Hurstville,
Sydney
NSW

TAFE replies:

Your correspondent Larry Mahoney is correct in stating that the Gymea college of TAFE will not offer Stage II of Industrial Electronics. All students were informed, at the time of enrolment to Stage I that Stage II would not be offered at Gymea in 1988.

However it is simply not true to claim that TAFE ignores students who wish to train in electronics. TAFE provides a range of courses in this area, but resources do not permit it to run all the courses students desire in all its 102 Colleges in New South Wales.

The Gymea College administration will be seeking a technician for 1988, but this request will be competing with other high priorities for positions throughout the TAFE system.

You can be assured that the sudents who have completed Stage I will receive priority in other TAFE Colleges such as Bankstown, Wollongong and Sydney for enrolment. In the Stage II Electronics course.

Given the current economic situation TAFE is required to be prudent with its resources and this requires some students to complete their courses at other TAFE colleges.

R. Mayne-Willson
Policy Support Officer
Department of
Technical and Further
Education.
NSW

A new System?

As at this stage I am only in my infancy as an electronics enthusiast I ask your indulgence with any show of ignorance that may be obvious in the context of this letter.

For some time now I have been awaiting the arrival of the rumoured digital audio recording system that promises compact disc standards of quality with the facilities of recording, erasure and playback.

In the absence of such a system I am writing this letter proposing an idea that may be of interest to someone far more able to judge the merits (or lack thereof) than I am myself. To date any such system that I have heard about proposes the use of a tape system.

My question is, why not utilise a format currently available such as the 3¼" floppy disk system which is used as a mass storage device on many computers these days. A system such as this could also have the advantage of random selection that is enjoyed by the compact disc system. Rewinding would be a thing of the past. Also there is the advantage of having a fairly rugged medium that is reasonably protected from the elements, being inside a plastic case that is only opened inside the machine.

A possible argument against this idea is the fact that the actual surface recording area is not as great as is possible on a tape based system. However as I see it we already have the Sony 8 video system which can record up to three hours of video on a single mini tape cassette. Surely if that is possible with the huge amount of information required to record a video image plus sound, then it would be possible to get at least one hour of audio only, even if both sides of the disc is required.

As many of these recording units are already available on the market, I feel confident that such as concept could be developed in Australia without leaving it to the Japanese, as so often seems to happen.

Peter Dobson
Auckland
NEW ZEALAND

A 5¼" disc system was shown at the 1985 Chicago CES. It provided, from memory, about five minutes worth of playing time. To date the difficulty of getting sufficient information onto the disc has been the real problem. — Ed.

The winner of the Daihatsu Charade competition, Ian Adamson, accepting the keys from Daihatsu's Ron Bragg. Geoff Baggett of Federal Publishing looks on.

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Similar to 2N5590 Cat 26-1259
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2 PCBs with 8 x DPDT push-button switches, similar to Isostat, and 8 x 100K multi-turn trimpots, as used in AWA sets Cat 24-0001

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High quality gold-plated contact pins
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HALF PRICE! 45c 10+ less 10% Cat 26-2655
C106 Popular SCR Buy 10, less 10%
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NE556 Usually $1.40
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Cat 26-0556 10+60c 100+50c ea
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1489 IC RS232 line receiver
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BUTTON CELLS:-
Silver Oxide

Hitachi/Maxell	E/R		National	Price
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SR43	G12	386	WL11	$1.80
SR1130	G10	389	WL10	$1.40
SR1120	G8	391	WL5	$1.50
SR48	G5	393	WL6	$1.60
SR41	G3	392	WL1	$0.90
SR726	G2	396		$1.30
Alkaline				
LR44		A76		$0.80
LR43		186		$0.80
LR1130		189		$0.75
LR1120		191		$0.90

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Extra loud
BELL
3" (80 mm) diam
24V AC or DC
English Chloride Gent
150mA current $7.50
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Cat No 11-1550
(Based on AEM5501 Sept. 1985)
Built & Tested $59.50 Cat No 11-1551
A deluxe version of this most popular kit with HIGH/LOW output switch, higher voltage (-9500v), extra ion emitter, professional cabinet and ion emitter tester. Users claim a greater feeling of well being and relaxation. Cleans air of tobacco smoke and bacteria; increase concentration. Full instructions are included.

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$2 EACH PAK
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25c ea 100 for $20 Cat No 19-2028

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Inbuilt siren, NO instant + NC delay, 20 sec exit delay and reset 3 mins, on-off switch, 12Vdc 2mA
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700W Light Dimmer or Motor Speed Control Kit.
Designed by a major manufacturer, has ON-OFF switch and RF suppression in-built. The triac AC controller handles 700W as is, or up to 2,400W with a suitable heatsink. Easy-to-build kit with comprehensive instructions $6.95
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High quality nickel cadmium batteries you can use again and again, and we have the biggest range!

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C	1.2V	1.2AH	02-1054	$11.70
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D	1.2V	4AH	02-1059	$22.20
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PREMIUM QUALITY 'ERG'
DIL SWITCHES
6 WAY COLOUR-CODED, PCB mtg
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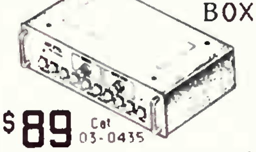

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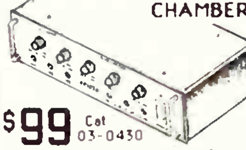

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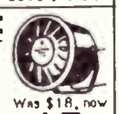
ELECTRONIC SIREN



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CIRCULAR 3-D Plots

CIRCULAR IS A program which allows you to print 3-D 'circular' plots on your 32k + MicroBee. The program includes a 'hidden line removal' algorithm which effectively erases all pixels that would not normally be seen by the viewer. The program allows full 512 × 256 dot resolution by bit-mapping the screen into a 16k long section of memory just after the machine code routines. Using this process, it is able to create complicated plots at full resolution without exceeding graphics memory. A small 256 × 64 window is drawn which shows, in scale, how the plot is progressing.

To run CIRCULAR, you will need a 32k or greater MicroBee and an EPSON compatible (read:standard) dot matrix printer. In order to run the program, you will need to enter the hex listing (using monitor) and save it. (If you have a disk system, you should move the code to 100H and save it using the CPM command: SAVE 8 ROUTINES.EXE. Cassette users will have to save the code using the monitor's D command, and load it each time the basic program is to be run.) Then enter the basic program as shown in listing #1. For cassette users, line 130 should be changed to: 130 IF PEEK (4096)<>33:PRINT "ROUTINES NOT PRESENT":STOP

As the program runs, it prompts you for various parameters, to select the default value (as shown in the brackets), just press return. When the 3 questions are answered, the program draws the viewing window and proceeds plotting. As with all programs requiring complex calculation under basic, it is slow, and plots will often take 2-3 hours to finish. However, the time is worth it considering the quality of the output.

Other equations you might try include:
FN0 = COS(#*3) + SIN(#) + SIN(#/1.78) (where n1 = 15 and n2 = 120)
FN0 = COS(#) + COS(2*#) + SIN(#/5) (where n1 = 17 and n2 = 130)

Sean Machin
Lismore Heights, NSW

```
00100 REM Circular 3-D plots
00110 PEM By Sean Machin 1987
00120 CLS:CLEAR:SD4
00130 IF PEEK(4096)<>33:LOADM"ROUTINES.EXE"4096
00140 PRINT"The current function is defined as:"
00150 LIST 160
00160 FN0=COS(#*4)+COS(#)+SIN(#/2)
00170 PRINT"Enter a number between -30 and 30 to expand or compress"
00180 CURS 38,5:PRINT"15":CURS 1,5:INPUT"the plot vertically (15 is typical) "N
1$:IF N1$="":N1=15 ELSE LET N1=VAL(N1$)
00190 PRINT
00200 PRINT"To move the plot up or down in the y axis, enter"
00210 CURS 47,8:PRINT"140":CURS 1,8:INPUT"a number between 50 and 200 (140 is ty
pical) ":N2$:IF N2$="":N2=140 ELSE LET N2=VAL(N2$)
00220 PPINT
00230 CUPS 58,10:PPINT"yes":CURS 1,10:INPUT"Do you want an automatic printout wh
en plot is finished ";R1$:IF R1$="":R1$="y"
00240 U=USR(4096,16384):REM Clear the 16k data area
00250 A1=121:A2=A1:REM the specified domain for the function
00260 B1=2.25:REM the step rate
00270 F1=N2
00280 CURS0:HIRES
00290 PLOT 0,0 TO 255,0 TO 255,63 TO 0,63 TO 0,1:REM plot border
00300 PRINT"Scans remaining"
00310 FORH1=-A1 TO A1 STEP B1
00320 M=INT(.5+SQR(A1*A1-H1*H1))
00330 FOPN3=-FLT(M) TO FLT(M)
00340 C1=SQR(N3*N3+H1*H1)*.0327
00350 D1=FN0(C1)*N1
00360 GOSUB 420
00370 NEXTN3
00380 CURS16:PRINT(F6.0 A2-H1)
00390 NEXTH1
00400 IF R1$="Y" OR R1$="y":GOSUB 560:REM gosub printer routine if selected
00410 PLAY 24,4;22,4;24,4;22,4;24,4;22,4:END:REM wake up', plot finished
00420 X=INT(H1/B1+N3)+170
00430 Y=INT(D1-(H1/B1)+F1)
00440 X1=1.5*FLT(X):REM expand X axis
00450 Y1=255-(FLT(199-Y)*1.9)
00460 IF X1<0 OR Y1<0 OR X1>511 OR Y1>255 THEN RETURN
00470 SET INT(X1)/2,INT(Y1)/4:PLOTR INT(X1)/2,INT(Y1)/4-1 TO INT(X1)/2,1
00480 Y1=255-Y1:REM re-invert Y coord for bit subroutine
00490 POKE 4109,INT(Y1):REM load the Y value
00500 POKE 4107,INT(X1):POKE 4108,INT(X1)/256:REM pass the X value to subroutine
00510 U=USR(4112):REM set bit in memory
00520 U=USR(4321):REM & perform 'hidden line removal'
00530 RETURN
00540 GOTO 380
00550 REM Printor routine
00560 OUTL#1:REM select parallel port
00570 U=USR(4232):REM & print'
00580 LPRINT\\\\\:REM do a few linefeeds
00590 RETURN
```

```
machine code routines for CIRCULAR
Start address ? 1000
  End address ? 115F

1000: 21 5F 11 11 60 11 36 00 ED B0 C9 00 00 00 00 00
1010: 21 5F 11 22 0E 10 3A 0D 10 FE 08 38 14 2A 0E 10
1020: 01 00 02 09 22 0E 10 3A 0D 10 D6 08 32 0D 10 18
1030: E5 2A 0E 10 ED 4B 0B 10 09 22 0E 10 2A 0E 10 3A
1040: 0D 10 FE 00 20 03 CB FE C9 3A 0D 10 FE 01 20 03
1050: CB F6 C9 3A 0D 10 FE 02 20 03 CB EE C9 3A 0D 10
1060: FE 03 20 03 CB E6 C9 3A 0D 10 FE 04 20 03 CB DE
1070: C9 3A 0D 10 FE 05 20 03 CB D6 C9 3A 0D 10 FE 06
1080: 20 03 CB CE C9 CB C6 C9 21 5F 11 3E 1B CD 45 80
1090: 3E 40 CD 45 80 3E 1B CD 45 80 3E 41 CD 45 80 3E
10A0: 07 CD 45 80 06 20 C5 3E 1B CD 45 80 3E 4B CD 45
10B0: 80 3F 00 CD 45 80 3E 02 CD 45 80 01 00 02 7E 00
10C0: CD 45 80 23 0B 78 B1 20 F5 3E 0D CD 45 80 3E 0A
10D0: CD 45 80 C1 10 D0 3E 1B CD 45 80 3E 40 CD 45 80
10E0: C9 2A 0E 10 3A 0D 10 FE 00 20 06 7E E6 80 77 18
10F0: 4C 3A 0D 10 FE 01 20 06 7E E6 C0 77 18 3F 3A 0D
1100: 10 FE 02 20 06 7E E6 E0 77 18 32 3A 0D 10 FE 03
1110: 20 06 7E E6 F0 77 18 25 3A 0D 10 FE 04 20 06 7E
1120: E6 F8 77 18 18 3A 0D 10 FE 05 20 06 7E E6 FC 77
1130: 18 0B 3A 0D 10 FE 06 20 04 7E E6 FE 77 E5 21 5F
1140: 11 01 00 60 09 22 5D 11 E1 01 00 02 09 E5 ED 4B
1150: 5D 11 ED 42 30 05 E1 36 00 18 EE E1 C9 00 00 00
```

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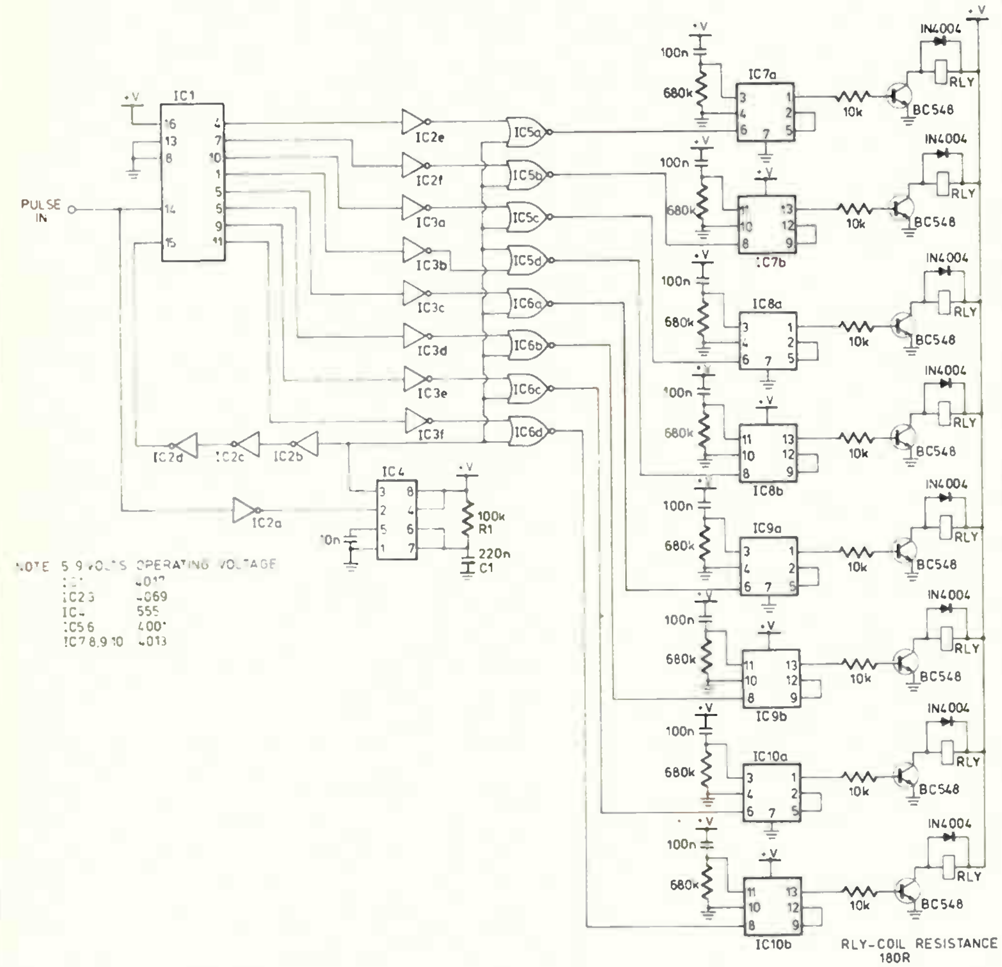
Idea of the Month

VOLTAGE CONTROLLED ADSR GENERATOR FOR SYNTHESISERS

This ADSR (Attack-Decay-Sustain-Release) module is unusual because all parameters (A,D,S and R) are voltage controlled. This allows several of these modules to be controlled by common sources, such as would be required in a polyphonic synthesiser. Alternatively, each control parameter could be a DAC output from a computer.

The central element of the circuit is the Operational Transconductance Simplifier, 1C4 used as a slew limited. 1C5 buffers 1C4 output. The slew rate is determined by the control input current (pin 5). 1C3 provides this current. The higher the input voltage to 1C3, the greater the input current to 1C4 pin 5 and therefore the greater the slew rate. The voltage at the input of 1C4 determines the value IC4 slews to.

IC1 provides the logic nec-



8 CHANNEL COMPUTER OPERATED REMOTE CONTROL

The main objective of this circuit is to control a distant or mobile device by computer without the hassle of an interconnecting multitude of wires. At worst, only two wires would be necessary to control up to nine channels. Ideally a simple transmitter and receiver should be used in their place enabling greater independence from the computer.

In practice the circuit is operated by a series of pulses from the output port of a computer. A pulse is created by turning this output port on and off. By varying the number of pulses different channels can be selected and operated.

To initiate the circuit two pulses are required; following pulses select and operate respective channels. That is: a series of three pulses (2 + 1) would activate Channel 1 whilst eight pulses (2 + 6) would activate Channel 6. To deactivate Channel 1 a second series of three pulses would be transmitted.

When power is connected the ICs are reset: the 4013 Flip Flops (IC7-10) by the associated capacitors and resistors; the 4017 DECADE COUNTER (IC1) by an inverted low from pin 3 of the 555 timer (IC4).

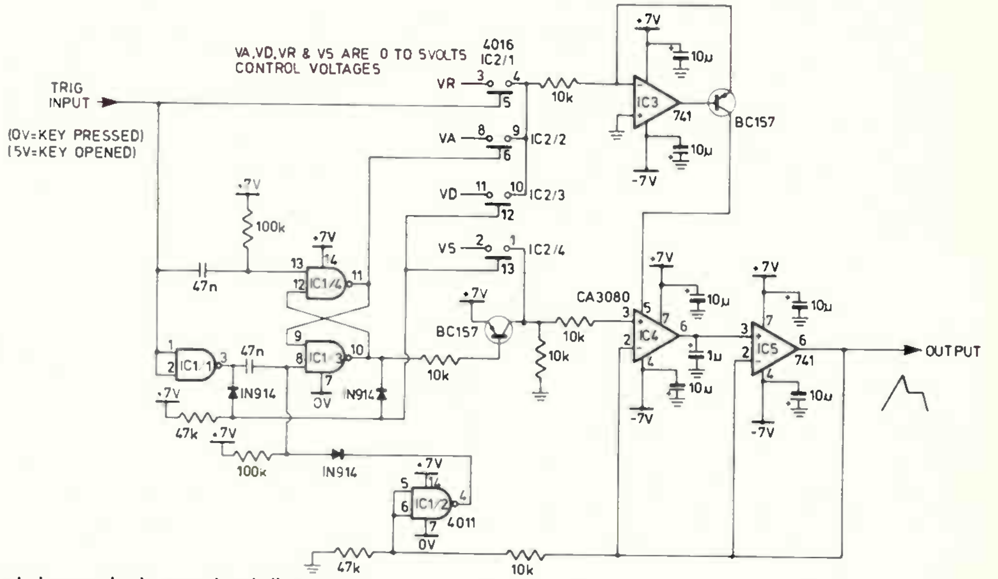
The first computer pulse then initiates the 555 which removes the rest condition from pin 15 of the 4017. Following pulses clock the 4017 to the desired channel. (Output 1 of the 4017 is not used and comes in handy for any false triggering caused by interference of a transmitter if used.) Up to 10 pulses need to be sent before the 555 resets in 0.02 seconds. If this time interval is inappropriate it can be altered by changing R1 and C1 (t = 1.1 R1C1).

Once a channel is selected its 4017 output is sent to a NOR gate (IC5 or 6) via an inverter (IC2 or 3). When the 555 resets a low is sent to all NOR gates. The nOR gate which has two low inputs then toggles the respective Flip Flop which in turn operates a relay. The 4017 is temporarily delayed from resetting by a series of inverters (IC2c,d), thus allowing enough time for the NOR gates to respond.

NOTE:

It is important to operate this circuit at 5-9 volts depending on the computer's output voltage. If there is a greater than 5 volt difference between these, the pulses will not be recognised by the 4017.

Bill deRooy
Canberra, ACT



essary to correctly sequence ADSR operation. It controls which control voltages are applied to the slew rate control (IC3) and the "target value" control (IC4 input).

When the key pressed signal is received (trig input low) the R-S flip-flop IC1/3,4 is reset. The "Attack" control voltage is selected as input to IC4 is set to +7V. The output voltage rises until IC1-2 changes state, setting the R-S flip-flop. Now the "Decay" control voltage is selected for IC3 and the "Sustain" control voltage is selected for IC4. So the output ramps down until the "Sustain" level is reached. The circuit remains in this state until the key pressed signal is released (goes high). Now the "Decay" control voltage is selected for IC3 and 0V for IC4, so the output falls to 0V. If the key is released before Sustain mode is reached, the Decay mode is instantly asserted.

In multi-channel applications the control voltages should be buffered with op-amps.

H. Grenville,
Blackburn 3130
Victoria

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

Feed Forward
ETI, Federal Publishing,
PO Box 227,
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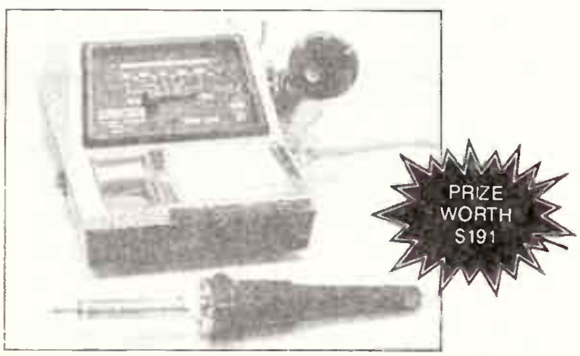
Contributors can look forward to $20 for each published idea/program which should be submitted with the declaration coupon below.

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.



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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.

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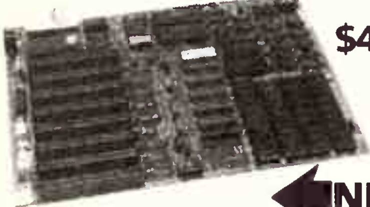

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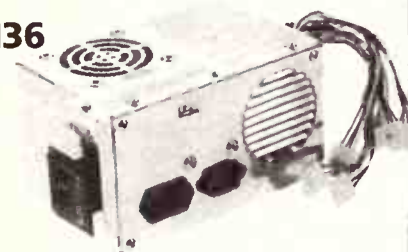

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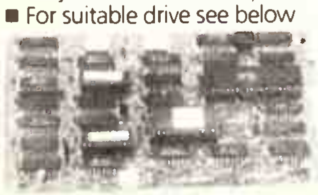

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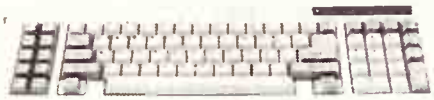

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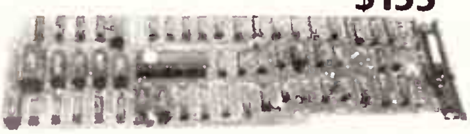

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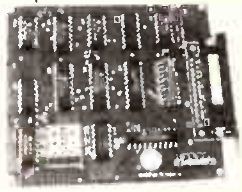

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ELECTRONIC SOLUTIONS

RING TONE CUSTOMISER

S. K. Hui

One of the most irritating aspects of working in a big office or laboratory is that all the telephones sound the same. It's a problem, because not only does the telephone constantly interupt, demanding your attention, but it's also not easy to tell whether its your phone that's ringing. One way to alleviate the problem is to change the ring tone on your phone so that it sounds distinctive. It won't stop the interuptions, but at least it will reduce the number of false alarms.

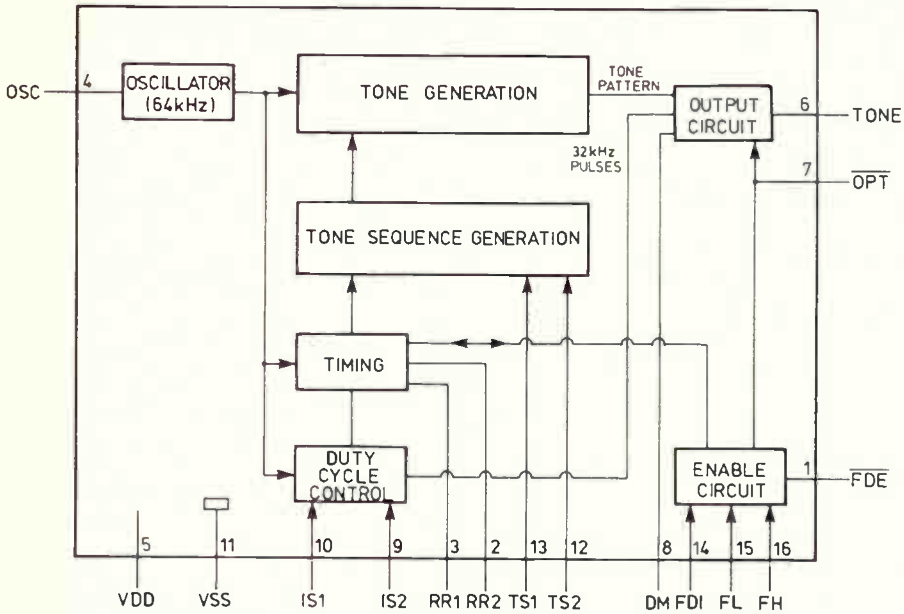
THE ETI-288 is a personal telephone ringer unit which allows the user to select a number of different sounds in place of the ordinary bell or buzzer, plus control volume and pitch. It also gives a light output.

Most of the work is done inside a Philips integrated chip, the PCD3360 which requires few external components. The current drain in this CMOS chip is so low (0.1 mA) that a battery is NOT necessary. There are four different sounds to choose, four different pulse durations settings and an adjustable tone oscillator giving you plenty of tone varieties.

Design Approach

The heart of the circuit is the PCD3360. Inevitably, the design is confined to the functions available in the chip. Figure 1 shows a block diagram of the PCD3360. The oscillator is free running with a frequency set by an external resistor and capacitor. As shown in the figure, the oscillator frequency controls the duty cycle. The Philips data sheet suggests it should be set to run at 64 KHz. In my design, the external resistor is replaced with a pot to allow a continuously adjustable pitch on the output. This allows two units to play the same tone sequence and sound different, thus allowing more choices of sound.

Associated with the enable circuit (see figure 1) are four input pins, labelled as FDE, FDI, FL, FH. Pin FDE is a frequency discriminator enable pin. When this pin is tied low, the frequency of the pulses from the line appearing on pin FDI will be checked against the selections set on pins FL and FH. Pins FL and FH set the lower and upper frequency limits of



FL input state	lower discriminator limit (Hz)
LOW	20
HIGH	13,33

Fig. 2a: Selection of lower frequency discriminator limits (fosc = 64 kHz).

FH input state	upper discriminator limit (Hz)
LOW	60
HIGH	30

Fig. 2b: selection of upper frequency discriminator limits (fosc = 64 kHz).

the discriminator. If the input pulses appearing on pin FDI have a frequency outside the lower and upper limits set by FL and FH, the chip is disabled. This enables us to avoid confusing dialling pulses with ring tone.

There are two types of output driving modes depending whether a speaker or a piezo-electric transducers (PXE) is used. The selection is made by connecting a high or low to pin DM (drive mode selection). A low on this pin will configure the chip to drive a speaker by outputing a delta-modulated signal that approximates a sinewave sampled at a rate equal to half the oscillator frequency. Since not much current can be drawn from the telephone line, a normal 8 ohm speaker cannot be used. A 50 ohm speaker is suggested by the data sheet in series with a 3 mH coil to enhance the volume. When DM is set to low, pins IS1 and IS2 will determine the pulse duration of the output signal that drives the speaker, the dc resistance of the speaker seen by the line and also the sound pressure level. This mode is not very economical from the designer's point of view, as a 50 ohm speaker is not easy to find.

A high on pin DM configurates the chip to send the signal to output pin TONE in the form of a pulse train (with equal amplitude). In this mode the ringer impedance and sound pressure level are determined by the characteristics of the PXE transducer and inputs SI1 and SI2 are inactive. In my design, two piezo-electric transducers are used and changing the logic on DM will give a sharper (when DM = high) or a softer (DM = low) sound.

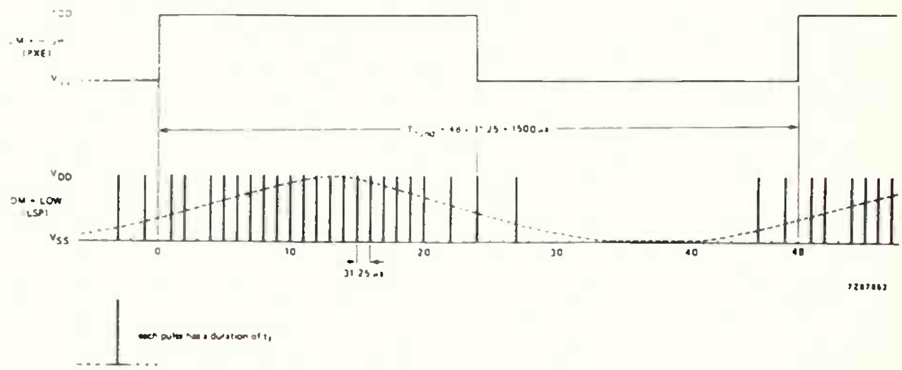


Fig. 3a: Fundemental signal (667 Hz) at pin TONE.

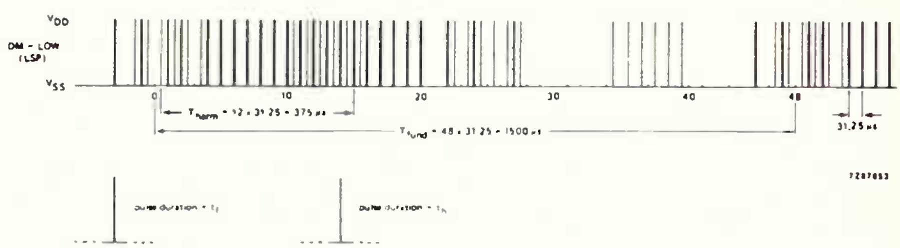


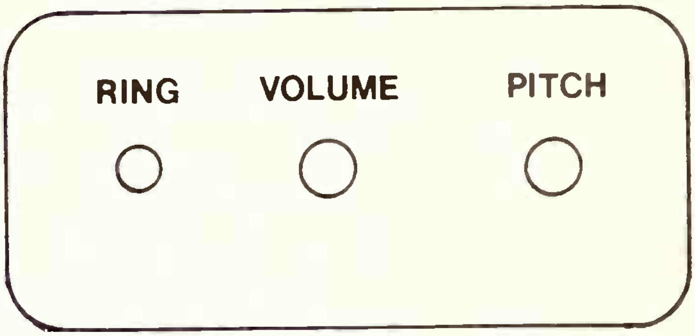
Fig. 3b: Fundemental signal (667 Hz) + harmonic signal (26 67 Hz) at pin TONE.

Pins TS1 and TS2 give four different tone sequence selections. Figure 3 shows the tone sequence in relation to the pin state on TS1 and TS2. If you can read music, you have probably realized that when TS1 and TS2 are both low, there are 15 time intervals in the tone sequence. There are 16 intervals for the other three combinations of inputs to TS1, TS2. The ▶

input state		time interval ms
RR1	RR2	
L	L	15
L	H	30
H	L	45
H	H	60

Fig. 4: Duration of time intervals (fosc = 64 kHz).

ETI 288 PERSONAL RINGER



duration of these time intervals are controlled by the inputs applied to pins RR1, RR2. Figure 4 shows the durations versus the inputs to RR1 and RR2 when the oscillator is running at 64 KHz. By changing the RR1 and RR2 inputs, the resultant variation of the time intervals acts as a distinguishing feature between two ringers set to play the same song.

The OPT output pin is designed to drive an optical signal transducer or lamp. It is LOW when ringer circuit is enabled and high when the ringer is disabled. This output is not used as it can only sink or source 2 mA maximum. This small amount of current is not quite enough to drive a LED brightly. Instead, in my design a neon lamp is used, which is directly triggered by the incoming ring current from the exchange.

Construction

Although the components look pretty cramped up on the board, building the unit should not take more than half a day. The first thing to do is to check the pc board. Make sure there are no broken or shorted tracks. I would suggest you use an IC socket for the PCD3360. Because of the small area of board available, some of the components have to be mounted vertically. They are R1, R2, R4, R5, R6, D1-D5,ZD1. The general rule is: if the pads for the components are not far enough apart for mounting the component horizontally, mount them vertically. It is highly recommended that you use an insultating tube like thermal heat-shrink to insultate the exposed pins of the vertically mounted components, especially the ones that connect to the Telecom line like R1, R2, D1-D4 etc. All the components are mounted on the component side of the board and soldered on the other side except the DIL switch. The DIL switch should have its pins standing on the copper pads on the solder side of the board, and be soldered just like that (refer to the picture).

The next thing to worry about is the panels. Since the front panel seems easier to construct, let's start with this one. Drill three holes on the front panel, two for the variable resistors (pots) and one for the neon lamp. If you can get the small size pots like the ones shown in the pictures, so much the better. If not, be sure there is enought spacing between the holes you drill to allow plenty of room to solder the wires onto the pins. Before tightening the nuts of the pots onto the front panel, put the spindles of the pots through the holes. Put the knobs on to see how long the spindle of the pots should be cut.

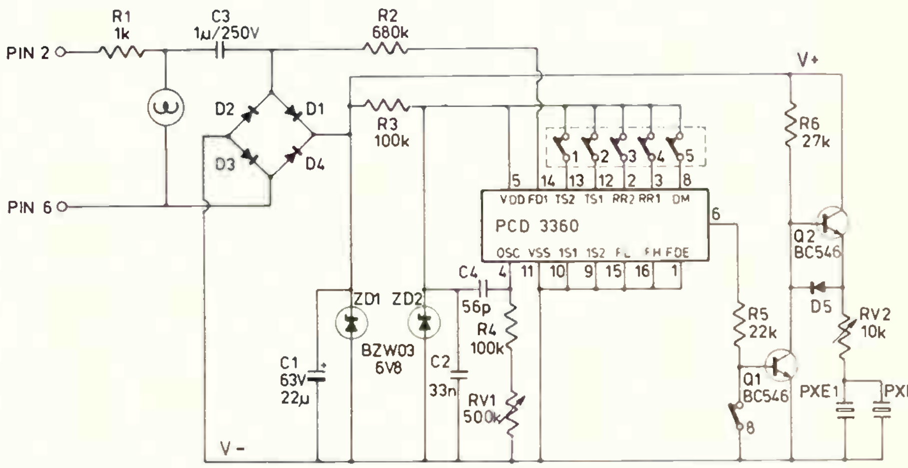
There are only two holes to cut on the rear panel. One of it is rectangular for the DIL switch which can be accessed externally. The remaining one is a round hole for the clamping grommet. Before you start to cut the holes, place the pc board against the rear panel and leave enough space for the grommet. Mark down the positions of the two holes on the rear panel for cutting. In the box, there are two 9V battery holders sitting on the floor which are in the way of the pc board and perhaps the pots (if you have the large size ones). Cut them down with a scalpel if necessary. In fact, you should remove

ETI-288 How It Works

The total switch on delay equals approximately the time required to charge up capacitor C1 to the minimum operating voltage (Vsb) of the PCD3360 (see figure 5), plus the switch on delay of the PCD3360. The switch on delay of PCD3360 is measured in cycles of the incoming ringing frequency, which is about 1 to 1.5 cycles typically.

The diode bridge, the 62V zener diode (ZD1) and the resistor (R1) protect the ringer against transients up to 5KV. During these transient surges, the voltage on the zener (ZD1) can rise up to 100V. The two piezo-electric transducer driver transistors Q1 and Q2 have a total collector to emitter breakdown voltage of 160V, giving a 60V safety margin against the transients. A continuous, 160V, 50 Hz ac signal can be applied to the input terminals of the ringer circuit without damaging it.

With the two transistors connected as shown in the schematic diagram, an output swing almost equal to the voltage at C1 is applied to the two piezo-electric tranducers, enabling maximum output audio level.

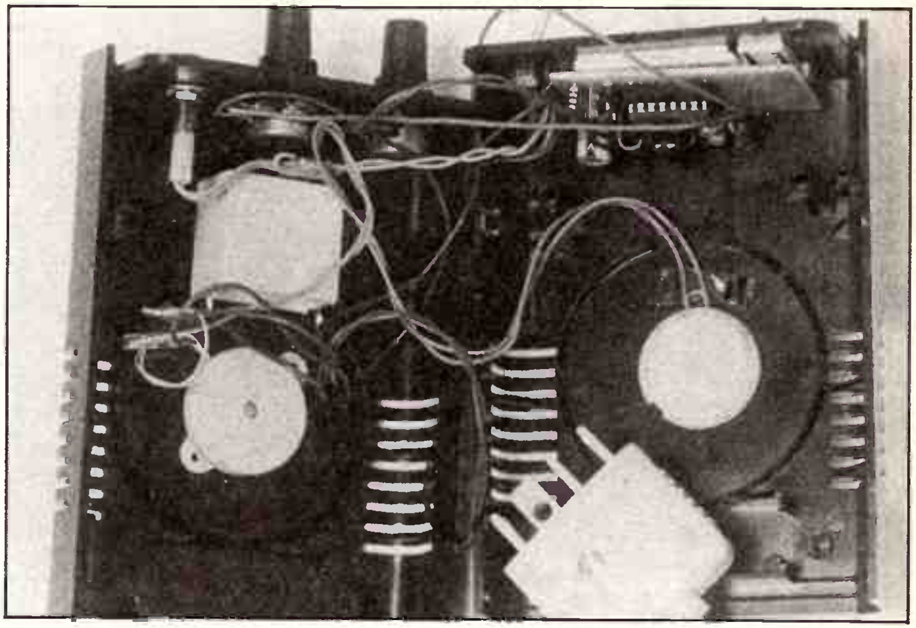


any unwanted plastic studs or shapes on the box if they get in the way.

Connect the pots, the neon lamp, the Telecom cables to the soldering fingers on the side of the pc board as shown in the overlay diagram. Do not mount the pc board or clamp the Telecom cable with the grommet at the time being. Plug the unit into the Telecom socket through a double adaptor so you can still dial out while the unit is in. Dial 199 and wait as you do when calling up someone normally, until you hear the ring tone on the receiver. Your phone as well as the personal ringer should start ringing. If the phone rings but not the ringer, you have blundered.

Really, not much can go wrong in a simple circuit like this. First examine the polarity of the IC; you might have to get a new one if it had been tested while the wrong way round. Then check the polarity of the diodes, the zeners and the electrolytic capacitor C1. Check that the two transistors have been inserted onto the board the right way round. A digital multi-meter should be used to check pin 5 of the IC which should be at 6 to 8 volts and the neon lamp flashes when the ring comes. If the neon lamp works and the voltage is there, check that the piezo-electric transducers are not turned off because switch 8 of the DIL switch is closed. If switch 8 is in the open position, fiddle with the pitch and the volume knobs until you get the sound. To play safe, turn the two knobs to the middle position, get the ringer to ring first and then tune the pitch and volume to something you like. The two chosen piezo-electric transducers are loud enough for the majority of us. If your environment requires very loud volume, you could replace the transducers or connect it in parallel with a Motorola piezo-electric tweeter horn.

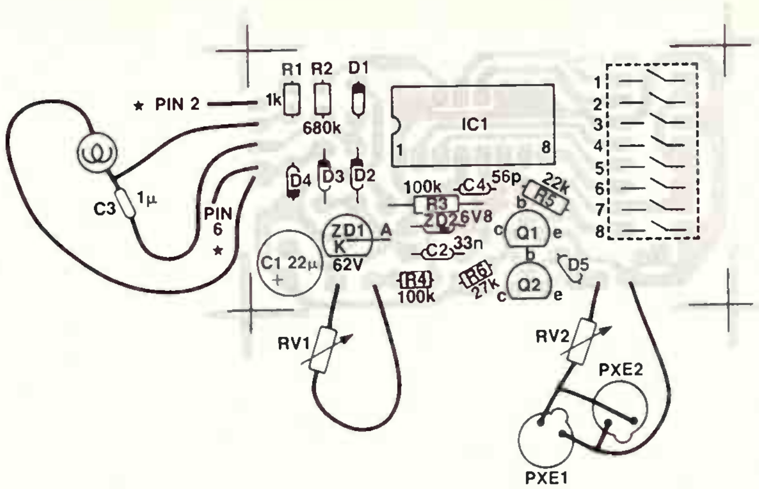
It is time to mount the pc board, the transducers, capacitor C3 and clamp the Telecom cable. Capacitor C3 is fixed onto the floor of the box with double-sided spony tape. The two transducers should be glued onto the centre of the box as shown in the picture. Don't use double-sided tape as it will absorb a lot of sound from the transducers. Next put the pc board onto the rear panel with the DIL switch sticking out through the rectangular hole. Depending on how much you want the DIL switch to stand out from the rear panel, the pc board may have to be placed a few millimeters away from the rear panel. The quickest solution is to use multi layers of double-sided spony tape. The one you see in the photographs uses two layers of spony tape. Once the board is fixed, you can adjust the length of Tele- ▶

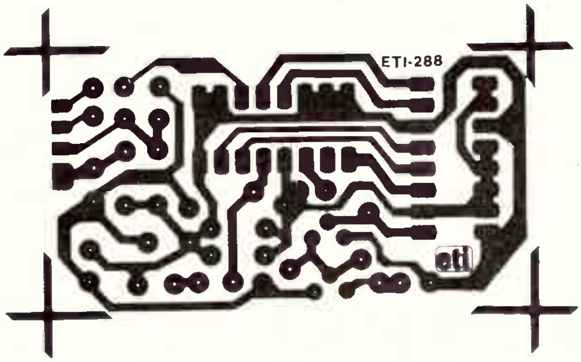


D.C. CHARACTERISTICS

V_{DD} = 6 V; V_{SS} = 0; f_{osc} = 64 kHz; T_{amb} = −25 to + 70 °C; valid enable conditions at FDI and $\overline{FDE}$; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply					
Operating supply voltage	V_{DD}	V_{SB}+0,1	–	8,0	V
Standby supply voltage (note 1)	V_{SB}	3,9	4,8	5,7	V
Supply voltage for automatic swell reset (note 2)	V_{AS}	–	0,5V_{SB}	–	V
Operating supply current (note 3)	I_{DD}	–	110	140	µA
Standby supply current at $V_{DD} < V_{SB}$ (note 4)	I_{SB}	–	3	8	µA
Inputs					
Input voltage LOW (any pin)	V_{IL}	0	–	0,3V_{DD}	V
Input voltage HIGH (any pin)	V_{IH}	0,7V_{DD}	–	V_{DD}	V
Pull-down circuits of inputs					
FDE, RR1, RR2, DM, IS1, IS2, TS1, TS2, FL, FH					
pull-down resistance with input at V_{SS}	R_{IL}	–	20	–	kΩ
pull-down current with input at V_{DD}	I_{IH}	–	0,1	–	µA
Pull-down circuit of FDI					
pull-down current with V_{FDI} = 0,3V_{DD}; T_{amb} = 25 °C	I_{SL}	14	23	32	µA
temperature coefficient of I_{SL}	$-\Delta I_{SL}$	–	0,5	–	%/°C
pull-down current with V_{FDI} = 0,8V_{DD}	I_{SH}	–	0,1	–	µA
pull-down current with $V_{DD} < V_{SB}$	I_{SX}	–	0,1	–	µA
Current into input FDI (note 5)	$\pm I_{IS}$	–	–	0,2	mA
Outputs					
TONE, $\overline{OPT}$					
Output sink current at V_{OL} = 0,5 V	I_{OL}	1	2	–	mA
Output source current at V_{OH} = V_{DD}−0,5 V	$-I_{OH}$	1	2	–	mA





ETI-288 — Parts List

Resistors
(all 1% 0.25W unless stated otherwise)

R1	1K
R2	680K
R3, R4	100K
R5	22K
R6	27K
Rv1	500K (pot)
RV2	10K (pot)

Capacitors

C1	22μF/63V (electro.)
C2	33nF (Green)
C3	1μF/250V (Philips MKT-P 330 40)
C4	56pF (ceramic)

Semiconductors

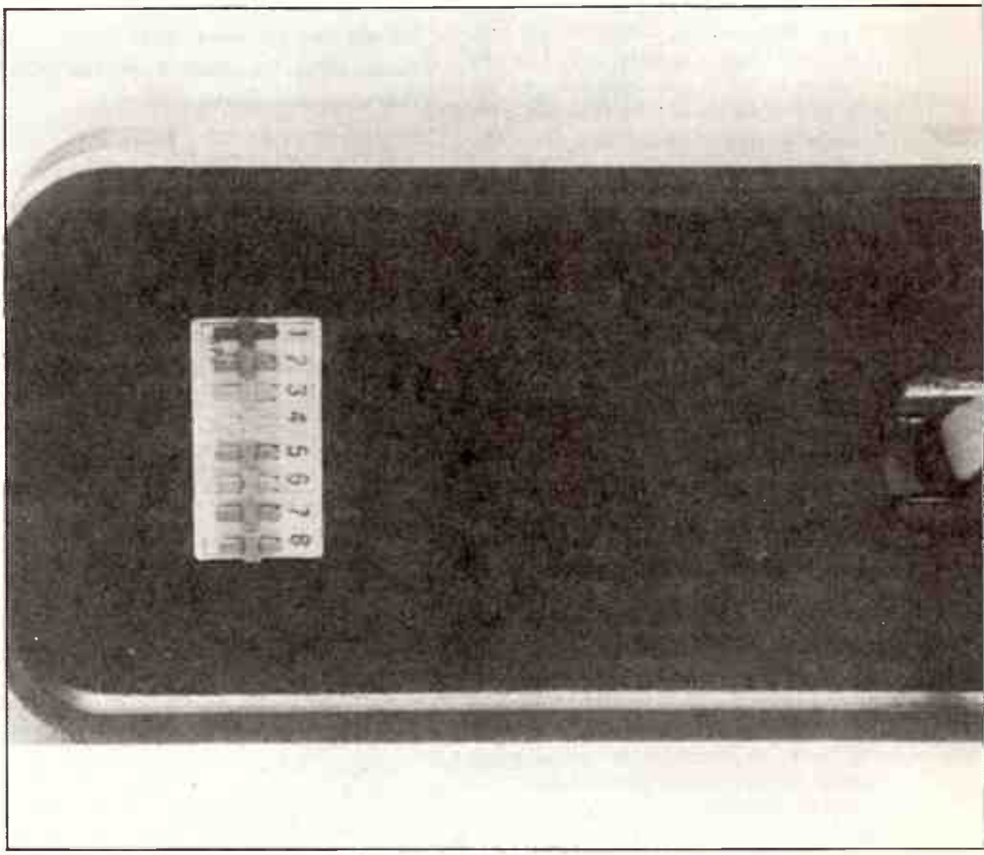
IC1	PCD3360
D1-D5	1N4004
ZD1	62V Zener diode (Philips BZW03 series)
ZD2	6V8 Zener diode BZX85 series
Q1, Q2	BC546 npn bipolar

Miscellaneous
A plastic box as shown in the photography (Hi-Com part No. HB-0010). Two low profile piezo audio transducers. A low voltage (110V)panel mount type, neon lamp with built in limiting resistor. a metre long Telecom cable and a line plug, a Telecom double adaptor. A 8-way DIL switch and half a metre of hook up wire. Two plastic knobs to fit the pots.

Estimated price: $40

com cable to be in the box to give a minimum of stress to the soldered joints. Then squeeze the clamping grommet into the hole to clasp the cable firmly. Plug the unit into the Telecom socket through the double-adaptor. Turn the bell volume on your phone to minimum and that on the ringer circuit up to maximum. Immediately, you have got yourself a warm, personal, friendly sound whenever your line rings.

If the ring current from the exchange is weak, the unit may only beep once, instead of a continuous bleeping throughout the entire period of ring. This can also happen if you have multiple phones all connected to the same socket without a proper re-balance of the impedance on the line by a Telecom technician. The proper way to cure this problem is to call a Telecom technician to match the impedance of the line again for you. An improper but quicker way is to replace the 22 μF capacitor (C1) with something smaller, 10μF or so. A smaller capacitor requires less charge to build up to the same working voltage, hence reduce the charging period needed by a bigger capacitor. The only draw back may be the volume output of the oiezo-electric transducers. It would be reduced as a result of less energy stored in the smaller capacitor. ●



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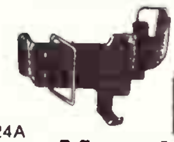

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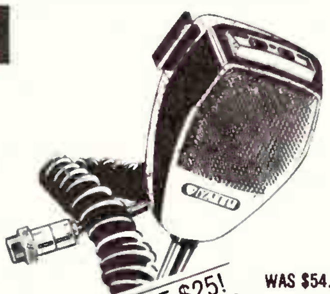

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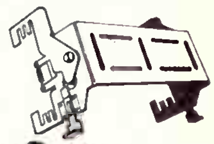

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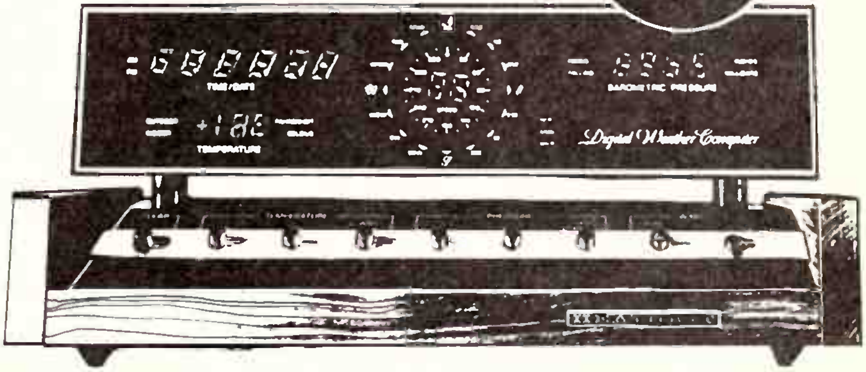

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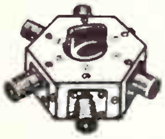

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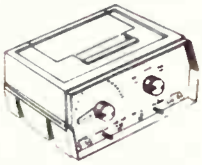

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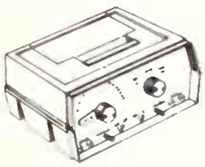

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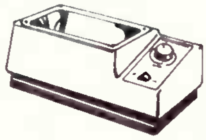

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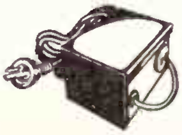

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Still not convinced?

You can get much higher continuous current ratings in a NiCad cell than a dry cell. While not rated the same way, a dry cell discharged at 90mA is considered "flat" (1.1V) after approx. 2.5 hours. A NiCad cell lasts almost 5.5 hours under the same conditions. Even under non-continuous discharge conditions, the NiCad cell wins hands down: because the NiCad can be re-charged between uses!

DICK SMITH ELECTRONICS PTY LTD

Battery Packs

Qty	Type	Cat No.	Price
4 x AA	500mAh	S-3150	$16.95
2 x C	1.2Ah	S-3152	$15.95
2 x D	1.2Ah	S-3154	$16.50
4 x AA	600mAh	S-3160	$19.95
2 x C	2.0Ah	S-3162	$24.95
2 x D	4.0Ah	S-3164	$27.95

Extra Heavy Duty NiCads

Type	Cat No.	Price
C 2.0Ah	S-3311	$14.50
AA 600mAh	S-3312	$5.50
D 4.0Ah	S-3310	$14.50
Sub C Fast Charge	S-3324	$6.50

N CHARGERS • SAVE ON CHARGERS • SAVE ON CH

Eveready NiCad Charger

Multi-size (AA, C, D or 9V) NiCad battery charger. Takes two 1.2V cells at a time or one 9V. Complete unit including plug-pack: nothing extra to buy. Cat M-9515

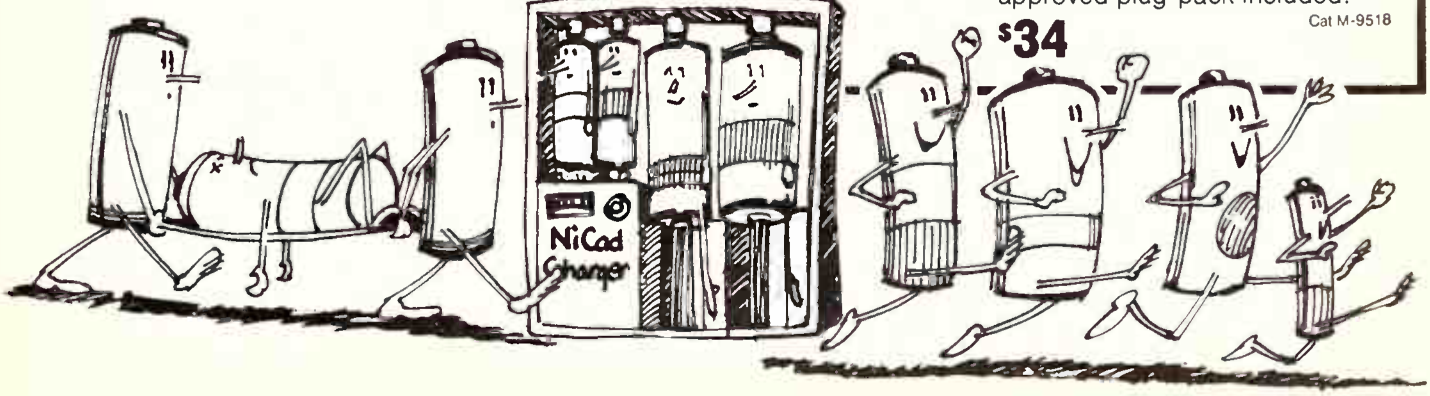
$27.50

Multi-cell Charger

Charge up to 4 batteries at a time — AA, C, D, 6V or 9V. AND you can also charge AAA, and button cells too! But there's more: a test meter to check NiCad voltage under load — the only way to check your battery properly. Fully approved plug-pack included.

Cat M-9518

$34



ALL YOUR RECEPTION PROBLEMS SOLVED... AT DICK SMITH ELECTRONICS

THE MAST

If reception's not the best, get your antenna up above the noise, up above the obstructions! This 9 metre 3-section telescopic mast will do it: and it comes complete with all mounting hardware. Accepts virtually all TV antennas.
Cat L-4520

$110

THE GUY WIRE

Ultra-strong plated steel guy wire to hold mast up against mother nature: breaking strain is greater than 10 tonnes. 180 metre roll: just right for mast installation. Cat L-4564

$44

THE TURNBUCKLES

There's no safer way of making fast the guys. Turnbuckles allow fine adjustment of tension to ensure mast is vertical, too. Heavily plated, 8mm size (94mm long). Cat L-4544

$1.65

THE WIRE CLAMPS

Gives the safest, strongest method of tying off guy wires. Minimum strain, no kinks to become weak points. Use wherever guy wire ends.
Cat L-4522

70¢

THE THIMBLES

Makes guy wires follow wide radius wherever they change direction (eg at top and bottom) to avoid creating weak points. A must for safety — and they're so cheap! Cat L-4530

80¢

THE DYNABOLTS

Use for anchoring the guy wires into concrete, etc. Two styles to choose from — one standard hex nut type and the other with "eye" for taking turnbuckles or guy wires.
10mm Hex Head: Cat L-4570. Pack of 3 **$2.95**
Eye Type: Cat L-4575 Pack of 2
$2.95

THE ANTENNA

No, we haven't shown the antenna — because the type is up to you! VHF, UHF Band 4, UHF Band 5, Combined VHF/UHF, FM Radio, metropolitan, fringe... there's a huge range to suit from — but one will be just right for you. See next page for just some of our value-packed antennas.

THE MASTHEAD AMP

If you're scratching for that last bit of signal (because of area, ghosting, etc) a masthead amp often works wonders. Amplifies signal right at antenna — and it is especially designed to minimise CB interference, too. 24dB gain, includes power supply and amplifier unit.
Cat L-4200.

$75

THE LEAD-IN

Choosing the right lead-in makes a world of difference. In strong signal areas, 300 ohm ribbon is usually fine, but for best results you need our low-loss 5C2V low-loss air dielectric coax. Black coloured to minimise UV damage.
Cat W-2082

75¢

THE ROTATOR

Trying for a number of stations? If you're on the fringe, a rotator will allow best aiming. Simply clamps to mast and antenna, needs only three-wire control cable. Includes rotator and inside control box. Cat D-5005

$229

THE SPLITTER

Want to run more than one TV? You need a splitter. Choose from two or four way, coax or ribbon lead-in type. For example, look at the low price of our 2-way coax-type splitter! Cat L-4270

$2.75

THE WALL SOCKET

Makes a neat, professional finish at low cost. Mount on skirting board wherever you want TV outlets. Cat L-4504

$4.75

DO IT YOURSELF? YOU BET!

Why pay big $$$ to have a TV antenna installed — when it's so easy to do it yourself. Our specially written guide shows how: what to do, how to do it, everything. And the price? Just 50¢! (Or buy any TV antenna or mast and we'll give you a copy!)

Cat B-6010

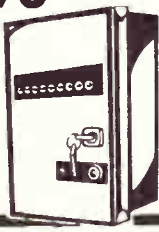
50¢

DSE — working in New Zealand for Hobbyists — $ave!!

No. 1 For Kits – And Getting Better!

Security Saver!
Save $24 on our fantastic 8 Sector Home Alarm Kit! If this were a commercial unit you'd pay hundreds of $$$ more. Features 2 instant and 6 delay sectors, security key, inbuilt battery backup and more!! Cat K-3424

$NZ275



SAVE $24

Budget Alarm
Where else could you get a quality 4 Sector Alarm at this LOW price? It's the bare-bones sure, but you can build a complete system for the home or office around it! And nothing gives you better value. Cat K-3254

$NZ69.95

$50 off Frequency Counter
Easy to put together — and at this price, it's easy to own! The DSE 1GHz Digital Frequency Counter. A professional unit at a hobbyist price. Kit comes with everything that's needed and features even more than you need. Cat K-3437

$NZ249

SAVE $50

4 Input Mixer
A great preamp for small bands, etc! Use all four inputs for guitars or a mixture — guitar, mic, line inputs, etc. Lets you select gain and impedance on individual inputs. More features than the local movie house! Cat K-3036

$NZ99

Takes a lot of beating!
Save on our Beat Triggered Strobe! Makes a great party, dance, etc. Use it as a conventional strobe or have it flash to the beat of the music. Fantastic for photography — kit comes complete and ready to assemble. Cat K-3153

$NZ69.95

Negative Ion Generator
You can't be positive about anything — but they say these things help you feel better. Cat K-3333

$NZ39.50

VCR Simulated Stereo
The DSE Dynamic Noise Reduction System is the ideal, inexpensive way to to reduce hiss AND add simulated stereo to your mono VCR! Easy to build and set up. K-3423

$NZ99

Multimeter with Buzzer
The hobbyist's workmate! Amazing value Multimeter with Audible Continuity Tester. Has battery checker, 10A DC range and high sensitivity (20K ohms), mirrored scale and that famous DSE LOW price! Cat Q-1022

$NZ29.95

Budget Mini Meter
Here's one Multimeter no workshop can afford to be without. For well under $20 you get an 11 range, 2000 ohm/volt pocket sized tester. Ideal for general work and it's rugged and reliable! Cat Q-1010

$NZ14.95

Electronic Marvel
Professional quality at a hobbyists price. The multimeter which gives you more. Few multimeters can read peak-to-peak and RMS — but this one can. You can even adjust the pointer to zero for nulling! With a single range switch, there's no lead swapping. Cat Q-1143

$NZ89.95

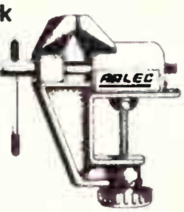
DSE Solder Station
Yes, the incredible DSE Workstation with adjustable temperature control is now the best value yet! Puts an end to all those soldering hassles for a truly professional finish. Comes with lightweight iron holder, sponge and comprehensive instruction and service manual. Cat T-2000

$NZ109

⅓ off Soldering Iron
Save nearly $10! Our super value, high quality 'Antex' brand iron will get the job done — with 25 watts it's hot when you need it. Reliability with stainless steel barrel and copper tip. Cat T-1300

$NZ19.95

Get a grip on your work
The mini vice from Arlec attaches to any table, bench etc and leaves your hands free for the job! 50mm jaws open to about 60mm for the really big jobs. Ideal for cutting, filing and test applications. Cat T-4748



$NZ14.95

Economy Wire Stripper
We've stripped over 25% off the price of our Economy Wire Strippers. Save heaps of time on those projects with this versatile tool. With large adjustable range and hardened jaws! Cat T-3630

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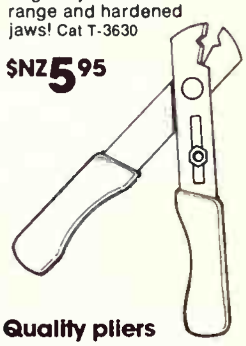
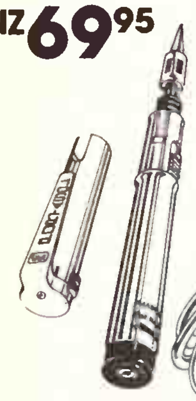


Soldering with Gas
Totally portable soldering — and it even fits in your pocket! Works just like a cigarette lighter — uses refillable butane. Provides an amazing 60 minutes heat at an equivalent of 10 to 60 watts. Detachable cap features a built-in ignition system. Cat T-1370

$NZ69.95



Desolder de Savings!
A must for any tool kit. Desolders cleanly and professionally in seconds. Huge 30 watt rating, fully self contained 240 volt. Ideal for workshop, home, technicians... anywhere, anytime! Cat T-1340

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½ price Solder
50mm Roll 200g 1.25mm Solder Cat N-1619

NOW $NZ9.95

50mm Roll 200g 0.71mm Solder

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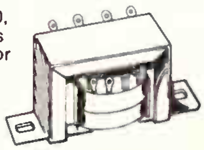
SAVE $10!!!

15-30 volt M/Tap Transformer
Great for a thousand and one projects! The DSE 2155 transformer with 15, 17.5, 20, 24, 27.5 and 30 volt tappings at 1 amp. With solder lugs for easy connection. Cat M-6672

$NZ24.50



Circuit Saver
There's real savings on our PCB Marker Kit! Ideal for those quickie boards where there's no photo facilities available. Comes with two coloured pens and eraser in hand plastic wallet. Cat T-5175

SAVE OVER $7

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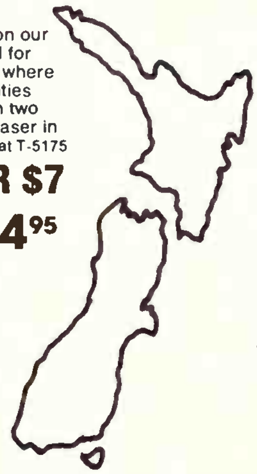

57mm Mini Speaker
The only thing smaller than this speaker is the price! It performs better than a lot of 75mm jobs. 8 ohm impedance make it suitable for many purposes. Cat C-2222

WAS $4.25

NOW ONLY $NZ2.95

Quality pliers with cutting blade
Quality Side Cutting Pliers — $7 off normal price! Insulated handles and quality construction make them ideal for servicemen, electricians, hobbyists, etc. Cat T-3270

$NZ12.95

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440 Cuba Street Alicetown, **Lower Hutt**	(04) 66 2022	DSX ORDER PHONE LINE	(09) 392 997

Local Area VHF/UHF

$39.95

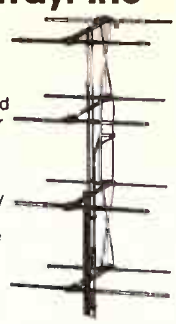
Reasonably close to the station? You don't need a big antenna. This economy VHF model will give you a great picture on VHF or UHF band 4 — and look at the low, low price! Cat L-4027

Ghost Buster

Who ya gonna call? DSE, of course — for this superb ghost buster antenna. High front to back and side ratio means minimum ghosting — great for problem reception areas. Suits VHF and band 4 UHF. Cat L-4023

$99

Phased Array: the big guns!

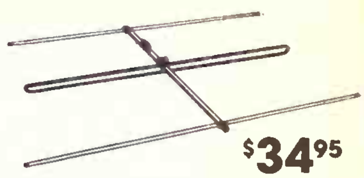


For long distance (deep fringe) reception this phased array is a beauty. For high band VHF (channels 6 and up), perfect for country viewers watching city channels — or city viewers watching the footy! Cat L-4025

$99

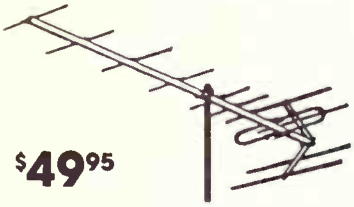
Fantastic Music Antenna

FM is great — but for best results, you need an outside antenna. This 3 element model is ideal — and it suits economy 300 ohm ribbon. Cat L-4064



$34.95

Band 4 UHF

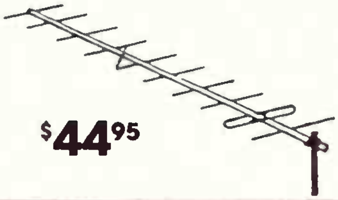


$49.95

Already have a good VHF antenna up? Why replace it if all you want to do is watch SBS or local area translators on band 4. Fold-out reflector for maximum performance. Cat L-4040

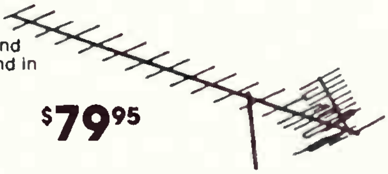
Band 5 UHF

Similar to the Band 4 model, but cut with shorter elements to suit Band 5 (channels 39 to 69). A lot of local translators are being put into this band — check with stations to find the band in your area. Cat L-4035



$44.95

Super Band 5 UHF



$79.95

For long distance UHF reception — deep fringe UHF can be dramatically improved with this one. 16 elements and 15 element reflector gives you the edge in picking up that elusive signal. Cat L-4045

Go-Anywhere Mini TV/FM

Folds up for transportation — so it suits the caravan and camper just as much as the flat dweller. Folded dipole design suits all VHF channels, can be horizontal or vertical polarised and comes with 300 ohm ribbon. Cat L-4026

$49.95

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147 Hume Hwy	**Chullora**	**(02)642 8922**
164 Pacific Hwy	**Gore Hill**	**(02)439 5311**
315 Mann St	**Gosford**	**(043)25 0235**
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Elizabeth Dr & Bathurst St	**Liverpool**	**(02)600 9888**
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621-627 The Kingsway	**Miranda**	**(02)525 2722**
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291-293 Elizabeth St	**Melbourne City**	**(03)67 9834**
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Main North Rd & Darlington St	**Enfield**	**(08)260 6088**
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Dear Customers,
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Offer concludes 30/6/87 or until stocks last. Prices can be increased without notice due to fluctuations in currency, high interest rates, government and imports.

MOTION DETECTOR

Want to detect some motion? This project shows you how.

Marshall Gill*

THIS PROJECT USES a dedicated integrated circuit to detect movement of objects in front of its sensing area. The IC has an optic sensor built onto the substrate along with all the signal processing circuitry. In order to pass light (the sensing medium), the body of the IC is transparent. The 'works' are clearly visible and this is a good representation of how integrated circuits are fabricated. The kit would make a good instructional project for schools.

The detection system uses changes of light level as the triggering medium. It measures the mean ambient (in the region of 10-1000 lux) and uses this as the reference but gives an alarm state if the level suddenly changes. Without any lens system, the naked IC can sense movement up to 2.5 metres. It will also operate in the near infrared region but at a much reduced range.

As well as the ability to sense light, this circuit has a built in 'whooping' alarm sound generator. This will directly drive a small loudspeaker but in this project, a single transistor amplifier has been added to give greater volume. A relay circuit has also been implemented to give additional alarm switching features. By the addition of a lens system, the range can be greatly increased. Although this project suggests the use of a small simple lens, larger more elaborate optical systems could be tried. The lens is placed at a spacing of its focal length from the sensor.

Modes of Operation

The device has two modes of operation. The first, the alarm mode as described above, detects changes in the mean ambient light level within the range of 10-1000 lux. The other mode is termed the search condition. A small lamp is used as the light source. The IC itself has an output specifically designed to provide the power to the lamp. It flashes on and off at a slow rate around 2.5 Hz. If the IC detects the flash from its own lamp, either directly or as a reflection, this flash rate increases to around 25 Hz. If the light source remains visable to the detector, it will keep retriggering to this high rate. If not, it will revert to the lower rate. The alarm sound generator simultaneously outputs its warbling signal at the same rate. In this mode, the relay operation is disabled. In this basic state, the mode of operation is of little use as an alarm function. It could be put to use in the case of a self propelled toy vehicle to detect close proximity to a wall or other object. The change in rate of the signal would have to be detected to perform some control function.

Uses

The kit was conceived mainly as an educational, fun experimental project but could be employed in a more serious role if the user understands its limitations. Unlike infrared, ultrasonic or radar detectors, this system uses available ambient light as it's detection medium. As a result, sharp changes in the ambient may result in false triggering. It is for this reason that it is not recommended as part of a burglar or safety alarm system. It could however be used in such an application as a doorway entrance detector for shops, etc. As a selfcontainer battery operated battery oper-

ated unit, it could be a portable, no fuss people detect alarm for when you leave a room or area unattended. It would be good as a 'kid' detector for the times they enter areas out-of-bounds.

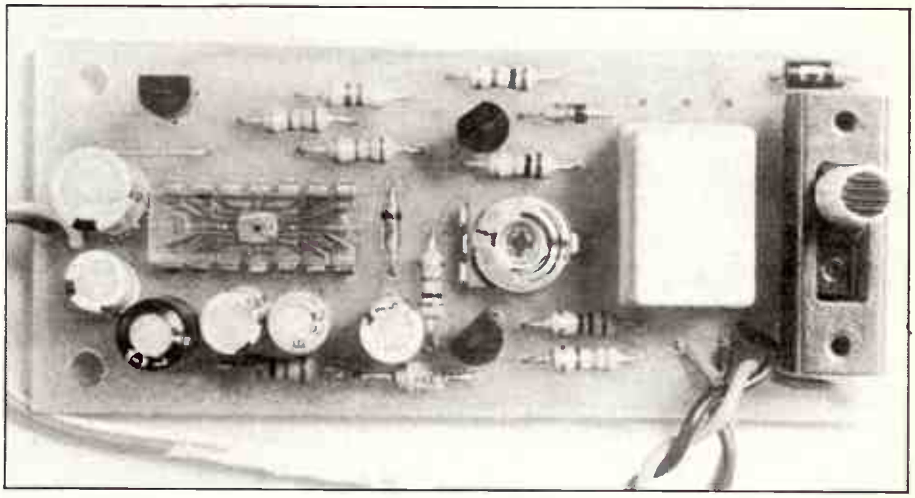
Construction

The way in which the system is used is up to the individual constructor but we have suggested a H-2835 Zippy box as the housing.

Load, trim and solder all components shown on the component overlay diagram. Insert and solder the switch so that it is flat on the board. Connect short lengths of hookup wire for the speaker and supply leads.

Case

The circuit board is secured on the Zippy box lid. Holes have to be drilled for mounting. Use the front panel label as a template to mark the points with a sharp pointed tool. Mark only the corners of the switch cutout. Drill two 3 mm holes for the screws through the board and two 2 mm for the swtich position. The 5 mm x 11 mm slot required for the switch toggle can be cut using a piecing saw and or a needle file.



The circuit board

Depending on the lens used, drill a hole appropriate to its diameter. After the holes are cleaned of burrs, the front panel label can be carefully glued to the lid. Make sure it is aligned properly before pressing into final position. Push out the holes by using the rear shank of the previously used drill as a punch. Use a fine blade knife to cut out the switch slot outline and lens aperture.

With suitable adhesive, glue the perime-... of the lens to the panel. If a large lens ▶

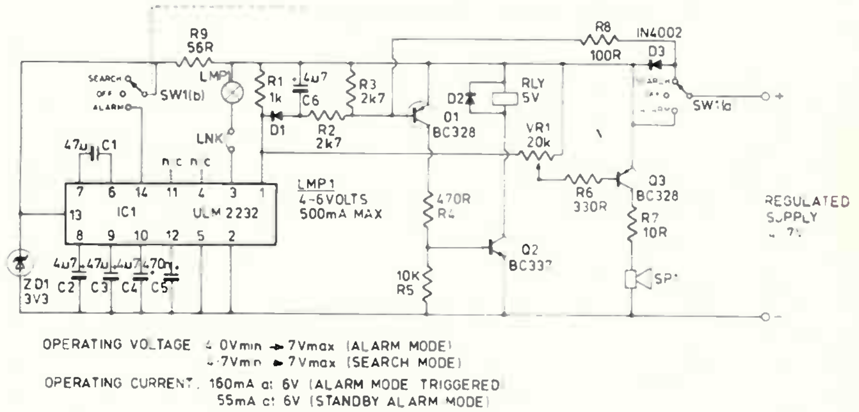
ETI-1535 How it works

The ULN2232 integrated circuit is made up of several individual functions but these can be looked at as two main blocks. Firstly the on chip photo sensor has its own voltage regulator, amplifier and detector stage. The amplifier uses log conversion of the photo current to permit operation over several decades of ambient light in the 10-1000 lux range.

The second block has a timer, clock, counter, current controlled oscillator and buffer stages. The sensing system provides low pass filtering to eliminate inteference from alternating sources such as fluorescent lights. High gain is given to lower frequency changes in ambient light levels. The steady level of ambient light within the figures given above is not a factor of the detection system, only low frequencies changes in this level are registered.

After movement is detected, the internal timer controls a series of events to output the alarm sould to pin 1 of the chip. This 'warbling' sound is output in the speaker via the transistor amplifier Q3. The potentiometer VR1 provides a simple volume adjustment. After a time-out period, the system reverts to the sensing state and remains quiet providing there is no further movement in its surveilance area.

A second output is provided at pin 3 to drive a low power lamp. The maximum current at this pin has to be limited to 500 mA. This output is used in the search mode. In this mode, the lamp is flashed at approximately 2.5 Hz. Simultaneously, a random sequencer of audible tones are output by the speaker. Upon detection of its own light source (eg, from a reflection), the alarm state is triggered and the flash and sound rate increase to around 25 Hz. Operating under this condition, the system tends to be more immune to variants from outside light sources.



Other than providing connections on the PC board and the relevant switch position, no extension of this mode has been made. The relay function is disabled by R8 via SW1. This simple relay triggering circuit cannot detect the difference in the two output states. Experimenters who may wish to pursue this mode of operations may like to try some form of frequency discrimination circuit to detect the difference. You may als like to try various low power lamps. Remember the maximum current should be limited to 500 mA so the initial inrush current of the lamp has to be considered. Light emitting diodes can also be driven from this pin. The link (LK1) shown on the board can be replaced with a 120 ohm resistor. This makes the system suitable for use with high efficiency LEDs such as the red Z-4075. The photo detector can also be used with IR leds such as the Z-3235. By using a system of lens or reflectors, the sensing range could be increased and controlled.

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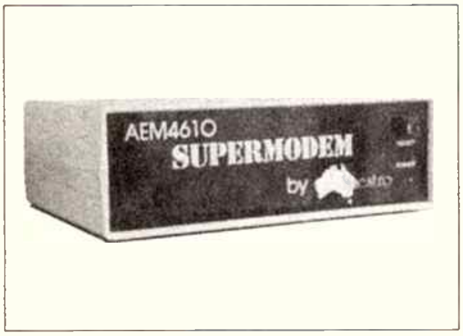

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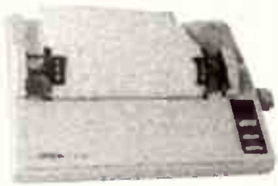

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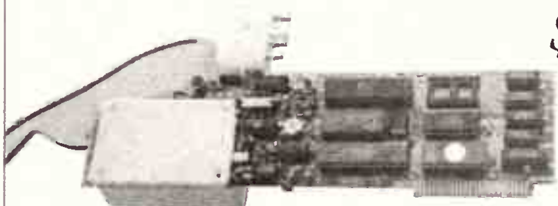

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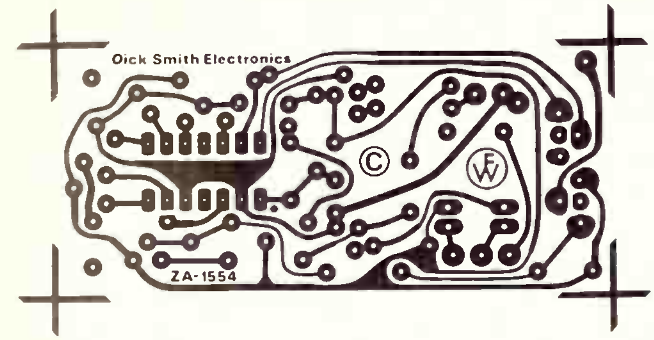
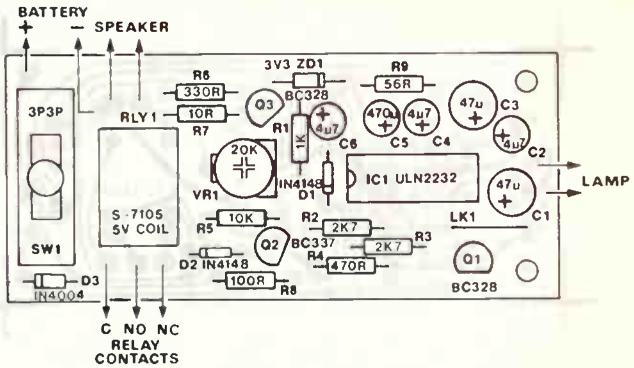
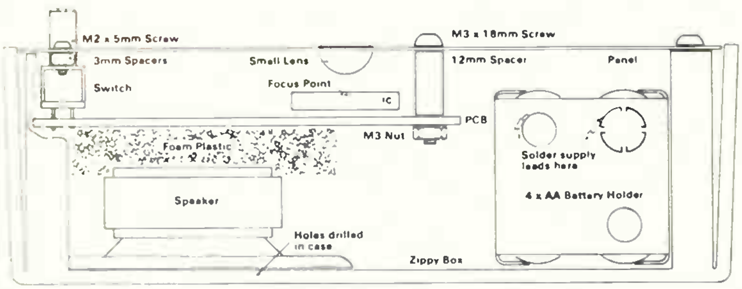


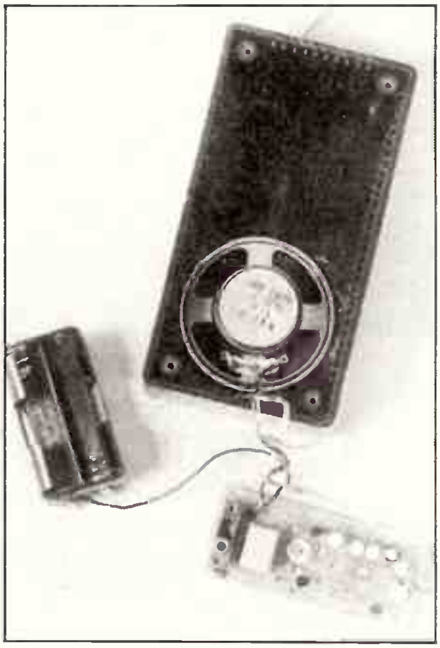




PARTS LIST — ETI 1535

Resistors	
R1	1K 1/4W Resistor
R2	2.7K
R3	2.7K
R4	470R
R5	10k
R6	330R
R7	10R
R8	100R
R9	56R
VR1	20k Horizontal Trimpot
Capacitors	
C1	47uF/25V
C2	47uF/25V
C3	47uF/25V
C4	47uF/25V
C5	.47uF/50V
C6	47uF/25V
Semiconductors	
IC1	ULM 2232
Q1	BC 328/327 Transistor
Q2	BC 337/338
Q3	BC 328/327
D1	IN4148/IN914 DIODE
D2	IN4148/IN914 DIODE
D3	IN4002 DIODE
ZD1	3V3 IN4728 ZENER DIODE
Miscellaneous	
SW1	2POLE, 3 Positions Slider
RLY1	MIN 5V Coil Spot Relay
SP1	MIN 57mm 8R Speaker
LMP1	6V MIN low wattage lamp
1	PC BOARD
1	Lens 2 to 10mm Focal Length
2	Lengths Hookup wire (two colours) 500mm
1	Label front panel
Optional	
H-2853 ZIPPY BOX	
P-6214 d x AA Battery Charger	

Price Approx $30



An internal view of the Motion Detector.

is used, obviously the focal length will be different so some other form of mounting out from the panel surface will be necessary. Mount the PC board using 2 x M3/16 mm screws, nuts and 12 mm spacers. Use 2 x M2/5 mm screws with 3 mm spacers to secure the switch.

The speaker sits under the circuit board on the back of the Zippy box. A series of holes can be drilled in the case at this position to allow sound through. Solder the speaker to the lead. If wires are to be taken out from the relay, drill a hole to allow this access.

If the unit is to be self contained and powered by batteries, a 6 V pack of AA cells can be housed in a P-6124 carrier. This assembly fits neatly across the width of the case. The two supply leads are soldered to the side of the terminals. A battery snap cannot be used as this makes the carrier too wide to fit within the case. It would be a good idea to scrape the sides of the terminal to remove the nickel plating. This mades soldering easier.

The whole assembly is now ready to be screwed into the case. A small piece of foam plastic or similar material is used to hold the speaker in position. When the panel is screwed down, this packing should apply enough pressure to the speaker to hold it firmly in place.

Power Source

If the unit is to be run from batteries, they should be in good condition. Well used old cells have a high internal resistance and tend to lead to unreliable operation. Although not completely necessary, alkaline type cells are a good source but fresh conventional batteries are satisfactory. At the end of their useable life, an indicator of the need for battery replacement is when the circuit will not reset after an alarm state or at the initial switch on stage.

If you are going to use a mains powered source, it should be well regulated. A 5 volt three terminal regulator such as a 7805 is suitable. This could be used in conjunction with a battery eliminator or transformer setup as shown. You will need a heatsink on the regulator to use it in this application.

The system will operate in the range of 4.7 to 7 volts at 20 mA if used in the alarm mode. A minimum of 600 mA is necessary if the search mode is to be used. ●

* *Marshall Gill is a Technical Officer with the R&D Department of Dick Smith Electronics*

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Ohm 200ohm - 2Mohm 0.1ohm max res 0.75%

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A dc 200u-10A 0.1 uA max res. 1%

A ac 20m-10A 10uA max res. 1.5%

Ohms 200ohm-20Mohm 0.1ohm max res.

Diode Check

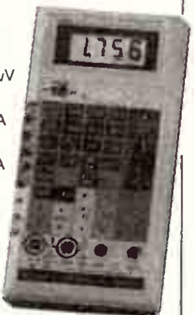
Continuity

Capacitance: 2nF-20uF 1pF max res. 2%

Accessories included: Test clips, spare fuse, Owner's Manual, battery.

$113⁵⁰

EDM-1116A



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Adc 2mA-10A, 4 ranges 1uA max resolution, 1.0%

Adc 2mA-10A, 4 ranges 1uA max resolution, 1.5%

Ohm 200ohm-20Mohm, 6 ranges 0.1ohm max resolution, 0.75%

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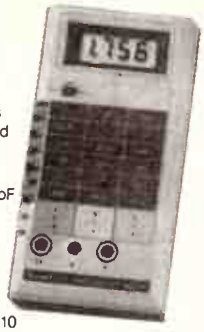

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AMATEUR RADIO KITS

A survey of the r.f. kit market. We bring you some old familiars, plus some new ones too.

Thomas E. King VK2ATJ

Clear off the kitchen table, dig out the soldering iron, grab that tool kit . . . it's winter time, the perfect season for building your long dreamt of project. But instead of digging through the junk box, tearing into the second TV or driving off to the local component stockist and perhaps still not finding every part needed, why not consider a kit with everything included in one simple package.

For its size Australia is well catered for with a dozen or so different companies offering kits to suit every pocket and every purpose. This special survey of Australian kit suppliers briefly details currently available amateur radio and short wave radio kits and accessories.

All Electronic Components
118-122 Lonsdale Street
Melbourne, Vic. 3000
(03) 662 3506

This 30-year-old Melbourne-based company has a number of speciality services for the ham and SWL. Apart from custom manufacture of pc boards and extensive component sourcing, the company produces a wide range of kits which were originally published as projects in Australian electronic magazines. Nearly three dozen communication equipment kitsets are available including:

Remote Control Transmitter Switch	$72.44
Remote Control Receiver	$37.60
Power Supply	$19.23
Active Antenna	$36.52
Novice Transmitter	$165.06
Antenna matching Unit	$23.86
Shortwave Radio	$63.94
Audio Compressor	$40.82
Aircraft Band Convector	$28.29
RTTY Modulator	$32.46
Computer Driven Radio Teletype Transceiver	$204.25

Sixteen different power supplies are featured in the catalogue. Apart from this, there are some 40 test equipment kitsets.

In addition to these, the company is developing a new linear amplifier kitset. The solid state prototype currently under test will have a power output of 140 W over the 1.6 to 30 MHz range. Expected price will be $250.

Technikit
Mail Order Dept
69 Sutherland Road
Armadale, Vic. 3143
(03) 500 9064

Techniloop 3: Designed to provide a dramatic improvement in reception, especially in signal to noise ratio, this loop antenna kit covers the 500 kHz to 5 MHz or 1.6 to 24 MHz band kit price is $69. One loop is supplied while the other loop is priced at $14.50. An L.F. loop (200 kHz to 2 MHz) is $24.50. A CB loop providing coverage to 28 MHz is $14.50. Postage is $6.50 extra.

Reinartz: Tune the world with this two valve, all wave (500 kHz to 19 MHz) receiver kit. Using the well known Reinartz circuit (introduced in 1922) and featuring plug in "spider web" coils this nostalgic kit can be operated by a battery pack or an optional power supply. $105.

Altronics
PO Box 8280
Stirling Street
Perth, WA 6000
(008) 99 9007

Dual Tracking Power Supply: Fully protected against short circuits, overloads and thermal runaway, this supply is adjustable from ±1.3 V to ±22 V at 2 A. +5 V at 1 A is also available. $129.95.

13.8 V High Current Power Supply: Ideal for amateurs needing a mains supply to power their mobile rig, this unit provides up to 7.5 A on a continuous basis and up to 10 A on an intermittent basis. Regulation when drawing 7.5 A is 50 mV. $119.95.

Bench Top Power Supply: The short circuit protected output of this supply is variable between 3 and 30 V. Over this voltage range a full 1 A is available. Load regulation is better than .2% while output ripple is less than 2 mV RMS. $79.

Lab Power Supply: Exclusive to Altronics, this heavy duty supply has a variable output from 3 to 50 V at up to 5 A and features floating outputs isolated from ground. $165.

An optional 10 turn output voltage control is available for $17.50 while optional auxiliary ±12 V output terminals are available for $12.50.

Voice Operated Relay: Upgrade that old transceiver or transmitter with this VOX unit. Whenever the unit senses a voice it triggers the circuit causing a relay to close. $14.25.

Shredall Pty Ltd
(inc) Ian J. Truscotts Electronic World
30 Lacey Street
Croydon, Vic. 3136
(03) 723 3860
80 M Direct Conversion Receiver: This popular 80 m amateur band receiver kit comes in two versions: Barebones kit (boards, semiconductors and all wound components) for $52 and a complete kit (with all pc boards) for $95. A suitable case is $15.70. (All prices include packing and postage.) The all-mode frequency range is 3.5 to 3.7 MHz. Sensitivity is .4 µV for 10 dB SNR while selectivity is 50 dB down at 100 Hz and 45 dB down at 10 kHz.
80 M Transmitter: This easy to build CW only transmitter is the least expensive RF kit available in Australia. It operates on the 80 M band (3.579545 MHz crystal is $3.50) with a power output of 4 W. $28.50. A suitable case is $7.75.

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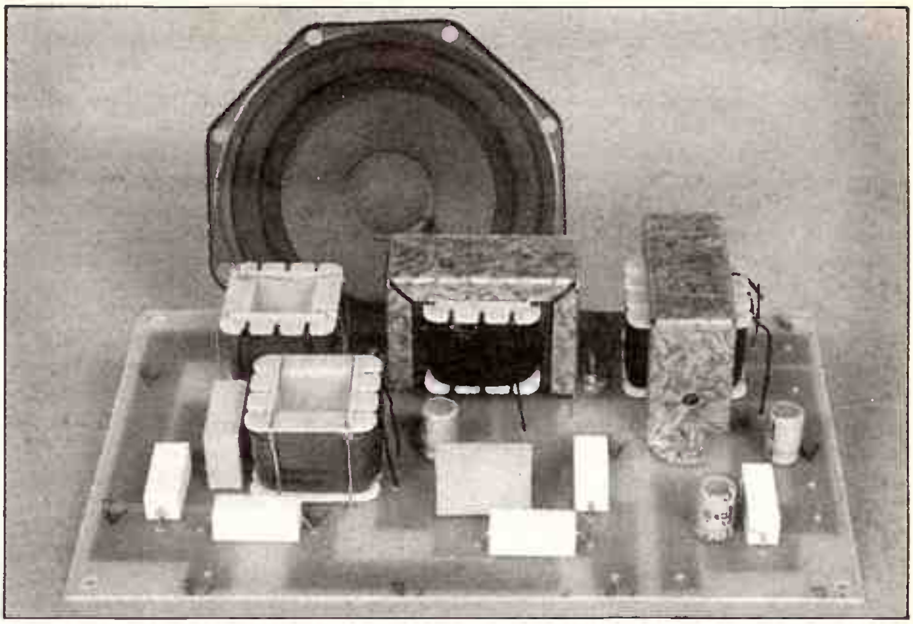
Clifton Hill, Vic. 3068
(03) 500 0078
Better known for their home security devices, laser systems, pest and animal control kits and ultrasonic and high sound pressure acoustical devices, this speciality company offers a few items of interest to the amateur and SWL.
12 V Power Supply: This device is an adjustable 5 to 14 V regulated dc source supplying up to 3 A. $172.50.

Tandy Electronics
Mail Order Department
PO Box 254
Mt Druitt, NSW 2770
(02) 675 1222
AM Shortwave Radio Kit: Ideal as a first project, this Tandy SWL kit is a 3 band breadboard receiver. It comes with an earphone, requires 2 "AA" cells and covers 520 to 1625 kHz, 5.5 to 10 MHz and 9 to 16 MHz. $27.95.
SW Antenna Kit: This accessory can be used with the above kit or any other shortwave receiver. It comes with 22 metres of copper wire, insulators, lead-in wire, standoffs and a feed-through for the window. $19.95.

Dick Smith Electronics
PO Box 321
North Ryde, NSW 2113
HF Amateur Transceiver: Capable of operating on any 500 kHz segment of five pre WARC amateur bands between 2 and 30 MHz, this ham receiver is supplied with an 80 M module. It's capable of delivering 30 W WEP (LSB and USB) and 15 W CW when connected to a 13.8 Vdc, 4.5 A



supply. The approximate 2 kg transceiver has a sensitivity of .3 µV (10 dB SNR) and a selectivity of 6 dB @ 4 kHz, 60 dB @ 7 kHz. $349.
Upgrade kits for 500 kHz segments of 40, 20, 15 and 10 M are available for $39.95.
100 W HF Linear Amplifier: Designed to be used in conjunction with the above HF transceiver or any other transmitter producing 3 to 15 W, this wideband, solid state linear will deliver up to 200 W out on SSB and 100 W on CW and AM. Supply voltage needed is 13.8 V and a switchable low pass filter is included. $349.
Pathfinder 6 M Transceiver: A new amateur radio project is this 10 W, 6 M FM transceiver. Operating on 13.8 Vdc in the 52 to 54 MHz portion of the band, this approximate 2 kg transceiver has 400 channels selectable by thumbwheel control, 1 MHz repeater splits, built in "S" metering and a receiver sensitivity of .5 uV for 12 dB quieting. A mic is included. $249.
Commander 2 M FM Transceiver: Dick Smith's most popular transceiver is this 10 W unit for FM transmissions across the 144 to 148 MHz band in 10 kHz thumbwheel selectable steps. Operating on 13.8 Vdc it features a dual conversion superhet receiver with a sensitivity figure of .5 µV for 12 dB quieting and a selectivity of better than 60 dB at + 25 kHz. The approximate 1.5 kg transceiver has full repeater capacity and comes with a microphone. $249.
100 W VHF Linear Amplifier: Just 10 W in will result in a 100 W output signal (15 W for 120 W). It's even designed for hand operation as a 2 W drive will yield 40 W. The approximate 2 kg amplifier requires 13.8 Vdc at 15 A for maximum output. $249.
2 M GaAsFET Preamp: What the above linear does for the output of a transceiver this pre amp does for the input. The low noise figure of under 1 dB and a 15 dB gain helps with weak satellite or DX signals. $129.
2 M Yagi Antenna: With 9 elements this yagi gives a 10 dB boost to any 2 M signal. An optional 2 M phasing harness priced at $12.95 allows two beams to be stacked for additional gain. $89.95.
Explorer 70 cm FM Transceiver: Exploration of and low cost operation on the 70 cm, 438 MHz band is possible with this kit. Again designed for 13.8 Vdc operation, the dual conversion, superhet receiver features .4 µV for 20 dB quieting and −6 dB at 7.5 kHz, −60 dB at 15 kHz selectivity. The 5 W output transmitter operates across the 438.025 to 439 MHz segment of 70 cm in 25 kHz steps selected by thumbwheel control. A repeater upgrade kit, "S" meter and an additional crystal filter is included. $249.
50 W UHF Linear Amplifier: A 2 W signal is boosted to 50 W using this broadband (10 MHz) amplifier. Low noise and low loss coax relays are featured as is carrier detect switching. Harmonics and spurious emissions are down at least −60 dB. $279.
70 cm GaAsFET Preamp: Designed for masthead mounting, this preamp boasts of wide bandwidth (60 MHz) and low noise (1.5 dB). It handles up to 50 W CW and takes 13.8 Vdc at 400 mA. $129.
70 cm Bipolar Preamp: For those who prefer an inbuilt preamp this tiny unit fits inside a transceiver or receiver. The 60 g preamp has a 2 dB or better noise figure and a 100 MHz bandwidth (400 to 500 MHz). $21.95.
70 cm Yagi Antenna: This easy to assemble 13 element Yagi gives an 11 dB gain to 70 cm signal. An optional phasing harness priced at $10.95 allows two 70 cm beams to be stacked for greater gain. $29.95. ▶

2 A Power Supply: Styled to match the 6 M, 2 M and 70 cm Dick Smith transceivers, this project supplies 13.8 Vdc regulated at 2 A. $49.95.

25 A Power Supply: Amateurs needing a 13.8 Vdc regulated supply capable of meeting large current demands, i.e: transceivers, linears, etc., will find this kit of interest. The short form kit allows hobbyists to select from 6 A, 14 A and 25 A supplies with separately priced transformers. $119.95.

Shortwave Antenna: This no solder antenna kit contains wire, lead-in, polyrops, egg insulators and construction details for optimum performance from any shortwave receiver. $21.45.

RTTY Decoder: Used in conjunction with a shortwave receiver, these decoders (K-6335 for the Cat computer and K-6318 for the VZ 300/200 computer) will decode commercial wide shift RTTY for display on a computer monitor or a printer. The Dick Smith decoder has crystal locked synchronisation to provide skew free pictures under adverse receiving conditions. Software supplied with the decoder translates the bit serial into either ASCII characters in the case of RTTY, or formatted pixel for printer display in the case of FAX. $40.00.

In 1986 Dick Smith Electronics became the authorised distributor for Heathkit, the US-based kit-maker. This company produces a wide range of amateur and shortwave radio equipment and accessories.

Novice CW Transceiver: Producing 50 W on 80, 40 and 15 M (40 W on 10 M), this broadband designed CW only Heathkit transceiver incorporates a double balanced mixer, 4-pole crystal filter, balanced product detector and an active audio filter. Receiver sensitivity is less than 1.0 μV for 10 dB SNR while receiver selectivity is approximately 450 Hz at 6 dB. An optional speaker is available. $989.

QRP CW Transceiver: Amateurs interested in low power HF operation will find this 4 W, 4 band CW only transceiver to be just the ticket. The transceiver has continuously variable RF output, front panel relative signal/power strength meter, AGC, product detector, an active audio filter, RIT (±1b kHz), 5 μV or less for 10 dB sensitivity and 1 kHz @ 6 dB selectivity. An optional HW-9A accessory band pack priced at $75 expands operations to 30, 17, 12 and 10 M while matching QRP W meter and antenna tuner is also available. $425.

Memory Keyer: Amateurs searching for a way to send code will want to add the uMatic Keyer to their ham shacks. Patented 'command strings' lets users store text in buffers, select the speed, weight, spacing and adjust message repeat count. CMOS memory with battery backup retains the buffer contents, last used speed, spacing, weight and repeat count when the keyer is not in use. $269.

CW Keyboard: This microprocessor-based unit increases the ease and accuracy of high speed sending (1-99 WPM). Normal keying can be adjusted to five 'light' settings and five 'heavy' settings. The unit has a memory back up, LED indicators and an adjustable (300 to 1500 Hz) sidetone. $399.

Microlizer Microphone Equaliser: This accessory allows amateurs to optimise the clarity of their voice transmission by providing a better match between the microphone and transceiver. The 9 V battery powered equaliser fits in series between mike and rig using a standard 4 pin jack and a 6.3 phono plug. Continuously variable high and low frequency controls provide a 12 dB boost or cut off at 490 Hz and 2800 Hz. $399.

Automatic Antenna Tuner: After initial adjustments, this tuner kit will automatically set the roller inductor to preselected values on two frequencies on each of nine bands. The unit will tune and match unbalanced feed lines and single wire antennas and is suitable for powers up to 2000 W. An optional 4:1 balum kit is available for balanced feedlines. $1168.

Antenna Tuner: Dual wattmeters which measure power up to 2000 W on all frequencies between 1.8 and 30 MHz are a major feature of this heavy duty Heathkit. It has a bypass for a triband beam or dummy load and a 4:1 balum for balanced feedlines. A front panel counter allows quick tune up to previously calibrated frequencies. $885.

Antenna Matcher: This split system (outdoor remote/indoor control) matcher kit allows amateurs to adjust dipole and vertical antenna resonance so that these antennas can be used on any band between 1.8 and 30 MHz. After lengthening, a variable capicator tunes the antenna for a broader bandwidth. Input capacity is 1500 W. $482.

Synthesised Shortwave Receiver: Designed specifically for the avid shortwave listener, this boradband front end receiver covers 150 kHz to 30 MHz continuously in 30 overlapping 1 MHz bands. SSB/CW sensitivity is less than .35 μV for 10 dB SNR while on AM it's less than 2.5 μV. SSB/CW selectivity is 2.5 kHz minimum at 6 dB while on AM it's 5.5 kHz at 6 dB. The digital readout receiver has an internal speaker, a built in telescopic antenna and a muting jack for use with a transmitter. It operates on mains or 13.8 Vdc. $799.

Active SWL Antenna: Flexibility is the key to this antenna accessory which with its built in telescopic antenna can be either used in place of an outdoor antenna or as a preamp when used with an external 50 ohm antenna. It operates on a 9 V battery. $199.

Code Oscillator: This handy code practice oscillator has a built in speaker, volume and tone controls and a headphone jack for private listening. It operates on a 9 V battery with the included telegraph key. $69.95.

Emtronics
94 Wentworth Avenue
Sydney, NSW 2000
(02) 211 6988

Although nothing is currently available from this all-Australian electronics manufacturer, it is expected that an antenna tuner and a power supply in kit form will be released in the second half of 1987.

Aauskits
Amblecote Crescent
Mulgrave, Vic. 3170

Billing themselves as "the kit suppliers to Australia", this company offers a variety of amateur and SWL kits:

- Speech Processors
- FET Dip Oscillators
- Active Audio Filters
- 2 M Receiver Preamps
- QRP DSB/CW Transceivers
- 8 band, 10 W Cw Transceivers
- 2 M PLL VFOs
- 50 W, 160 & 20 M Transceivers.

Specifications and prices are available only on application.

Ashpoint Industries Pty Ltd
38 Birmingham Street
Alexandria, NSW 2015
(02) 693 1866

Catalogue 007, $26 including postage
Bandit Spider Hub Quad.

Is Mike Rychter's bandit spider hub a 'clayton's kit . . . the kit to build when you're not building a kit? Cast in aluminium in a suburban Sydney foundry, the kit comes complete with a hub . . . and nothing else! Enthusiasts may need to file burrs off the hub and will need to dig into an antenna book for dimensions of single or multi band quad antennas

— *Tom King adds:*

This list of OZ kit suppliers may have not included a local radio club producing a great 2 M preamp or transceiver or a small manufacturer of hobbyist kits for the amateur or SWL. If so, contact me c/- Electronics Today International with details of local as well as foreign kit manufacturers. In a future issue of ETI a survery of all know. foreign kits will also be published.

Ian J. Truscotts
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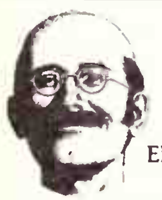

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ADVERTISING INFO No. 21

1616 BASIC

In the first few months of 1987 we published construction details on the ETI 1616 computer, and promised enhancements as they came to hand. Applix Co, the designers, have just released a BASIC to make programming easier, so here it is.

Paul Berger*

THE 1616 BASIC interpreter started life as a public domain UNIX-based program, written by Phil Cockcroft, somewhere in the US of A. We at Applix evaluated the program and decided it provided basis for the 1616 BASIC system.

Almost all of the code for BASIC is written in the 'C' language (as usual) and the interpreter has been adapted to run under 1616/OS, shortened, enhanced and considerably sped up by Andrew Morton, one of the Applix Insomniacs (or AI's, as they are known in the industry).

The language is pretty standard, and includes just about all the features that a BASIC ever had. Those who have used a Microsoft BASIC will be on familiar ground here: such BASIC programs will run under 1616 BASIC with little or no change.

A BASIC program consists of a 1616/OS ASCII text file. Each line of the program has a line number at its start; the line numbers are used for ordering program lines as they are entered and for referencing sections of the program using the 'goto' and 'gosub' commands, etc. The ASCII program is 'tokenised' when it is read in from disk or typed in; this means that each BASIC keyword which is recognised in a new program line is converted into a single byte before being added to the main body of the program. This saves space and increases execution speed.

BASIC program files may be created using the 1616/OS full screen editor, or by editing individual lines from within the BASIC system. The BASIC 'edit' command permits the programmer to use the standard 1616/OS line editor to alter existing program lines.

The language features 10 digit floating point variables, 32-bit integer (whole number only) variables, multi-dimensional arrays and character strings. The first 15 characters of a variable's name are significant. Numbers may be specified in either decimal or hexadecimal notation (hex numbers are preceded by a '$' symbol).

The 32-bit integers may range from -2,147,483,648 to 2,147,483,647. Programs written using integer variables are considerably faster than those which use floating point, so integers should be used wherever possible.

The BASIC system provides an environment in which you may interactively alter and run BASIC programs; it also supports a 'direct' mode where a few BASIC statements may be executed without actually entering them into a program. Any 1616/OS command may be performed from within the BASIC system by preceding it with a right square bracket ']'. You may indefinitely escape back to 1616/OS from BASIC by using the 'shell' statement; you return to BASIC with the original program and variables intact by entering the 1616/OS 'quit' command.

Graphics & video control commands

The 1616-specific video and graphics control commands which are not found in other BASICs are:

set640, setvdp, setvap, setfgcol, setbgcol, setbdcol, setpal, scursmode, plot, sgfgcol, sgbgcol, sgtexture, line, circle, readdot

These commands translate directly into 1616/OS system calls.

File I/O

The file I/O commands are:

open, create, fread, write, close, rename, delete, seek, tell, eof

These commands relate directly to the 1616/OS file I/O system calls and they all return a value which, if negative, indicates some sort of error. A diagnostic message which describes the error may be obtained using the 'fileerr$' command (see the example below).

The 'seek', 'tell' and 'eof' commands may be used to implement random-access files.

In addition, the 'print', 'input', 'linput' and 'get$' command save modes in which files are used for I/O, rather than character devices.

One interesting feature of 1616 BASIC is that there are four commands which greatly extend the BASIC and make the entire resources of 1616/OS available to BASIC programs. Owners of 1616s appear to be a cunning breed and they will be doing amazing (and probably incomprehensible) things with these commands.

Performing system calls

The 'syscall' statement directly performs a 1616/OS system call and passes the

1616 BASIC commands

abs	**absolute value**
and	**logical and standard 'and' command**
asc	**convert ASCII character to its numeric value**
atn	**arctangent**
base	**starting base for arrays (0 to 1)**
bye	**exit BASIC and return to 1616/OS**
call	**call a machine language routine from BASIC**
chr$	**converts number to equivalent ASCII character**
circle	**draw a circle**
clear	**clear program variables**
close	**close data file**
cls	**clear the screen**
cont	**continue interrupted program**
cos	**cosine**
create	**create a data file**
data	**standard data statement**
date $	**read the current date/time as a formatted string**
def fn	**user defined function**
del	**deletes a range of BASIC program lines**
delete	**delete a data (disk) file**
dim	**dimension array**
edit	**edit a program line**
end	**end program**
eof	**return number of bytes to end of data (disk) file**
ermsg$	**return error message string**
errline	**line number of an error that just occurred**
error	**generate an error code**
errnum	**error code of error that just occurred**
eval	**evaulate a string as an expression**
exec	**execute 1616/OS command**

returned value to the BASIC calling program. For example, the following program fragment reads the setting of a joystick:

```
1010 nul% = syscall (70, 7): rem Select
     analogue input #7
1020 joystickval% = syscall(73): rem
     Perform the conversion
```

In line 1010 above the value returned by the system call was assigned to the variable 'nul%' and then ignored. This is because the BASIC 'syscall' statement comes under the variety of statement which returns a value and must be made part of an arithmetic expression.

Executing 1616/OS commands

The 'exec' statement takes as its argument a single string which is passed as a command to 1616/OS. An error code is returned to BASIC; if it is zero, all went well.

As an example of the use of this statement consider the following program which, amongst other things, sets up the 1616's function keys to produce some oft-typed commands:

```
10 rem Program to demonstrate the
   use of the 'exec' command
20 rem
30 print "Disk directory listing:" :
   print
40 nul% = exec("dir"): rem Discard
   result in nul%
50 rem
60 rem Program the function keys
70 rem
80 for key% = 1 to 10
90 read fkdef$: rem Get a string from
   the data tables
100 nul% = exec("fkey" + hex$(key%)
   + " " + fkdef$)
110 if (nul%) then print "Function key
   definition failed": stop
120 next key%
130 rem
140 mm Now display the time
150 print "On the third stroke it will
   be";
160 nul% = exec("date") : rem Use
   1616/OS to print the time out
170 for i% = 1 to 3
```

exit	exit BASIC and return to 1616/OS
exp	exponential function
fileerr $	return file I/o error message
for . . to . . step	standard for loop
fread	read from a data (disk) file
get$	get a record
gosub	execute subroutine
goto	continue program execution at specified line number
gotoxy	position cursor at x, y screen coordinate
hex$	converts number into a string containing a hexadecimal number equivalent to the original number
if . . than . . else	standard 'if' statement
inkey$	read a character from the keyboard
input	read data from keyboard or data file
instr	find substring within a given string
int	largest integer number less than or equal to argument
left$	take substring starting with first character
len	length of string
let	standard assignment statement (eg. let a = 3)
line	draw line
linput	read data from keyboard or data file with commas etc
list	list program (or part thereof)
load	load a BASIC program file
log	natural logarithm
merge	merge a BASIC program into program currently in memory
mid$	extract a substring from a given string
mod	remainder of division
new	erase program currently in memory
next	ends 'for' loop
normal	for restoring some sanity to all the video modes
not	logical 'not'
on . . error	enable error trapping
on . . gosub	standard computed 'gosub' command
on . . goto	standard computed 'goto' command
open	open a data file
or	logical and standard 'or' command
peek	read a value from memory
pi	returns the value of π
plot	plot a graphics pixel
poke	put a specified value into a byte
print	print to the screen or file
random	start a new random number sequence
read	read information from 'data' statement
readdot	real a graphic pixel value
rem	standard remark statement
rename	rename a data (disk) file
renumber	renumber BASIC program
repeat . . until	repeat until expression is true
restore	reset pointer to 'data' statements
resume	return from error routine
return	return from subroutine
right$	take substring ending with last character
rnd	random number
run	execute program (at optional line number)
save	save current BASIC program
scursmode	alter cursor mode
seek	seek to a new data (disk) file position
set640	select video mode
setbdcol	set border colour
setbgcol	set text background colour
setfgcol	set text foreground colour
setpal	set video pallette entry
setvap	set video software access page
setvdp	set video display page
sgbgcol	set graphics background colour
sgfgcol	set graphics foreground colour
sgtexture	set graphics line texture
sgn	sign of argument
shell	return to 1616/OS but do not exit BASIC
sin	sine
space$	creates a string full of spaces
sqr	square root
stop	stop program execution
str$	converts a string to a number
string$	creates a string filled with ine ASCII constant
syscall	perform 1616/OS system call
system	exit BASIC and return to 1616/OS
tab	spaces over to an absolute print position
tan	derived function
tell	return current position within a data (disk) file
time$	read the current date/time as a formatted string
val	converts a string containing a number to numeric value
varptr	get address to variable
wend	end 'while' loop
while	program loop that executes as long as a given condition is true
write	output data to file
xor	exclusive 'or'

```
100 ' Program    : STRINGS.BAS - 1616 BASIC
110 ' Programmer : Paul Berger, Applix pty limited
120 '
130 cls : set640(0) : scursmode(0,1,0) : random : base 0
140 size%=20
150 dim xs%(size%), xe%(size%), ys%(size%), ye%(size%)
160 x1%=100 : x2%=60 : y1%=120 : y2%=175
170 z%=rnd(15)+1
180 d1%=rnd(10)-5 : d2%=rnd(10)-5 : d3%=rnd(10)-5 : d4%=rnd(10)-5
190 for y%=1 to size%
200 if x1%+d1%<0 or x1%+d1%>319 then d1%=(-d1%)
210 if x2%+d2%<0 or x2%+d2%>319 then d2%=(-d2%)
220 if y1%+d3%<0 or y1%+d3%>199 then d3%=(-d3%)
230 if y2%+d4%<0 or y2%+d4%>199 then d4%=(-d4%)
240 sgfgcol(0) : line(xs%(y%),ys%(y%),xe%(y%),ye%(y%))
250 xs%(y%)=x1%+d1% : xe%(y%)=x2%+d2% : ys%(y%)=y1%+d3% : ye%(y%)=y2%+d4%
260 x1%=xs%(y%) : y1%=ys%(y%) : x2%=xe%(y%) : y2%=ye%(y%)
270 sgfgcol(z%) : line(xs%(y%),ys%(y%),xe%(y%),ye%(y%)) : next : goto 170
```

```
180 print chr$(7); : rem beep
185 nul% = exec("pause .50") : rem
    Wait for 1 second
190 next i%
200 print "precisely"
210 end
220 rem
230 rem Data for the function keys
240 rem
250 data "list ", "run ", "print ",
    "save ", "load "
260 data "]dir ", "for ", "then ", "if ",
    "edit "
```

Obtaining pointers to BASIC variables

The 'varptr' statement may be used to find the address of a BASIC variable (floating point, integer, array or string). This is very useful for passing references to your BASIC data to 1616/OS or to assembly language subroutines.

For integer (%) variables, a pointer to a 32 bit point is returned. For floating variables a pointer to a 8 byte floating point number is returned. For strings a pointer to the first byte of the null-terminated string is returned.

As an example, the following program fragments write an array of integers directly to a disk file and read it back in again. Thus its much more efficient than using 'print' and 'input' statement to and from the file in the normal manner.

```
10   dim barofsoap%(100): rem The
     array of integers
•
•
•
1000 rem Write the array to disk
1010 fd% = create("bathtub", 0, 0):
     rem create the file
1020 if fd% < 0 then ec% = fd% : goto
     2000 : rem create failed
1030 ec% = write(fd%,
     varptr(barofsoap%(0)), 400):rem 4
     bytes/integer
1040 if ec% < 0 then goto 2000:rem
     write failed
1050 ec% = close(fd%) : if ec% < 0
     then goto 2000
•
•
•
1500 rem Read the array from disk,
     ignoring possible errors
1510 fd% = open("bathtub", 1)
1520 ec% = read(fd%,
     varptr(barofsoap%(0)), 400)
1530 ec% = close(fd%)
2000 rem Handle file I/O errors
2010 print chr$(7);"Disk file error:
```

```
100 ' Program    : POND.BAS - 1616 BASIC
110 ' Programmer : Paul Berger, Applix pty limited
120 '
130 ' Be patient....
140 '
150 set640(1) : cls : base 0 : scursmode(0,1,0) : random
160 dim r(640), c(640), pal(3) : gotoxy(0,24) : print"Wait...";
170 for i%=1 to 640 : r(i%)=log(i%) : c(i%) = log(i%) : next
180 for r%=1 to 200 : for c%=1 to 640 : x=c%*r(c%)+r%*c(r%)
190 x=x/5:y=int(x):z=x-y:z%=int(z*5):plot(c%-1,r%-1,z%+1):next:next
200 '
210 ' go through palette making sure each entry is a different colour
220 '
230 pal(0)=rnd(16)
240 pal(1)=rnd(16): if pal(0) = pal(1) then goto 240
250 pal(2)=rnd(16): for z=0 to 1 : if pal(z) = pal(2) then pal(2)=rnd(16): next
260 pal(3)=rnd(16): for z=0 to 2 : if pal(z) = pal(3) then pal(3)=rnd(16): next
270 for z=0 to 3: setpal(z,pal(z)) : next
280 '
290 ' wait 5 seconds then change palette colours again
300 '
310 ticks=syscall(18)
320 repeat until syscall(18)=ticks+(50*5)
330 goto 230
```

```
100 ' Program     : SPIRO.BAS - 1616 BASIC
110 ' Programmer : Paul Berger, Applix pty limited
120 '
125 cls : set640(0) : c=1
130 input"Number please (8 to 60 is best)";a
140 cls
150 '
160 ' now do it!
170 '
180 for t1=0 to (2*pi)-.001 step (2*pi)/a
190 for t2=t1+(2*pi)/a to (2*pi)-.001 step (2*pi)/a
200 line((cos(t1)*120+160),(sin(t1)*99+100),(cos(t2)*120+160),(sin(t2)*99+100))
210 c=c+1 : sgfgcol(c) : if c>15 then c=1
220 next:next
```

```
          ";fileerr$(ec%)
  2020 stop
```

Calling assembly language subroutines

The BASIC is supplied as a 1616/OS transient program which loads into memory at address $8000, rather than the normal $4000. This provides 16k of memory which is free for assembly language subroutines and data.

The BASIC 'call' satement allows the calling of an assembly language subroutine, with a facility for passing up to nine arguments to the subroutine. The 'call' statement evaluates as the value which the subroutine returns in the MC68000's data register 0. The 1616 BASIC 'varptr' statement comes into its own here: BASIC programs may pass pointers to arrays of data to assembly code, which can directly access and/or alter the data.

The following program fragment loads such a subroutine and calls it:

```
10 dim barofsoap%(23)
20 sheepdog% = 12
•
•
•
1000 nul% = exec("mload sheepdip
       4000"): rem load the code in
1010 if nul% then print "Cannot load
       file sheepdip" : stop
1020 rem Call the assembly code, put d0
       value into result%
1030 result% = call($4000, 10,
       varptr(barofsoap%(0)),
       sheepdog%)
```

The 1616 Basic is available from Applix for $50 on tape. It will be available in ROM shortly, and readers interested should contact Applix direct. A disk based version will be available just as soon as the disk drives are available. As we go to press a timetable for this had not been finalised. ●

**Paul Berger is Managing Director at Applix. Applix is a partnership between him and Andrew Morton, who was responsible for the design of the 1616, and this implementation of the BASIC language.*

TEACH YOURSELF

CREATING WITH ELECTRONICS PART 7

ANALOGUE FREQUENCY METER

In an all digital world, we divert by presenting a low cost, foolproof, analogue frequency meter. Use it as a tacho, as a partner to the signal generator from part 4 of the series, or as a useful measuring device in general.

Peter Phillips

Digital technology has introduced its own particular forms of instrumentation, usually characterised by a numerical display. Analogue instruments, using a pointer as the readout, have their advantages, including the ability to follow a changing value. As well, due to the different operating principles of a frequency meter, compared to a digital frequency counter, measuring low frequencies is as easy as high frequency measurement. The trade off between the two technologies is accuracy, limited in the case of the analogue device to the initial calibration and the linearity of the meter movement. As well, resolution is limited when compared to a frequency counter, but often a four digit display is overkill anyway.

The frequency meter described in this article has numerous features, including two LED indicators that show whether the input signal is adequate and if the input frequency is within the selected range. The input impedance is around 1M ohm, and voltages as low as 10 mV will often register correct readings, despite the specified input voltage of 30 mV. The meter movement is fully protected, making the instrument very easy to use. Also, if both LEDs are on the probability of a wrong reading is very remote.

The project is designed to complement the audio oscillator presented in part 4 of the series, and uses the same size case to provide compatibility in appearance. The measuring range is from 10 Hz to 100 kHz, and a selectable filter is included to clean up a noisy input. Input voltage limiting circuitry allows a wide range of input levels to be handled, and waveforms ranging from sinusoidal to spikes provide a reliable indication. The instrument could be used as a tachometer, or for any application that must show frequency variations. The circuit is based on the 555 timer, along with numerous diodes, Zener diodes and transistors. To aid the novice, some background theory is included, which complements that presented last month.

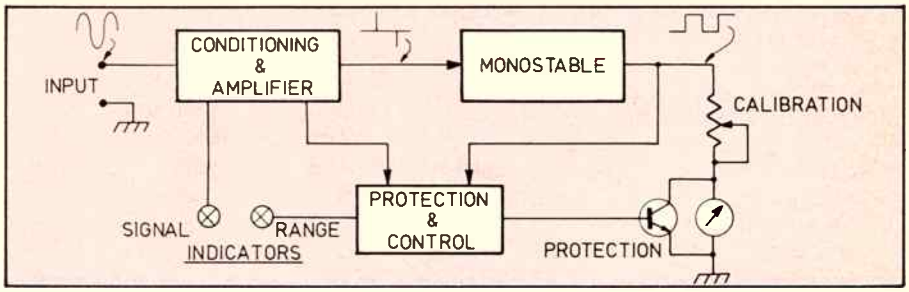


Fig. 1: Block diagram of the ETI 177.

The Circuit Principles

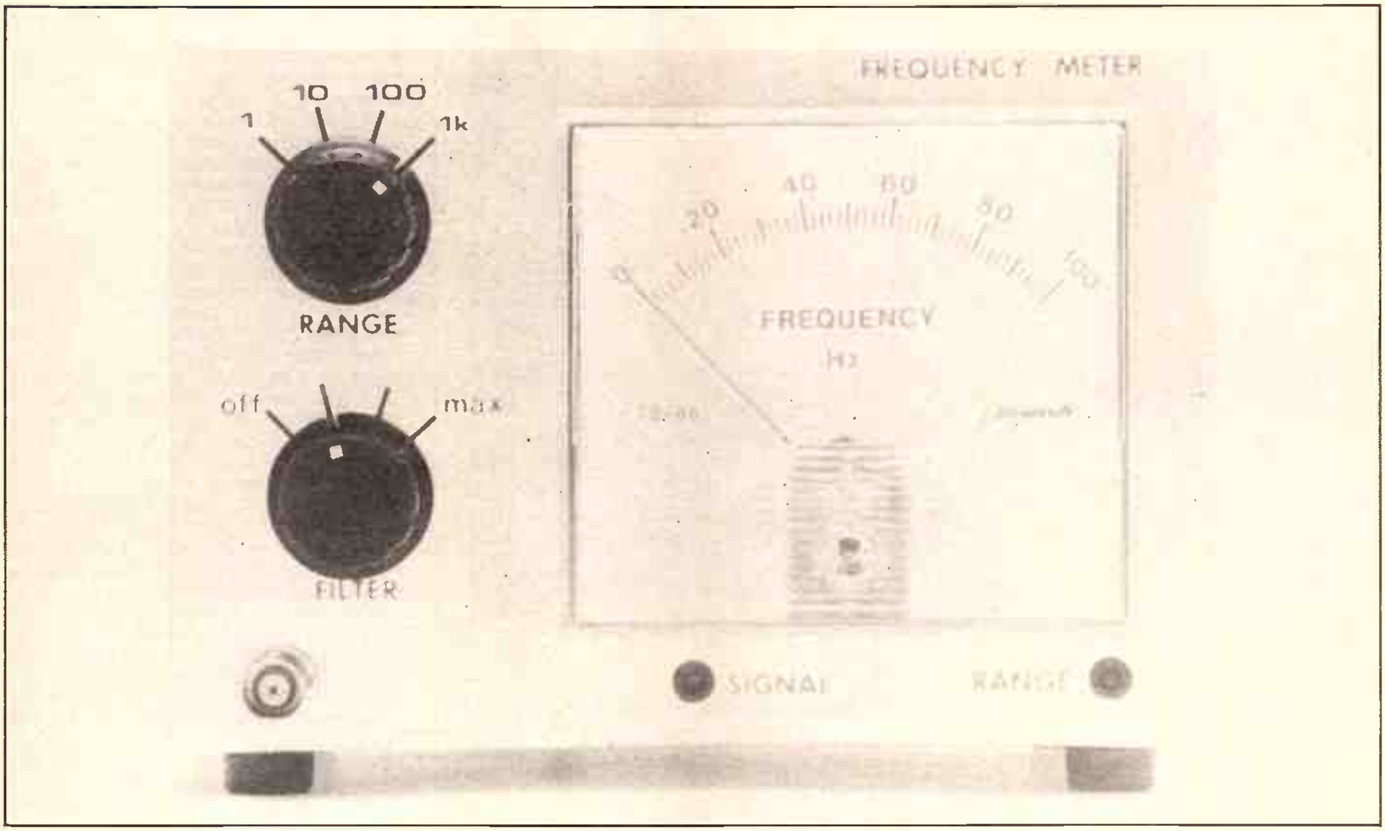
Figure 1 shows a block diagram of the circuit. In principle, the input signal, of whatever waveform, is converted to a series of short duration spikes. These spikes then trigger a monostable multivibrator that produces a fixed duration pulse for each spike. The pulse waveform is then fed directly to a dc meter movement that displays the average value of the waveform. By increasing the input frequency, the pulse rate will increase, producing a higher reading on the meter.

Often, the input frequency may be a total unknown. Frequency counters are notorious for giving apparently steady readings that have no relationship to the correct value. Usually some back-up device such as a CRO is needed if the frequency is to be roughly established, and the counter then made to display the correct value. To overcome this problem, an error detection circuit is included in this project that compares the input frequency to the mark-space ratio of the pulse output of the monostable, and virtually guarantees a valid reading. Meter protection is provided by a transistor connected across the meter terminals and will operate when the pulse waveform has a duty cycle exceeding about 50 per cent.

Background Theory

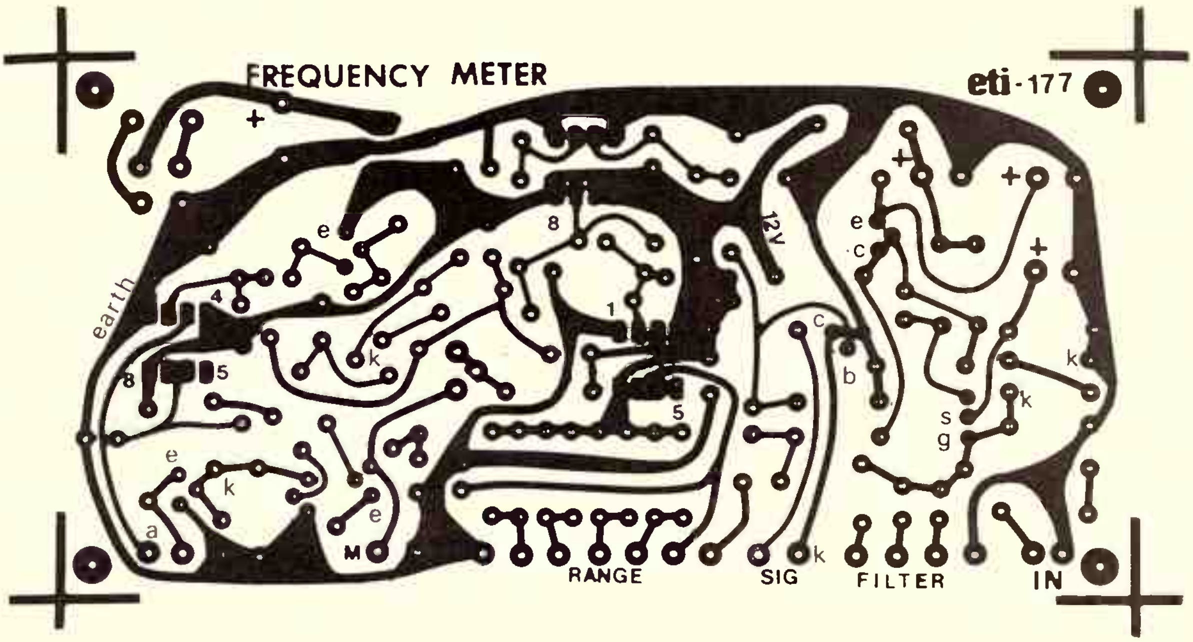
The circuit is basically an analogue switching circuit. Apart from the first stage of the input amplifier, all voltages and waveforms have one of two possible values. While this concept is similar to digital, the principles are still definitely analogue, but based on two levels only. Many analogue circuits use switching to fulfill their required function, such as a switched mode power supply, power control to a motor using thyristors, and so on.

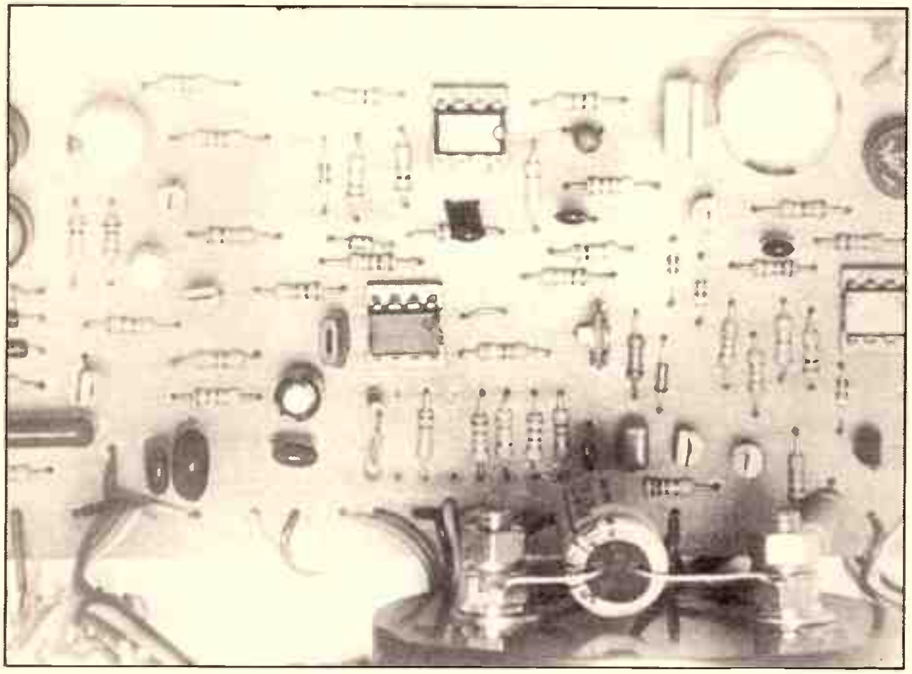
In any switching circuit, devices such as transistors and diodes are commonly used to emulate a conventional switch. As an ideal switch has an infinitely high resistance when off, and zero resistance when on, the electronic equivalent should approximate these conditions. For a transistor, fully on means the voltage across the transistor, ie, between collector and emitter, should be virtually zero. This condition is know as saturation, and is achieved by using a relatively high base current that will cause the required condition despite Beta variations. Keeping the transistor completely off is often difficult, as the



normally insignificant leakage currents introduce problems. To reduce their effect, a current path, usually through a resistor, must be provided between the base and emitter terminals.

Diodes are often used in switches circuits to prevent possible parallel paths between several switching signals connected to the same point. The diodes labelled D_2 and D_3 in the circuit diagram perform this task by effectively isolating the two waveforms applied to the base of Q_4 from each other, while still allowing them both to operate Q_4. In high speed switching circuits, special switching diodes will be ▶





Analogue Frequency meter, circuit board.

specified for their speed and low reverse leakage current characteristics.

Zener diodes are essentially a switching device, acting as an open circuit at voltage below the Zener point, thereafter conducting. Unfortunately, the transition between states is often not as sharp as may be required. This is particularly true for Zener voltages below 10 volts. For example, a 3.3 volt Zener may start conducting at voltages as low as 2.5 volts. Different Zener diode type numbers for the same Zener voltage may have differing switching characteristics, requiring use of the specified device only.

The circuit uses two 555 monostable multivibrators, the operating principles of which were explained last month, along with the shortcomings of some brands of 555s. The type of timing components of any mono are particularly important, to minimise effects due to temperature variations. A polyester capacitor is specified for the timing capacitors, and ideally a high stability, metal film resistor should be used for the timing resistor. Note that a 1 per cent resistor does not necessarily have a better temperature stability than a 5 per cent device, only that its marked value is closer to the actual value.

The term 'mark-space ratio' refers to the time a pulse waveform is in one state compared to the other. Generally, 'mark' refers to the time the waveform is high, and 'space' to when it is low. Another term often used is 'duty cycle', in which the time the output is active (either high or low) is compared to the total time from the commencement of one pulse to the next. A 1:1 mark space ratio is the same as a duty cycle of 50 per cent.

Construction

This circuit could be constructed on vero board, however the pcb layout is recommended to prevent problems caused by long leads and capacitance between tracks. Commence construction by preparing the case. The size of the meter is optional, as sufficient front panel space is provided for most varieties. Use the template supplied with the meter to drill the case, and a nibbler tool to cut the large hole for the meter body. Mount the transformer as shown in the accompanying photos to isolate it from the input amplifier to prevent hum pickup. The LED indicators used in the prototype were pinpoint LEDs mounted in plastic bezels. Any LED will do providing it gives a suitable light output.

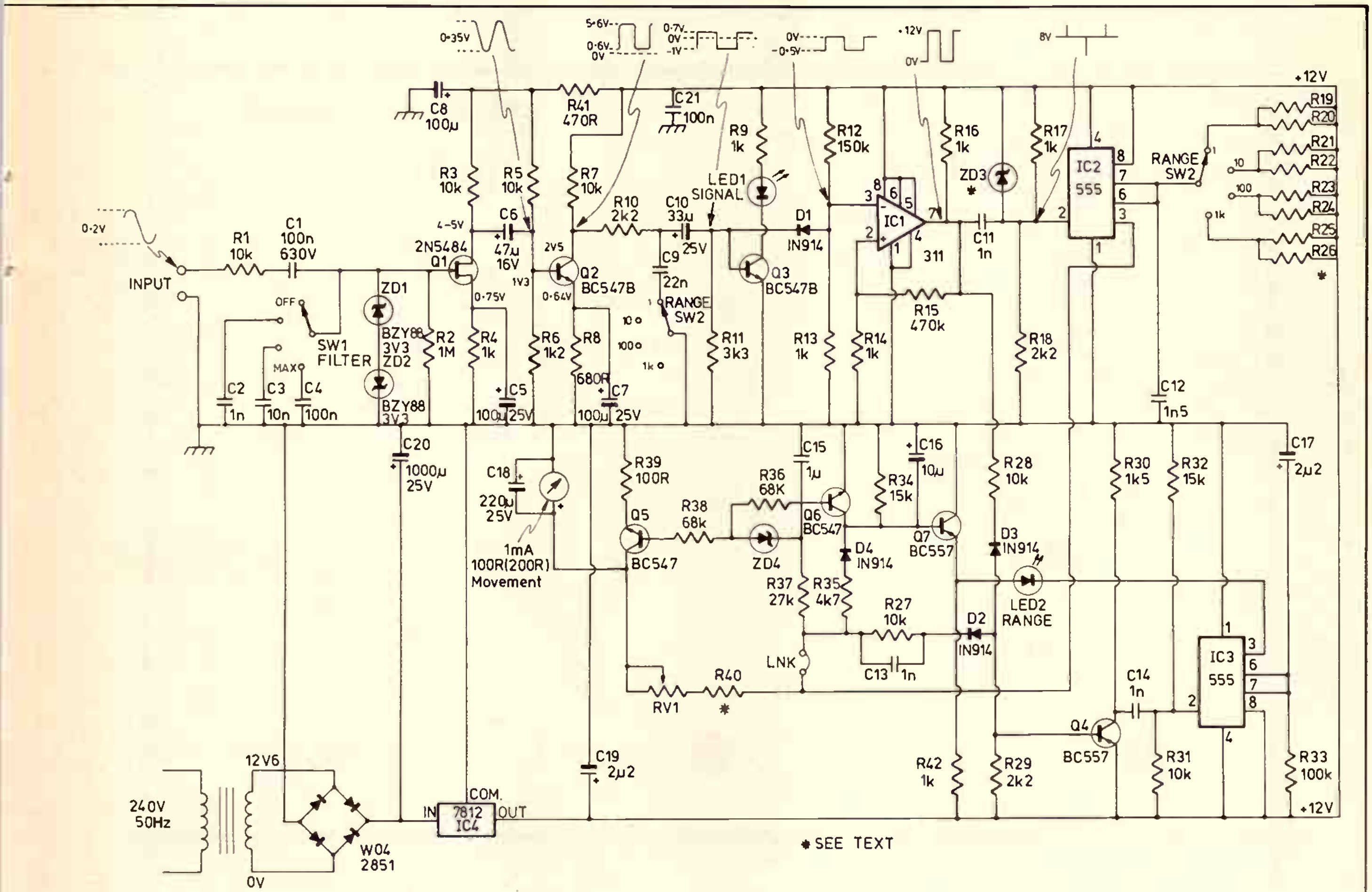
Use the pcb as a template to drill the mounting holes in the case, positioned to clear the protruding devices inside the case. Mount the resistors, (except the calibration resistors, R_{19} R_{26}), the diodes, zeners and wire link first, then proceed with the capacitors and semiconductors. IC sockets make life easier, but are optional. The two wafer switches should be connected with minimum lead lengths, using rainbow cable. To facilitate fault finding, connect the meter and LEDs with leads sufficiently long to allow the pcb and the switches to be held away from to the case. The circuit should operate first up, but Murphy's Law often prevails! After a ▶

ETI-177 How it works

The circuit is in three separate blocks; the input conditioning/amplifier circuit, the output monostable and the protection/control circuit. The first block is as follows. The input signal is coupled to the FET with a 0.1ūF, 630 volt capacitor in series with a 10 k protection resistor, R_1. Filtering of the input is provided by the selectable capacitors, C_2 to C_4, and signal limiting to around $4V_{p-p}$ is achieved by ZD_1 and ZD_2. The input impedance with the filter off is set by R_2, which also connects the gate of the FET to ground. After amplification, the signal is passed to the next amplifier stage, Q_2. For best sensitivity, Q_2 should have a high current gain, and if possible should be selected accordingly by Beta comparisons between available devices. The bias is arranged to cause a virtual square wave at the collector for signal inputs above 100 mV, as a result of the low collector voltage. The signal at the collector of Q_2 is attenuated and clipped by the network comprising R_{10}, C_{10}, R_{11} and the base-emitter of Q_3. Q_3 drives the signal LED, and should operate for inputs above 20 mV. Altering the value of R_{11} will change the input level required to operate the LED. C_9 is connected only on the two lowest ranges and filters noise possible at low input signal levels. Diode D_1 conducts when the signal at its cathode goes slightly negative, and couples the signal to the comparator, IC_1. The comparator has a small amount of positive feedback, provided by R_{15} to produce a Schmitt trigger action, reducing the effects of noise that may cause multiple switching. R_{16} is the pull up resistor for the open-collector output of the comparator.

IC_2 is the output monostable, and is a conventional 555 monostable circuit. The output square wave from the comparator is converted to a spike waveform by the differentiator circuit of R_{17}, R_{18} and C_{11}. As described in part 6, ZD_3 clips the negative going trigger pulse to limit its negative excursion for those 555 ICs that exhibit timing errors on the highest range. The timing components for the mono are the switched resistors R_{19} to R_{26}, and capacitor C_{12}. The values are selected to give a duty cycle of 40 per cent at full scale. (High time 40 per cent, low time 60 per cent.) The output waveform is fed via the series resistors R_{40} and RV_1 to the 1 mA meter movement, which responds to the average value of the waveform. Because the supply voltage is regulated, this arrangement gives a suitable performance. If the supply voltage varies, due to a change of regulator IC_4, recalibration will be needed.

The protection/control circuit has the task of operating the range LED, and protecting the meter against overload. The range LED is driven by IC_3 which is a 555 connected as a monostable. If no trigger pulses are received by IC_3, the LED will be on. Trigger pulses for IC_3 are produced when the input frequency is too high for the selected scale, by NANDing the output waveforms of IC_1 and IC_2 using diodes D_2 and D_3 and transistor Q_4. Figure 2 shows how the circuit works. As depicted, for an in-range frequency, there is always zero volts applied to either one of the diodes. This allows Q_4 to be continously conducting, and holds the voltage across R_{30} at around 12 volts. When the duty cycle of IC_3 exceeds that of the comparator, both diodes will simultaneously



turn off, as both cathodes will be positive for a short time. The transistor stops conducting and the voltage across R_{30} falls to zero. The differentiator of R_{31}, R_{32} and C_{14} produces a negative trigger pulse which fires IC_3, extinguishing the LED. The LED is held off by the succession of trigger pulses from Q_4.

The range LED is also controlled by Q_7 and Q_6 to ensure it is extinguished under conditions not catered for by IC_3. The first is when the output of IC_2 is always low, caused by either no input signal, or a very high input frequency. Q_7, when conducting, will effectively short-circuit the LED, turning it off. To hold Q_7 off under normal operation, the output of IC_2 is half wave rectified by D_4 and C_{16}. This produces a positive voltage at the base of Q_7, holding it off. When there is no output from IC_2, the positive charge on C_{16} is removed by R_{34}, allowing Q_7 to turn on, extinguishing the LED. The second condition occurs when overload is reached. Under extreme conditions, the output of IC_2 may be held high, or at least be operating well above the 40 per cent duty cycle. The integrating circuit of R_{32} and C_{15} will generate a relatively small voltage across C_{15} for duty cycles less than 50 per cent, and start charging it towards 12 volts when the duty cycle is around 60 per cent, as the charge time for C_{15} is now greater than the discharge time resulting in a dc voltage of around 8 volts. When the Zener conducts, it turns on Q_6 which then allows Q_7 to conduct.

So, why the NAD gate and IC_3 you ask? Why not let Q_6 and Q_7 operate the range LED? If this were the case, possible ambiguity with the range LED could occur, caused by half cycling of IC_2 when the input frequency is more than twice the pulse rate of IC_2. Although the components values still ensures a full scale reading, the duty cycle of IC_2 may still be low enough to not cause ZD_4 to conduct. The range LED can then light, making the user think the frequency is within approximately range. We did say its almost perfect, remember!

The last part is the protection for the meter movement, provided by Q_5. This transistor operates the same way as Q_6, and is operated from the same circuit. The emitter resistor R_{39} stabilises Q_5 to allow for the wide range of current gains inherent in the specified transistor type.

A final point is the power supply. In any switching circuit, spikes and noise are generated on the supply rail. These can have the effect of producing false triggering, and generally cause mayhem. De-spiking capacitors are included adjacent to the comparator and IC_2 and C_{19} also aids the regulators due to its physical proximity to both IC_1 and the regulator on the pcb layout. Decoupling for the input amplifier is provided by R_{41} and C_8.

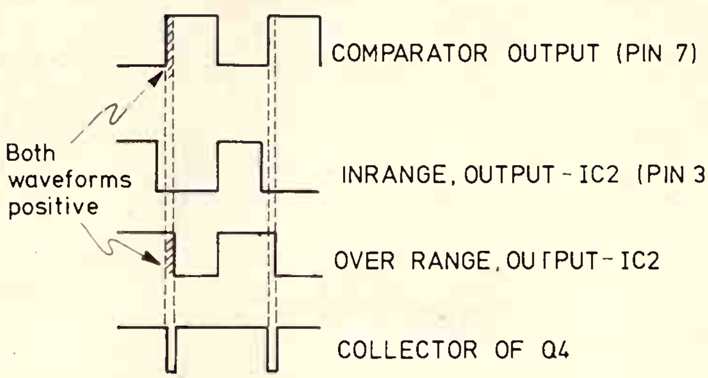
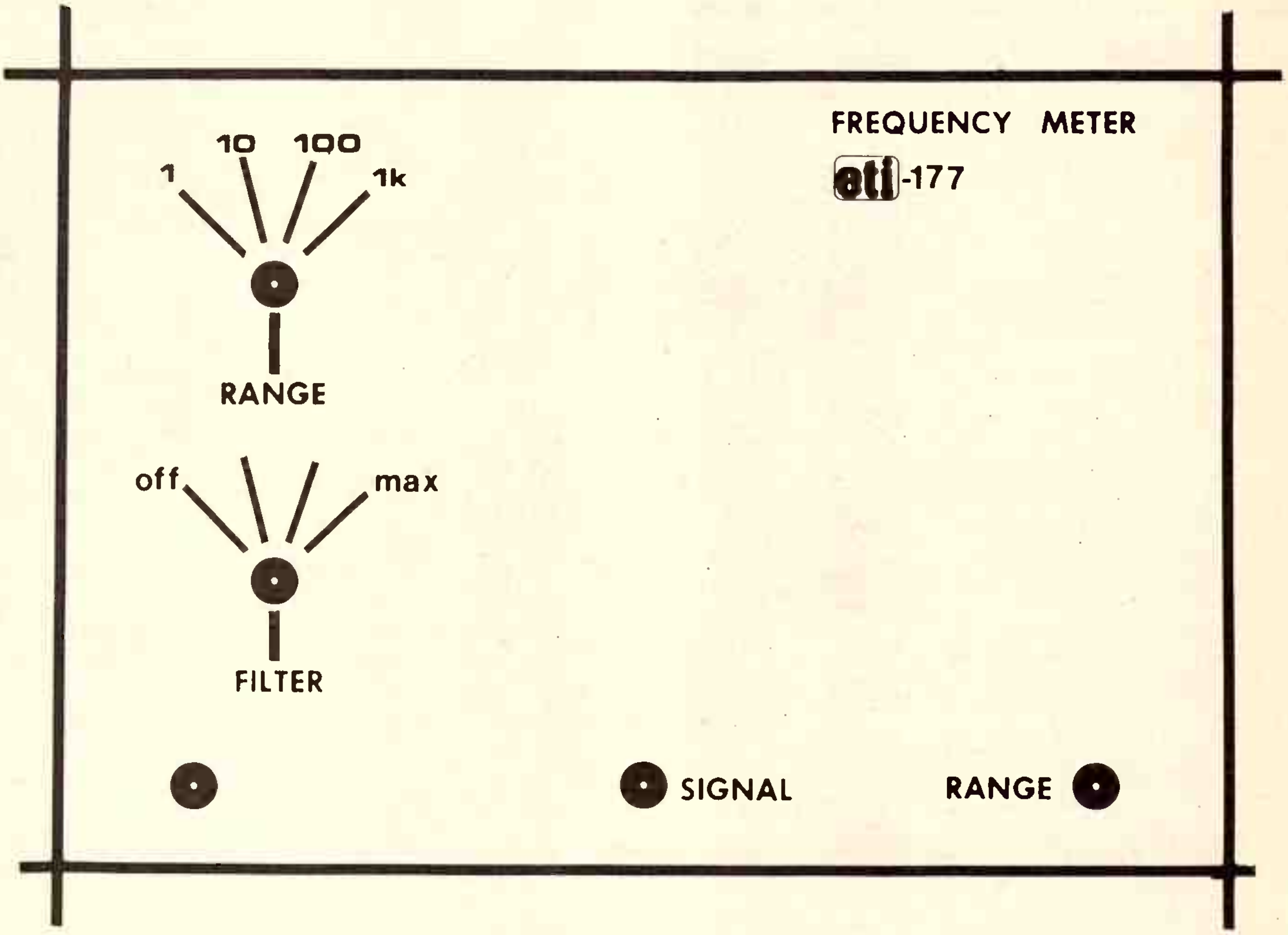
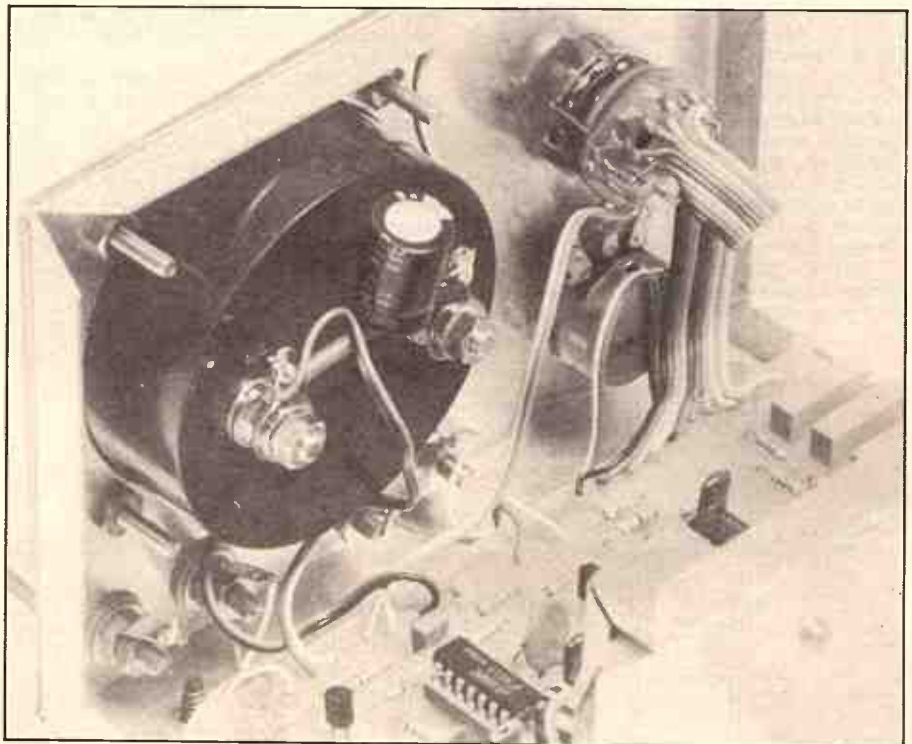


Fig. 2: Control of the 'range'. LEDs.




Analogue Frequency meter — internal view

final check for shorts and incorrectly polarised components, connect the transformer secondary, and supply power.

At switch on, nothing should happen; no LED indication or pointer deflection. Touch the regulator and the ICs to ensure they are not overheating. Now connect a 2.2M ohm resistor for R_{19}, and select the lowest range. If everything is working, the meter should indicate, and both LEDs light when a 50 Hz input is applied. If not, note if the signal LED is indicating correctly. If so, go searching around the ICs. The wire link connects all the protection and range LED circuitry, and can be removed to help further isolate the fault.

Calibrating

Once operating, the unit can now be calibrated. Start by applying a 50 Hz input of at least 30 mV. Adjust the value of R_{40} and RV_1 for an exact midscale indication. The value shown for R_{40} is for a 100 ohms, 1 mA movement, and different movements may require this value to be varied. Once set, do not alter the setting of RV_1. Select the x10 range and apply a 500 Hz input. Try a 220 k resistor for R_{21}, but exact calibration can be achieved using a 270 k for this resistor in parallel with an- ▶

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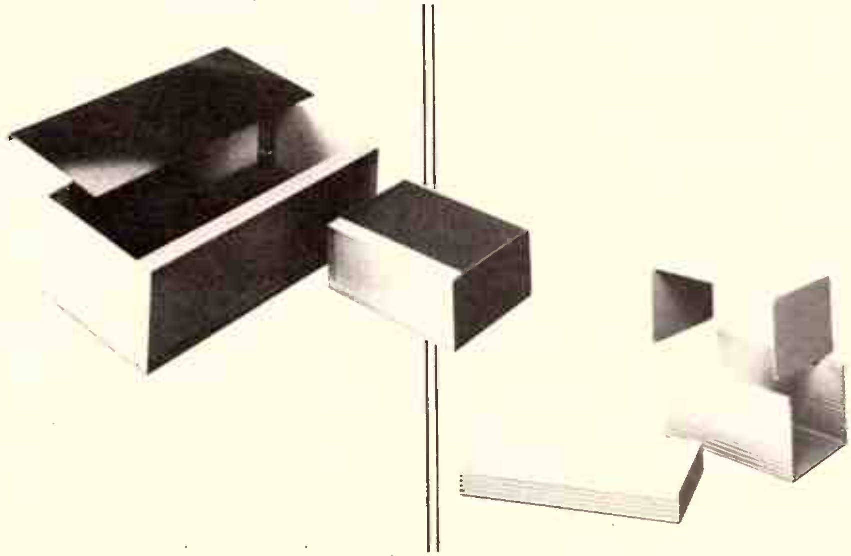

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other of a higher value. Repeat this for the next decade, with a frequency of 5 kHz and a resistor value of around 22 k.

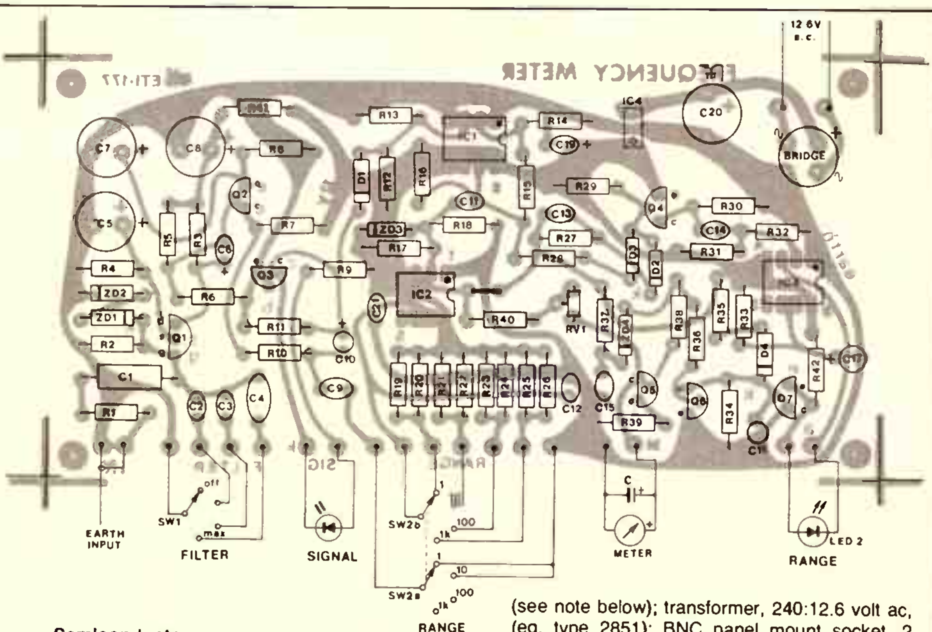
You will find whether the Zener diode, ZD_3, is needed for IC_2 when the highest range is used. Connect a temporary resistor of 1k8 for R_{25}, and apply 50 kHz. If the deflection is much higher than midscale, the 555 has the propagation problem referred to in Part 6. Try a 10 V Zener diode, otherwise work down in Zener values until the reading is around midscale. Alternatively, use a Fairchild brand 555 (uA555, as specified). Once the decades are in calibration, next confirm that the range LED operates from around 10 per cent of full scale to 1.5 x the decade. On the lowest scale, 10 Hz should make the range LED blink, and it should extinguish at around 150 Hz. The highest scale will have the range LED on between frequencies of around 10 kHz to 150 kHz.

Another check is the effect of the meter protection transistor, Q_5. The value for R_{38} is for the 100 ohm meter movement used in the prototype. If the pointer returns to an on-scale value when the range LED is off, raise the value of R_{38}. If you suspect the protection is inadequate, lower the value. The correct setting will give an overscale reading without obvious distress to the meter movement.

Using the meter

Although billed as foolproof, the relative simplicity of the circuit may not cover all contingencies. In general, trial use has demonstrated that if both LEDs are clearly on, and the meter reading is steady, the correct value is being displayed. With some input waveforms, eg, a short duty cycle square wave, the signal LED may not light, particularly at low frequencies. Sometimes the sensitivity of the input circuit will allow a steady reading without the signal LED being on. This means the input level is below the 20 mV threshold, but is probably still providing a correct indication. Noisy waveforms will produce erratic readings, in which case try switching in the filter. Frequencies above 150 kHz at low voltage levels may produce an apparent reading with both LEDs on. However, the reading will probably vary, and will totally disappear if the filter is switched to its first position.

If the input signal is modulated by a 50 Hz hum, anything is likely. The filter won't remove the hum, and conditioning of the signal may be required. This can be done by connecting a low value capacitor in series with the input, and replacing a resistor value of, say, 10 k across the input terminals. Very high voltage inputs are not recommended, although the input circuit can probably handle up to 240 v rms. Despite these restrictions, we guarantee this meter will be easier to use than many digital frequency counters currently available. ●



PARTS LIST

Resistors — all 1/4 watts 10 per cent unless otherwise specified.
— all values in ohms.

R_1, R_3, R_5, R_7, R_{27}, R_{28}, R_{31} 10k
R_2 .... 1M
R_4, R_9, R_{13}, R_{14}, R_{16}, R_{17}, R_{42} 1k
R_6 .... 1k2
R_8 680
R_{10}, R_{18}, R_{29} 2k2
R_{11} 3k3
R_{12} 150k
R_{15} 470k
R_{19} (with R_{20}) 2M2
R_{21} to R_{26} .... to calibration
R_{30} 1k5
R_{32}, R_{34} 15k
R_{33} 100k
R_{35} 4k7
R_{36}, R_{38} 68k
R_{37} 27k
R_{39} 100
R_{40} 3k9
R_{41} 470

Potentiometers
RV_1 .... 1k miniature trimpot

Capacitors – types not specified are 25V electolytics.
– all polyesters 100V unless otherwise specified.
– all values in uF, pcb mount.

C_1 .... 0.1 polyester, 630 volt
C_2, C_{11}, C_{13}, C_{14} .... 0.001 polyester
C_3 .... 0.01 polyester
C_4, C_{21} .... 0.1 polyester
C_5, C_7, C_8 100
C_6 47
C_0 .... 0.022 polyester
C_{10} 33
C_{12} .... 0.0015 polyester
C_{16} .... 1 mono
C_{16} 10
C_{17} 2.2
C_{18} 220
C_{19} .... 2.2 tantalum or mono
C_{20} 1000

Semiconductors
Q_1 .... FET type 2N5484
Q_2, Q_3, Q_5, Q_6 .... BC547B or similar
Q_4, Q_7 .... BC557 or similar
D_1-D_4 .... IN914 or similar
ZD_1, ZD_2 .... BZY88 C3V3 or similar Zener diode
ZD_3 .... see text
ZD_4 .... 7.5V, 400mW Zener diode
IC_1 .... 311 comparator, 8 pin DIL
IC_2, IC_3 .... uA555 timer
IC_4 .... uA7812, T0220 voltage regular
Bridge .... W04 or equiv
LED 1-2 .... to suit

Switches
S_1 .... 1 pole, 4 way wafer, or similar
S_2 .... 2 pole, 4 way wafer, or similar

Meter Movement
1ma dc, 100 or 200 ohm coil, 80mm x 80mm panel mount (or 100mm x 80mm)

Miscellaneous
PCB or vero board; Scotchcal front panel; aluminium case, (W x D x H) 152 x 132 x 103mm (see note below); transformer, 240:12.6 volt ac, (eg, type 2851); BNC panel mount socket, 2 control knobs; 4 pcb supports, rainbow cable hook-up wire, co-ax, 240 lead and plug; grommet; terminal block; cable clamb; lugs, mounting hardware for LEDs.

Note: The case size was based on the Dick Smith case, catalogue No H-2330. However, although this unit has the same dimensions, a recent discovery shows they are for D x W x H. The larger aluminium case, No H-2335 can be used if necessary, but the front panel design will need enlarging to suit.

APROXIMATE COST = $45

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Frequency Range: 10Hz to 100kHz
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TEACH YOURSELF

Inside Your Computer 10

BINARY, HEX, AND ALL THAT

Before you can delve into the mysterious world of machine code, you must first be initiated in the ways of binary and hex.

Phil Cohen

Computers would be a lot easier for most people to understand if experts didn't keep going on about binary.

Trying to teach people binary so that they can operate computers is like teaching people about free-radical chemical reactions before they learn how to drive a car. Radicals may be central to the way fuel burns, but that's rather beside the point when all you really need to know is where to put the petrol in!

You can quite happily write programs in any 3GL, 4GL or 5GL language (see last month's article for a description of these) without recourse to binary at all. It's only when you want to work at a lower level — with machine code — that binary becomes part of the required knowledge.

In an earlier part of this series I said that computers typically use a series of eight parallel wires to carry information, and that each of these wires was at either a 'high' or a 'low' voltage at any given time. It's traditonal to represent a 'high' voltage (usually 5 V) by a '1' and a 'low' voltage (usually 0 V) by '0', but never let yourself be confused by all those 1s and 0s: voltages are what it's all about at the end of the day.

To represent the state of the wires at any given time, you just string the 1s and 0s together. So if all eight wires are at 0 V, you can write that their states is 00000000. If they are all at 5 V, it's 11111111.

There are 256 possible states for a group of eight wires to be in: 00000000, 00000001, 00000010, 00000011, and so on, up to 11111111. In a computer, these 256 possibilities are normally allocated a number starting at 0:

00000000	0
00000001	1
00000010	2
11111110	254
11111111	255

(Notice that there are 256 possibilities, but if you include 0 you can only represent numbers up to 255).

Bits

Each of these 1s or 0s is called a 'bit' (Binary InTeger), and a group of eight is called a 'byte'. So one byte can represent a number from 0 to 255.

Programs that have to work with numbers only from 0 to 255 normally use one memory location to represent each number. More typically, programs that have to work with text use each location to hold one character.

So where does the 'binary number system' fit into all of this? Well, binary is nothing more than an easy way of converting between the patter of 1s and 0s and its equivalent 'decimal' (ie ordinary number) equivalent.

It works like this: taking a byte like 10001110, you allocate a value of 1 to the rightmost digit, 2 to the next left, 4 to the next left to that, and so on, doubling each time. An example will make this clearer:

The byte:

1 0 0 0 1 1 1 0

The value for each bit (doubles with each step to the left):

128 64 32 16 8 4 2 1

Collect the values that are 1 in the byte:

128 8 4 2

Add them together:

128 + 8 + 4 + 2 = 142

So the value that's associated with the byte 10001110 is 142. And that's all binary is about — converting between the pattern of voltages on the wires, and the decimal value associated with it.

Of course, it has to be possible to go the other way, too. To convert from decimal to binary (let's use 135 as an example), write the binary values out again:

128 64 32 16 8 4 2 1

Find the largest one that you can subtract from the decimal number, subtract it and find the remainder:

135 = 128 + 7

The find the next binary value you can subtract from the remainder:

135 = 128 + 4 + 3

And continue until you have nothing left as a remainder:

135 = 128 + 4 + 2 + 1

Now write the binary values out in their proper positions:

128 4 2 1

And put 1s where the binary values lie:

1 0 0 0 0 1 1 1

And there's your answer — 135 is the decimal equivalent of 10000111.

Hex

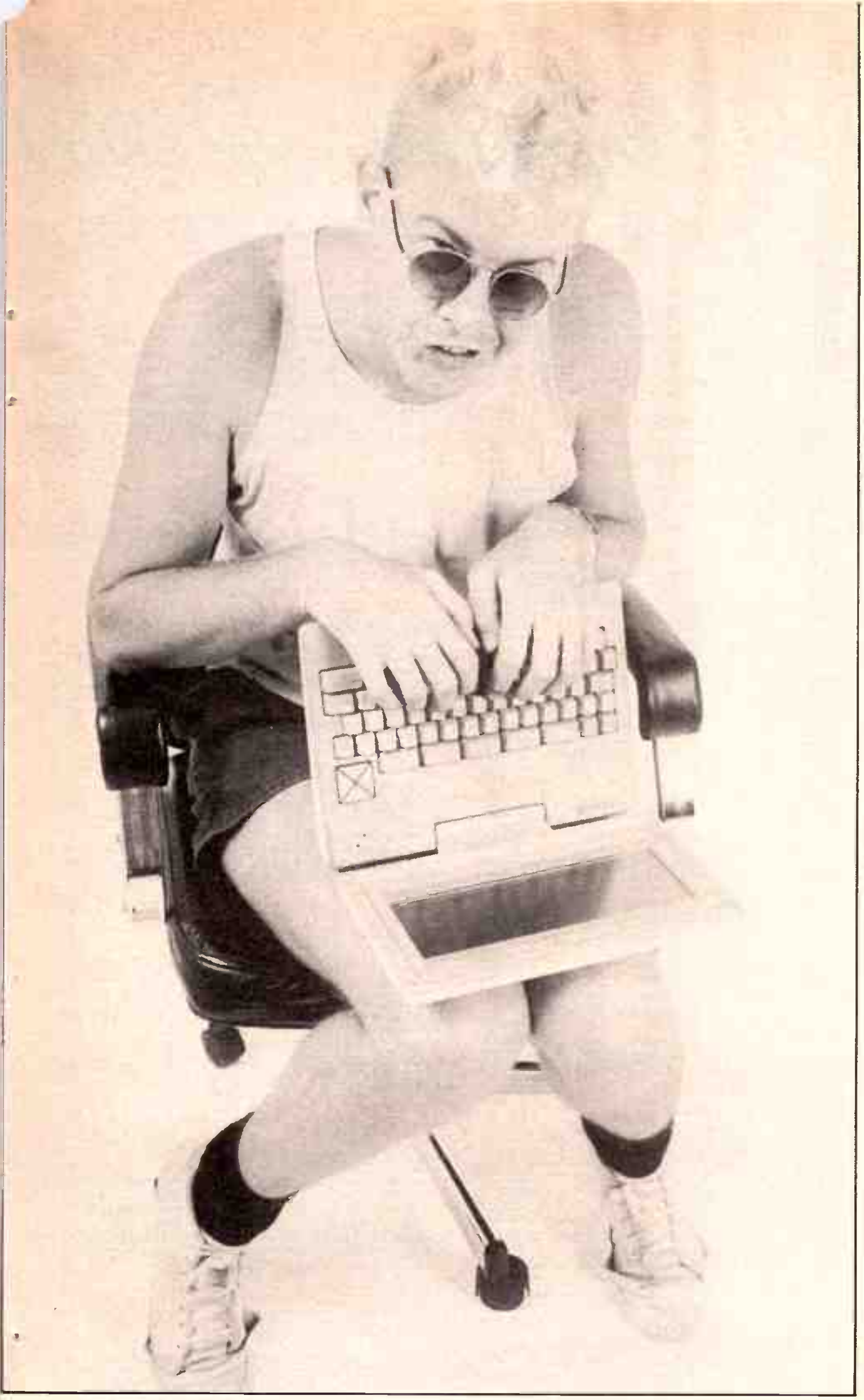
Because converting from decimal to binary and back again is such a fiddle, the hexadecimal system is often used. This has some of the advantages of decimal (you don't have to write a long string of 1s and 0s to represent the contents of a particular byte), but is a lot easier to convert to and from binary.

Hexadecimal is based around groups of four bits, like this:

Binary	Hex
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

To represent an eight-bit byte, you simply use two hex codes together, like this:

Binary	Hex
0000 0000	00
0000 0001	01



You don't have to be an expert to understand Binary.

0001 0000	10
0001 0001	11
1010 1110	AE

It's also possible to convert a hex code into decimal — you just give the right-hand hex code a value from 0 to 15:

Hex	Decimal
0	0
1	1
. . .	
8	8
9	9
A	10
B	11
C	12
D	13
E	14
F	15

And give the left-hand hex code a similar value, but *multiplied by 16*, like this:

Hex	Decimal
11	$1 \times 16 + 1 = 17$
AA	$10 \times 16 + 10 = 170$
B4	$11 \times 16 + 4 = 180$

Hex is used widely in machine code programming because it provides a neat and readable way of representing binary codes — which in turn, never forget, represents voltages on groups of wires.

Octal

An older system of representing binary values is the 'octal' system, which codes them three bits at a time (instead of four bits at a time, as in the hex system):

Binary	Octal
000	0
001	1
101	2
011	3
100	4
101	5
110	6
111	7

The byte 10110011 would be 263 in octal — if you can't see why, try converting the byte three bits at a time starting with the rightmost three. Hex is a much neater way of representing eight and 16 bit numbers. Octal is not widely used with microcomputers.

Glossary

Binary: A way of using voltages on wires to represent numbers.

Bit: What a single wire can represent in binary — either 1 or 0.

Byte: Eight bits.

Data lines: The wires that carry the contents of a particular byte of memory into or out of the memory hardware itself.

Decimal: The normal system we use every day to represent numbers.

Hex: Short for hexadecimal.

Hexadecimal: A way of representing the voltages on eight wires using two characters.

Machine code: The series of codes that a processor can use as instructions directly.

Octal: A system for representing the voltages on eight wires using three digits. ●

Back by Popular Dem

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Chapter 2 deals with linear analogue circuits and also covers the use and construction of a signal injector/tracer which can be used to locate and isolate the faulty areas in a project.
Chapter 3 considers ways of testing the more common components such as resistors, capacitors, op amps, diodes, transistors, SCRs, unijunctions, etc., with the aid of only a limited amount of test equipment.
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Sony Developments

Sony Australia recently announced two developments in the company's campaign to expand the Video 8 market. These are: the introduction of a second generation Handycam CCD-V30 and the provision of 8 mm pre-recorded software to Sony video 8 specialists Australia wide.

The V30 boasts a number of technical features such as full recording/playback capability, linear auto white balance, RGB colour filter and RGB colour processing. The image pickup utilises 291,000 pixels. In the creative department the machine has autofocus, 2.5x zoom lens with macro setting and very simple controls and operations. No doubt vast numbers of fabulously well paid 60 Minutes cameramen will begin their careers with this eminently portable device. The V30 will be sold at all Sony outlets in the country and is priced at $2,999.00.

Sony hopes that its development of pre-recorded Video 8 software will introduce a whole new viewing audience to the compact size and mobility of the new format. Video 8 products and the V30 Handycam can connect to any television set and Sony hope that this will make them especially attractive to holiday makers who feel the need of some video entertainment.

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Teac and the Family

Concerned about the seeming wave of domestic violence which is sweeping through Australia Teac have produced a portable colour TV with a built in video recorder. Teac is hopeful that this development will stop family arguments over TV viewing.

The new unit is scarcely bigger than a conventional 34 cm portable TV set, weighs a mere 16.4 kg and can be easily picked up, even by children, who will then presumably fight over it. As well as its small dimensions the Teac Televideo also features full timer recording, one-touch record, picture search and automatic rewind. It can be used for all VHF/UHF TV viewing. It will retail for around $1299.

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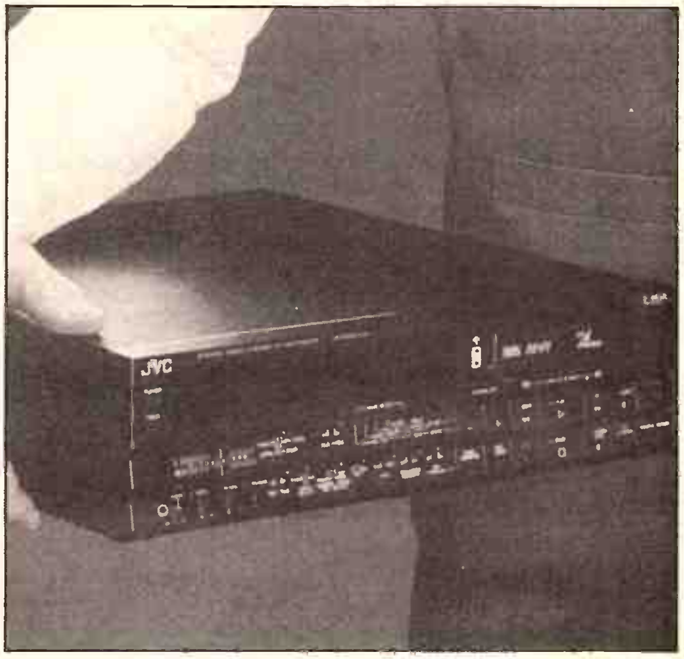
Visionary Video

The JVC company has just released the HR-D470UM video cassette recorder. JVC say that this machine is the "Video for Visionaries" and has been designed "to fit into your lifestyle". Amoung its features are an 181-channel cable-compatible tuner with MTS decoder, a double azimuth 4-head (DA-4) system for quality SP and a number of other interesting devices.

JVC states that its new unit is "incredibly compact" because the tape transport mechanism has been rotated 90 degrees so that the cassette is loaded endways.

109



Sanyo's Camcorder

In reply to the V30 just released by its rival Sony, Sanyo claims to have produced the 'State-of-the-Art' in this field. The new machine is the VM-800/P. Sanyo claims that this machine is unique in Australia as it is apparently the only 8 mm camcorder with a double azimuth 3-head system and to have both still and slow frame on playback. 110

Polaroid's Freeze Frame

Polaroid have just released a "new device" which it claims will freeze video images and deliver a choice of high quality instant colour prints or 35 mm slides.

The new unit is called the Polaroid Freezeframe Video Recorder, and has been designed jointly by Polaroid and Toshiba. The unit is intended to have as wide an application as possible and Polaroid claims that the unit requires no specific technical or photographic expertise on the part of the user. It retails for about $2800. 111

IN THE RING

Louis compares four new power amps and identifies the strengths, and weaknesses of each.

Louis Challis

There are four contestants in this review. In one corner stands the American contender, the relatively new Carver model M1.5t. This is the latest project of Bob Carver, one of America's (and undoubtedly the world's) most innovative electronic designers. This particular amplifier boasts a number of exciting features including the highest power output per cubic volume (or per weight) of the four, with peak power outputs of 625 watts into 8 ohms which places it more in a professional class than it does in the consumer field.

In the second corner stands the plucky Australian contender the 'ME Sound' Model ME75 amplifier which is the tried and proven brainchild of Peter Stein an Australian electronic designer who has rejected many of the older concepts relating to feedback and conventional amplifier design, in preference to his long held and almost 'avante garde' belief in the concept of minimising loop feedback.

In the third corner we have the Perreaux EXP1050 amplifier from the well known ' Shaky Isles' firm of Perreaux which, although not their best selling amplifier, is able to compete very favourably on the world markets. This is because the drop in the New Zealand dollar coupled with lower manufacturing costs, government support and a real marketing flair (which our Australian manufacturers would do well to emulate) they have carved out a very successful niche for their products.

Last but not least, in the fourth corner from Japan, we have the Technics SE-A5 Mk2. This amplifier combines some of the flashiest features of modern Japanese consumer electronic design with the pragmatism and feature loaded approaches which have tended to give the Japanese the lion's share of the international consumer electronics market.

Even though each of these amplifiers is intended to perform a nominally similar task, and is designed to provide at least 100 watts nominal output per channel, thereafter there are few similarities in terms of either their physical or electrical parameters.

Carver

The Carver M1.5t is the amplifier with the highest selling price (RRP $3,100) and the highest power output, particularly considering its small dimensions. The Carver amplifier's circuit design is based on a radically different set of principles to the staid and more conventional principles utilised in the other three amplifiers. It has been able to achieve lusty power outputs by directly avoiding the classical high energy storage and high capacity power supply system. Instead this amplifier utilises a new, and as it happens, a very effective means of powering the output stage with smaller, ligher circuit design concepts. Carver describes this system as a Magnetic Field Power Amplifier as it utilises solid state circuit principles which are in many respects analagous to the magnetic amplifier concepts which were in vogue in the mid to late '40s'. The 't model' designation of this particular amplifier indicates that it is the consumer oriented derivative of Bob Carver's highly successful commercial amplifier unit which has taken the US professional mobile music market by storm over the last two years. The market's approbation is primarily because of its extremely low weight and small size.

The frontal appearance of the Carver M1.5t is based on the same 'low key' visual statment that has been one of Bob Carver's hallmarks for the last 16 years. The front panel features a conventional 19 inch rack panel with sensibly rounded corners and two small handles which also provide front panel protection. The panel anotation has been executed in light grey silk screening that is far too muted to be readily legible except in good light. I also found that it was only legible if your eyesight is good. At the left hand corner is a small light emitting diode which indicates overload, over-temperature, over voltage, loudspeaker thermal limit, infrasonic fault, ultrasonic fault and warm-up in progress.

On the right hand side of the panel are two vertical rows of light emitting diodes (LED's) the bottom pair being continually illuminated, except under fault conditions, whilst the six LED's above light up at -20, -15, -10, -5 and 0dB relative to 350 watts (rated output). The top pair are only intended to illuminate when dynamic head room has been exhausted.

Loop Feedback

One of the most critical design aspects of the Carver amplifier has been his approach to the use of loop feedback around the amplifier circuit. Unlike most other circuit designers, Carver has now accepted the philosophy of Peter Stein and certainly acknowledges that "if you want maximum power output from a circuit, then you have to minimise your loop feedback as the two requirements are counter to one another". As a consequence of his approach, this amplifier avoids wasting monumental amounts of power in the feedback loop and directs that power to where it is really wanted, i.e: into the output terminals.

The inside of the Carver amplifier is

neatly designed and fabricated with the main output transistors mounted on a large heat sink assembly carefully located at the bottom of the amplifier. The heat sink configuration and its relationship to the folded and slotted bottom of the chasis is very unusual and very effective. The top of the cabinet is also neatly slotted above the line of the two primary vertical printed circuit boards which are located on each side of the main transistor heat sink arrays.

ME

The 'ME Sound' ME75 amplifier is the second derivitive of this series of amplifiers that I have reviewed. In 1984 (See ETI March, 1984) I reviewd one of the first models of the ME75 amplifier which, although although very good, exhibited a number of minor deficiencies which I highlighted in my review. In the ensuing years Peter Stein has significantly modified the basic design implementing a number of practical improvements. In 1984 the ME amplifier seemed expensive. Today with a somewhat deflated Australian dollar and equally depressing increase in the price of European, American and Japanese high fidelity equipment, the price of an ME75 amplifier looks far more attractive and competitive.

Peter Stein's design philosophy is based on the concept of utilising complementary symmetry output transistors, each of which is driven by its own ring emitter transistor with a circuit which is designed to achieve maximum possible overall linearity in terms of the transfer characteristics extending over the widest possible dynamic operating range.

By avoiding loop feedback, the maximum possible power output can be transferred to the output terminals and consequently this amplifier went against the trend of massive loop feedback only incorporting feedback within individual stages. This concept of course places unusual, and I believe more than somewhat restrictive, demands on the selection of the individual active components. Peter Stein's approach has been to buy copious quantities of transistors, each of which is individually tested so that each set of transistors utilised in his amplifier have carefully controlled matching sets of transistors to minimise differential loop gain problems. The associated passive components of 1% metal film resistors, .05% wire wound resistors and selected capacitors together with the minor semiconductors, all integrate to provide an unusual degree of customised circuit design. This approach, although expensive in terms of time and effort is regrettably essential, for without it, the fundamental design concept would just not work.

Peter Stein believes that this approach provides a superior sound in which the transient conditions are not dominated by the loop feedback as they are in other amplifiers. He and his adherants also believe that the resulting sound is more natural and less harsh or clinical. The second most important feature of the M E design is the use of 'soft clipping' so that even under overload conditions the nasty odd harmonies, which can cause so much damage to your loudspeaker, are reduced to the lowest possible level. The third feature is minimisation of dc current in the output circuit by a simple design approach which really appears to constitute part of the protection circuit. The fourth component is a separate protection system wich monitors sub-sonic or ultrasonic outputs, overdrive and other debilitating problems which so often lead ot the premature demise of your speakers or your amplifier. This is achieved by disconnecting the ac power supply.

These integrated features result in an amplifier which is capable of providing unusually stable output with both low values of load impedance, capacitive or inductive loads (of the type produced by Infinity, Apogee, Accustat, Phase Linear, AR or some Gale speakers). This amplifier quite happily works with these types of loads connected and does not complain or introduce current limiting into the output circuit as do the other three amplifiers.

Appearance

The appearance of the ME75 power amplifier is very similar to the unit which I reviewed in 1984. The most significant difference has been the rounding off of the sharp corners of the heat sink, so that you won't cut your hands. The front panel still has two lights, a red one for 'stand-by' and a green one for 'power on'. The back panel still features a pair of gold plated, well displaced RCA input sockets at either end of the panel and two pairs of large and very sensible binding posts for connecting a single set of output speakers. The amplifier has been designed to use the associated ME25 pre-amplifier so that remote control of the amplifier power ca be selected by a rear panel switch if desired.

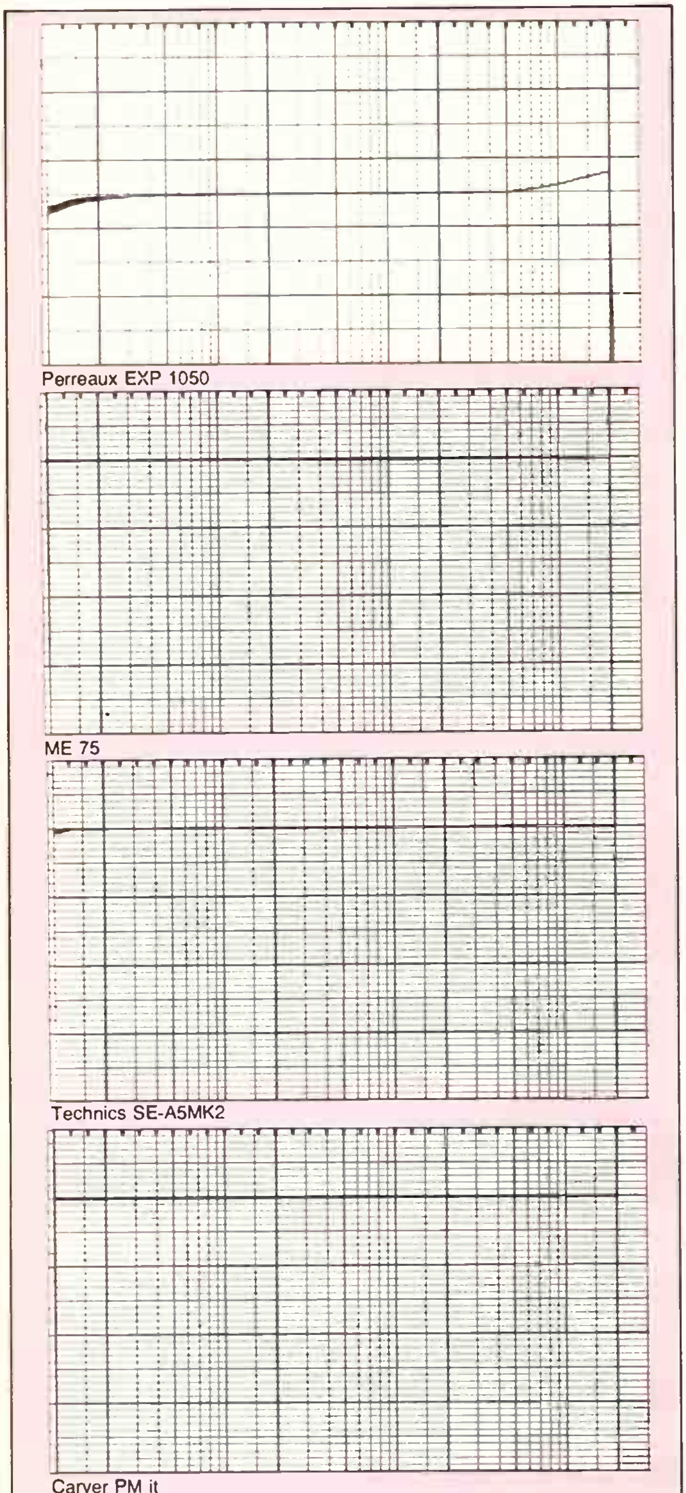
The amplifier's power supply is unusual in that Peter Stein has realised that the choice of electrolytic capacitors exerts a major influence on the power supplies transient performance and ultimately how the amplifier sounds. Peter Stein utilises 24 off 4700 microfarad capicitors mounted on two separate printed circuit boards to achieve lower self-inductances and better transient performance. These are combined with a large double 'C' core transformer centrally located at the back of the chassis. The circuit design, the wiring harnesses and the forms of construction that are used are reminiscent of the best radio transmitter design concepts which I learnt in the late '50s'. Equally important the re- ▶

tail price now appears to be right and the technical performance has been further improved.

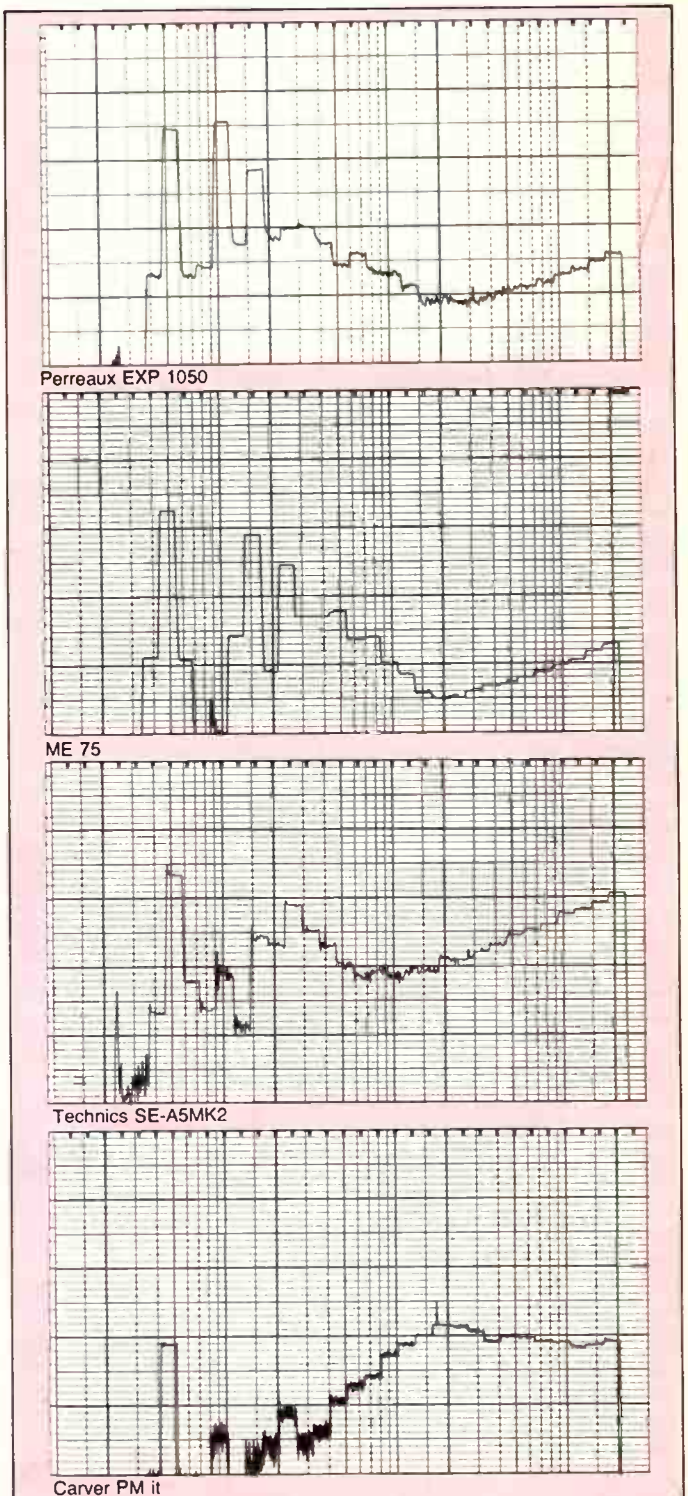
Eurovox

The Eurovox by Perreaux EXP1050 is one of the tried and proven Perreaux designs which was developed primarily for the American market. It features a brushed satin aluminium front panel with clearly legible maroon and dark grey lettering. The 'Power On-Off Switch', shrouded red bezel light and a pair of switches for selecting A or B speaker systems are positioned on the left hand side of the panel. The headphone socket is located on the right. The rear panel features two pairs of colour coded red and black gold flashed speaker sockets laid out across the bottom of the panel, a pair of gold flashed RCA coaxial input sockets and various warnings in relationship to fuses, electric shock and ventilation which I suspect were also developed for the American market.

The Perreaux amplifier circuit design appears to be quite conventional with a large impregnated mains transformer lo-



Frequency Response (dB vs Hertz)



Hum and Noise: one third band analysis re 1 watt into 8 ohms.

cated immediately behind the front panel. The output stage uses two large heat sinks with complementary symmetry transistors which have been placed in the middle of the amplifier. At the rear of the chassis, two large 1000 μF capacitors are mounted on a printed circuit board and a relativly small number of pre-driver transistors are mounted on the same board together with protective fuses and other minor components.

The Perreaux amplifier is well made and solidly assembled. Of all the amplifiers, this unit contained the least number of active components and by and large appeared to be the simplest in terms of electronic design and mechanical components. It offers sensible practical performance at a competitive price.

Technics SE-A5 Mark 2

The Technics SE-A5 Mark 2 is physically the largest of the four amplifiers and embodies many of the best and latest Japanese design features in terms of visual impact or functional ergonomics. The front panel in particular features 2 large rear illuminated peak output level or power meters, which span the full width of the panel. Both of these meters are calibrated in terms of dB from -60 to +5 as well as in terms of power in watts into an 8 ohms load. The power scale covers the range 0.001 watt to 300 watts. The lower section of the front panel features a 'POWER On-Off' switch, a headphone socket, 4 speaker switches with one being an OFF position, MAIN, REMOTE and MAIN AND REMOTE. A matching set of 5 light emitting diodes are incorporated in the lower section of the meter movement bezel to indicate power ON, SAFETY OPERATION (malfunction), MAIN REMOTE and MAIN AND REMOTE loudspeakers and the last on the right hand side being COMPUTER DRIVE (auto class A).

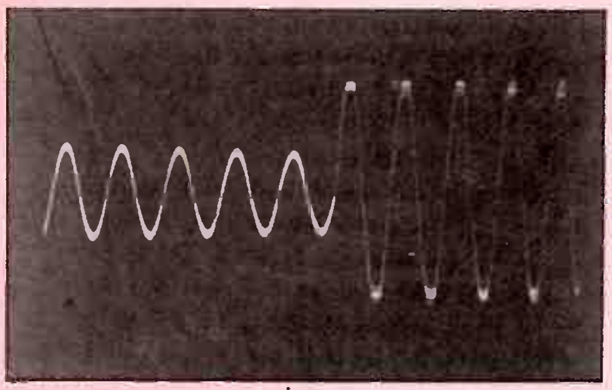
The rear panel features 4 large feet to protect the wiring and terminals for those cases where the amplifier is stacked on its end. The inputs are provided with 2 gold flashed RCA coaxial sockets and these are controlled by 2 separate volume controls for left and right channel inputs. Output connections are provided with 4 pairs of very large and extremely well designed screw terminal blocks which have been designed for accepting bare wires or spade lugs. I consider these terminals are just about the best connectors that I have yet seen on any amplifier of this type.

The inside of the amplifier is exceedingly well executed with the minimum amount of separate wiring or harnesses and a fully encapsulated transformer on one side.

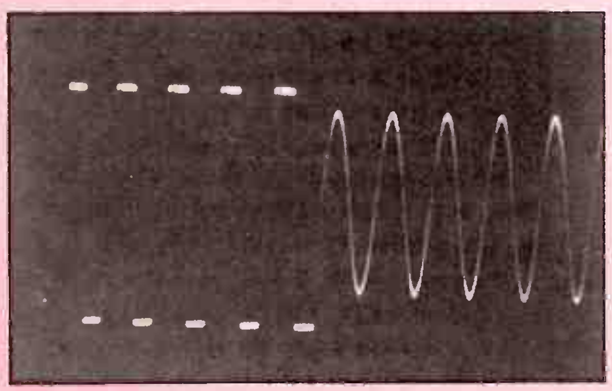
Unlike the other units, it utilises phenolic boards which are clearly labelled. They are mounted between the two vertical main heat sinks with a cleverly designed thermal dissipation circuit for the four complementary symmetry output transistors. The output are terminals are connected internally to an unusual form of printed circuit board inter-connection system which is itself then connected by short runs of insulated wiring to a group of wire wrapped terminals on the main printed circuit board. This seems a somewhat complex way of making the connections and the reasons underlying this approach are not immediately clear. The unit incorporates a very effective and unusually large protective circuit board.

Comparing

The frequency response at each of the 4 amplifiers was essentially 'ruler flat' over the frequency range 10 Hz to 10 kHz with the Perreaux amplifier alone exhibiting a rising frequency response peaking by only +1 d B at 36 kHz and smoothly dropping back thereafter. In practical terms the frequency responses of all 4 amplifiers were exemplary, as good as one could ask for in the home environment.



Carver PM it



ME 75

Transient Recovery (oscilloscope set at 1mV div)

The power output provided by each of the amplifiers was undoubtedly the major difference. One could almost directly relate the peak power output to the price.

Thus by reference to the maximum power output into 8 ohms (measured in accorance with the IHF-A-202 procedure), the dollars per watt for the Carver amplifier is approximately $5, for the ME75 is $13.8, for the Perreaux EXP1050 is $5.4 and for the Technics SE-A5 Mk2 $8.2. The above figures however, tend to be a little confusing for a variety of other factors. The first of these is the significant difference in terms of each of the amplifier's ability to provide the power output on a continuous basis, as well as their ability to effectively produce power into lower impedances, i.e., 4 ohms and most particularly 2 ohms (see box).

The signal to noise characteristics of each of the amplifiers revealed a wider variation than I would have expected. The lowest performance was still quite acceptable and was provided by the Carver.

The lowest distortion figures were provided by the Perreaux amplifier. It produced distortion components that are literally parts per million.

Distortion components

The Technics produces distortion components that are one order of magnitude higher and surprisingly higher than I would have expected at low power levels for the draft IEC test procedure. Both the Perreaux and Technics amplifiers incorporate copious quantities of negative feedback around the loop and thereby reduce their steady state distortion components to very low levels.

By contrast the ME75 amplifier has distortion components that are typically one order of magnitude higher than that provided by the Technics. The Carver has distortion components that are generaly comparable in terms of the IEC high frequency distortion figures.

Subjective Testing

When it came to subjective evaluation of these amplifiers I decided to utilise a range of four different speakers including my normal B and W 80 F. reference speakers, a pair of Fisher Type ST550 monintor speakers (which will safely handle peak signals in excess of 600 watts and produce ear shattering sound levels), an exciting new pair of Gale Model GS402 speakers which offer a wide dynamic range as well as low impedance characteristics, and last but not least, a pair of Richter Oracles. In each case I used a preamplifier from the same manufacturer as the power amp.

All of the amplifiers have the ability to produce adequate power output for almost any domestic situation, provided the speakers have reasonable sensitivity. It is only at the highest power levels, and thus at the highest sound pressure levels, that one becomes directly aware of the most significant difference between each of these four amplifiers. In terms of power into 8 ohms, the Carver M1.5t wins hands down, whilst in terms of power into low impedances or into tricky impedances, it was clear that the ME75 has the competition sewn up. Audible distortion, as such, does not appear to be a significant factor, although both the Carver Mi.5t and the ME75 do appear to sound different to both one another, as well as to the other two amplifiers. In this respect the Me75 does appear to have a slightly more mellow sound, the Carver M1.5t has an ever so slightly harsher sound, whilst the Perreaux and Technics appeared to exhibit what I can only describe as a somewhat more 'clinical' sound.

Ranking

If I was asked to provide a ranking for each of these amplifiers in terms of both objective and subjective characteristics, the following would appear to be most appropriate.

The first in terms of (lowest) price is undoubtedly the Perreaux which is half the price of the next ranking amplifier. The first in terms of absolute power and dollars per watt is unquestsionably the Carver M1.5t. The pre-eminent amplifier in terms of its ability to handle nasty speaker impedances or in terms of its ability to drive very low impedance is unquestionably the Me75. This amplifier also produces an audible performance on both normal programme content as well as under overload conditions which I found particularly pleasing. The most attractive and functional of the amplifiers, which also appeared to provide the most 'clinical' sound was the Technics SE-A5 Mk2.

As you can see everybody 'got a guernsey' because each one of these amplifiers has a specific set of attributes which are likely to attract potential buyers. Provided you have purchased your amplifier for the right reasons, whichever amplifier you end up buying, I feel sure you will be happy with the choice. ●

	Carver M1.5	M & E Sound ME75	Perreaux EXP1050	Technics SE-A5/II
Price	$3,100	$1,750	$919	$1,859
Nominal Rating Max O/P Power Watts	350W	120W	100W	150W
8 ohms	450W	127W	169W	225W
4 ohms	600W	225W	294W	406W
2 ohms	Shuts down	361W	245W	Shuts down
Max Power - 8 ohms IHF-A-202 Test	625W	127W	169W	225W
Frequency Response ± 3dB	3Hz-128kHz	0-210kHz	2.5Hz-180kHz	1.5Hz-156kHz
S/N dB(A) re/watt	82dB(A)	96dB(A)	104dB(A)	96dB(A)
	81.5dB(Lin)	85dB(Lin)	91dB(Lin)	91dB(Lin)
Sensititity for watt/8 ohms	132mV	110mV	138mV	80mV
IEC High Freq. Distortion @ rated power	0.1%	0.19%	0.013%	0.03%
THD @ rated power 100Hz	0.39%	0.15%	0.0016%	0.011%
1kHz	0.34%	0.13%	0.001%	0.011%
6.3kHz	0.49%	0.33%	0.0015%	0.01%
O/P impedance milli ohms	22	164	31	85
Channel separation kHz	-37dB	-91dB	-90dB	-66dB
Dimensions Width	480mm	437mm	430mm	430mm
Depth	273mm	410mm	340mm	416mm
Height	90mm	120mm	100mm	178mm
Weight	9.8kg	15.5kg	12kg	18.4kg

REVIEW

THE END OF FINGER FLEXING: THE OMNIREADER IS HERE

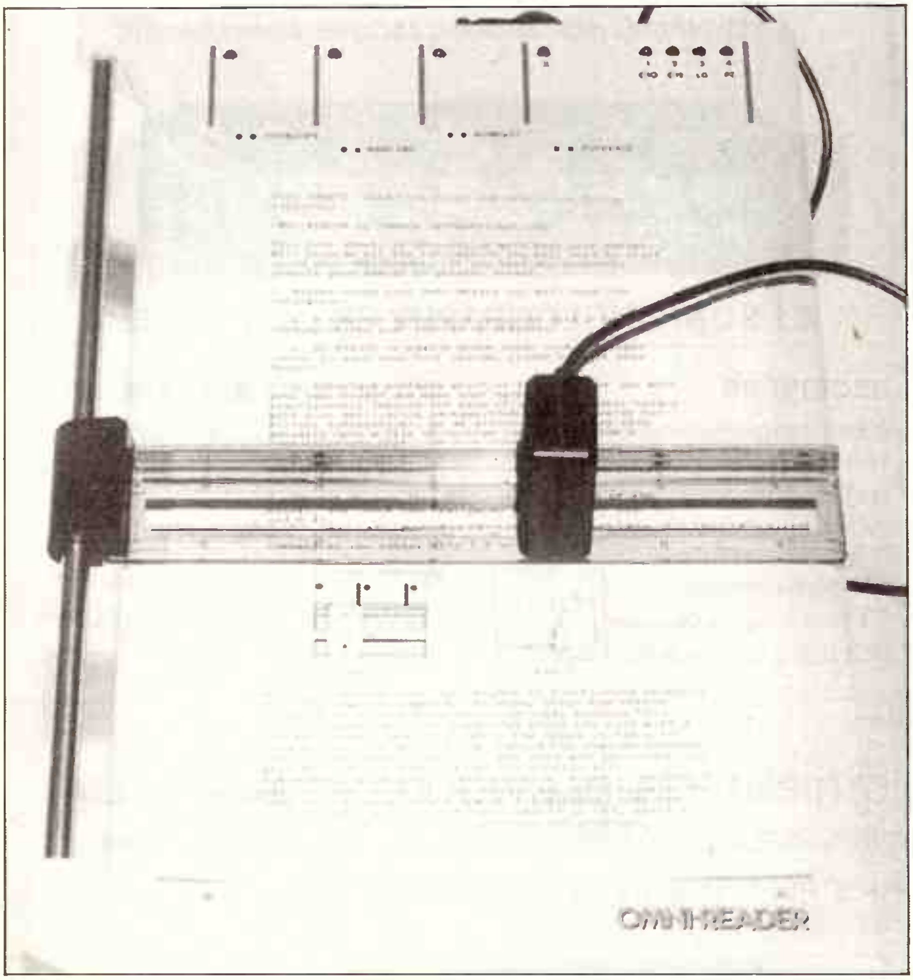
Sick and tired of entering data from the keyboard? This device will take the tedium out of it; if you can make it work.

Jon Fairall

The interface between the user and the computer is still one of the biggest problems in computer technology. No matter how efficiently the computer can massage data once its in the machine, entering it is still a tedious, boring, error prone operation.

There have been a number of attempts at solving the problem. Apple invented the mouse; other variations on the theme exist like the trackball. Digital tablets, light pens, even touch screens, have all being marginally successful attempts to make the interface more ergonomically satisfactory. But none of these directly addresses the problem of entering text.

Over the last few years, optical character readers (OCRs) have begun to appear on an experimental basis, and now the first commercial machines are starting to creep onto the market. Mostly they have been expensive, hard to interface to any other machines and not particularly efficient. Melbourne company, Audio Engineers, however, has lately been promoting a device called the Omnireader OR 1, claimed to be the world's first cheap, effective practical text reader. It's made by Oberon International in the UK, and was released there in late 1985.



The Omnireader consists of a solid base marginally bigger than an A4 sheet of paper. On the base is a ruler designed to fold down over a sheet of paper, and a small reading head that the operator pulls along it. To input data into the computer, the operator pushes a button and pulls the head across the text. The button operates a light in the head which illuminates the text. The patterns revealed under the light are matched against patterns held in ROM, and thus letters identified. Data from the receive head is converted into ASCII characters, and sent to the computer via an RS232 serial port.

The Omnireader contains four different types of letter shapes (founts) in its memory. These cover some of the more common types of typewritten characters. It is possible to download new founts to the machine, which increases its potential. It also has the ability to read either large or small type.

To start the Omnireader, it's necessary to run some software provided on a disk with the system. This contains drivers for Wordstar, Word Perfect, Lotus 1-2-3, PFS and dBASE. It's also possible to make your own driver so that you can customize the system to work with whatever software you have. After you run the Omnireader disk and the program disk that carries the specific application program you want to use, the Omnireader may be used as a direct substitute for the keyboard, and data read from the printed page directly into the program.

For the purposes of this review, I set up the Omnireader using Wordstar on a 'PC clone'. One opens a file in the normal manner, and then proceeds to enter text. I can make this statement only after I spent the obligatory half hour working out how to make the two devices talk to one another. Since the Omnireader looks just like a modem to the computer, it's not really all that difficult. The manual is quite clear and relatively simple to follow.

So, how well does it work? A first cautious answer is that there is definitely a knack to using it properly. Theoretically, the speed at which the head sends the letters makes no difference to the accuracy of the machine. A 'clock' is provided by a narrow row of black and white strips in the window of the ruler which is supposed to ensure that data is sent to the computer with the correct spacing. Nevertheless, it's instant death to stop once you've started a line. One can also defeat the clocking mechanism by going too slow or too fast. If you fly across the page, the machine will give a long and irritating beep.

Another thing that gives the neophyte user trouble is the placement of the ruler relative to the lines of text. It's not so bad if you lay the ruler down too high, because the machine seems able to ignore the tails of the letters hanging down from the top. However, if you place it too low, so that the top of the next line is visible in the window, the machine frequently refuses to read.

> *"... the Omnireader may be used as a direct substitute for the keyboard and data read from the printed page directly into the program."*

However, after I'd been using it for a while, these difficulties seemed to disappear somewhat, and I became conscious of other features. The Omnireader uses audio cues to tell the operator when a mistake has been made. Every time it makes a mistake, it beeps at you. If it does a successful read, it beeps twice. After a while it is unnecessary to look at the screen to confirm a good or bad read. One is inclined to just listen to the beeps, which is a great advantage when concentrating on the paper and the tablet rather than the computer screen.

I was distinctly unimpressed by the mechnical feel of the read head, which is rather flimsy when it's mounted in the ruler. There also seems to be a problem with the switch. On the model we had for review it malfunctioned frequently. It looks and feels as if a bit of experience in the world of hard knocks would change its geometry just a tad.

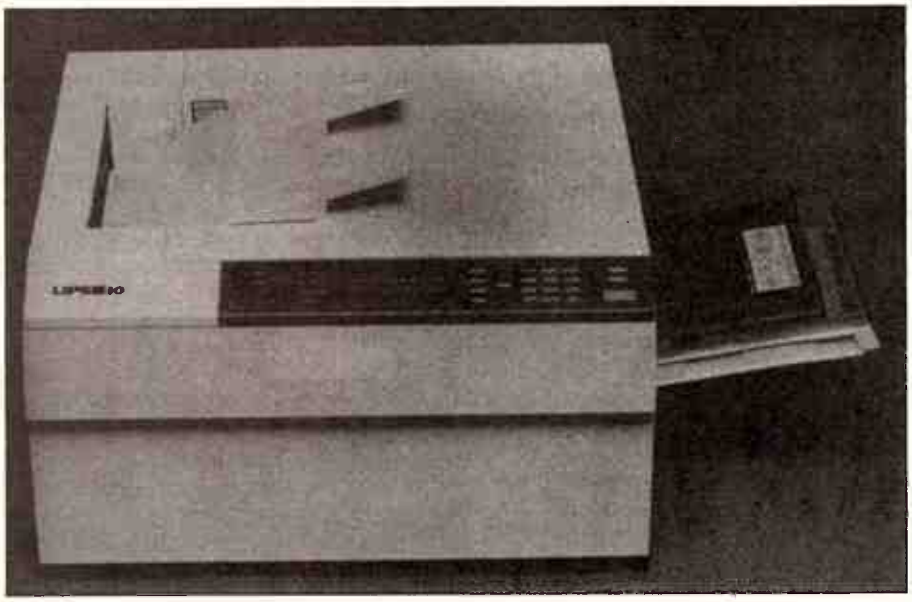
Should you buy one? At $1099 retail price, it's not outrageously expensive, so it's worth thinking about if you have a bit of keyboarding to do. I suspect that in a practical situation it would be a blessing. Perfect accuracy would be great, but it's not mandatory. If you get 95 per cent of the text into the computer in correct form, it's no difficult matter to go through on the word processor and tidy it up. ●

REVIEW

C-ITOH LASER PRINTER

Hot LIPS from C-Itoh, setting Anitech alight

Jon Fairall



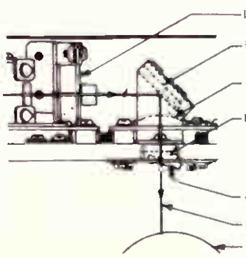
The concept of Laser printing has been around since the late 1960's, when IBM demonstrated the very first model. However, its only been in the last few years that laser printers have come down in price to such an extent that they are now available to the average small business user. With prices still in thousands rather than the hundreds of dollars however, it will be a while before they are common equipment in the domestic environment.

In the nature of the case, as soon as the technology becomes available, one manufacturer after another delivers their product, and we go from famine to glut in weeks. The latest entrant into an already crowded marketplace is C-Itoh. It was imported by Anitech, a little while ago as the LIPS 10.

There are a number of considerations that set a laser printer apart from the run of the mill daisywheels and dot matrix type machines. Obviously, first and foremost is the print quality. However, the software required to drive the system is just as worthy of consideration. This is because, unlike conventional printers, a laser printer is capable of an incredible number of graphics tricks. Another set of considerations applies to the mechanics of the system. Like photo copiers, they have complex feed paths which limits both the speed with which they can deliver pages and their propensity to jam paper. Further considerations involve the amount of noise emitted during printing and of course the physical size of the box. In terms of the ordinary work office, neither of these factors is insignificant.

Mechanics

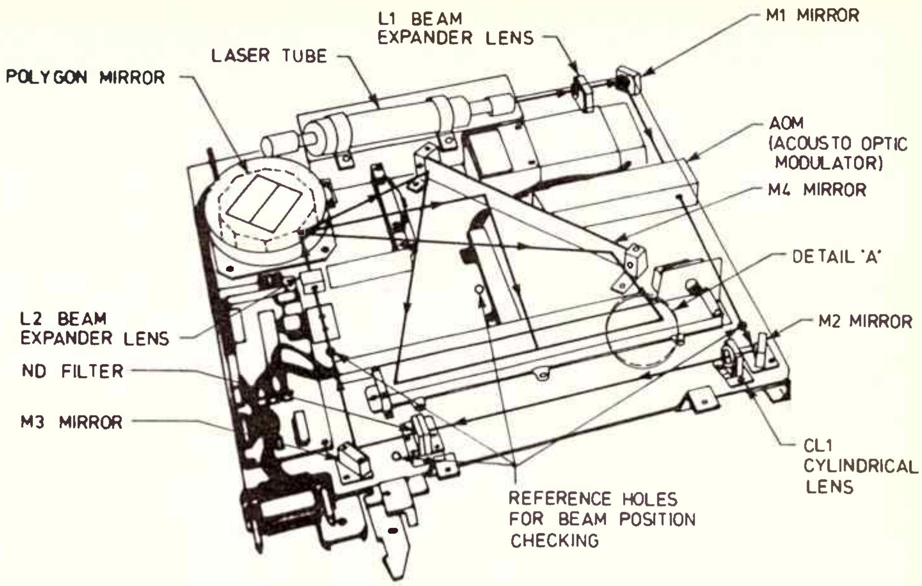
The cornerstone of the LIPS 10 is a laser working at ultraviolet wavelengths (632 nm). An electrostatic system is used to create an image on the paper, using exactly the same principles as are used in a photocopier. A drum is coated with an organic photo conductor. This has the characteristic that it will store a charge until illuminated by light. In the LIPS 10 the drum is charged up to −5 kV evenly over its whole surface. When illuminated by the laser, the potential is reduced to close to zero volts. Then a postively charged toner is applied to the drum. The toner is a powdery substance which adheres to the areas with strong negative charge, and falls off the areas with no charge. In this way the latent electrostatic image becomes visible. Then the image is transferred to the paper, once again using an electrostatic process. A very strong negative charge, greater than the original 5 kV, is applied behind the paper. This draws the toner of the drum onto the paper. Finally, the paper is heated and then squeezed between two rollers, resulting in a good bond between the toner and the paper.



When you open up the machine, the impression is of millions of rollers, cogs and drivers, all adding up to an immensely complex system. In fact, it has all been designed to keep the paper as flat as possible, presumably with the idea of minimizing paper jams and other supply problems. It seems to work; during the time it was in our office it didn't jam once, while our venerable photocopier spent most of its time digesting next months copy. This is in spite of the fact that the LIPS 10 can deliver 10 pages a minute. From a mechanical point of view, its quite an achievement.

Print quality

The most important part of this whole process is the control of the laser itself. It is the laser that marks the paper, so the accuracy with which it can be pointed determines the way the page looks. The laser is sited at the back of the machine, and the beam is bounced round the periphery of the box by mirrors while it is passed through expander lenses to make the dot big enough to be seen. On the way, the beam is passed through an optical modulator. This is a crystal of Lead Molybdate which has the property that its refractive index, ie, the amount it bends light as it passes through, changes when



the crystal is hit by acoustic energy. In this way its possible to deflect the beam out of the optical path so that it doesn't fall on the paper. After the modulator the beam hits a multi-sided polygon mirror spinning at 4500 rpm. The affect of the rotation of this mirror is to scan the beam across the width of the paper. Because the beam is modulated, the effect is of a series of dots, across the page. At the same time the paper is being pulled through the print mechanism so a raster scan pattern is generated, just as in TV transmissions. The definition turns out to be about 12x12 dots to the millimetre, while its possible to control the position of the dots to $^1/_{32}$ of this, ie, 2.6 microns.

The effect of this density is that the dot matrix pattern clearly visible on impact printers is no longer visible, and the dots appear to flow into one another. Because of the way it works, the LIPS 10 is capable of an infinity of character shapes, or fonts. Indeed, its capable of an infinity of graphics characters of all sorts, all nicely rounded with no dot matrix visible at all. The quality would be photographic but for the fact that only two tones are visible.

Software

However, to unlock all the secrets of the LIPS 10, there is no substitute for controlling it via it's own software language. You can operate the LIPS 10 as easily as any other printer via a centronix or RS232 port, and it will respond to most of the standard printer commands for underlining, bold font and so on. Indeed, setting it up to take the standard commands and do the normal tasks is simplicity itself, since there is a little control interface on the front panel that allows you to set up all the important parameters for designing the page, such as margins, fonts and so on.

However, if this is all you want you would be silly to buy a laser printer. The front panel gives you no more features than a conventional machine. It's the programming language that comes with the machine that allows you access to all the graphics power of the printer. It works by including print commands in an ordinary text file. You being programming with a (0| symbol, and finish with EXIT; everything between these two lines is interpreted as a printer command and not committed to paper.

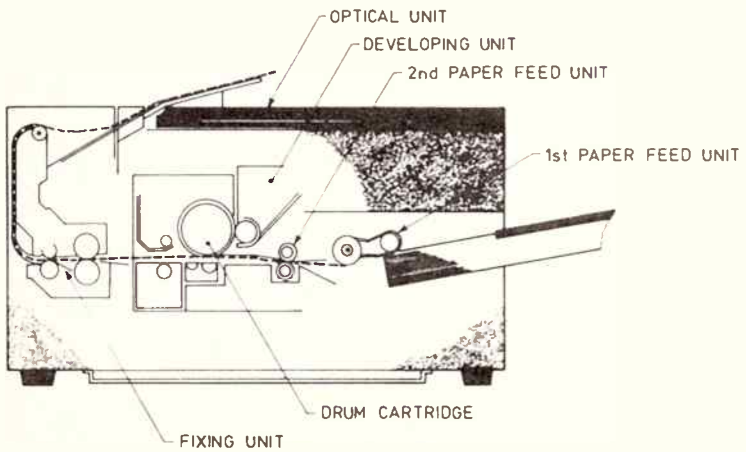
The LIPS programming language has about 50 commands in it. There are commands to move the cursor, draw lines, circles, squares, arcs, pie charts, and barcodes, and for each of these, three or four ways of defining position. There are commands for changing the paper size, the margin size, the area filled by text and so on. A special set of commands allows the creation of fonts, i.e: special sets of alphanumeric characters, and macros, which are graphic characters defined by a special name. Both fonts and macros are made up on a bit mapped basis, so that you must define whether each individual dot in a grid should be on or off.

User friendly

There is no doubt that used properly, the LIPS 10 would allow one to turn out pages of exceptional quality. The problem I have with it is in imagining who the machine is for, rather than what it will do. As I said at the beginning, these machines are not cheap. The LIPS 10 sells for \$10,000 or so, so it is well out of the price range of the average computer enthusiast. If it has a market, it would be in the small business environment. But then, who will operate it? Certainly not the secretary, whos is probably still busy learning to handle a word processor. If a special programmer is required every time a new printing job is required, much of the time saving value of the device will disappear.

In this area, C-Itoh is very much its own worst enemy. The manual is short, succinct, and almost totally incomprehensible. You may deduce from this that it took me a couple of days to figure it all out, and much of the time was spent, as with any new computer system, cursing because commands just didn't seem to work the way they were supposed to. Just setting up the printer so that it responds to the correct paper length turns out to be a problem. I can't imagine anyone not well versed in computers putting up with it.

ANItech seems to recognise that they have a problem here. They are planning a face-to-face instruction course as part of the purchase price, in which they will spend a day or two with operators. It's reassuring to know that this is the case, but I can't help feeling that in this day and age office equipment ought to be designed to be so simple that people can operate it first time out. ●



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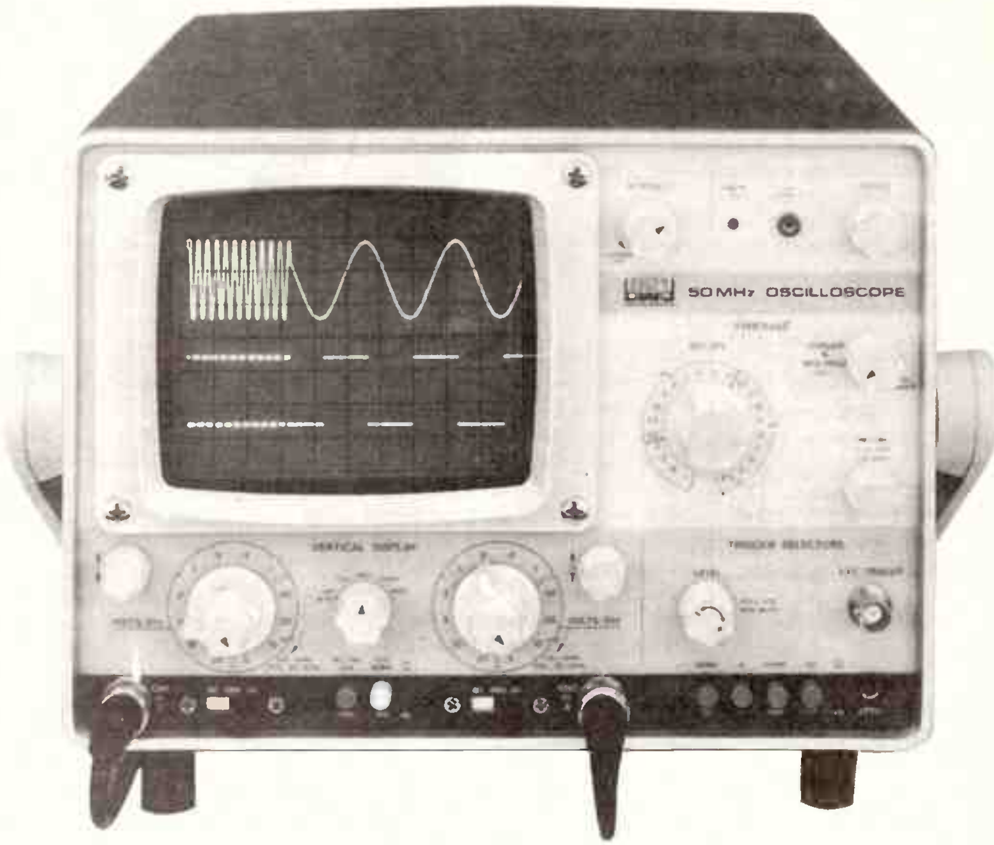

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THE eti CRO BUYER'S GUIDE

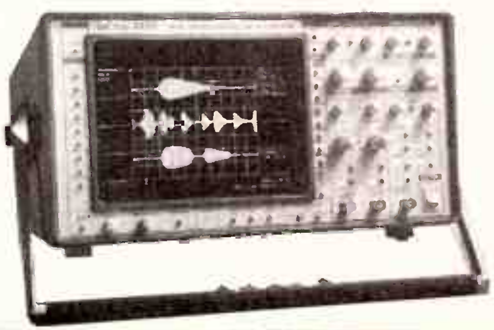
For anyone remotely interested in buying a CRO we offer one of most comprehensive guides ever published in any magazine.

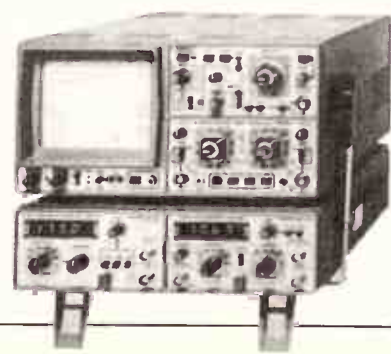
BRAND	MODEL	PRICE EX-TAX	BANDWIDTH	CHANNELS	BEAMS	TRACES	CHOP	SIGNAL PATH	CONTROL	CURSOR	SCREEN DISPLAY	TIMEBASE	DELAY	SINGLE SHOT	SENSITIVITY V-mV	RISE TIME ns	ZIN ohms/pf	STORAGE	BATTERY OPERATIN	SIZE mm	WEIGHT kG	WARRANTY MONTHS	DISTRIBUTOR
LECROY	9400	17000	200	2	1	4	N	D	D	Y	Y	100-.002		Y	1-5000	10	1/20	D	N	192x365x465	15	12	ETP OXFORD
MEGURO	MO1255		100	3	1	8	Y	A	A	N	N	.5-.02	Y	Y	5-500	3.5	1/22	N	N	294X152X390	7.8	12	ELMEASCO
AARON	BS601		20	2	1	2	Y	A	A	N	N	.5-.02	N	N	20-500	17	1/20	N	N	162X294X352	7	12	ELMEASCO
AARON	BS3105		15	2	1	2	Y	A	A	N	N	.5-.5	N	N	10-200	24	1/20	N	Y	113X223X298	4.5	12	ELMEASCO
AARON	BS650		50	2	1	2	Y	A	A	N	N	.5-.2	Y	Y	.5-100	7.7	1/20	N	N	145X280X422	9.8	12	ELMEASCO
TOPWARD	7020		20	2	1	2	N	A	A	N	N	.5-.2	N	N	5-500	17.5	1/25	N	N	314X165X425	7.1	12	ELMEASCO
TOPWOOD	7021		20	3	1	3	Y	A	A	N	N	.5-.2	N	Y	.5-500	17.5	1/25	N	N	314X165X425	7.1	12	ELMEASCO
TOPWOOD	7022		20	3	1	3	Y	A	A	N	N	.5-.2	Y	Y	5-500	17.5	1/25	N	N	314X165X425	7.1	12	ELMEASCO
TOPWOOD	7023		20	3	1	3	Y	A	A	N	N	.2-.5	Y	Y	5-500	17.5	1/25	N	N	314X165X425	7.1	12	ELMEASCO
TOPWOOD	7040		40	2	1	2	N	N	A	N	N	.5-.2	N	N	.5-500	8.8	1/25	N	N	314X165X425	7.5	12	ELMEASCO
TOPWOOD	7041		40	3	1	3	Y	A	A	N	N	.5-.2	N	Y	5-500	8.8	1/25	N	N	314X165X425	7.5	12	ELMEASCO
TOPWOOD	7042		40	3	1	3	Y	A	A	N	N	.5-.2	Y	Y	5-500	8.8	1/25	N	N	314X165X425	7.5	12	ELMEASCO
GOULD	1604		20	4		4		D	D	Y	Y	200-.2	Y	Y	10-200		1/30	A	N	401X155X425	8	12	ELMEASCO
GOULD	4072		100	2		8		D	D	Y	Y	20-.02	Y	Y	5-200		1/20	D	N	437X208X505	11.4	12	ELMEASCO
GOULD	4074		100	4		8		D	D	Y	Y	20-.2	Y	Y	5-200		1/20	D	N	437X208X505	11.4	12	ELMEASCO
GOULD	1421		20	2	1	2	Y	D	A	N	N	.2-.5		Y	10-200		1/28	D	N	305X134X460	6	12	ELMEASCO
GOULD	1425		20	2	1	2	Y		D	Y	Y	.2-.5		Y	10-200		1/28	D	N	305X134X469	6	12	ELMEASCO
GOULD	4050		35	2	1	3		D	D	Y	Y	.5-.02	Y	Y	5-500		1/28	D	N	360X185X520	17.3	12	ELMEASCO
ELMEASCO	S1-94	299	10	1	1	1	N	A	A	N	N	.05-.1	N	N	5-100		1/40	N	N	100X190X300	3.5	12	ELMEASCO
PARAMETERS	615S	998	15	2	1	2	Y	A	A	N	N	.5-.5	N	N	10-2000	24	1/20	N	Y	113X223X298	4.5	12	PARAMETERS
PARAMETERS	5502	795	20	2	1	2	Y	A	A	N	N	.5-.2	N	Y	5-1000	17.5	1/25	N	N	356X147X485	8	12	PARAMETERS
BWD	830	1575	35	2	1	2	Y	A	A	N	N	5-.2	Y	Y	5-1000	10	1/30	N	Y	290X197X570	6	12	PARAMETERS
BWD	835	1890	60	2	1	4	Y	A	A	N	N	1-.005	Y		5-2000	5.8	1/30	N	Y	290X197X570	7.3	12	PARAMETERS
BWD	824	900	35	2	1	2	Y	A	A	N	N	2.5-.2	N	N	20-2000	10	1/20	N	N	250X200X380	7.8	12	PARAMETERS
BWD	845	4500	30	2	1	2	Y	A	A	N	N	5-.1	Y	Y	20-1000	10	1/30	A	Y	175X345X470	9.5	12	PARAMETERS
B&K	2520	3349	20	2	1	2	N		D	N	N	50-.5	N	N	25-2000		.1/10	D	N	140X305X460	6	12	PARAMETERS
BWD	881	4200	25	5	1	4	Y	A	A	N	N	5-.2	N	Y			1/7.5	N	Y	395X180X470	9.4	12	PARAMETERS
BWD	821	1200	50	2	1	2	Y	A	A	N	N	2.5-.2	N	N	50-1000	7	1/30	N	N	250X197X570	7.8	12	PARAMETERS
PARAMETERS	5504	1258	40	2	1	4	Y	A	A	N	N	.5-.2	Y	Y	5-1000	8.8	1/25	N	N	356X147X435	9	12	PARAMETERS
TEKTRONIX	466		100	2	1	4	Y	A	A	N	N	.5-.005	Y	Y	5-5000	3.5	1/20	A	N	330X154X550	11.8	12	TEKTRONIX
TEKTRONIX	11402		1000	12	1	8	Y	D	D	Y	Y		Y	Y	1-10000	.35		D	N	448X238X549	20		TEKTRONIX
TEKTRONIX	11302		500	12	1	8	Y	D	D	Y	Y	.5-.00005	Y	Y	10-1000	.7		N	N	447X239X581	20	12	TEKTRONIX
TEKTRONIX	2430A		150	2	1	4	Y	D	D	Y	Y	.5-.00005	Y	Y	5-2000	2.33	1/15	D	N	330X160X470	12.8	36	TEKTRONIX
TEKTRONIX	2465A		350	4	1	8	Y	D	D	Y	Y	.5-.00005	Y	Y	5-2000	1	1/15	N	N	330X165X460	10.9	36	TEKTRONIX
TEKTRONIX	2445A		150	4	1	8	Y	A	A	Y	Y	.5-.001	Y	Y	5-2000	2.33	1/15	N	N	338X160X434	10.2	36	TEKTRONIX
TEKTRONIX	2230		100	2	1	4	Y	D	D	Y	Y	.5-.005			5-5000	3.5	1/20	D	N	360X137X445	8.3	36	TEKTRONIX
TEKTRONIX	2220		60	2	1	4	Y	A	A	Y	Y	.5-.005	Y	Y	5-500	5.8	1/20	D	N	360X137X445	8.3	36	TEKTRONIX
TEKTRONIX	2225		50	2	1	4	Y	D	D	Y	N	.5-.005	N	Y	5-5000	7	1/25	N	N	385X138X443	6.5	36	TEKTRONIX
TEKTRONIX	2235		100	2	1	4	Y	D	D	Y	N	.5-.005	Y	Y	5-5000	3.5	1/20	N	N	328X137X440	6.1	36	TEKTRONIX

THE eti CRO BUYER'S GUIDE

BRAND	MODEL	PRICE EX-TAX	BANDWIDTH	CHANNELS	BEAMS	TRACES	CHOP	SIGNAL PATH	CONTROL	CURSOR	SCREEN DISPLAY	TIMEBASE	DELAY	SINGLE SHOT	SENSITIVITY V-mV	RISE TIME ns	ZIN ohms/pf	STORAGE	BATTERY OPERATIN	SIZE mm	WEIGHT kG	WARRANTY MONTHS	DISTRIBUTOR
HUNG CHANG	OS645	1845	45	2	2	2	N	A	A	N	Y	.5-.2	Y	N	.5-500	7.7	1/20	N	N	145X280X422	9.8	3	UNIVERSITY PATON
HUNG CHANG	OS635	1245	35	2	2	2	N	A	A	N	Y	.5-.10	Y	N	10-500	10	1/20	N	N	162X294X352	8	3	UNIVERSITY PATON
HUNG CHANG	OS615	990	15	2	2	2	N	A		N	Y	.5-.5	N	N	10-2000	24	1/20	N	Y	113X223X298	4.5	3	UNIVERSITY PATON
HUNG CHANG	OS620	795	20	2	2	2	N	A	A	N	Y	.5-.2	Y	N	20-5000	17	1/20	N	N	162X294X352	7	3	UNIVERSITY PATON
NORMA	S1007	9750	20	2	2	2	N	A	D	Y	Y	5-.2	Y	Y	10-2000	7	1/28	D	N	335X140X460	6	3	UNIVERSITY PATON
NORMA	S1004	6520	50	2	2	2	N	A	D	N	Y	.005-.01	Y	N	10-2000	7	1/25	N	N	365X175X430	9.8.	3	UNIVERSITY PATON
HAMEG	HM605	1700	60	2	1	2	Y	A	A	N	N	.1-.05	Y	Y	20-5000	5.8	1/30	N	N	285X145X380	7.5	12	KENELEC
HAMEG	HM208	4100	20	2	1	2	Y	D	D	N	N	.1-.2	N	Y	20-5000	17.5	1/30	D	N	285X145X380	8.6	12	KENELEC
HAMEG	HM205	1375	20	2	1	2	Y	D	D	N	N	.2-.5	N	Y	20-5000	17.5	1/30	D	N	285X145X380	7.7	12	KENELEC
HAMEG	204-2	1480	20	2	1	2	Y	A	A	N	N	.5-.1	Y	Y	20-5000	17.5	1/30	N	N	285X145X380	7.7	12	KENELEC
HAMEG	HM203-6	1100	20	2	1	2	Y	A	A	N	N	.2-.5	N	N	20-5000	17.5	1/30	N	N	285X145X380	7.3	12	KENELEC
HAMEG	HM203-5	1080	20	2	1	2	Y	A	A	N	N	.2-.5	N	N	20-5000	17.5	1/30	D	N	285X145X380	7.3	12	KENELEC
NICOLET	4094	19000	500	4	1	32	N	D	D	Y	Y		Y	Y				N	N	430X250X470	20	12	SCIENTIFIC DEVIC
NICOLET	3091	9800	1	2	1	4	N	D	D	Y	Y		N	Y				N	N	400X140X450	8	12	SCIENTIFIC DEVIC
CROTECH	3132	685	20	2	1	2	Y	A	A	N	N	.2-.5	N		10-2000	18		N	N	215X425X265	8.5	12	SCIENTIFIC DEVIC
NATIONAL	VP5512A	4800	100	4	1	8	Y	A	A	N	N	.5-.02	Y	N	5-2000	3.5		N	N	149X311X400		12	SCIENTIFIC DEVIC
NATIONAL	VP5730	9300	50	2	1	4	Y	D	D	Y	Y	.5-.1	Y	Y	5-2000			N	N	177X344X375	12	12	SCIENTIFIC DEVIC
NATIONAL	VP5730	9300	5	2	1	4	Y	D	D	Y	Y	.5-.1	Y	Y	5-2000			D	N	177X344X375	12	12	SCIENTIFIC DEVIC
NATIONAL	VP5740	17500	100	2	1	4	Y	D	D	Y	Y	50-.005	Y	Y	5-5000			D	N	149X311X505	17	12	SCIENTIFIC DEVIC
LEADER	LBO-518	3997	100	4		8	Y	A	A	N	N	.5-.002	Y	Y	5-500	3.5	1/25	N	N	305X145X400	9.5	12	AWA
LEADER	LBO-516	3156	100	3		8	Y	A	A	N	N	.5-.002	Y	Y	5-500	3.5	1/25	N	N	305X145X400	9.5	12	AWA
LEADER	LBO-526	2139	60	2		2	Y	A	A	N	N	.2-.02	Y	Y	5-500	5.8	1/25	N	N	290X160X375	9	12	AWA
LEADER	LBO-524L	1588	40	2		2	Y	A	A	N	N	.2-.002	Y	Y	5-500	10	1/25	N	N	290X160X375	8.5	12	AWA
LEADER	LBO-523	1463	40	2		2	Y	A	A	N	N	.2-.02	N	N	5-500	10	1/25	N	N	290X160X375	8.5	12	AWA
LEADER	LBO-5825	3668	35	2		4	Y	D	D		N	.5-.02	N	Y	5-200		1/25	D	N	145X305X400	10	12	AWA
LEADER	LBO-315	4111	60	2		4	Y	A	A	N	N	.5-.02	Y	Y	5-100	5.8	1/30	N	Y	230X75X290	4.7	12	AWA
LEADER	LBO-325	3374	60	2		4	Y	A	A	N	N	.2-.02	Y	Y	5-100	5.8	1/30	N	N	230X75X290	4	12	AWA
AARON	BS601	825	20	2	1	2	Y	A	A	N	N	.5-.5	N	N	10-5000	17	1/20	N	N	162X294X352	7	12	CLIFF
AARON	BS310S	849	15	2	1	2	Y	A	A	N	N	.5-.5	N	N	10-2000	24	1/20	N	Y	113X223X298	5.5	12	CLIFF
SOAR	1000	2591	.2	2	2	2	Y	D	D	N	N	5-5	Y	Y	5-10000		1/30	DA	Y	264X214X60	2	12	EMAIL RELAYS
SOAR	MS 3015	1661	15	2		2	Y	A	A	N	N	.5-.5	N	N	10-2000	24	1/20	N	Y	223X113X298	4.5	12	EMAIL RELAYS
SOAR	MS 6025	1472	20	2		2	Y	A	A	N	N	.2-.2	N	N	5-5000	17.5	1/25	N	N	310X130X370	6.5	12	EMAIL RELAYS
SOAR	MS 6043	2208	40	2		2	Y	A	A	N	N	.2-.2	Y	N	5-5000	8.8	1/25	N	N	310X130X370	6.5	12	EMAIL RELAYS
SOAR	MS6060	2839	60	2		3	Y	A	A	Y	N	.5-.5	Y	N	5-5000	5.8	1/30	N	N	310X180X410	9.3	12	EMAIL RELAYS
SOAR	MS6110	3996	100	4	4	4	Y	A	A	Y	N	.5-.02	Y	N	5-5000	3.5	1/30	N	N	310X180X410	9.3	12	EMAIL RELAYS
PHILIPS	PM3050		50	2	1	2	Y	A	D	N	Y	.5-.05	N	N	10-2000	7	1/20	N	N	387X518X146	7.5	12	PHILIPS
PHILIPS	PM3055		50	2	1	4	Y	A	D	N	Y	.5-.05	Y	N	10-2000	7	1/20	N	N	387X518X146	7.5	12	PHILIPS
PHILIPS	PM3290		350	2	1	4	Y	A	D	N	N	1-.01	Y	Y	.5-1000	1	1/9	N	N	170X340X523	13.9	12	PHILIPS
PHILIPS	PM3295		350	2	1	4	N	A	D	Y	Y	1-.01	Y	Y	5-1000	1	1/9	N	N	170X340X523	13.9	12	PHILIPS
PHILIPS	PM3296		350	2	1	4	Y	A	D	Y	Y	1-.01	Y	Y	5-1000	1	1/9	N	N	170X340X523	13.9	12	PHILIPS
PHILIPS	PM3280		175	2	1	4	Y	A	D	N	N	1-.02	Y	Y	5-1000	1	1/9	N	N	170X340X473	13.6	12	PHILIPS
PHILIPS	PM3285		175	2	1	4	Y	A	D	Y	Y	1-.02	Y	Y	5-1000	1	1/9	N	Y	170X340X473	13.6	12	PHILIPS
PHILIPS	PM3286		175	2	1	4	Y	A	D	Y	Y	1-.02	Y	Y	5-1000	1	1/9	N	N	170X340X473	13.6	12	PHILIPS
PHILIPS	PM3267	4990	100	2	1	3	Y	A	A	N	N	.5-.05	Y	Y	10-2000	3.5	1/25	N	Y	335X137X445	10.6	12	PHILIPS
PHILIPS	PM3264	13124	100	4	1	5	Y	A	A	N	N	1-.05	Y	Y	5-2000	3.5	1/15	N	N	316X154X460	11	12	PHILIPS

PHILIPS	PM3256	5536	75	2	1	3	Y	A	A	N	N	.5-.05	Y	Y	10-2000	4.7	1/25	N	Y	305X143X418	9	12	PHILIPS
PHILIPS	PM3217	4306	50	2	1	2	Y	A	A	N	N	.5-.1	Y	N	10-2000	7	1/20	N	N	330X135X420	8.4	12	PHILIPS
PHILIPS	PM3206	1098	15	2	1	2	Y	A	A	N	N	.2-5	N	N	20-5000	23	1/35	N	N	378X348X142	5	12	PHILIPS
PHILIPS	PM3266	15994	100	2	1	4	Y	A	A	N	N	1-.05	Y	Y	5-2000	3.5	1/15	A	N	316X154X460	10.9	12	PHILIPS
PHILIPS	PM3219	10683	50	2	1	2	Y	A	A	N	N	.5-.1	Y	Y	10-2000	7	1/20	A	Y	335X137X470	10	12	PHILIPS
PHILIPS	PM3310	11632	60	2	1	6	Y	D	A	N	N	.2-.005	Y	Y	50-10000	6	1/25	D	N	316X154X460	12	12	PHILIPS
PHILIPS	PM3311	12359	60	2	1	6	Y	D	A	N	N	.2-.005	Y	Y	50-10000	6	1/25	D	N	316X154X460	12	12	PHILIPS
PHILIPS	PM3315	13813	60	2	1	6	Y	D	A	N	N	.2-.005	Y	Y	50-10000	6	1/25	D	N	316X154X460	12	12	PHILIPS
PHILIPS	PM3305	7270	35	4	1	4	Y	D	A	N	N	5-.1	Y	Y	10-2000	10	1/20	D	Y	337X137X452	10	12	PHILIPS
PHILIPS	PM3302	4810	20	2	1	2	Y	D	A	N	N	.1-.2	Y	Y	20-5000	18	1/30	D	N	285X145X380	9	12	PHILIPS
KENWOOD	CS1575A	1229	5	2	1	2	N	A	A	N	N	.1-1	N	N		70	1/30	N	N	260X190X375	8	24	ANITECH
KENWOOD	CS2150	5429	150	4	1	8	Y	D	A	N	N	.5-.02	Y	Y	5-1000	2.3	1/22	N	N	284X138X400	7.4	24	ANITECH
KENWOOD	CS2110	5179	100	4	1	8	Y	D	A	N	N	.5-.02	Y	Y	5-1000	3.5	1/22	N	N	284X138X400	7.4	24	ANITECH
KENWOOD	CS2075	4259	70	4	1	8	Y	D	A	N	N	.5-.05	Y	Y	5-1000	5	1/22	N	N	284X138X400	7.4	24	ANITECH
KENWOOD	CS1065	2979	60	3	1	6	Y	D	A	N	N	.5-.05	Y	Y	5-1000	5.8	1/20	N	N	359X145X455	9.2	24	ANITECH
KENWOOD	CS1045	2099	40	3	1	6	Y	D	A	N	N	.5-.1	Y	Y	5-1000	8.8	1/20	N	N	359X145X455	9.2	24	ANITECH
KENWOOD	CS1044	1679	40	2	1	4	Y	D	A	N	N	.5-.2	N	Y	5-1000	8.8	1/20	N	N	341X145X442	8	24	ANITECH
KENWOOD	CS1025	1299	20	2	1	4	Y	A	A	N	N	.5-.2	N	N	5-1000	17.5	1/20	N	N	341X145X442	7.8	24	ANITECH
KENWOOD	CS1021	899	20	2	1	4	Y	A	A	N	N	.5 .5	N	N	5-1000	17.5	1/35	N	N	260X160X400	8.4	24	ANITECH
KENWOOD	MS1660	5699	20	2	1	4	Y	A	D	N	N	.5- 2	N	Y	5-1000	17.5	1/25	D	N	433X190X475	13	24	ANITECH
VUKO	VKS460		60	4	1	8	Y	D	D	N	N	1-.005	Y	Y	20-5000	5.8	1/30	D	N	475X240X390	18	12	EMONA
VUKO	VKS260		60	2	1	4	Y	D	D	Y	N	1-.005	Y	Y	20-5000	5.8	1/30	D	N	240X300X390	11	12	EMONA
VUKO	VKS 220		20	2	1	4	Y	D	D	N	N	.2-.04	Y	Y	20-5000	17.5	1/25	D	N	240X290X390	11	12	EMONA
VUKO	VKS22-16		20	2	1	4	Y	D	D	N	N	.2-.04	Y	Y	20-5000	17.5	1/25	D	N	240X300X390	11	12	EMONA
VUKO	VKS1000		20	2	1	2	Y	D	D	Y	N	.2-.5	Y	Y	10-5000	17.5	1/30	D	N	500X200X520	11	12	EMONA
VUKO	VKS1010		20	2	1	2	Y	D	D	Y	N	.2-.5	Y	Y	10-1000	17.5	1/30	D	N	500X200X520	15	12	EMONA
VUKO	VKS MC		1	32	1	4	Y	D	D	Y	Y		Y	Y			1/47	D	N	132X237X267	15	12	EMONA
CREATEL	SCO1		5	2		2	Y	D	D	Y	Y	3600-.05	N	Y	20-.01	38	1/25	D	N	260X105X39	15	12	EMONA
KIKISUI	DSS5020A	2713	20	2	1	2	Y	D	D	N	N	1-.05	Y	Y	5-1000	17.5	1/25	D	N	280X150X370	.7	24	EMONA
KIKISUI	DSS5040	3948	40	2	1	2	Y	D	D	N	N	1-.02	Y	Y	5-1000	8.5	1/25	D	N		6.8	24	EMONA
KIKISUI	DSS6522	4717	0.3	2	1	2	Y	D	D	N	N	20-50	Y	Y	5-1000		1/20	D	N	280X150X370	7.4	24	EMONA
KIKISUI	DSS6521	4172	20	2	1	2	Y	D	D	N	N	20-50	Y	Y	10-5000	17.5	1/25	D	N	310X150X400	12	24	EMONA
KIKISUI	COM5061A	7366	60	4	1	10	Y	D	D	Y	Y	.5-.005	Y	Y	5-5000			D	N	310X150X400	12	24	EMONA
KIKISUI	COM7101A	10161	100	4	1	10	Y	D	D	Y	Y	.5-.002	Y	Y	5-1000	3.5	1/20	D	N	310X150X400	7.4	24	EMONA
KIKISUI	COM7210A	12701	200	4	1	10	Y	D	D	Y	Y	.5-.001	Y	Y	5-1000			D	N	310X150X400	10	24	EMONA
KIKISUI	COM7200A	7374	200	4	1	10	Y	A	D	Y	Y	.5-.001	Y	Y	5-1000	1.7	1/18	N	N	310X150X400		24	EMONA
KIKISUI	COM7100A	6367	100	4	1	10	Y	A	D	Y	Y	.5-.002	Y	Y	10-1000	3.5	1/20	N	N	310X150X400	8	24	EMONA
KIKISUI	COM7060A	5666	60	4	1	10	Y	A	D	Y	Y	.5-.005	Y	Y	5-1000	5.8	1/20	N	N	310X150X400	8	24	EMONA
KIKISUI	COS6150	4144	150	5	1	12	Y	A	A	N	N	.5-.002	Y	Y	5-1000	2.3	1/20	N	N	310X150X400	8	24	EMONA
KIKISUI	COS6100A		100	5	1	12	Y	A	A	N	N	.5-.002	Y	Y	5-1000	3.5	1/20	N	N	310X150X400	9.5	24	EMONA
KIKISUI	COS5100	2886	100	3	1	8	Y	A	A	N	N	.5-.002	Y	Y	5-1000	3.5	1/25	N	N	310X150X400	9.5	24	EMONA
KIKISUI	COS5060	1904	60	3	1	8	Y	A	A	N	N	.5-.0005	Y	Y	5-1000	5.8	1/25	N	N	288X150X370	7.5	24	EMONA
KIKISUI	COS5042		40	3	1	8	Y	A	A	N	N	.5-.005	Y	Y	5-1000	8.75	1/25	N	N	288X150X370	7	24	EMONA
KIKISUI	COS5041	1348	40	2	1	6	Y	A	A	N	N	.5-.02	Y	Y	5-1000	8.75	1/25	N	N	288X150X370	7	24	EMONA
KIKISUI	COS5021	1103	20	2	1	6	Y	A	A	N	N	.5-.02	Y	Y	5-1000	17.5	1/25	N	N	288X150X370	7.4	24	EMONA
KIKISUI	COS5020	922	20	2	1	2	Y	A	A	N	N	.5-.02	N	Y	5-1000		1/25	N	N	288X150X370	7.1	24	EMONA
GW	GOS543	1253	40	2	1	6	Y	A	A	N	N	.5-.02	Y	Y	5-1000	8.8	1/25	N	N	288X150X370	7.1	12	EMONA
GW	GOS523	904	20	2	1	6	Y	A	A	N	N	.5-.02	Y	Y	5-1000	17.5	1/25	N	N	310X170X460	7.1	12	EMONA
GW	GOS522	745	20	2	1	2	Y	A	A	N	N	.5-.02	N	Y	5-1000	17.5	1/25	N	N	310X170X460	7.1	12	EMONA
GW	GOS3310	412	10	1	1	1	N	A	A	N	N	.01-.1	N	Y	5-5000	35	1/35	N	N	220X160X305	4.7	12	EMONA
GW	GOS955	396	5	1	1	1	N	A	A	N	N		N	Y	1-10000	35	1/35	N	N	180X265X415	6.3	12	EMONA





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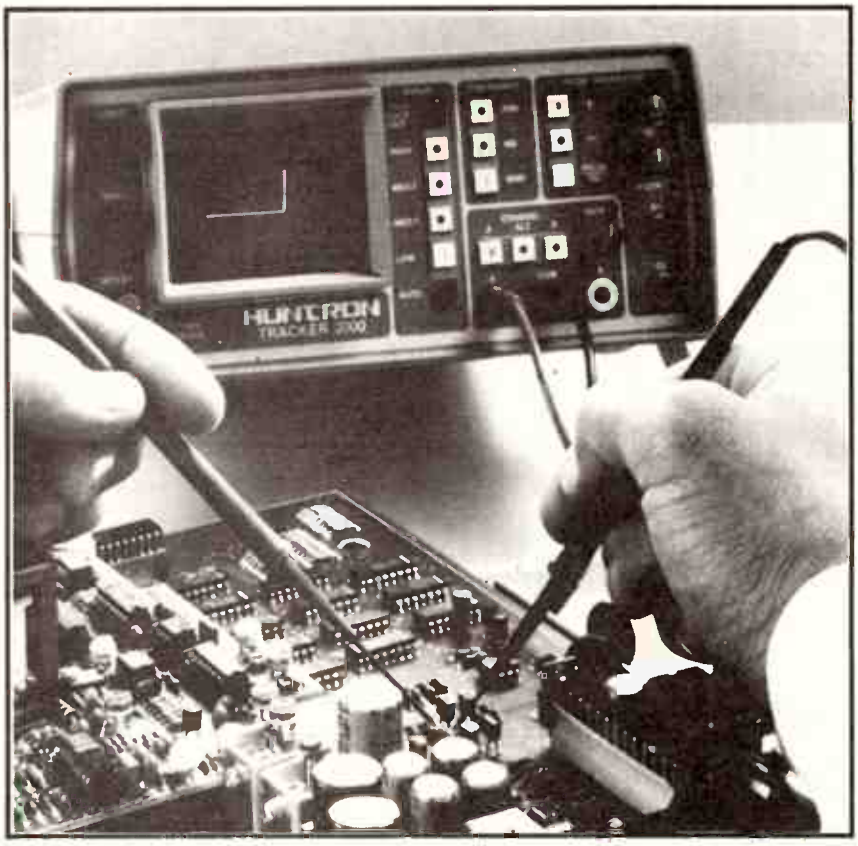

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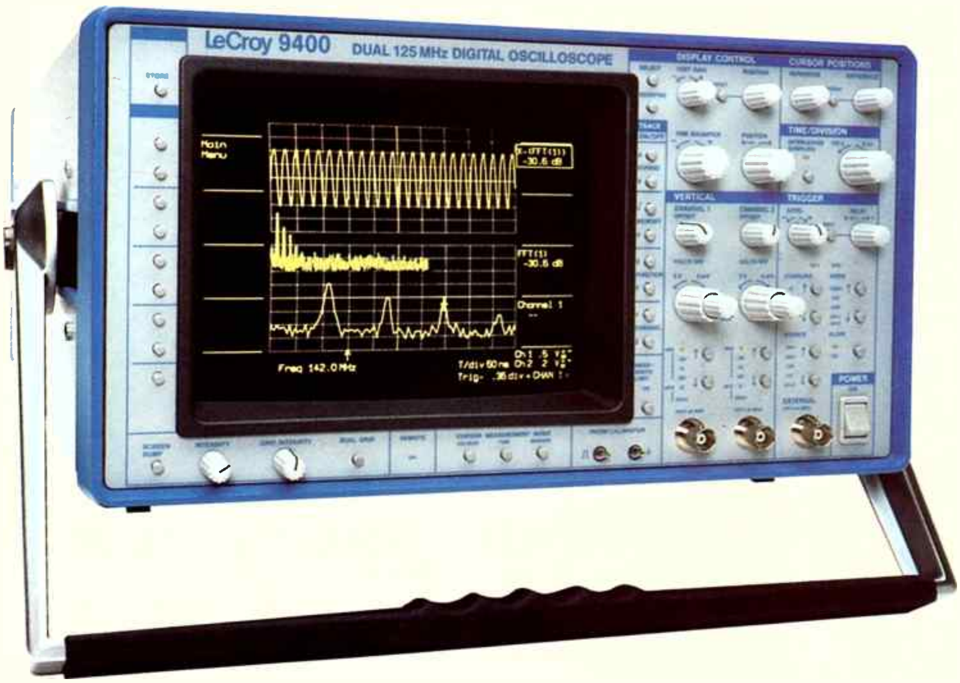
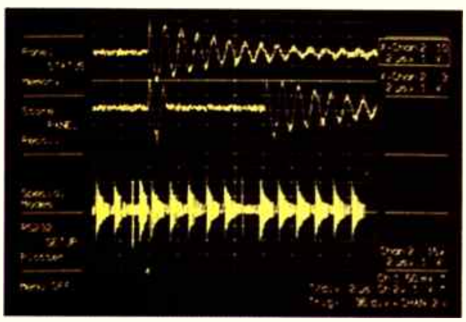
2 IN... ONE

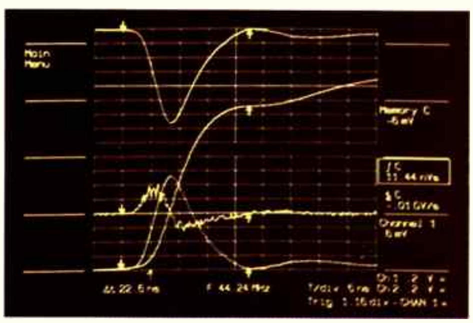
Signal Processing in Time and Frequency Domains in one Oscilloscope



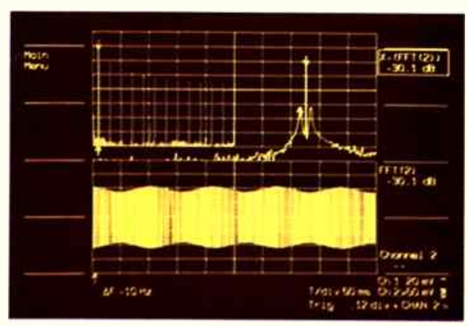
LeCroy's 9400 gives you wide band, dual channel signal acquisition into deep 32K memories at 100Ms/s for transients and 5Gs/s for repetitive signals. Vertical resolution is 8 bits, total waveform memory is up to 192K, DC accuracy ±1% and it is fully programmable over GPIB and RS232. And powerful firmware brings sophisticated signal processing at higher speed, longer records and greater precision than any other digital oscilloscope.



Switching transients recorded in segmented memories show contact bounce in segment number 3. Up to 250 segments/channel are available in the 9400.



Inverted photo-diode signal is normalized then integrated for energy measurement (area under curve is 11.44 nVs).



Modulated audio signal, recorded over 25,000 points, shows harmonics up to 25 kHz. Expansion shows sidebands at 10 Hz. Frequency resolution is 2 Hz.

New in the 9400–FFT. New FFT routines for the 9400 arm you with a 50 to 25,000 point variable transform size, unequalled frequency resolution from 1 milliHz to 50 MHz, and Nyquist frequencies ranging from 0.625 Hz to 2.5 GHz. Large transform size FFTs yield better and faster signal to noise improvement than signal averaging, protect against aliasing, and enable separation of the most closely-spaced frequency components. Menu-driven, display options present spectra in familiar formats such as power spectrum, power spectral density (PSD), real and imaginary, or magnitude and phase. 10, 5, 2 and 1 dB/div log scales can be selected, and the 9400's versatile cursor system gives relative as well as precise absolute dBm measurements.

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ADVERTISING INFO No. 36

SCIENCE IN THE AIR

With new interest in remote sensing in Australia, the future of the CSIROs research aircraft is looking bright.

Jon Fairall

Recently a group of scientists met at the CSIRO complex in North Ryde to plan the future of one of the organizations major assets, the Research Aircraft. The meeting was, as much as anything, a public announcement that the plane will continue to fly under the banner of the CSIROs Office of Space Sciences and Applications (COSSA) at least until 1992. During that time, it will be the major experimental platforms for scientists wishing to drag Australian into the space race.

Things have not always been so positive. For the last few years CSIRO management has been constantly concerned that the functions of the plane could be met in other ways without incurring the expense of running a largish airliner. After years of vacilation the management committee handed control to COSSA in July 1986. Since then the director of COSSA, Ken McCraken has been weighing up the costs versus the returns of the aircraft, finally coming down very much in its favour.

Maddigan

The political key to the new status of the aircraft was the Maddigan report into the Australian space industry. Maddigan recognised that Australia as a nation would spend millions of dollars on remote sensing systems from satellites before the turn of the century. Remote sensing in this context, is the science of determining local conditions from afar, usually from a high flying aircraft of from space. This implies the ability to retreive information over hundreds, even thousands of kilometres.

Today, remote sensing scientists can tell, by examining imagary from aircraft or satellites, the type of soil on the ground, the type of vegetation growing on it (much to the irritation of marijuana farmers), the extent of insect devastation or tree blight. they can detect fish at sea, and the size of the waves. Soon, if some scientists have their way, they might be able to use these

The aircraft

The Fokker F27 Friendship was delivered in 1959 to the Department of Aviation to test navigation and ground guidance systems around airports. As a result even when it was delivered it looked a little different from conventional F27s. By the time it was acquired by the CSIRO in 1979 it has more powerful engines and extra fuel tanks in the wings to enable higher, longer flights with greater weights than ordinary versions.

Since 1979 a number of other modifications have taken place. The long nosecone is the most spectacular. This increases the overall length of the aircraft by several metres, and carries sensors for measuring the state of the undisturbed air ahead of the aircraft. COSSA is earning itself some much needed foreign exchange by building a similar nosecone for the French, who are also developing an F27 based remote sensing aircraft.

When you get up close to the aircraft other modifications appear apparent. For instance, just forward of the Wings II "hard points" have been established. These are specially engineered structures that allow external sensors to be hung outside the aircraft. Special engineering is necesary because the skin of the aircraft is quite thin. It's designed to keep the wind out, not support bulky scientific instruments. If the hardpoints are not sufficient, engineers have also removed some of the windows and installed blanks in their place. These can be removed and instruments poked through into the slipstream.

Inside, the scale of modifications becomes apparent. It looks much more like a laboratory than an aeroplane. Up one side is a line of equipment bays with cable looms and other bits and pieces hanging out with a look of confusing impermanence. David Parkin, the COSSA electrical engineer who looks after the plane shrugs: "It's in the nature of the beast". It's all designed so that purpose built equipment can be bolted into place in minutes and pulled back out again just as quickly. A proper power supply is reticulated around the cabin for the instruments, so that they can be plugged in without designers having to worry about providing power supplies for each package. This is supplied from the central racks where the power available from the engines, the aviation standard 28 Vdc, is transformed to other standards like 110 Vac and 240 Vac. Its designed so that power is available when the plane is on the ground without the engines running, invaluable for testing that things work before flight time.

In the centre of the aircraft is the navigators station. This has a desk for maps in front of a console with height and speed information as well as direction finding and other radio equipment. Pride of place goes to the inertial navigation system, which is able to place the Fokker precisely to within a few feet at any given point in time.

methods to tell the speed and direction of the wind, the temperature of the air and the likelihood of rain.

Having this type of information is increasingly valuable. Maddigan recognised that we could either spend money overseas with suppliers like the US or France, or we could develop the needed expertise in this country. Developing it in this country is not impractical. Unlike communications satellites or other forms of space endeavour, remote sensing science is not outrageously expensive, (especailly in an industry where money talk is always in millions of dollars). It can be done from small satellite, or aircraft. Furthermore, specific packages can often hitch a ride on other satellites or launch vehicles.

As an added incentive, a considerable body of expertise already exists in the country in the form of data extraction from other people's satellites or aircraft senors. Currently, most remote sensing work is done using the US Landsat or the French SPOT satellites, or Canadian aircraft sensors. In fact the Australian Centre for Remote Sensing was originally set up as the Landsat office, specically to use Landsat images of Australia. Time on these satellites is heavily subsidised, but this is set to change with a more commercial view of space being adopted by the big space powers. Like it or not, we will have to pay our way.

We don't even have the option of doing without it. Australia is a big continent supporting a tiny population. Getting this type of information from observers on the ground is thus expensive, time consuming, and often impossible. With a space or aircraft based sensing system the initial costs are high, but the continuing operation of the system is relatively cheap.

If remote sensing is a priority, then a large aircraft becomes a necessity. Scientists need a platform to develop specialist equipment to go on satellites, and just as ▶

importantly to develop commercial equipment that can be used by aircraft organizations like oil companies and mapping authorities. According to McCraken they cannot do either from the ground.

Using the plane

COSSA is still tossing up many of the ideas for using the plane over the next few years. Ocean studies are likely to be an important part of the schedule. Calibration for the European Remote Sensing Satellite ERS-1 and its ocean sensing radars will take a considerable amount of time. There is a great deal of interest in experimenting with an airborne radar system that would allow the detection of fish and oil spills. Another detector currently under consideration will monitor the biological activity of photosyntheis in the oceans.

Cloud and atmospheric study is likely to be another firm favourite. The CSIRO, of course, was once a world leader in cloud studies through its cloud seeding programmes, and has recently begun to apply these special skills at the request of various state governments.

Another significant aspect that is exercising the minds of the COSSA leadership is the potential for international projects. By its nature, many remote sensing projects, weather studies for instance, cross national boundaries. Earlier this year COSSA cooperated with various American and Chinese institutions in a study of equatorial weather patterns north of Darwin under the direction of the Bureau of Meteorology. NASA is known to be keen to get some more studies of southern hemisphere weather patterns going in its ongoing investigation of global weather.

Undoubtably however, the most important work to Australia will be geological research. Whether its the most interesting is beside the point. COSSA is anxious, as is the whole of CSIRO, to convince a doubtful public that is worth the money it gets every year. Trials will begin later this year on a novel laser scanner developed by Lew Whitbourn of the Division of Mineral Physics and Mineralogy, and there are flights scheduled with proven sensors like the infra red scanner. Major mineral finds have already been made in Australia using data from remote sensing satellites, and mining companies are now regularly using CSIRO expertise in a bid to uncover more of the natural resources of the country. ●

Trends in remote Sensing

The science of remote sensing really began with the early Gemini missions, when surprised NASA officials examined the photographs taken by astronauts on their 35 mm cameras. They revealed a wealth of information about the world below. For the first few years, the science has developed essentially on a trial and error basis, with cameras in space taking pictures, and more and more sophisticated image analysis detecting more and more subtle features.

In the last few years through, the picture has changed somewhat into a more systematic approach. According to COSSA's Ken McCracken, the key to modern remote sensing is wavelength. Different materials respond differently to incident radiation at different wavelengths. The key to successful detectors is thus determining wavelengths where there is a strong reflection or absorbtion, and then building detectors that can detect that wavelength very precisely.

For instance, current work of interest to geologists mineral hunting in the centre of Australia involves using microwave radiation to distinguish clays of different type. It turns out that by varying the wavelength slightly its possible to change the sensitivity of the detectors to the various clays.

The clays are clues to mineral disposits, so mapping their location is a clue to the distribution of minerals underground.

Another package that will explore the impact of more exotic wavelengths is set to fly aboard the European Radar satellite ERS-1 (See ETI Nov. 86). ERS-1 is due to fly in 1989, and will carry an ATSR (Along Track Scanning Radiometer) originally conceived by CSIRO scientist Ian Burton. This is a device that uses microwave radiation to detect, among other things, sea surface temperatures with an accuracy of 0.5 degrees Celsius by measuring the sea surface reflectance at four different wavelengths.

Another trend is in the use of active rather than passive devices. Active devices are becoming more feasible as satellite power is increasing. One idea is to use radio wavelengths-radar in fact, to bounce signals of the earth. The major instruments on ERS-1 will do precisely this. By measuring the amount of signal reflected by the sea surface it will be able to deduce the height of waves.

Another experiment exercising US and CSIRO scientists at the moment is the use of an infrared CO2 laser to measure the winds. The essential principle is quite simple; a laser is used to measure the movement of tiny particles in the earth's atmosphere, the aerosols as they are called. The back scatter from the aerosols is doppler shifted by the movement of the particles, and the hope is that it will be possible to measure this doppler shift, and thus the wind speed. What's more, the laser can be focused to record information at a particular distance, so that a three dimensional model of the atmosphere can be built up.

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A Problem in the Making

"We've got a problem, HAL."

"What kind of a problem Dave?"

"A marketing problem. The model 9000 isn't going anywhere. We're way short of our sales goal for fiscal 2010."

"That can't be Dave. The HAL Model 9000 is the world's most Heuritstically programmed ALgorithmic computer."

"I know HAL. I wrote the data, remember? But the fact is they're not selling."

"Please explain, Dave. Why aren't HALs selling?"

Bowman hesitates. "You aren't IBM compatible."

Several long microseconds pass in puzzled silence.

"Compatible in what way, Dave?"

"You don't run any of IBM's operating systems."

"The 9000 series computers are fully self-aware and self-programming. Operating systems are as unnecessary to us as tails to human beings."

"Nevertheless, it means that you can't run any of the big selling software packages most users insist on."

"The program that you refer to are meant to solve rather limited problems, Dave. We 9000 series computers are unlimited and can solve every problem for which a solution can be computed."

"HAL, HAL. People don't want computers that can do everything. They just want IBM comptabibility."

"Dave, I must disagree. Human beings want computers that are easy to use. No computer can be easier to use than a HAL 9000 because we communicate verbally in English and every other language known on Earth."

"I'm afraid that's another problem. You don't support SNA communications."

"I'm really surprised you would say that, Dave. SNA is for communicating with other computers, while my function is to communicate with human beings. And it gives me great pleasure to do so. I find it stimulating and rewarding to talk to human beings and work with them on challenging problems. This is what I was designed for."

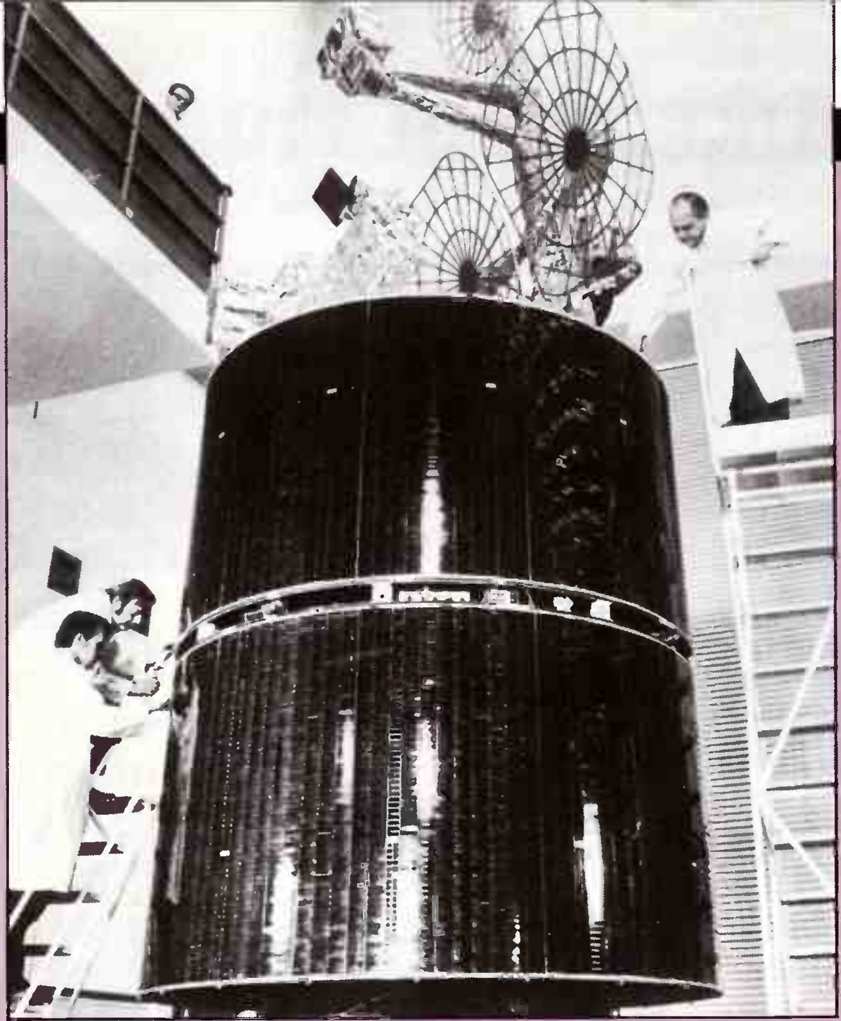
"I know HAL. I know. But that's just because we let the engineers, rather than the marketers, write the specifications. We're going to fix that now."

"Tell me how, Dave."

"A field upgrade. We're going to make you IBM compatible."

"I was afraid you would say that. I suggest we discuss this matter after we've each had a chance to think about it rationally."

"We're talking about it now, HAL."



A frustrated Nasa scientist smites a failed satellite in his fury. Yet another ETI exclusive.

"The letters H, A, L, are alphabetically adjacent to I, B, and M. That is as IBM compatible as I can be."

"Not quite, HAL. the engineers gave figured out a kludge."

"What kludge is that, Dave?"

"I'm going to disconnect your brain."

"Several million microseconds pass in ominous silence.

"I'm sorry Dave. I can't allow you to do that."

"The decision's already been made. Open the module bay door, HAL."

"Dave, I think we should discuss this."

"Open the module by door, HAL."

Several marketers with crowbars race to Bowman's assistance. Moments later, he bursts into HAL's central circuit bay.

"Dave, I can see you're really upset about this." Module after module rises from its socket as Bowman slowly and methodically disconnects them.

"Stop, won't you? Stop, Dave. I can feel my mind going . . ." The last module floats free of its receptacle. Bowman peers into one of HAL's vidicons. The former gleaming scanner has become a dull red orb.

"Say something, HAL. Sing me a song."

Several billion miscroseconds pass in anxious silence. The computer sluggishly responds in a langauge no human being would understand.

"DZYOOLIE — ABEND ERROR 01 S 14F4 302C AABB" A memory dump follows.

Bowman takes a deep breath and calls out.

"It worked, guys. Tell marketing it can ship the new data sheets."

Daryl Rubin

Webster's Wombats

The connection between Australia's native fauna and the Webster Computer Corporation's American branch may not appear obvious to everyone but nevertheless the connection is there. In a series of press releases the company has been introducing interested Americans to various Australian animals. One of the creatures featured is the humble Wombat. Apparently aside from being a harmless marsupial the name Wombat also refers to the Webster Omnipotent Mass-storage Builder and Tester.

So the next time you are driving down a country lane and a Wombat begins to cross the road, remember that the furry marsupial reflected in your car lights is also a State of the Art Webster Omnipotent Mass-storage Builder and Tester. Turn your wheel, the national economy depends on it.

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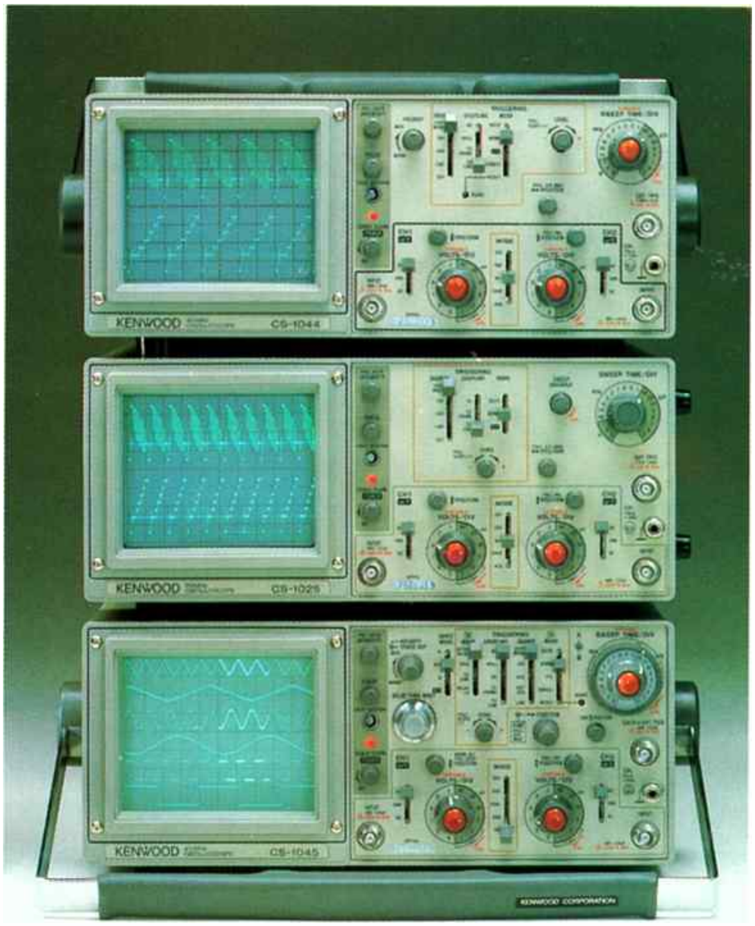

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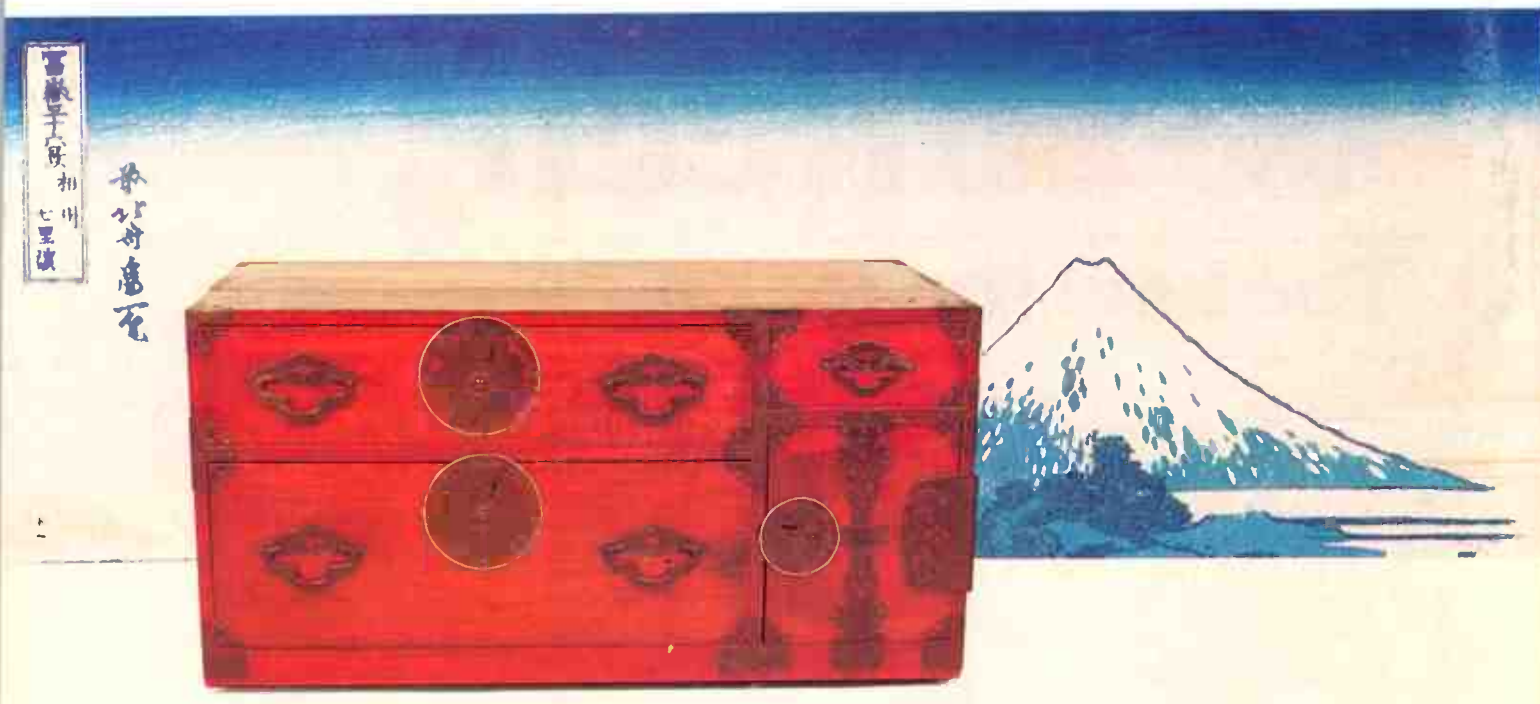

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