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Victoria and Tasmania: Virginia Salmon, The Federal Publishing Company, 23rd Floor, 150 Lonsdale Steet, Melbourne, Vic. 3000. Phone: (03) 662-1222 Melbourne. Telex: 34340, FEDPUB.

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Queensland: John Perry, The Federal Publishing Company, 25 Balaclava Street, Woolloongabba, Qld. 4102. Phone: (07) 391-8922. Telex: AA145520.

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Japan: Genzo Uchida, Bancho Media Services, 5th Floor, Dai-Ichi Nisawa Building, 3-1 Kanda Tacho 2-chome, Chiyoda-ku, Tokyo 101. Phone: (03) 252-2721 Tokyo. Telex: 25472, BMSINC.

PPC

PROUDLY PRINTED IN AUSTRALIA

ELECTRONICS TODAY INTERNATIONAL is published monthly by the Electronics Division of the Federal Publishing Company Pty Limited, 140 Joynton Avenue, Waterloo, NSW 2017 under licence from Double Bay Newspapers Pty Limited, General Newspapers Pty Limited and Suburban Publications Pty Limited. Typeset by ESN-The Litho Centre, Sydney. Printed by ESN-The Litho Centre, Sydney. Distributed by Gordon and Gotch Limited, Sydney. *Maximum and recommended Australian retail price only. Registered by Australia Post, Publication No NBP0407. ISSN No 0013-5216.

Electronics Today INTERNATIONAL

SEPTEMBER 1985

FEATURES

PROJECTS

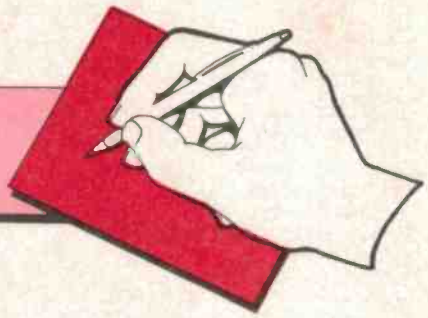
REVIEWS

OFFERS

DEPARTMENTS

COVER: Optical car alarm switch photograph by Derek Goard; HP PC Instruments photograph by Greg McBean.
SUPPLEMENT: Cover, page 4 and page 5 photographs compliments of Pirimal Hi-Fi and Video, Burwood, NSW.

Letters to the Editor



Oh, brother!

I WOULD LIKE to say that your mag has improved much over the last several months. It is brighter and covers news in more detail, besides my sister is doing a great job of the artwork (G'day sis!). I've been buying electronics mags since they were about 2/6d and have seen changes (gawd I'm feeling old) in both semiconductors and circuits. Once audio/radio projects filled the pages and now most projects are based on digital bits. It seems popular projects are drifting away from radio (real radio, winding coils, etc) now that I've switched from micros to shortwave.

Paul B. Jones,
Moora, WA

Origin of 'breadboard'

IN THE ARTICLE by Ian Thomas in the June 1985 edition of *ETI* he mentions that he does not know the meaning of the term breadboard as applied to making up circuits for experimentation.

In the early '30s when I started building radios, all the components were constructed from heavy bakelite and had mounting holes in their bases. Wood screws were used to mount these components onto a wooden baseboard to which the front panel (of thick ebonite) was mounted. A convenient piece of wood for the baseboard was the board which mother used to cut the bread on; it was soft, smooth, and about the right size.

The 'breadboard' was therefore used for the base of all construction efforts in those days. It is indeed a far cry from the "rat's nest" type of prototyping used today, but was needed to take the weight as well as the size of the components available then.

So there you are Mr Thomas, a mystery no longer!

Thanks for an interesting magazine.

Don Smith,
Deniliquin, NSW

Piano tuners

IVAN CRISP'S MICROBEE electronic tuning fork in June's *ETI* is an ingenious application but would-be piano tuners beware!

First, perfect fifths and stretched octaves are totally unacceptable. If there's one interval we need perfectly in tune it's the octave. The others are all deliberate compromises.

Second, tuning the entire keyboard with 'mathematical' accuracy is disastrous because highly tensioned strings just don't behave that way. You can blame physics for *that* fact of life. Well-tuned pianos are increasingly 'sharp' to the right of keyboard centre, and increasingly 'flat' to the left.

I strongly advise, with any electronic aid, to just tune all the notes of a middle octave, say A220 to A440, and then tune unison octaves to this reference octave by zero beats. This should be done using single strings (mute the others) and then relating bichords and trichords in turn to the tuned string of each note as necessary.

Otherwise you'll be calling in that less perfect do-it-all-by-ear piano tuner to correct the mess!

John Gale,
Beecroft, NSW

Star Wars perspective

THE APPEARANCE IN the May *ETI* issue of the feature article "The Strategic Defence Initiative" seemed to me to give credence to inaccurate statements.

The author perpetuated the idea that the only possible implementation of SDI is space-based sophisticated laser weapons. However, what is almost never described in the press is the "High Frontier" programme. The cost estimate is $15 billion, with five to six years for deployment. The technology is relatively simple: orbiting satellites armed with non-nuclear and non-explosive intercept devices — the ICBM is destroyed by high kinetic energy. The missile would be 'torn to pieces'. When it was revealed that Australia was researching the "electromagnetic rail gun", which may have possible use for space defence systems, the immediate government reaction was to run scared from such possible involvement.

The article argues that such a system (laser based or otherwise) could not be "leakproof", and is therefore useless. It claims that if the system is even 99 per cent effective, 140 warheads could get through, and "140 atomic warheads landing on the USA would effectively mean the end of the nation".

But could the arrival of 140 warheads arriving in the US really cause the "whole" destruction of the US? No! If we assume that each warhead is a 1 megaton, then all concrete and stone buildings over an area of 24 miles would be destroyed. The area thus covered by 140 explosions would be 3360 sq m. Let's not say that the destruction of 3360 sq m will be a pleasant thing, but when we consider that the area of the US is over 3,000,000 sq m we discover that approximately 0.1 per cent of the US would be destroyed. Hardly total destruction!

It is also false to say that "it is always possible for the Soviet Union to build one more rocket than necessary to overload the [defence] system". Dr Robert Jastrow says calculations show defence stations only need to be increased in proportion to the square root of the number of offensive missiles, not in direct proportion.

Surely there is more merit in a defence system that is incapable of killing anyone, than in an offensive Mutually Assured Destruction concept. Thus it seems that anti-defence defeatists ignore off-the-shelf programs for space-based defence and counter with a "star wars" version that will cost "trillions", and "probably won't work". The result is a clouding of the issue, millions spent on study programmes, with the predictable outcome that it is "too expensive or won't work". That is correct — their version won't work. That's why they offered it.

We have been so busy worrying needlessly about either being burnt to a crisp or freezing (the "nuclear winter" myth), that we have rendered ourselves incapable of thinking clearly and acting rationally.

R. J. Long,
Brisbane, Qld

Cable direction

WITH REFERENCE TO the letter of reply by Mr Goldfinch, July *ETI*, on direction sensitive speaker cable, may I make a tongue-in-cheek observation.

If a wire (conductor) is better at passing power one way than another, is it perhaps a new form of semiconductor (diode)? As a diode's non-linearity in an audio path causes distortion, perhaps a solution would be to place two of these cables parallel, but one with its ends reversed (ie, its amplifier end to the speaker end). Would this enable audio ac signals to pass along even better? *ETI* labs, go do your stuff.

Another thought, a microwave circulator exhibits the direction sensitivity to power transfer noticed by Mr Goldfinch — perhaps Telecom and OTC can save millions.

To be fair, however, as super flexible low loss dc power supply cables, they are hard to beat and have been used in the computer and mobile area successfully . . . Without ever worrying about the marked direction of the cables.

Leonard Spyker,
Doubleview, WA

SERVICES

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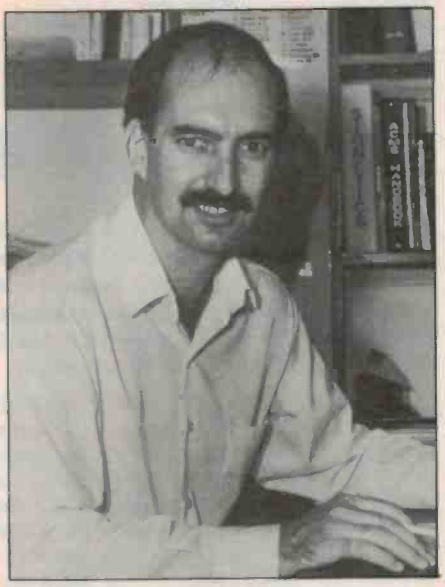


IF ACCEPTED, THE PROPOSAL by Senator Peter Walsh to re-introduce tertiary education fees would be the most destructive and ill-conceived action any government could take.

The re-introduction of fees has been proposed simply to save money. Senator Walsh justifies it by saying that those who use tertiary institutions, tech colleges, institutes of technology, CAEs and universities tend to come from better off families, who can afford to pay fees.

What Senator Walsh neglects to say is that his proposal will drastically cut tertiary enrolments by students from less well off families! And this will save the Minister for Counting Pennies heaps of money.

The whole issue raises the question of why we need education in the first place. I would suggest the most important reasons are to improve the quality of life and wealth of the whole community.

But how can it be that education can have these results for the community? If we look for what creates wealth it is obviously access to money to invest and the commercial and technical skills to apply the investment better than any one else. In today's sophisticated financial world the money follows those with the skills to spend it best.

So what's left? It all comes back to the skills and knowledge of those who make up the community. And these, contrary to some opinions, don't come with the tap water.

What will happen if Senator Walsh gets his way? The most likely outcome will be a return to the enrolment patterns of before 1974. There would be a 30-40% reduction in total enrolments and the most expensive courses like medicine and law would be dominated by those from well off families. Those not so well off would be relegated to the courses which would leave them less well off after graduation.

The present system allocates educational resources to those who perform well in a test of their academic ability. Whether or not this test can be improved, the principle is one designed to get the most out of limited educational resources. Any system which does not have this as a principle must be less efficient.

What irks me most is that Senator Walsh's proposal has a good chance of success. About 80% of Australians have no tertiary qualifications, so the argument is about a minority in the community.

Further there seems to be an attitude held by many Australians that having an education is a definite disadvantage. The theory goes the higher the qualification the less capable someone becomes. Such ideas, of course, are based on a misunderstanding of the roles of theory and practice.

Because education cannot be weighed and measured, some seem to believe it to be worthless — I think education is invaluable.

The problem with much of public debate is that it is not the quality of an opinion that wins the day, but the number of people holding it.

David Kelly
Editor

NEXT MONTH

SOUND REVIEW
Yamaha has built a highly respected reputation on its hi-fi gear. The A-320 hasn't let Yamaha down, rather it points to a new design vista of simplicity without compromise.

SOLDERING SUPPLEMENT
Slaving over the hot iron isn't the only way to solder, but it is the practical way for most people. This bonus supplement looks at how to go about soldering in the old tried and true way and lets you in on the new industrial technique of wave soldering. As well, it describes the wire wrapping alternative and reviews some of the products available to the solderer.

DATA COMMUNICATIONS
Once you've got your hardware what can you do with it? Like all stories, there are two sides to this one. Services offered are more practical than you might think while the communication channels afford opportunity to the aware business.

LIGHT BULB SAVER
A practical project designed to prevent high currents blowing out your bulbs when you turn the light on at a moment of voltage peak. It could save you money and hours in light bulb replacements!

Big Blue and the student vote

Is IBM trying to woo Australian students? Will they vote for IBM when they get the chance? Recent events at the University of Queensland brought these questions into sharp focus when it was revealed that Queensland University has accepted a process control system from IBM for the Chemical Engineering department, worth some $2m dollars.

The news comes after last year's announcement of continuing funding of projects being undertaken at RMIT and the University of New South Wales that are rapidly turning IBM into one of the major corporate sponsors of our university system.

According to Queensland University's chancellor James Foots, the university is one of only five around the world to receive the equipment. Others include Waterloo in Canada and Imperial College, London.

Funding university students has long been IBM policy overseas. Corporate reasoning has been that students trained on IBM machines retain an empathy with the company that lasts until the students have risen to decision making positions. In fact in the US IBM has a history of making the most lavish of grants to schools and colleges in order to keep students working on their machines.

The logic must be sound, because IBM is far and away the largest computer maker in the world today, in terms of dollars sales.

There are significant benefits to the university in the quality of both teaching and research, according to professor Brian Wilson, vice chancellor of the university. He says: "The agreement between the university and IBM represents an important addition to university facilities at a time when government funding of universities is coming under increasing strain".

He said advanced control systems were used successfully by many of the world's major companies in fields such as food, chemical and oil industries, and the development of this field of study at the University of Queensland would help Australian industry become more competitive on a world scale.

The equipment includes a 4341 mainframe computer with 1.8 gigabytes of disk storage, twelve 3279 colour terminals, a series 1 computer and a 3411 tape drive. It is precisely the same equipment as is used to control some of the world's most efficient oil refineries, although in the university environment students will be able to design their own systems of pipes and tanks to practise on.

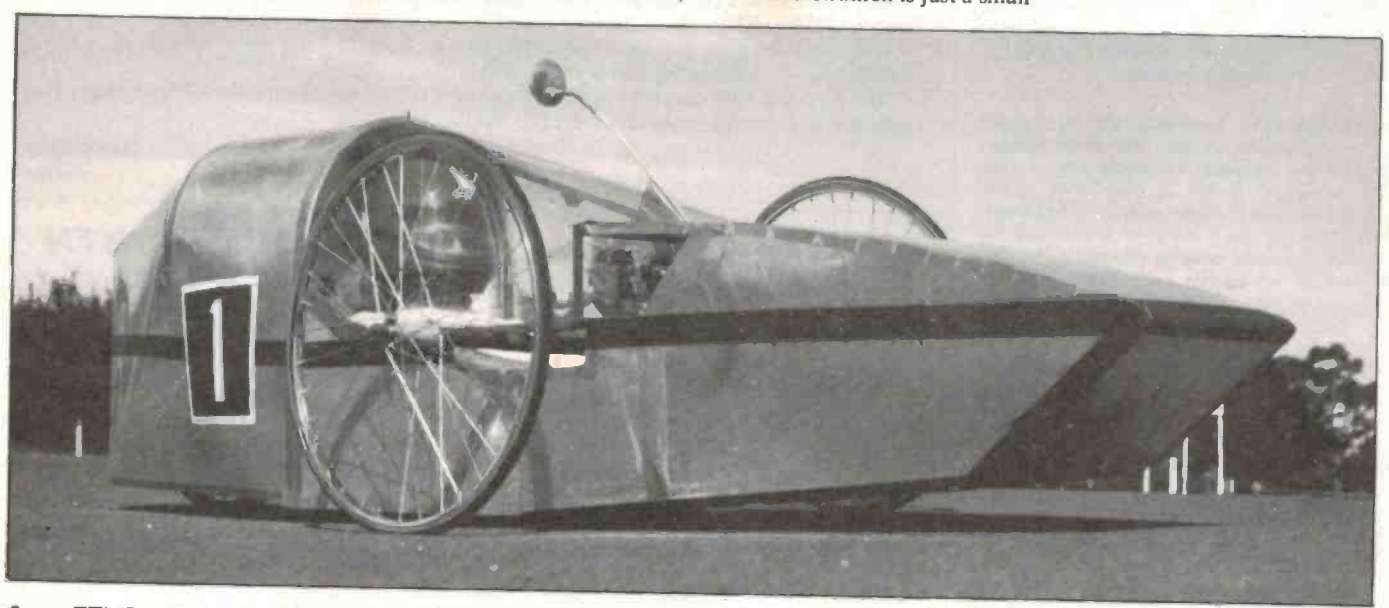
Angelico wins

Bruno Angelico has won the Victorian electrathon at an average speed of 35.8 kph. His car, the Silver Streak, lapped the 0.6 km course in 60.33 seconds.

The electrathon is open to anyone with an electric vehicle, although there are regulations regarding the size of battery permitted. The aim is to drive as far as possible in two hours on only 25 kg of batteries. It's held every year by the Australian Electric Vehicle Association to encourage interest in electric vehicles.

Pride of place this year went to the Sinclair C5 electric bike, although it did not enter the contest, since its batteries weigh considerably less than the regulations required. Also present were entries from Preston TAFE and RMIT. However it was really a day for enthusiastic amateurs.

The Electrathon is just a small part of the AEVA's yearly programme. If you are interested in learning more about electric vehicles or the association contact **Bruno Vaskelis on (03) 63-7263 or call at AEVA, 4th floor, 126 Russell St, Melbourne.**



Outback TV

Communications Minister Duffy says the highest priority is being given to developing a system that will endow regional Australia with services similar to those available in metropolitan regions as soon as possible.

Duffy expects that procedures put into place now will ensure three commercial stations throughout Australia before 1990. This will be accompanied by a substantial increase in areas covered by SBS TV.

The Minister said that the pace with which this would occur would depend to a large extent on the money available. It involves large capital expenditure and increased operating costs, so industry co-operation is essential.

It appears that the government's initiative has bi-partisan support in Canberra, so we can expect work to continue irrespective of the change of political fortunes in Canberra.

New lasers

The Australian Industrial Research and Development Board has given a grant of $239,000 for the development of an industrial laser of 2000 W output. The developing company, Radiation Research of Southport, Queensland, is in the middle of a $500,000 development program that will see commercial exploitation of technology developed by the CSIRO in Sydney.

Preliminary research was conducted at CSIRO's national Measurements Laboratory in Lindfield, Sydney, and at the school of mathematics at Macquarie University. The two organizations collaborated in constructing an experimental version of the device. It had a 75 W output and an active region only 8 cm long.

It has been agreed that the two organizations will play a continuing role in the development of the laser as sub-contractors to radiation research.

CO2 lasers are the most common type of high powered laser. Over twenty are in service in Australia, where they are used for cutting plastics and sheet metal. Overseas, uses include heat treating and welding.

In dollar terms this market is considered to be one of the most viable laser markets of all, especially as the current generation of power lasers is considered too big and sluggish to be really useful in an industrial situation. Industrial CO2 laser sales were $US54m in 1984 with sales growth predicted to be above 25 per cent.

BRIEFS

Custom chips
Plessey has announced that its CAD chip design system, called CLASSIC is now on-line. It operates in a VAX 11/750 DEC mainframe and can be used for custom cell or gate array techniques.

Workshop
The third design workshop for the 6502, 6809 and 68000 series micros is being held in Brisbane 24-26 September 1985. It will deal with the more advanced aspects of microprocessor design. Contact the course secretariat at Q Search, Queensland Institute of Technology (07)223-2195 for more information.

NSWIT going up
Otis elevators has donated $6000 worth of equipment to the engineering department of the NSW Institute of Technology. The donation is part of a $1.7m project for re-equipping labs at the Institute.

New venture co
McPerhson's Ltd and the Australian Industry Development Corporation have joined forces to produce Engineering Innovation Ltd, a new marketing and management company for high technology goods. McPhersons and the AIDC will provide $3m to the venture in the first three years. For further information contact Robert Zahara on (03)699-3588.

Obsolete cash
An exhibition of new "cashless society" technology will be held in Melbourne next year. The exhibition will be trade only. For further information contact BPI Exhibitions, 162 Goulburn St, Darlinghurst, Sydney NSW 2010. (02)266-9799.

The ultimate camera
Olympus Camera Co of Japan has just launched the OM40 camera, with the claim that it has solved the last remaining problems in automatic exposure. It measures light from a number of different areas in the screen to determine an optimum exposure setting.

New science chief
Dr Keith Broadman has been appointed head of the CSIRO to replace Paul Wild who retires soon. Also appointed to the board are Adrienne Clarke, Kevin Foley and Graham Spurling.

Radio University

A new course on data communications is starting on Radio University in Sydney. The course starts September 17 and runs for 10 weeks. It's designed to train systems staff in data communications technology. According to university officials the object is to raise the level of understanding of communications technology without requiring participants to develop technical expertise.

The course is just one of many being run on Radio University. Others include management, BASIC programming, patient care, negotiating skills and traffic management.

Radio University VL2UV broadcasts on 1692 kHz, just off the top of the broadcast band. Signals originate in the University of New South Wales and are receivable at least over the whole Sydney metropolitan area. Reliable reception is reported as far away as Richmond, Penrith and Campbelltown. If you live in Perth you may need a long aerial.

To pick up broadcasts on 2UV a simple adjustment to a standard radio is all that is required. Remove the back of the set. Tune to 2SM, 1269 kHz, and then identify the tuning gang and the oscillator coil. You should find one or two small trimmers on the back of the gang. These will be trimmers for the oscillator and aerial. You will find that one of them will cause the radio to detune. You can confirm this by retuning with the tuning knob.

Keep moving the trimmer and the tuning gang to keep the radio tuned to 2SM. Eventually you will reach a stage where the indicator needle is showing 1170, 2CH. At this stage you will have retuned the radio so that it can receive 1692 kHz, 2UV. Tune in, and adjust the aerial trimmer to give maximum signal.

It may be that you will not be able to achieve sufficient tuning variation with the trimmer. In that case, alter the main oscillator instead. This is usually a coil with an adjustable slug, probably in a metal can near the tuning gang. The procedure is exactly the same.

For more information on courses contact **Radio University, UNSW, PO Box 1, Kensington, NSW 2033.**

Labtam wins

The Labtam series 3000 microcomputer system has won an Australian design award. According to John Sciffer, Labtam's national sales manager, winning the award will be an extra boost for Labtam as it is experiencing record domestic sales at the present time.

An Australia-wide distribution network, which was finalized in April this year, is starting to contribute quite substantially to revenues.

Labtam has also just released a 32-bit system using the 32032 Natsemi chip set with Unix, making for an exceptionally powerful system.

Self analysis at CSIRO

The CSIRO has been going through agonies of "auto analysis" ever since Barry Jones suggested they weren't doing a very good job of selling the Australian public on their activities.

The net result of years of neglecting the public was last year's savage budget cuts. Comments by Science Minister Jones after the event seemed to show that the politicians thought the CSIRO was a soft touch.

It appears that the move was unpopular though, and not just with CSIRO supremo Paul Wild and cronies. A recent committee appointed to look at the CSIRO's organization showed that most people in the community thought that Australia should be spending more money on science in general and the CSIRO in particular.

The committee, headed by Mr Baillieu Myer, has made a list of 38 recommendations, most of which are quite reasonable, according to Wild. Among them: appoint a director of public communications to develop more effective strategies for communicating with the public, subsidize film, publications, displays etc to the tune of half a million dollars a year and be more aggressive in marketing information.

Space crystal

Can the zero gravitation environment in a space capsule be used to manufacture products not available on Earth? This question has haunted much research and budgetry considerations in the USA, Europe and the USSR.

One small step towards the answer came with the work done on Spacelab 3 in March. A research team from California tried to grow a mercuric iodide crystal in space to determine if it is less flawed than a similar crystal grown on Earth. Unflawed crystal can be used to build improved radiation detectors of one type or another.

Scientists have reasoned that lack of gravity might have interesting effects on the growth of crystals in space. Typically, crystals are grown via a vapour deposition method. On Earth, small variations in atmospheric temperature, and vapour transport can seriously affect the way in which the crystals grow. The crystal's fragile structure is also deformed under its own weight as it grows.

All these parameters could be controlled better in space, and this could lead to the ability to grow extremely large structures that are perfect crystals. They would have remarkable properties, in both electrical, electromagnetic and physical terms.

The research will take several months to complete. The crystal is being analyzed in both physical and electrical labs to determine its properties. Publication of the results will make interesting reading.

COMPANY NEWS

Arlec has appointed Conwell Trading of Townsville to be its agent in north Queensland. Its address is 21 Mackley St, Garbutt, Qld 4814.

Ran Data Corp has finalized arrangements to move into the European market with an agreement with Telecommunications Radioelectriques et Telephoniques (TRT). The quick Australian claims 95 per cent of the local encryption market and hopes for similar magic in Europe.

Tech-Rentals has opened new branches overseas in Singapore and Hong Kong and in Brisbane. The company is moving into a new range of satellite equipment including spectrum analyzers.

Mach Systems has just opened a new printed circuit board facility in Melbourne. It's equipped with the latest in soldering technology and is capable of handling surface mounting techniques. More information from Mach Systems, 70 Keys Rd, Moorabbin, Vic 3189. (03)555-0133.

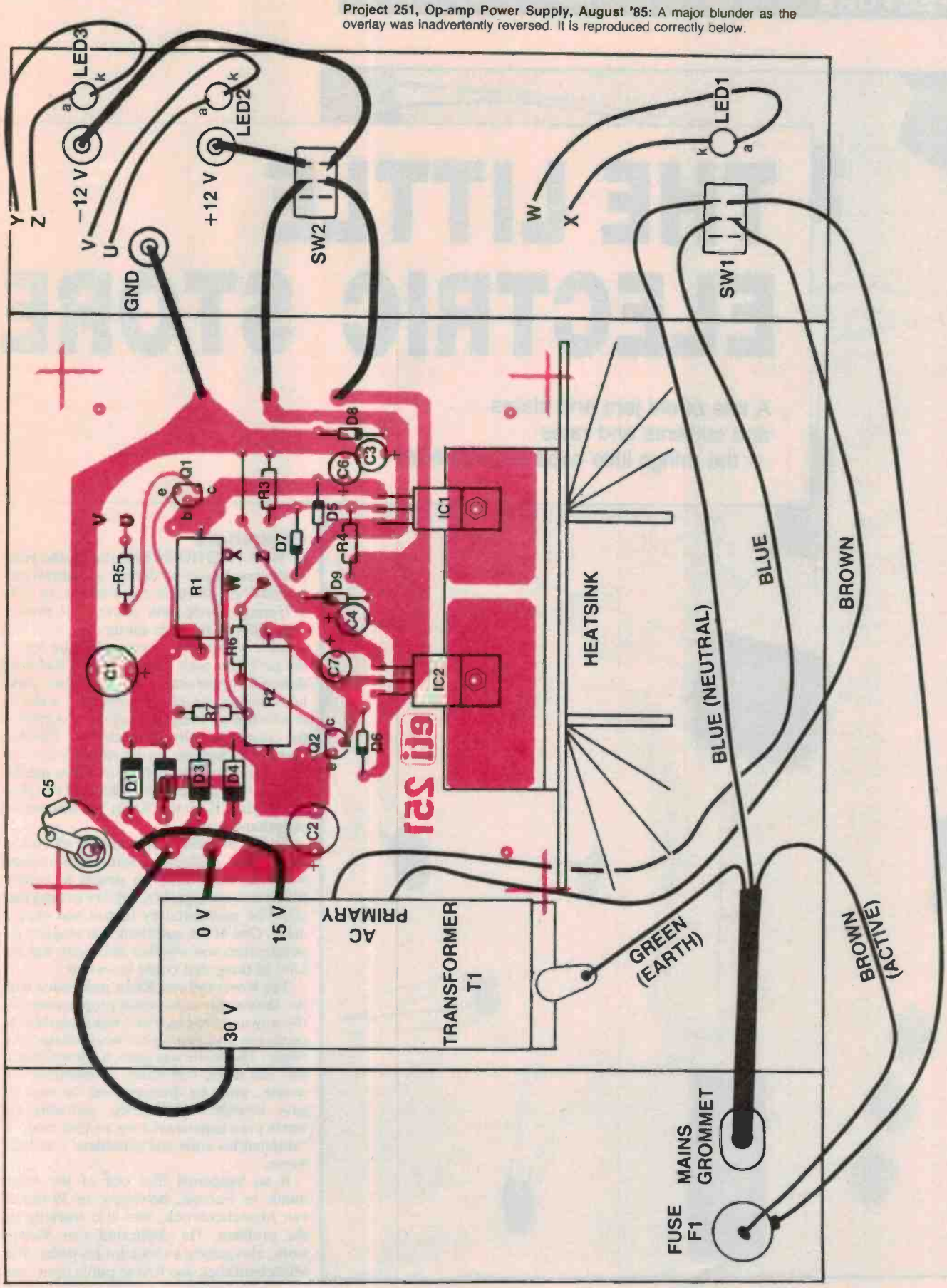
Magna-techtronics has moved into new premises at 7 George Pl, Artarmon, NSW 2064. (02)427-0666.

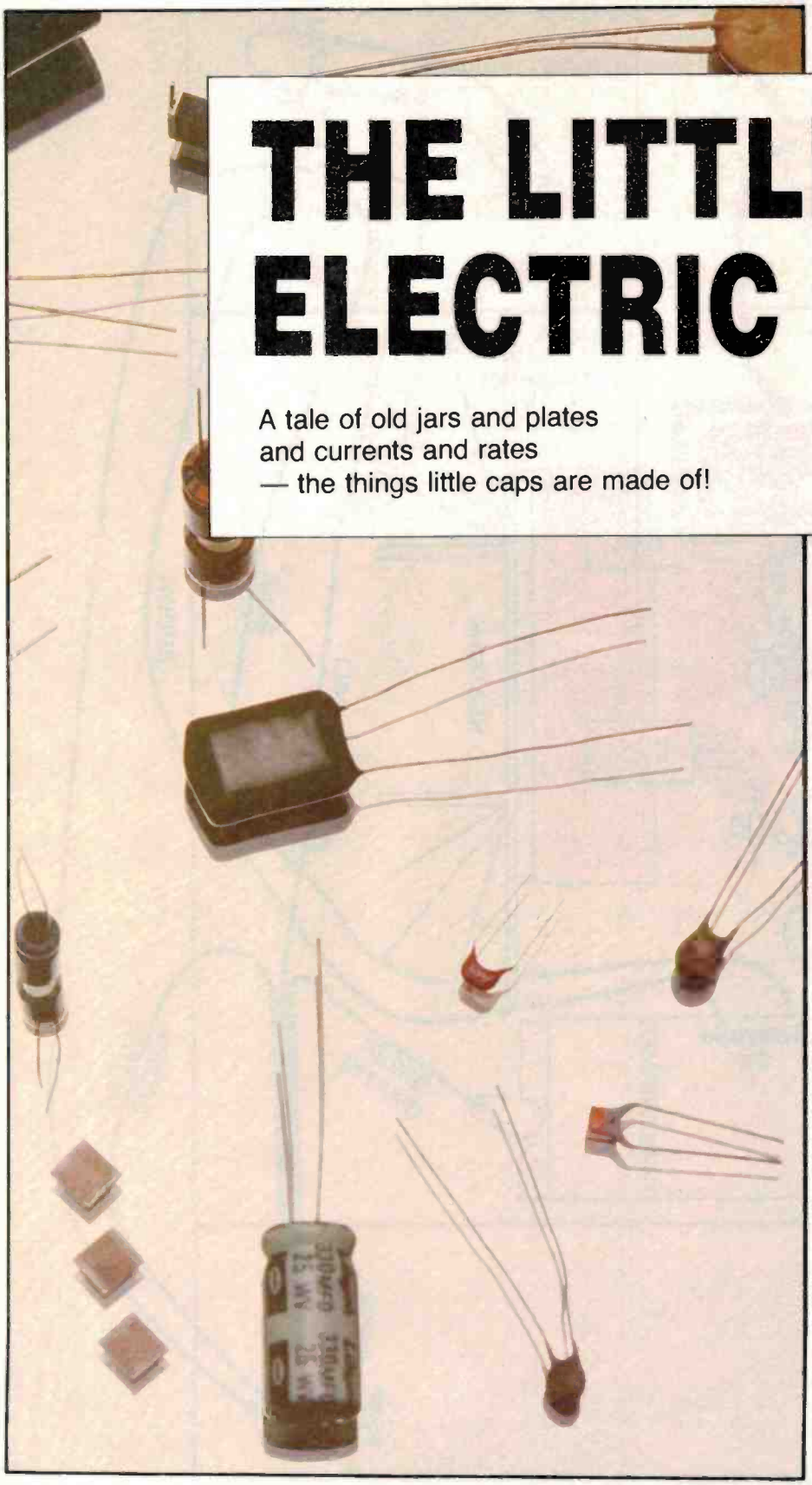
Active winner

Active Electronics held its Lucky Draw on 30 May for a Trio CS1022 oscilloscope. It was held to promote Active's new store at 887 Springfield Rd, Springvale, Melbourne.

The winner was Ross Bell of Keysborough, Vic. He is currently in the final year of his Certificate of Technology in Electronics. In 1983 Ross was top electronics student and was given the Philips award for electronics.

Project 251, Op-amp Power Supply, August '85: A major blunder as the overlay was inadvertently reversed. It is reproduced correctly below.





THE LITTLE ELECTRIC STORE

A tale of old jars and plates
and currents and rates
— the things little caps are made of!

Capacitors

IT WAS FASHIONABLE during the years of the renaissance to dabble in 'natural philosophy' via practical experiments. In 1745 a German cleric with intellectual pretensions did just that. He set up a glass jar and filled it with water, then sealed the top of the jar with a cork, through which had been driven a copper stake. To the copper stake he connected an electric machine, a device in which a spinning glass globe was rubbed to create an electrical charge. Nothing seemed to happen, so he stopped the machine, and grabbed hold of the glass jar. Instantly, his muscles contracted and the glass went flying. E.G. von Kleist had discovered capacitance.

To put the scene into context: electricity was still a mysterious force, but enough work had been done for people to believe that it was manageable, subject to laws that could be uncovered by reason and experiment. One of the questions that plagued experimenters was whether electricity was the kind of thing that could be stored.

The Reverend von Kleist proceeded with the thoroughly reasonable proposition that the way to store electricity was probably the same way you store most small things: in a bottle. The bottle was glass, a known insulator, and inside was water, a conductor. Of course, when he disconnected the wire he gave himself a bad shock, probably the worst ever experienced up to that time. It "stunned his arms and shoulders", he later wrote.

It so happened that one of the finest minds in Europe, belonging to Professor van Musschenbroek, was also working on the problem. He duplicated von Kleist's work, also getting a shock for his pains. Van Musschenbroek was first to publicize it, and

TABLE 1: COMPARISON OF DIELECTRICS (courtesy Rifa)

Type	Poly-propy-lene	Poly-styrene	Poly-ester	Ceramic NPO	Ceramic Hi-K	Mica	Aluminium oxide	Tantalum oxide
e	2.2	2.4	3.3	450	12000	7	10	28
typical capacitance	10n-100µ	47p-50n	1n-10µ	1p-10n	1n-10µ	1p-100n	100n-1F	10n-1000µ
max V dc	2000	500	600	200	100	500	450	125
dissip-ation factor	0.05	0.02	0.8	0.1	3	0.2	10	10
typical tolerance	5%	1%	10%	10%	80%	1%	30%	5%

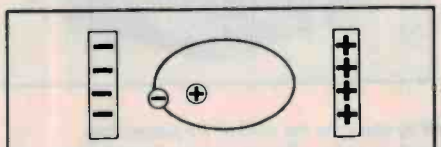


Figure 1. The elliptical path of an electron around the nucleus of an electric field.

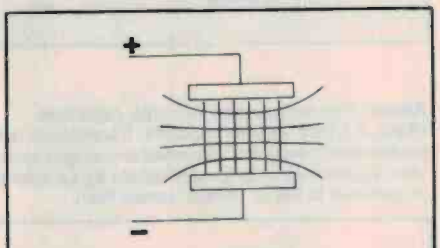


Figure 2. The field between two conductors. The vertical lines are the equi-potential lines which connect points of equal potential. The horizontal lines are the field lines and represent direction of movement of a free charged particle.

Jon Fairall

so the device was named after the town where he did his experiment. The electric bottle is known to us today as the Leyden jar.

An explanation of the strange effects of the Leyden jar was not long in coming. The glass was an insulator, the water a conductor, the hand of the experimenter also a conductor, especially when wet from pouring water into the jar. Van Musschenbroek realized that in such a device the effects of electricity were condensed. It was, he said, a "condenser" for electricity. Today we call such a device a capacitor.

Practical capacitors were developed almost as soon as an explanation of the Leyden jar effect. These simply substituted metal foils for the water and the experimenter's hand. Connection to the inner conductor was via a chain threaded through a rubber stopper.

So, what was this wonderful new effect that had been discovered?

Fields

Capacitance is a measure of the ability to store electric charge. To understand how this works it's necessary to go back and think about some fundamentals of physics and electricity. Matter is composed of atoms, and all atoms are electrically neutral. However the constituents of the atom are not. The nucleus has a positive charge and the electron a negative charge.

One of the fundamentals of electronics is that unlike charges attract and like ones repel. So, if we have a point with a surfeit of electrons, and another point with a lack of them, then all the electrons will flee the negative point and congregate at the postive point. However, this is not the whole story, because how many electrons flow depends on the type of material they are imbedded in. Some materials, such as copper and aluminium, encourage electron flow. We call them conductors. Other don't, and we call them insulators or dielectrics.

What's happening? Electron orbits, normally circular, are distorted by the presence of a charge. There is a gradient of force across the electron orbit, so that on the side closest to the origin of the force, the disrupting force is stronger than on the side furthest away. This turns the orbit into an ellipse. The stronger the force, the steeper the gradient, the more elliptical the orbit. When this distorting force gets too great, the electrons sheer off and become negative ions. The amount of force necessary to achieve this depends on the quality of the material. The atoms in conductors are vulnerable, those in dielectrics resistant.

The problem with this account is that it involves what is known as "action at a distance". The electrons are depleted *here* and the atom reacts *there*. Exactly the same problem worried Newton when he was working on the theory of gravitation. We can explain things with an abstract mathematical idea called a field. Fields have been involved in gravitation and magnetic theory as well as in electrical theory.

You can give a field some kind of physical reality and delineate it with equi-potential lines. That is to say, lines along which the strength of the field is the same. At right angles to this run field lines, which indicate the direction of movement of a free charged particle in the field. As you can see from Figure 2 the rules are that field lines leave and enter their source at right angles; they never cross, and they flow from a positive point to a negative one.

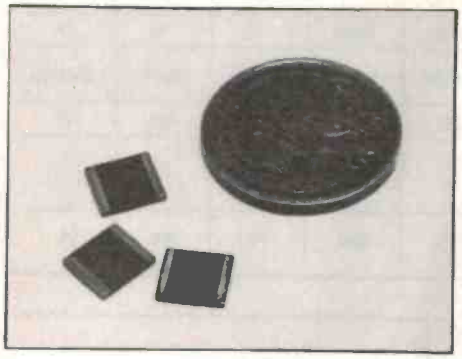
Another way to think about the field: consider what the presence of the field means to the atom across which it is impressed. Each of these has electrons in an orbit of greater or less eccentricity. This is a higher energy state that normal, and thus represents a source of energy. It is potential energy, however, since one can't get at it until a conducting path is provided. Then it becomes real energy, showing itself in the deflection of an ammeter. In effect, the electric field is an energy store.

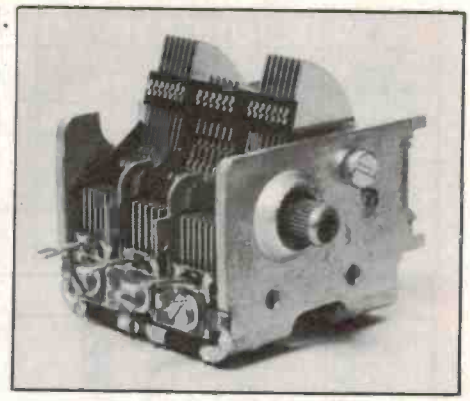
Practical capacitors

So how do we turn this theory into a practical capacitor? The earliest capacitors consisted of two sheets of parallel metal with an air gap. This is still a preferred method of doing things for variable caps. Early in the game however, it was discovered that other materials make better dielectrics, and for most applications solid materials are used.

There are two main types of capacitors, both conforming to the general pattern of conductor-dielectric-conductor. One is the foil type, in which a strip of dielectric, like mica or ceramic is sandwiched between two strips of conducting foil. Leads are soldered to the foil and the whole assembly heated to seal it against moisture.

A variation on this theme is called "metallization", particularly favoured with the plastic dielectrics like polyester and polystyrene. Here the conductor material is vapourized in a vacuum container and deposited onto the dielectric, which is then wound up to form the capacitor. This method has the advantage that it is possible ▶





Above. Tiny surface mounted 'chip' capacitors.
Right. A typical variable capacitor. Capacitance is varied by changing the area of the plates. This fundamental design has remained unchanged since the birth of radio, although variable capacitors are now often superseded in radio applications by varactor diodes which have a capacitance level directionally proportional to the dc voltage across them.

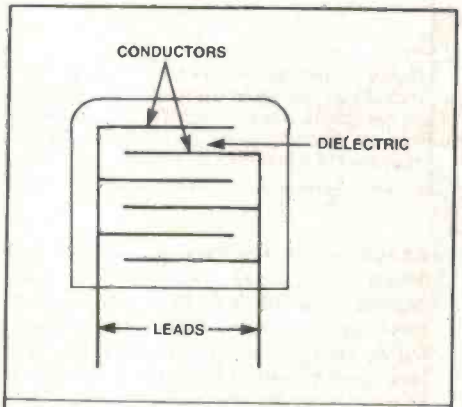


Figure 3. A typical capacitor.

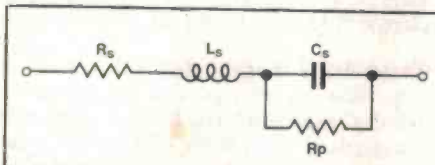


Figure 4. The equivalent circuit of a capacitor showing inductance and resistance in series with the capacitance. The capacitor is also shunted by resistance.

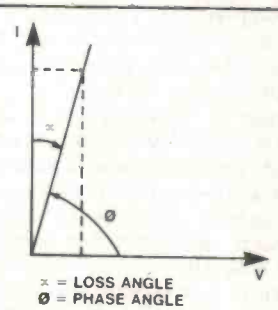


Figure 5. The loss angle.

to make the metal layer extremely thin, in the order of microns. Modern techniques allow the dielectric to be of this order of thickness as well, so an extremely compact capacitor results.

Even more compact are the new monolithic capacitors, especially intended for surface mounting. These SMDs (surface mount devices) are made from microslices of ceramic and silver packaged in a cube a few millimetres on a side. It's possible to obtain up to 0.1 μF by this method, sufficient to bypass TTL in typical applications.

The other major type of capacitor is the polarized electrolytic. A metal post composed of aluminium or titanium serves as the anode. An extremely thin oxide layer is grown on the outside of the post to serve as the dielectric. The cathode is an electrolyte. Normally an electrolyte is a liquid, but in this case the electrolyte is impregnated in paper or some other porous substance. With this structure it clearly makes a difference which way the current flows through it, and in fact this type of capacitor can only be used when the current flows in a single direction.

Equivalent circuits

In theory a capacitor is simply a capacitor. In practice, a capacitor, like every other device on a circuit board, has capacitance, inductance and resistance. The only difference is that the capacitance is controlled, and hopefully, the inductance and resistance minimized.

The equivalent circuit of a real capacitor is shown in Figure 4. It shows series inductance, and both series and parallel resistance. The series inductance is present in the device leads and indeed, in the body of the component itself. As one would expect, the inductive effects increase with frequency, and so the practical effect on the capacitor as a whole is a decrease in the impedance up to a certain frequency, called the resonant frequency, followed by an increase. This effect is present in all capacitors, but it can be minimized by careful design, and also by careful mounting on a pc board. The rule is: keep the leads short.

Series resistance is a measure of loss in the capacitor. It is measured as the loss angle or dissipation factor. These are different ways of approaching essentially the same thing, and they are often used interchangeably, especially in ac theory. Theoretically, in a pure, ie, lossless capacitor, there is a phase difference between current and voltage of 90 degrees. Current leads voltage. In a resistor there is no difference. In a practical component the resultant phase angle is a result of the vector sums of resistance and capacitance (see Figure 5). As a result, the loss angle is a good measure of the extent to which power is absorbed in the capacitor, and thus a measure of the extent of series resistance.

Parallel resistance is more commonly known as insulation resistance, and in fact is a measure of the ability of the dielectric to carry a direct current. As the area of the dielectric and thus the capacitance goes up the insulation resistance comes down.

Compromise

Given all this, what are the limits that constrain capacitor design? As always when dealing with nature, there are compromises to be made.

Capacitance in any capacitor is proportional to $e \times \frac{A}{d}$

where e = the dielectric constant, A is the conductor area and d the distance between the conductors. Since the maker usually wants to get as much capacitance into as small an area as possible, he can do any of three things: increase A or e; or decrease d.

Increasing e has been a preoccupation of scientists since 1745. However, as we will see, high values of e often have nasty side effects. Modern trends have included research into plastics that has seen products like polystyrene and polypropylene join standards like polyester. Research is also going on into the creation of new types of ceramics.

The problem is that large dielectric constants are associated with some undesirable electrical properties. Perhaps the most notable in a practical sense is that such dielectrics are unstable. They tend to be sensitive to temperature, frequency and voltage, and any or all of them can cause the capacitance value to change quite dramatically.

The most dramatic example of this can be seen in ceramic capacitors. Ceramic is not, as often imagined, a single type of dielectric. In fact ceramic capacitors are made by mixing up a brew of 'powders'; a little of this, a little of that. Graphs of capacitance against temperature and dc volts are shown in Figure 6 for two types of dielectric, NPO and BX. With an NPO dielectric, a capaci-

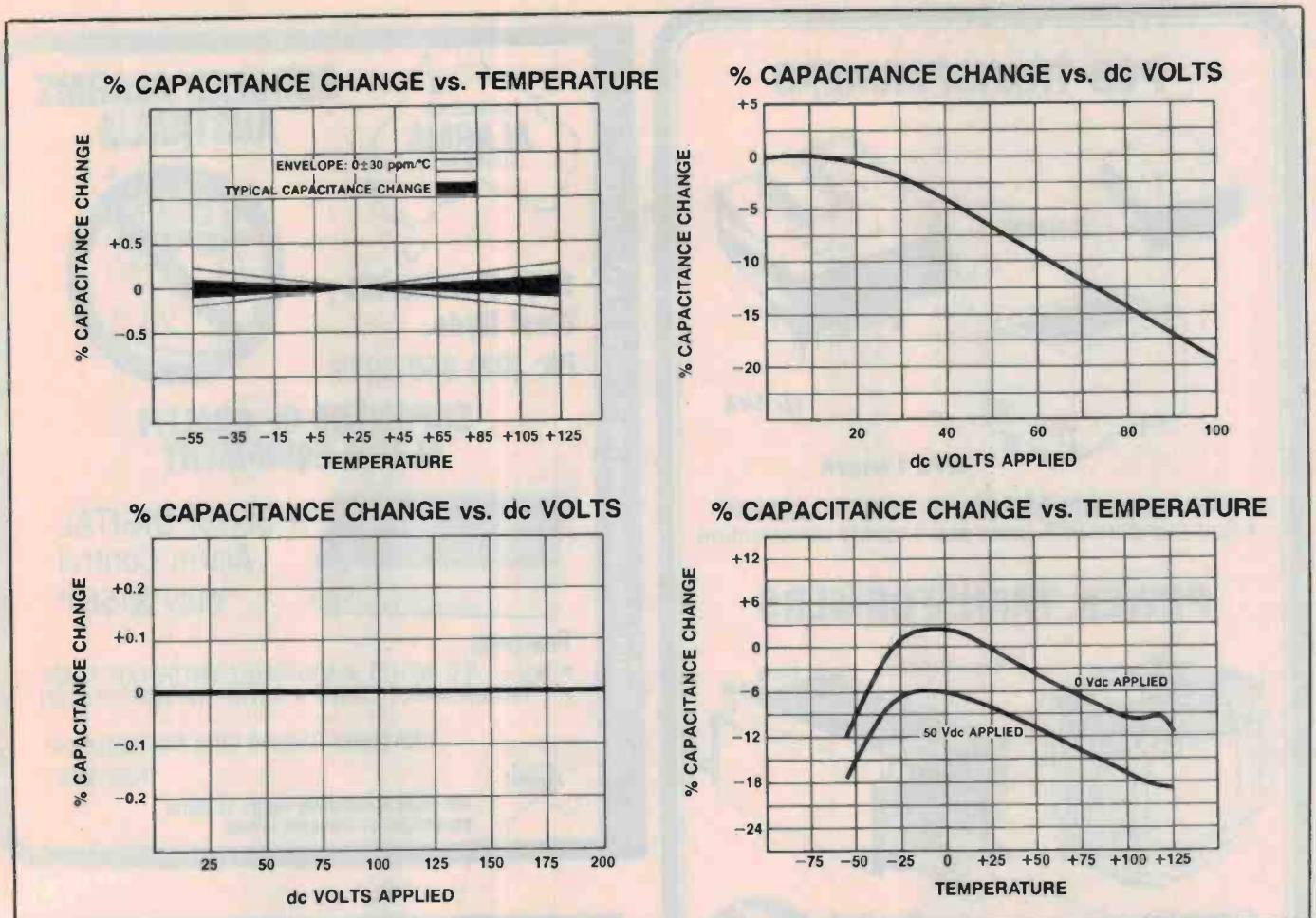


Figure 6. Comparison of two ceramic dielectrics.

tor about a millimetre cubed can have between 1 and 150 pF of capacitance. An equivalent sized BX ceramic capacitor will range between 100 pF and 5.6 nF.

The state of the dielectric also changes with frequency. Most significantly, the dissipation factor increases dramatically with frequency in any given dielectric, and as usual, it's the ones with the higher dielectric constant that are hardest hit. Tantalum for instance, has much worse high frequency response than either ceramic or plastic film capacitors. Ceramic or plastic can be used to decouple high frequency transients from integrated circuits; tantalum is essentially useless in this application.

Another factor is the question of ageing. There are many applications where there is a requirement for capacitors to last 30, 40 or even 50 years without significant changes in capacitance. Expensive equipment in telephone exchanges would be a prime example. Front runners for this application are polystyrene and polypropylene, with dielectric constants around three.

Designers have a number of tricks up their sleeves to increase the value of A. Perhaps the earliest, and still the commonest technique is to roll the dielectric up like a Swiss cheese (see Figure 7). A rather more subtle measure is to increase the microscopic corrugations in the surface of the conductor, thus effectively increasing A without increasing the bulk of the whole assembly. Etched aluminium surfaces do just this, resulting in substantial increases of A. Perhaps the most spectacular example is NEC's Supercap which uses a layer of activated carbon that is so rough it has a surface area of 10,000,000 cm^2 for every gram of carbon. Going down this route has resulted in a farad of capacitance in a 20-cent sized package. (See ETI March 1985 for a description of Supercaps.)

Manufacturers have made some remarkable achievements in pursuit of super thin film dielectrics. In 1951 Du Pont in the USA announced Mylar, the first of the plastic films suitable for miniature capacitors. It is still in use today as "Mylar C" and available down to 1.5 μm. Films of these dimensions are used by Wima in Germany to produce ultra miniature capacitors with lead spacings only 2.5 mm apart. Paper layers in metallized capacitors have been produced that are only 10 μm thick. Rifa is now manufacturing polypropylene dielectrics as thin as 4 μm. Research is currently underway that will allow large scale manufacturing of 1 μm sheets.

There are many problems with relying on super thin dielectrics. Some idea of scale: 20 layers of Mylar film one on top of the other would be thinner than a human hair. For a start there are mechanical problems that come from handling materials that thin. It tears easily and is very susceptible to heat. However these problems can be overcome (at a price). What cannot be overcome is the voltage sensitivity of such capacitors. All things being equal, the thinner the dielectric the less voltage you can put across it. ●

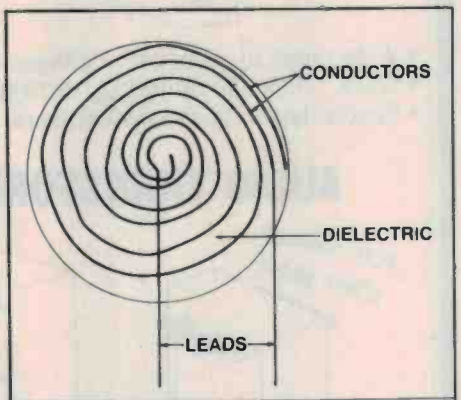


Figure 7. Structure of a typical thin dielectric metallized capacitor.

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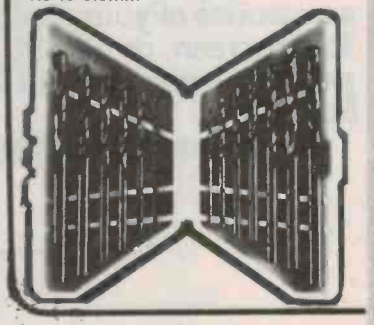

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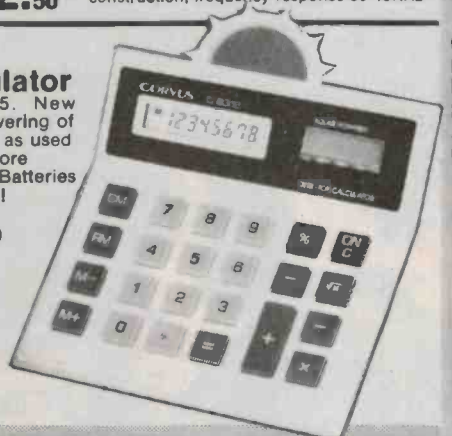

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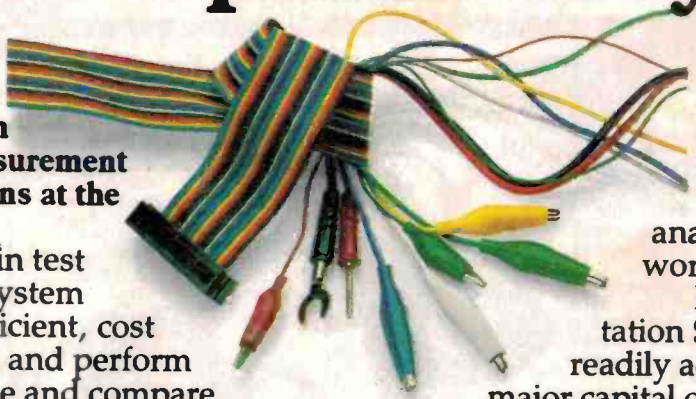

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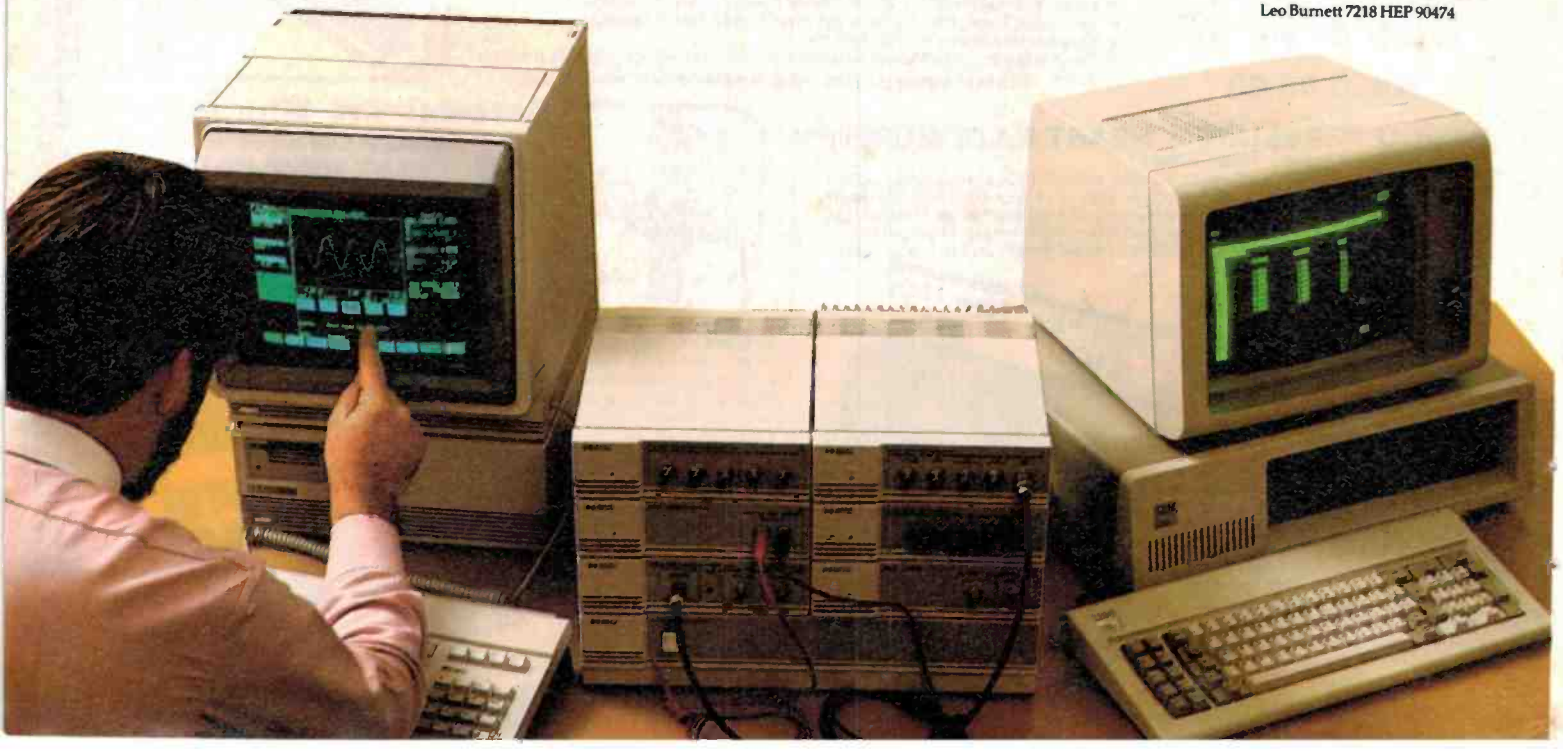

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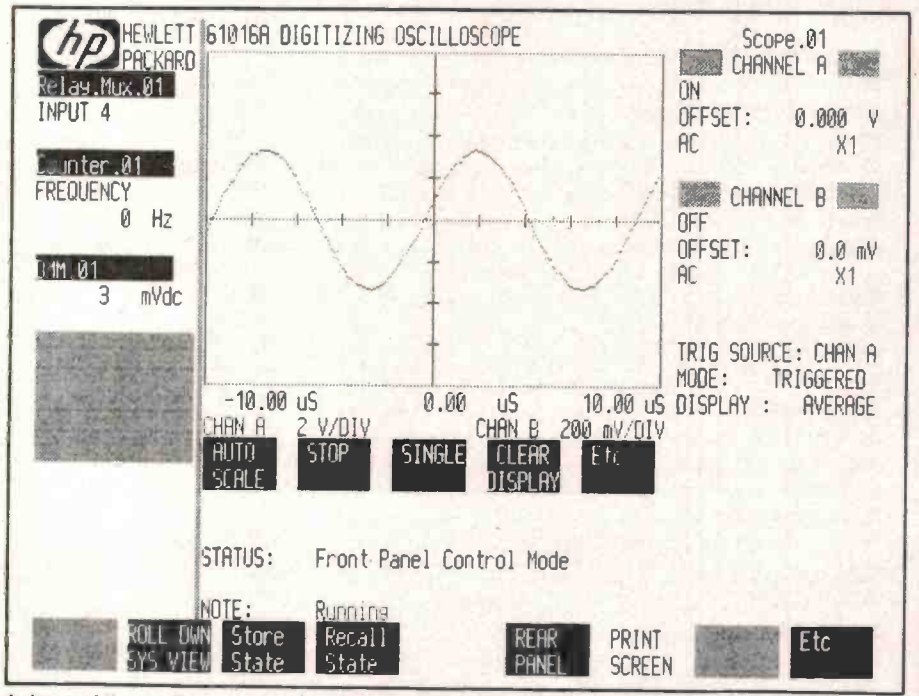
Robert Irwin

HEWLETT-PACKARD HAS always had a big name in instrumentation and test gear. One of its latest offerings is a series of computer controlled test instruments which it calls the "PC Instruments System". This consists of a series of instrument modules designed to interface, via the HP Instrument Bus, to either HP's own HP-150 computer or the ever popular IBM-PC. The concept behind the PC Instruments System is to put the potential power of these PCs to work in a fully software driven test instrument environment.

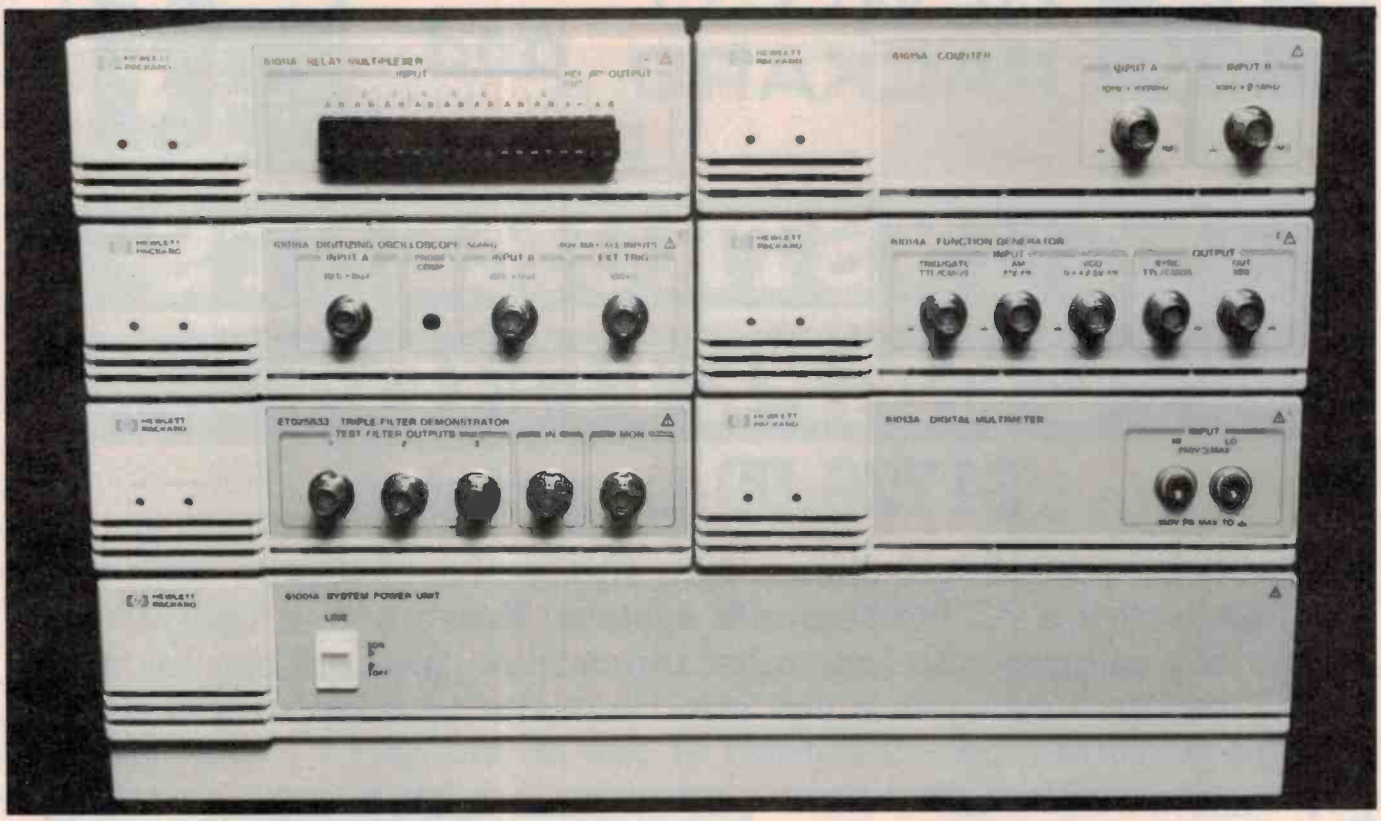
The idea of computer control in test instruments is by no means a novel one but the usual implementation is to take a complete, stand-alone unit, such as a DMM, and include, to a greater or lesser extent, some sort of computer interfacing. This, of course, has the advantage that the instrument can be used either with or without a computer but, of necessity, considerably raises the cost of the instruments to a level that puts versatile automatic test set-ups into the 'big league' and requires many dollars and much time to implement. Indeed, Hewlett-Packard itself has been instrumental (excuse the pun) in the design and marketing of just such equipment. It has its own implementation of the IEEE-488 general purpose industrial bus going under the name "HP Instrument Bus" (HP-IB) and has produced a number of test instruments capable of using this bus to interface to a computer.



A dump of the oscilloscope front panel screen using the "print screen" function.

The PC instrument system

The main difference in the new line of HP products is that the test instruments are dedicated, software driven peripherals which, in themselves, have no display or control facilities. The 'front panel' is software created and graphically displayed on the computer VDU. This eliminates the need for, and thus the cost, of individual displays and controls on each instrument. The instrument modules contain only the hardware necessary to interface the computer to the outside world in the appropriate way. The computer does the rest. By taking this approach, Hewlett-Packard has tried to exploit the possibilities presented by the increasing power and decreasing cost of a personal computer set-up.



The modules stack neatly on the optional system power unit.

As far as hardware goes, the system, at present contains eight modules. The instruments included are a digitizing oscilloscope, digital multimeter, function generator and universal counter. The four remaining modules are not strictly instruments but perform various functions to increase the versatility and ease of use of the system; they include a digital I/O, relay multiplexer, dual voltage DAC and an eight-way, high power relay actuator.

All of the modules are the same size and shape and are designed to sit very neatly and securely on top of one another to save bench space. On purchase, each unit is supplied with its own power supply in the form of a small plug-pack type arrangement but a master supply to power all the units is available.

Apart from the interface card for either the HP-150 Touchscreen computer or the IBM-PC and the computers themselves, the only other hardware needed is the various probes and clips that you will require to connect the instruments to a circuit.

Soft touch

Just as important as the modules themselves is the software that runs them. As mentioned previously, both the HP-150 Touchscreen and the IBM-PC can be used to drive the system. In the case of the former, the touchscreen is used to great advantage to implement a 'soft key' system on the screen, whereby a displayed 'button' need only be touched to actuate the function it represents. A more conventional keyboard curser control duplicates the process from the keyboard if the operator desires.

The system software which comes with the modules performs several duties. The most obvious, on power up, is the generation of detailed graphics representing the front panel of the instrument being used. All the switches and knobs usually found on a similar stand-alone unit are displayed and changing settings or functions is usually only a matter of moving the cursor over the relevant section and pressing the return key. In this manual mode all the units can be driven as you would a normal instrument. When several instuments are being used at once, the front panel of the currently used instrument is displayed as normal but the left hand column of the screen is reserved for what is termed a "system view window". This displays the current status and readout of all the other instruments in the system.

Programming ease

The use of 'soft' front panels enables the price of each module to be kept to a minimum, but this is only the tip of the proverbial iceberg as far as software development goes. The main power of the PC instruments system, indeed its reason for being, is the ability to run programmed test sequences under computer control. A problem with past systems has been the time and money involved in developing software to run them. In the main, programs would be developed from scratch to accommodate the needs of a particular user and the instruments used. The HP instruments software has been designed to be as general purpose as possible and easy to program so that working systems can be developed and debugged with a minimum of time and programming proficiency. Several features of the system software make this possible.

All the instruments can be set up manually to the desired initialized states and, by use of a key on the soft front panels, this 'system state' can be stored on disk, under a user definable name. Also from front panel mode, a user named 'program shell' can be created from which a full test program can be developed. The program shell is a BASIC program which contains all the initialization instructions and subroutines needed to drive the system from GW BASIC. From this base program a user written program can be developed to perform the desired tasks.

Because all the necessary subroutines have been created in the shell, simple CALL commands can be used to control the instrument functions. For example, to set the system up to a pre-stored system state you can issue the command:

CALL INITIALISE SYSTEM (statefile)

where "statefile" is the name of a system state that was stored from the front panels. This command will then set up the entire system to the desired state. Changing the settings of the instruments or reading a measurement etc are all done in a similar manner using various CALL commands.

With this prewritten program shell, quite sophisticated test programs can be written in BASIC by even those with minimal experience on the system. This makes in- ▶

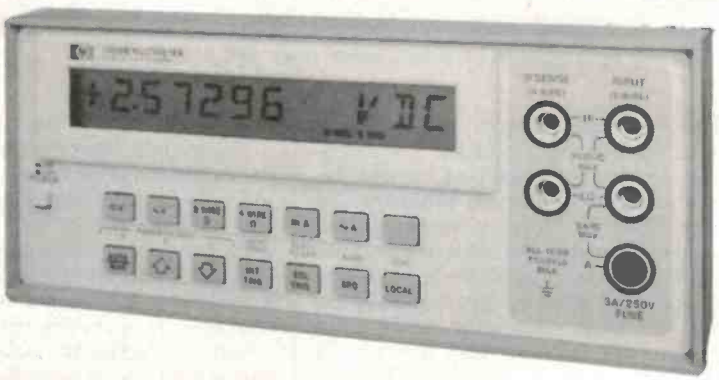
HEWLETT PACKARD and present eti

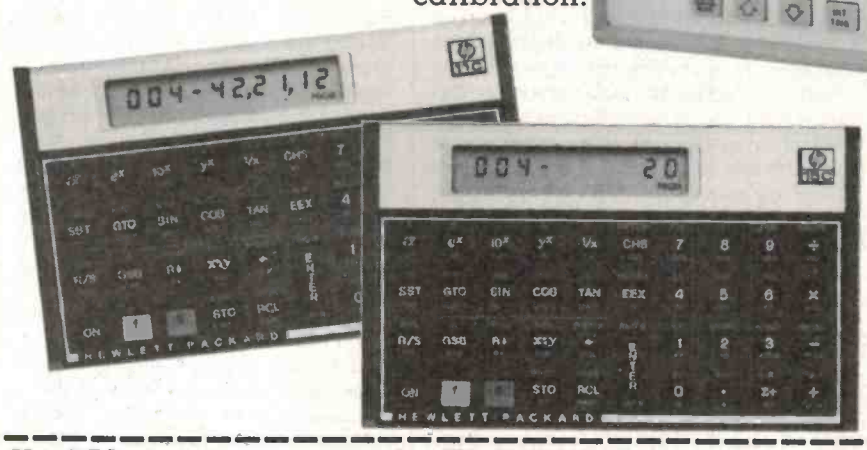
PC INSTRUMENTS COMPETITION

$1726.00 in prizes!

Hewlett Packard has shown how innovative it can be with the release of the PC Instruments system. Now its your turn! If you can suggest the four most innovative applications for the PC Instruments system you can be in the running to win a high performance multimeter or one of two great programmable calculators.

You could win this high performance **HP 3468B** five function digital multimeter. It has 1 uV sensitivity and electronic calibration.





Or you could win one of these two runner up prizes, a **HP 11C** or a **HP 15C** scientific programmable calculator.

Closes November 1, 1985

Yes! Please enter me in the HP-ETI-PC Instruments Competition . . .
I think the four most innovative applications for the PC Instruments would be:

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....

Name: .....

Address: .....

..... Postcode.....

State.....Phone .....

Company/Organization .....

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house program development by the user companies (or individuals) very economical and easy to do, enabling automatic testing to be implemented at a greatly reduced cost. The cost of changing or updating system software is also made more palatable.

In case you were wondering about having to junk the very expensive, HP-IB compatible digital CRO you have just purchased, fear not! Some additional hardware and software is available to turn your computer into an HP-IB controller. Being compatible with the PC Instruments System, this software enables you to control both the instrument modules and the HP-IB compatible equipment from the same BASIC program allowing the power of the stand-alone modules to be combined with the ease of use of the PC Instruments.

Data handling

Obtaining reading and measurements is one thing. Turning them into useful information is another. To help ease the pain, optional Data Acquisition software is available for the PC Instruments System. This enables the logging of data and the configuration of the system for multiple scanning and recording operations. A graphics utility then enables the data to be presented in a visual form directly to aid in the interpretation of incoming data. The Acquisition software is menu driven in a similar fashion to the soft front panels and is therefore very user friendly and, once accustomed to the soft panels, easy to adapt to.

Included in the PC Instruments System software is a DIF (Data Interchange Format) conversion which makes it possible to directly drive some powerful and widely used third party software such as Lotus 1-2-3, VisiCalc, Picture Perfect and Wordstar. The resources here are immense and can be tapped to expand the Instruments System into quite a sophisticated data acquisition and processing system. Complex graphical and numerical analyses of incoming data can be performed enabling useful data to be presented to the user with a minimum of delay.

Shape of things to come

There is no doubt that the new PC Instruments System is a pioneering venture for Hewlett-Packard. Its acceptance and usefulness in the marketplace are, as yet, unknown quantities. I feel sure, though, that this approach to PC instrumentation will find many a niche to fill. In the instrumentation field HP enjoys a deservedly high reputation for quality and reliability in its products. When personal computers were first introduced they were viewed by the professionals as nothing more than toys but, with their decreasing price and increasing power, they have found their way into an ever increasing bag of applications. With the IBM-PC becoming virtually an industry standard, there should be a great deal of interest in the Instruments System from anyone who would benefit from an automated test set-up without the resources to expend the megabucks and many hours to get a conventional system up and running. The PC Instruments System could point the way to the future of test instrumentation and provide yet another avenue for development in the ever expanding personal computer revolution.

HP INSTRUMENTS SYSTEM — A BRIEF REVIEW

After reading the brochures and press releases on HP's new Instruments System, I was, as you can imagine, quite keen to get my hands on one and take it for a test drive. There being only one complete system in this sunburnt land of ours, it was, understandably, in great demand.

Eventually I managed to persuade the relevant powers at HP to ship the system out to the ETI lab for a quick review. There were four days in between the system being shipped up from Melbourne to being sent up to Brisbane. Four days! I had visions of still being lost in the opening menu with an operator's manual stapled to one hand and a GW BASIC manual clutched in the other in that short time. But I was pleasantly surprised.

The system finally arrived and after a few trips lugging the gear up several flights of stairs to the lab it was time to set it up. This was my first surprise. The system was completely easy to put together. The test computer supplied was the HP-150 Touchscreen with 10M Winchester hard disk and a 3½" micro floppy. Only five of the instrument modules were available for testing at the time and these stacked neatly and securely, in two rows, on top of the power ▶

supply unit. The modules were connected together in a "daisy chain" with ribbon cable and IDC connectors which connects back to the HP-IB interface on the computer. Accompanying the instruments was HP's excellent Thinkjet printer which connected to the computer via a very sturdy looking multicore cable. This left three mains plugs to find sockets for.

Before getting down to the nitty-gritty, a word about the cosmetics of the system. All the modules are identical in shape and size (295x212x65 mm) and weigh in around the kilo mark on average. This makes for a compact and light system which should have no trouble finding a place on even the most cluttered benches. The cases are made from the same light grey plastic as the computer and are moulded so that they will interlock when stacked on top of each other. The power supply is two modules wide and allows the instrument modules to stack neatly on top. The faces of all the modules contain no switches or displays but have various sockets or terminal blocks according to their functions. Two green LEDs appear on the left-hand side of each module to indicate POWER ON and whether the module is currently active or not.

The five modules I was able to look at were the digitizing oscilloscope, function generator, frequency counter, relay multiplexer and digital multimeter. After finding all the necessary ON buttons and pressing them, a reassuring humming from the Winchester and a few blinking LEDs told me that the system was getting ready. After about 30 seconds the first signs of life appeared on the screen. The system was configured to jump into the applications management software upon power up and, after a few preliminary messages, did so. I searched through the directory and found the SOFT PANELS program and, with a mere flexing of a finger (the Touchscreen does make life easy!), fired it up. The usual copyright and header pages appeared and then, voilà, in front of me was a digital multimeter awaiting my commands. On the left hand side of the screen was a system status column which gave the state of all the other instruments. I quickly stepped through the front panels of each instrument and had a bit of a play with the 'knobs'. The range switches and the like are arranged in what HP calls 'roll switches'. These switches display the current setting as well as one either side. To change the setting you first roll the switch up or down and then select the centre setting.

After playing with the system in manual mode for a while it soon became obvious that this was not its strong point. Although all the instruments (with the exception of the function generator which I will explain later) perform their set tasks very well indeed, the user tends to get a little frustrated at not being able to instantly change ranges and settings. Also, having to keep alternating between front panels to change setting tends to be a little time consuming. However, this is not what the system is specifically designed for.

The aim of the game is automated testing so to this end it was time to delve into the mysteries of programming the system, and with a cursory burrow into the relevant manuals they disappeared rather quickly. Assisted by only a passing acquaintance with GW BASIC it soon became apparent that creating BASIC programs for specific applications was almost trivial. The first step in the programming sequence is to set up the initial states of all instruments. This is done in the manual mode and once you are satisfied with the set-up you store the state of all instruments by pressing the STORE STATES button on the screen. You may specify which disk you want it stored on and give the state a name of your choice. You may store as many different states as you want and also, within each state, you may configure each instrument a number of times so that, for example, if you want to have two DMMs each with different settings, you simply set it up one way under one name (DMM.01 is the default name) and the other way under a different name.

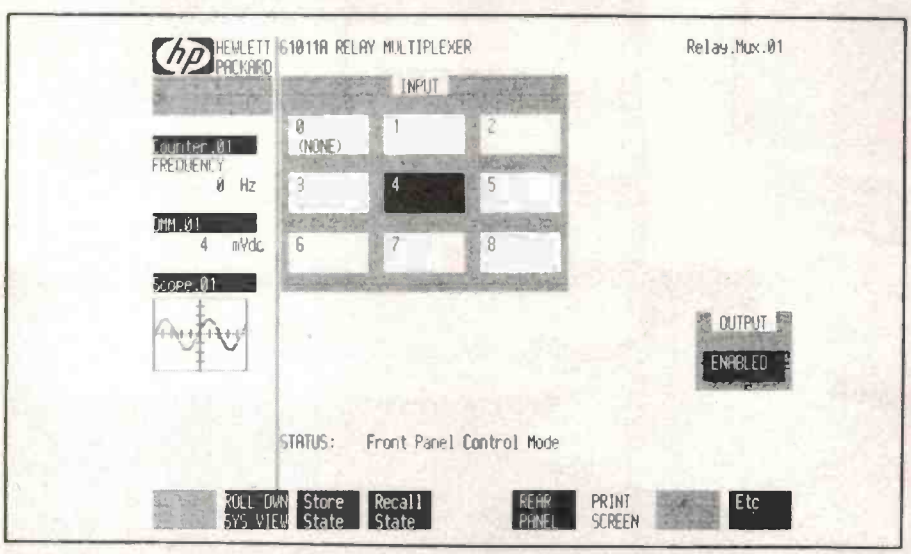
Once you have stored the initial state of all the instruments a PROGRAM STORE button then lets you create a program shell in BASIC with a user given name. Once you have done this you can jump into BASIC and write the rest of your program. The program shell is a BASIC program that uses the line numbers up to 1000 and contains all the necessary subroutines and initialization sequences to drive the modules. The user written program is added from line 1000 onwards. To get the modules to perform functions a set of CALL instructions is used. For example, CALL OUTPUT.ENABLE (MUX.01) turns on the output of a relay multiplexer called MUX.01. Initializing the system to a previously stored state can be accomplished with a CALL INITIALISE.SYSTEM(state) where "state" is the name of a statefile created in the front panels mode.

To test the system out I wrote a short program to take measurements of a dc voltage reference every 20 seconds. Although only a simple test, it was enough to assure me that there would be no problem in creating quite sophisticated test routines even with my severely limited experience with the system. Because the program is written in BASIC, there is also potential for modifying and operating on the incoming measurements directly. Thus programs may incorporate computational and graphical subroutines if desired. The system software is also able to talk to sophisticated data handling packages such as Lotus 1-2-3 and VisiCalc which enables some pretty fancy data manipulation. Unfortunately, I didn't have the time to check this out myself so I'll have to take HP's word for it.

Although thoroughly taken with the potential and the ease of use of the system, I did find a few 'bugs'. After doing an autoscale on the oscilloscope two vertical lines appeared on the left side of the screen. The only way I could get rid of them was to call up the front panel of another instrument and then go back to the scope. These lines are possibly meant to be there but their purpose eluded me. Another problem I came across in the test system was that sometimes when calling up the FRONT PANELS program initially, the system would 'hang' and I would have to do a cold start. This seemed to happen more often when the modules were connected to a circuit ready for measurement but it did happen once when there was nothing on the inputs. I suspect, though, that this was a problem with the computer (it has been crated all over Australia and is bound to get a bit of rough handling) rather than the Instruments System.

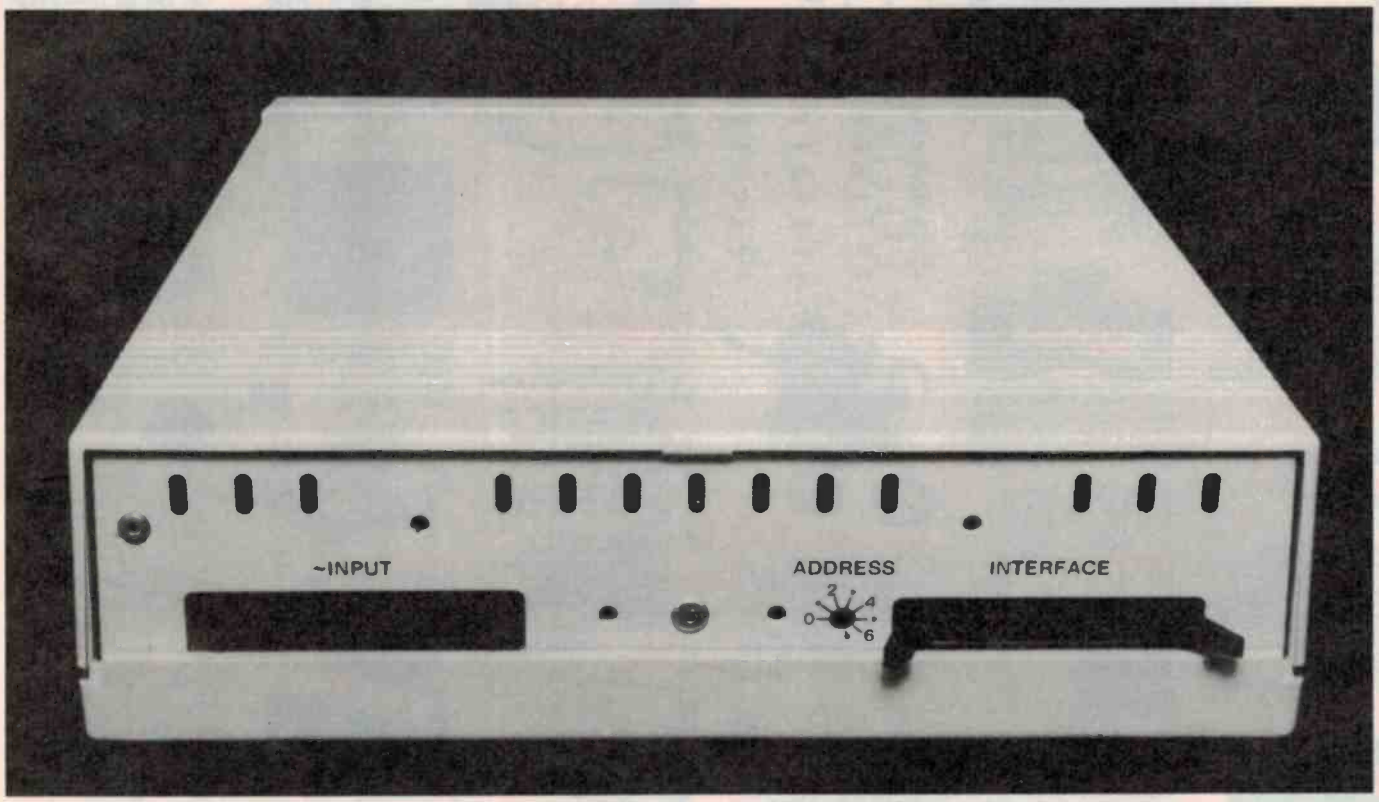
At the time of this review the only function generator module available was a prototype one. This module only worked intermittently so there was no way to assess its performance. HP assures me that the production unit works perfectly.

All too quickly the time came for the Instruments System to make its sojourn north. Apart from a few minor problems, the system performed impeccably and was a real pleasure to use. The potential power and usefulness of this system is great and will be at home in both small and large scale applications. I can see the system as an invaluable test aid in any electronics development set-up (such as the ETI lab . . . hint, hint!) and with the simplicity of programming, its use should be versatile enough to make it a very cost effective proposal for even smaller organizations. Hewlett-Packard has laid a new direction in automatic testing with the PC Instruments System and has opened a new avenue in the expanding personal computer revolution. ●



The front panel of the relay multiplexer. Note that the status of the rest of the instruments displayed down the left hand side of the screen.

A close up of the front of the counter module. Note the absence of controls and display.



The rear panel of the counter module showing the interface, power sockets and recessed switch for address selection.

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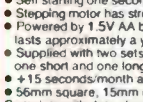

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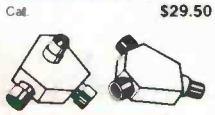

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17c	**16c**	**15c**	**11c**
18 Pin Cat.			
18c	**17c**	**16c**	**13c**
20 Pin Cat.			
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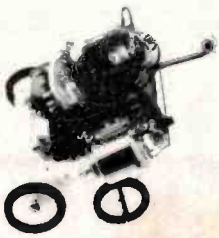
24 Pin Cat.			
35c	**33c**	**32c**	**28c**
40 Pin Cat			
45c	**40c**	**35c**	**30c**



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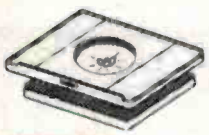

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- Speaker Phone with Built-in Amplifier for Detecting Busy Signal during communication.
- Auto/Manual Answer, Manual Originate, Auto Disconnect.
- Carrier Detect Indication. 20 Memories (each with 18 Digits Capacity) for Auto-dialing.
- BELL 103 CCITT V21 Compatible.
- 300 BPS Full Duplex.
- Last Number Redial.
- Pushbutton Keyboard.
- Volume High or Low Control.
- FCC Approved Direct Connect.
- "In-use" Dialing Indicator.

Cat. X19105 **$199**
(Not Telecom approved)

RITRON MULTI PURPOSE MODEM

Our New RITRON Multi Purpose Modem has arrived and has all the standards you require.
Just check the Ritron's features:

- CCITT V21 300 Buad Full duplex
- CCITT V23 1200/75
- Bell 103 300 Full duplex
- Bell 202 1200 Half duplex
- Auto answer, auto disconnect.

Telecom Approval No. C84/37/1134
Cat. X19103 **$379**

BAUD RATE/BIT CONVERTER FOR RITRON MODEM

NEW!

1200/75 baud
Cat. **$99**

CICADA 300

- 300 baud
- Provides full 12V bipolar output signal
- Direct connect modem
- Full duplex operation

(Phone not included)
Cat. X19101 **$190**

NEW!

DESK MOUNTED LAMP MAGNIFIER

This unit magnifies any object under a clear cool fluorescent light. The magnification is the maximum obtainable (lens 127mm diameter biconvex 4 Dioptres, focal length 254mm) consistent with minimum distortion and eyestrain and good off-angle viewing. It is NOT cheap, but then again it will definitely last a lifetime. It is built like a Rolls Royce! Spare fluoro tubes are available from electrical outlets. If you have trouble with fine PCB work or component identification but still want both hands free, this is for you.

TECHNICAL INFORMATION
Illumination: 22W Fluorescent
Weight: 81.6Kg
Lateral Extension: 254mm
Vertical Extension: 254mm
Fixing: Heavy table base (grey) with two chrome plated flexible arms.

Cat. **$169**

NEW!

MEMCON CRAWLER

The latest in our range of robots!
Programmable 3 wheel crawler with on board RAM. Programs entered by detachable keyboard.
Cat. K **$79.95**

NEW!

UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less for less chips).
Features include:

- Erase up to 9 chips at a time
- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures EPROMs are thoroughly erased
- Engineered to prevent UV exposure
- Long life UV tube
- Dimensions 217 x 80 x 68mm
- Weight 670 grams

Cat **$89.50**

NEW PHONE PLUGS & SOCKETS

We hear on the grapevine that all future installation will use the U.S.A type of plug and sockets for communication lines.

NEW!

TELEPHONE CURL CORD

- U.S. plug to U.S. plug
- Replacement hand set cord
- Length 4.5 metres
- Colours: cream, dark brown.

Cat. Y16022 **$7.95**

TELEPHONE EXTENSION CABLE

NEW!

- U.S. plug to U.S. socket
- Length 10 metres
- Cream colour cable

Cat. Y16024 **$8.95**

NEW!

TELEPHONE ADAPTOR

- Australian plug to U.S. socket
- Length 10cm
- Cream colour cable

Cat. Y16026 **$6.95**

NEW!

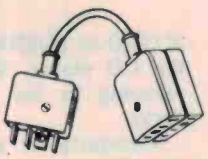
TELEPHONE EXTENSION CABLE

- U.S. plug to 2 U.S. sockets
- Length 10 metres
- Cream colour cable

Cat. Y16028 **$10.95**

AUSTRALIAN TYPE COMMUNICATION PLUGS/SOCKETS

We still have great stocks of Australian type phone plugs and sockets!



TELECOMMUNICATION PLUG TO 2 SOCKETS.

Ideal for modem connections.
Cat. Y16014 **$12.95**

TELECOMMUNICATION PLUG/SOCKET

Plug Cat. Y1601 **$3.95**
Socket Cat. Y16018 **$4.95**

TELECOMMUNICATION EXTENSION LEADS

Cat. Y16010 5m **$12.50**
Cat. Y16012 10m **$14.95**

SPECTROL 43P

Equiv (Bourns 3006)
Great for precision work.

R14200	10R	R14290	10K
R14210	20R	R14300	20K
R14220	50R	R14310	50K
R14230	100R	R14320	100K
R14240	200R	R14330	200K
R14250	500R	R14340	500K
R14260	1K	R14350	1M
R14270	2K	R14360	2M
R14280	5K		

1-9 **$1.10** 10+ **$1.00**

NEW!

NEW SLOPING CASES

Plastic with metal front panel, available in two sizes:
Cat. H10450 190x120mm **$9.95**
Cat. H10455 256x185mm **$17.95**
(measurements are approx. only)

NEW!

IBM COMPATIBLE DISK DRIVE

(NEW MITSUBISHI 4851)
Slimline 5 1/4" disk drive. Double sided, double density 500K unformatted. 40 track/side. Steel band drive system.
Cat. C11901 **$199**

LOOK WHAT'S NEW!

NEW!

UTILITY CASE

A must for all technicians, hobbyists and handy-men. Features clear plastic lid so you can tell at a glance the contents, up to 48 compartments, adjustable to suit your needs.
A place for everything and everything in its place!
Cat. H10449 **$14.50**

IBM* COMPATIBLE COMPUTER

256K RAM,colour graphics, 2 serial and 1 parallel ports, 2 disk drives, 3 months warranty
an incredible $1,950
*IBM is a registered trademark

NEW!

NEW SWITCHES

10-9 SPDT Cat. S11040 **$1.50** **10+** **$1.40**
DPDT Cat. S11042 **$1.60** **$1.50**

DIGITAL MULTIMETER

YFE YF1100 FEATURES

- Large easy to read 3 1/2 digit display
- Facilities for transistor and diode testing
- Clearly laid out front panel
- 10A DC AC range
- Priced to undersell the others

Cat. Q16025 **$79.50**

PUSH BUTTON DIALLERS

Tired of old fashion dialling and re-dialling engaged numbers? These convenient push button diallers include last number redial (up to 16 digits) and instructions for an easy changeover.
Cat. A12030 **$19.95**

NEW COMPUTER PRODUCTS!

NEW!

RS232 MINI PATCH BOX

- Interface RS232 devices
- With male to female 25 pin inputs
- 25 leads with tinned end supplied
- Complete with instructions

Cat X15654 **$25.95**

RS232 GENDER CHANGERS

- Saves modifying or replacing non-mating RS232 cables by changing from male to female to male
- All 25 pins wired straight through

NEW!

Male to Male
Cat. X15650 **$19.95**

NEW!

Female to Female
Cat. X15652 **$19.95**

NEW!

SUPPRESSION FILTER

- Suppresses over a wide frequency range 100Hz to 50MHz
- Incorporates voltage dependent transient suppression device
- Ideal for word processors, personal computers etc. Will also suppress interference on audio and video equipment
- Voltage drop on full load 1.5 volts
- Earth leakage at 250V 50Hz is 0.35mA
- DC resistance 50 milliohms - series inductance 3.5mH
- Current rating 6 amps at 250V-50Hz

Cat. X10094 **$39.95**

METAL CORNER PROTECTOR BRACKET

Ideal for speakers, amps, cases etc.
Cat. H11800
1-9 **$1.20** 10+ **$1.00**

NEW!

ALARM WARNING INDICATOR I

- Starts flashing when ignition is turned off
- Simple to install
- Power supply 12V DC (10-15V)

Cat. A12053 **$12.90**

NEW!

ALARM WARNING INDICATOR II

- LED flashing light
- Underdash mounting
- Deters thieves
- 12V DC operation

Cat. A12054 **$11.90**

NEW!

UNIVERSAL CAR RADIO/CASSETTE LEAD

Connects stereo unit to battery, speakers switch. Universal plug fits most stereo units. Fuse carrier in red lead with 3A fuse.
Cat. A12052 **$2.95**

ROD IRVING ELECTRONICS
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TELEX: AA 151938

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$500 plus	$12.50

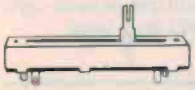
This is for basic postage only, Comet Road freight, bulky and fragile items will be charged at different rates.

Errors and ommisions excepted

LOOK AT OUR RANGE

4SP TRIMPOTS

1-9 **$1.10** 10+ **$1.00**



LOG SLIDES POTS

We ordered log instead of linear for the graphic equalizer, so take advantage!
1-9 **$0.65** 10+ **$0.60** 100+ **$0.50**

36 WAY CENTRONICS CRIMP PLUG

Cat. P12200
1-9 **$7.95** 10-99 **$7.50** 100+ **$7.25**

ELECTRET MIC INSERTS

With pins for easy board insertion.
1+ **$1.25** 10+ **$1.10** 100+ **$1.00**

Surround sound decoder

An Australian company has developed a system to maximize the effects of video movies.

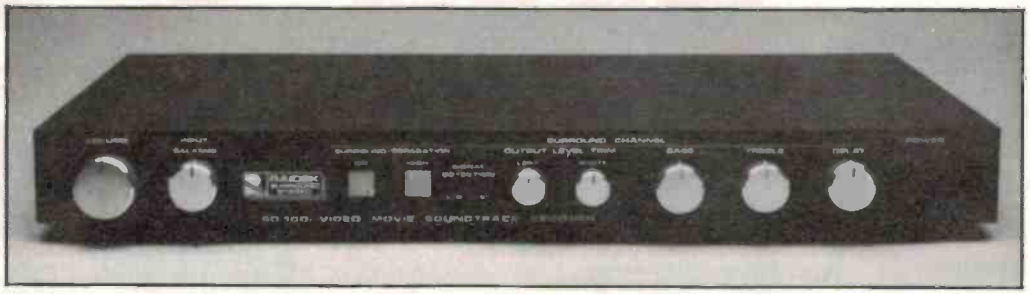
In any cinema much of the impact of a film recorded in Dolby stereo derives from the surround sound information it contains, which creates aurally what the various 3D processes try to do visually. This effect is achieved by encoding a third "surround" channel onto the Dolby stereo movie soundtrack. The third channel is then decoded in the cinema and fed to speakers around the walls.

The Raidek Surround Stereo System has been developed to decode this additional channel from normal home stereo video cassettes which carry exactly the same two-channel soundtrack as the Dolby stereo films, complete with the encoded surround channel.

The new system has been incorporated in the Raidek SD100 Video Movie Soundtrack Decoder and can also be used with stereo movie broadcasts or simulcasts on television. It was launched at the Sun/Australian Hi-Fi Show in Sydney earlier this year and attracted interest from both the public and professional people.

The SD100 connects directly between a stereo video recorder and a normal hi-fi system. The unit includes a proprietry decoder circuit, the operation of which matches the MP matrix encoding system used in the production of 35 mm Dolby stereo movies. A delay line for the rear "surround" channel takes advantage of the Haas effect to improve front to back separation, and two in-built 25 Wrms power amplifiers drive the rear speakers. There is also a separation enhancement circuit to help overcome the loss of front to back separation encountered when playing conventional linear stereo soundtracks, as opposed to the newer hi-fi format.

Further information about this decoder can be obtained from **Raidek Sound Industries Pty Ltd, 30 Williams Rd, North Rocks, NSW 2151. (02) 871-7873.**



Car CD players

Compact digital audio disc players for car installation are proving popular for the companies that already have them on the US market — Sharp, Nippon Gakki (Yamaha), JVC, Grundig, Fujitsu Ten, Trio-Kenwood and Blaupunkt. Not surprisingly Sanyo, Philips, Matsushita, Audiovox and Kraco are now planning to follow suit.

Americans can expect to see most of the new players before the end of 1985 and the remainder early next year. No doubt they will hit the retail outlets in this country later on.

With the exception of the Philips unit, all players will be sold with an AM-FM tuner. Prices vary from around $US300 for a budget model to around $US600 to $US700. As well as the CD player, Sharp will be releasing its first car cassette decks.

Manufacturers are conscious that buyers want CD players with tuners and this is the trend even though car space limitations pose considerable problems in designing small models.

The involvement of so many more companies in the car CD market, and the considerable competition that this will create, is a clear indication of the popularity of the compact disc in general, especially considering that it's not long since Sony, Pioneer and Mitsubishi initiated the launch of the household variety.

Cordless remote control VCR

Philips' new model VR6541 VHS video cassette recorder features an 11-function infrared remote control that operates TV channel change, standby, and high speed picture search of 10 times the play speed in both forward and reverse.

The recorder has a 16-channel receiver with a 14-day, 2-event, 2-channel timer. It includes an electronic fluorescent tape counter and memory with digital channel display, automatic playback and rewind, automatic blank scan, noiseless freeze frame and instant timer recording.

Signal-to-noise ratio is better than 45 dB and horizontal resolution is more than 250 lines.

The VR6541 is a slimline model and, although it includes the features of many more expensive VCRs, the price tag is moderate.

Regional ABC subtitles

The Australian Caption Centre reports that ABC programs with Supertext subtitles are being transmitted in regional areas in all states. However, although it seems that most regional transmitters are able to carry the subtitles, they have not all been tested.

With a view to extending subtitled television, the Centre is calling for viewers with decoders to write to its Public Relations section notifying whether or not ABC subtitles can be picked up in their areas.

In mid-1985 the ABC was transmitting nine hours of subtitled programs including such favourites as "Minder", "Rumpole of the Bailey", "All Creatures Great and Small", and "Fast Lane".

The Australian Caption Centre's postal address in each capital city is GPO Box 9959.

High performance stereo receiver

NAD has released a successor to its NAD 7125 receiver. The new model, the NAD 7130, has more power, better FM performance and more features than its predecessor.

The 7130 employs the same rugged chassis and elegant front panel and controls as NAD's top selling 7140 and 7155 receivers. Features include high current design and +3 dB of IHF dynamic headroom, meaning that it produces more than 60 watts/channel of dynamic power into any speaker impedance from 8 ohms down to 2 ohms. Unlike other receivers in its price range, the speaker terminals are heavy duty binding posts that provide a secure high current connection for speaker cables of any kind or size.

The pre-amplifier section of the 7130 includes a quiet moving coil input as well as a moving magnet input with very wide dynamic range. The CD input supplements a separate auxiliary input that can be used for hi-fi, VCR or TV sound.

The receiver's FM tuning section uses a MOSFET front end that is nearly immune to strong signal overload, a direct 75 ohm coaxial input for maximum sensitivity and shielding, and three ultra-linear ceramic IF filters for an optimum combination of selectivity and stereo separation. It also includes NAD's "dynamic separation" circuit (to reduce noise in weak stereo signals without impairing stereo separation) and a dual notch, low pass multiplex filter that completely suppresses subcarrier interference.

For more information about the NAD 7130 contact **Falk Electrosound Group, 28 King St, Rockdale, NSW 2216.**

BRIEFS

No fuss VCR

Philips' 'no fuss' VR6441 VHS video cassette recorder has an 8-function wired remote control and a 14-day, one event timer for recording. The video search goes ten times faster than play speed, in forward and reverse.

New microphone plug

Arista Electronics has a new type of 6.35 mm microphone plug in heavy duty brass. It can be easily dismantled to allow access to the solder terminations, and has an 8-digit numbered indicator on the rear to identify to which microphone it belongs.

TV/video cabinet

A new 820 mm wide TV/video cabinet is available from Systemline furniture. It will hold most TV receivers and has a full-width adjustable shelf for a VCR of any size. There's storage space for tapes, too.

500 series VCRs

Sharp describes its new 500 series VCRs as "affordable". Features include a programmable timer, auto blank section scan function, auto playback function, 4-hour recording playback, and noiseless freeze (still) frame.

Stereo sound from mono TV

The Zap synthesizer will convert any mono sound to stereo. It sells for $29.95 and is available from Zap Electronics (02) 858-2288.

Stereo integrated amplifier

The Yamaha A-320 stereo integrated amplifier is of a simple and straightforward design to give maximum signal transmission purity. Tone control circuitry has been eliminated, and independent left/right volume control also eliminates conventional balance control. With dynamic power rating, the A-320 delivers substantially higher power when transient musical peaks demand it, without clipping or distorting the audio signal.

Studio monitor speaker

The NS-1000x professional studio monitor speaker from Yamaha features the beryllium midrange and tweeter domes recently introduced in the company's NS-1000M system, as well as Yamaha's exclusive pure carbon cone woofer.

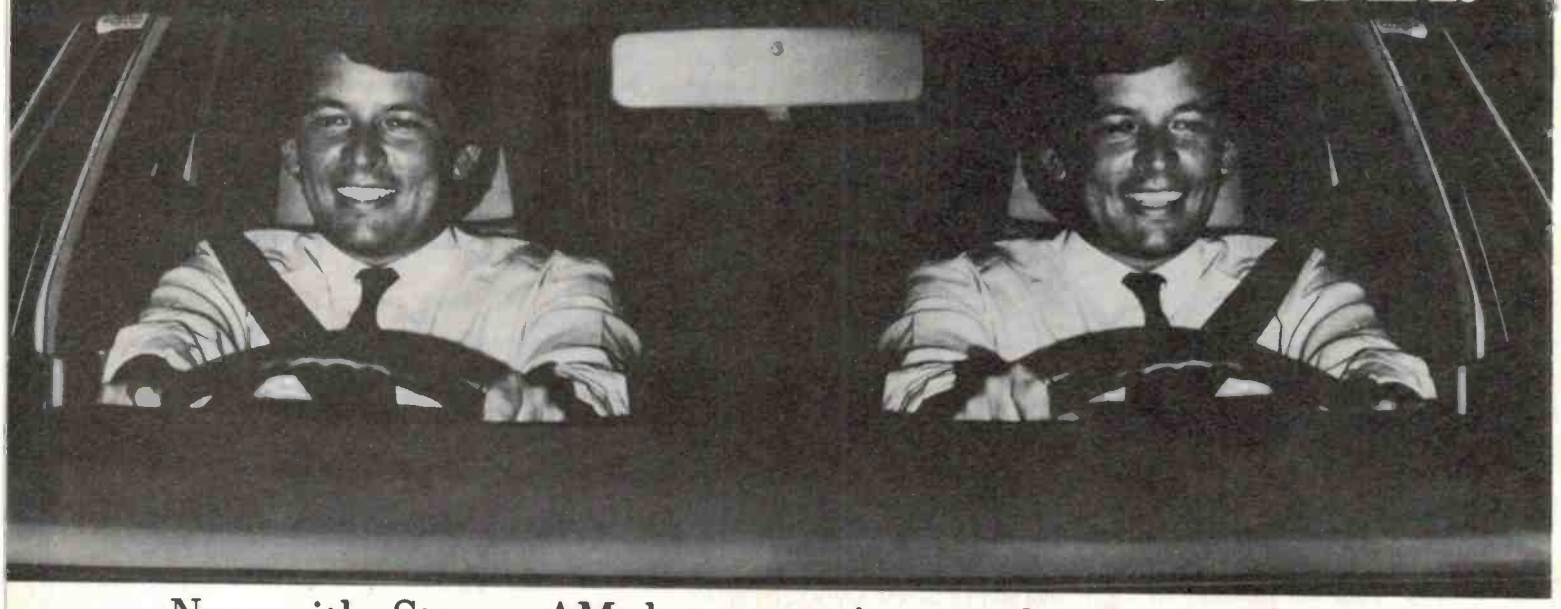
The 30 cm woofer cone is constructed of pure carbon fibre sheets. It has exceptionally rigid and responsive qualities, ensuring accurate piston movement, and provides the essential balance of high response and damping necessary for bass response. The outer circumference of the cone is corrupted on the reverse side, further contributing to rigidity. The woofer is also backed by a powerful strontium ferrite magnet.

The high performance midrange driver incorporated in the NS-1000x has an ultra-light pure beryllium dome of just 0.6 g. The diameter of the dome is 8.8 cm and fine response accuracy is enhanced overall with a powerful strontium ferrite magnet.

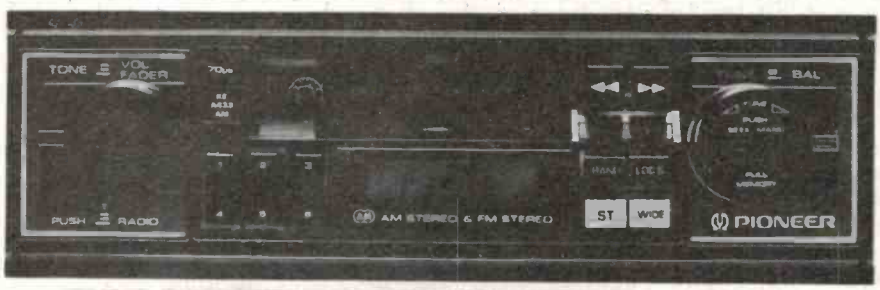
The tweeter has a 3 cm diameter pure beryllium dome weighing 0.028 g. An ultra-light diaphragm provides good pistonic motion, allowing the tweeter to respond more accurately to frequencies well beyond the audible threshold of 20 kHz.

Part of the advanced Yamaha crossover network, the inductors of the NS-1000x are wound entirely with pure copper wire for greater conductivity. They are then securely potted in the single-unit network base. Off-axis alignment of these inductors is then used in order to all but eliminate inductive coupling. All network capacitors are the MP type, which is the most efficient in minimizing information loss.

NOW PIONEER PUTS TWICE AS MUCH STEREO FUN IN YOUR CAR.



Now with Stereo AM here, Pioneer puts twice as much stereo fun in your car with the launch of the KEA 433AM Electronic Tune AM/FM stereo cassette player.



PIONEER. FIRST IN STEREO AM.

Pioneer has always led the way in car stereo sound.

From designing the most advanced tuner/deck combinations, graphic boosters and power amps to building the widest range of speakers in Australia.

KEA 433AM lets you listen to the widest range of AM and FM stations in brilliant stereo sound.

From the top rock and roll stations to the classics. From talk-back radio to sports broadcasts, everything will sound twice as good because it's in stereo.

And like all Pioneer products the advanced features of the KEA 433AM are equally brilliant.

From AM/FM stereo, electronic station preset and seek, lock in fast forward and rewind, auto tape replay and metal tape facility to a built-in fader system for 4 speaker control.

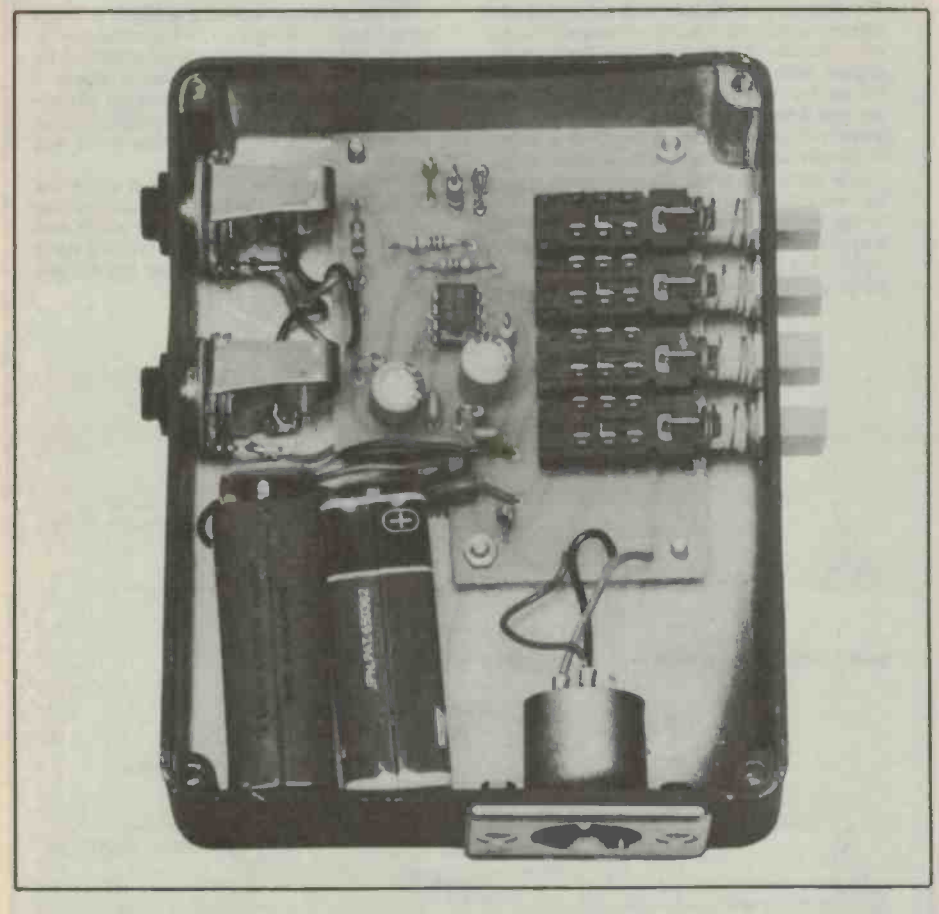
You can own the Pioneer KEA 433AM stereo radio cassette for around $400.* It's a small price to pay, to make everything you listen to in your car twice as much fun as before.

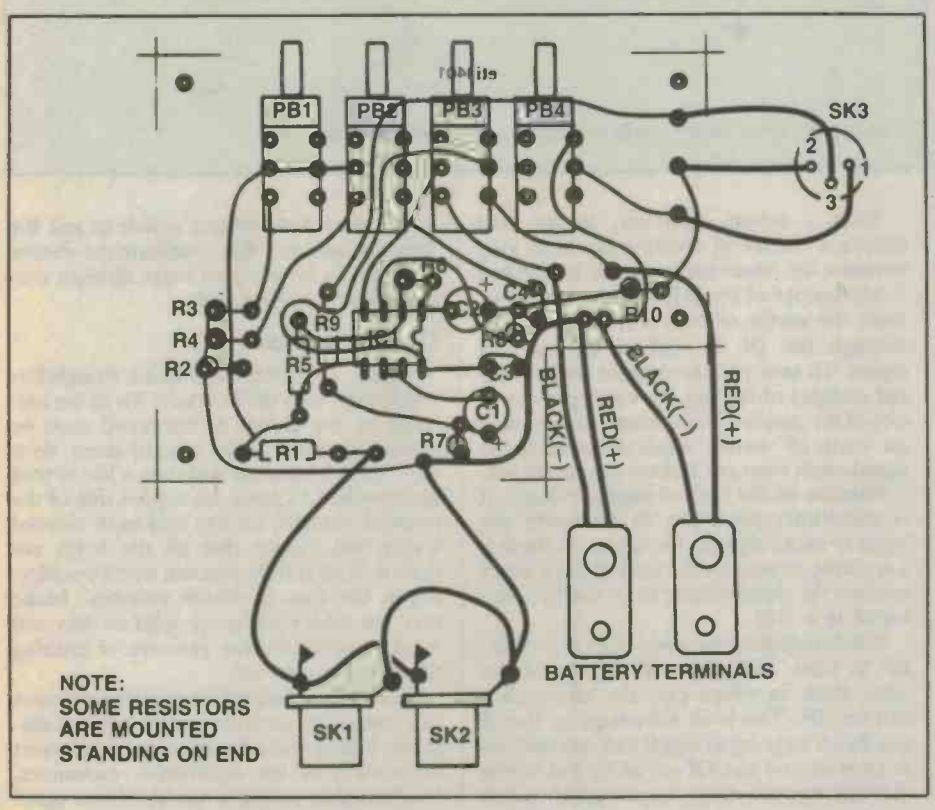
PIONEER®

The power to move you.

*Check your Pioneer Entertainment Retailer for price.

PIO 2018A





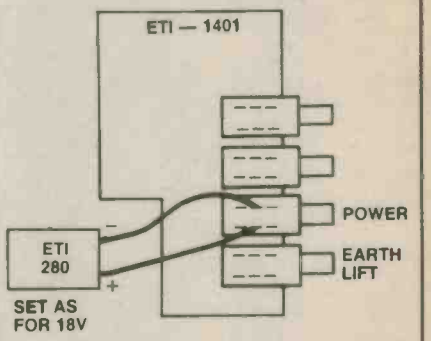


Figure 3. The ETI-280 Low Battery Indicator can be hooked into the circuit by soldering its inputs to the power supply switching as shown. The ETI-280 should be set for an 18 V supply as detailed in the relevant article. Mounting the board is up to you but the lid of the box might be easiest.

PARTS LIST — ETI 1401

Resistors.....all ¼ watt, 5% unless noted
- R1.....470k
- R2.....1M
- R3.....47k
- R4.....4k7
- 5, 6.....1M 1%
- R7, 8.....100k
- R9, 10.....680R

Capacitors
- C1, 2.....47µ 35 V electro
- C3, 4.....100n ceramic bypass

Semiconductors
- IC1.....TL072

Miscellaneous
- PB1, 2, 3, 4.....DPDT pc mount pushbutton (Isostat range or similar)
- SK1, 2.....6.5 mm insulated mono jack
- SK3.....male 3-pin XLR panel mount socket

ETI-1401 pc board; 30 x 94 x 120 diecast aluminium box; 2 x 9 V battery terminals; 4 x 6 mm standoff spacers; 4 x 6BA nuts and bolts; 4 small rubber feet; hookup wire.

Price estimate: $30

take care to get it the right way round.

You should now solder short lengths of hookup wire to all the input and output points on the pc board, which will later be wired up to the sockets. Also, solder the 9 V battery terminals to the board making sure you get the polarities correct. Finally, check the underside of the board and ascertain you have created no solder bridges between tracks.

The next thing to do is to prepare the case. Remove the lid and don't lose the screws! By examining the pictures you should be able to get a rough idea of the lay-

WHY A BALANCED LINE?

One question that may be asked is why go to all this trouble to generate a signal which is 180 degrees out of phase with the signal with which you started. A lot of professional audio gear (mainly mixers and amplifiers) is designed with differential input stages. Now, the main properties of a differential amplifier are that it has two inputs and that it will only amplify those signals which create a difference between the two inputs. In other words, if you apply the same signal to both inputs you will ideally get no output. If you apply differing signals to each input, the differential amp will amplify the difference between each input. This property is exploited in balanced audio systems to minimize hum due to induction in the leads connecting the system together.

To see how this is done examine the single ended system in Figure 1. We see that any induced hum in the cable will be amplified by the same amount as the incoming signal. If A_V is high then even a small amount of radiated hum from, say lighting circuits, could get into the system through the cable and create a problem.

If we now examine the balanced system in Figure 2 we see that any hum picked up in the cable will be the same in both in phase and out of phase. Because the differential input amp will only amplify difference signals, the hum is eliminated.

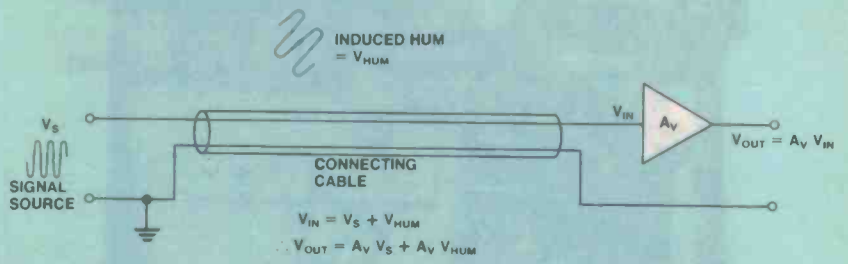


Figure 1. Unbalanced system. Hum can be picked up in the connecting cable.

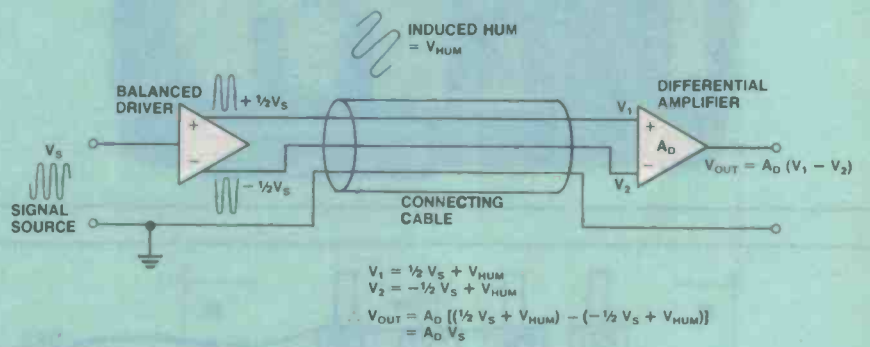


Figure 2. Balanced system rejects hum pickup in the connecting cable.

Robert Irwin

Design details

TL072 dual op-amp forms the heart of the circuit. These op-amps are very low noise, FET input devices and are ideally suited to this application, one being used as a unity-gain buffer and the other as a unity-gain inverter. This provides two anti-phase signals for the balanced output. To cater for large input voltages such as those from a keyboard or the output of a power amp, two pads (attenuators) are provided to give 20 dB or 40 dB of attenuation.

Power is provided by two 9 V batteries which are connected to give split ± 9 V rails. It was decided to use two batteries rather than one to give a bit of extra headroom, and they can also be run down further before the DI will begin to cut out. Some of the more expensive commercial units incorporate back-up battery systems and the like, but for the sake of keeping the cost down, we decided against such circuitry in this case. For anyone wishing to add some form of low battery indication, the ETI-280 (March 1985 ETI) could be built into the unit. (See Figure 3.)

All the switches are push-on/push-off types and mount directly on the pc board. They sit in a row down one side of the unit and should be out of the way. The prototype was housed in a small diecast aluminium box sturdy enough to be kicked about and trodden on. (I think they call it 'roadworthy'!)

The output socket is the standard male, 3-pin XLR socket which looks like the back of a standard microphone so a normal balanced mic lead can be used to connect the box into the system.

The input impedance is kept as high as is practical (around 500k or so), so that minimal loading will be put on the instrument connected to it, and there are two paralleled input sockets so that the instrument can be hooked up to an amplifier as well as going through the DI.

Such a set-up, however, means that there's a chance of creating an earth loop between the mixer (or whatever is attached to the output of the DI) and the amplifier, since the earths of both will be connected through the DI as well as through the mains. To save you the trouble (and potential danger) of ripping the earth pin out of one of the pieces of equipment, we included an 'earth lift' switch which disconnects the signal earth from pin 1 of the output socket.

Because of the limited supply voltage, it is sometimes necessary to attenuate the input to avoid clipping the signal, so there is a resistive attenuator network ('pad') which enables the input voltage to be cut by a factor of 10 or 100.

When switching between pads it is possible to have both pads switched in at the same time, in which case the attenuation will be 100. This is an advantage in that if you had a large input signal and you had the attenuation on the DI set at 10 but found that this was not enough, you could switch in the next pad without switching out the previous one and thus eliminate the chance of getting a large signal burst through during the switching period.

Construction

Again, construction is quite straightforward. Start with the pc board. To fit the batteries in, the corner of the board must be cut out, so if this is not already done, do it now. (Use a hacksaw and then a file to trim up the edges.) Check the copper side of the board thoroughly for any broken or shorted tracks and ensure that all the holes are drilled. If all is well, you can start by soldering in the four pc-mount switches. Make sure the solder joints are solid as they will need to withstand the pressure of pushing the switch in and out.

Next, locate and solder in all the resistors and capacitors according to the overlay diagram, taking special care to get the correct orientation of the electrolytic capacitors. You can then solder in the IC. Once again ▶

SONICS ACTIVE DI BOX

This inexpensive, easy to build DI box was designed in conjunction with *Sonics* magazine and is fine for both live PA and home recording work. It takes an unbalanced input and produces an output suitable for driving a balanced audio line.

A VERY USEFUL bit of equipment to have lying around if you're doing a bit of home recording or setting up any sort of PA system is a so-called 'DI' box. DI stands for 'direct injection' or 'direct insertion' and involves taking a signal source from one piece of equipment and conditioning it such that it will be suitable for connection to another piece of equipment.

In audio applications, a DI box is used to take an unbalanced output from an instrument (and sometimes an amp) and convert it to a signal that looks like it has come from a balanced microphone output. This, then, allows it to be plugged directly into a balanced-input mixer. In live situations, particularly where long cable runs are encouraged, a DI box can be used as a balanced line driver for any unbalanced mics or other single-ended outputs which may need to be sent down the multicore and thus minimize any hum pickup down the line.

The usual method of obtaining a balanced signal from an unbalanced one is to use a 'balanced output' line transformer, but the disadvantage of this is that good audio-quality transformers of this type cost quite a bit. One of the original criteria for the design of this DI was that it should be cheap enough for even the most limited of home studio budgets to accommodate, so it was decided to go for an inexpensive 'electronically' balanced system that would be easy to build and useful for a variety of live and studio applications.

SPECIFICATIONS

Signal-to-noise ratio	> 100 dB rel to 0 dBm
Distortion	< 0.03% @ + 4 dBm
Input impedance	> 500 kohm nominal
Output Impedance	600 ohm nominal

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SINGING MOISTURE METER
A novel way to check whether your plants need watering, the "Singing Moisture Meter" emits a high or low tone according to how wet or dry the ground is. (ETI 047)
WAS $7.95 NOW $5.75

BUZZ BOARD
Test your steadiness of hand with this updated version of an old game of skill. The "Buzz Board" is a sophisticated version of a simple game in which the player attempts to pass a small metallic loop along a bent wire path without making contact with that wire. The "Buzz Board" also features an adjustable time delay unit which means the buzzer will only sound if the metal loop touches longer than the set time. An fun kit to make and even more fun to use! (ETI 048)
WAS $4.50 NOW $3.25

ELECTRONIC BONGOS
An electronic version of bongo drums that are played just like the real ones - only you tap small metal plates instead! (ETI 063)
WAS $5.90 NOW $4.40

BIPOLAR PROM PROGRAMMER
Every digital workshop should have one! Can be used to program the popular fusible-link PROMS like the 74S188/288, 82S23 & 82S123 etc (ETI June'83) ETI 688
Cat. K46880
WAS $49.50 NOW $36.95

ELECTRIC FENCE
Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automative ignition coil, it should prove an adequeate deterrent to all manner of livestock. Additonally, its operation comforms to the relevant clauses of Australian Stnd 3129. (EA Sept. '82) 82EF9
Cat. K82092
WAS $19.50 NOW $14.50

RADIOTELETYPE CONVERTER FOR THE MICROBEE
Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too (ETI Apr.'83)
WAS $20.00 NOW $14.95

FUNCTION GENERATOR
This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 160Hz with low distortion and good envelope stability. It has an inbuilt four-digit frequency counter for ease and accuracy of frequency setting. (EA April '82, 82AO3A/B)
Cat. K82040
Cat. K82041 **$87.50**

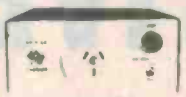
EA AM STEREO DECODER
AM stereo is now broadcast in Australia on an experimental basis. This add-on decoder works with the Motorola C-QUAM system.
(EA Oct '84) 84MS10
Cat. K84101 **$27.50**

EPROM PROGRAMMER
If you have ever wanted to rewrite or extend the operating system of your microcomputer or if your're interested in dedicated microprocessor applications then this EPROM Programmer is just the thing. It is an inexpensive unit that uses readily available IC's, interfaces directly to the expansion bus on the back of all the popular 8080/Z80 microcompputers and programs 2708's, 2716's, 2758's and 2732's. (EA July '80) 80PP71
Cat.
$79.50
(Horwood case supplied)

PARABOLIC MICROPHONE
Build a low cost parabola, along with a high gain headphone amplifier to help when listening to those natural activities such as babbling brooks, singing birds or perhaps even more sinister noises. The current cost of componenets for this project is around $15 including sales tax, but not the cost of batteries or headphones. (EA Nov. 83) 83MA11
Cat. K83110 **$15.00**

EFFECTS UNIT
An "effects unit" that can create phasing, flanging, echo, reverb and vibrato effects.
(EA June '83) 83GA6
Cat. K83060 **$75.00**

PHONE MINDER
Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or it can perform either function separately. (EA Feb.'84) 84TP2
Cat. K84020 **$27.50**



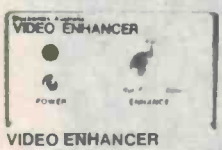
40 W INVERTER
This 12 240 V inverter can be used to power up mains appliances rated up to 40 W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May'82) 82IV5
Cat. K82050 **$54.50**

50V 5A LABORATORY POWER SUPPLY
New switchmode supply can deliver anywhere from three to 50V DC and currents of 5A at 35V or lower. Highly efficient design.
(EA May-June'83) 83PS5
Cat. K83050 **$149**

30 V/1 A FULLY PROTECTED POWER SUPPLY
The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both voltage and current metering is provided. (ETI Dec '83) ETI 162
Cat. K41620 **$52.50**

TEMP PROBE
Can measure temperature from -50- to 150-c. It simply plugs into your multimeter - great for digital multimeters. Accuracy of 0.1-c resolution of 0.1-c.
(ETI June'83) ETI 153
Cat. K41530 **$27.50**

LOW OHMS METER
How many times have you cursed your Multimeter when you had to measure a low-value resistance? Well with the "Low Ohms Meter" you can solve those old problems and in fact measure resistance from 100 Ohms down to 0.005 Ohms.
(ETI Nov. 81) ETI 158
Cat. K41580 **$39.50**



VIDEO ENHANCER
100's SOLD
Like tone controls in a hi-fi amplifier, touch up the signal with this Video Enhancer. (EA Oct '83) 83VE10
Cat. K83100 **$35.00**

VIDEO AMPLIFIER
Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead, it's much better! The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugback supply.
(EA Aug '83) 83VA8
Cat. K83081 **$17.50**

ELECTRONIC MOUSETRAP
This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again!
(ETI Aug.'84) ETI 1524
Cat. K55240 **$32.50**

MUSICOLOR IV
Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety.
(EA Aug.'81) 81MC8
Cat. K81080 **$99.00**

1W AUDIO AMPLIFIER
A low-cost general-purpose,1 watt audio amplifier, suitable for increasing your computers audio level, etc. (EA Nov. 84)
Cat. K84111 **$9.95**

VOICE OPPERATED RELAY
EA's great Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter or to control a slide projector. (EA Apr '82) 82VX4
Cat.
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MOSFET POWER AMPLIFIER
Employing Hitachi Mosfets, this power amplifier features a "no compromise" design, and is rated to deliver 150 W RMS maximum and features extremely low harmonic, transient and intermodulation distortion.
(ETI Jan.'81) ETI 477
Cat. K44770 **$69.50**

MICROBEE SERIAL-TO-PARALLEL INTERFACE
Most microcomputers worth owning have an 'RS232' connector, or port, through which serial communications (input/output) is conducted. It is a convention that, for listing on a printer, the BASIC LLIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel 'Centronics' interface printers. Save money by building this interface. (ETI Jan. 84) ETI 675
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(ETI 1405, ETI, MAR '85)
Cat. K54050 **$79.50**

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(ETI 280, March '85)
Cat. K42800 **$7.95**

PARALLEL PRINTER SWITCH
Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently, so that you can select one or the other at the flick of a switch.
(ETI 666, Feb. '85)
Cat. 46660 **$69.95**

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multaneously with your construction work:

1) After cutting your 15 tracks to program your code use a meter to make sure the positive and negative rails are no longer short circuiting. Then put one probe of your meter to the ground or Vcc rail and the other to one of the programming pins. Check whether that pad does connect to the ground ('0') or Vcc ('1') as programmed. Then repeat the same checking for the rest of the programmed pads. Make sure that you have the code correct.

2) As mentioned before, every time an insulated copper wire is soldered, make sure it connects the two points as required. This can be confirmed by checking the resistance between the two points joined by the wire.

3) Be careful not to let the pins of the LED touch the washer. And make sure the polarity of the LED is correct when you solder it on.

4) Give a little pull on the washers after you solder them. They should be as firm as a mountain.

5) There are several tracks right on the edge of the pc board. When inserting the pc board into the aluminium tube, those tracks should not be touching the inner wall of the tube. If they do, a strip of sticky tape on both edges of the pc board will insulate the tracks from the tube.

6) You need four mercury batteries piled up in order to give you enough voltage. They are the same kind of battery you use in a calculator. The body of the battery is usually the positive terminal and it *must* be insulated from the tube. You can roll the four batteries together with a piece of paper, like rolling a cigarette. Stop the paper from coming loose with a bit of sticky tape. Whenever you change the batteries, don't forget to put the batteries inside the paper tube before you put the whole lot back in.

7) Think before you put the batteries in. Wrong polarity will destroy your circuit instantly! The spring is supposed to make contact with the *positive* terminal and the washer at the end of the pc board is to the *negative* terminal of the battery.

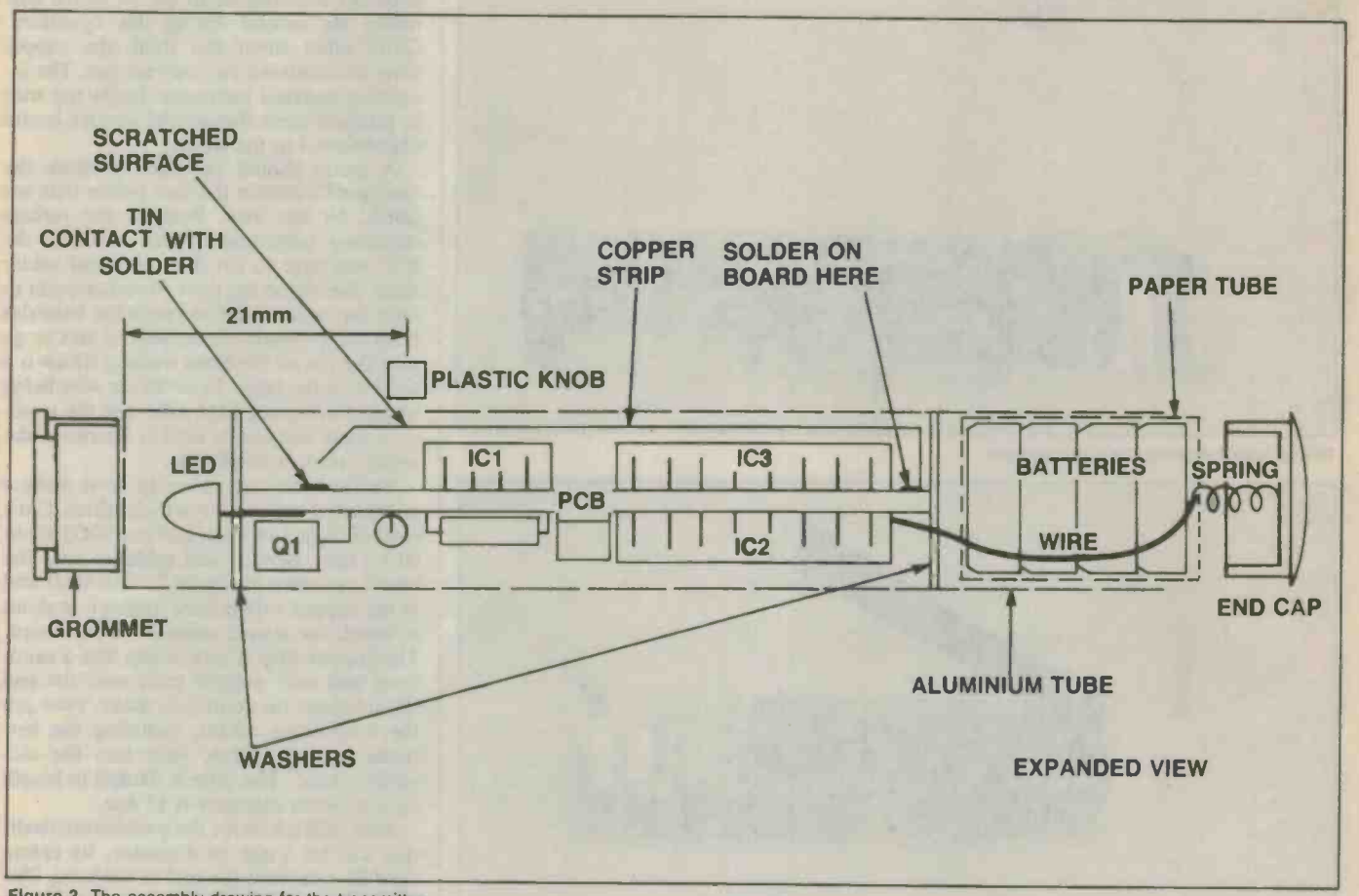
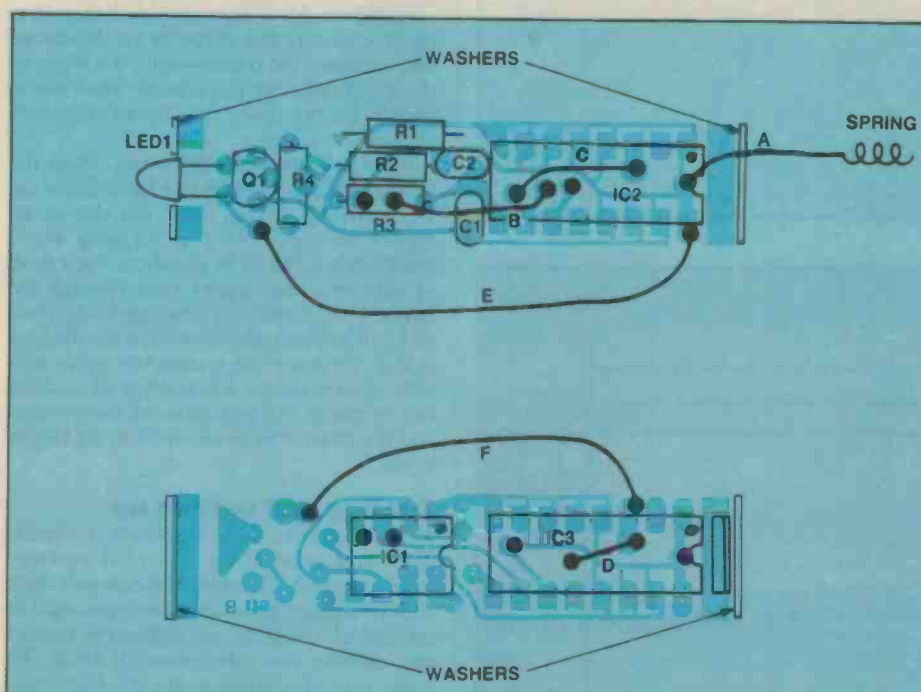


Figure 3. The assembly drawing for the transmitter.



PARTS LIST — ETI-343

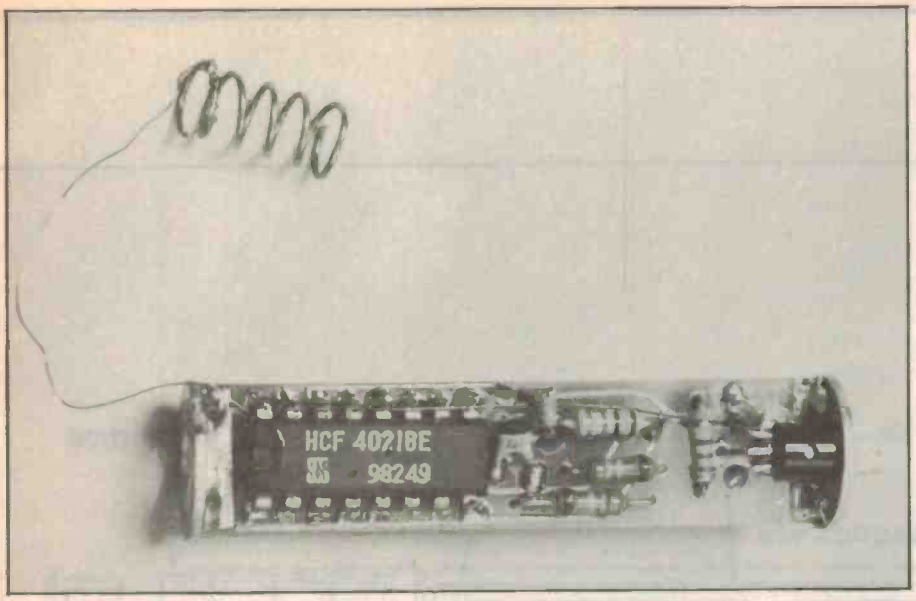
Resistors.....all ¼ W, 1% tolerance
R1, 2.....values are optional, see Table 1
R3.....10k
R4.....5k6

Capacitors
C1.....1n resin dipped monolithic ceramic
C2.....18p miniature ceramic

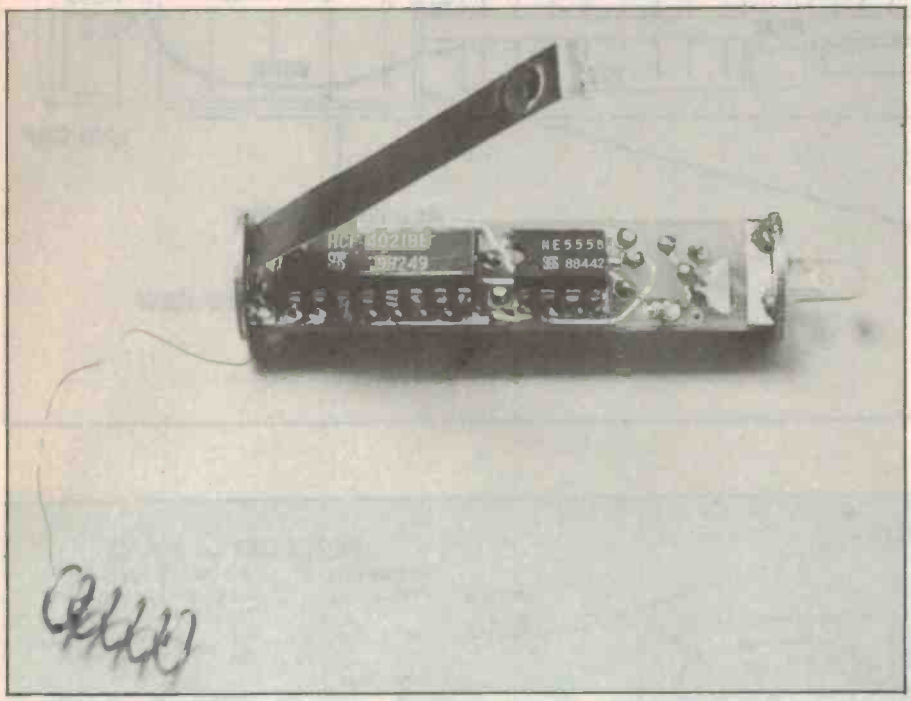
Semiconductors
IC1.....LM555
IC2, 3.....4021B
Q1.....BC549C
LED1.....Red, megabrite 1000 mcd

Miscellaneous
Two brass washers (max outer diameter 13 mm, min diameter for centre hole 5 mm). Half metre of 32G BNS insulated copper wire and a section of light gauge aluminium tube (length 94 mm inner diameter 13 mm). A soft metal spring with coil length about 10 mm long, 2 mm pitch and coil diameter between 5 to 8 mm. One plastic cap and a grommet to fit tightly into the ends of the tube. ETI-343 double-sided pc board. Copper or brass sheet (30G) about 60 x 4 mm. One 5 mm diameter plastic knob. Mercury batteries are not included here.

Price estimate: $19-$24



The pc board showing side A components.



The pc board showing side B components.

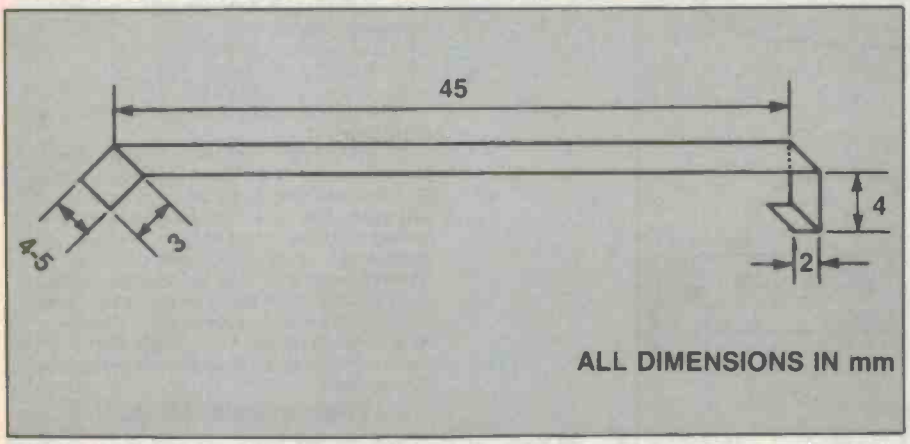


Figure 2. Bending diagram for the copper strip to make a pushbutton switch.

ends are soldered on to the pc board normally. Be careful during this operation. Quite often when you think the copper wires are soldered on, they are not. The insulating material melts and keeps the wire in position even though the copper is still unconnected to the track.

A meter should be used to check the resistance between the two points that are joined by the wire. Because the surface mounting technique is used here for the ICs, you have to cut their pins and solder them directly on the pads. Another point to look for: wire A has to reach the batteries from the pc board. Inevitably, it has to go past the rim of the brass washer, which is a tight fit in the tube. To avoid the wire being trapped in between the tube and the washer, a small slot can be filed in the rim of the washer using a needle file.

The last thing you have to do is make a pushbutton switch for the transmitter. Cut a strip of copper or brass (28G or 30G) about 60 x 4 mm. Bend it and solder it onto the board as shown in Figure 2. The other end of the copper strip is bent so that it is about to touch the tinned contact on the board. The copper strip is now acting like a cantilever and only a slight push near the end should cause the contact to make. Now put the transmitter circuit, including the batteries and the plastic ends into the aluminium tube. The tube is 94 mm in length and the inner diameter is 13 mm.

Next drill a hole for the pushbutton itself: this will be 5 mm in diameter, its centre sited 21 mm from the end of the tube. The plastic knob is inserted through the hole; it will land on the end of the copper cantilever (see Figure 3). When operated this efectively connects the batteries to the circuit and activates the transmission. To improve the quality of your 'home made' pushbutton switch, tin the tip of the copper strip with solder.

Now you are ready for a test. Push the button and see whether the LED lights up. If everything is OK, take out the knob, scratch the copper strip at the point where the knob is going to be glued on. Put a drop of glue onto the copper strip through the hole on the aluminium tube, press the plastic knob back on and allow time for the glue to dry. To make the transmitter more reliable against shock, a few drops of araldite can be put in the gap between the washers and the inner wall of the tube to fix the pc board.

Testing and setting up

Normal practice is to construct a circuit, first, set it up and then, if it is not working, troubleshoot it. Because of its compactness and the surface mounting technique used in this circuit, it will be very difficult to correct any mistake once the circuit is built. To make sure everything works the first time, the following points should be observed si-

used and the rest of the 15 bits are used as data (code).

The design of this project is based on the same principle. Two 8-bit shift registers are cascaded into a 16-bit shift register. Pressing the ON button will load a pre-programmed bit pattern to the shift register. The oscillator will clock out the data in the shift register one bit at a time. If the particular bit shifted out is a one, it turns on the LED, otherwise it turns the LED off. In order to increase the signal-to-noise ratio at the receiving end, it is recommended to use a high efficiency LED with at least 500 mcd output power. The registers are connected in a circulating fashion: any bit shifted out of the shift register will also be shifted back to the last bit of the 16-bit train. So long as your finger is pressing the button, the code will be transmitted repeatedly. As opposed to the one shot transmission, I've found that this technique allows greater drift in the receiver clock before errors start to occur.

Transmitter construction

The transmitter circuit is very simple, but fiddly work when you come to construct it. This is unavoidable as there are so many things that have to be squeezed into a tiny space of about 12.2 cubic cm. The order in which the components are placed on the board is important. Pads on the pc board with a small middle hole have to be drilled with a 0.8 mm drill bit. Solid pads should be left alone. The first job you have to do is program your own transmitter code by cutting the tracks on the pc board. The pads where pins 15, 14, 13, 4, 5, 6 and 7 of IC2 and IC3, and pin 1 of IC2 are to be soldered to have ground and Vcc connected to them through thin tracks. Initially then, the positive and negative supply rails are short circuited.

Now, if you want to program pin 7 of IC3 to be a '1', you have to cut the track joining the ground to the pad. If a '0' is desired, cut the track connecting Vcc to that pad instead. Never cut both tracks, or the pad will have floating state input. After cutting the fifteen tracks, it's good practice to measure the resistance between ground and Vcc. If they have zero or just a few ohms resistance, you'd better go back and check your cutting. Also, check that all the relevant pins are shorted to one rail or the other.

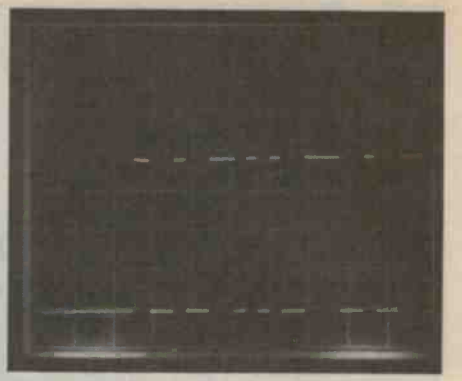
Because of lack of space available on the pc board, six flying wires are used. Thin 32 BNS insulated copper wire is preferred over normal hook up wire. The wires' labelling is as follows (please see the overlay diagram):

Wire A: connects from the Vcc track on the pcb to the spring;
Wire B: connects pin 3 of IC1 to pin 10 of IC2;
Wire C: connects pin 3 of IC2 to pin 11 of IC3;
Wire D: connects pin 3 of IC3 to pin 11 of IC2;
Wire E: connects pin 16 of IC2 to the anode of LED1;
Wire F: connects pin 3 of IC3 to resistor R4 as shown in the overlay.

It is important to solder wires B, C, D before any components. Then solder the resistors and the capacitors onto the pc board. Next, solder one of the Vcc brass washers on to one end of the pc board where the LED is going to be soldered on. Make sure the washer forms a right angle with the pc board. With some fiddling, you can insert the LED pins through the hole on the washer and solder them onto the board. It will be necessary to cut the pins to the right length and bend them to fit. You should make sure that the pins, after they are soldered to the board, do not touch the washer and are strong enough to hold the LED in position. Otherwise, the LED might short circuit the board and anything could happen. The remaining washer can be soldered to the other side of the board. Once again, the washer has to be at right angles to the pc board.

Cut a section of insulated copper wire about 9 cm long and solder one end of it onto the pc board as shown in the overlay and the other end to the spring. This is the wire labelled A.

The next component to be soldered is the transistor. Leave enough length on its pins so that you can bend the transistor over after it's been soldered. If you leave it vertical, it will be too high to go into the aluminium tube. Now you can solder all the ICs onto the board, then the wires E and F must be soldered directly onto the assigned pins of the ICs (see the overlay). The other



The 'captured' code. This photo shows the code "1" 0010011010100 — 1001 . . . which repeats itself. Note that the "1" (the first start bit) is longer than the other "1s" because of the parallel loading time. Horizontal scale: 5 ms/div; vertical scale: 1 V/div.

R1	R2	C1	555 TIMER OUTPUT	PERIOD OF CLOCK $T = T_1 + T_2$	TRANSMISSION RATE $F_{CK} = 1/T$
33k	270k	1nF	$T_1 = 0.21$ ms $T_2 = 0.187$ ms	T = 0.397 ms	2519 BITS/S
82k	470k	1nF	$T_1 = 0.3825$ ms $T_2 = 0.3257$ ms	T = 0.7082 ms	1412 BITS/S
680k	680k	1nF	$T_1 = 0.9425$ ms $T_2 = 0.47124$ ms	T = 1.414 ms	707.3 BITS/S

$T_1 = 0.693\ (R1 + R2)\ C1$
$T_2 = 0.693\ (R2)\ C1$

Table 1. Listed component values determine the clocking rate of the code (transmission rate). Same codes with different transmission rates do not interfere with each other.

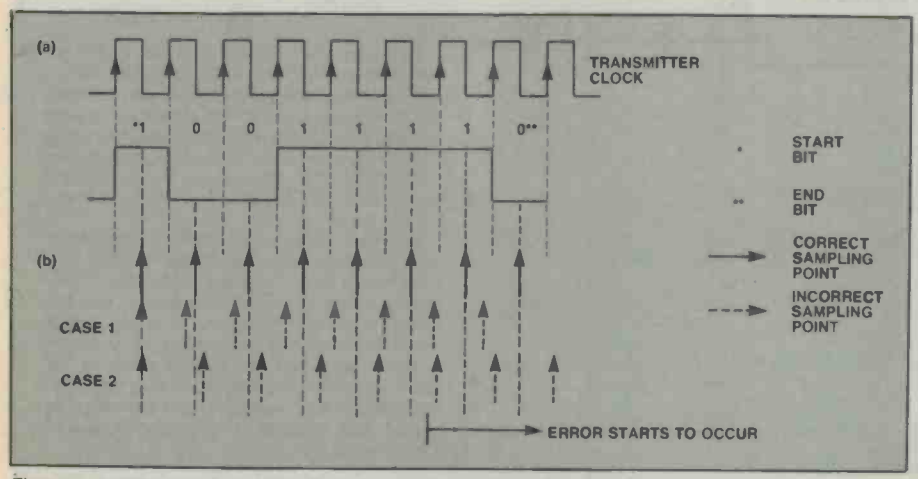
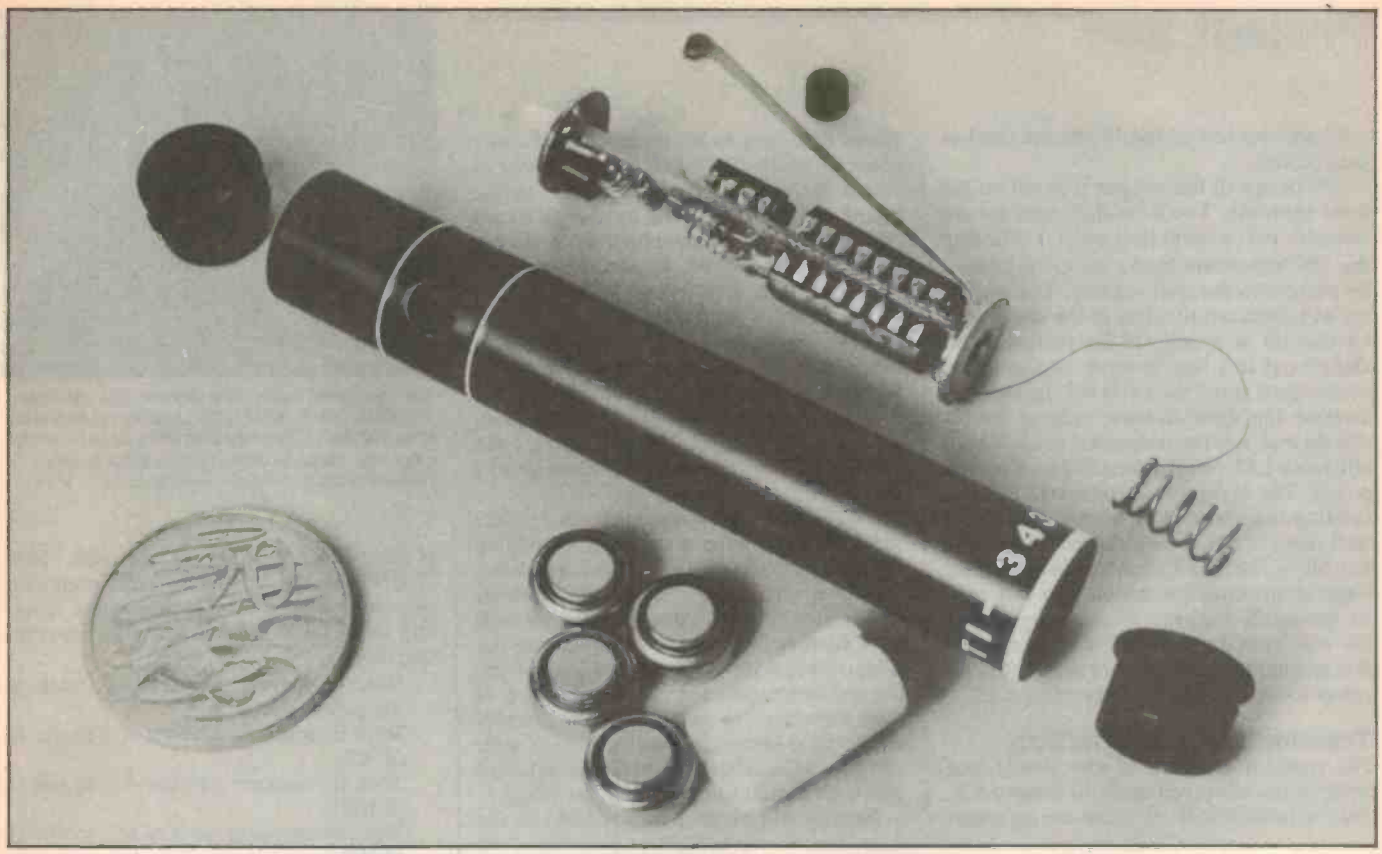


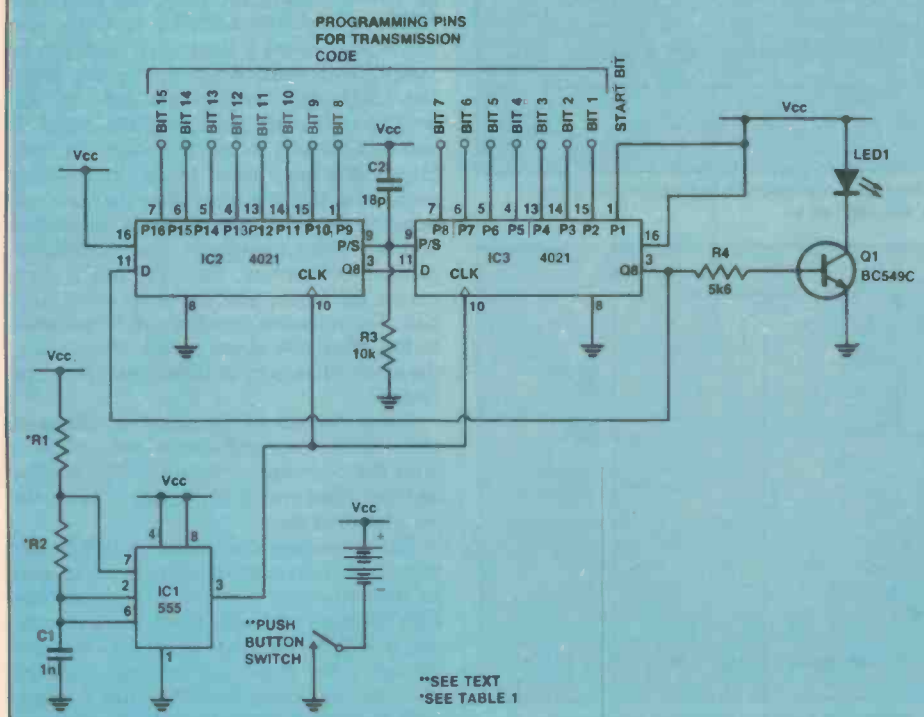
Figure 1. A drifting receiver clock affects the sampling instant. The sampling points drift away which results in error when the same data bit is sampled twice or missed.



All these parts fit into this compact transmitter making it an extremely 'handy' device.

HOW IT WORKS — ETI-343

The transmitter circuit is very simple. Pin 1 of IC3 is always connected to logic high. This is the start bit. The batteries are connected to the circuit when the button is pressed. Pin 9 of IC2 and IC3 will go high immediately because of the capacitor C2. The logic pattern at pin 1 of IC2 and pin 15, 14, 13, 4, 5, 6, 7 of IC2 and IC3 is loaded parallel into the shift registers (IC2, IC3). The voltage of pin 9 of IC2 and IC3 gradually dies away according to a time constant formed by C2 and R3. As soon as this voltage goes low, control of the 4021s shifts to the serial mode. The clock input, pin 10, is driven by an 555 set up as an oscillator. The bit in pin 1 of IC3 gets shifted out first, the bit in pin 15 of IC3 is shifted out second, and so on. Any bit shifted out at pin 3 of IC3 also 'circulates' back to pin 11 of IC2. Repeated transmission of the same code is possible under this scheme. Components R1, R2 and C1 determine the clocking rate of the data from the following equations:



$$F_{CK} = \frac{1.443}{(R1 + R2 + R2) \times C1 \text{ Hz}}$$

$$\text{Duty cycle of clock} = \frac{R2 + R1}{(R1 + R2 + R2)}$$

The start bit normally turns LED1 on longer than other bits. This is because during the parallel loading of the registers, the start bit is active at pin 3 of IC3 already. The start bit stays active for one period of the clock plus the loading time. Therefore, the loading time constant of the register is made small compared to the clock period. That is, C2 and R3 are small.

As I said before, three different transmission rates are given in Table 1 with their component values already calculated. If any reader wants to use a transmission rate not listed in the table, the above formulas can be used. Whatever rate you choose, make sure it is not faster than the fastest given in the table, otherwise, the loading time of the registers becomes comparable with the clocking period. This might upset the sampling mechanism in the receiver.

OPTICAL CAR ALARM SWITCH

Don't be fooled! This is not a torch at all but an optical car alarm switch. It consists of a transmitter (explained in Part 1) and receiver (Part 2) to deactivate car alarms and thus avoid delay mechanisms that can be exploited by the unwanted intruder. The project requires a little mechanical dexterity, but don't be too alarmed — we managed it!

S. K. Hui **Part 1**

THIEVES AND BURGLARS are getting really professional nowadays. A quick check of police or NRMA statistics will show that many of the stolen cars are equipped with alarm systems. The ordinary car alarm no longer gives you much protection at all! Scrapping the old one and installing a new sophisticated system is the best solution, but it's really expensive — you might be looking at $300 or more.

Many classy cars, like the Renault Feugo or new BMW have built-in alarm systems. These have one common feature — remote turn off of the alarm, unlike most of the "do it yourself" alarm systems, which work on an entry delay. Such delays are usually adjustable up to tens of seconds. Unfortunately, a skilled burglar can disable your alarm within a few seconds.

There is one inexpensive way to update your alarm system. The ETI-343 Optical Car Alarm Switch. It is intended to be used with the most stupid car alarm system and turns it into something like the BMW's.

The idea is fairly simple. You turn the entry delay in your existing alarm to minimum time. Any unauthorized person trying to open the door or the boot will trigger the siren instantly. A little pocket size transmitter is used to turn off the alarm through the window before you get in. You can program your own transmitter code, which has n x 32 x 1024 different combinations. It is possible to have n number of different rates to clock out the code. Theoretically, n is an infinite number, but in this article, n is chosen to be three, ie, three different sets of resistors and capacitors are given in Table 1 for different rates of transmission. A different set of components will give you a different bit rate of transmission. Two transmitters with the same code but different bit rates will not interfere with each other. It is possible for you to invent a new transmission rate (bit rate) which is not listed. The only trouble is that you have to go through the calculation of the component values, and you need enormous patience to tune the receiver oscillator to the correct value. This will be discussed in the next issue.

This project can be used in other applications. Turning off your car alarm is one typical application. I am sure many of you can figure out other innovative ways of using it.

Principle of transmitter circuit

The whole system works on the principle of asynchronous communication. It is a bit like the 6850 ACIA (asynchronous communication interfacing adaptor). Those who are not familiar with this device will find the following useful.

Suppose an 8-bit code, eg, 10011110 is transmitted. If the code is clocked out by the rising edge of the transmitter clock, the waveform of the data will look like that in Figure 1a. This same waveform is sampled at the receiver end with a sampler circuit. According to the Nyquist sampling theorem, the rate of the sampling has to be at least twice as fast as the maximum data rate in the transmitter. The sampling circuit is controlled by an oscillator. Usually there is a drift in the oscillator due to environmental factors such as temperature. The drift in the sampling rate can be minimized by having the oscillator oscillating many times faster than the actual sampling rate. The frequency of the oscillator is then divided down to give the correct sampling rate. Since nothing is perfect in this world, drift in the sampling rate can never be gotten rid of completely.

The ideal sampling point is in the middle of the mark (logic 1) or in the middle of a space (logic 0). This is shown in Figure 1b. The first bit transmitted is called the start bit and is used to synchronize the receiver oscillator. This allows the start bit to be sampled right in the middle. Since the transmitter clock is not transmitted to the receiver, the subsequent samples are controlled by the receiver oscillator which is not synchronized to the transmitter clock. The receiver oscillator is almost certainly drifting in the oscillator relative to the received signal. The effect is, as shown in Figure 1b, that the sampling points are drifting away from the middle of the bits. Eventually, wrong samples will be taken. In practice there is a limit to the maximum length of the word one can transmit without re-synchronizing the oscillator with the next start bit. In standard formats, the word normally contains a start bit, seven or eight bits of data, a parity bit and one or two stop bits. In our particular case, only one start bit is

FROM JAYCAR ELECTRONICS

AT LAST! A low cost 10 Amp Digital Multimeter with transistor test facility

Digital multimeters are very popular these days but good quality ones with 10 amp scales generally cost well over $100. We think that is too expensive so we've decided to do something about it.

Jaycar is pleased to announce a direct import digital multimeter with sensational specifications at an unheard of price!

Check the specs:

DC VOLT	0.1mV - 1000V
AC VOLT	0.1mV - 700V
DC CURRENT	1uA - 10A
AC CURRENT	1uA - 10A
RESISTANCE	0.1 - 20 Mohm
CONTINUITY	less than 30 ohm @ 1mA
hFE TEST	0-1000 10uA 2.8V NPN/PNP
DIODE TEST	1mA

Basic accuracy of Volts, Current & resistance is between 0.5 - 1.2% depending on range.
DIMENSIONS 170(H) x 90(W) x 35(D)mm

FEATURES

- ★ 0.5" high digits
- ★ High quality probe set supplied!
- ★ Vinyl carry case supplied!
- ★ Built in tilting bail!
- ★ LED & buzzer continuity test!
- ★ Precision thin film resistors used for long term accuracy!
- ★ CMOS logic. 1000-2000 hours battery life!
- ★ Single function range switch
- ★ Complete with battery, spare fuse (2AG) and instruction manual
- ★ Protected ON/OFF switch!
- ★ Auto polarity
- ★ Protected
- ★ Floating decimal point

Cat. QM-1530

SPECIAL INTRODUCTORY PRICE

$79.95

AT LAST! A low cost 10 Amp Digital Multimeter/ Transistor Tester & Capacitance Meter!

Jaycar is proud to announce a genuine low cost high performance combination Multimeter/Capacitance meter for the enthusiast! This unit is all the most commonly needed test gear rolled into one!

Similar units are on the market to sell from around $150 to over $200. Why pay more when you can get a Jaycar direct import for less?

DC VOLT	0.1mV - 1000V
AC VOLT	0.1mV - 700V
DC CURRENT	1uA - 10A (20A max 30 secs)
AC CURRENT	1uA - 10A (20A max 30 secs)
RESISTANCE	0.1 - 20M ohms
CAPACITANCE	1pF - 20uF (2%)
CONTINUITY	less than 30 ohms @ 1mA
hFE TEST	0-1000, 10uA 2.8V
DIODE TEST	1mA (Buzzer & LED)

FEATURES

- ★ 0.5" high digits
- ★ High quality probes supplied!
- ★ LED and Buzzer continuity test
- ★ Precision thin film resistors for long term stability
- ★ CMOS logic. 1000 - 2000 hours battery life!
- ★ Meter protection. Fused
- ★ Complete with battery, quality probes, spare fuse
- ★ Floating decimal point
- ★ Auto polarity
- ★ Impact resistant case

Cat. QM-1540

INTRODUCTORY PRICE

$119.00

PROGRAMMABLE MOBILE ROBOT

Features: ★ 4 bit microprocessor controlled ★ 3 speed gears selected by programming through micro ★ Can travel in 4 directions plus angles and curves ★ Has lights and audio ★ Complex routines can be easily programmed (up to 48 commands long).

Cat. XR-1024

ONLY $49.95

MIXERS BACK IN STOCK!

These are sophisticated mixers that have excellent specifications - SEE PAGE 86 of our 1985 CATALOGUE for full features and specs.

STEREO AUDIO MIXER

Cat. AM-4200

ONLY $125.00

PRO-QUALITY CONSOLE

Cat. AM-4202

ONLY $399.00

THE ULTIMATE CAR THEFT DETERRENT

The most sophisticated car alarms these days use ultrasonic sensors inside the cabin of the car to detect unauthorised entry. If the perimeter sensors fail the ultrasonic gets them as a second line of defence. It is virtually impossible not to trigger them once you are inside the car.

Jaycar has made a scoop purchase of the UK made AT-90 Ultrasonic Detector Module. This unit is basically a proximity detector which connects to your car alarm system.

When the AT-90 is installed it fills the inside of the car with a steady pattern of ultrasound (ignition off, car closed). A movement within the vehicle or disturbance of windows or roof causes a disruption to the pattern and the AT-90 sends a signal to your main car alarm triggering it.

JAYCAR SELLS THE KIT FOR $55.00

BUT - you can add a built and guaranteed AT-90 to your alarm system TODAY for only $24.50!!

Cat. KJ-6665

SAVE $30.50

SX-2000 Full Featured Electronic Ignition SLASHED!

The SX-2000 is the UK based Sparkrites best ever selling electronic ignition. It is a reliable Transistor Assisted Ignition design with very high performance.

- Static timing light
- Anti-theft disable switch
- Instant conventional ignition switch over
- "Systems Functioning" lamp indicator
- Inbuilt heatsink
- Special mounting clips attach straight to coil (Patented feature)
- Easily transferred from car to car.

At $59 Jaycar consistently runs out of the KIT version of this ignition ALL THE TIME. This unit is not a kit but the fully BUILT AND TESTED version. So when we tell you the price you will be thoroughly astounded!

FOR SEPTEMBER this unit is only $39.50!!

Hurry! Stocks are limited!

Cat. KJ-6650

SAVE $20

MAIL ORDER HOTLINE (02) 747 1888

UNBELIEVABLE KIT SALE

SENSATIONAL PRICES ON 5000 AMP-SYSTEM KITS

Check the special prices for the famous ETI 5000 series deal of a lifetime...

FAMOUS JAYCAR 'BLACK MONOLITH' SERIES AMP

NORMALLY $339

THIS MONTH $299

SAVE $40

For further savings check the package deal below.

FAMOUS JAYCAR 'BLUEPRINT' 5000 SERIES PRE-AMP

NORMALLY $319

THIS MONTH $275

SAVE $44

Check below for package price further savings.

FAMOUS 1/3 OCTAVE GRAPHIC EQUALISER 5000 SERIES

NORMALLY $199 ea

THIS MONTH 2 for $319

SAVE $79

For further savings check below.

THIS SPECTACULAR PACKAGE DEAL

PACKAGE DEAL 1

5000 'Black Monolith' Power Amp
5000 'Blueprint' Pre-amp

TOGETHER FOR ONLY **$550**

SAVE over $100 on normal prices

PACKAGE DEAL 2

5000 'Black Monolith' Power Amp
NORMALLY $339
5000 'Blueprint' Pre-amp
Normally $319
5000 Series 1/3 Graphic Equaliser
Normally $398

NORMALLY $1056

THIS MONTH YOU GET THE LOT FOR $799

A MASSIVE SAVING OF $257.00

Freight by Comet anywhere in Australia $13.50

NOTE: If demand temporarily exceeds our ability to supply kits we may part ship. This will get you started on what is after all a fairly ambitious project. We will only honour the prices, however, if you order NOW!

ELECTRONIC IGNITION SENSATIONS! SPARKRITE SX-500

Jaycar has made a massive scoop purchase of a great little Transistor Assisted Electronic Ignition. It is not a kit. It is fully built and tested!

- Builtin static timing light
- Only 4 wires to connect!
- Fits all 12V neg earth vehicles (inc. motorcycles) that use a coil and contact ignition.
- 3 position switch which enables you to immobolise vehicle or switch back to conventional ignition instantly
- Helps keep ignition in tune
- Stops arcing of breaker points
- Greatly extends points life
- Generally improves performance

The unit is supplied in a metal case with all wiring and fitting pieces included!! Instructions included.

Normally this unit would sell for about $49.95. But at Jaycar you pay ½ that in September!

GRAB THEM WHILE THEY LAST!

Cat. KJ-6653

ONLY $24.95 ea

BRITISH MADE - QUALITY!

SAVE $25

Jaycar ELECTRONICS

Incorporating ELECTRONIC AGENCIES

NUMBER 1 FOR KITS

MAIL ORDER HOTLINE (02) 747 1888

N.S.W. SHOWROOMS

SYDNEY: 117 York Street Tel: (02) 267 1614
CARLINGFORD: Cnr. Carlingford & Pennant Hills Road. Tel: (02) 872 4444
CONCORD: 115/117 Parramatta Road. Tel: (02) 745 3077
HURSTVILLE: 121 Forest Road. Tel: (02) 570 7000
GORE HILL: 188/192 Pacific Highway (Cnr Bellevue Avenue) Tel: (02) 439 4799

QUEENSLAND BURANDA: 144 Logan Road. Tel: (07) 393 0777

MAIL ORDERS: P.O. Box 185, CONCORD 2137

HEAD OFFICE: 115-117 Parramatta Road, CONCORD 2137
Tel: (02) 747 2022 Telex: 72293

SHOP HOURS

Carlingford, Hurstville & Gore Hill
Mon-Fri: 9am - 5.30pm. Thurs 8.30pm. Sat 12pm
Sydney
Mon-Fri: 8.30am - 5.30pm. Thurs 8.30pm. Sat 12pm
Concord
Mon-Fri: 9am - 5.30pm. Sat 12pm

POST & PACKING

$5 - $9.99	$2.00
$10 - $24.99	$3.75
$25 - $49.99	$4.50
$50 - $99.99	$6.50
$100 - $198	$8.00
Over $199	$10.00

COMET ROAD FREIGHT ANYWHERE IN AUSTRALIA ONLY $13.50

MasterCard
VISA

MAIL ORDER VIA YOUR PHONE

SILLY SPEAKER SENSATIONS

PIONEER

UNBELIEVABLE SPEAKER BARGAIN

PIONEER 4" 8 OHM 10 WATT SPEAKER

NORMALLY $5.95 ea

SAVE A MASSIVE $4.95

MINIMUM BUY 4 pcs

Cat. AS-3025

ONLY $1.00 ea

PLEASE NOTE: Due to weight add extra $1 Post & Packing

SILLY PRICES

PIONEER

PIONEER SURPLUS ECONOMY TWEETER

Normally worth about

$4.00 each

Limited Quantity

Cat. CT-2000

ONLY $1.00 ea

PIONEER

We have made a bulk purchase of DISTRESS STOCK SPEAKERS, and can offer you the basics for some speaker kits at ridiculous prices.

GRILLED MIDRANGE AND TWEETER

Two really nice Pioneer matching speakers. Put them with a crossover $12.95 ea Cat. CX-2615 and with one of the woofers on this page for a fabulous system, which would handle up to 50 watts RMS, depending on the woofer chosen.

TWEETER Cat. CT-2005

USUALLY $6.95 ea

MIDRANGE Cat. CM-2078

Usually $14.50 ea

BUY 2 OF EACH FOR ONLY $29.90

SAVING YOU $13.00

Almost the cost of the 2 tweeters

Sorry No PIC available for tweeter

PIONEER

GREY MIDRANGE & TWEETER

Basically the same specs as the grilled ones, except both speakers have square grey frames.

TWEETER Cat. CT-2040

USUALLY $5.95 ea

MIDRANGE Cat. CM-2042

USUALLY $12.50 ea

BUY 2 OF EACH FOR ONLY $23.90

SAVING YOU $13.00

More than the two tweeters!

NEVER TO BE REPEATED PIONEER 6" WOOFER 4 OHMS

Another huge scoop once only purchase. Ideal woofer for cars, or a small speaker box, or even two in a tower box.

★ Power Rating 15 watts RMS ★ Nominal Resonant Frequency 40-45Hz ★ Nominal Sensitivity 97dB/W ★ Response Range fo - 4,000Hz

WE STOCK THIS IN A TWIN CONE VERSION for $17.50 A REALLY SPECIAL PRICE WOULD BE $10. BUT WE HAVE SLASHED THEM TO ONLY $6.00 ea.

THAT'S CRAZY. Limited Quantity.

Cat. CW-2105

SAVE $11.50

ONLY $6 ea

PIONEER

TOO MUCH MIDRANGE OR HIGHS? If this is your problem put one of each in line with your speakers. They are easy to install and come with wiring instructions. Power handling 80 watts RMS system power.

NORMALLY $7.95 ea THIS MONTH

1 TWEETER Level Control and 1 MIDRANGE Level Control for

$7.95

THAT'S 2 for 1 or ½ PRICE

Mid Control Cat. AC-1680

High Control Cat. AC-1682

MANUFACTURERS/ WHOLESALERS!!

Turn your surplus stock into cash!!

Jaycar will purchase your surplus stock of components electronic equipment or traded-in gear in good condition. We are continually on the lookout for sources of prime quality merchandise that can be resold to electronic enthusiasts.

Call Gary Johnston or Bruce Routley NOW (02) 747 2022

PIONEER

PIONEER 12" GUITAR SPEAKER 65W RMS

Strictly limited quantity. Crazy price. They won't last.

USUALLY $59.50

SAVE $20.00

Cat. CG-2381

SAVE $20.00

PIONEER

★ Impedance 8 ohms ★ Power rating 65W RMS ★ Sensitivity 97dB/w ½ metre ★ Frequency range 80 - 6kHz ★ Resonance frequency 80hz

ONLY $39.50

PIONEER DOME TWEETER

LESS THAN ½ PRICE

A dome tweeter for under $10! Ridiculous! Only 250 available.

USUALLY $18.50

SAVE $9.55

Cat. CT-2020

★ Impedance 8 ohms ★ Power rating 25W RMS - 100W RMS system power ★ Crossover frequency 2000Hz ★ Sensitivity 95dB/w ½ metre ★ Frequency range 2000 - 20,000Hz

PIONEER

SAVE $9.55

ONLY $8.95

PIONEER HORN TWEETER

Great sounding black anodised square metal horn. Two together sound great. Limited quantity.

LESS THAN ½ PRICE

WAS $13.50 SAVE $7.00

Cat. CT-2014

PIONEER

★ Impedance 8 ohms ★ Power rating 12W RMS - system 60W RMS ★ Crossover frequency 2000Hz ★ Sensitivity 101 dB/w ½ metre ★ Frequency response 2000 - 20,000Hz

SAVE $7.00

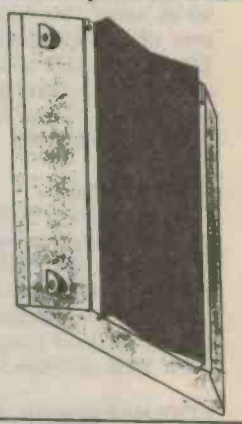
ONLY $6.50

MOTOROLA PIEZO TWEETER BARGAIN!

This Hi Fi high power tweeter is a surface mount, cone dispersion line source unit that is fitted with its own grille. The use of high temperature materials in its construction means it can be used in automotive applications. Two piezo units provide a wide (90°) dispersion horizontally with a narrow dispersion vertically. Sensitivity is 98dB @ 2.8V @ ½m. Frequency response easily goes out to 40kHz. The KSN-1071 normally sells for a very reasonable **$24** each (pre-devaluation). While stocks last this unit is available from Jaycar for the ridiculously low price of **$12.95 each!** A high quality, high power Hi Fi Tweeter for a prayer!

Cat. CT-1918

ONLY $12.95 ea



APOLOGY

In our July ads we advertised that our Salvage Warehouse was at Concord. By the time the ads hit the streets we had had a change of plan and the stock had been moved to GORE HILL STORE. We apologise for any inconvenience caused.

INNERBOND

Innerbond is the ideal substance for lining the insides of speaker cabinets. It has excellent damping properties and is clean and non-irritating. Comes on a roll approximately 900mm wide. Thickness is 25mm.

Cat. AX-3690

$4.50/metre

GRILLE CLOTH

High quality, acoustically transparent grille cloth is ideal for protecting those expensive drivers - but making sure all the sound gets through. Comes in a 1.5 x 1 metre roll. Black in colour.

Cat. CF-2752

$10.50/metre

7 WAY SPEAKER SWITCH

This stereo speaker switch will enable you to select any combination of three pairs of speakers. Comes complete with wall plate. Has easy to connect screw terminals. Full instructions supplied. Separate switch for each pair of speakers. Not the cheap rotary switch type.

Cat. AC-1676

ONLY $12.95 ea

BUT THIS MONTH SAVE $4.00

ONLY $8.95 ea

BRIEFS

Software package for pc board layout

Technical Imports has introduced a promising software package called the "Auto-router" which runs on most MS-DOS compatible personal computers. The package consists of software tools and templates to automate route tracing on double sided pc boards. Contact Technical Imports, 220 Pacific Hwy, Crows Nest, NSW 2065. (02)922-6833.

dc fan

Announcing the Biscuit dc Blower from E.G. & G. Rotron which uses dc brushless technology to produce twice the pressure of an equivalent ac blower! Its impressive specs are: 120.7 mm square x 31 mm deep, 0.273 kg weight and 44.6-51-.6 dBA noise power emission level. If you're interested in this piece contact Total Electronics, 9 Harker St, Burwood, Vic 3125. (03)288-4044.

Free journal

Analog Dialogue Volume 18, No 2 is a technical journal on data acquisition components and systems. In this issue you can find out why flash converters work better with track-and-holds, and about the HAS-1201, a 12-bit, 1 MHz hybrid A-D converter with internal track-and-hold amplifier. This journal can be obtained from Parameters, 41 Herbert St, Artarmon, NSW 2064. (02)439-3288.

LCD dot matrix display

Called "Optrex", this LCD display from Amtex Electronics offers 160 JIS type characters including alphabet, numeral and kana with 32 special characters and symbols displayed by internal character generator (ROM). Random symbols can also be displayed and Optrex includes functions to clear the display, move the cursor, blink a character, etc. It uses a single +5 V power supply and is available from Amtex Electronics, 36 Lisbon St, Fairfield, NSW 2165. (02)728-2121.

MIC multimeter

The series "V" MIC 4½ digit multimeters features peak hold, TTL logic level and pulse detect, pulse memory, conductance, audible continuity check, and transistor h_{FE} measurement. Contact J.C. Tanloden, 11 Stroma Ave, Balwyn North, Vic 3104. (03)857-9563 to check out the specs or purchase one of these devices.

STD bus video board

Bytewyde Systems has introduced a low cost intelligent video controller designed to act as the display subsystem for any STD bus processor. The BWS-2010 offers composite video or TTL video output with separate sync for direct connection to standard industrial VDU monitors. A parallel 8-bit interface is provided for keyboard connection. You can get more info on this from Prologue Australia outlets or from Bytewyde, PO Box 146, Canterbury, Vic 3126.

Quick Ni-Cad charger

A 20 minute Ni-Cad battery charger is on the market. Called the "Reflex 20", it uses a system of "burping" which is an interjection of negative pulse between positive charging pulses to achieve the speedy recharge. The charger and battery system is suitable for portable communications, paramedic and video equipment and for demands for uninterrupted power. For more information contact Christie Electronics, 33 Higginbotham Rd, Gladesville, NSW 2111. (02)807-1444.

PROM programmer

The SE4942 EPROM programmer is a portable unit for programming devices up to 256K bit capacity. Available with it is an optional add-on SE49402 to make a RAM/PROM memory emulation unit. The SE4942 programmer has an RS232 port to allow up-line and down-line loading of PROM data. It operates on 90 to 240 Vac. More information is available from Alfatron Pty Ltd on (03)758-9000.

Sweep function generators

The series 8050 multipurpose function generators provide sine, triangle and square waves and pulses with variable amplitude, symmetry and offset over a frequency range of 50 mHz to over 5 MHz. Output can be continuous, gated or triggered. Maximum output amplitude is 20 Vp-p into open circuit or 10 Vp-p into 50 ohms. Contact Paton Electrical, 90 Victoria St, Ashfield, NSW 2131, (02)797-9222 for further information.

Indoor/outdoor digital thermometer

Zap Electronics has available a miniature electronic thermometer with sensors for ambient temperatures and a remote probe and lead for outdoor temperatures. It can be used to measure liquid temperatures, body temperatures or surface temperatures in the range of −40°C to 120°C to 0.1 resolution. It sells at $27.50. For enquiries phone Zap on (02)858-2288.

STD bus PC interface

The Pro-Log LYNXSOFT allows a LYNX1 STD Subsystem to communicate with any PC or terminal asynchronously using RS-232-C interface or via an auto-answer modem. No additional software or hardware modifications are needed for the PC or any terminal to read from or write to any I/O port or memory location. For further information contact Pro-Log (Australia), PO Box 1, Canterbury, Vic 3126.

CRT photography kit

Polaroid is distributing a budget-priced NPC photo "Screenshooter" kit for off-the-screen CRT photography. Comprising a CRT screen hood, a bracket for standard 35 mm SLR cameras, a Polaroid OneStep 600 instant colour print camera with bracket and supplementary lens and extension tube, it sells for $240 rrp plus tax.

Screened plastic boxes

BOSS Industrial Mouldings Ltd is now ofering the complete BIM2000 range of plastic multipurpose boxes internally coated with 0.05 mm thick, matt black emi/rfi conductive shielding.

The ABS boxes have all the normal electrical screening protection facilities associated with steel or diecast aluminium enclosures, and also provide light weight, easy drilling, as well as impact and chemical resistance advantages plus considerable cost savings.

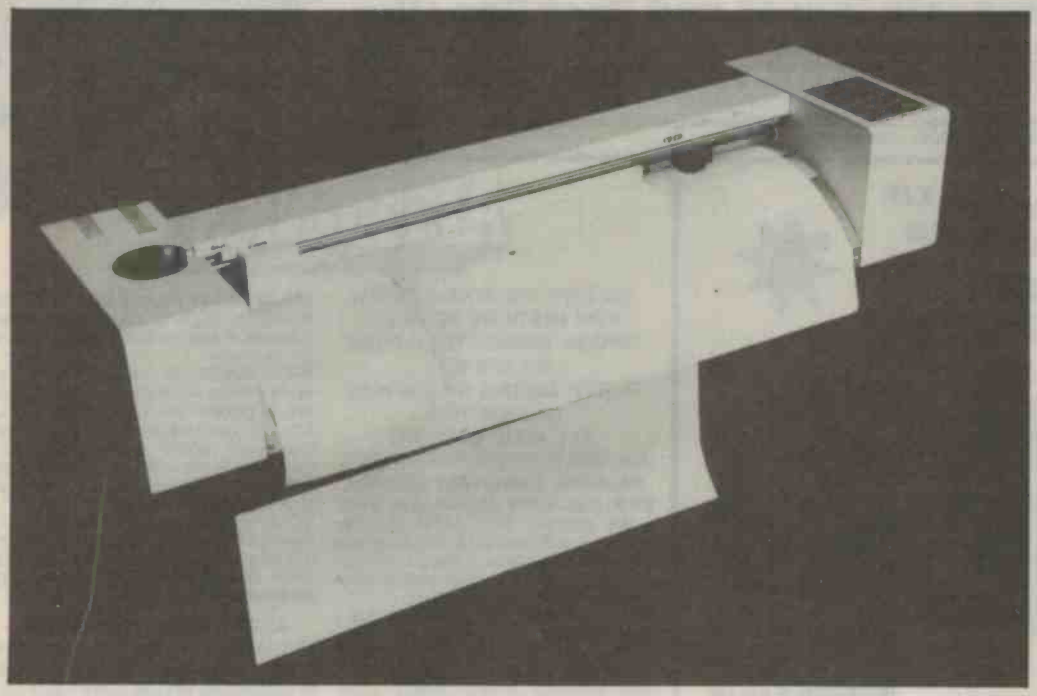
The low or deep profile lids are firmly secured to the base by screws running into brass hank bushes which not only provide a good electrical connection for total screening but also ensure that these boxes are splash and moisture proof and therefore suitable for a wide range of hostile electrical and environmental conditions.

Moulded in seven sizes ranging from 100 x 50 x 25 to 190 x 110 x 90 mm, the shielding capacity (attenuation) of the boxes over the range of 5-1800 MHz is 50-90 dB.

For further information contact **Crusader Electrical Components, 81 Princess Hwy, St Peters, NSW 2044. (02)519-6685.**

The plot thickens

The Graptek GP9101 is perhaps one of the most cost effective plotters ever released on the Australian market. Things like the 8-bit parallel port or RS232C input port, automatic self and interface tests are only basic features of this machine.



It can handle several sizes of paper, including A1, A2, A1S, B2 and B3. A choice of pens is also available including fibre tip and draughting pens. The pens ride in a pen holder that houses four different pens, making it ideal for architectural, internal design or draughting. Furthermore, the machine has different types of numerical and character patterns in its ROM, which allow the user to plot numbers, mathematical symbols, Greek letters, scientific symbols and even Japanese characters.

A convenient facility is the ability to plot standard curves automatically. This saves a lot of time in writing a program to generate them. A set of simple parameters (like radius, curvature, slope, etc) corresponding to the particular curve to be drawn is all that is required by the machine. The parameters are sent to the plotter using either ASCII or binary format.

The machine plus all the accessories like special pens and paper etc are currently ex-stock! If you are urgently in need of a plotter, get on down to **Electrical Equipment at 8 Lyon Park Rd, Unit C, North Ryde, NSW 2113** or phone **(02)888-9000. Price is $7500.**

Low cost industrial multimeters

Two additions to the 20 series family of industrial-grade handheld multimeters, the Fluke 21 and 23 are high-energy protected and specifically designed to survive in rugged environments in such applications as plant facilities and production equipment maintenance, automechanics and electrical contracting.

Extensive overload protection and high-energy fusing have been built into the meters. The Fluke 21 clears short-circuit faults to over 10,000 amps and the Fluke 23 is 10 amp fused for protection to 1,000,000 amps.

For volt/ohm protection the 21 uses a 1200 V metal oxide varistor while the 23 features a 430 V MOV in series with a spark gap.

The high-visibility (industrial) yellow case is constructed entirely from non-metallic materials with specially recessed input jacks to accommodate safety designed test leads. Both meters come with insulated alligator clips.

For added safety, the Fluke 23 has software "Touch Hold" which allows the operator to take readings in dense circuitry or areas of high current and voltage without looking away from the probes. The meter automatically locks in the reading and beeps. It then updates when a new measurement is taken.

For further information contact **Elmeasco Instruments, 15 McDonald St, Mortlake, NSW 2137. (02)736-2888.**

Compact PROM programmer

The new Minato model 1863 PROM programmer can program both MOS and bipolar PROMs by changing a PROM unit.

The CPU section is equipped with an 8-bit microprocessor (Z80), enabling a variety of functions such as the checking of a PROM and data editing by serial interface.

In addition the model 1863 offers high-speed 400 cps PTR, and functions such as blank check, and program read and verify. Other features include one-touch operation and compact size for excellent portability.

For more information contact **Ampec Electronics Pty Ltd, 1 Wellington St, Rozelle NSW 2039. (02)818-1166.**

Bonanza

Components and Products — our Competitors prices.

cent until you get your statement next month!

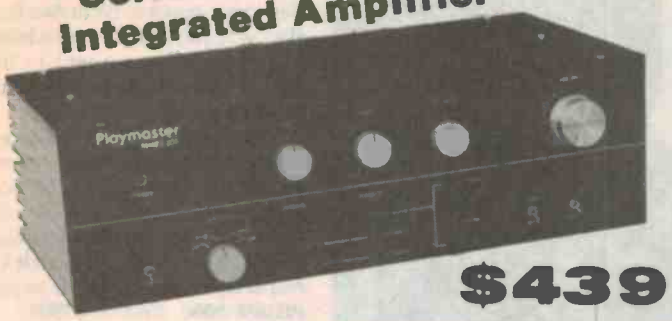
Dear Customer
Don't forget to tell us where you saw this advertisement — we'll be delighted to send you the bonus free offer mentioned at the beginning of the ads.

Just Arrived
– Ultrasonic Insect and Pest Repeller

PESTREPELLER is effective in controlling mice, rats, roaches, fleas, flies, crickets, silverfish, waterbugs, moths, ants, and most other common pests, Laboratory research has shown ultrasonic sound waves attack the auditory and nervous systems of most common pests causing them pain and discomfort. 130 decibels of sound waves are out of the range of hearing of humans and most household pets such as dogs, cats fish and birds, and farm animals.

Specifications—Dimensions: 100 x 90 x 80 **Power Supply** adaptor supplied 240/9V **Frequency Range** 30KHz to 65KHz variable **Output Level** 130db Cat A 0083 **$49.50**

Build this Fantastic New Kit
NO COMPROMISE DESIGN
Ultra Fidelity Series 200 Mosfet Integrated Amplifier



$439

INCREDIBLE VALUE

FEATURES: — This brilliantly designed stereo amplifier will equal or better just about any integrated commercial amp regardless of price. It is a no-compromise design capable of delivering 100 watts per channel at very low distortion. Four basic stereo inputs are provided for both moving magnet and moving coil cartridges. Also three high level stereo inputs are provided for compact disc players, AM/FM tuner and auxiliary input which could be from a stereo TV tuner of Hi Fi VCR. Input facilities are also provided for two stereo cassette decks and full monitoring facilities are available for either deck plus dubbing from Deck 1 to Deck 2 or vice versa. • Full CMOS Analog switching (soft touch) • Twist Type speaker lead binding posts supplied • De-thump muting in-built • All Hi-Spec low noise IC's used. • Incredibly accurate RIAA equalisation. • No control wiring whatsoever • Led indication of switch status (on/off) • All components mount on the PCB, even pots and sockets • Super efficient Toroidal Transformer—Low Hum • Uses Hitachi Mosfet Power devices • In-built over drive protection • Centre detents on Bass, Treble and Balance controls; multiple detents on volume control. • Heavy Duty Heatsinks.

SPECIFICATIONS: — **Power Output:** 100W RMS into 8 Ohms (per channel) **Freq.Response:** 8Hz to 20KHz +0 -0.3db 2.8Hz to 65KHz +0 -1db **Input Sensitivity:** 0.775mV for full power **Hum:** -100db below full output **S/N Ratio:** 94db flat -100db A-weighted **Distortion:** 0.01% @ 1KHz **Stability:** Unconditional Cat K 5030

Low Cost Power Transformer

An Exlusive Altronics Design

Why didn't we think of it years ago!!

240V to 9, 12, 15, 18, 21, 24 volts at 60VA (60W) High grade silicon steel laminations (Sorry we could not do a Toroid at this price).Our Multitap 1 amp and 2 amp Transformers have proved so popular we decided to release a big brother. Maded right here in Australia. Use of high grade Silicon steel has enabled surprisingly compact dimensions (70mm x 70mm x 58m High) **Outputs:** Two Simple Secondaries, each with just one tap, permit an amazing range of outputs i.e.

Voltage	Current	Centre Tap
3	6.6A	No
6	6.6A	Yes
9	6.6A	No
12	5A	No
15	4A	No
18	3.3A	Yes
21	2.9A	No
24	2.5A	Yes

And the Best News is the Low Price

Just $22.50 Cat M 2165

ALTRONICS COMPONENTS

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$3.00 DELIVERY AUSTRALIA WIDE - We process your order the day received and despatch via. Australia Post. Allow approx.7 days from day you post order to when you receive goods. Weight limited 6Kgs.

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INSURANCE — As with virtually every other Australian supplier, we send goods at consignees risk. Should you require comprehensive insurance cover against loss or damage please add 1% to order value (minimum charge $1).When phone ordering please request "Insurance".

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5(6.5)MHz Oscilloscope Kit

$249 (See EA Oct '84)

Over the years many people have asked, "Do you have a CRO Kit"? — Our answer - up until now - has been that built and tested units were not dearer than kits, if you could get a kit at all. The Altronic K 2000 Cathode Ray Oscilloscope kit has a guaranteed 5MHz band width but should go to around 6.5MHz. It also features 75mm (3") CRT Blue Phosphor with accurate graticule, separate vertical and horizontal BNC input sockets etc. Remember, a 5MHz scope is usually adequate to troubleshoot most micro processor and other digital circuitry as well! This is a wonderful opportunity to learn electronics and end up with a valuable piece of test equipment as well. The Altronic K 2000 kit is absolutely complete. The chassis is prepunched and every component including nuts and screws are provided, along with instructions. Cat. K 2000

BENCH TOP POWER SUPPLY

Electronics Australia have released this superb new supplykit in our very attractive H 0480 instrument case — thus complementing the Frequency Counter,Function Generator projects etc. Cat K 3210 **$59**

FEATURES:

- Output variable between 3 and 30V
- Short circuit Protection
- Full 1 amp output over entire voltage range
- Load switching
- Current limiting fully variable-twin selectable ranges
- Dual Scale Meter
- Separate earth terminal provided

SPECIFICATIONS:

- Output Voltage—3 to 30 Volts
- Output Current—0 to 1 Amp (fully variable)
- Load Regulation—better than 0.2% from 0 to full load
- Output ripple—less than 2mV RMS

Kits and Bits at Bargain Rates

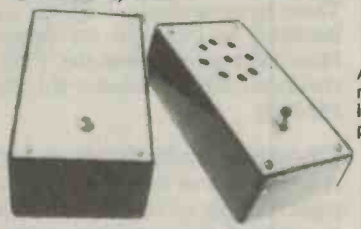
MICROBEE OWNERS

As we no longer sell the Microbee Computer range, we now have these surplus products which we want to quite regardless of cost. Don't let these unbelievable prices put you off — these are all 1st quality products. Naturally 1st come 1st served. So phone order yours right now!

FAX DECODER

(ETI Sept.'83)

Now $15



This project allows you to decode the signals of shortwave stations transmitting radio facsimile weather maps, satelite pictures etc.• complete kit of parts includes DB15, Ribbon cable • Software listing. Cat K 9733

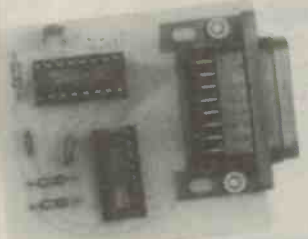
Radioteletype Decoder (ETI April '83)

Display RTTY encoded messages on your Video Monitor. Receive up to date weather information International News before the Papers all sorts of coded military info. Simple circuit uses PLL techniques. Single PCB Construction. Kit includes DB15 Plug and Backshell for connection to microbee. Shielded pretinned PCB. Cat K 9733

Now $20

PARALLEL PRINTER INTERFACE $15

Build your own interface and Save $$



A simple kit to build-takes about 20 minutes. Save on the cost of a built interface and save the cost of a serial printer. Cat K 9671

CAR SECURITY SYSTEM KIT

ETI 340

$10 Off Now **$49**

This New ETI Design represents the ultimate in vehicle protection systems available today.

The Design uses stratigically placed Ceramic Resonance Mics to detect any tampering with your vehicle. Features + Automatic arming with entry and exit delays + dash mount led to indicate status of alarm + extra alarm inputs that can be wired to protect your boot, car HiFi etc.

Supplied complete with Two resonance Microphones, security window stickers and exclusive ABS case with drilled and silk screened front panel. We have also included a fully identified terminal block on the case to allow easy installation in your vehicle.

++ADDED BONUS++

This System includes circuitry to monitor your dash warning lights and will inform you of any abnormal condition.

REF ETI APRIL 1984

K 4340 ..... ~~$59.50~~

K 4341 additional sensors . $8.00

STATE OF THE ART TOROID POWER TRANSFORMERS

For the same price as your common garden heavy, bulky, buzzing iron (any old iron at that!) transformer you can now design in a superb Toroid Power Transformer from Altronics.

NEW FOR '85

ALL WITH 240V PRIMARY

Why a Toroid?

- Smaller size and weight to meet modern "Slimline" requirements.
- Low electrically induced noise demanded by compact equipment.
- High efficiency enabling conservative rating whilst maintaining size advantages.
- Lower operating temperature.
- Simple, quick single bolt mounting.

Cat No.	Sec V	VA	Ea.	10Up
M 3050	12V + 12V	160W	45.00	43.50
M 3060	25V + 25V	160W	45.00	43.50
M 3065	30V + 30V	160W	45.00	43.50
M 3070	35V + 35V	160W	45.00	43.50
M 3075	40V + 40V	160W	45.50	43.50
M 3080	45V + 45V	160W	45.50	43.50
M 3085	12V + 12V	300W	55.00	52.50
M 3088	25V + 25V	300W	55.00	52.50
M 3090	30V + 30V	300W	55.00	52.50
M 3092	35V + 35V	300W	55.00	52.50
M 3100	40V + 40V	300W	55.00	52.50
M 3105	45V + 45V	300W	55.00	52.50

The toroidal transformer is now accepted as the standard in industry, overtaking the obsolete laminated type. Industry has been quick to recognise the advantages toroidals offer in size, weight, lower radiated field and, thanks to **Altronics—Low Price.**

DIMENSIONS

Diameter 110mm

Height 42mm (160VA Models) 52mm (300VA Models)

Leads 200mm length

Made in UK Quality

Highly Recommended For:

- Audio Amplifiers • Power Supplies
- Microprocessor/computer equipment

MANUFACTURERS AND BULK USERS PLEASE CONTACT OUR WHOLESALE DEPT. FOR BULK QUANTITY RATES.

Multipurpose

9V @ 6.8A | 12V @ 5A | 18V @ 3.3A | 24V @ 2.5A

BRIEFS

Single row 90° sockets

With 2 to 25 positions Series 0517 Vertisockets, single row devices can be positioned at a 90 degree angle from the pc board. Collet style sockets with gold contacts and tin or gold plated shell are on 0.100 centres, and the strips are end-to-end stackable on 0.100 centres. Single-in-line Vertisockets are moulded so they can be broken to any number of pins. For more information contact Ampec, 21 Bibby St, Chiswick, NSW 2046.

Surface mount technology manual

A free 112-page "How To Use Surface Mount Technology" manual is available from Texas Instruments' Semiconductor Division. It gives a comprehensive overview of the subject, including information about terminology, the connection process, testing, and reliability. To obtain a copy, contact Texas Instruments, Semiconductor Division, 6 Talavera Rd, Nth Ryde, NSW 2113.

High isolation opto couplers

Telefunken's new CNY21 opto coupler is housed in a 14-pin DIL. This mounting arrangement enables an input to output isolation of 10 kV, but high CTR of 60 per cent at 10 mA input is maintained due to light pipe construction. Turn on and off times are 3.4 and 2 microseconds. The CNY21 is availble from Promark Electronics, 208/6-8 Clarke St, Crows Nest, NSW 2065.

Wideband, unity gain op-amp

The Harris HA-2541 unity gain stable monolithic operational amplifier achieves 40 MHz unity gain bandwidth. It's designed for video and pulse applications requiring stable amplifier response at low closed loop gains. Harris IC products are distributed by VSI, 16 Dickson Avenue, Artarmon, NSW 2064.

One millisecond vacuum relay

A new vacuum relay for high frequency hopping has been released by STC-Cannon Components. Called the RF46-26S, it can be used in many other circuits and applications requiring high speed operation and long life. For more details contact STC-Cannon Components, 248 Wickham Rd, Moorabbin, Vic 3189.

Low power serial I/O controller

The dual-channel, low-power Z80L S10 is a versatile data communication interface which although designed as part of the Z80L family is also suited to many other CPUs. Supporting all common synchronous or asynchronous protocols, it performs the functions tranditionally done by UARTs and USARTs as well as synchronous communications controllers. Further information is available from the George Brown Electronics Group, 174 Parramatta Rd, Camperdown, NSW 2050.

Connector data sheet

A data sheet detailing the range of Suyin connectors available in Australia can be obtained from J C Tanloden Pty Ltd, 11 Stroma Ave, Balwyn Nth, Vic 3104.

Flat cable D-sub connectors

Total Electronics has introduced IDCs which incorporate a pin and socket to permit mass termination by insulation displacement of flat cable with 0.050" standard pitch round conductors. Available with 9, 15 or 37 contacts, they are mateable with standard D-sub contact arrangements and can be interchanged in existing applications. For more about these connectors, contact Total Electronics, 9 Harker St, Burwood, Vic 3125.

16 MHz CHMOS microcontroller

The 80C51BH-1 8-bit mircocontroller combines higher speed with the benefits of CHMOS. Features include a built-in "Boolean processor", 32-programmable I/O ports, programmable power modes and a UART port. Operation is at 4 V to 6 V with a current of 205 mA at 5V and 16 MHz. More details can be obtained from Intel Australia Pty Ltd, 200 Pacific Hwy, Crows Nest, NSW 2065.

Miniature current transformers

Crompton 770 Series miniature current transformers have primary and secondary current ratings for applications which include extending the range of moving coil indicators, converting mains load current to electronic signal levels, operating electronic relays and ground fault protection devices, and providing galvanic isolation. The transformers will slip over mains cables and their small size allows pcb mounting. Contact Crompton Instruments, PO Box 492, Campbelltown, NSW 2560. (02) 603-2066.

Octal transceiver

The 'F552 octal transceiver has two 8-bit registers for temporary storage of data flowing in either direction. Each register has its own clock pulse and clock enable input as well as a flag flip-flop which is set automatically when the register is loaded. These separate clocks, flags and enables provide considerable flexibility as I/O ports for demand-response data transfer. More information about the 'F552 is available from Fairchild Australia, 366 Whitehorse Rd, Nunawading, Vic 3131. (03) 857-9563.

Chopper switching regulator

A new series of hybrid chopper switching regulators for dc input voltages up to 45 V maximum, 2 A output, is available in moulded plastic packages. These regulators require very few external components. High conversion efficiency of 85% is achieved with precise voltage settings of ±2% for 12, 13 and 24 V outputs. For further details contact Autotronics Pty Ltd, 1/3 Marshall Rd, Kirrawee, NSW 2232. (02) 521-3711.

Mitel microelectronic data book

Mitel's semiconductor products division has produced a catalogue giving technical data for its digital products and telecommunications devices. Coverage includes ISDN and DTMF components, modems, analogue Telecom components, microprocessor peripherals and logic interface circuits. The catalogue is available from Mitel's Australian representative, Benmar International, Level 59, MLC Centre, Sydney, NSW 2001. (02) 233-7939.

ECL programmable array logic

The recently introduced PL1016P8 Programmable Array Logic device, from National Semiconductor, has a maximum input-to-output delay time of six nanoseconds. It's a user-programmable replacement for multiple discrete ECL logic chips, and accepts 16 inputs to produce eight outputs. For further information contact National Semiconductor, 3 High St, Bayswater, Vic 3153.

Electronic components brochure

Mayer Krieg has a new brochure covering its range of electronics components, including film capacitors, connectors, switches, lab materials and fibre optics. Contact Mayer Kreig, PO Box 1803, Adelaide, SA 5001. (08)223-6766.

High speed 64K static RAMs

A family of high-speed 64K static random access memories has been developed using Motorola's high performance second generation silicon-gate HCMOS III technology.

The 8K x 8 bit MCM6164 is now available and will be followed by the MCM6188, with 16K x 4 bit organization, and the MCM6187 organized with 64K x 1 bit.

This 64K SRAM family offers high performance similar to that established by the MCM6168, a 4K x 4 static RAM designed with 1.5 micron design rules. These fully static RAMs contribute the speed necessary for cache memory, video applications, engineering work stations, and automated test equipment (ATE).

An improved address-transition-detection (ATD) technique is employed to optimize speed, achieving maximum access times of 70 nanoseconds for the MCM6164. The ATD design has also been made impervious to address skew and fast voltage spikes.

Positive and negative logic chip enable pins are available, providing more system design flexibility than single chip enable devices. Output enable increases data bus control. Operating from a single +5 volt (±10%) power supply, the fully static design eliminates the need for external clocks or timing strobes. Low maximum power consumptions inherent in HCMOS designs are maintained with 60 milliamps in active mode, 5 mA maximum standby (TTL levels), and 2 mA maximum standby at CMOS rail input levels.

These 64K fast static RAMs come in 600 mil, 28-pin plastic dual in-line packages (DIPs) with JEDEC standard pinout.

For further information contact **Motorola Memory Products in Sydney, (02)438-1955, or Melbourne, (03)561-3555.**

Cutless core transformers

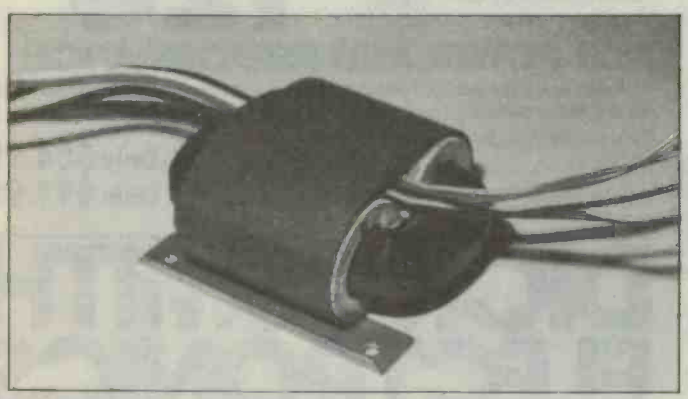
Lamron has released a range of "low leakage flux" cutless core transformers which are 30 per cent smaller than the normal EI-type transformers. The new range covers a VA rating from 15 VA to 210 VA and provides one to three secondary windings.

The core of the 'cutless' transformer is wound from one continuous steel strip, forming a toroidal core. The primary and secondary circuits are wound onto plastic bobbins. They are fitted one on each side of the core, with an air space of approximately 6 mm between the windings providing isolation in excess of 4000 volts.

Compared with EI-type transformers, advantages of the cutless core transformers include lower temperature elevation at the same duty cycle, leakage flux of less than 1/10 of the conventional model, and improved acoustic performance. As well, transformers can be located to within 10 mm of a CRT tube without causing distortion.

Complete power supplies are available using the cutless core transformers with "L" shaped open frame mounting or fully enclosed ventilated covers. Custom built versions are also available.

For more details about these transformers contact **Lamron Pty Ltd, PO Box 438, Ryde, NSW 2112. (02)808-3666.**



Variable volume piezo buzzer

The type KPE 960 continuous tone piezo electric buzzer, newly available from IRH Components, has a knurled knob which increases or decreases the hole dimensions, thus giving varied sound pressure.

This feature makes the KPE 960 suitable for applications where a high sound pressure is required, particularly in the security industry. Using a voltage of 12 Vdc and with the acoustic volume control "open", a minimum of 95 dB at 100 cm is achieved. Sound pressure is reduced by 15 dB with the control in the "closed" position.

The KPE 960 will operate on any dc source, from 1.5 to 16 V, and the sound is clear and audible over a considerable distance. It has a resonant frequency of 2500 Hz and current consumption is 3.5 to 70 mA, depending on voltage.

Considering the sound pressure achieved, the buzzer is quite small: 38 mm in height with a case diameter of 50 mm. Termination is achieved by flexible leads.

For more information about the KPE 960 contact **IRH Components, 32 Parramatta Rd, Lidcombe, NSW 2141. (02)648-5455.**

Hot Wheelin' R/C

TAMIYA

As an electronics hobbyist, you appreciate technical quality. . . like these famous Tamiya radio controlled build-it-yourself models. If you haven't been an enthusiast till now here's just the thing to change your mind.

THE HORNET

You can't miss it! This fantastic ready to assemble model is the slickest off-roader you'll ever see. Front wheel independent suspension, oil filled rear shocks, spiked rear tyres, powerful RS540S motor and much more! With Tamiya's superb quality and our amazing value there's hardly any competition at all!

Cat Y-2526

$129*

HOTSHOT

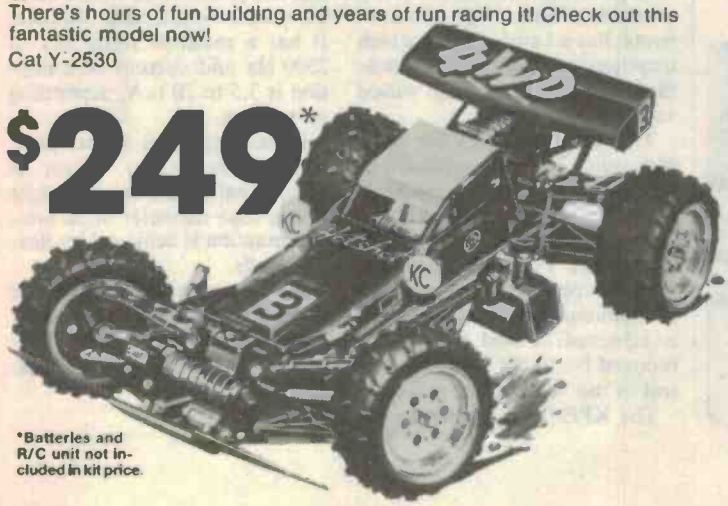
No wonder they call this the Hotshot! Shaft driven 4WD that lets you take it anywhere!

Gearbox and diffs are sealed for reliability, oil damped shocks, rugged Lexan body and more! Thanks to real 4WD it handles superbly at high speeds and will tackle the roughest terrains.

There's hours of fun building and years of fun racing it! Check out this fantastic model now!

Cat Y-2530

$249*



*Batteries and R/C unit not included in kit price.

THE FROG

An off-road racer that's built for performance! This ready to assemble 1/10th scale model has sturdy ABS frame and durable polycarbonate body.

Sealed differential and gearbox, three step forward and reverse speed control and adjustable oil damped shocks!

A bargain value kit it comes complete - ready to assemble! Look at our low, low price!

Cat Y-2528

$199*

Quality 2CH Radio Control

It's all under control! No more problems with interference or crosstalk. Here's great value and top quality! The two channel Sanwa radio controller comes complete with servos, mounting screws, everything to get your machine moving! (Less batteries!) Cat Y-1250

$124.95

FOR POWER AND PERFORMANCE:

To keep your Tamiya kit running at peak performance you'll need reliable battery power.

Low profile Tamiya NI-cad battery (S-3326) ..... **Only $54.95**

Quick charge leads (Y-2521) ..... **Only $11.95**

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IBM® AT COMPATIBLE HARD DISK CONTROLLER OK FOR FLOPPIES
Western Digital's WD1002-WA2 interfaces up to **two** rigid **Winchester** disk drives and up to **two floppy disk drives** to the **IBM Personal Computer, model AT.** The same controller can be hooked up to **Interdyne's** ID1010 floppy compatible **10 Mbyte tape backup** drive providing an extremely cost effective data storage combo.
Other features of the WD1002-WA2 include control of floppy drives at **four data rates** 125Kbps, 250Kbps, 300Kbps, 500Kbps, **concurrent transfers** on a floppy and a Winchester drive.

PRIAM 70 MBYTE WINCHESTERS BOOST PC, XT and AT PERFORMANCE
PC VARs are finding that many applications are benefitting from the **30 msec. average access** times offered by Priam's Vertex V170 range of **high** performance, **high capacity 5.25"** hard disk drives. As well as speeding up disk access by a factor of 3 the seven fold increase in capacity will provide the capacity necessary for **LAN linked systems.** Western Digital's **1002-WX2** and **WA2** controllers are **directly compatible** with the V170.

CML's MONOLITHIC AUDIO FILTERS MAKE THEIR DEBUT.
The FX306, from **Consumer Microcircuits** is the first in a series of **switched capacitor filter arrays** consisting of standard lowpass, highpass and bandpass sections together with amplifier and limiter block. The **CMOS** device operates from a **single 5V** rail and features a **4th order highpass** filter and a **6th order lowpass** filter which, when combined, form a standard **300-3,400 Hz bandpass.** An additional 6th order lowpass filter plus an **uncommitted op-amp** allow for customizing in applications in telephony, cellular/mobile radio, speech scrambling and audio frequency band limiting.

OPTOCOUPLER BELTS ALONG AT BETTER THAN 10 MHz
Dubbed the **PC910, Sharp Corporation's** super high speed optocoupler incorporates an **inbuilt inverting gate,** OPIC, to output a predictable logic swing at the highest data transfer rates.

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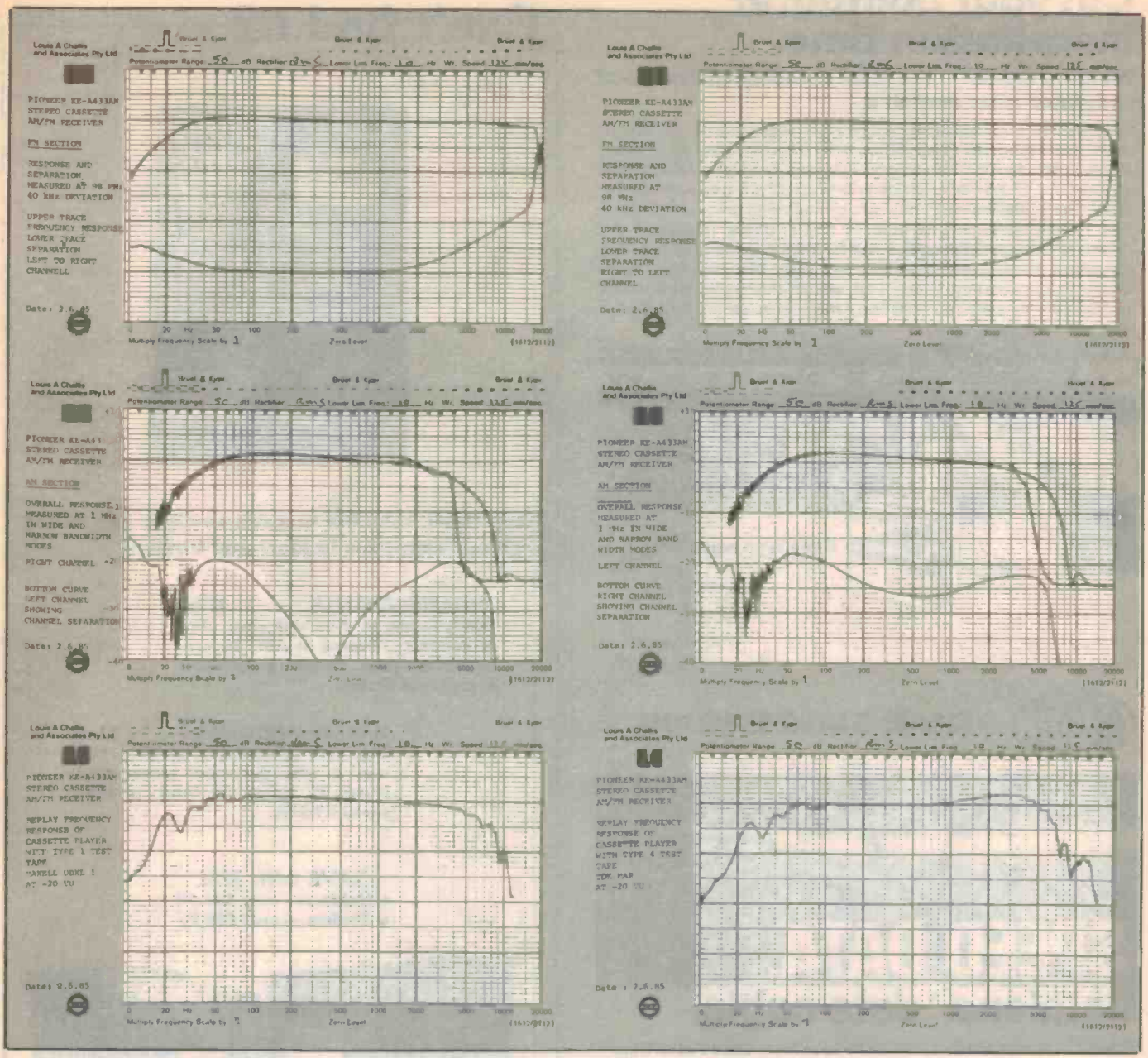
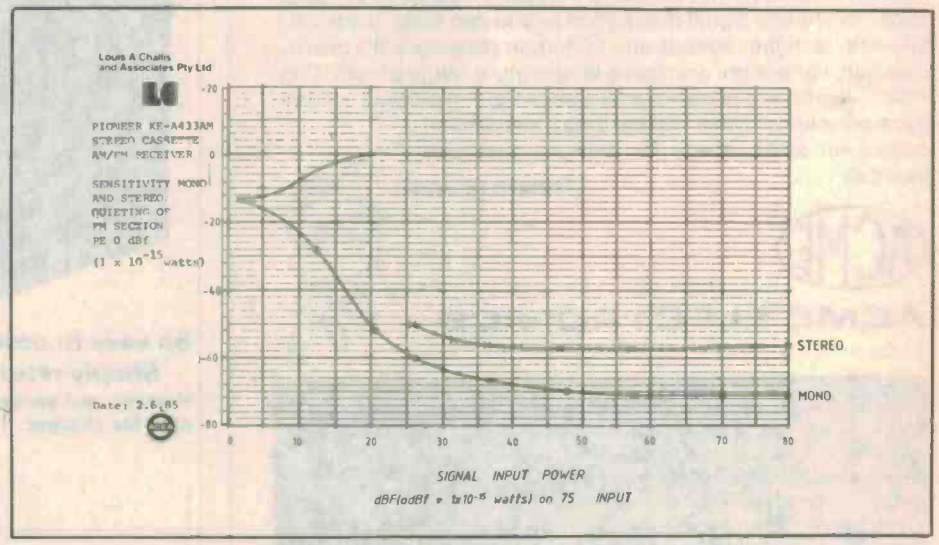
DAN00x



and extremely good reception on AM. Even in the inner-city area where FM is virtually unusable because of multi-path interference, the AM stereo reception was a revelation, especially when compared with any of the other car radios which I currently own. Most of these are brand new or 'state of the art'.

The cassette recorder performs well and provides good but not outstanding performance, provided you don't use Dolby C encoded tapes. Dobly B tapes sound good but not outstanding, while ordinary pre-recorded tapes sound reasonable.

The Pioneer KE-A433AM is the first car radio that I have listened to which provides 'good listening' with AM stations. It is supplemented by an excellent FM tuner, a good but not brilliant cassette player and offers good all-round performance. This is truly one piece of electronic Pioneering. ●



porate a Dolby noise reduction facility and so the maximum signal-to-noise that can be achieved is limited to a figure in the order of 45 dB unweighted and 56 dB A-weighted.

The amplifier distortion was evaluated at the rated output of 4 watts as well as at 0.4 watts at test frequencies of 100 Hz, 1 kHz and 6.3 kHz. The total distortions at the 4 watt level were 1.3%, 0.3% and 0.82% respectively which is good; at the 0.4 watt level these were down to 0.5%, 0.35% and 0.34% respectively, which is excellent.

The FM tuner covers the frequency range from 87.5 MHz to 108 MHz and provides an excellent and very usable sensitivity of 13 dBf for mono (with a 26 dB signal-to-noise ratio) and 23 dBf for stereo (with 46 dB signal-to-noise ratio). The frequency response of the FM tuner is extremely flat with an almost perfect 21 Hz to 18 kHz bandwidth and well in excess of 28 dB channel separation across the middle of the band from 60 Hz to 2 kHz.

With the help of Radio Manufacturing Engineers in Sydney (which is the Australian agent for the Motorola C-Quam system and which has also recently commissioned most of the AM stereo modulation units now in use in Australia), I was able to perform accurate measurements of the AM stereo separation to supplement the measurements performed with our Hewlett-Packard AM signal generator. This signal generator revealed that the AM tuner sensitivity is 18 microvolts for 20 dB signal-to-noise ratio. The supplementary measurements, performed with Radio Manufacturing Engineers' signal generator, revealed that the channel separation differs slightly between left to right channel and right to left channel. In the left to right channel there is typically 18 to 25 dB separation over most of the bandwith whilst in the right to left channel separation there is a different characteristic with a very healthy 45 dB separation at 400 Hz and generally excellent channel separation all the way out to 9 kHz.

The most important characteristic, however, was not the stereo separation so much as the AM bandwidth. In the attached level recordings this is clearly seen to be a healthy 6 kHz in the WIDE position and just over 4 kHz in the NARROW position at the -6 dB points. This bandwidth is twice the bandwidth provided by any of the new AM mono (or stereo) receivers that I have tested and a credit to both Pioneer and the concept of 'stereo AM radio'.

Subjective testing

The subjective assessment of this particular unit was gratifying and I tested it in the home as well as under normal reception conditions while installed in a four-wheel drive vehicle. Around the inner-city area and at reasonable distances out of Sydney, the unit provided excellent reception on FM

MEASURED PERFORMANCE OF PIONEER KE-A433 AM

CASSETTE CAR STEREO WITH FM/AM ELECTRONIC TUNER

Serial number : EL 02276

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

Tape	Dolby	Lower - 3dB Point	Max. Point & Frequency	Upper - 3dB Point
Type I	OUT	30 Hz	+1.5 dB @ 55 Hz	6 kHz*
Type 4	OUT	37 Hz	2 dB @ 3 kHz	6 kHz*

* Azimuth alignment

SPEED ACCURACY : +1.5 with TDK Reference tape
(AS 2680 Clause 2.2.1)

WOW AND FLUTTER :
(AS 2680 Clause 2.2.2)

WOW : Average 0.2% peak to peak

FLUTTER : Unweighted 0.15% RMS

Weighted 0.07% RMS

HARMONIC DISTORTION :
(at rated output)

Tape : Denon DX 8/60 at 4 watts amplifier output

		100Hz	1kHz	6.3kHz	
0VU :	2nd	-54.2	-62.8	-42.5	dB
	3rd	-47.8	050.9	049.3	dB
	4th	-38.1	-	-69.2	dB
	5th	-56.4	-61.7	-	dB
	TOTAL	-37.5	-50.3	-41.7	dB
	T.H.D.	1.3	0.30	0.82	%

with 0.4 watts amplifier output and at -6 VU

-6VU :	2nd	-56.8	-54.8	-51.2	dB
	3rd	-54.3	-50.9	-54.1	dB
	4th	-47.2	-	-	dB
	5th	-65.0	-62.6	-	dB
	TOTAL	-45.9	-49.2	-49.4	dB
	T.H.D	0.50	0.35	0.34	%

EQUALISATION IS in accordance with IEC 268-3B

DYNAMIC RANGE :

Tape : Denon DX 8/60

Dolby Out 45 dB(Lin) 56 dB(A)

FM TUNER :

Frequency Range : 87.5-108 MHz

Usable Sensitivity : (40 kHz deviation)

MONO for signal to noise	26 dB	13 dBf
STEREO for signal to noise	46 dB	23 dBf

AM TUNER :

Frequency Range : 531-1602 kHz

Usable Sensitivity : 18 microvolts for 20 dB signal to noise ratio on Mono signal

the knurled wheel of the TONE control immediately behind and a tabbed FADER control for setting the level between the front and back stereo speakers, being the last of the three controls. The VOLUME control uses a push-on/push-off switch providing four functions at the one location.

At the top of the central panel on the left hand side is a small pushbutton labelled 70 μs which allows you to select 120 or 70 microseconds equalization for standard gamma ferric oxide or chrome and metal tapes, which is an important feature. To the right of this is the loading slot for your cassettes which operates fully automatically once you correctly push your cassette into the well. To the right of this are FAST FORWARD and FAST REWIND buttons, labelled by the now internationally used double arrows. When operating in the fast forward mode, the tape automatically ejects when the end of the tape is reached.

On the lower left hand side of the central facia are three very small vertically disposed rocker switches which provide the facility for pre-setting and selecting six FM (1), six FM (2) and six AM stations. These are initially set through the use of the manual tuning knob, which during the first five seconds of selecting a station, allows the frequency to be entered by pressing the appropriate button. The station selection is memorized as long as the car battery is connected to the receiver by the separately fused memory voltage supply.

In the lower centre of the facia is a rear illuminated liquid crystal display on which a considerable amount of information can be displayed. On the left hand side are the letters ST to indicate stereo, F1 to indicate that the FM 1 band has been selected, F2 to indicate the FM 2 band and AM to indicate that the AM band has been chosen. These are selected sequentially by pushing the very small black button labelled BAND immediately to the right of the display.

The station frequency is displayed by four large digits which indicate in kilohertz (kHz) or megahertz (MHz); the word SEEK is displayed while the receiver is searching for the next highest or lowest broadcast station by pushing the outer most control on the right hand side of the deck and rotating it to the right or to the left.

The letters LOC are displayed with the local station switch immediately to the right. This setting discriminates against the weak stations so that only the strong carrier frequencies are tuned in.

On the extreme right hand side of the display is the memory ME indicator which is displayed for five seconds when a pre-set station is selected and below it the logged number of the station is displayed with a prefixed PRE and the pre-set number immediately below.

Below the two black switches on the right hand side of the facia are two light blue switches, one labelled ST for selecting either stereo or mono reception and the other labelled WIDE for selecting wideband or narrowband corresponding to 6 kHz or 4 kHz at the -6 dB point.

On the extreme right hand side of the panel is the manual TUNING knob, the left channel/right channel BALANCE control, which really seems to be wasting a control function considering how much potential is incorporated in the left hand coaxial controls.

The unit is provided with grommets and hardware, but not with speakers which Pioneer obviously considers to be a personal matter and dependent on the type of vehicle into which the stereo system is to be installed.

The inside of the unit would undoubtedly be considered a radio technician's delight with one large mother printed circuit board at the base, a separate L-shaped AM stereo pc board and a separate FM front end mounted on an extremely small pc board. There are also separate sub-boards for balance, switching, volume control 1 and volume control 2, and a switch assembly board. The synthesizer is contained on a large square integrated circuit with 52 pins at the front of the motherboard. It is intriguing to see how much circuitry and advanced electronics is now incorporated into a relatively simple piece of consumer electronics selling for only a few hundred dollars.

After the designers shoe-horned in the auto reverse cassette deck, there is almost negligible space left over inside the chassis for anything else that they may have forgotten. I was able to clearly identify the Motorola MC 1302 op C-Quam chip with the help of the service manual that Pioneer provided with the unit. This is an extremely well presented document which provides clear and explicit instructions on removal, alignment and even on basic repair procedures.

PIONEER KE-A433AM
CAR STEREO CASSETTE
WITH FM/AM ELECTRONIC TUNER

Dimensions:	*180 mm (wide) x 50 mm (high) x 135 mm (deep)*
Weight:	*1.5 kg*
Manufacturer:	*Pioneer Electronic Corporation, Tokyo, Japan*
RRP:	*$439*

Apart from the speakers and the external aerial, the unit is self-contained and incorporates two 4 watt amplifiers that the manufacturer specifies as 6 watts in the time honoured Japanese system "at a level where distortion doesn't matter".

Objective testing

The objective testing of this particular unit was a delight for we had available all the facilities necessary to put the unit 'through its paces'. I started with the cassette deck using our pre-recorded test tapes. These revealed that the replay frequency response extends from 30 Hz to 6 kHz at the -3 dB points with the type 1 test tape, and from 37 Hz to 6 kHz with the type 4 test tape. The limited high frequency responses measured are primarily a result of the differences in azimuth alignment between the Pioneer reference alignment tapes and those which we use. Previous measurements on other Pioneer cassette recorders have always shown those differences to be significant. With other pre-recorded material and/or other test tapes, it is possible that a wider bandwidth would result.

The speed accuracy of the cassette recorder was 1.5% high, whilst the wow and flutter figures were particularly good for a car player. The wow was 0.2% peak-to-peak and the weighted flutter only 0.07% rms. The cassette recorder *does not* incor- ▶

THE NEW AM FRONTIER — Pioneer's KE-A433AM car stereo radio cassette

The introduction of AM stereo has been, well, so so. Something new, but no great sound achievements. The Pioneer KE-A433AM car radio cassette has broken through the static 'state of the art', however, with an impressive AM receiver outshining the good accompanying FM and cassette facilities.

Louis Challis

PRIOR TO THE advent of FM broadcasting in Australia, amplitude modulation, medium frequency radio transmissions (AM to you) were generally regarded as offering some degree of fidelity by a small number of listeners who owned radio receivers with reasonable intermediate frequency stage (IF) bandwidths. In the halcyon days of radio, between 1945 and 1965, many of us owned AM receivers which would pass a 6 kHz wide audio signal, and I well remember my father's valve radio which provided an 8 kHz bandwidth. In the ensuing period, overseas pressures and subsequently overseas design concepts, pushing for narrower station frequency spacings, have resulted in a situation where most AM receivers offer 3 kHz, or at best 4 kHz, effective bandwidth. The resulting sound is generally little better than an 'across town' telephone call.

This is really a deplorable situation, particularly when Australia can boast of one of the finest AM broadcasting systems in the world, with most stations offering at least 8 kHz bandwidth and the ABC having prided itself on an even superior transmission bandwidth.

It wasn't until FM arrived on the scene that radio listeners were once again offered decent bandwidths and above average quality sound. When FM car radio receivers became available I, like most other purchasers, looked forward to an uncompromising quality sound and the chance to hear mobile music in the same way that we had grown used to hearing it in our homes.

But 'lo and behold', our hopes and expectations were soon dashed. What we heard was marred by deep signal fades, multi-path problems and problems of signal sensitivity in many parts of the inner-city areas, even in reasonably close proximity to the transmitting station. In desperation one would switch back to AM, only to be assailed by sounds of an announcer or his music apparently propagating 'down a long pipe'.

We had to wait for some clever designers in America who developed and marketed the 'AM stereo concept', for AM radio transmission to be given 'a new lease of life'.

There are now four competing systems for AM stereo in the United States with the Motorola "C-Quam" system well in front of the others at the moment. This view was reinforced at the American Winter Consumer Electronics Show where the vast majority of the radio receivers incorporated the Motorola system. Nowhere was this market penetration more noticeable than in the field of car radio receivers where the American travelling public are just as disturbed by the FM propagation problems, as are their Australian brethren.

One of the fastest selling car stereo cassette receivers with FM/AM electronic tuners in the USA right now is the Pioneer model KE-A433AM. This unit was first released in Australia without much fanfare late in 1984, at a time when 'AM stereo transmission' was still in the future. Unfortunately that negated one of the strongest selling features for the intending public.

In the intervening period, nearly every major radio station in Sydney and Melbourne has decided to update its modulators to provide 'true AM stereo' and not surprisingly the majority have chosen the Motorola C-Quam system to ensure compatability with the most popular decoding chip being used by Japanese and American radio receiver manufacturers.

Design

The KE-A433AM is an excellent example of the new trend in synthesized car receivers, with electronic tuning using a microprocessor to determine precise AM and FM station carrier frequencies in 9 kHz and 100 kHz steps respectively. This feature ensures that each station is precisely tuned and that the resulting level of audio frequency distortion and separation between left and right channels is optimized.

The front panel of this FM/AM cassette radio is deceivingly simple, very much a 'wolf in sheep's clothing'. On the left hand side are three concentric controls with the VOLUME control outermost in the centre,

BIG CHOICE ART UNION No. 131

CHOOSE THE BEST RECORDING EQUIPMENT IN AUSSIE AND THEN PICK IT UP AND WE'LL PICK UP THE TAB TO $50,000

Choose this 1st prize and win recording equipment including a multi track tape recorder and a mixing console (value $50,000) plus a Ferrari GTS 308 (value $80,300) plus a North/South American holiday for two (value $34,000) plus NEC Cassette recorder (value $1,700) plus Profeel TV system (value $3,000) plus Beta Hi-Fi (value $1,000) plus 100" Sony TV Screen (value $10,000). **Total value $180,000.**

BIG CHOICE ART UNION NO. 131 DRAWN 4TH OCTOBER, 1985.

Choose this as your $180,000 first prize or select from these alternatives:

A Silver Spirit Rolls Royce ($161,000) **plus** a $19,000 diamond pendant **OR**
A Mack Ultraliner (Model MHR 613R) **or** a Mack Superliner (Model 721RS) both with extras **OR**
A Cuddles "35", **plus** a Cuddles "30" Cruiser with luxurious extras **OR**
A GTS 308 Qualtrovalvole Ferrari ($80,300) **plus** a Haines Hunter 850 FBC Cruiser with dual Volvo 6 cyl. turbo motors ($89,700) **plus** a $10,000 diamond pendant **OR**
A John Deere 8850 Tractor with a John Deere 1610 Chisel Plough or Cultivator ($177,000) **plus** a Honda 4 wheel TRX250 ($3,000) **OR**
A 40' x 13' "Watermaid" steel hulled semi-cruiser houseboat ($59,500) **plus** an XJS Jaguar Saloon ($65,500) **plus** a Nth/Sth American holiday for two ($55,000) **OR**
A "Round Australia" package including a Range Rover, Viscount caravan, 2 trail bikes, camera equipment, $10,000 of Flag Inns accommodation and services, a Ford Fairlane, camping equipment, diamond pendant, and a Haines Hunter Cabin Cruiser.

Each of these prizes valued at $180,000

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$10 Book Choose from: A Ford Spectron XLT **OR** a BMW K100 motorcycle with extras **OR** a Mitsubishi L300 4WD Wagon **OR** Ford Falcon GL Sedan **OR** a diamond pendant
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$20 Book Choose from: A Nissan Patrol 4WD Wagon **OR** a Haines Hunter 19' 4" Cabin Cruiser with 140 h.p. Johnson outboard with Roll-Ezy trailer **OR** a Ford Fairmont 4.1 EFI T-Bar Auto. Sedan (with extras) **OR** or a diamond pendant
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$40 Book Choose from: A Ford Fairlane plus a $2,000 diamond pendant **OR** a 19' 6" Haines Hunter Cabin Cruiser with a 185 h.p. Johnson outboard with Roll-Ezy trailer and extras **OR** a 12.2 metre Haulmark tri-axle semi-trailer complete with gate sides, with cap tarp and side curtains and 6-15RX22.5 wide profile tyres
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$50 Book A Citroen CX25 GTI 2500 plus a $3,000 diamond pendant **OR** the new magnificent Renault 25 automatic saloon **PLUS** a $4,000 diamond pendant **OR** a 4 door Range Rover (with extras) **OR** an LTD Luxury Saloon (with extras) **OR** a 21' Haines Hunter Cabin Cruiser with 260 h.p. Merc Cruiser stern drive with extras on a Roll-Ezy trailer
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Permit No. A7390 **A.C.T. Permit No. 85/287**

POPULAR TEST DISC MARK II — Denon Digital Audio Check CD

The last Denon test disc we reviewed became a standard for the reviewer as well as a whole lot of readers. Well the standard has regenerated and we're got it for review with a special reader offer.

Louis Challis

WHEN I REVIEWED the Denon Technical CD Test Disc in August 1984, I created a demand amongst our readers that proved to be something of an embarrassment. Overnight that disc became Australia's top selling CD disc. Had there been a 'Top 20' of CD discs it would undoubtedly have been Number 1 (numero uno!).

As it happened the demand so far outstripped the supply that *Electronics Today International* and TEAC Australia Pty Ltd were literally 'caught with their pants down'. While that problem was solved, the magazine received many requests from readers for information on other suitable software which was less technical and which could fulfil some of the 'more basic' needs for readers who had recently purchased a new CD player.

When the first CD players were released in 1982, Sony and Philips provided some exciting demonstration discs. They were truly 'state of the art' and provided a pot-pourri of classical and pop music suitable for demonstrating the fantastic attributes and full potential of the CD medium. Regrettably, those discs were "not for sale" and were provided only to retailers to assist them in 'clinching sales'. Since then, other recording companies have recognized the need for suitable selections of demonstration material which would not only provide the wherewithal for shops to demonstrate the potential of their products, but would also provide CD owners with a similar capability.

Obviously, the most potent demonstration disc would synthesize the features of the Denon Technical CD disc with the features of sampler discs like the "Telarc Sampler" Volumes 1 and 2, which contain extracts from the best of Telarc's digital compact disc catalogue.

Fortunately, the Denon Digital Audio Check CD (catalogue 33C39-7441) does just that. This disc provides a full hour of content with only the first 14 of its 26 tracks devoted to material specifically designed for technical equipment checking. Tracks 15 to 26, which are more than 45 minutes in duration, are devoted to superb examples of music.

Tracks 1 to 14 contain some excellent testing material as follows:

Tracks 1 and 2 provide material through which you can audibly check for channel balance and for correct phasing of the two channels feeding to your loudspeakers.

Tracks 3 and 4 provide test signals on both channels in turn, at 1001 Hz and at −16 dB to accurately check your channel balance.

Tracks 5 and 6 provide 'absolute silence' through which the internal noise characteristics of your CD and/or amplifier can be rapidly and readily assessed.

Tracks 7, 8 and 9 contain sine wave sweep signals, the first being a sweep from 5 Hz to 22.05 kHz which goes lower and higher in frequency than any other CD test sweep signal that I have previously found. The second sweep is a level sweep at 1 kHz, which starts with a reference signal at −20 dB and then progresses in 1 dB steps from −60 dB to 0 dB. The 0 dB signal, has to be *carefully* watched, as it could destroy your speakers if the amplifier output signal is set too high. The third sweep is a phase sweep in which the reference signal from left to right channel sweeps from 0° to 360° at a sweep rate of 6° every half second.

Track 10 is a band of white noise which enables you to assess the difference in quality of sound between one set of loudspeakers and another, as well as the differences in tone control or equalizer settings should you wish to experiment.

Tracks 11 to 14 provide four different levels of the same music with a maximum recording of 0 dB followed by −20 dB, −40 dB and −60 dB repetitions.

Even without tracks 1 to 14, which are almost as invaluable as the data on the original Denon Technical CD disc, tracks 15 to 26 provide some of the most outstanding 'musical vignettes' (my words not the editor's) from the large catalogue of digitally recorded music currently available from Denon in Japan.

Two pieces in particular took my fancy and I believe they will entrance you in exactly the same way if you are a classical music lover. These are Debussy's "Golliwog's Cakewalk" (track 19) and Mozart's "Violin Concerto No 5 in A Major" KV2129 (track 17). If you like pop music, Billy Joel's "Just The Way You Are" (track 25) and T Monk's "Bemscha Swing" are equally exciting as demonstration pieces.

Whatever your taste in music and irrespective of whether you wish to use track 7 to test your hearing, or the response of your loudspeakers, this disc, to quote an American company's popular advertisement, "has it all". At a special ETI offer price of only $25 (see page 2 of the supplement). I believe that the Denon Digital Audio Check CD is a worthy offspring to the original disc, even 'more beautiful than the mother'.

Your appreciation of how good a disc this really is will only be fully revealed when you listen to it. ●

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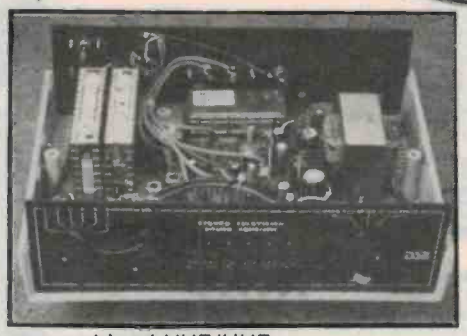
It's a top quality UHF to VHF downconverter too!

Yes! You could save up to $1000 or more . . .

Build our stereo TV decoder and you won't have to buy a stereo TV: you'll save about $1000 PLUS get a top hi-fi quality sound that many commercial TV's can't come close to!



Our Stereo TV Decoder also gives you combined VHF/UHF coverage: even more reason to keep your VHF TV! Just look at what else you get:

- 6 preset stations
- Stereo indicator
- Special bi-lingual channel
- Exclusive low-drift RF circuitry
- Audio line outputs (for your hi-fi)
- Switchable output (channel 0 to 1)

And the built-in stereo audio amplifier makes it ideal for personal listening or those hard of hearing. What's more, it can be linked to our Teletext Decoder kit (K-6315): what a performer!

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And the best news of all: right now, save $50 on this amazing kit!

SPECIFICATIONS

Input Frequencies: VHF Ch.0 - 11 (46.25 - 273.25MHz)
UHF Ch.28 - 63 (471.25MHz - 855.25MHz)
Intermediate Frequencies: Picture - 36.875MHz
Sound #1 - 31.375MHz
Sound #2 - 31.133MHz
2nd IF Frequencies: Sound #1 5.5MHz
Sound #2 5.742MHz
Outputs: Composite Video - 1V p-p into 75 ohms
RF output - Ch0/1 preselectable 1.5mV
Speaker outputs - 1.0 watt RMS max
Audio line outputs - 300mV p-p into 4.7K
Distortion: Line outputs - 3% THD max typically 1%, Speaker outputs - 3% THD max

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WAS $249 . . . NOW

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Cat K-6325

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

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- Over 1000 of these kits now sold.
- Super Finish front panel supplied at no extra cost.

Please note that the "Superb Quality" Heatsink for the Power Amplifier was designed and developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms
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

Normally $319, now only $289
Assembled and tested $499
packing and post $10

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- 1% Metal Film Resistors are supplied.
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- Specially Imported black anodised aluminium knobs.

Available Assembled and Tested. (We believe that dollar for dollar there is not a commercial unit available that sounds as good!)

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

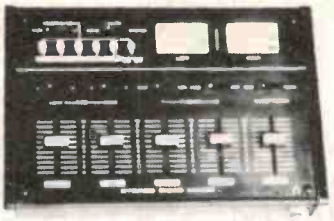
Normally $289, now only $249
Assembled and tested $599
packing and postage $10

THIRD OCTAVE GRAPHIC EQUALIZER

SPECIFICATIONS:
BANDS: 28 Bands from 31.5Hz to 16KHz.
NOISE: -0.008mV, sliders at 0, gain at 0(=103dB0).
20KHz BANDWIDTH DISTORTION: 0.007% at 300mV signal, sliders at 0, gain at 0, maximum 0.01%, sliders at minimum.
FREQUENCY RESPONSE: 12Hz=105KHz, +0,=1dB, all controls flat.
BOOST AND CUT: 14dB

Cat. K44590

1 Unit ... **$199**
2 Units ... **$379**
packing and postage $10

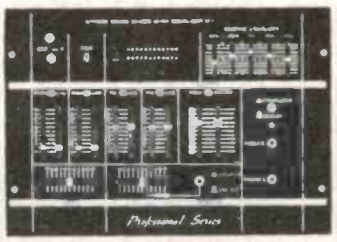


UNIVERSAL MIXER WITH CUE CONTROL

- Microphone inputs 2 high or low impedance.
- Two stereo phono inputs magnetic or ceramic.
- 1 stereo line input for tape or tuner.
- Cue function with LED indicator for each input.
- Tape recorder output connections.
- Dual VU meters to monitor output and cue level.
- Mono/stereo mode selector.
- Battery test button to check their condition.
- DC or AC adaptor operation.

Input Sensitivity: Mic. low 0.7mV at 600 Ohm,Mic High 3.5mV at 50k ohm
Phono Mag. 2.5mV at 50k ohm, Phono Cer. 150mV at 100k Ohms
Tape Tuner: 150mV 50k ohms
S/N Ratio: More than 55dB
T.H.D.: Less than 0.5%
Frequency Response: 20 - 20kHz + – 2dB
Output Level: 300mV
Recording Output: 120mV
Power Source: 9V DC (PP100/9)
Dimensions: 265 x 195 x 70mm
Weight: 1.8kg

RRP $157 **OUR PRICE $139**



UNIVERSAL STEREO MIXER WITH GRAPHIC EQUALISER

The MM4 is our most flexible mixer. Incorporating the most advanced IC technology for performance and reliability. Built in graphic equaliser virtually eliminates the need for a pre-amplifier. Features 4 stereo program and 2 microphone inputs.

SPECIFICATIONS:
Input Sensitivity:
Mic. 1.5mV at 10k ohm
Phono. 1.5mV at 50k ohm
Line 75mV at 50k ohm
Rated Output:
Amp 1V/600 ohms
Rec. 1V/600 ohms
T.H.D.: Less tham 1% at 1kHz
Hum and Noise:
Mic. -52dB
Phono -62dB
Line -65dB
Frequency Response:
Mic. 30 - 16kHz (-1dB)
Phono 30 - 20kHz (RIAA + – dB)
Line 20 - 30kHz (-1dB)
Power Source: 240V AC 50Hz
Size: 360 x 260 x 85mm
Weight: 2.9kg

EQUALISER SECTION
Control of Frequency: 60Hz, 250Hz, 1kHz, 3.5kHz, 12kHz
Control Range: + – 12dB boost or cut - centre detent
Headphone Output: (Cue)50mW at 75 ohm at 0.5% T.H.D.
Talk Switch: -14dB

RRP $354 OUR PRICE $319

12 CHANNEL STEREO MIXING CONSOLE

Loaded with professional features but simple to operate. A 3 position attenuation switch with –15dB, 0dB, +15dB, together with separate mic. and line inputs allows perfect matching with any input signal. Foldback with the pre-fade send or on stage monitoring. Includes bass and treble controls plus a left and right 5 band graphic equaliser. Other features include effect return panning, P.P.I. overload indicators and stereo headphone monitoring. Ideal for disco's with 2 stereo disc inputs with cross fade. A high quality 12 channel mixer for the professional enthusiast.

SPECIFICATIONS
Inputs:
12 x Mic – 46dB at 47k ohm
12 x Line – 20dB at 20k ohm
12 x Phono – 52dB at 50k ohms (approx 2mV at 1kHz)
Effect Return – 20dB at 50k ohm
Ouputs:
PGM Out 0dB at 10k
F/B Out 0dB at 10k ohm
Effect Send 0dB at 10k ohm
Rec. Out – 4dB at 10k ohm
Headphones + 10dB at 600 ohm (100 - 1k ohm)
Equaliser (Channel): Bass + – 12dB(100Hz), Treble + – 12dB(10kHz)
Equaliser (Master): 100/330/1k/3.3k/10kHz. (5 band stereo) + – 12dB
Frequency Response: 20 - 20kHz (+ 1dB, 3dB)
S/N Ratio (IHF-A): 120dB
T.H.D.: 0.15% at 1kHz
Peak Indicators: 12 x LED
Power Supply: 240V AC 50Hz
Power Consumption: 8W
Dimensions: 662(W) x 356(D) x 105(H)mm
Weight: 8kg

RRP $999 **OUR PRICE $899**

AUDIO/MIKE PROFESSIONAL MIXER

This compact mixer has a host of unique features and is ideally suited for the most discerning user. Just look at these features....

- Two microphone inputs with pan-pot control and high/low impedance selectors
- Stereo 8 segment LED level meters to monitor outputs
- Two stereo phono inputs with magnetic/ceramic selectors and fader control
- Two stereo tape inputs with dubbing outputs
- Two stereo line inputs
- Slide master volume control
- Rear/front microphone input selector
- Talkover switch with talkover variable volume control
- Cannon socket for talkover microphone
- AC operation

Input Sensitivity:
Mic. Low 0.3mV 600 ohms High 3mV 50k Ohms
Phono Mag. 3mV 50k ohms Ceramic 150mV 50k Ohms
Tape/Tuner 150mV 50k ohms
T.H.D. Less than 1%
S/N Ratio: More than 58dB
Crosstalk: Better than 50dB at 1kHz
Frequency Response: 20 - 20kHz RIAA + – 2dB
Ouput Level: 900mV at 600 ohms
Recording Output: 280mV at 60 ohms
Talkover Range: 0 - 24dB
Power Source: 240V AC 50Hz
Size: 355 x 230 x 75mm
Weight: 3.2kgs

RRP $357 **OUR PRICE $319**

TDK AUDIO TAPE BARGAINS

Description	Cat. No.	1-9	10+
DC46 TDK	A11305	2.75	2.10
DC60 TDK	A11307	2.95	2.25
DC90 TDK	A11309	3.50	5.50
DC120 TDK	A11311	5.50	4.25
AD60 TDK	A11315	3.75	2.95
AD90 TDK	A11317	4.75	3.50
AD120 TDK	A11319	6.95	5.50
ADX60 TDK	A11320	4.95	3.50
ADX90 TDK	A11322	5.95	4.50
SA60 TDK	A11325	5.35	3.95
SA90 TDK	A11327	5.95	4.50
SAX60 TDK	A11329	5.25	3.95
SAX90 TDK	A11332	6.95	5.95
MAC60 TDK	A11335	10.95	9.35
MAC90 TDK	A11337	11.50	8.75
MAR60 TDK	A11340	13.50	10.95
MAR90 TDK	A11342	17.20	15.35

ELECTRONIC CASSETTE DEMAGNETISER

Save $2. Rec retail $19.95
Cat. A1006 NOW $17.95

PLEASE NOTE NEW MAIL ORDER PHONE NUMBER

ROD IRVING ELECTRONICS
425 High Street, NORTHCOTE, 3070 VICTORIA, AUSTRALIA
Phone (03) 489 8866
48-50 A'Beckett Street, MELBOURNE, 3000 VICTORIA, AUSTRALIA
Ph. (03) 663 6151
Mail Order and correspondance: 56 Renver Rd., CLAYTON 3168
TELEX: AA 151938

NEW MAIL ORDER HOTLINE (03) 543 7877 (2 lines)

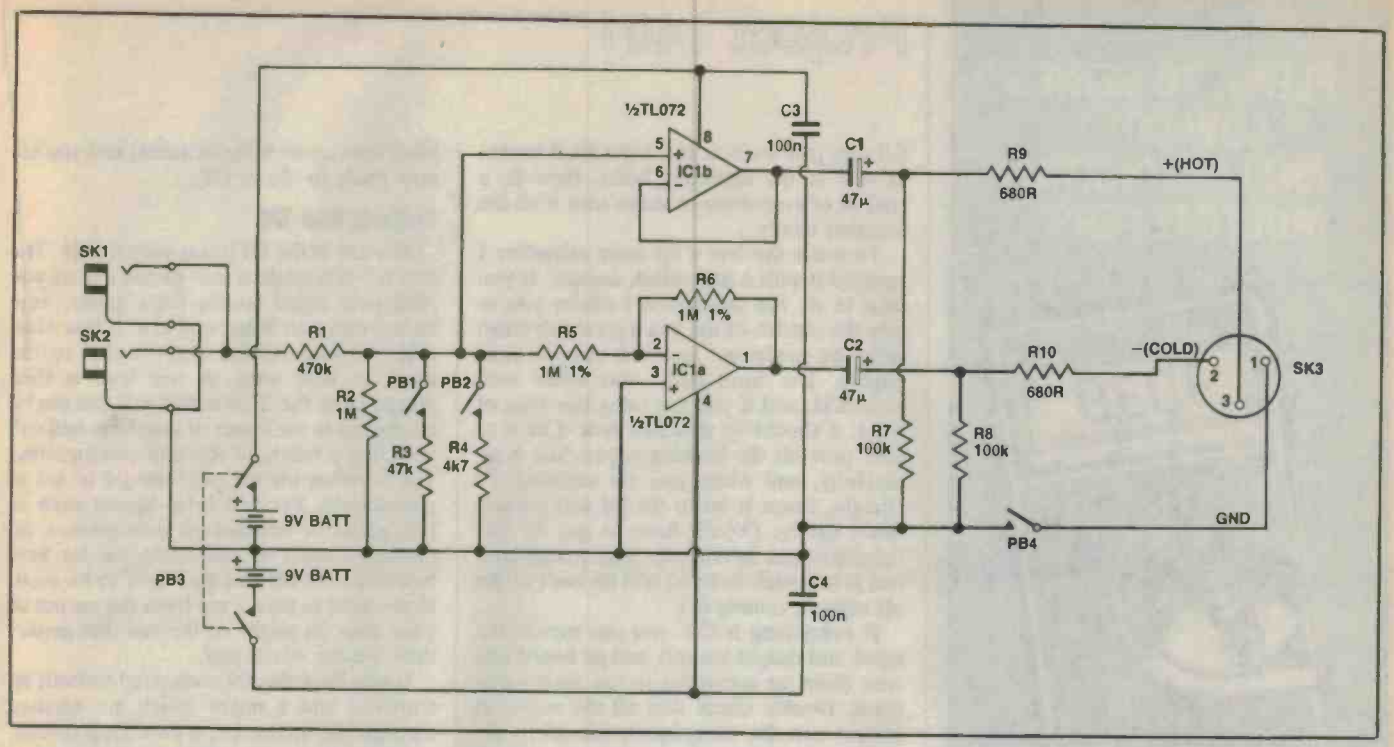
POSTAGE RATES

$1-$9.99	$2.00
$10-$24.99	$3.00
$25-$49.99	$4.00
$50-$99.99	$5.00
$100-199	$7.50
$200-$499	$10.00
$500 plus	$12.50

This is for basic postage only, Comet Road freight, bulky and fragile items will be charged at different rates.

MasterCard VISA

Errors and ommisions excepted



HOW IT WORKS — ETI-1401

Referring to the circuit diagram, SK1 and SK2 are connected in parallel and provide the signal input and signal through connections. The signal is fed immediately to the voltage divider network formed by R1, R2, R3 and R4. With PB1 closed, the input voltage is attenuated by a factor of 10 (20 dB). When PB2 is closed, the attenuation is 100 (40 dB). With both PB1 and PB2 open, the input signal goes through essentially unattenuated.

The output of the attenuator network is fed to the inputs of both of the op-amps. IC1a is configured as a unity gain inverter (set by R5 and R6) and IC1b is configured as a unity gain buffer. The output of IC1a will be 180° out of phase with the output of IC1b (and thus the input signal). The outputs of both op-amps are ac coupled to the output jack by C1, C2, R7 and R8. R9 and R10, will set the output impedance to 680 ohms.

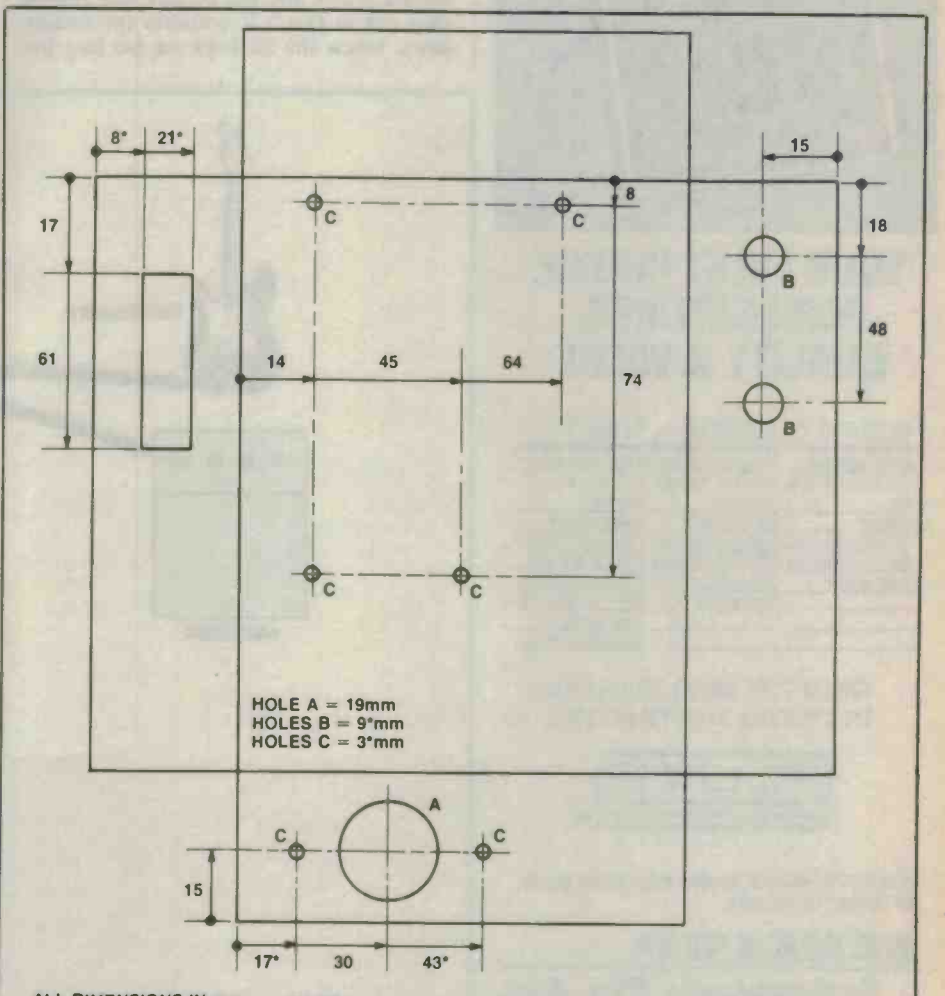
The pushbutton switch, PB4, disconnects the signal earth from the earth pin of the output jack. This enables earth loops to be avoided when the signal earth is connected to mains ground via the input jack.

The power to the op-amp is supplied by two 9 V supply rails. PB3 connects the battery to the circuit and C3 and C4 provide noise decoupling.

out inside the box, and you can follow the drilling diagram or your own intuition to mark the position of the oblong cutout for the switches. The easiest way to cut this out is to drill a few holes and then file out the remaining metal.

To check the size, put on the switches, and, once they move easily, you can mark the position of the pc board mounting holes and drill them.

The board is mounted using 6 mm stand-off spacers. Do a trial fit to make sure the board, holes and cutout line up, after which you can mark and drill the holes for the two



ALL DIMENSIONS IN mm

NOTE:
VIEW IS LOOKING FROM BENEATH THE BOX WITH THE SIDES SPLAYED OUT

*INDICATES THAT THE EXACT DIMENSION DEPENDS ON THE HARDWARE BEING USED

6.5 mm jack sockets and 3-pin XLR socket as well as the mounting holes. Now do a trial fit of *everything* to make sure it all fits together neatly.

To make the box a bit more attractive I sprayed it with a matt black enamel. If you wish to do the same then I advise you to give the outside of the box a good rub down with fine sandpaper and then clean it thoroughly. The front panel was made with Scotchcal, and if you are using this type of label, it should be attached now. Cut it to size, peel off the backing paper, line it up carefully, and when you are satisfied it's straight, lower it on to the lid and press it down firmly. (You'll have to get all this right first time as once the label makes contact it will stick fast and will be hard to get off without ruining it.)

If everything is OK you can mount the input and output sockets and pc board and wire them up according to the wiring diagram. Double check that all the wiring is correct and the components are all in the correct places and the correct way round, then put in two 9 V batteries (preferably new). Screw the lid back on (so that the label lines up with the switches) and you are now ready to 'do or DI'.

Using the DI

The use of the DI box is very simple. The two 6.5 mm sockets are paralleled so you plug your signal source (bass guitar, keyboard, etc) into either end and, if you wish, take a lead from the other socket to the input of your amp. A mic lead is then plugged into the XLR socket and this can be connected to the mixer or stage box and will look like a balanced 600 ohm microphone. The switches for the pads should be set as appropriate. For low level signals such as bass guitar or unbalanced microphones, no padding should be necessary, but for keyboards the 20 dB pad may have to be used. If you wish to take a tap from the output of your amp (as might be the case for guitar) then use the 40 dB pad.

If you have the DI connected to both an amplifier and a mixer which are earthed through the mains and a hum loop results, switch in the 'earth lift' to break the loop. You don't need to do this unless a hum loop is present. ●

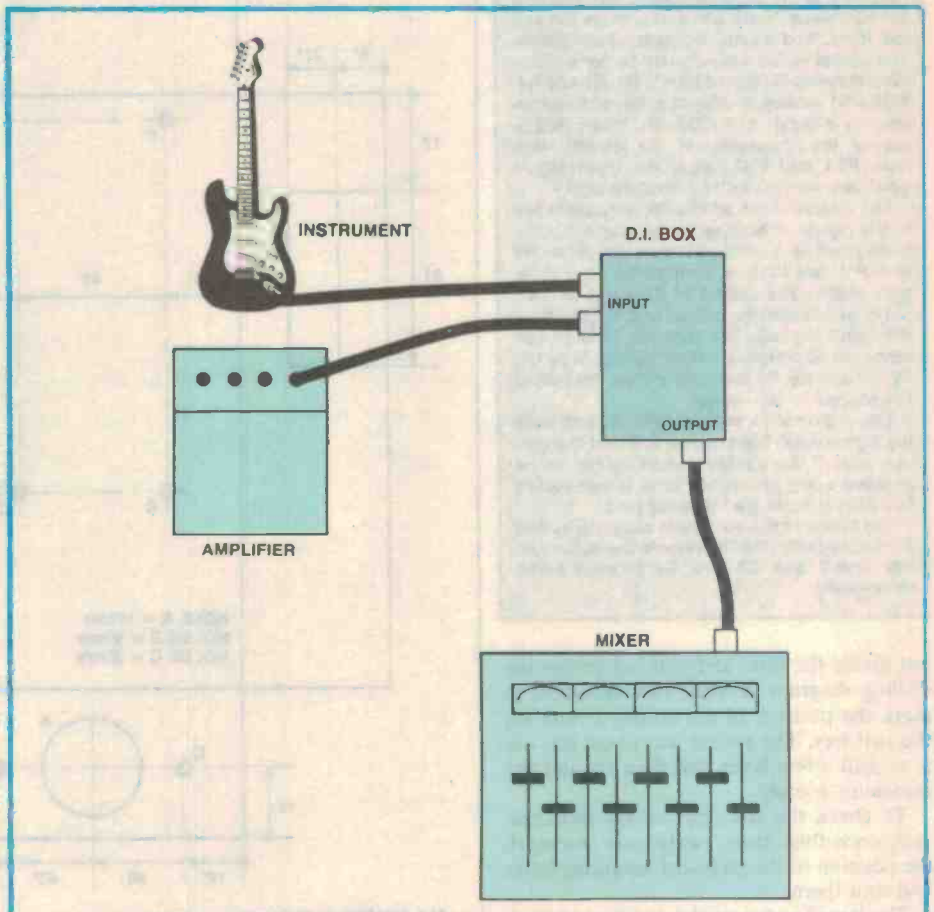


Figure 4. A typical connection for the DI box. The line to the amp is optional and can be deleted if monitoring through the mixer.

FOR SALE: ESCORT DMM 1346 4½ digit true rms, mint cond. $170. Greg (02)524-6702.

FOR SALE: TEKTRONIX/LAVOIE 545 oscilloscope, 30 MHz BW dual channel, full delayed sweep, new CRT diff. plug-in, manuals, mint cond. $750 ono. (02)869-1840 ah, 419-6424 bh.

FOR SALE: MICROBEE tape copier, backup at 300/1200, change auto start, removes double headers, etc, free postage. $9. J. Arnold, 36 Victoria St, Rooty Hill, NSW 2766.

FOR SALE: HITACHI V-152B 15 MHz dual channel CRO with probe, ex cond $325. G. Sutton (03)725-3803.

WANTED: 2650 MICROWORLD BASIC to suit Binbug; EPROM or cassette with manual; also software. R.P. Carter, 74 Allunga Dr, Gladstone, Qld 4680.

FOR SALE: CP/M USERS Group disks to vol 203 SIG/M 8" SSSD $9 incl. p&p, Sig/M catalogue $6, other formats. Also vol's 1-50 for "C" User Group. CP/M Users Group, GPO Box 2403, Melbourne, Vic 3001. RCP/M (RBBS) ph (03)754-5081.

FOR SALE: SUPER 80 assembler with full screen editor $15, disassembler $9, teleprinter $85, good cond. R. Vowels, 93 Park Dr, Parkville, Vic 3052.

FOR SALE: B&W DM70 PROF monitor speakers, large reconed 14" woofer and 9 electrostatic panels. Superb sound. $880 ono. (02)869-1840 ah, 419-6426 bh.

FOR SALE: TEKTRONIX 524 oscilloscope, 10 MHz, BW TV field/line sync separator, probes, manual. $350. (02)869-1940 ah, 419-6426 bh.

FOR SALE: VZ200 TAPE copier, backup all m/c programs incl chess, tennis. Send $10 incl. p&p to Nick Safafoudis, PO Box 31, Huntingdale, Vic 3166. (03)568-1060.

FOR SALE: MICROBEE — Beeshaping positions basic geometrical shapes; Mensuration draws basic prisms to scale, calculates volume and area; Vector resolves two vectors. $9 ea. G. Gardoz, 1 Yarana Dr, Mt Helen, Vic 3350.

WANTED: DBX BOOM sub-harmonic synthesizer. Dean Horler (03)580-8079.

FOR SALE: AUDIOPHILE grade passive components ETI-5000 power amps (metal film capacitors, etc), $20/module. P. Roberts, 22 Lupton St, West Chermside, Qld 4032. (07)359-6946.

FOR SALE: LOW IMPEDANCE, wide response omnidirectional cassette recorder microphone, suits most recorders. $4 incl p&p. A. Vennonen, 3 Simpson St, Watson, ACT 2602.

FOR SALE: SERIES 5000 pre-amp and power amp kit, complete and unused (supplied by Irving). $450 delivered. Peterson, 54 Cliff St, Merimbula, NSW 2548.

- We'll publish up to 24 words free of charge for you. Copy must be with us by the first of the month preceding the month of issue. Please print or type advertisements clearly! Every effort will be made to publish all advertisements received; however, no responsibility for so doing is accepted or implied. We reserve the right to refuse advertisements considered unsuitable.
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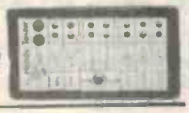
ETI Mini-Mart, P.O. Box 227, Waterloo NSW 2017.

KITS, KITS AND MORE KITS

IN-CIRCUIT TRANSISTOR TESTER

Ref: EA September 1983

Have you ever unsoldered a suspect transistor only to find that it checks O.K? Troubleshooting exercises are often hindered by this type of false alarm. You can avoid these hassles with the "In Circuit" transistor, SCR and diode tester.
The kit does just that, tests devices WITHOUT the need to unsolder from the circuit! VERY handy!
The Jaycar kit includes a Jiffy box and Scotchcal panel showing the truth table for device checking.
Cat. KA-1119



ONLY $17.95

"RAILMASTER" Pulse-Power Train Controller

Ref: EA September 1984

This is a state-of-the-art train controller offering tremendous features.

- ★ Variable simulated inertia
- ★ Full short circuit protection including both audible and visual indicators
- ★ Power and track monitor indicators
- ★ Adequate power for double and triple heading locos
- ★ Fixed 12V DC and 15V AC power for lighting and accessories
- ★ Optional walk-around throttle

The Jaycar kit includes realistic Scotchcal front panel and the special console case only available from us. The large paddle switches have been specially imported just for this kit. We believe that you will be delighted with this unit.
Cat. KA-1560

$89.95

Optional Walk Around Controller Cat. KA-1559

ONLY $9.95

Diesel Sound Simulator

Ref: Ea November 1984

This project mounts inside a model train (i.e. goods wagon) and produces a noise similar to a diesel locomotive. The 'speed' varies according to the throttle action for added realism. All listed parts provided.
Cat. KA-1561

$19.95

Steam Sound Simulator

Ref: EA December 1984

Build this realistic steam sound simulator for your model train layout. It features an infra-red optical switch to synchronise the "chuffs" to the wheel rotation. Like the KA-1561, it picks up the power from the railway tracks. All specified components supplied including 32 ohm headphone type transducer.
Cat. KA-1562

$17.95

Motorcycle Intercom • Ref: EA Feb 1984

What a great kit! This full duplex unit enables you to talk to your pillion passenger whilst riding with your helmets on! Powered by the bikes battery - you can both talk at the same time if you wish as there are no switches to activate. The Jaycar kit includes the special headphone inserts and all parts.
Cat. KA-1533

ONLY $39.95

DWELL/TACHOMETER

Ref: EA Sept. 1985

Tune up your car quickly and easily with this handy piece of gear. The Jaycar kit includes case, large meter and Scotchcal meterscale.
Cat. KA-1612

ONLY $34.95

Suits 4-6 or 8 cylinder cars

8 SECTOR BURGLAR ALARM • Ref: EA Jan/Feb 1985

Why buy a commercially made up unit for more when you can buy this kit and SAVE money! A unique feature of this kit is the fact that you can wire N/O and N/C alarm sensors ON THE SAME LINE.

- ★ 8 SECTORS
- ★ 2 delayed entry sectors
- ★ Steel box
- ★ Includes battery and siren driver in the price
- ★ Variable exit and entry delays

Cat. KA-1580

$149.00

STEREO AM DECODER (Australian Standard)

Ref: EA October 1984

This unit uses the Australian standard Motorola CQUAM decoder chip. It will decode the new AM stereo transmissions (with suitable AM tuners). The Jaycar kit is supplied with 1% resistors in lieu of the standard ones, for extra precision.
Cat. KA-1555

ONLY $24.95

Digital Bench Type Capacitance Meter

Ref: EA August 1985

NEW!

- ★ Easy to assemble
- ★ 4 digit LED readout
- ★ Measures from 1pF to 99.9uF
- ★ 3 ranges
- ★ Bench type mains powered

Cat. KA-1595

ONLY $79.95

PLAYMASTER SERIES II MOSFET AMP KIT

Ref: EA Jan/Feb/March 1985

"... s stereo amplifier that will equal or better just about any integrated commercial amplifier, regardless of price". Leo Simpson, Editor of EA, February 1985.

MAIN FEATURES

- Switchable phono input for MM and MC cartridges
- Electronic signal switching
- Full facilities for dubbing between two cassette decks
- Monitor loop for either of two cassette decks or a signal processor
- Click action pushbutton switches for selection of sources, dubbing and tape monitor with LED status indicators
- Centre detents on bass, treble and balance controls, multiple detents on volume control
- Heavy duty heatsinks
- Power transformer for low hum and noise
- Easy to build - all parts except power supply mount directly on the two printed circuit boards; wiring has been kept to an absolute minimum
- 100 watts RMS per channel into 8 ohm load
- Less than 0.01% total harmonic distortion

Cat. KA-1500

ONLY $429.00

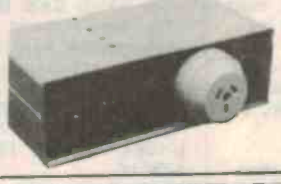
40 WATT DC INVERTER

Ref: EA August 1985

An upgrade of a previous design featuring a smart new ABS case.
Cat. KA-1598

NEW!

$79.95



300 WATT INVERTER

Ref: EA Sept. 1985

This totally new design is a vast improvement over the EA June 1982 project. It features a modern all-plastic case, easier assembly, toroidal type inverter transformer, auto start up and double, switched power outlets.
And it's cheaper than the old model!!
The Jaycar kit contains all specified parts to enable you to complete the project in one go.
Cat. KA-1610

ONLY $199.00

NEW

Car Booster Amp

Ref: EA August 1985.

This project enables you to have 2 x 50 watts RMS! of power for your car sound system. In order to do this, a special high voltage power supply forms part of the system. Absolutely stunning value for money. Around half the price of inferior commercial units.
The Jaycar kit is, as usual, absolutely complete.
Cat. KA-1600

ONLY $179

NEW

5(6.5)MHz OSCILLOSCOPE KIT

Ref: EA October 1984

Over the years many people have asked, "Do you have a CRO kit?" Our answer - up until nov - has been that built and tested units were no dearer than kits, if you could get a kit at all.
The Jaycar KJ-7050 Cathode Ray Oscilloscope kit has a guaranteed 5MHz bandwidth but should go to around 6.5MHz. It also features 75mm (3") CRT Blue Phosphor with accurate graticule, separate vertical and horizontal BNC type input sockets etc. Remember, a 5MHz 'scope is usually adequate to troubleshoot most microprocessor and other digital circuitry as well!!
This is a wonderful opportunity to learn electronics AND end up with a valuable piece of test equipment as well.
The Jaycar KJ-7050 kit is absolutely complete. The chassis is prepunched and every component including nuts and bolts are provided, along with instructions.
Cat. KJ-7050

ONLY $269.00

LOWEST PRICE EVER! LUCKY LAST!

Lyrebird 73 Note Piano

Ref: EA Oct 1981 — Jan 1982

This fabulous piano kit has an amazingly realistic sound. Many hundreds of happy users enjoy this kit, but all good things come to an end. We have 12 kitsd left and that's it!
This is your absolute last chance to own a 6-octave piano at an unbelievable price. Sorry no deposits, no back orders as no more will be built after these 12 have been sold.
Cat. KA-1350

~~$475~~
~~$385~~
$299

SAVE $176.00

Please add $20 for freight/packing

ETI 1401 DIRECT INJECT BOX

Ref: ETI Sept. 1985

This unit accepts unbalanced audio inputs (line or mic. level) and produces a line level balanced signal to drive mixers or balanced input equipment. The Jaycar kit includes die-cast box, specified push button switch bank and all other parts.
Cat. KE-4708

ONLY $34.95

NEW!

"ELECTRIC FENCE"

Ref: EA Sept. 1982

mains or battery powered, this electric fence controller is both inexpensive and versatile. It should provide an adequate deterrent to all manner of livestock. Additionally, its operation conforms to the relevant clauses of Australian Standard 3129. The kit does not include automotive ignition coil which is required.
Cat. KA-1109

ONLY $18.50

30 VOLT - 1 AMP BENCH TOP POWER SUPPLY

Ref: EA January 1985

This new design features a modern moulded plastic bench top type case, variable output from 3 - 30V and variable current limiting over 2 ranges. Overload protection and switchable voltage/current metering is also provided.
Cat. KA-1574

ONLY $68.50

JAYCAR FAVOURITES FOR YOU!

Biotron "Electronic Blood/Alcohol Checker

Simply blow into the mouthpiece to see if you are over the limit. Dual analogue meter and LED go/borderline/no go readout. Calibrated in Australia. Surprisingly accurate. Can be recalibrated if the law changes. Reads for 0.05.
Cat. YS-5100

NORMALLY $78.00
SAVE $29.00
ONLY $49.00 ea

ULTRASONIC HOUSE ALARM

This alarm is fully self-contained, even includes the siren. Place it on a shelf, (it looks like a speaker) and the ultrasonic waves detect movement. Great for single room protection, or can be used as a master control for a whole house.
You can connect an external on/off switch, external horn siren. It has provision for N/O instant circuit and N/C instant and delay. A battery compartment is there for C cells, but we recommend a 1.2A 12V Gel battery. Cat. SB-2480 $26.50 and 240V power supply Cat. MP-3019 $22.50

WE HAVE A LIMITED NUMBER AVAILABLE FOR
ONLY $69.00
Normally $99.00
SAVE $30.00

Cat. LA-5140

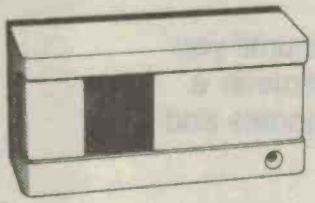
INFRA RED MOVEMENT DETECTOR

The Infra red or IR detector for short, falls into the Black Magic category. It basically is a high gain passive tuned receiver of a particular IR band. The heart of the unit consists of a high gain lens (antenna?) which has a "Commutated" field of view. Its reception pattern is comb like, but highly tuned to the IR wavelength of human bodies. When a human passes within proximity of the pickup area, the lens will selectively pick up IR radiation and then not. Movement across the pickup area will result in a series of pulses sent to a detector circuit.
IR detectors are very reliable as they do not transmit and will not respond to non heat radiating objects. Curtains, for example, can wave about without tripping the alarm. Even the cat is unlikely to trip the unit.

FEATURES:
- 12V DC powered
- Small 77mm x 62mm x 51mm
- Double sensor
- Computerised OC to lower failure rate
- Built-in test lamp
- Alarm output SPST 30V DC @ 1A
- NO or NC terminations

Cat. LA-5017

SAVE $20.00
ONLY $89.00 ea



VIDEO ENHANCER

Ref. EA October 1983
A simple but effective kit to help improve copy recordings of video tapes. The Jaycar kit includes the box and Scotchcal label.
Cat. KA-1118

WAS $39.50
SAVE $14.50
ONLY $25.00 ea

DC CONVERTOR

This unit plugs into your car cigarette lighter socket and will provide up to 300mA at 6 and 9V DC. Ideal to power the Ghetto Blaster in your car! We only have a few left - so hurry!
Cat. MP-3015

NORMALLY SELL FOR AROUND $10
This Month $2.95
that's 2/3 OFF!

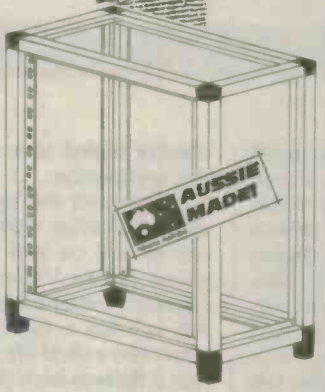
BARGAIN OF THE CENTURY!!

How do we do it? Another

BARGAIN!!

Once again, Jaycar has secured a massive below-cost scoop purchase. This time a nifty combination VHF/UHF television tuner assembly! We dare not mention the name of this famous Japanese brand!!! ★ Brand, spanking new ★ Separate VHF rotary tuner ★ Separate UHF rotary tuner ★ All knobs & wiring INCLUDED! ★ Attractive front panel fascia included! ★ Circuit diagram included!
Be quick to secure one of these bargains.
Cat. DM-9004

LAST FEW!!!!
SAVE $50.00!!!
ONLY $19.95 ea



"ZIP RACK" 19" RACK SYSTEM - NEW LOWER PRICES AND A WIDER RANGE!

The natural finish (silver) rack frames are now cheaper and we now have black frames as well!
THE RACK IS AVAILABLE IN 3 SIZES

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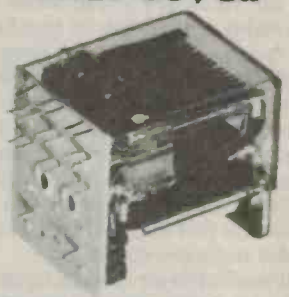

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Project 168

VERSATILE CONTINUITY TESTER

Checking continuity seems the most trivial of tasks until you try it. Sure as anything when you look at your multimeter a probe will slip. This project is designed for mere mortals and will even check circuits that include a light globe.

Ian Thomas

A WHILE AGO I was faced with the job of checking out a large motherboard. I used the old trusty DVM and found that it's an incredibly tedious job as you have to wait for three or four readings before the display stabilizes. If there are hundreds of continuity checks to be made, then it literally adds hours to the job. Normal buzzer type continuity checkers often inject large currents and voltages into the board under test and can damage semiconductors. The actual resistance that most old style buzzers detect is also not too well defined.

It seemed to me that it'd be nice to have a little box with probe leads attached that beeped when the resistance between the leads was less than a set value. To complete the picture it'd be even nicer if the threshold resistance at which the beep occurred could be set to any desired value within limits. For example, if you were checking out the wiring of your car it would help if your continuity checker could tell the difference between a light bulb and a short circuit. With this in mind it became clear that the sort of sensitivity range needed was between 1 ohm and 20 ohms. Calibration didn't seem to be all that important and ±20% seemed to be a reasonable figure to work to.

While I can't speak for all readers I know that I personally have a genius for leaving battery powered equipment left on. I must get through about 10 batteries for my DVM in a year and they're usually flat when I want the DVM most (usually 11 pm on Sunday night when the job has to be delivered on Monday!). Clearly, the continuity checker should have some way of avoiding this aggravation.

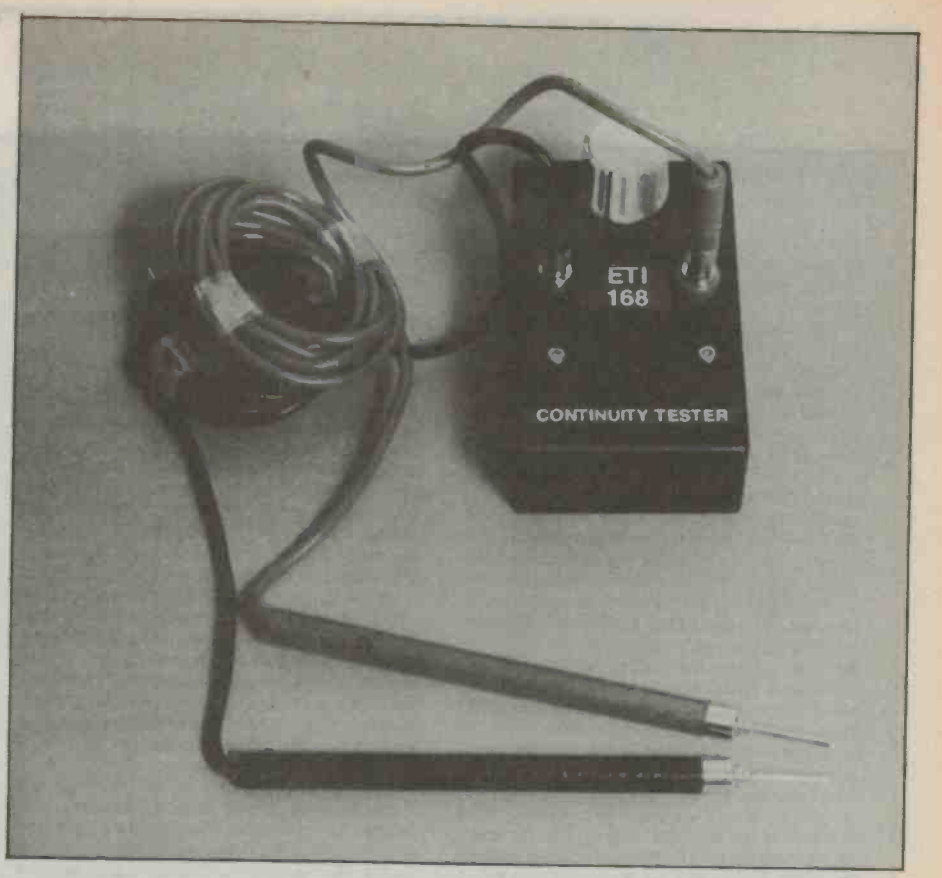
The neatest way to fix this problem is to make the device draw so little power that it *can* be left on and not go flat. A quick phone call to Union Carbide (they make Eveready batteries) told me that your basic AA cell has a capacity of about 0.7 amp hours and a shelf life of about five years before it flattens itself due to internal leakage. Now five years is equal to 43,800 hours so the internal leakage of the battery is equivalent to about 15 microamps. If the current drawn by the continuity checker was made less than this, then the life of the batteries alone would determine how often they needed to be replaced and the checker could be left on all the time — great!

Since I wanted the checker to be as small as possible I settled on two AA cells as the power supply, which gave me a three volt rail or ±1.5 volts and ground. Smaller batteries would probably be OK but they'd be hard to mount. The AA cells battery holders can be bought at almost any hobbyist shop.

For the beeper I chose one of the Piezoelectric transducers that are available from most of the bits and pieces shops. The actual model was an HPE127 from the ubiquitous Richard, that's nice and cheap and is very thin and convenient to mount in a box. These transducers have to have some sort of signal generator to drive them and the obvious way to do this is to use a CMOS oscillator. If the oscillator is gated off but power is left on then it only draws the leakage current of the CMOS gates which is measured in nanoamps. This certainly meets the current requirements. The oscillator is only used when the continuity checker is being used so the output load doesn't contribute to battery life at all (nobody works *that* hard!).

The sensing of the resistance across the probes wasn't quite as simple. The normal way to measure resistance is to inject a current through the resistance then measure the voltage drop caused by the current. Now as the battery must be treated gently, and we don't want to risk damaging any semiconductors that may be in the circuit, the current used must be restricted to a few milliamps. This means that the voltage drop to be measured must be only a few millivolts. This isn't absurdly small but it certainly prohibits the use of any simple transistor circuits.

Integrated circuit operational amplifiers have input offset voltages of only a few millivolts and would work very nicely as voltage comparators, but the normal TL082 type of op-amp draws about 5 mA — far too much for the battery life requirements. However, National Semiconductor makes an op-amp labelled the LM4250 the current consumption of which can be set by an external bias resistor. The total power used can be reduced to almost nothing but, as with all things, something has to be lost as the current drain is reduced. In this case it's the op-amp bandwidth. This means that when the op-amp is used as a comparator, the lower the power consumption, the



slower the output will switch. Experiment showed that at ridiculously low power consumption it still worked just fine. One nice property about the variable power drain op-amp is that as the total current used is reduced then the input bias current need is reduced as well. The whole device can be operated at higher impedances without generating offset voltages — better and better.

The bias current for the LM4250 is set by a resistor that bleeds current from the positive rail through what is effectively a diode. This sets up internal currents and determines the total device power. If an 11 megohm resistor is connected from the bias input to ground with ±1.5 volt rails then the total op-amp current drawn is *less than 1 microamp*. This seemed to be just what was needed. The input offset voltage wasn't specified for currents this low so I decided to use an offset adjust to null out any stray millivolts. The circuit given in the data sheet didn't work as the integrated circuit was operating at such low power. However, a simple resistor potentiometer arrangement from ground to the offset adjust inputs did the deed just fine.

I chose to ignore the fact that the offset null circuit drew half as much power as the IC, as it was still minute! This gave me a zero offset comparator to sense the voltage produced by the test current in the probe resistance and a very low power oscillator to drive the piezo-transducer. Even the price of the micropower op-amp isn't too bad: it can be bought for about $3.

Construction

I decided to fit the continuity checker into the smallest of the boxes that Dick Smith sells, the UB5. It isn't all that much bigger than the two AA batteries used to power it so it made for a rather cramped design, but everything fitted OK. The board layout shows that all the available area in the box is used — most of it by the batteries. All the components are mounted on the board with the exception of the threshold adjust pot. The batteries are mounted in a battery holder that's also available from our aviating adventurer's establishment but as the tester only uses two cells I had to modify a four cell holder.

I started by running a fine hacksaw through the battery holder to cut off one side. I didn't cut through the wire springs that make contact with the cells but only the plastic. The part to be kept is the side that has the clips to bring out the power, and the cut is made along the flat divider between the cells on the side away from the clips. After cutting the plastic I carefully drilled out the rivet on the cut-off piece to completely separate the two sections. The spring that's separated when the rivet is drilled out must be kept as it's needed later. Once the battery holder is completely separated, file off all the dags and rough edges so the bottom of the cut-down holder should be straightened out to form a long head to be soldered into the board later.

The printed circuit isn't all that complicated and shouldn't give you any trouble to make. Some of the tracks had to be made with 0.020" tape which can be a bit fiddly to do as it is run between IC pins. When taping between pins it's very important to watch the spacing of the tape as there isn't a great deal spare. Of course the easiest way is to buy a ready-made board or buy a copy of the artwork from ETI. However you make it, the board dimensions mustn't be any bigger than those shown as it fills all the available space in the box.

To mount the battery holder on the board I made use of ye olde trusty Araldite. The two holes on the earth track must be drilled out to accept the straightened out springs that protrude through the bottom of the battery holder. The spring that was freed when the rivet was drilled out of the cut-off piece of battery holder had the rivet end straightened out and was reinserted into the holder in its original position. This left two leads protruding through the bottom of the holder. Mix up a small amount of glue and bond the battery holder onto the board with the straightened springs through the board and soldered onto the earth track. You have to be careful in positioning it so as not to cover any of the holes for components or accidentally fill them with glue. After the glue has set you can assemble the rest of the components on the board. Take care that both ICs are in the right way (CMOS ICs are instantly destroyed if they're put in reversed).

As there is *very* little spare space in the box it's necessary to cut away the top of the two battery terminals to allow enough free space for the potentiometer (see photo). A ▶

HOW IT WORKS — ETI-168

The continuity checker can be divided into three sections: the probe resistance sensing circuit; the oscillator; and the transducer driver.

The probe resistance sensing is done with the LM4250C operational amplifier. R1, a 390 ohm resistor, holds the hot probe input at the positive supply voltage. The hot probe is connected to the negative input of the operational amplifier through R2. R2 and C1 simply provide ac decoupling for the probe input so it won't pick up any rf signals or high mains fields. The operational amplifier dc operating conditions and power drain are set by R4, RV1 and R5. They draw approximately 100 nanoamps from pin 8 of the operational amplifier and set its quiescent operating current at about 600 nA. RV1's wiper is connected to the positive input of the operational amplifier and the dc voltage it produces can be varied between about 5 mV and 150 mV.

When a resistance is connected between the probes the external resistance and R1 form a potential divider that divides down the positive supply voltage. If the divided down voltage is less than the voltage on the positive input pin 3 then the operational amplifier output pin 6 will go positive to within about 0.6 volt of the positive supply. For the minimum potentiometer setting this corresponds to about 1 ohm and for the maximum about 70 ohms, which are the minimum and maximum resistance limits of the checker.

When pin 6 of the operational amplifier is negative (probes open circuit or greater than the threshold resistance) pin 1 of gate a is held low which holds the gate output high. When the gate input goes high it allows gates a and b to act as a free running multivibrator at about 7 kHz. This works in the following way:

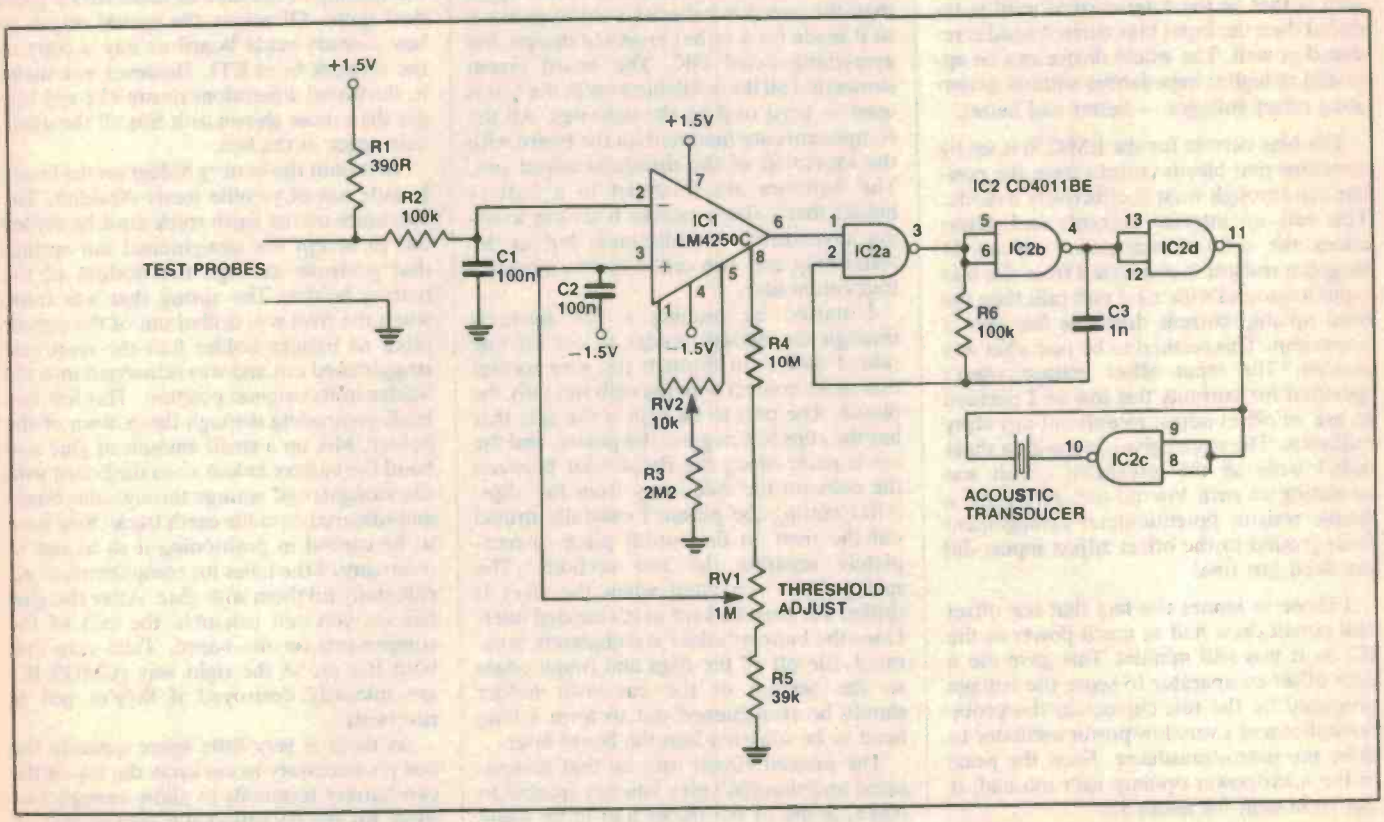
Imagine that the output of gate b has just gone positive. C3 couples directly to pin 2 of gate a and forces it high too. This means that gate a's output goes low. R6 then starts to discharge C3 and starts to pull pin 2 negative. After a few hundred microseconds pin 2 of gate a reaches the gate threshold and gate a's output goes positive. Gate b then changes state and its output goes negative reinforcing the transition of gate a through C3. Gate b's output then remains negative until R6 can recharge C3 when the process is repeated in reverse to force pin 6 positive again. This forms a free running oscillator to drive the transducer. However if pin 1 of gate a is held negative by the operational amplifier then gate a's output remains positive and oscillation stops. Under this condition the gates only draw the quiescent current of CMOS gates which is negligible.

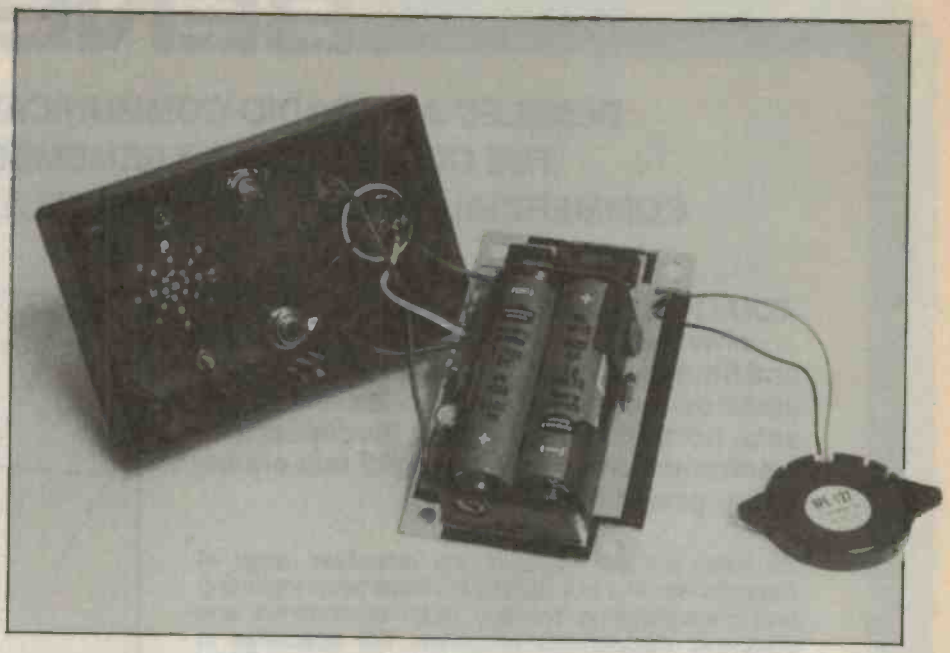
The other two gates in the package are used to drive the acoustic transducer in a bridge configuration. When gate c's output is positive, gate d's output is negative and vice versa. This means that the ac signal applied to the transducer is effectively twice the supply rails and makes sure that the sound is clearly audible.

little discrete work with a hacksaw blade and sidecutters is needed to make sure it'll fit. When only the bottom quarter of the terminals is left solder two insulated pieces of wire onto the remnants of the terminals *but do it quickly* as the plastic of the battery holder will soften with the heat. Cut and strip the other ends of the two pieces of wire to a neat suitable length and solder them onto the pads on the board. This connects up the power supply and avoids any trouble with intermittent battery connections during the life of the checker.

Cut three pieces of wire about 70 mm long and strip the ends about 5 mm. It makes life a lot easier if you use different colours but it isn't essential. Solder them into position on the three terminals of the potentiometer and then solder the other ends into the board in the right place. Next cut two more pieces about the same length and connect them to the board for the probe inputs. Finally, connect the transducer to its two pads and the checker is ready to test before it goes into the box. Put two AA cells into the holder and try touching the probe leads together. You should hear a nice clear "peeeeep". If all is well, you're ready to adjust the op-amp offset.

Twist the probe leads together to form a semi-permanent connection (don't get carried away! — you've got to get them apart again) and temporarily solder a piece of wire between pins 2 and 3 of the op-amp.



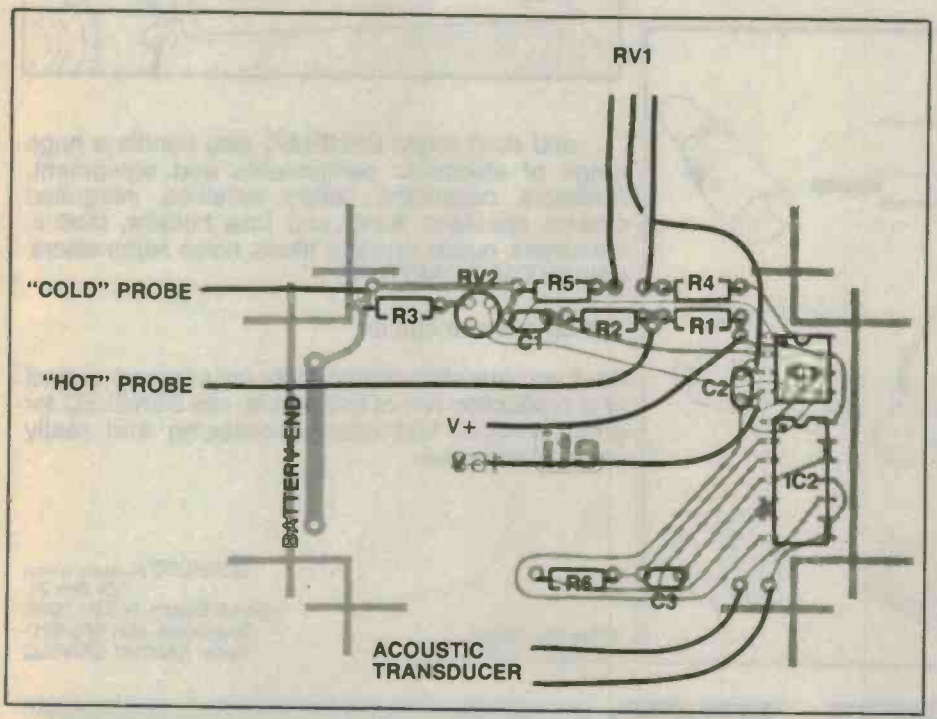


Then adjust RV2 until the peep just starts. Back the pot off a whisker and set it so that the tone starts and stops as you move your hands near the wires. The object is to set the pot so the op-amp is floating in the middle of its active region but there is so much gain that the minutest changes in circuit conditions will cause it to go one way or the other. When this is right remove the piece of wire from between pins 2 and 3. Finally, work over the bottom of the board cutting off all the component leads *as short as you can*. None of them should protrude more than a millimetre. It's a good idea to take the batteries out while you do this. Your soldering may need a little touching up here and there too.

The next step is to prepare the box. First place the transducer where you want it over the plastic box and mark off the two mounting holes, then drill them out to 2.5 mm. Next mark off the exact centre between the mounting holes and drill out a tasteful and artistic pattern of holes to let the peeeep out of the box. Feel free to let your mind run riot with regard to the pattern — the sound isn't fussy! Next insert two 2.5 mm x 10 mm pan head screws into the holes so the heads are on the outside and tighten two nuts onto each of the screws. This should nicely space the transducer away from the lid of the box when it's slipped over the free ends of the screws. Try it for size *but be careful of the leads from the transducer*. They're thin and easy to break off! The transducer isn't to be fixed in place yet.

Next mark off where you want the probe leads to come out. I used sockets that are specially made for this job, which I bought from Jaycar. Pull the sockets apart and use the plastic bushings to mark off the holes. The sockets *must* be as far over to the sides of the box as possible or they'll foul the batteries. To position them, hold the plastic bushings on the inside of the box where you want them, but hard up against the side of the box, and mark off the centre with a scribe or pencil. Then drill holes on the centre of the marks with the right size drill to clear the centre part of the bushings. Deburr the holes (be gentle here as the plastic's soft and if you're not careful the deburring tool will cut right through the box!). Assemble and screw the sockets into position with the solder tags between the two nuts, pointing away from the centre of the box.

Now carefully mark off where the potentiometer is to go in the box. Once again the body of the potentiometer must go hard up against the side (end) of the box so it doesn't foul the batteries. Drill out the hole to accept the potentiometer and check to make sure you've measured it right. If it's a little out a small amount of adjustment may be necessary with a rat tail file. Finally screw in the potentiometer and transducer and solder the probe leads (untwisted — see, I told you not to do it too tightly) onto the sockets. Put the batteries back in and test the unit again to make sure nothing was damaged during the lead cropping.



PARTS LIST — ETI-168

Resistors.....all ¼ watt, 5% unless noted
R1.....390R
R2,6.....100k
R3.....2M2
R4.....10M ±10%
R5.....39k
RV1.....1M 16 mm diameter linear law pot
RV2.....10k trimpot 6.3 mm diameter

Capacitors.....all ±10% 63 volt
C1, 2.....100 nF met poly
C3.....1nF met poly

Semiconductors
IC1.....LM4250C
IC2.....CD4011BE

Transducer
HPE127 piezo resonator (Dick Smith cat #L7022)

Miscellaneous
ETI-168 pc board; 28 mm 54 mm x 83 mm box; battery holder; 2 x AA batteries; 2 probe leads; 2 x 4 mm panel mount sockets; 2 x 25 mm x 10 mm pan head screws and nuts; hookup wire; insulating tape; double sided sticky tape; glue.

Price estimate: $33.35

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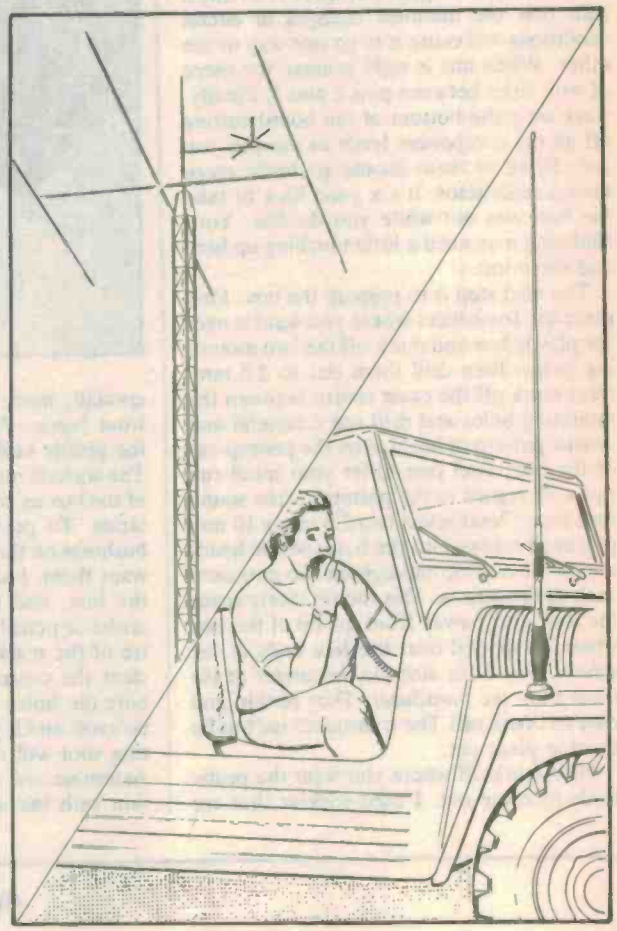

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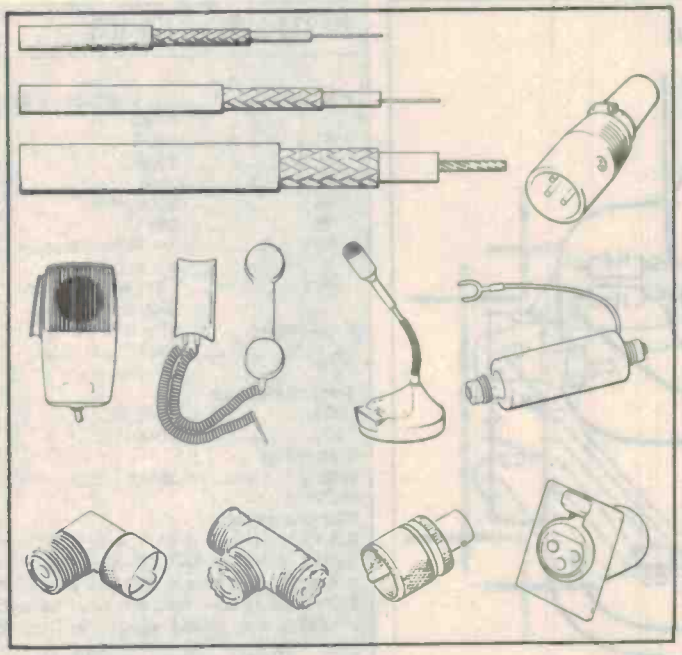

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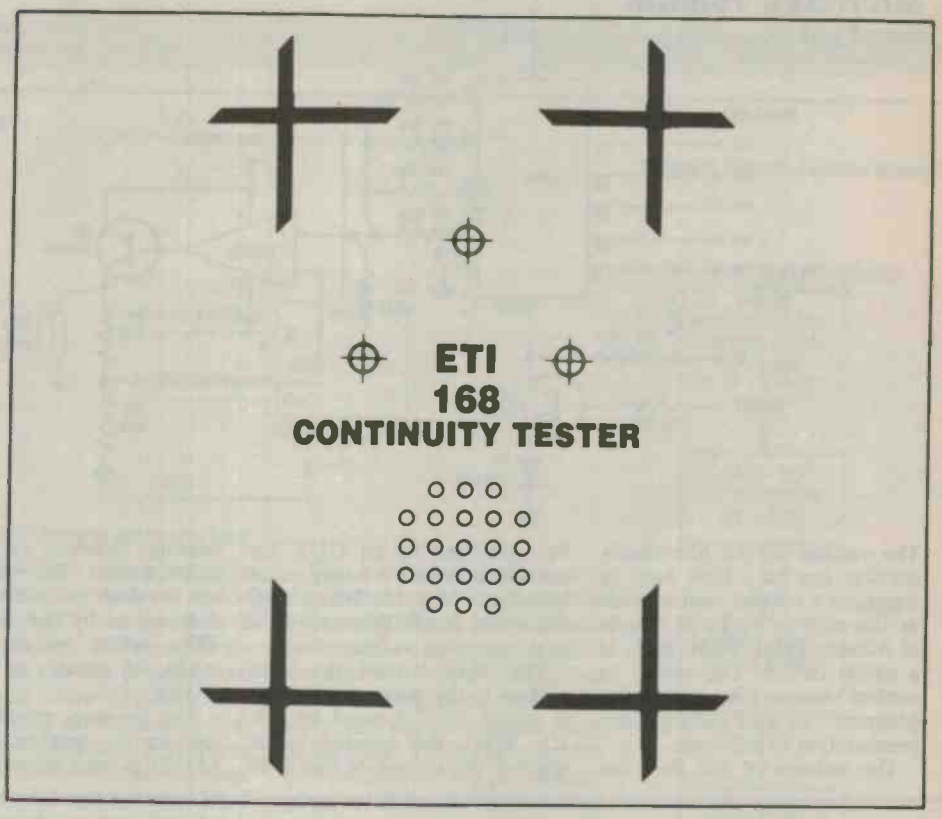
Finally, mount the board onto the metal bottom of the box in the following way. Cover one side of the lid completely with insulating tape so the tape just overlaps. The idea is to have a neat layer of tape over the whole surface. Cut away the tape with a razor blade so the holes are free. Then stick the board onto the lid with foam double-sided sticky tape. I used "Permastik Double Mounts" bought from BBC Hardware — it's pretty handy stuff to have around, in fact you probably already have some. Only cover the part of the board that's free of track — it's deliberately laid out that way. When you stick the board onto the lid make absolutely sure it's positioned so the battery holder only just misses the end of the box. This is so much easier than drilling screws holes and such. Last but not least, screw the works into the box and check once again that it works.

To pretty things up you can calibrate the knob you've attached to the pot by holding different value resistors between the probes and checking where the peep starts by rotating the knob. Mark off each value on the lid and the job's completed. This project's already saved me hours (and *many* dollars) in checking out the motherboard I already mentioned. I'm sure it'll help you too. ●



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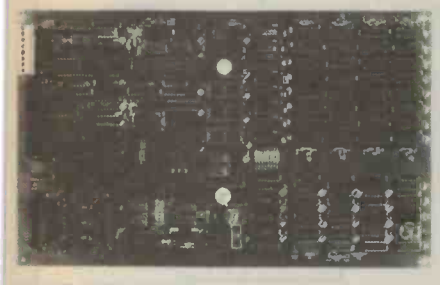

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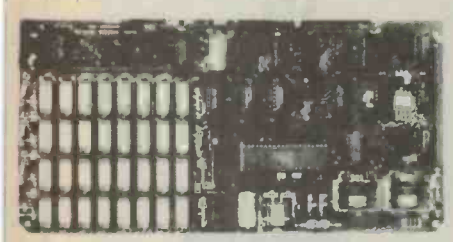

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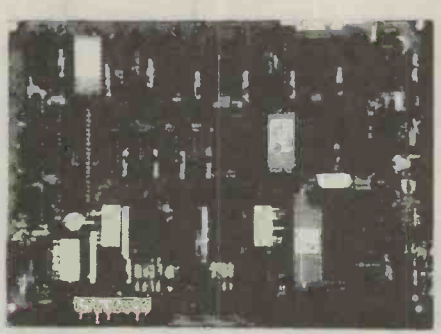

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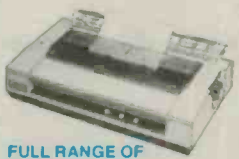

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This kit, available exclusively from Rod Irving Electronics, is the ideal way to free up your computer when YOU want to use it! Do away with those annoying delays while your printer grinds away. This 64K buffer will hold 16 average pages of text! This kit is easy to build for the average hobbyist!

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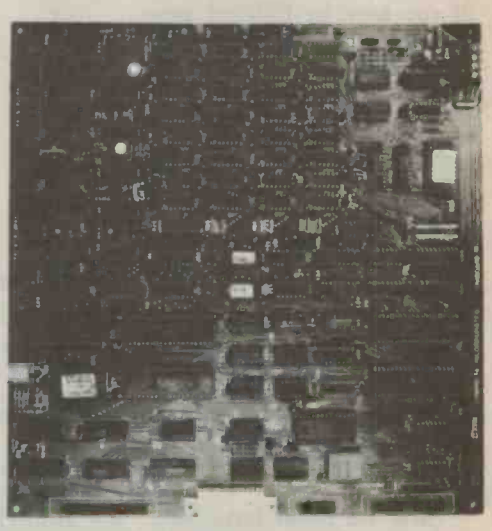
- Current rating 6 amps at 250V-50Hz

Cat. X10094 **$39.95**



6809 "UNIBOARD"

NEW SINGLE BOARD COMPUTER KIT!

Many software professionals feel that the 6809 features probably the most powerful instruction set available today on ANY 8 bit micro. Now, at last, all of that immense computing power is available at a truly unbelievably low price.

CHECK THE FEATURES!!!

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- Powerful on board system monitor. (2732). Features commands such as Go to, Alter, Fill, Move, Display, or Test Memory. Also Read and Write sectors Boot Normal, Unknown and General Flex.
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Ideal for colleges. O.E.M.'s, Industrial and scientific uses.!

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(Please specify 5¼ or 8 inch)

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27128	$12.50	$11.50	$7.50
6116	$2.95	$2.75	$2.50
41256	$14.50	$12.50	$10.00
62648	$19.50	$17.50	$14.00

PARALLEL PRINTER SWITCH

Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently, so that you can select one or the other at the flick of a switch. (ETI 666, Feb. '85)

Cat. 46660 **$69.95**

Alpha lock for the Bee

R. J. Martingdale, Springfield Court, Mill Park, Vic 3082

If you have an EPROM programmer, this is a project that might interest you. It involves minimal hardware alterations to a Microbee and the addition of a subroutine in the Bee's operating system to drive a shift lock LED, just like the big boys have.

All that is needed is a routine to read the state of memory location 0101H, and the addition of an LED driver routine. The read routine is done as an extension of the keyboard scan routine. Since this routine is called very often anyway, it is not necessary to worry about constant monitoring of the state of 0101H.

There are rather fortunately some spare bytes of ROM between A4EB and A4FD. To make the alterations use the Bee's machine code monitor to download the block of RAM A000 to AFFF into a section of ROM, make the changes required as per the program and then burn a new EPROM.

The LED driver routine outputs to a convenient port where it is latched by a simple flip flop. Data line D0 only is latched and therefore the status of bits 1 to 7 is unimportant.

Figure 1.

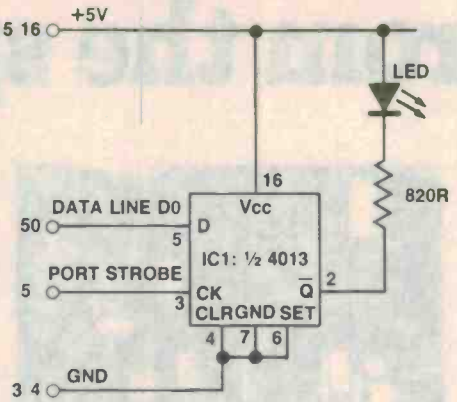
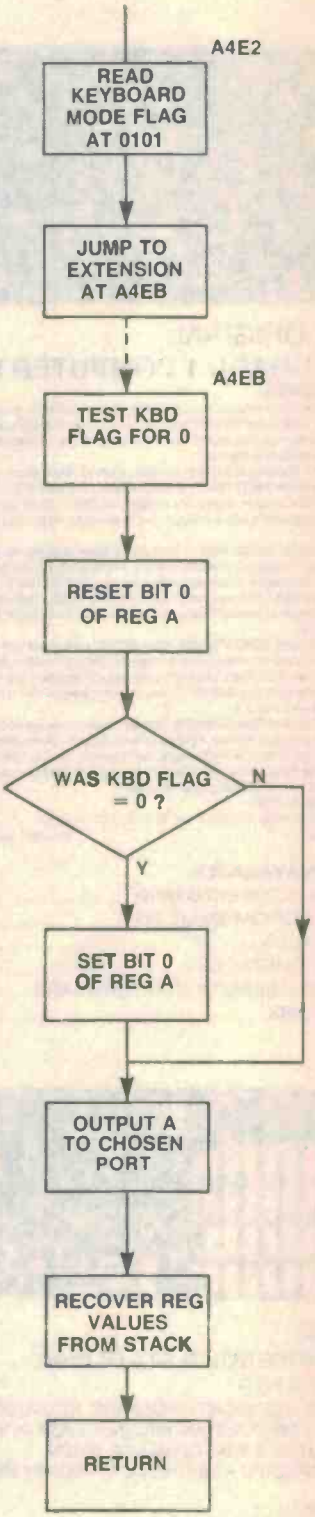


Figure 1 is a circuit diagram of the hardware add on. It consists of just one IC with the pins bent underneath and wires soldered directly onto them surrounded by heatshrink. It can be tucked away into any convenient place in the case. The LED may also be mounted in any convenient position, although the favoured position is inside the lock switch itself.

Figure 2. Extended routine flowchart.

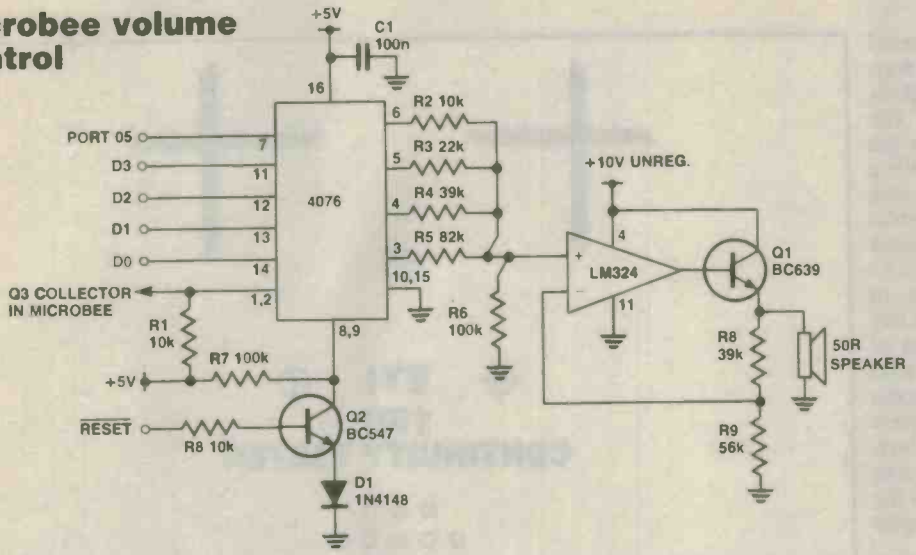



```
ADDR   CODE    LINE    LABEL  MNEM    OPERAND

                00100 ;Modified Microbee keyboard scan routine
                00110 ;Extended to add "Alpha-lock" indicator driver routine
                00120 ;R.Martindale 12/06/1985
                00130
0400            00140          DEFR    16
A4E2            00150          ORG     0A4E2
                00160
                00170 ;Tail end of scan routine (modified)
                00180
A4E2 3A0101     00190          LD      A,(0101)        ;read kbd flag
A4E5 1804       00200          JR      0A4EBH          ;jump to routine extension
                00210
A4E7 F6FF       00220          OR      0FFH            ;unmodified section
A4E9 18ED       00230          JR      0A4D8
                00240
                00250 ;Keyboard scan routine extension
                00260 ;to drive kbd status indicator
                00270
A4EB B7         00280          OR      A               ;test kbd mode
A4EC CB87       00290          RES     0,A             ;set bit 0 of A accordingly
A4EE 2802       00300          JR      Z,LOKIND
A4F0 CBC7       00310          SET     0,A
A4F2 D304       00320 LOKIND   OUT     (04),A          ;out status to chosen port
                00330
                00340 ;Relocated kbd scan routine end
                00350
A4F4 F1         00360          POP     AF
A4F5 E1         00370          POP     HL
A4F6 D1         00380          POP     DE
A4F7 C1         00390          POP     BC
A4F8 C9         00400          RET
                00410
A4F9 00         00420          NOP
A4FA 00         00430          NOP
A4FB 00         00440          NOP
A4FC 00         00450          NOP
A4FD 00         00460          NOP
                00470
0000            00480          END
```

IDEAS FOR EXPERIMENTERS

Microbee volume control



The volume of the Microbee's speaker can be a little loud at times, so a volume control such as this sent in by **L. M. Doyle of Milsons Point, NSW 2065,** is a handy device. The ability to control volume from within the program can also enhance the presentation of software.

The volume of the Bee can be controlled by an OUT 5,n command, where n is any value between 0 and 15. When n=0 the sound is off. When n=15 it is at maximum volume.

The 4076 latches the data written to the port and presents it to the DAC formed by R2-R5. When the speaker bit is toggled the output of the 4076 switches between tri-state and active modes. The output voltage level in the active mode is determined by the data in the 4076, while in the tri-state mode, R6 ensures an output of 0 volts.

The op-amp provides some gain for the speaker signal. An LM324 is used because its outputs have the ability to go right down to 0 volts. The reset line is used to tristate the inputs of the 4076 to avoid losing the data on a cold start.

All connections from the circuit to the Bee can be made on the lower board with the exception of the 5 volt supply, which should be battery packed to retain audio output at switch on. The battery supply can be obtained via pin 13 on the core board. This pin is not used on some Bee's, so the track to it can be cut and battery applied. This means the core board can be unplugged without desoldering any cables.

The data lines were taken from the outputs of IC9 on the Bee, while port 05 is available at pin 5 of IC39. The connection to Q3 is made after the speaker is disconnected and reconnected to the circuit. Finally, RESET can be found on pin 18 of X3.

The whole circuit can be built on a small pc board and double sided tape used to secure it to the underside of the lower board on the Bee.

'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 60 W Portable Cordless Soldering Iron, a 240 Volt Charging Adaptor together with a Holder Bracket. The prize is worth approx. $100.

Selections will be made at the sole discretion of the editorial staff of ETI Magazine. Apart from the prize, each person will be paid $20 for an item published. You must submit original ideas of circuits which have not previously been published. You may send as many entries as you wish.

COUPON

Cut and send to: **Scope/ETI 'Idea of the Month' Contest, ETI Magazine, P.O. Box 227, Waterloo NSW 2017.**

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Title of Idea .....

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

Name .....

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RULES

This contest is open to all persons normally resident in Australia, with the exception of members of the staff of Scope Laboratories, The Federal Publishing Company Pty Limited, ESN, The Litho Centre and/or associated companies.

Closing date for each issue is the last day of the month. Entries received within seven days of that date will be accepted if postmarked to and including the date of the last day of the month.

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.

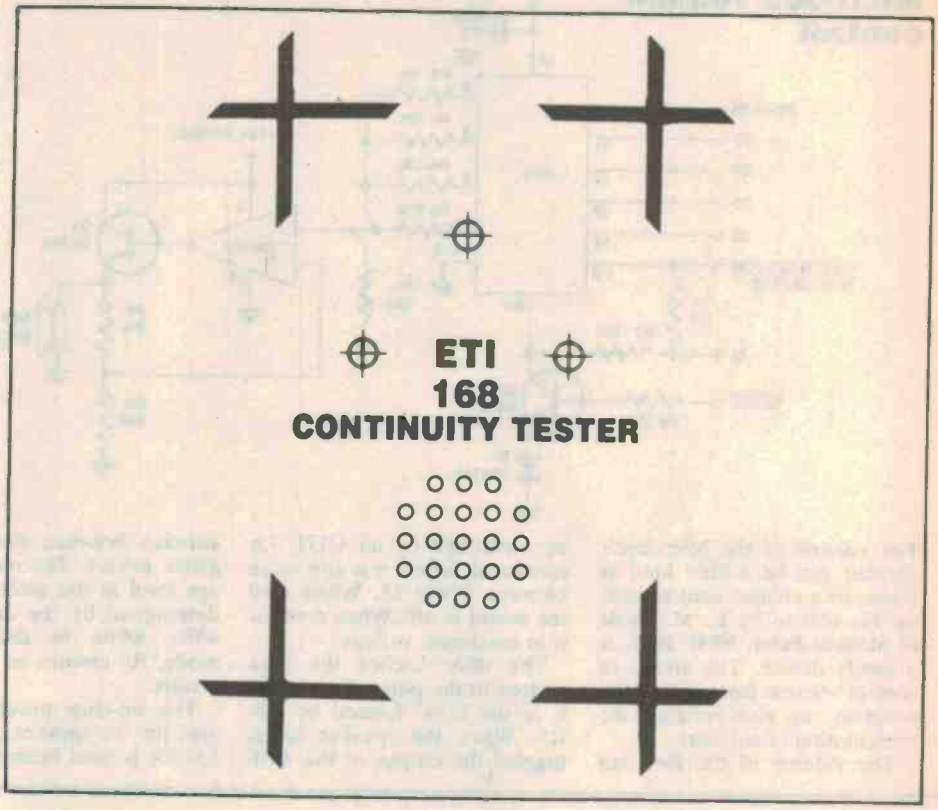
The winner will be advised by telegram the same day the result is declared. The name of the winner, together with the winning idea, will be published in the next possible issue of ETI Magazine.

Contestants must enter their names and addresses where indicated on each entry form. Photostats or clearly written copies will be accepted but if sending copies you must cut out and include with each entry the month and page number from the bottom of the page of the contest. In other words, you can send in multiple entries but you will need extra copies of the magazine so that you send an original page number with each entry.

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

Finally, mount the board onto the metal bottom of the box in the following way. Cover one side of the lid completely with insulating tape so the tape just overlaps. The idea is to have a neat layer of tape over the whole surface. Cut away the tape with a razor blade so the holes are free. Then stick the board onto the lid with foam double-sided sticky tape. I used "Permastik Double Mounts" bought from BBC Hardware — it's pretty handy stuff to have around, in fact you probably already have some. Only cover the part of the board that's free of track — it's deliberately laid out that way. When you stick the board onto the lid make absolutely sure it's positioned so the battery holder only just misses the end of the box. This is so much easier than drilling screws holes and such. Last but not least, screw the works into the box and check once again that it works.

To pretty things up you can calibrate the knob you've attached to the pot by holding different value resistors between the probes and checking where the peep starts by rotating the knob. Mark off each value on the lid and the job's completed. This project's already saved me hours (and *many* dollars) in checking out the motherboard I already mentioned. I'm sure it'll help you too. ●



boards, components, etc, Rod Irving Electronics!

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The Positronic Computers PC-186 single board Computer is a general purpose microprocessor based computer that is specifically designed for the small business and hobby computer market. The PC-18 uses the APX 80186-3 (8MHz) or APX 80186-1 (10MHz) microprocessor. By fully utilizing all of the integrated features of the 80816 the PC-186 provides more features than is found on any other single board computer.

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- Centronics parallel printer adapter
- CMOS battery backed calender clock
- I/O Expansion bus
- 16 Kbytes of EPROM (2764's)
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The PC-186 may be purchased as either a mini-kit with only bare PCB and a minimum of necessary components; a full kit with all parts necessary to complete the construction of the PC/186; and as an assembled and tested single board computer.
Please phone (03) 663 6580 for a price.

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"Grappler" style card allows hi-resolution screen dumps to your Epson compatible printers. Fully functioned for flexible flow of output.

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BIG BOARD II

OVER 1,000 SOLD!

Jim Ferguson, designer of the "Big Board" distributed by Digital Research Computers, produced this stunning computer "Big Board II".

FEATURES:

- **4 MHz Z80 CPU AND PERIPHERALS CHIPS:** The Ferguson computer runs at 4MHz. Its monitor code is lean, uses Mode 2 interrupts, and makes good use of the Z80-A DMA chip.
- **64K RAM + 4K STATIC CRT RAM 24K (E) EPROM STATIC RAM:** "Big Board II" has the three memory banks: the first memory bank has eight 4164 RAM's that provide of user space and 4K of monitor space. The second memory bank has two 2K and 8 SRAMs for the memory-mapped CRT display and space for six 2732s or 2K x 8 static RAMS, or pin compatible (E)PROMs, the third memory bankb is for RAM or ROM added to the board via the STD bus. Whether bought as a bare board, a full Kit, or assembled and tested, it comes with 450nS2732A EPROM containing the monitor.
- **MULTIPLE DENSITY CONTROLLER FOR SS/DS FLOPPY DISKS:** The "Big Board II" computer has a multiple density disk controller, it can use 1793 or 8877 controller chips. The board has two connectors for disk signal with 34 pins for 5 1/4" drives, the other with 50 pins for 8" drives.
- **EXCELLENT ON BOARD VIDEO:** The "Big Board I" computer uses a 6845S CRT controller and 8002 Video Attributes controller to produce a display of quality terminals. Characters are formed by a 5 x 7 dot matrix on 15.75KHz monitors and a 7 x 9 dot matrix on 15.75KHz monitors. The display is user programmable with the default display 24 lines of 80 characters.
- **STD BUS CONNECTOR:** "Big Board II" brings its bus signals to a convenient place on the PC board where users can solder a STD socket. bus cards can be plugged directly into it, and it can as well be connected by bus cable to industry standard card cages.
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- **PROM PROGRAMMING CIRCUITRY AND SOFTWARE:** The "Big Board II" computer has circuitry and drivers for programming 2716s, 2732(A)s, or pin-compatible (E)PROMS.
- **CP/M CAPABILITY:** CP/M with Russell Smith's CBIOS for the "BIG BOARD II" is available ..... (plus tax) $230

The CBIOS 5" or 8" is avail. separately ..... (plus tax) $65

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EPROM PROGRAMMER

If you have ever wanted to rewrite or extend the operating system of your microcomputer or if you're interested in dedicated microprocessor applications then this EPROM Programmer is just the thing. It is an inexpensive unit that uses readily available IC's, interfaces directly to the expansion bus on the back of all the popular 8080/Z80 microcompputers and programs 2708's, 2716's, 2758's and 2732's. (EA July 80) 80PP71

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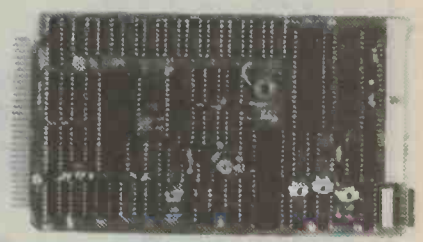
(Horwood case supplied)



THE LITTLE BIG BOARD

FEATURES:

- Z80A CPU (4 MHz)
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- Up to four, 8 inch or 5.25 inch double sided, double density or single density floppy disk drives.
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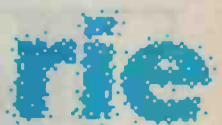

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SATELLITES SHINE ON IREECON SHOW

The Institute of Radio and Electronics Engineers' convention, IREECON, is the largest electronics show of its type in Australia. This year delegates will witness an exhibition and a conference programme of more than 300 papers.

Jon Fairall

IREECON '85 PROMISES to be the biggest and best IREECON yet. It's put on every second year by the Institute of Radio and Electronics Engineers of Australia as a forum for technicians and managers to discuss common problems and enthusiasms. This year's convention will be held from 30 September to 4 October at the Melbourne Royal Exhibition Building. IREECON is divided into two sections, a series of lectures and a product exhibition.

IREECON '85 will be dominated by the launch of Aussat 1, and many of the most interesting exhibits and speakers are expected to come from the satellite sector of the market. Aussat itself will be heavily represented in the lecture series with eight of its top people delivering papers, plus a stand in the exhibition hall. The stand, we are assured, will be "spacey". Make what you will of that.

The big satellite users will be presenting their side as well, with papers from Telecom, the ABC and SBS. Manufacturers are also weighing in. Scientific Atlanta and Hughes Aircraft are both represented on the lecture program. Hughes is augmenting its presence with a stand as well.

Satellite technology will be well in evidence on the exhibition stands. Andrew Antennas is planning to be the first to make a live demo of Aussat signals. It will also be showing off a locally designed fully mobile up- and down-link 4.6 m antenna for professional use amidst a plethora of TVRO dishes. Others to look out for include Antenna Engineering and Hills.

Since the last convention in 1983 optical fibre has well and truly climbed out of the

EXHIBITORS AT IREECON '85

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Alcatel-Thomson
Allen-Bradley
Ampex Australia
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GEC Radio
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Poul Kirk Electronics
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Pro-Log (Australia)
PSI Computer Systems
Quantum Electronics
Quinto
Radio Manufacturing Engineers
Radiospares Components
Rank Electronics
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Rockwell-Collins (Australasia)
Rohde & Schwarz (Australia)
Rose Music
Royel International
Scientific Devices Australia
Singapore Trade Development Board
Sony (Australia)
South Australia Technology Park
Standard Communications
Standard Telephones & Cables
Syntec International
Tasmanian Development Authority
TBC
Techtel
Tektronix Australia
Telecom Australia
Telesat Canada
Telmak
Temple-Smith Australia
Three Arts Services
Torrens Industries
TR Services
Turnbull Electronics
Ulna
Varian
Vema Australia
Vicom Australia
Vision Control
Western Australian Group, Dept of Industrial, Commercial & Regional Development
Xenitek

laboratory into the market, and this is reflected in the number of papers and exhibits dealing with optical fibre technology. But practitioners of the art still maintain a fairly 'way out' image. Prize for best title of the show goes to GE Rosman of Telecom with a paper entitled "Fleet Footed Photons Flatten Fermions".

Manufacturers showing optical fibre products include Australian manufacturer Integral Fibre Systems, with a range of communications devices that send RS232 compatible signals over several kilometres at 100 kbps without repeaters. It also has some fault detection equipment that should be interesting.

Broadcasters and broadcasting products are well represented on the stands. Companies with interesting products include Hagemeyer, which will be showing off a rejuvenated range of JVC professional products, including plumbicon and saticon cameras. RME will have audio processing systems, FM translaters, cartridge machines and a C-QUAM AM stereo exciter.

Robert Bosch has some interesting European and US equipment, including its FGS 4000 graphics machine. Main contest in video machine interest is likely to come from Fairlight Instruments, which will be showing off its Computer Video Instrument, and Quantum, distributors of the Quantel Paintbox and other video goodies.

A lot of interest is likely to be generated by the British stands at the show. Eleven British companies have got together to provide a view of the latest in British broadcasting technology. It was put together by the Association of Sound and Communication Engineers, which has hired 220 square metres of exhibition space. Products on display include record cleaning equipment from Keith Monks, timecode generators and readers from Avitel, autocues from Autocue Limited, conference systems from Auditel, an Aston4 video character generator and in-line mixing consoles from Soundcraft.

Another trend visible in the show is the emphasis on new manufacturing techniques like surface mounting and VLSI. There will be papers delivered by Clarke and Paltridge of Austek, the Adelaide semiconductor manufacturer, and another by A Legrand of NSD Australia on gate array technology.

Electronic Development Sales will be showing off its disk controlled wire wrapping machine from Spain; Royel International will have soldering tools and manufacturing work stations and Penn Central will be showing some pick-n-place machines from Dynapert.

There is perennial interest during the exhibition in the suppliers of test and measuring instruments. Rohde and Schwarz will highlight the latest developments in the field with an advanced LF-HF radiomonitoring receiver, a scaler network analyzer coupled to a sweep generator and the MUF 2 transcope, which, according to R&S is all you will ever need to troubleshoot a TV transmitter. R&S will also have a Grundig field strength meter on show.

BWD will be showing a lot of equipment from Hang Chung with a BWD badge on it. Pride of place will go to the company's Powerscope 2. This is a 5 channel 50 MHz CRO valued at around $3000, designed to replace the Powerscope 1.

STC has some instruments especially tailored to optical fibre system analysis. One is an Anritsu Chromatic Dispersion Characterizer, another an optical spectrum analyzer. STC will also have broadcast test gear amid spectrum analyzers and frequency counters.

Elmeasco will be in the running with Biomation logic analyzers and the latest in test gear from John Fluke in the US. As well, the company is distributing for Datacom North West which makes modems and communications equipment.

IREECON '85 will also provide a showground for some of the companies that provide services to the industry. Radiospares will be there with resistors, capacitors and just about everything that was ever stuck on a circuit board, Austral Cables will be showing off its range of cables and fibres and DEC, the big computer maker, will be showing what can be achieved with DECtime. If you want to know what it is, get along to Melbourne.

THE MASTER-CARD SYSTEM SOLUTION

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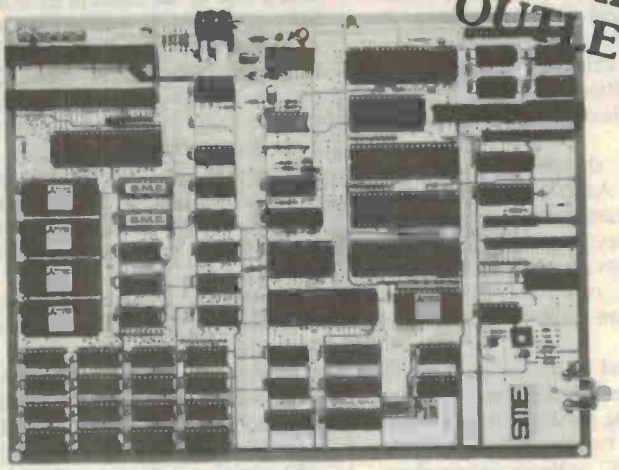
THE MASTER-CARD — FEATURES

THE MASTER-CARD is a fully tested and proven Single Board Computer that provides all the necessary requirements for a complete computing system.
THE MASTER-CARD features a 4 Mhz Z80A CPU running CP/M Plus Version 3.0 with 128K of fast dynamic RAM and an 8K Monitor/BIOS Eprom — all standard.
The floppy disk controller handles 3.5", 5.25", 8" and combinations of floppy disk drives. A CRT controller provides an 80 x 24 video display ready for connection to a video monitor.
Parallel keyboards and a Centronics printer are catered for by a Z80 PIO chip while a Z80 SIO provides the two RS232C serial ports.
Other features of **THE MASTER-CARD** include a battery backed real time clock, three spare 28 pin eprom sockets, 16 parallel TTL I/O lines and two expansion slots with Z80 signals.

Using THE MASTER-CARD

THE MASTER-CARD is easy to use. Connect power, drives, keyboard and monitor and the job is done!
Video information from the board is connected via a standard RCA socket while all other signals for peripheral devices are brought out to standard .1 by .1 pitch connectors. Power is connected via a six pin plug on the board.
As with all SME Systems boards and systems, FULL BIOS SOURCE CODE is provided on a 5.25" 80 track disk (8" format optional) along with the ready to run CP/M Plus. This allows systems implimentors and hobbyists to tailor their boards to suit a specific task.



The Master-Card Single Board Computer

The KNIGHT-2002

The **KNIGHT-2002** is a complete ready to use CP/M Plus microcomputer based on the powerful **MASTER-CARD** single board computer.
Features of this machine are its industry standard CP/M Plus, 128K byte memory, dual 1 Mb fast 3 Ms step drives and high quality ergonomic screen and keyboard.
The KNIGHT is housed in an attractive grey plastic case with the monitor placed on top and the keyboard located at the front.
KNIGHT-2002 is aimed at the smaller business and advanced hobbyist market where the 1 Mb floppy disks provide enough storage for most normal needs.
Software for KNIGHT can be chosen from the world wide market since KNIGHT uses the industry standard CP/M-80 (Plus) operating system and will run all standard CP/M programs.
Included with KNIGHT is the Utilities disk along with a comprehensive operator and technical manual that guides the user through startup, operation and repair of the unit.

The KNIGHT-2012

The **KNIGHT-2012** is an expanded **KNIGHT-2002** with a half height 10 Mb mini Winchester hard disk drive replacing one of the floppy disk drives.
Supplied with this KNIGHT are programs to allow backing up data from the hard disk to floppies giving complete data security.
The combination of hard disk and KNIGHT features make this computer one of the most powerful and fast computers in its class.
This high capacity unit is primarily designed for the needs of larger businesses where stock, payroll and accounting data far exceed the capabilities of floppy disks.

THE MASTER-CARD Specifications

CPU	Z80 @ 4 Mhz
RAM	128 K Dynamic
EPROMS	8 K MonBios Eprom 3 Spare 28 pin sockets
KEYBOARD	Parallel Keyboard Port
DISPLAY	80 x 24 CRT Display Eprom
SERIAL PORTS	2 by RS232C Serial
BAUD RATE	Software Programmble
PRINTER	1 Centronics Printer Port
TTL I/O	20 TTL I/O Lines
DISKS	8" Floppy Disk Support 5.25" Floppy Disk Support Winchester via add-on card
O.S.	CP/M Plus version 3.0
CLOCK	Real Time, Backed
EXPANSION	2 Slots
PCB	Resist, Legend, Plated Thru Double sided
SIZE	215 x 280 (8.5" x 11")
POWER	+5v @ 1.2A, +12v/−12v @ 0.1A

KNIGHT-2002 Specifications

* ALL the features of THE MASTER-CARD

KEYBOARD	87 keys, Tactile feedback FUNCTION KEYS Yes, 10 programmable
KEYPAD	Numeric + Cursor
ERGONOMIC	Yes, low profile with tilt
DISPLAY	Separate Green Video Monitor
DISKS	2 x 1 Mb DSDD
EXPANSION	2 Free slots
SIZE	120h x 465w x 430d

KNIGHT-2012 Specifications

* The KNIGHT-2002 plus the following.

DISKS	1 x 1 Mb Kb floppy disk 1 x 10 Mb hard disk
EXPANSION	1 Free slot

* All disk sizes unformatted

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	EXEMPT	TAX
MASTER-CARD (with CP/M Plus)	$ 895.00	$125.30
KNIGHT-2002 1 + 1 Mb	$1995.00	$279.30
KNIGHT-2012 1 + 10 Mb	$4600.00	$644.00
Video Monitor (Green screen)	$ 175.00	$ 24.50
Hard disk interface (#3100)	$ 175.00	$ 24.50
Wire wrap card (#3120)	$ 40.00	$ 5.60
Utility Disk and manual	$ 50.00	$ 7.00

* Prices and Specs. Subject to change without notice.
* Trade Enquiries welcomed.

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D/S D/D	$38.00	$36.50
VERBATIM DATALIFE		
S/D D/D	$27.95	$26.95
D/D D/D	$39.95	$37.95
VERBATIM VALULIFE		
S/D D/D	$24.95	$22.95
D/D D/D	$31.95	$29.95

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1-9	10+
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IC SPECIALS!

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2764	$8.25	$7.95	$6.00
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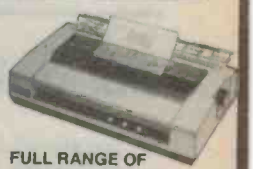

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Errors and ommisions excepted

RS232 quick cabler

The Quick Cabler-20, distributed in Australia by Datacraft, permits the interconnection of terminals, printers and other RS232 devices — and tells you how it did it.

The device has three slide switches which perform line swapping functions. Configuration changes are performed on pins [2] Transmit Data, [3] Receive Data, [4] Request to Send, [5] Clear to Send [6] Data Set Ready, [8] Data Carrier Detect, and [20] Data Terminal. Each of the swapping functions performed by the switches is clearly labelled on the box so the user is kept aware of the current configuration.

Six tri-state LEDs monitor both positive and negative voltage on pins 2, 3, 4, 5, 6, and 20. There is also a lead forcing function that helps satisfy even the most non-standard lead requirements. The unit pulls pins 16 and 25 to a logic "1".

An instruction manual provides a checklist of factors, outside the basic RS232 cabling requirements which are critical to successful interfacing. This maual is permanently attached to an inside compartment of the Quick Cabler-20 case, so it won't be lost!

The Quick Cabler-20 sells for $228 including sales tax. It is featured in the Black Box Catalog available free from **Datacraft, Maroondah Highway, Croydon, Vic 3136. (03)726-9911.**

Six-colour A4 plotter

An intelligent A4 plotter with six colours for drawing graphs on paper or overhead projection sheets has been introduced by Philips Test & Measuring Instruments.

With a high 60 cm/s positioning speed and a 40 cm/s writing speed, the PM 8154 plotter produces hard copy, colourful plots very quickly. A special printer mode with 56 characters/line and 40 lines/page enables simple addition of text.

The plotter is available with either an RS232 or an IEEE 4888 instrument bus interface as standard.

Other features include electrostatic paper hold-down and a special adaptor for Rotring pens, allowing a choice of line thicknesses.

For more information contact **Philips Scientific and Industrial, 25-27 Paul St, Nth Ryde, NSW 2113. (02)888-0403.**

Club Call

L. Linnertson has been elected secretary of the **Newcastle Microbee Users Group.** New contact address for the club is 6 Mowbray Ave, Edgeworth, NSW 2285. (049)58-4134.

The **SVI-MSX Users Group** has opened its membership ranks to all owners of MSX computers (regardless of make) in Australia, New Zealand, New Guinea and the South Pacific. The group has a comprehensive library of user-written software and publishes a monthly newsletter. For Tasmanian members there is a home banking service operated through the Island State Credit Union. Contact the group via PO Box 191, Launceston South, Tas 7249.

The **Western Surburbs Microbee Users Group** meets on the first Wednesday and third Thursday each month at the Multiple Sclerosis Centre, Cnr Furlong and St Albans Rds, St Albans, Vic 3021. Contact (03)741-3625, 336-1019 or for RBBS system (03)366-7055.

The **Mugs 68xx Club,** which deals with all facets of 68xx micro systems, meets at 7.30 pm on the second Tuesday of each month at Balwyn Branch Library, 366 Whitehorse Rd, Balwyn, Vic 3103. For further information contact club secretary Tony Douglas, 10 Savannah Cres, Epping, Vic 3076. (03)401-4592.

PC paintbrush

Technical Imports is marketing a new 'paint' package, the PC Paintbrush, for the IBM-PC family and most MS-DOS compatibles. It will run on most 320 x 200 colour graphics cards and on 19 higher resolution cards including the IBM Enhanced Graphics Adaptor, PCjr, Tecmar Graphics Master and the Hercules monochrome and colour boards.

With text there is a choice of 14 founts (roman, italic, sans serif, euro, etc) of both vector and bit-mapped types, presentable in 15 styles (light, medium, bold, shadow, outline, kerning, etc), and nine sizes. OCR founts and proportional spacing are also available.

The paintbrush has a selection of nine input/cursor control devices from a range of mice, joysticks, digitizers and touchscreens. The output list of 30 brand name devices includes printers, pen plotters, inkjet copiers and HP Thinkjet.

The PC Paintbrush allows the user to capture graphs, charts and images from any other graphics software (including Lotus 1-2-3, Wordstar, Super Calc 3) and dress them with text, colours and textures. Pull-down menus provide countless drawing options such as 10 line widths, variable brush types, scaling area fill, definable fill patterns, zooming, a grid for regular shapes, snap-to grids, create / cut / store / recall / paste/ move/copy entire creations or parts of your image as symbols/ objects, etc. In the production of 3D pictures it is possible to invert, shrink, expand and tilt objects, plus rotate them in increments of 90 degrees.

The screen menu can be removed at will so the entire area can be filled with graphics or screen dumps to photographic output devices. In addition, stored pictures can be rearranged in any sequence and played back as an electronic slide show.

The PC Paintbrush is priced at $250 RRP and there are no 'extra' cost options. For more details contact **Technical Imports Australia, PO Box 176, Crows Nest, NSW 2065. (02)922-6833.**

BRIEFS

More storage for IBM PC
Teac's PS-5150 mass storage system is plug compatible with the IBM-PC. It is a single compact unit that combines a 5¼" hard disk drive and the MT-2ST digital cassette tape streamer to give a capacity of 10M bytes formatted. For more information contact Measurement & Control Division, Electrical Equipment Limited, 2-8 Lyon Park Rd, North Ryde, NSW 2113.

Educational software sourcebook
Tandy Australia Ltd has released a major reference manual, *The Educational Software Sourcebook*, covering over 600 software packages designed for classrooms and school administration. Copies are available from Tandy stores for $14.95 RRP.

CSIRONET commercial franchise
The Australian computer network CSIRONET has signed a commercial franchise agreement giving Intran Australia management and marketing rights for CSIRONET services in Perth and Adelaide. Intran is a proprietary company formed by the South Australian based Information Delivery Pty Ltd and the Western Australian non-profit company, Systems Research Institute of Australia. CSIRONET is claimed to be Australia's most extensive computer communications network.

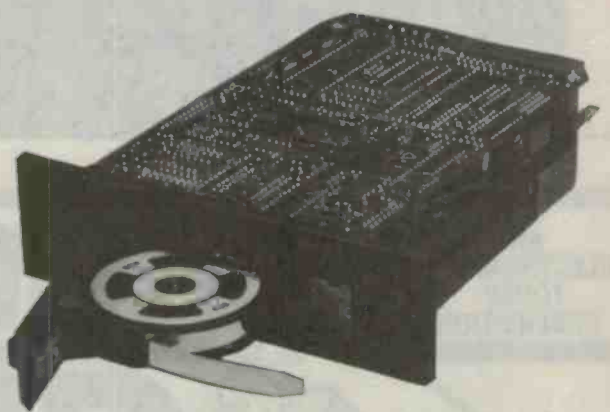
Microsoft Pascal
The new Microsoft Pascal 3.3 is able to link to Fortran, C and Macro Assembler. A major feature is the inclusion of a portion of the Microsoft C Library to support two function calls. For further information contact Microsoft Pty Ltd, 17 Rodborough Rd, Frenchs Forest, NSW 2086 (02)452-5088.

Engineering graphics for PCs
The IBM Personal Computing Engineering/Scientific Series of hardware and software options offers extended graphics capabilities. Another new release from IBM, the Personal Computer Enhanced Colour Display and Enhanced Graphics Adapter, offers high-definition text and graphics in up to 16 colours simultaneously from a palette of 64 colours.

Poor person's software
The California based Poor Person Software organization, which specializes in CP/M 2.2 computers, has appointed Glyphic Software of Sydney as its sole Australian distributor. An early release is the Write-Hand Man which allows the user to perform other tasks while wordprocessing or running a data base application. Catalogues are available from Glyphic Software, PO Box 391, Pennant Hills, NSW 2120.

Software competition
A first prize of $1000 is being offered in the Jacaranda National Educational Software Award, an annual competition established to encourage the design and development of high quality software for infant, primary or secondary school use. Prizes of $500 and $250 will be awarded to the runners-up. Entry forms are available from Jacaranda Software, 65 Park Rd, Milton, Qld 4064. Entries must be submitted by 1 November, 1985.

Tape drive links
Daneva Australia's newly released ID series of tape transport provides 10M bytes of storage on ¼" tape. The series interfaces directly with SA300 and SA450 floppy controllers, and the unit fits into the same space occupied by the standard half-height floppy. Further details are available from Daneva Australia, 64-66 Bay Rd, Sandringham, Vic 3191.



Apple videotex

Apple Computer Australia has released datamodem and software bundles for Apple Macintosh and IIc personal computer users who wish to access Australia's growing array of videotex services.

The bundles for both computers are based on the sophisticated yet compact Apple Modem 1200, a 300 bps and 1200/75 Prestel full duplex datamodem with Hayes Smartmodem compatibility. This modem features automatic dial and automatic answer. With communications software, it allows remote connection across standard Telecom telephone lines with any approved Australian modem at 300 bps, or connection at 1200/75 with any normal Australian videotex (Prestel) modem. As well, any US standard Bell 103 modem can be connected at 300 bps.

The Modem 1200 was designed and manufactured for Apple Computer Australia by Sydney-based NetComm. It acts as the base for a standard Telecom telephone handset and is normally supplied with all necessary accessories, but without software.

Netcomm also designed the new Apple videotex communications bundles.

The MacVideotex software makes full use of the Macintosh interface. The user can make complete files of videotex transmissions or cut and paste from videotex while transmissions continue. "Saved" material can later be "massaged" as MacWrite documents. Auto dial, auto log-on and screens may be printed.

On the Apple IIc with Modem 1200, the Videotex II software converts the IIc to a full interactive videotex terminal with the ability to save videotex transmissions. Auto dial, auto log-on and printing facilities also apply.

The new bundles allow users to access Telecom's Viatel videotex service, which includes financial and currency information, banking services (from the Commonwealth, ANZ, Westpac and National Australia banks), travel booking services, and current affairs information. Viatel users will also be able to utilize the videotex service to send telex messages.

Both videotex bundles will support the CET teleloading protocol, allowing users to download programs and datafiles.

Bundles for the Macintosh and IIc cost $795 RRP, including tax. The software packages are available separately to current modem owners for $99 RRP.

For more information contact **Apple Computer Australia, 37 Waterloo Rd, Nth Ryde, NSW 2113. (02) 888-5888.**

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Alarm Clock

David Rapson, Bellevue Heights SA 5050

This is a digital clock program with an alarm/reminder call. The time is displayed in hours, minutes and seconds. You will need to make slight modifications to the program if you run a 2 MHz machine. Then line 310 should read: FOR N=1 to 382.

If you want a twenty-four hour clock you will have to alter line 430. This should read: IF (F=2) and (E=5) ... instead of IF (F=1) and (E=3).

```
00160 REM Written by David Rapson  S. Australia  24 May 1984
00170 CLS : PRINT "                <<<< Digital Clock >>>>"
00180 PRINT : PRINT
00190 PRINT "Would you like a reminder call  (y/n) ?";
00200 Q1$=KEY$ : IF Q1$="" THEN 200
00210 PRINT : PRINT
00220 IF Q1$="y" OR Q1$="Y" THEN INPUT "Message:";M1$ :   INPUT "Alarm time plea
se  hh,mm ";T,R ELSE LET U=9 : GOTO 250
00230 U=(T/10) : T=T-(U*10)
00240 S=(R/10) : R=R-(S*10)
00250 PRINT:INPUT "Enter current time please!  HH,MM,SS ";E,C,A
00260 POKE 220,22 :REM removes cursor (poke 220,111 to restore)
00270 F=(E/10) : E=E-(F*10)
00280 D=(C/10) : C=C-(D*10)
00290 B=(A/10) : A=A-(B*10)
00300 CLS : REM this is the start of the timing loop
00310 FOR N=1 TO 755: NEXT N :REM this may need some adjusting
00320 A=A+1
00330 IF A<=9 THEN 440
00340 A=0 : B=B+1
00350 IF B<=5 THEN 440
00360 B=0 : C=C+1
00370 IF C<=9 THEN 440
00380 C=0 : D=D+1
00390 IF D<=5 THEN 440
00400 D=0 : E=E+1
00410 IF E<=9 THEN 430
00420 E=0 : F=F+1
00430 IF (F=1) AND (E=3) THEN LET A=0:B=0:C=0:D=0:E=1:F=0
00440 CURS 21,8 : PRINT F1E1" : "1D1C1" : "1B1A1
00450 IF F=U AND E=T AND D=B AND C=R THEN CURS 1,14 : PRINT F1E1":"1D1C,M1$ :FOR
 I=1 TO 38 :PLAY 1119 :NEXT I : B=B+1 : R=R-1
00460 GOTO 310
```

False Keyboard

Jeff Brown, Echuca Vic 3564

If you want to trick your friends (and who doesn't?) try this false keyboard. Simply type in the following program and save it so that when you reload, it will automatically start. (To make an auto start program go to monitor and type: >D "filename" B 8C0 C3E 801E <CR>; this is the same as SAVING in BASIC.)

When you load the program for your friends it will come up with the "ready" message, just as if you had pressed RESET. Let your friends type RUN and watch the expressions on their faces as all the wrong letters come up on the screen. If they press RETURN the "syntax error" message comes up and if they press RESET the "ready" message will come up, but the keys will still be jumbled. The LOCK key still works, as do BACK SPACE and DELETE. There is no way out!

```
00100 CLS
00110 PRINT"Ready'\'>";
00120 POKE 140,1:POKE 162,30:POKE 163,128
00130 DIM A1$(65)
00140 STR$(300)
00150 FOR I=1 TO 65:READ A1$(I):NEXT I
00160 K1$=KEY$:IF K1$=""THEN 160
00170 IF K1$=CHR$(8):PRINT CA1 81;:GOTO 160
00180 IF K1$=CHR$(9):GOTO 160
00190 IF K1$=CHR$(10):GOTO 160
00200 IF K1$=CHR$(13):PRINT \\'Syntax error'\\'>";:GOTO 160
00210 IF K1$=CHR$(27):GOTO 160
00220 IF K1$=CHR$(32):PRINT CA1 32];:GOTO 160
00230 IF K1$=CHR$(127):PRINT CA1 127];:GOTO 160
00240 P=PEEK(257)
00250 IF P=0:LET L=26
00260 IF P=1:LET L=0
00270 X=INT(RND(#39)+1
00280 X=X+L
00290 PRINT A1$(X);
00300 GOTO 160
00310 DATA "A","B","C","D","E","F","G","H","I","J","K","L","M"
00320 DATA "N","O","P","Q","R","S","T","U","V","W","X","Y","Z"
00330 DATA "1","2","3","4","5","6","7","8","9","0","-","@","?"
00340 DATA "a","b","c","d","e","f","g","h","i","j","k","l","m"
00350 DATA "n","o","p","q","r","s","t","u","v","w","x","y","z"
```

CONTRIBUTORS PLEASE NOTE

All contributions to this column should be accompanied by a listing of the program from a printer. Hand written or typed listings are not acceptable.

There are two reasons for this. The first is that a listing from your computer gives us some guarantee that *you* have got the listing correct.

Secondly, if you present us with a neat final copy of your program we can use photographic techniques to reproduce it in the magazine, without risk of errors.

However, if you present us with a scrawl done on the back of someone's old fag packet it needs to be manually typed twice here, with consequent increase in labour on our part and increase in the probability of errors.

Contributors will be paid $20 for each item published in this column. Submissions must be original programs which have not been previously published. You may send as many programs as you wish with the accompanying declaration.

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

David Rapson, Bellevue Heights SA 5050

This program allows you to change the shape of the cursor used in BASIC. Enter and RUN the program. When the menu comes up it will allow you to choose six different types of cursor.

```
00140 REM Written by David S Rapson  S. Australia  16/3/1984
00150 CLS :INVERSE : PRINT" Cursor Selector ": NORMAL : PRINT
00160 PRINT "1  Block solid"
00170 PRINT "2  Block flashing slowly"
00180 PRINT "3  Block flashing fast"
00190 PRINT "4  Underline solid"
00200 PRINT "5  Underline flashing slowly"
00210 PRINT "6  Underline flashing fast"
00220 PRINT "7  Exit to Basic"
00230 PRINT
00240 PRINT"Select";
00250 A1$=KEY$
00260 IF A1$="" THEN 250
00270 IF A1$>"7" OR A1$<"1" THEN 250
00280 IF A1$="1" THEN LET X=1
00290 IF A1$="2" THEN LET X=96
00300 IF A1$="3" THEN LET X=64
00310 IF A1$="4" THEN LET X=15
00320 IF A1$="5" THEN LET X=111
00330 IF A1$="6" THEN LET X=79
00340 IF A1$="7" THEN END
00350 POKE 220,X
00360 GOTO 110
```

Trapdoor

Neil Blanchard, Ross Creek Vic 3352

The object of this game is to get 15 scouts safely across an old bridge. Random holes appear, through which the scouts may fall if you are too slow to save them.

The space bar starts each scout across the bridge and the 'J' key makes him jump the holes. However, if you press the 'J' key too early he will move backwards. There is a minimum of one hole and a maximum of five holes appearing at random.

I have also marked the program with some REM statements. Line 97 selects a random speed for moving the scout across the bridge, line 113 has a loop as a time delay for the speed the scout moves, and line 61 deletes the cursor.

```
00001 CLS:SPEED 30:CLEAR:POKE257,01
00003 FORA=64272TO64272+(16*4)-1
00005 READ B
00007 POKEA,B
00009 NEXTA
00011 FORA=64000TO64015
00013 POKEA,0
00015 NEXT A
00017 CLS
00018 REM START OF PROGRAM
00019 CURS18,2:PRINT"** Welcome to TRAPDOOR **"
00021 CURS4,6:PRINT"Please type in your name [max 8 letters]"
00023 CURS4,8:INPUTM1$:L=LEN(M1$)
00025 IFL>8THENCURS4,8:PRINT[A20 32]:GOTO23
00027 IFM1$=""THEN23
00029 FORZ=1TO200:NEXTZ
00031 CURS4,10:PRINT"Do you requires instructions Y/N"
00033 Q1$=KEY:IFQ1$=""THEN33
00035 IF Q1$="Y" OR Q1$="y"THEN 37 ELSE61
00037 CLS:CURS22,2:PRINT"<<< TRAPDOOR >>>"
00039 PRINT "You are in charge of 15 overweight boy scouts, You have to"
00041 PRINT"get all the boys across a dangerous, old bridge. Beneath this"
00043 PRINT"is a wild, rushing river. As each scout moves across the bridge"
00045 PRINT"a hole may appear. You have to press the 'J' key to make the"
00047 PRINT"scout jump the hole. If you're slow, he will drop into the river"
00049 PRINT"below and drown. If you press the key too soon your boy will"
00051 PRINT"go back 4 steps. Press space bar to start each boy."
00053 PRINT"Be careful. Some scouts get nervous and try to run across."
00055 PRINT"Good luck,  "M1$
00057 CURS20,15:PRINT"Hit any key to continue"
00059 IFKEY=""THEN59
00061 CLS:POKE220,20:REM  DELETES CURSOR
00063 N=15:F=0:S=0
00065 CURS2,2:PRINT"Number to cross"N
00067 CURS30,2:PRINT"Number across"S
00069 CURS2,3:PRINT"Number drowned"F
00071 PCG
00073 FORC=61956TO62011:POKEC,-78:NEXTC
00075 FORG=61952TO61955:POKEG,-77:NEXTG
00077 FORG=62016TO62018:POKEG,-77:NEXTG
00079 FORG=62080TO62081:POKEG,-77:NEXTG
00081 POKE62144,-77
00083 FORG=62012TO62015:POKEG,-76:NEXTG
00085 FORG=62077TO62079:POKEG,-76:NEXTG
00087 FORG=62142TO62143:POKEG,-76:NEXTG
00089 POKE62207,-76
00091 FORE=62336TO62463:POKEE,94:NEXTE
00093 CURS58,6:PRINT[A5 32]:CURS26,14:PRINT[A14 32]
00095 IF N=0THEN153
00097 P=61888:W=22:V=INT(RND*75)+15:REM  SETS RANDOM SPEED
00099 CURS17,2:PRINT[A4 32]:NORMAL:CURS17,2:PRINTN:PCG
00101 K1$=KEY$:IFK1$=""THEN101
00103 IF K1$=" "THEN105ELSE101
00105 H=61952+(INT(RND*56)+4)
00107 POKEP,-79:A1$=KEY$:IFA1$=""THEN109ELSE111
00109 IFP+68=HTHENPOKEH,32:GOTO127ELSE113
00111 POKEP,32:IFP<61892THEN113ELSELETP=P-4:POKEP,-79
00113 FORZ=1TOV:NEXTZ:REM TIME DELAY FOR SPEED
00115 POKEP,32:P=P+1:IFP<61951THEN107
00117 POKE61951,32:S=S+1:N=N-1
00119 CURS38,6:NORMAL:PRINT"Phew!":PCG
00121 CURS43,2:PRINT[A4 32]:NORMAL:CURS43,2:PRINTS:PCG
00123 FORZ=1TO200:NEXTZ
00125 GOTO93
00127 IFP+68=>HANDP+68<H+5THEN129 ELSE105
00129 A1$=KEY$:IFA1$=""THEN133
00131 IFASC(A1$)=74ORASC(A1$)=106THEN137
00133 POKEP,32:P=P+1:POKEP,-79:FORZ=1TOV:NEXTZ
00135 IFP+64=HTHEN139ELSEGOTO129
00137 POKEP,32:P=P+2:POKEH,-78:GOTO105
00139 POKEP,32:IFP>62336THENLETF=F+1:GOTO145
00141 P=P+64:POKEP,-79:PLAYW
00143 FORZ=1TO10:NEXTZ:W=W-1:GOTO139
00145 CURS16,3:PRINT[A4 32]:NORMAL:CURS16,3:PRINTF
00147 N=N-1:POKEH,-78:CURS26,14:PRINT"gurgle gurgle"
00149 POKEP,94:FORZ=1TO25:NEXTZ
00151 PLAY10,2,5,3,7,2,5,2,10,2,9,2,10,2:GOTO93
00153 CLS:NORMAL
00155 IFS=15THENCURS4,4:PRINT"WELL DONE. YOU'VE SAVED ALL YOUR SCOUTS.":GOTO165
00157 IFS<15 AND S>12THENCURS4,4:PRINT"GOOD TRY, "M1$:GOTO165
00159 IFS<12 AND S>8THENCURS4,4:PRINT"BAD LUCK,"M1$ ". YOU'VE LOST SOME GOOD S
OUTS":GOTO165
00161 IFS<8AND S>5THENCURS4,4:PRINT"NOT GOOD ENOUGHT,"M1$". YOUR LOSSES ARE HE
VY":GOTO165
00163 CURS4,4:PRINT"SHAME ON YOU, " M1$","F" OF YOUR SCOUTS DROWNED."
00165 FOR Z=1TO500:NEXTZ
00167 CURS4,6:PRINT"DO YOU WANT TO TRY AGAIN Y/N?"
00169 Q2$=KEY:IFQ2$=""THEN169
00171 IF Q2$="Y" OR Q2$="y" THEN61
00173 CURS4,8:PRINT"DOES SOME ELSE WANT TO PLAY Y/N?"
00175 Q3$=KEY:IFQ3$=""THEN175
00177 IFQ3$="Y"ORQ3$="y"THEN17ELSEPOKE220,111:CLS:END
00178 REM DATA FOR MAN AND BRIDGE
00179 DATA28,127,34,85,73,34,28,62,82,89,65,127,54,36,36,55
00181 DATA0,255,129,129,129,66,36,255,0,0,0,0,0,0,0,0
00183 DATA0,255,131,130,130,132,132,136,136,144,144,160,160,192,192,192
00185 DATA 0,255,193,65,65,33,33,17,17,9,9,5,5,3,3,3
```

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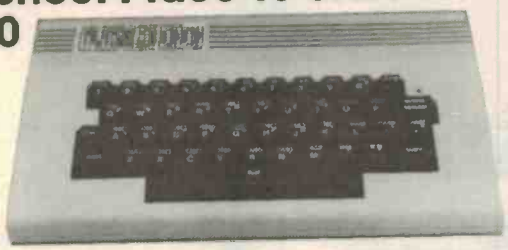

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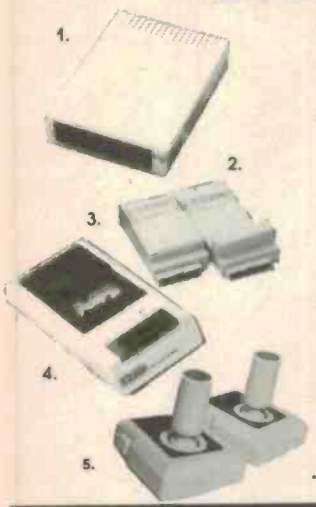

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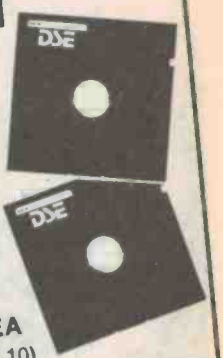

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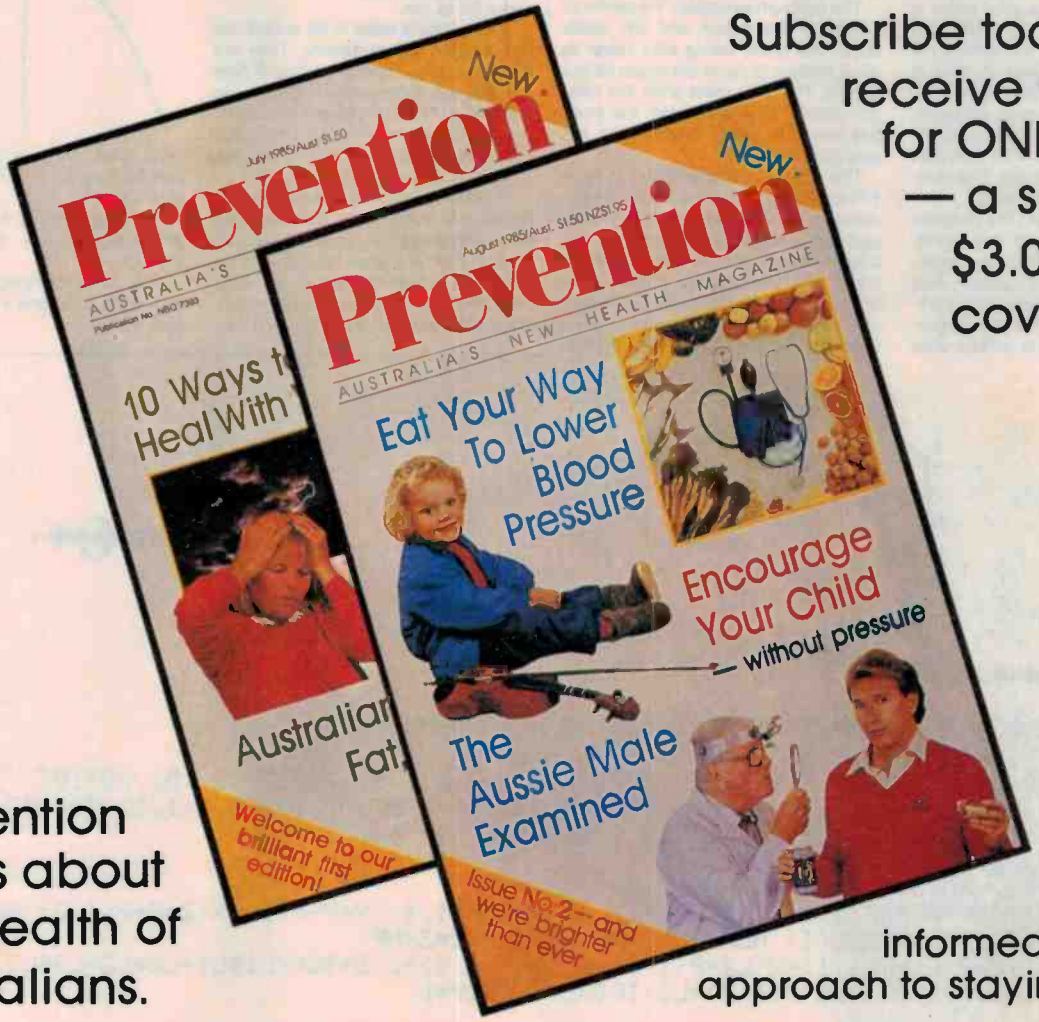

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Hexagon

Peter Skilton, Seaford Vic

This program illustrates the principles of rotation and projection of a three dimensional object onto a VDU screen.

Mutually perpendicular x,y,z axes are chosen as shown in the diagram. Each vertex of the hexagonal prism is numbered 1 to 12 and the data statements in lines 30 and 40 contain the x,y,z co-ordinates of these vertices in this numerical order. When constructing the figure, the program automatically draws lines between the adjacent points: joins 1 to 2, 3 to 4 as indicated by the bold lines and arrows. The number of points at this stage is NP.

To complete the object the program draws NL lines between the points. The pairs are given in the data statement in line 50 and their constructed lines are shown dashed in the diagram. The variables SU and HW give respectively half the number of screen units used and the height-to-width ratio of the screen border. Therefore, by providing NW, NL and NP and the vertex co-ordinate any 3D object can be drawn and rotated on the screen.

The program calculates the centre of gravity of the object and will rotate about this point, taking care never to allow rotation to move the object off the screen. The user must enter the rotation details when prompted, the positive rotations being indicated on the axis diagram.

The rotation transformation in lines 175 to 185 will cause the prism co-ordinates to be updated indefinitely after each step. Note that the prism in the diagram has been rotated several times. The speed of successive rotations seems to be governed by the rate of drawing, the 3K expander cartridge used and the screen refreshment rate.

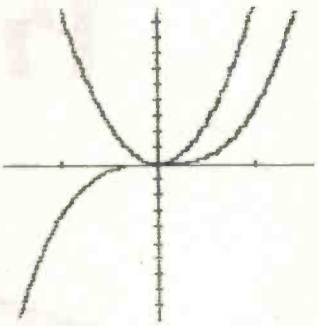
Graph Sketch

Paul Marshall, Oxford, N. Canterbury, NZ

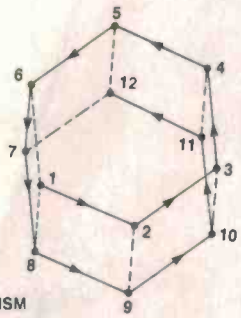
This program will plot any function on a cartesian plane and will also perform some operations on the function. It requires a super expander and an additional 8K to run.

The functions need to be edited into the program before running. They are function A (line 10) and function B (line 20) and are expressions defining y in terms of x. Axes ranges are requested when the program is run. If similar scales are required for both axes then y must be approximately 0.6x.

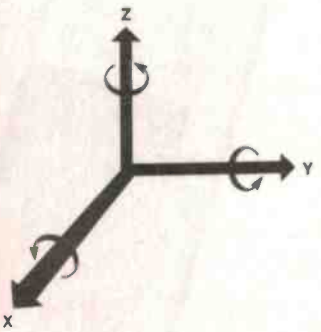
There is some delay while the calculations are done. Axes are displayed when the program is ready to continue. Pressing key A causes function A to be printed, B causes function B, E erases both functions and F ends the program. D will differentiate the last function entered, I will integrate it, V attempts to plot the inverse and R repeats the last plot. The '+', '−', '*', and '/' symbols must be followed by A or B to perform an operation on the appropriate function.



The accompanying screen dump shows the functions $y=x^2$ and its integral: $y=0.5x^3$.



HEXAGONAL PRISM




```
10 REM HEXAGONAL   DRAWS AND ROTATES AN HEXAGONAL PRISM
20 REM P.F.SKILTON  12/83
30 DATA0,0,0,.5,-.707107,0,1.5,-.707107,0,2,0,0,1.5,.707107,0,.5,.707107
40 DATA0,.5,.707107,1,0,0,1,.5,-.707107,1,1.5,-.707107,1,2,0,1,1.5,.707107,1
50 DATA6,1,7,12,5,12,4,11,3,10,2,9,1,8
100 NP=12:NL=7:HW=0.713:SU=511
105 DIMNP(3),RO(3,3),C(2*NL),P(NP,3)
110 FORI=1TONP:READP(I,1),P(I,2),P(I,3):X=X+P(I,1):Y=Y+P(I,2):Z=Z+P(I,3):NEXT
115 FORI=1TO2*NL:READC(I):NEXT:X=X/NP:Y=Y/NP:Z=Z/NP
120 FORI=1TONP:L1=P(I,1)-X:L2=P(I,2)-Y:L3=P(I,3)-Z:D=SQR(L1*L1+L2*L2+L3*L3)
125 P(I,1)=L1:P(I,2)=L2:P(I,3)=L3:IFD>LYTHENLY=D
130 NEXT
135 LY=SU/LY:PRINT"CENTRE OF GRAVITY: ":PRINT:PRINT"   X = ";X
140 PRINT"   Y = ";Y:PRINT"   Z = ";Z:PRINT
145 DEFFNX(J)=INT(HW*LY*P(J,2)+SU+0.5)
150 DEFFNY(J)=INT(SU-LY*P(J,3)+0.5)
155 PRINT" ROTATION IN DEGREES: ":PRINT
160 INPUT"   X-AXIS = ";X0:INPUT"   Y-AXIS = ";Y0:INPUT"   Z-AXIS = ";Z0
165 X0=X0*π/180:Y0=Y0*π/180:Z0=Z0*π/180:GRAPHIC 2:COLOR 6,6,1,1
170 SX=SIN(X0):CX=COS(X0):SY=SIN(Y0):CY=COS(Y0):SZ=SIN(Z0):CZ=COS(Z0)
175 RO(1,1)=CZ*CY:RO(1,2)=-SZ*CX-CZ*SY*SX:RO(1,3)=SZ*SX-CZ*SY*CX
180 RO(2,1)=SZ*CY:RO(2,2)=CZ*CX-SZ*SY*SX:RO(2,3)=-CZ*SX-SZ*SY*CX
185 RO(3,1)=SY:RO(3,2)=CY*SX:RO(3,3)=CY*CX:GOTO205
190 FORI=1TONP:FORR=1TO3:NP(R)=0
195 FORC=1TO3:NP(R)=NP(R)+RO(R,C)*P(I,C):NEXT:NEXT
200 FORJ=1TO3:P(I,J)=NP(J):NEXT:NEXT
205 SCNCLR
210 FORI=1TONP-1:DRAW 3,FNX(I),FNY(I) TO FNX(I+1),FNY(I+1):NEXT
215 FORI=1TO2*NL-1STEP2:DRAW 3,FNX(C(I)),FNY(C(I))TOFNX(C(I+1)),FNY(C(I+1)):NEXT
220 GOTO190
```

```
1 PRINTCHR$(14):GOTO30
5 REM P.R.MARSHALL
6 REM 36 HIGH ST.
7 REM OXFORD, N.Z.
10 Y=X*X
19 RETURN
20 Y=2*X
29 RETURN
30 PRINT"s xxxxgraphsketchxxxx"
35 PRINT
37 PRINT" a:fUNCTION a(LINE 10)"
38 PRINT" b:fUNCTION b(LINE 20)
40 PRINT" oPERATORS:+ - * /"
41 PRINT:PRINT" d:dIFFERENTIATE"
42 PRINT:PRINT" i:INTEGRATE"
43 PRINT:PRINT" v:INVERSE"
44 PRINT:PRINT" r:rEPEAT"
45 PRINT:PRINT" e:eRASE"
46 PRINT:PRINT" f:fINISH"
50 PRINT
60 U=1.74:N$="AB+-/*IDVEFR"
61 INPUT" x,y rANGES";RX,RY

65 IFRX<=0ORRY<=0THEN61
70 R=RX:GOSUB105:SX=T
80 R=RY:GOSUB105:SY=T
90 GOTO200
105 IFR<=1THEN139
110 T=.1
120 IF10*T>=RTHEN195
130 T=10*T:GOTO120
139 T=1
140 IFT/10<=RTHEN190
155 T=T/10:GOTO140
190 T=T/10
195 RETURN
200 DIMA(127),B(127),C(127),D(127)
203 FORXH=0TO127
205 X=(XH-64)/64*RX:GOSUB10:A(XH)=Y:NEXT
213 FORXH=0TO127
215 X=(XH-64)/64*RX:GOSUB20:B(XH)=Y:NEXT
220 SCNCLR:GRAPHIC2
225 DRAW2,512,0TO512,1023
226 DRAW2,0,512TO1023,512
230 A1=512:A2=1023:A3=512*SX/RX:A4=503:A
5=521:GOSUB260
235 A2=0:A3=-A3:GOSUB260
240 A3=-512*SY/RY:GOSUB270
250 A2=1023:A3=-A3:GOSUB270
255 GOTO405
260 FORG=A1TOA2STEPA3:DRAW2,G,A4TOG,A5:N
EXT:RETURN
270 FORG=A1TOA2STEPA3:DRAW2,A4,GTOA5,G:N
EXT:RETURN
405 GETA$:IFA$=""THEN405
406 FORT=1TO12
408 IFA$=MID$(N$,T,1)THENZ=T
410 NEXT
438 IFZ>2ANDZ<7THEN465
440 FORT=0TO40:D(T)=U:NEXT
451 FORXH=0TO127
460 ONZGOTO475,500,550,600,650,700,750,8
00,850,220,950,1000
465 GETA$
470 O=0:IFA$="B"THENO=1:PRINT"▲":GOTO440
471 IFA$="A"THENPRINT"▲":GOTO440
472 GOTO465
475 D(XH)=A(XH)
480 NEXT:GOTO900
500 D(XH)=B(XH):GOTO480
550 REM +
560 IFA(XH)=UORB(XH)=UTHEND(XH)=U:GOTO48
0
565 IFOTHEN580
570 D(XH)=C(XH)+A(XH):GOTO480
580 D(XH)=C(XH)+B(XH):GOTO480
600 REM -
610 IFA(XH)=UORB(XH)=UTHEND(XH)=U:GOTO48
0
615 IFOTHEN630
620 D(XH)=C(XH)-A(XH):GOTO480
630 D(XH)=C(XH)-B(XH):GOTO480
650 REM /
655 IFC(XH)=UTHEND(XH)=U:GOTO480
660 IFOTHEN690
675 IFA(XH)=0ORA(XH)=UTHEND(XH)=U:GOTO48
0
680 D(XH)=C(XH)/A(XH):GOTO480
690 IFB(XH)=0ORB(XH)=UTHEND(XH)=U:GOTO48
0
695 D(XH)=C(XH)/B(XH):GOTO480
700 REM *
710 IFC(XH)=UTHEND(XH)=U:GOTO480
715 IFOTHEN730
720 IFA(XH)=UTHEND(XH)=U:GOTO480
725 D(XH)=C(XH)*A(XH):GOTO480
730 IFB(XH)=UTHEND(XH)=U:GOTO480
740 D(XH)=C(XH)*B(XH):GOTO480
750 REM INTEGRATE
752 IF XH=64THEND(64)=0:GOTO480
753 IFC(XH)=UTHEND(XH)=U:D(64)=0:GOTO480
755 IFXH<64THEN780
756 IFXH=127THEN480
760 D(XH+1)=D(XH)+RX*(C(XH+1)+C(XH))/127
:GOTO480
780 D(63-XH)=D(64-XH)-RX*(C(63-XH)+C(64-
XH))/127:GOTO480
790 GOTO480
800 REM DIFFERENTIATE
802 IFC(XH)=UTHEN480
805 IFXH=127THEN480
810 D(XH)=(C(XH+1)-C(XH))*64/RY
820 GOTO480
850 REM INVERSE
851 IFXH<>0THEN855
853 FORG=0TO127:D(G)=U:NEXT
855 IFC(XH)=UTHEN480
860 G=INT((C(XH)*64/RY)+.5)+64
865 IFG>127ORG<0THEN480
870 D(G)=(XH-64)*RY/64
880 GOTO480
900 F=0
901 FORXH=0TO127
902 IFXH=0THENF=1
905 C(XH)=D(XH)
910 IFD(XH)=UTHENF=1:NEXT:GOTO405
912 CH=64-D(XH)*64/RY
916 IFCH<0ORCH>127THENF=1:NEXT:GOTO405
919 IFF=THEN:POINT2,XH*8,CH*8:F=0:NEXT:GO
TO405
920 DRAW2TOXH*8,CH*8
925 F=0:NEXT
930 GOTO405
950 GRAPHIC0:PRINTCHR$(142):END
1000 REM REPEAT
1010 D(XH)=C(XH):GOTO480
```

Halley's could disrupt radio signals

Halley's comet will pass Earth in February next year, at a distance of 90 million miles.

While most Australians will be looking skywards, hoping for a glimpse of the comet, shortwave listeners will be eager to find if this famous body causes any disruption to shortwave transmissions as it passes between the sun and the Earth. Scientists will also be evaluating the composition of the comet and communications experts will be studying the effect, if any, on the ionosphere.

In a recent broadcast over Radio Nederland, Jonathan Marks asked John Branigan about Halley's Comet, which will become visible as a distant speck through binoculars on 20 November. The comet will be moving fast and will swing around the sun early next year. When it comes out from behind the sun, it will be met by three probes.

The probes are well on their way, and will reach Halley's Comet in March next year. The first probe to pass through the comet is the Russian-French Vega 1, which passes Halley on 8 March 1986 at 10,000 km — described as a "safe" distance. This probe will be looking at the comet and taking readings of its composition. A second Russian probe, Vega 2, is scheduled to come within 5000 km of Halley, a distance considered dangerously close. Both Vega probes, launched last December, will inspect Venus en route. The final satellite launched by the European Space Agency in July is on a suicide path, moving to within 500 km of the comet. It will penetrate well into the dust cloud and try to analyze the comet's tail, and it probably will not survive. As well as these major probes, two Japanese probes have been sent but they will not venture into close proximity of the comet.

There is some debate as to whether or not the material in the tail of Halley's Comet could affect the ionosphere. When the comet was last sighted some 75 years ago knowledge of radio propagation was in its infancy. Over the past 50 years some large comets have followed a similar path, with little effect on radio communication.

People living in the Southern Hemisphere should be able to get a good view of the comet as it goes around the sun in February and March. Those in the Northern Hemisphere will get a brief glimpse in November when it first appears and then another in April, though this latter will be only a poor sighting before Halley's Comet disappears for another 75 years.

— Arthur Cushen

BBC programmes in focus

Two programmes of interest to shortwave listeners are heard in the BBC World Service: "Waveguide" comments on reception and frequency changes, while "Letterbox" presents comments, praise and criticism about BBC programmes.

"Waveguide" is a weekly broadcast of 10 minutes in which frequency changes in the World Service, surveys of receivers and aerials, and general information on how best to receive London are discussed. Recently rescheduled, the broadcast is now heard on Tuesdays at 1115 and 2100 UTC, Wednesdays at 0430 UTC and Thursdays at 0130 UTC. The signals best received in this area are the transmissions on Wednesdays at 0430 UTC on 9410 and 5975 kHz, and Tuesdays at 1115 UTC on 6195, 11750 and 15070 kHz.

"Letterbox", featuring comments about BBC programmes from listeners worldwide, is conducted by Margaret Howard and broadcast on Mondays at 0530 UTC, Fridays at 1445 UTC and Saturdays at 0145 and 2315 UTC. The major criticism from listeners is the change of broadcast times of many favourite programmes. However, one must realize that there are over 600 programmes scheduled in the World Service each week, so trying to provide one broadcast of a programme to each area of the world during peak listening time is a massive jigsaw job.

The broadcast of "Letterbox" on Monday at 0530 UTC is early for listeners in Australia, while the transmission at 1445 UTC is too late for New Zealand and eastern Australia, though suitable for Western Australia.

Margaret Howard receives a variety of comment, both praise and criticism, and she is able to bring to the microphone heads of various BBC departments who are able to answer listeners' questions fully and with some authority.

Comment on BBC programmes is always welcomed at **"Letterbox", BBC Bush House, Box 76, The Strand, London WC2B 4PH.**

— Arthur Cushen

Right. Margaret Howard, compere of the popular BBC "Letterbox" programme.
Below. Members of BBC World Service's "Waveguide" team pictured in the studios at Bush House, London. Left to right: Andrew Piper, presentation organizer, BBC World Service; Mike Sollars, BBC engineer; Tom Walters, producer, and Elizabeth Francis presenter.

Improved gospel signals

New transmitters and new aerial systems have helped Australian listeners to get better reception of gospel broadcasters, particularly from the Pacific basin area.

HCJB in Quito, Ecuador, is now using a new 49-metre band aerial resulting in excellent reception in the South Pacific. This new antenna provides coverage of Europe and the South Pacific, with a power capability of 500,000 watts. It is HCJB's second largest antenna structure, measuring 108 metres in both height and width. Only the station's steerable antenna is larger than this.

HCJB's broadcasts to Europe cover the area from the southern edge of the USSR to north of Lapland at the tip of the Scandinavian peninsula. This coverage includes all of central and northern Europe. In the South Pacific direction the coverage extends from Sydney, south to include Melbourne, and then across to South Australia and Western Australia where other antenna beams have been weaker in the past. HCJB uses the 49-metre band to Europe until 0830 UTC on 6205 kHz, while the frequency of 6130 kHz is used to Australia between 0700 and 1100 UTC.

The Far East Broadcasting Company's new station on Saipan in the Northern Marianas is now in operation with three 100 kW transmitters on the air, however there will soon be five transmitters strategically located in a u-shape on a cliff high over the Pacific. The Chinese transmissions of KFBS are heard at 0900 UTC on 11710 kHz. The programme of a gospel nature includes English lessons and Chinese discussion, as well as gospel songs in English and Chinese. The company's second transmitter opens at 0900 UTC on 11720 kHz broadcasting in Russian. The third transmitter opens at 1000 UTC on 15115 kHz in Indonesian. Chinese transmissions are also observed during our mornings from 2100 UTC on 9515 and 9730 kHz, while 15225 kHz is used at 2200 UTC for Indonesian broadcasts.

Transmitter site of KNLS Anchor Point Alaska, which broadcasts gospel programmes to the Pacific.

Adventist World Radio has announced plans for a station at Guam, to be known as AWR Asia. The transmitter, using 100 kW, will augment the present service to Asia which is carried through the Sri Lanka Broadcasting Corporation. Programmes originate from the AWR studios in Poona, India, and are part of the AWR gospel chain of stations. The Poona studios also send "Radio Monitors International", a weekly programme for shortwave listeners which is broadcast from SLBC on Sunday at 1100 UTC on 11835 kHz. The programme is compiled by Adrian Peterson and includes an exhange of information with Radio Canada International on a fortnightly basis.

The Alaskan station KNLS at Anchor Point is now using 9540 kHz for its English broadcast to the Pacific at 0700-0930 UTC. The second transmission at 1730-2000 UTC remains on 7355 kHz. The KNLS English broadcast from 0700 generally consists of popular music, while a transmission from 0930 in Russian contains jazz and dixieland material.

The KNLS schedule from 5 May the uses new frequencies. Broadcasts are at 0700-0930 UTC on 11850 kHz, 0930-1200 UTC on 9695 kHz, 1200-1500 UTC on 9695 kHz, 1500-1730 UTC on 7355 kHz, and 1730-2000 UTC on 7355 kHz.

— Arthur Cushen

Gabon relay captures audience

A survey released by Radio Japan shows that its European audience has increased dramatically following the introduction of programmes carried from the Africa No 1 transmitters at Moyabi, Gabon, and beamed to Europe. In the past Radio Japan has had difficulty providing listeners in Europe with an effective signal and has used the transmitters of Trans-Europe at Sines, Portugal, to help improve reception.

In asking German listeners if they picked up Radio Japan broadcasts to Europe direct or via Gabon, the survey found that 83 per cent preferred the relay base because it provided better reception. Some 77 per cent of listeners to the Italian programme indicated they favoured the relay station. English listeners, too, preferred the relay base, with the broadcast at 0700-0800 UTC favoured by 63 per cent of the audience and the transmission at 1500-1600 UTC reaching 68 per cent of the audience.

Radio Japan broadcasts to Australia daily from 0845-0945 UTC and uses two frequencies, 11875 and 15235 kHz. There is a special broadcast, "Hullo Australia", during the Sunday evening transmissions, and 10 minutes of DX news on Mondays at 0910 UTC.

Radio Japan this year celebrates 60 years of broadcasting. The first transmissions were made on 22 March 1925, with broadcasts on medium and shortwave from JOAK, Tokyo, Today the station broadcasts in 21 languages from facilities in Japan as well as from the relays in Gabon and Portugal.

— Arthur Cushen

KILOHERTZ COMMENT

AUSTRIA: Austrian Radio in Vienna broadcasts to Australia 0700-0900 UTC on 11840 kHz with English 0830-0900 UTC. A second transmission in English at 1030-1100 UTC is on 15270 kHz. Station KTWR Agana, Guam, also uses 11840 kHz causing some interference to the 0830 UTC broadcast from Vienna.

BELGIUM: A transmission in English is received from Brussels at 0030-0125 UTC on 9925 kHz. This transmission offers excellent reception. On Mondays, "Radio World" highlights news of interest to the shortwave listener. A further transmission heard Monday to Friday 0800-0855 UTC is received on 9880 kHz and is for reception in Australia.

FINLAND: Helsinki transmits to the South Pacific 0830-0855 UTC daily on 15115 kHz using 250 kW. The programme features news from the Scandinavian countries. On Saturdays from 0730 UTC a magazine programme highlights news stories of the week, while on Mondays there is an audience response programme during which letters from listeners are answered.

SWITZERLAND: Swiss Radio International has made a major change in its English broadcast, which is now at 0830-0900 UTC and 1000-1030 UTC on 9560, 15305, 15570 and 17830 kHz. The popular "Swiss Shortwave Merry-Go-Round" is now heard each Saturday with the two Bobs who discuss the radio listening hobby. This year Swiss Radio International is celebrating 50 years of operation: it started in 1934 using the transmitters of the League of Nations.

UNITED KINGDOM: Last year the BBC announced plans to build a high powered shortwave transmitting site near Stratford-on-Avon. There was considerable local opposition to the plan, particularly from the Royal Shakespeare Theatre, which was concerned that rf energy would get into equipment, resulting in the love scenes from "Romeo and Juliet" being punctuated by a sudden burst of the BBC theme "Lily Bolero"! The BBC staged a simulated demonstration to remove these fears. However Britain's Environment Secretary, Mr Patrick Jenkin, rejected the application so the BBC may have to reconsider an earlier plan to build the new shortwave station at Washford West, where it already has mediumwave transmitters.

USA: Voice of America is using some out-of-band channels between 0000-0400 UTC in English to Central and South America. Reception has been noted on 9455 and 11580 kHz, and a service to the Far East is well received on 15205 kHz during the same hours. On Fridays these frequencies carry a magazine show at 0230 UTC which includes "Worldwide Shortwave Spectrum", a feature programme for shortwave listeners. The transmissions to Australia at 2200-2400 UTC are on 15185 and 17740 kHz, while broadcasts from 1100 UTC are transmitted on 6110 and 11715 kHz. Voice of America operates round the clock in English and signals are audible most of the day.

USSR: Radio Moscow World Service in English operates 24 hours a day with transmissions directed to Australia for 17 hours daily. Best reception is at 0100 UTC on 15510, 17730, 17850 and 21530 kHz. At 0600 UTC, 15490 kHz joins the programme and at 0900 UTC signals are received on 9790, 11770, 15490 and 15500 kHz. Highlights include "Radio Newsreel" daily at 0510 and 0810 UTC, "Moscow Mailbag" on Mondays and Fridays at 0520 UTC, a DX programme on Sundays at 0520 UTC, and a "Learning Russian by Radio" programme on Sundays at 0230 and 0830 UTC.

This item was contributed by Arthur Cushen, 212 Earn St, Invercargill, New Zealand, who would be pleased to supply additional information on medium and shortwave listening. All times quoted are UTC (GMT) 10 hours behind Sydney time, all frequencies are in kilohertz (kHz).

DOC news

The Minister for Communications' **power to prohibit radio and television broadcasts** may be repealed.

The Minister for Communications, Mr Michael Duffy, said that power to prohibit broadcasts was incompatible with the ideals of a democratic society in peace time. He pointed out that adequate powers exist in other areas of legislation to cover such matters as obscene or indecent broadcasts, or the need to take complete control over broadcasting in an emergency.

The Australian Broadcasting Tribunal (ABT) will continue to have the power to direct commercial licencees to vary their programs to conform with standards determined by the ABT, and it also retains the right to censor any matter considered objectionable in nature.

This statement, however, was made before the Minister's threat to legislate over sporting broadcasts!

Termination clips for tower guys

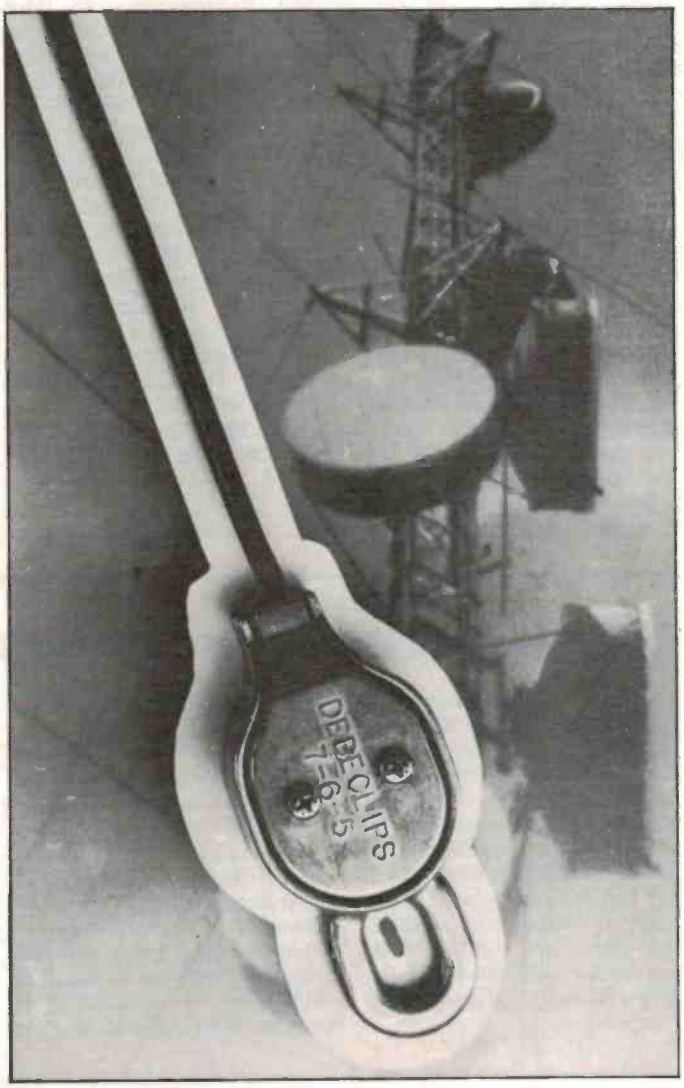
New guy termination clips for Debeglass tower guys are available from GFS Electronic Imports.

For those unfamiliar with Debeglass, it is a high tensile strength, low elongation, non-corrosive, non-conductive guy wire substitute. It has an extremely high strength-to-cross-section ratio brought about by the use of a continuous filament fibreglass core sheathed in UV stabilized PVC. For example, 4 mm DB-4 has a tensile strength of 430 kg, while 5 mm DB-5 is rated at 560 kg tensile strength.

Until recently standard termination procedures for Debeglass included the use of thimbles and 'D' clamps. The new Debeclips offer a time saving alternative which is particularly noticeable on large installations.

Attachment of a Debeglass guy to a Debeclip involves simply knotting the end of the guy, inserting it into the Debeclip, then screwing on its cover.

For further information about Debeglass tower guys and the new Debeclip terminations contact the Australian distributors, **GFS Electronic Imports, 17 McKeon Rd, Mitcham, Vic 3132. (03)873-3777. Telex 38053 GFS.**



We've got semis galore!

Rod Irving Electronics have a huge range of semis at very competitive prices!

ICL7106	19.50
ICL7116	19.50
ICL7117	21.50
ICL7611	6.95
ICL7612	6.95
ICL7660	5.90
ICL7663	4.90
ICL7664	4.90
ICM7211	12.50
ICM7216A	48.50
ICM7216B	44.50
ICM7217A	18.50
ICM7218A	18.50
ICM7224A	21.50
ICM7226A	48.50
ICM7227A	19.95
ICM7213A	15.50
ICM7240	7.50
ICM7242	3.90
ICM7250	7.90
ICM7260	7.90
ICM7555	2.75
ICM7556	2.95

74S

74S00	.60
74S02	1.00
74S03	1.00
74S04	1.00
74S05	1.50
74S08	1.00
74S09	1.50
74S10	1.00
74S11	1.00
74S15	1.60
74S20	1.20
74S22	1.50
74S30	1.00
74S32	1.00
74S37	1.70
74S38	1.70
74S40	1.20
74S51	.80
74S64	1.20
74S65	1.20
74S74	1.30
74S86	1.60
74S109	2.50
74S112	1.30
74S113	1.30
74S133	1.20
74S134	1.40
74S135	1.30
74S138	3.30
74S139	3.30
74S140	1.90
74S151	3.10
74S153	2.00
74S157	3.10
74S158	3.10
74S160	5.90
74S161	5.90
74S162	7.90
74S163	7.90
74S168	11.50
74S169	11.50
74S174	4.50
74S175	4.50
74S181	8.50
74S182	3.40
74S199AN	4.10
74S189	8.50
74S194	3.30
74S195	2.90
74S196/82590	4.90
74S197 82591	4.90
74S201	8.90
74S214AN	P.O.A.
74S225	10.90
74S226	7.90
74S240	6.90
74S241	6.90
74S244	9.90
74S251	3.90
74S253	4.90
74S257	3.30
74S258	3.30
74S260	2.90
74S274	POA
74S275	POA
74S280	8.90
74S281	POA
74S283	7.90
74S287	4.90
74S288	4.90
74S299	13.90
74S301	13.90
74S314	POA
74S330	POA
74S331	POA
74S373	9.90
74S374	9.90
74S381	9.90
74S387	3.30
74S412 8212	5.90
74S428 8212	7.90
74S470	9.90
74S471	9.90
74S472	9.90
74S473	9.90
74S474	9.90
74S475	9.90
74S482	11.90
74S489	7.90

74H

74H00	.60
74H01	.80
74H02	.80
74H03	.80
74H04	.90
74H05	.90
74H08	1.10
74H10	.80
74H11	.80
74H12	.80
74H15	.80
74H20	.80
74H21	.90
74H22	.80
74H30	.90
74H40	.90
74H50	.90
74H51	.90
74H52	.90
74H53	.90
74H54	.90
74H55	.90
74H60	.90
74H61	.90
74H62	.90
74H64	.90
74H65	.90
74H71	1.40
74H72	1.20
74H73	1.80
74H74	1.80
74H76	1.90
74H78	1.80
74H87	7.90
74H101	1.80
74H102	1.80
74H103	2.50
74H106	2.50
74H108	2.50
74H113	1.10
74H114	1.10
74H183	7.80

74C

74C00	.50
74C02	.60
74C04	.80
74C08	.80
74C10	.80
74C14	1.40
74C20	.80
74C30	.80
74C32	.50
74C42	1.90
74C48	2.50
74C73	1.40
74C74	1.70
74C76	1.90
74C83	2.30
74C85	2.30
74C86	1.50
74C89	8.90
74C90	1.90
74C93	1.90
74C95	2.00
74C107	1.20
74C150	6.50
74C151	4.20
74C154	6.00
74C157	3.75
74C160	1.90
74C161	1.90
74C162	2.00
74C163	2.00
74C164	2.50
74C165	2.50
74C173	1.90
74C174	1.90
74C175	1.90
74C192	2.00
74C192	2.00
74C193	2.00
74C195	2.00
74C200	14.00
74C221	2.75
74C240	3.75
74C244	3.95
74C373	4.75
74C374	4.45
74C901	3.00
74C902	2.50
74C903	2.50
74C904	2.50
74C905	15.00
74C906	2.90
74C907	2.90
74C908	2.75
74C910	14.00
74C911	12.50
74C912	12.50
74C914	4.50
74C915	4.00
74C917	15.50
74C918	2.90
74C920	12.50
74C921	12.50
74C922	7.50
74C923	7.90
74C925	9.90
74C926	9.90
74C927	9.90
74C928	9.00
74C929	9.50
74C930	2.75
74C932	2.50
74C941	2.50
74C989	8.90

74LS

74LS00	.35
74LS01	.40
74LS02	.40
74LS03	.40
74LS04	.60
74LS05	.60
74LS08	.40
74LS09	.80
74LS10	.60
74LS11	.80
74LS12	.80
74LS13	.90
74LS14	.80
74LS15	.80
74LS19	.90
74LS20	.50
74LS21	.90
74LS22	.90
74LS24	.90
74LS26	.90
74LS27	.90
74LS28	.90
74LS30	.40
74LS32	.70
74LS33	.70
74LS37	.70
74LS38	.80
74LS40	.80
74LS42	.80
74LS47	1.00
74LS48	1.00
74LS49	1.80
74LS51	.70
74LS54	.80
74LS55	.80
74LS63	2.80
74LS73	.80
74LS74	.80
74LS75	.80
74LS76	1.00
74LS77	1.00
74LS78	1.10
74LS83	.70
74LS85	.60
74LS86	.80
74LS90	.60
74LS91	.80
74LS92	.60
74LS93	.70
74LS95	1.20
74LS96	1.20
74LS107	.80
74LS109	.60
74LS112	.70
74LS113	.70
74LS114	.80
74LS122	1.30
74LS123	.90
74LS125	.80
74LS126	1.20
74LS132	1.50
74LS133	4.90
74LS136	1.50
74LS138	.80
74LS139	.80
74LS145	2.10
74LS147	2.50
74LS148	1.90
74LS151	1.20
74LS152	1.95
74LS153	1.00
74LS154	2.95
74LS155	1.00
74LS156	1.50
74LS157	1.10
74LS158	1.00
74LS160	1.00
74LS161	.80
74LS162	1.50
74LS163	1.10
74LS164	.80
74LS165	1.00
74LS166	2.55
74LS169	2.45
74LS173	.90
74LS174	.90
74LS175	.80
74LS181	4.00
74LS190	1.50
74LS191	1.20
74LS192	1.20
74LS193	1.20
74LS194	1.20
74LS195	.80
74LS196	.80
74LS197	1.75
74LS221	2.00
74LS240	1.90
74LS241	1.90
74LS242	1.90
74LS243	1.90
74LS244	1.50
74LS245	2.60
74LS247	1.30
74LS248	1.50
74LS249	1.60
74LS251	1.50
74LS253	1.20
74LS257	.70
74LS258	1.20
74LS259	1.50
74LS261	2.50
74LS266	1.20
74LS273	1.95
74LS275	6.80
74LS279	.80
74LS280	2.60
74LS283	1.50
74LS290	1.50
74LS293	1.30
74LS295	1.75
74LS297	6.50
74LS298	1.20
74LS299	3.90
74LS320	3.95
74LS321	3.95
74LS322	6.75
74LS323	6.50
74LS324	2.20
74LS326	2.20
74LS327	2.20
74LS352	2.20
74LS353	2.20
74LS354	3.95
74LS365	1.00
74LS366	1.00
74LS367	.80
74LS368	1.00
74LS373	1.90
74LS374	1.90
74LS375	1.00
74LS377	2.15
74LS378	1.20
74LS379	1.90
74LS386	1.00
74LS390	1.80
74LS393	1.80
74LS395	2.00
74LS396	2.50
74LS398	3.00
74LS399	1.90
74LS424	5.50
74LS440	5.50
74LS441	5.50
74LS442	5.50
74LS443	5.50
74LS445	2.20
74LS446	5.50
74LS447	1.90
74LS448	5.50
74LS449	5.50
74LS490	3.20
74LS540	5.95
74LS541	3.95
74LS621	2.75
74LS622	2.75
74LS623	5.95
74LS629	5.95
74LS640	3.95
74LS642	2.75
74LS643,	2.75
74LS644	2.75
74LS645	2.75
74LS668	1.75
74LS669	1.75
74LS670	2.75
74LS673	12.55
74LS674	12.55
74LS690	3.95
74LS691	3.95
74LS692	3.95
74L693	3.95
74LS696	3.95
74LS699	3.95

CDP

CDP1802	10.50
CDP1864	17.50

CPU

6502	13.00
6502A	13.00
6504	13.00
6520	5.50
6521	5.90
6522	13.00
6522A	13.00
6532	14.00
6545	19.50
6551	12.90
2651	23.00
6800	6.00
6802	7.00
6808	12.50
6809	10.00
6810	3.50
6821	5.50
6840	6.50
6845	12.50
6847	3.50
6850	7.90
6860	19.50
6875	15.00
Z80CPU	5.00
Z80ACPU	5.00
Z80BCPU	12.00
Z80P10	4.50
Z80AP10	4.50
Z80CTC	5.50
Z80ACTC	5.50
Z80DMA	16.00
Z80ADMA	16.00
Z80AS10	13.00
Z80S10	13.00
AD570	69.50
AD590	9.50
AD7524	17.50
AY-3-8910	14.50

AY-3-2513	14.50
MSM5832	16.50
MM58174	19.50
MM5303	7.50
MM5309	14.50
MM5369	4.95
LH0002	9.50
LH0042CH	9.50
LH0070	9.50
LH0071	9.50
TL061	1.50
TL062	2.90
TL064	4.90
TL071	1.20
TL072	2.90
TL073	3.20
TL074	4.90
TL081	1.90
TL082	2.50
TL083	2.90
TL084	3.45
TL494	4.90
TCA220	9.50
TCA280	4.50
TDA1024	2.80
TA7205P	3.90
TEA1002	17.50
UAA170	5.95
UAA180	3.75
LM10CH	7.50
LM301	.50
LM301H	1.50
LM302H	6.50
LM305H	1.50
LM307CN	1.00
LM308	1.00
LM308H	1.80
LM309K	1.80
LM310H	3.20
LM310H	3.20
LM311	1.00
LM311H	1.80
LM317T	2.50
LM317K	4.50
LM318	4.90
LM324	1.00
LM325	4.50
LM326	4.50
LM329DZ	.90
LM334Z	1.90
LM335Z	2.20
LM336 2.5V	2.95
LM338K	12.50
LM339	1.20
LM348	1.80
LM349	1.50
LM350K	10.50
LM351N	1.00
LM353	2.50
LM356N	2.40
LM357	2.40
LM358	1.40
LM361	3.50
LM377	4.90
LM378	3.95
LM380 8 pin	1.80
LM380 14 pin	1.80
LM381	3.50
LM382	3.50
LM383	3.90
LM384	3.50
LM386	1.95
LM387A	3.95
LM387	2.00
LM390	2.95
LM391	2.90
LM393	1.00
LM395T	9.95
LM396K	22.50
LF398	5.90
NE544	6.50
NE555	.40
NE556	1.20
NE558	6.00
NE560	4.50
NE567	2.00
NE570	5.90
NE571	5.90
NE592	6.90
NE594	9.50
LM709-14	1.50
UA710CN	1.00
LM711	1.20
LM723	.75
LM723CH	1.50
LM725	4.75
LM733	1.50
LM739	2.75
741	.40
UA747	1.30
UA748	1.00
MC1310	9.50
MC1312	7.95
MC1314	7.95
MC1315	8.95
MC1327	7.95
MC1350	1.95
MC1408L8	7.50
MC1437	4.95
MC1445	5.95
MC1456	1.95
MC1458	1.20
MC1466L	21.50
MC1469R	8.90
MC1488	1.20
MC1489	1.20
MC1494	6.40
MC1495	8.90
MC1496	2.50
LM1596	3.00
MC1648	8.90
LM1812	10.50
LM1830	3.90
LM2907	3.90
LM2917 8 PIN	4.90
LM2917 14 PIN	4.90
MN3001	17.50
CA3028	2.00
CA3046	1.90
CA3056	6.50
CA3059	5.95
CA3080	1.90
CA3086	1.90
CA3100E	7.95
CA3130E	2.20
CA3130T	2.95
CA3140E	2.20
CA3140T	2.95
CA3240E	11.95
CA3401	1.00
CA3900	1.20
CA3905	1.75
CA3909	2.95
LM3911	2.95
LM3914	5.90
LM3915	5.90
LM3916	5.90
LM3999Z	2.60
RL4136	1.95
RC4145	20.90
RC4194	3.90
MM5369	4.95

SCR & TRIACS

SC141D	1.90
SC141E	1.95
SC142E	2.95
SC146D	2.85
SC150D	4.95
SC151D	2.95
SC152D	6.90
C103YY	.90
C103B	.90
C106B	.90
C122D	2.50
C122E	2.95
C260D	8.50
C260E	8.90
2N2646	1.20
2N2647	2.50
2N6027	.90

TRANS.

AC125	1.20
AC126	1.20
AC127	1.20
AC128	1.20
AC187	1.50
AC188	1.50
AC149	3.40
AD161	2.90
AD162	2.90
AF118	2.90
BC107	.50
BC108	.50
BC177	.50
BC178	.60
BC179	.60
BC182L	.40
BC212	.30
BC318	.30
BC320	.40
BC327	.30
BC328	.30
BC337	.40
BC338	.40
BC546	.40
BC547	.20
BC548	.20
BC549	.20
BC550	.40
BC556	.40
BC557	.20
BC558	.20
BC559	.20
BC639	.50
BC640	.50
BCY70	1.90
BCY71	1.90
BD135	1.00
BD136	.90
BD137	.90
BD138	.90
BD139	.80
BD140	.60
BD201	.90
BD232	.90
BD233	.90
BD235	.90
BD236	.90
BD237	.90
BD238	.90
BD262	1.20
BD263	1.20
BD437	1.50
BD488	1.50
BD647	1.80
BD648	1.60
BD677	1.80
BD681	2.00
BD682	2.00
BDV64B	3.90
BDV65B	3.90
BDX63	6.50
Y96 (BUX 80)	4.90
BDY97 (BUX 80)	4.90
BF118	1.50
BF167	1.20
BF173	1.20
BF177	1.20
BF180	1.20
BF182	.90
BF183	.80
BF184	.80
BF198	.80
BF199	.60
BF200	1.20
BF245	1.50
BF337	1.50
BF338	1.90
BF458	1.00
BF459	1.00
BF469	1.20
BF470	1.20
BF494	.90
BF495	.90
BFW10	1.50
BFW11	1.50
BFW16	1.50
BFY50	1.20
BFY90	1.90
BFX90	1.50
BU126	2.50
BU208	4.90
BU326	3.90
BUX80	4.90
MFE131	2.90
MFE3001	9.90
MFE3003	6.95
MJ413	5.90
MJ802	7.50
MJ901	4.50
MJ1001	3.90
MJ11011	9.90
MJ11015	14.50
MJ11016	14.50
MJ15003	6.50
MJ15004	6.50
MJ15024	10.00
MJ2501	6.90
MJ2955	1.50
MJ3001	6.00
MJ4032	12.50
MJ4502	6.90
MJE340	1.50
MJE350	1.90
MJE371	2.90
MJE521	2.50
MJE700	3.50
MJE800	2.90
MJE2801	3.95
MJE2955	4.90
MJE3055	3.90
MJE13005	5.90
MJE13007	7.90
MJE13009	12.50
MPF121	2.50
MPF131	2.50
MPSA05	1.00
MPSA06	1.00
MPSA10	1.00
MPSA12	1.00
MPSA13	1.00
MPSA14	1.00
MPSA20	1.00
MPSA42	1.00
MPSA43	1.20
MPSA55	1.00
MPSA56	1.00
MPSA63	1.00
MPSA65	1.00
MPSA92	1.00
MPSA93	1.20
MPF102	.90
MPF103	.90
MPF105	.90
MPF106	.90
MPF109	.90
MPSL01	1.50
MPSL51	1.50
MPSU02	1.75
MPSU52	1.90
MPSU56	1.75
MP131	1.75
MRF221	19.50
MRF237	5.90
MRF238	29.50
MRF245	53.50
MRF455	37.00
MRF475	12.50
MRF603	19.50
MRF641	49.00
MRF646	53.00
MRF901	2.90
MPF131	1.90
TIP31A	.70
TIP31B	.70
TIP31C	.75
TIP32A	.70
TIP32B	.70
TIP32C	.75
TIP41C	1.50
TIP42A	1.40
TIP42C	1.50
TIP49	1.90
TIP50	2.20
TIP53	2.50
TIP111	1.50
TIP112	1.50
TIP116	1.50
TIP117	1.50
TIP120	1.50
TIP122	1.50
TIP125	1.50
TIP127	1.50
TIP145	3.40
TIP2955	1.50
TIP3055	1.50
2N301	4.00
2N697	1.00
2N918	1.00
2N1304	1.00
2N1613	1.20
2N2102	1.90
2N2219	.90
2N2222A	1.00
2N2369	1.00
2N2484	1.00
2N2646	1.20
2N2647	2.50
2N2894	1.00
2N2904	1.10
2N2905	1.10
2N2906	1.10
2N2907	1.10
2N3019	1.90
2N3053	.90
2N3054	1.90
2N3055	1.00
2N3096	1.20
2N3109	1.90
2N3251	1.90
2N3302	1.90
2N3440	1.80
2N3441	2.90
2N3442	3.50
2N3563	.30
2N3564	.30
2N3565	.30
2N3566	.30
2N3567	.30
2N3568	.30
2N3569	.30
2N3638	.30
2N3640	.30
2N3641	.30
2N3642	.30
2N3643	.30
2N3644	.30
2N3645	.30
2N3646	.30
2N3702	1.20
2N3704	1.40
2N3739	4.50
2N3771	5.50
2N3772	5.70
2N3773	5.90
2N3792	6.00
2N3819	1.20
2N3866	2.95
2N3904	1.00
2N3906	1.00
2N4030	1.50
2N4032	2.20
2N4033	2.20
2N4036	2.50
2N4121	1.50
2N4123	1.50
2N4236	1.90
2N4237	1.90
2N4248	.40
2N4249	.40
2N4250	.40
2N4258	.50
2N4355	.50
2N4356	.50
2N4360	1.00
2N4401	.30
2N4402	.30
2N4403	.30
2N4416	1.90
2N4427	3.90
2N4919	2.90
2N5088	1.00
2N5089	1.00
2N5139	1.20
2N5179	1.20
2N5190	2.50
2N5191	3.30
2N5192	3.10
2N5193	2.50
2N5194	2.95
2N5195	3.30
2N5210	1.50
2N5245	1.50
2N5303	8.50
2N5401	1.50
2N5457	1.00
2N5458	.90
2N5459	.90
2N5461	.90
2N5462	.90
2N5485	.90
2N5486	.90
2N5489	14.50
2N5590	26.50
2N5591	29.50
2N5641	19.50
2N5656	2.50
2N5770	.30
2N5777	1.50
2N5830	.30
2N5831	.30
2N5873	1.40
2N5874	1.70
2N5944	15.50
2N5945	18.50
2N5946	19.50
2N5961	1.80
2N6027	1.00
2N6049	1.90
2N6060	21.50
2N6083	26.90
2N6084	37.90
2N6122	1.90
2N6125	1.90
2N6130	1.90
2N6133	1.90
2N6256	14.50
2N6259	13.50
2N6274	29.50
2N6378	4.90
2N6425	4.50
2N6578	4.90
3N201	1.50
2SA683	1.50
2SC2028	3.95
2SC2029	3.95
2SC2166	4.95
2SC1730	1.95
2SC1969	6.30
2SC1973	3.95
VN66AF	3.95
2SC372	1.95
2SC495	2.95
2SC710D	1.95
2SC73	1.95
2SC900F	1.95
2SC945A	1.95
2SC1014	2.50
2SC1017	4.95
2SC1018	4.95
2SC1061	2.95
2SC1096	2.95
2SC1173	2.95
2SC1226	2.95
2SC1306	6.30
2SC1419	2.95
2SC1449	1.95
2SC1674	1.95
2SC1307	6.90
2SD288	3.95
2SD325	2.95
2SD525	3.95
2SK45	3.95
2SJ49	6.95
2SJ56	12.50
2SK134	6.95
2SK176	12.50
1N4002	.15
1N4007	.20
1N5400	.40
1N5404	.30
1N5408	.40
OA47	.80
OA90	.50
OA95	.50
5082-2800	2.95
5082-2811	4.95
HLMP6620	5.95

BRIDGES

1.5 AMP	
W005	.50
W02	.40
W04	.50
6AMP	
BPC602	2.90
KBPC604	3.50
KBPC608	4.50
10AMP	
KBPC1002	4.20
KBPC1004	4.90
35AMP	
KBPC3502	5.90
KBPC35014	MD
A3504	6.90
KBPC3510	MDA
3510	9.90

74

7400	.35
7401	.45
7402	.45
7403	.45
7404	.60
7405	.80
7406	.80
7407	.80
7408	.80
7409	.80
7410	.60
7411	.70
7412	.70
7413	.70
7414	.80
7416	.50
7417	.80
7420	.80
7425	.90
7427	.80
7430	.70
7432	.70
7437	.80
7438	.90
7440	.90
7442	.90
7445	1.00
7446	1.20
7447	1.50
7449	1.20
7450	.80
7451	.90
7473	.90
7474	.70
7475	.70
7476	.80
7485	1.20
7486	1.20
7489	3.90
7490	1.00
7493	1.00
7495	1.00
7497	2.30
74100	1.65
74107	1.20
74109	.90
74110	1.50
74121	.90
74122	.90
74123	1.50
74125	1.00
74126	1.80
74132	1.00
74139	1.50
74145	1.45
74150	1.50
74151	1.20
74154	1.75
74155	1.20
74161	1.20
74163	1.40
74164	1.20
74165	1.20
74166	1.70
74174	1.45
74175	1.20
74180	1.20
74190	1.00
74191	1.45
74192	1.65
74193	.80
74194	1.10
74195	1.00
74197	1.10
74221	1.90
74367	1.50
74368	1.50
75107	2.50
75110	2.50
75150	2.50
75154	2.50
75450	1.50
75451	.90
75452	.90
75453	.90
75461	1.50
75462	1.50
75471	3.00
75472	3.00
75491	2.00
75492	2.00
75493	3.00
8121	5.00
8123	4.00
8130	6.95
8131	6.95
8136	6.95
8303	5.50
8304	6.95
82S23	5.95
82S123	6.95
6311	5.95
8641	5.95
8820	6.95
8830	6.95
8832	6.95
8833	6.95
8834	6.95
8835	5.95
1488	1.00
1489	1.00
81LS95	3.75
81LS96	3.75
81LS97	3.75
81LS98	3.75
8T26	3.00
8T28	3.00
8T30	3.00
8T96	1.80
8T97	1.80
8T13	2.95
8T14	2.95
8080	8.00
8085	9.50
8086	39.00
8088	29.00
8155	6.50
8156	11.50
8185	37.50
8202	52.50
8203	69.50
8212	2.90
8214	4.90
8224	3.50
8226	4.90
8228	5.50
8237	39.00
8238	9.50
8243	8.50
8251	6.90
8253	7.50
8255	5.50
8257	16.50
8259	6.50
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8272	33.00
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8274	42.50
8275	38.50
8276	28.50
8279	8.50
8282	6.90
8283	6.50
8284	8.50
8286	8.50
8287	6.50
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8291	43.00
8292	34.50
8293 10	26.50
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FD1795	39.00
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74HC04	.60
74HC08	.60
74HC11	.60
74HC14	1.40
74HC27	.60
74HC30	.60
74HC32	.60
74HC74	1.10
74HC76	1.10
74HC85	1.40
74HC86	1.10
74HC123	1.40
74HC138	1.40
74HC139	1.40
74HC157	1.40
74HC165	2.50
74HC174	1.40
74HC221	3.60
74HC240	2.50
74HC244	2.50
74HC245	3.90
74HC367	1.40
74HC373	2.90

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74F04	.92
74F08	.79
74F10	.79
74F11	.79
74F20	.79
74F32	.79
74F64	.79
74F74	.89
74F86	1.19
74F109	.99
74F138	1.79
74F139	1.79
74F151	1.79
74F153	1.79
74F157	1.79
74F158	1.79
74F175	2.76
74F181	5.96
74F182	2.73
74F189	7.44
74F190	4.86
74F191	4.86
74F194	2.41
74F241	3.72
74F243	4.34
74F244	3.72
74F251	1.93
74F253	1.93
74F257	1.93
74F258	1.93
74F350	4.34
74F352	1.93
74F353	1.93
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4007	.40
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4010	.90
4011	.40
4012	.40
4013	.60
4014	1.90
4015	1.90
4016	.75
4017	1.50
4018	1.90
4019	.90
4020	1.80
4021	.150
4022	1.50
4023	.75
4024	1.20
4025	.80
4026	2.40
4027	1.20
4028	1.20
4029	1.50
4030	1.50
4031	2.95
4032	2.75
4033	2.75
4034	3.50
4035	1.95
4038	3.25
4040	1.20
4041	1.50
4042	1.00
4043	1.60
4044	1.20
4045	4.90
4046	2.50
4047	1.20
4048	1.20
4049	1.00
4050	1.00
4051	1.50
4052	1.50
4053	1.50
4054	3.90
4055	3.90
4056	4.20
4060	2.50
4063	2.00
4066	2.50
4067	9.90
4068	1.00
4069	1.00
4070	.90
4071	.40
4072	.90
4073	.90
4075	.90
4076	1.50
4077	.80
4078	.60
4081	.40
4082	.80
4085	2.20
4086	2.30
4089	3.50
4093	.75
4094	3.35
4095	2.40
4096	2.40
4097	6.50
4098	2.90
4099	3.90
4104	6.90
4160	1.25
4161	1.25
4163	1.25
4174	1.25
4175	1.60
4194	1.95
4433	2.75
MC14433	13.90
4435	7.95
4441	1.50
4443	3.90
4445	2.65
4446	3.55
4449	1.00
4450	3.75
4451	3.75
4457	5.90
4458	9.90
4469	14.90
4490	5.90
4495	3.95
4501	.50
4502	1.80
4503	.90
4504	2.00
4506	.75
4507	.40
4508	4.50
4510	1.50
4511	1.00
4512	1.10
4513	2.65
4514	2.90
4515	2.90
4516	1.45
4517	8.75
4518	2.50
4519	1.90
4520	1.20
4521	3.90
4522	1.90
4526	1.85
4527	2.65
4528	1.15
4529	1.80
4530	1.60
4531	1.65
4532	2.65
4534	8.90
4536	6.50
4539	1.65
4541	1.80
4543	2.50
4544	10.50
4549	7.25
4551	1.80
4553	5.80
4554	2.35
4555	1.10
4556	1.25
4557	7.85
4558	2.25
4559	7.25
4560	3.75
4561	1.80
4562	8.45
4566	3.00
4568	4.25
4569	2.80
4572	.75
4581	3.10
4582	2.25
4583	1.85
4584	.85
4585	2.10
45104	3.45
45106	7.85
45107	7.25
45109	7.25

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10MHz	4.90
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74HC11	.50
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74HC51	.60
74HC86	.60
74HC161	1.30
74HC164	1.40
74HC4020	1.40
74HC4040	1.40
74HC4066	1.20

74LS

74LS00	.30	74LS109	.35
74LS04	.30	74LS136	.55
74LS05	.30	74LS157	.45
74LS08	.30	74LS174	.55
74LS10	.30	74LS251	.65
74LS11	.35	74LS253	.55
74LS14	.32	74LS256	.70
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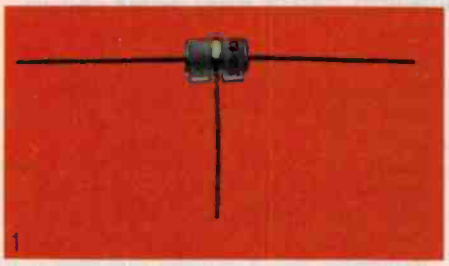

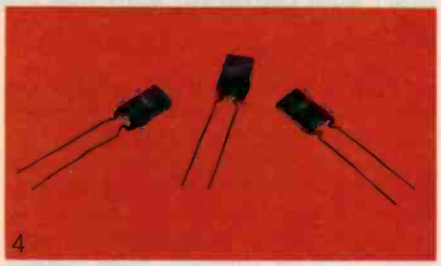

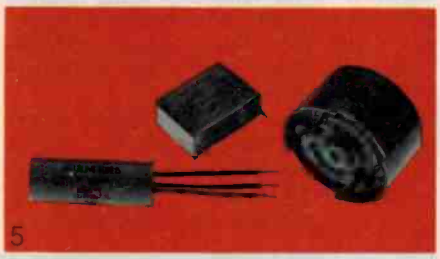

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766/2495 CSA

THE RECEPTION REPORT

Arthur Cushen

Receiving station verification cards is a bit like stamp collecting: all those exotic emblems from mysterious lands! Once you've picked up a broadcast the thing to do is to write a reception report to send to the station — broadcasters like nothing better than to know they are received. Then you can start wall papering with the verification cards they send out in reply.

A RECEPTION REPORT sent to any radio station should contain the following information: date, time locally and in UTC, details of reception conditions, the programme material broadcast, and information about your receiver and aerial. You should also give a comparison with other signals from the same area being received on the same band, and include return postage in the form of an International Reply Coupon or mint stamps of the country to which you are listening.

DATE: The date should be written in full, eg, Wednesday 4 September 1985, and not in figures. When printing the date in figures some countries, such as the United States and several European countries, would use the format of 9/4/85, which you might confuse as the 9th April instead of the 4th September.

TIME: Time should be given in UTC when dealing with international broadcasters, but with regional and local stations the local time should be quoted as well as UTC. Remember that Australia's east coast is 10 hours ahead of UTC, therefore stations heard before 10 am Sydney time are observing the previous day.

RECEPTION CONDITIONS: The conditions are often best expressed in your own words as regards local stations, and should cover the signal strength, readability of the signal, interference and the overall picture of reception.

Verifications from stations which no longer exist as well as from frequently heard stations are shown in this selection of QSL cards received over the past 40 years, on both medium and shortwave.

International broadcasting stations are familiar with either of the two reception codes, SINPO or SIO. SINPO stands for "Signal, Interference, Noise, Propagation and Overall merit" and is judged on a scale of 0 to 5 (see Table 1). When using the SINPO code, the overall merit figure should be the same as the lowest of the group, hence a signal 43443 is more correct than 43444, as the last figure denoting the overall merit of good has been depreciated by some interference.

The realization that many shortwave listeners find evaluation of propagation conditions difficult due to inexperience in day-to-day listening has led many international broadcasters to now use the SIO code, standing for "Signals, Interference and Overall merit". Among those using this code are the BBC, Radio Nederland, VOA and Radio Sweden. In the case of the VOA the interference rating is known as degradation (see Table 2).

Listeners will be able to judge the signal level from the S meter on their receivers, but seldom can a signal be rated 555; in fact many broadcasters are interested only in the signal range 2, 3 and 4. For instance, the BBC feels that a signal under 2 is of no value to the listener as reception would be very poor whereas a signal over 4 is a bonus.

The technical staff at mediumwave stations may not be aware of the reception codes. When writing to them you should describe the signal using some of the references indicated on the SIO code, eg, "your signal was strong with slight interference giving an overall picture of good reception."

PROGRAMME MATERIAL: The new listener should first aim at reporting broadcasts in the English language and submit at least 15 minutes of programme material. The length of a reception report overall will depend on the type of programme being broadcast.

If a station is carrying a transcribed gospel programme for 30 minutes, for example, only the name of that programme will be known to the broadcaster, and not its contents. The essential information is at the start and end of the programme and comprises local origination such as the time, frequencies and name of the programme, as

well as information that the station has on its log, all of which is verifiable.

In the case of a station broadcasting news, commentary and popular music, the names of the newsreader and commentator should be mentioned and then some details of the music programme, including the artists and names of the songs being played.

Reception conditions may be such that only parts of the transmission are audible, but always remember that the "hour" is the same in Sydney as it is in almost all countries and that on the hour, every hour, stations identify. There are some exceptions in stations in the 30 minute time zone, such as in South Australia and India. In the case of local mediumwave stations, commercial announcements are of value as they give street addresses, telephone numbers and the products being sold, so the station manager or engineer who receives your reception report can quickly identify if the broadcast was part of their transmission or not.

RECEIVER: You should describe the make and model number of your receiver and, if it is an old valve receiver, the number of tubes and the receiver's age. You should also indicate if it has frequency read-out which helps to give the station positive details of the frequency you are tuned to.

AERIAL: The aerial should be described clearly, such as 10 metres high, 20 metres long inverted L type, or a loop, long wire or beveridge, or perhaps it is a V beam, dipole, etc. This type of information about equipment (both aerial and receiver) gives the station an indication of whether you are listening under normal reception conditions with domestic type equipment or whether you have a professional receiver and are listening on a DXpedition, which is at a specially selected listening post outside the city and away from man-made interference.

COMPARISON: If you are listening on mediumwave you should compare a signal, say, from Adelaide, with other stations in that city, giving an indication of the various signal strengths of each audible station. When tuned to shortwave, for instance, the BBC transmissions to Australia should be compared to other European signals using the short path transmission across Asia, such as the Vatican and Deutsche Welle.

There should also be some indication of co-channel interference if this exists, and you should try to identify the station broadcasting on the same frequency — it will be underneath the transmission you are tuned to. There are other areas of interference such as jamming and sideband interference from a stronger signal on the upper or lower side of the station you are listening to. You should also comment on any other source of interference which is detrimental to good reception.

RETURN POSTAGE: It is a courtesy to send return postage with your reception report to almost all stations, including all mediumwave stations and most shortwave stations except the international broadcasters. Details on this matter are given in the *World Radio & Television Handbook*. It is better to send return postage when not required (in which case it will be returned by the station) than to fail to receive verification due to postage not being included. The simplest way to send return postage is by International Reply Coupon, which can be purchased from the post office and redeemed by the station to which you have reported reception (it receives the equivalent of return postage to Australia). The Universal Postal Union does not operate in some non-member countries, such as South Africa, and hence IRCs are not valid there.

Some DX clubs sell mint stamps, mainly from Australia, New Zealand and the United States, though there are services available which have mint stamps of most countries. A prepared verification card is also available from some DX clubs, setting out the details required to confirm your report, the date and time, and including an affixed return postage stamp; this makes it an easy matter for the station to verify your report (if it is correct!). But this type of card should only be used when previous attempts have been made to verify a station without success, as the station's own verification card or letter is more acceptable.

TABLE 1. SINPO CODE

S Signal Strength	I Interference	N Atmospheric Noise	P Propagation (Fading)	O Overall Merit
5 EXCELLENT	5 NONE	5 NONE	5 NONE	5 EXCELLENT
4 GOOD	4 SLIGHT	4 SLIGHT	4 SLIGHT	4 GOOD
3 FAIR	3 MODERATE	3 MODERATE	3 MODERATE	3 FAIR
2 POOR	2 SEVERE	2 SEVERE	2 SEVERE	2 POOR
1 BARELY AUDIBLE	1 EXTREME	1 EXTREME	1 EXTREME	1 UNUSABLE

TABLE 2. VOA SIO CODE

SIGNAL STRENGTH
5 — Very Strong
4 — Stong
3 — Fair
2 — Weak
1 — Nil (No VOA signal audible due to poor propagation or interference)

DEGRADATION
5 — None
4 — Slight
3 — Moderate
2 — Severe
1 — Extreme (No VOA signal heard because of interference)

OVERALL QUALITY

5 — Excellent	best possible shortwave reception, subject to no more than slight degradation.
4 — Good	can be tuned in and listened to with ease and without undue annoyance despite degradation.
3 — Fair	can be listened to only with difficulty because of annoying degradation.
2 — Poor	can be tuned in but only portions of program heard because of annoying degradation.
1 — Nil	VOA program cannot be heard for any reason.

INTERFERENCE AND DEGRADATION IDENTIFICATION, AND REMARKS
If the overall quality of a program is affected by interference, fading, atmospherics, etc, list the causes of such degradation in the proper column, using the following symbols:

A — atmospheric noise or static
C — code, teletype or other pulsed interference
F — fading
H — heterodyne (whistle or tone)
J — jamming
K — mayak jamming
fd — poor feed
L — local electric noise (auto ignition, generator, etc)
M — poor modulation
V — voice or music

Monitoring

Shortwave organizations employ monitors throughout the world to check their transmissions each day and send weekly reception log sheets to London, Montreal, Washington and other offices of international broadcasters.

I have reported on BBC reception each week since 1942, sending hundreds of international telegrams to London over the years as well as providing a report each week, covering over 70 frequencies which are checked each day. This information enables the international broadcaster to receive a continuing picture of reception in a given area from an experienced listener, generally using domestic type equipment so that an overly rosy picture of reception is not presented. Therefore, the report would be similar to that from anyone listening to London in the same area, who was using domestic equipment.

The broadcasters transmitting to an international audience make frequency changes on the first Sunday in March, May, September and November. This information is received weeks in advance of any projected frequency change, so that the monitor can check for usage of the frequency by any other broadcasters.

Listeners will be aware that frequency changes often occur to avoid interference from another station using the same channel, and a lot of background work is needed before the change takes place. For example, international telegrams to Stockholm are frequently beset by interference and new channels are found by the monitor, enabling a clearer signal to be received.

Another area of the monitor's work is band surveys, which are done on a regular basis. A complete band is surveyed over several hours and every signal is identified not only for its strength, but for length of transmission, location, and interference to the broadcast. This practical exercise shows ▶

frequency occupancy at a glance and enables engineers to note any unoccupied frequency that could be used.

Verification

Verification of your reception report could come in the form of a card or letters and may be accompanied by schedules, stickers, pennants and badges. The speed with which a station replies depends upon whether it uses airmail or seamail services. The unexpected arrival of a verification after many years is not uncommon. I recently received a verification from KGVW in Montana after 19 years — obviously the station had a spring clean and found my report!

The verification card should confirm the date and time of reception and the frequency. It should have the radio listener's name and address on it and the same information should appear in the verification letter. Due to the high cost of handling listeners' reports, a few stations have moved to other forms of acknowledgement. Radio Finland has an audience card which is only an acknowledgement and not a verification, while Radio Canada International sends out a blank card for the listener to detail reception of one of their transmissions and send it back to Montreal where it is verified and returned to the listener.

Verifications from stations which no longer exist and from countries which are no longer on the map are cherished by the older listener. They are valued archive material, and many tell the story of the changing world we live in, from both a geographical and historical angle. It is sad to find verification cards being auctioned or cut up for the postage stamps that are on them. The New Zealand Radio DX League archive housed at Radio New Zealand's Archives in Timaru is one place where these historic items of radio history are catalogued, so that listeners in the future can look back at the history of radio broadcasting as it occured from the first regular transmission in 1919.

The shortwave audience

The radio listener provides information to international broadcasters on reception, interference and general receiving conditions as well as commenting on the programmes and their popularity, and what he would like to hear. The station, in confirming reception, checks the log book for verifiable material and hence the verification card, often called a QSL card or letter, is legal proof of reception as it indicates the time and frequency and the name of the listener.

The listener's report also helps the station to survey its audience worldwide. The cost of making such a survey is tremendous.

On mediumwave, under local conditions, radio stations have an idea of their audience. For example, in Sydney four-weekly surveys by an independent research organization show the 'ratings' (or percentage of the audience tuned in) of various stations. Recent surveys show that 2WS is clear leader in the 25-55 year old age group with an average share of all ages of 16.5%. 2MMM on FM has 10.5%, followed by 2DAY FM 10.1%, 2UE 8.9%, 2CH 8.5% and 2GB 8.1%. Commercial radio stations base their 'audience pull' on this figure and use it to convince advertisers of the number of listeners tuned to their programmes.

International broadcasters have various means of research including the mail count. Austrian Radio's mail count for March-May 1984 amounted to 20,587 letters and reports from 89 countries, including 978 from Australia, 482 from New Zealand, 13 from Papua New Guinea and 27 from Vanuatu. In addition, 129 listeners sent cassette recordings to Vienna during the two months, from 30 countries.

The BBC and VOA each claim over 120 million listeners per week. According to an audience researcher, Graham Mitten of the BBC External Service, listening to the Voice of America has increased since President Reagan came to power as there is a greater degree of American prominence in world events and listeners worldwide want to hear the country's policies direct from VOA.

Both China and the USSR spend substantial sums on international broadcasting. However, the BBC researchers have discovered that the biggest spending does not guarantee the largest or most widespread audience. In terms of hours of broadcasting, the very top of the list of international broadcasters is the Soviet Union, yet no where is Radio Moscow's audience ranked as 'number one' outside the Soviet Union. In second place is the Voice of America followed by China, West Germany and the United Kingdom. Then comes North Korea and Albania. The BBC has carried out research throughout the world and has found very few people who listen to either North Korea or Albania on shortwave. Both these countries broadcast four times the amount of material each week as Radio Canada does, for example.

Radio Canada, broadcasting more than 160 hours a week in 12 languages, has an estimated audience of 12 million. This puts Canada in about 30th place insofar as the amount of programmes broadcast each week. Radio Moscow, by comparison, broadcasts over 2000 hours each week and transmits in more than 80 languages. Nevertheless Canada, like Australia, has a substantial audience because of the credibility of broadcasting and both follow the trend of the BBC — although the UK no longer has the prominence that it once did in world affairs; worldwide audiences tend to trust the BBC for news that is accurate.

International broadcasters are aware that they are facing tremendous difficulties in providing shortwave listeners with good clear reception, as they are faced with the problems of jamming and other deliberate interference. As well, the falling sunspots have meant an increasing strain on the frequencies allocated to worldwide broadcasting. To reach the audience in a primary area, relay bases are rapidly being added by international broadcasters through satellite links between the studio and the distant transmitters. Already the BBC, VOA, Deutsche Welle, Radio Nederland, Radio France International and Radio Japan are using this method to bring their programme services closer to distant audiences. ●

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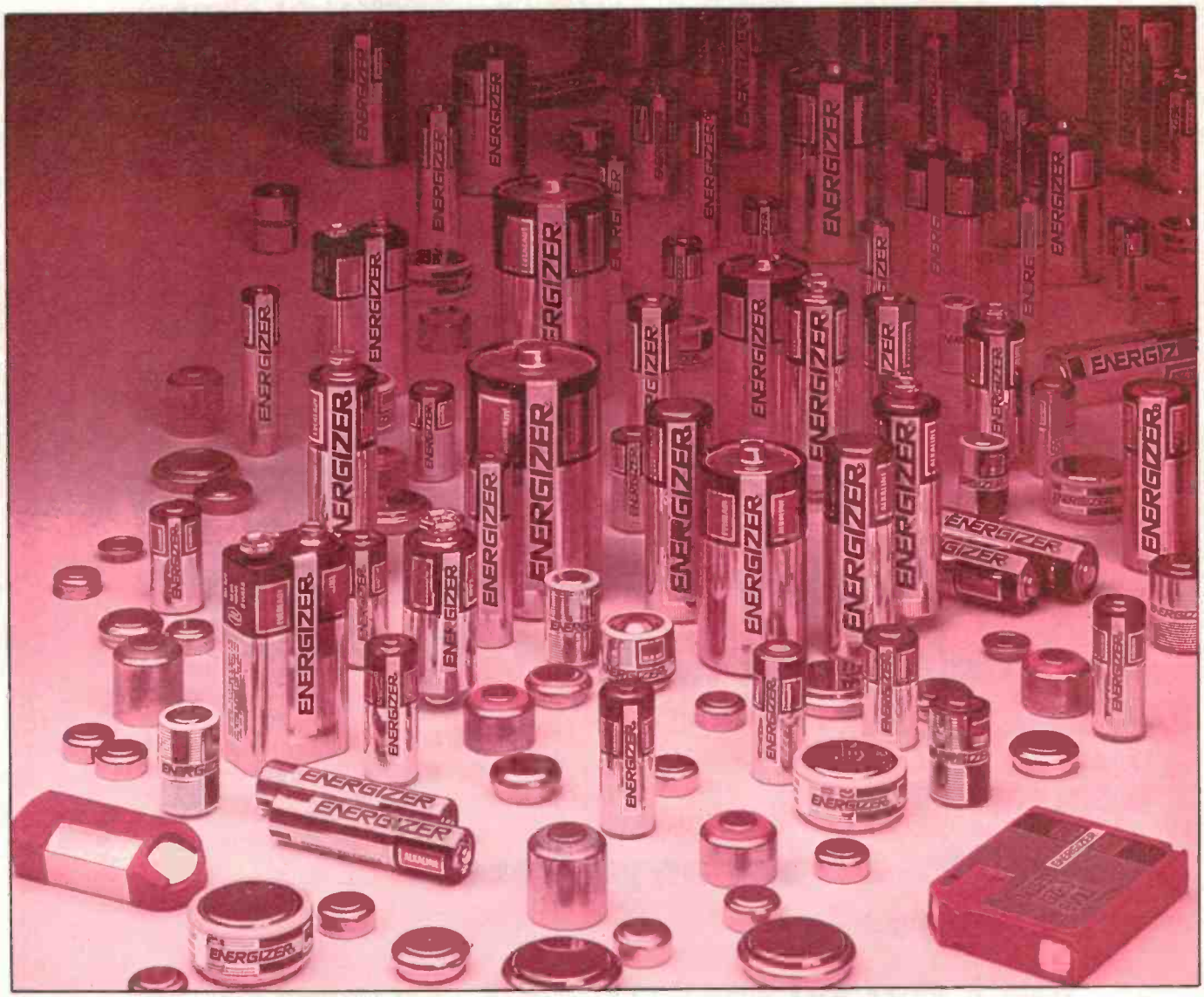
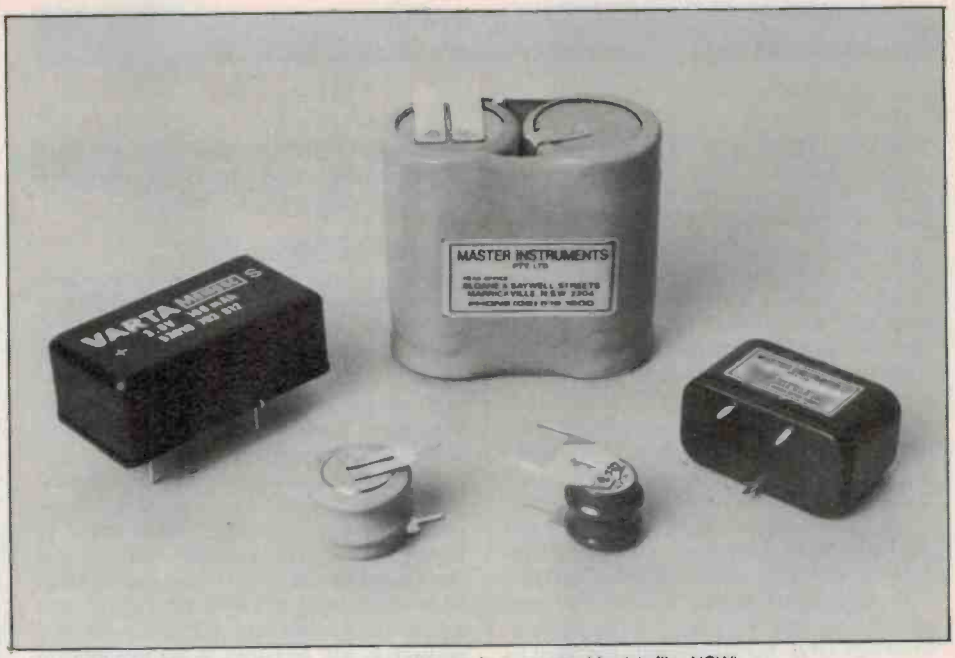
KNOW YOUR PASSIVE COMPONENTS

Part 2

What about transducers with a cardioid polar response? Perhaps you aren't quite certain which battery represents the best type for a given application. This article will answer these, and many other questions as we continue to examine more passive components that form the basis of electronics.

Peter Phillips





Various pc board mounting batteries (courtesy Master Instruments, Marrickville, NSW).

IN PART 6 of Starting Electronics the 'basic three' passive components were treated. We can now move into looking at more than this range. Passive components represent the majority of components in electronics, with batteries, meter movements, lamps, speakers, microphones, and a miscellany of things called transducers being covered in this article. We will also explain the meaning of the word "transducer". Included under the heading of transducers are speakers and microphones, and we will attempt to explain the plethora of 'technical terms' surrounding these items.

In future parts of the series, cabling and connectors, electronic 'hardware', transistors, etc will be presented. So, read on as the world of electronics spreads itself before you, with some of its secrets exposed.

Batteries

Very few electronic projects work without requiring a power source. (A mental teaser is to try and name a few . . .) Many circuits are designed for use with 'portable power', with some including a battery as a backup power source in case of power failure. The battery (or more correctly, the cell, a battery being a group of cells), is fundamentally a mixture of chemicals stored in a case. Different chemical systems produce different types. Basically, the chemical action within the cell will produce a voltage between the 'anode' or positive electrode, and the 'cathode' (negative electrode). The value of the developed voltage is a function of the type of chemicals employed, and the different compositions provide various characteristics which make different cells suitable for different tasks.

Generally, batteries can be grouped into one of two types, these being either primary or secondary cells. A primary cell is one that cannot be recharged, and, you guessed it, a secondary cell is one that can. Primary cells vary from the common zinc-carbon variety, the longer lasting alkaline types, through to the many miniature watch type cells available. Different sizes of these basic types, allowing different currents and voltages make up the large range of primary cells available. Miniature cells, such as those used in watches and calculators, use various chemicals, including lithium, silver oxide or mercury, and are usually used where very low currents are required. These cells are sometimes employed as backup power supplies for the memory system in computers and are available for direct placement on a pc board.

Testing the voltage of these cells, (normally around 1.35 V for mercury, 1.5 V for silver oxide) should be done with a high impedance voltmeter, like a DVM. An important point about primary cells is that they have, depending on their size and age, a fairly high internal resistance, which increases with age. This can sometimes cause erratic behaviour, particularly when the circuit uses power in a pulse form, as some digital circuits do. The average current may be small, but the individual bursts can be high enough to create severe voltage variations only visible on a cathode ray oscilloscope (CRO). Alkaline cells have a much lower, and more constant internal resistance, and are more suited to digital type circuits. A primary cell has a shelf life which would embarrass the corner store operator although very large cells can last for many years, and are often employed in burglar alarms as a backup supply.

Rechargeable batteries

Rechargeable batteries, (or secondary cells), are now extremely common, and represent better value for use in portable equipment. The two most common types are the lead acid, (as in motor cars), and the nickel-cadmium chemical systems. A third variety, using a nickel-iron chemical system (NiFe cell) is occasionally found, but has been largely superseded by the lead-acid battery.

The lead acid type is now available in the so called gel type, in which the electrolyte is stored in a gel form, and any gas that is produced during charging is recombined within the electrolyte, allowing the battery to be sealed and preventing leaks. However, like any sealed rechargeable battery, a safety valve is incorporated in case of accidents.

The lead acid gel cell has several advantages over the popular Ni-Cad variety, and as it is 'mess free' (unlike a car battery), it provides an excellent power source for burglar alarms, emergency lighting, or for computer backup supplies. Like most rechargeables, the gel cell comes in various ampere-hour (Ah) ratings. The Ah rating of a battery is generally the value of current the battery can deliver over a 20 hour period. Thus, a 2.6 Ah rating means a current of 130 mA for 20 hours, with temperature affecting this rating almost proportionally. The battery can deliver higher currents, but for a shorter period than the amps x hours relationship gives for the 20 hour rating.

Ni-Cads, as the nickel-cadmium rechargeables have become known, are available in the same sizes as the zinc-carbon batteries, although they have a lower output voltage (1.2 V per cell, as compared to 1.5 V per cell). An advantage of the Ni-Cad is its low output resistance, and its virtually constant voltage, almost to the end. (When they die, however, they die!) A disadvantage is the so called 'memory effect'. This means that they 'remember' how many times they have been charged and recharged, with an eventual reduction in capacity.

Ni-Cads should be charged with some care. If charged with a 'float' or trickle charge it becomes nearly impossible to hurt ▶

them with overcharging. However, if a high charging current is used, which is often preferable, both for the Ni-Cad and from the point of view of time, the current must be controlled to avoid the internal temperature of the cell rising to explosion levels. Some Ni-Cads come with temperature sensors built into them, allowing fast charging in conjunction with a suitable charging circuit. Clearly, their replacement with the same type is essential.

Some recharging circuits sense the battery's voltage, and switch to a lower charging current when a predetermined voltage level is reached. This type of charge circuit is simpler, but does not offer the same degree of battery protection, and would employ a lower value of initial charge current.

In comparison to the Ni-Cad, the lead acid battery (gel type) has a higher power-to-weight ratio, but is generally confined to fixed, and semi-portable equipment, due to its larger physical size and the fact that it's usually only available in 6 V or 12 V types. Should you wish to replace, say, a 12 V Ni-Cad system with a 12 V gel battery, care should be taken to ensure the recharging system incorporated within the equipment can safely cope with the change.

Meter movements

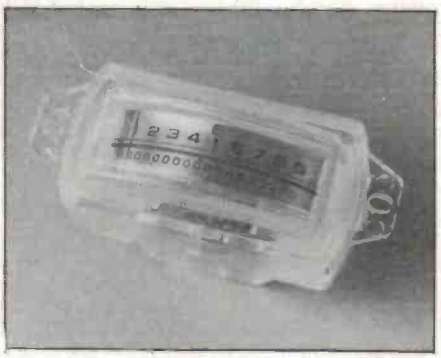
The analogue meter movement now finds direct competition in a range of solid state indicators using bar-graph displays, LCD displays, and digital displays. However, the moving-coil meter movement still has several advantages, including its simplicity, cheapness, and the fact that a changing value is more easily seen.

Meter movements are often used to display either a signal level, or an electrical quantity such as voltage or current. A power supply, (an essential part of any workshop) should have at least one meter to allow monitoring of either the output voltage, or the load current. Generally, a meter movement will be either of the moving-coil variety, in which a coil, suspended in a magnetic field deflects in proportion to the current flowing in the coil, or a moving-iron type, which has the coil fixed, and a metal disc that is attracted by the coil, again in proportion to the coil's current. The moving-coil is by far the most common, and is the only one we will consider here.

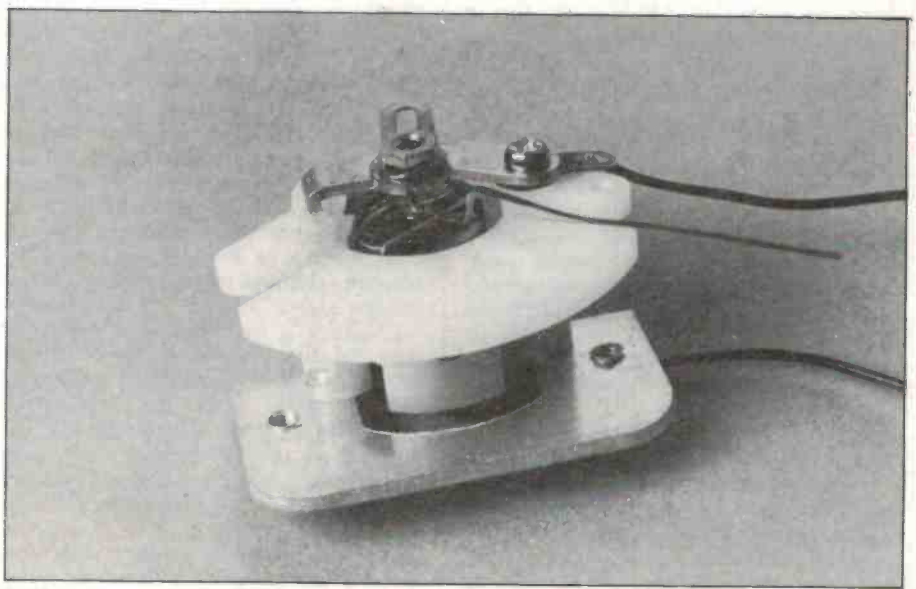
The main thing to know about a meter movement is how much dc current is required to cause the meter to reach full scale. This is known as the full scale deflection (FSD) current, and can be as low as 10 μA; less sensitive types might require up to 10 mA. A moving-coil meter movement cannot respond to ac (although a moving-iron one can), and a rectifier is required to convert the ac to dc if you need to measure an ac quantity. A meter movement becomes a meter if extra components are added, usually inside the case, with a scale also attached showing appropriate calibrations. For example, a 0-20 V panel meter can use the same meter movement as a 0-5 amp panel meter, it's only a matter of how to adapt it. Basically, a voltmeter has a resistor in series with the movement, and the ammeter has a resistor in parallel to limit the current in the meter movement to its full scale deflection value. The calculations to determine the size of the particular resistor are not difficult, and can be found in most text books on the subject.

Generally, meter movements employ a pivot and jewel suspension. The torque for the movement is generated against two oppositely wound spiral springs, with one spring being used to adjust the 'zero' of the pointer. The balancing of the movement is critical, and many movements are only accurate in one particular plane. More sophisticated movements employ a 'taut' band suspension, with two non-hygroscopic bands at either end of the coil assembly being pulled taut, with the movement suspended within the magnetic field by the two bands.

Meter movements are available in various forms, including edge reading, panel mount, and centre zero types. The main point to consider is the FSD current, which should be matched to the design specifications. It is possible to adapt a movement with a lower FSD current than that specified, but changes in component values will be necessary.



Above left. Panel mount meter. Above right. Edge reading meter.



Inside the meter showing the moving coil mechanism attached to the needle.

Indicator lamps

Indicator lamps serve the purpose of providing information. Mostly, they are characterized by being small and requiring only a small amount of power to operate. The three main varieties are LED (light emitting diode) indicators, filament lamps, and neon lamps. The neon indicator is generally only used to indicate a high voltage, such as the 240 V mains, and is usually made up of an assembly containing a neon tube and a series resistor, (around 220k ohms). The assembly will have a coloured bezel, and allow the unit to be mounted in a panel. The important thing to know is that you must *never* connect a neon bulb across

the voltage it is to indicate, unless the series resistor is present. Otherwise you'll blow just about every fuse between it and the power station. (Or almost!!)

Filament lamp indicators have the advantage of producing a fairly high light output, and a wide range of globes is available for the purpose. The main classification of such lamps is the voltage, the current, and the type of connection. Voltages can be as low as 1 V, but 6 V and 12 V varieties are the most common. The filament current requirements also differ, with around 100 mA being typical. The type of connection also varies enormously, with various sizes of Edison screw, bayonet cap, or slide base types being common. Some globes even come with only two wires protruding from the glass envelope, allowing pc board mounting.

Fittings are also available for the different types of globes, so naturally you would select one to match the other. The main thing to be aware of is that the replacement globe should have the same voltage, and approximately the same current requirements as its predecessor. It is also worth noting that incandescent indicator lamps require more power than, say, LED indicators, and their use in battery operated equipment is not recommended.

The LED is very commonly used as an indicator lamp, due to its longevity, (100,000 hours), cheapness and small power requirements. Typically, LEDs require around 2 volts at 10-20 mA, and are available in a wide range of shapes, including the common 5 mm and 3 mm round types, as well as rectangular or pin types. Colours are usually restricted to red, green, orange and yellow. (Orange and yellow can sometimes be hard to differentiate between.) Recent developments include a blue LED, but its low light output may make it a poor choice for an indicator.

Other LED types include infrared varieties, which give no visible illumination, (no good as an indicator, great for an infrared remote control), as well as LED packages containing two LEDs of different colours in the one white translucent encapsulation. This latter variety usually comes mounted in a chrome plated bezel, and has three wires, enabling the indicator to be used as a dual function device. Yet other types include the 'flashing' LED, which has an IC built in to produce a flash rate of around 1 to 5 Hz, when a 5 volt charge is applied.

An LED is essentially a dc operated device, and requires the correct polarity of applied voltage to operate. The reverse voltage capability of an LED is low, being around 5 volts. Special circuits allow an LED to be used with ac, and these should be consulted if necessary. Excessive current through an LED will cause its demise, and usually a series resistor is required.

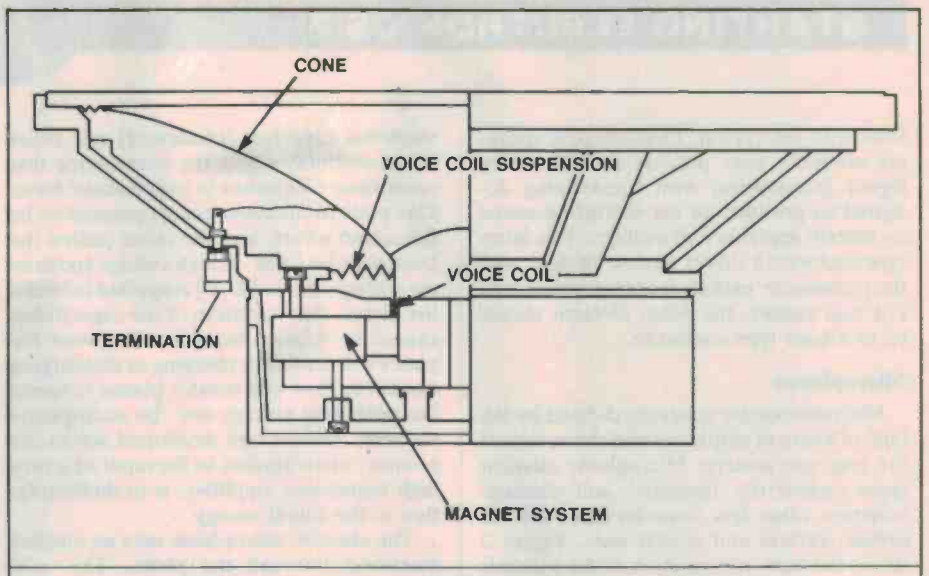


Figure 1. Cross-sectional view typical of a moving coil speaker.

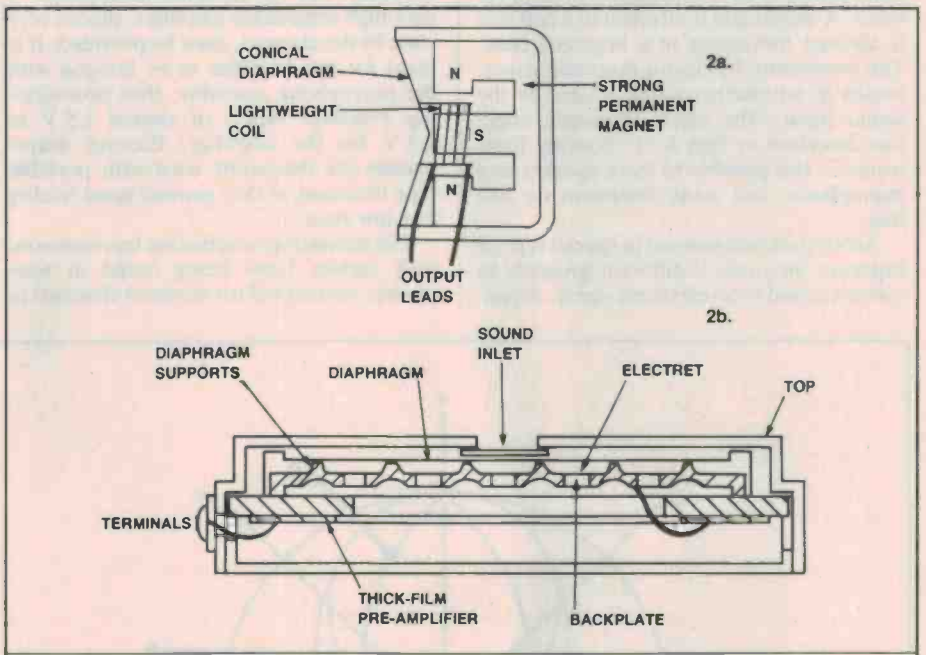


Figure 2a. A dynamic microphone and 2b, an electret microphone.

Transducers

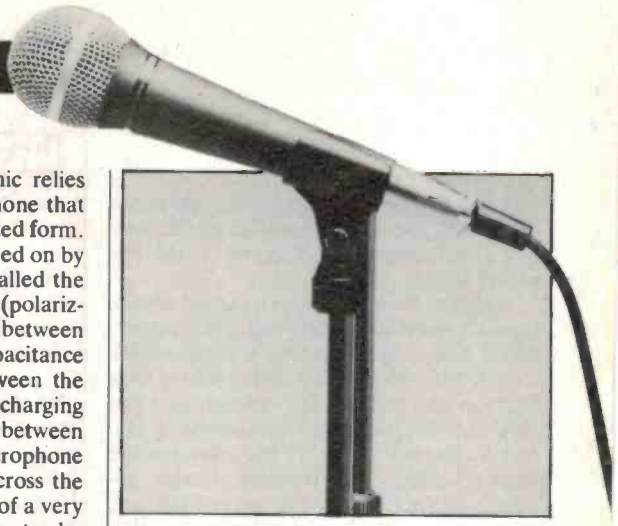
A transducer is essentially anything that receives energy in one form, and outputs energy in another form. In electronics, the only transducers of interest are those that have either an electrical input or output. A loudspeaker is a typical example. A speaker is, in fact a two way device, in that it will convert electrical energy to sound energy, and vice versa. For the purposes of this article, any dissertation on transducers must necessarily be scant, as herein lies a huge topic.

Speakers

Conventional speakers, designed for audio applications are usually rated by their nominal impedance (usually in the range of 4 to 40 ohms), power handling capability, frequency response, and physical size. Often one terminal will be marked "+", or something similar, which is an indication of the 'phasing' of the speaker.

Phasing refers to the direction of cone movement relative to the polarity of the applied voltage, and becomes important when two or more speakers are being employed. A speaker is best operated in a suitable enclosure, and the power rating of the speaker should be at least equal to that available from the driving source.

Speakers are normally of the moving-coil type, although other operating mechanisms are available. One variation is the piezo transducer. The piezo-electric effect results when the application of a voltage to a certain type of crystal causes a mechanical dis-



tortion of the crystal. Piezo-electric speakers normally only provide an output for higher frequencies, with some being designed to produce an ear-shattering sound by merely applying a dc voltage. This latter type includes a driver circuit integral with the transducer, making it ideal for an alarm. For best results, the piezo element should be in a horn type enclosure.

Microphones

Microphones are generally defined by the type of element employed and the nature of the response pattern. Microphone element types include the 'dynamic', and 'electret' varieties; other less common types are the ribbon, carbon and crystal ones. Figure 2 shows the basic construction of the dynamic and electret microphones. A dynamic microphone operates using essentially, the same principle as a loudspeaker, but in reverse. A diaphragm is attached to a coil that is allowed movement in a magnetic field. This movement, by electro-magnetic action, results in an electric output related to the sound input. The electro-magnetic effect was described in Part 6 of "Starting Electronics". It is possible to use a speaker as a microphone, and many intercoms do just this.

An electret microphone (a special type of capacitor mic) uses a different principle to convert sound to an electrical signal. A conventional capacitor (condenser) mic relies on an assembly within the microphone that constitutes a capacitor in a specialized form. One plate of the capacitor is operated on by the sound waves, and the other (called the back plate) is fixed. A high voltage (polarizing voltage, up to 200 V) is applied between the plates. Any variation of the capacitance caused by relative movement between the plates will result in a charging or discharging current to flow in a resistor placed between the polarizing voltage and the microphone element. The voltage developed across the resistor, when applied to the input of a very high impedance amplifier, is in direct relation to the sound energy.

The electret microphone uses an electret insulation between the plates. This substance has a polarizing voltage present within it as a result of its manufacture. However, like the capacitor microphone, a very high impedance amplifier, placed very close to the element, must be provided. It is usual for the amplifier to be integral with the microphone assembly, thus necessitating a voltage supply of around 1.5 V to 4.5 V for the amplifier. Electret microphones are frequently used with portable tape recorders as they provide good fidelity at a low price.

The remaining varieties are less common, with carbon types being found in telephones, and crystal (or ceramic) elements in cheap microphones. Ribbon mics are primarily used in professional applications, and are generally more expensive than the other varieties.

The response of a microphone to sounds from different directions is referred to as its 'polar' response pattern. Basically, a mic is either omni-directional, bi-directional, or uni-directional. Figure 3 shows the shape of the response curves for these three patterns. The term 'cardioid' is often used in place of, or in conjunction with the word uni-directional. The response curve of a mic identifies it to a specific application, with, for example, a highly directional (uni-directional) type being employed in conjunction with a video camera, and an omni-directional mic being most suited to a general purpose tape recorder application.

Other microphone characteristics include impedance, sensitivity and frequency response. Impedance can range from as low as 10 ohms right up to 50k ohms, and even into megohms for the crystal varieties. It is important to match the impedance of the mic to that of the device it must operate into, and sometimes an impedance matching transformer is required. Frequency response and sensitivity give an indication of the quality of the unit, and again should be matched to the application.

Other transducers in electronics include things like ultrasonic receivers and transmitters, record player pickups, tape heads, in fact anything that is, well . . . a transducer. A solar cell is a transducer that could also have been mentioned under batteries. A solar cell is a panel of material that will produce a voltage, around 0.43 V at a specified current, (usually around 20-30 mA), when exposed to sunlight. Applications are generally restricted to battery charging circuits, and various arrangements of solar cells are available that provide specified voltages and currents.

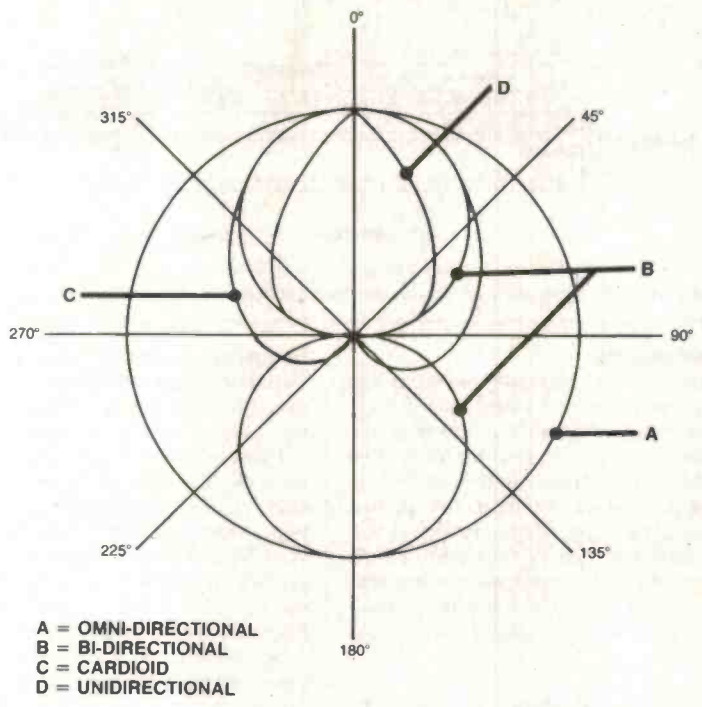


Figure 3. Polar response curves for microphones.

We wish to thank Dick Smith Electronics for the resistor and capacitor colour code artwork which appeared in last month's issue. Our apologies for losing August's acknowledgement.

SHOPAROUND

ETI-168: Continuity tester

The continuity tester contains a 16 mm 1M pot, which may pose some problems, a piezo electric resonator and an IC, the LM4250C you may not have heard of before. If you have trouble with these you might care to note the following: 16 mm linear pots are in stock at **Jaycar** in Sydney. The HPE127 resonator has the **Dick Smith** catalogue number #L7022 and the LM4250C is available at **Geoff Wood Electronics (02) 810-6845.**

ETI-1401: Sonics DI box

This is young Rob Irwin's latest offering in association with *Sonics* magazine. Isn't he doing well. It's very straightforward with the exception of the four DPDT pushbutton switches. Our prototype used Isostat switches. If you feel disinclined to hack things around you might like to try **Swann Electronic components (03) 544-3033, (02) 807-1944** or **RS Components (02) 669-3666.**

ETI-343: Optical car alarm switch

Welcome to the world of surface mount technology. Build this and you join the forefront of the revolution. However, don't get carried away. Before building it up you should give some thought to the mechanical problems associated with the case. Bits for a case like our prototype are available from **RS Components** and complete kits will be available from **Hi-Com Unitronics (02) 524-7878.** However you may elect to make your own arrangements if you can get other components more readily.

The 343 also requires a high intensity LED. The requirement is for 500 or 1000 mcd devices, known as megabrite LEDs. These are available if you do a bit of ringing around, although you may find your corner store deficient in this regard.

Artwork

For those constructors willing and able to make their own pc boards and/or front panels, we can supply same-size film transparencies of the artwork, positives or negatives as you require. From the list given below, select what you want and address your request/order to:

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FEATURE

THE HOUSE THAT CLIVE BUILT

— a tale of hard times, AI and clever telly

Clive Sinclair, the electronics innovator who gave us the ZX80 computer and the first small practical calculator, is in trouble. Not that his Sinclair Research and Metalab 'think tank' haven't a bundle of bright new ideas. They do. Problem is, there are some lemons too.

IN THE CITY OF LONDON, the financiers who make and break industry around the world, are scrutinizing Clive Sinclair again. The Sinclair empire is in trouble, reeling under shocks from several quarters. Talk is that Clive may be willing to sell his share of the business, or at least accept a less than majority shareholding.

The news is all of a piece. Around the world, the entrepreneurs who set up their businesses with nothing more than an idea and enormous amounts of energy are giving way to the grey-faced men in the pinstripes. Jobs and Wozniack are out of Apple — the new man is an IBM clone. At Atari and Commodore, accountants today muse on how to increase market share. In England, Sinclair holds on by the skin of his teeth.

Trouble in paradise? Why does Sinclair, businessman of the year, knight of the realm, need £15m? There are a few reasons: the recession, the downturn in pc business, bad judgement even. The fundamental reason is that the entrepreneur, the man with his eye on the main chance, the risk taker, will always have the dice stacked against him.

So, why would anyone want to invest in a company with trouble? Bail out an unhorsed knight? For that, there are a couple of reasons.

Firstly, he has an impressive track record of innovation. He started out selling radios and other electronic trinkets by mail order. He hit the jackpot when he produced the first small practical calculator. His Executive sold for £79 ($160) and seemed absurdly cheap. He hit upon the idea of multiplexing the display in order to save power, size and thus money.

Then he launched the ZX80, the first real computer to sell for under £100 ($200). It's difficult, now, to remember the significance of the ZX80. But for millions of people around the globe it opened up the world of computers. It only had 1K of RAM, and an absurd keyboard, but it was the first programmable device many people ever touched.

Developments quickly followed: the ZX81, then the Spectrum and finally the

ULTRA MINI TV

One of the most remarkable products to come out of Sinclair Research in the last few years has been the Flat Screen TV. It's being manufactured at the Timex plant in Dundee using a Sinclair design automatic plant. Sales are just starting to get under way in the UK.

The mini TV measures just 14 x 8.9 x 3.18 cm. According to Sinclair publicity it's 25 per cent smaller and only one-third the weight of an average paperback book. The screen measures 5 cm across, and battery power will put a picture on it for 15 hours continuously.

It took Sinclair Research £4m and six years to come up with the Flat Screen TV. Much of the time was taken up with just a few revolutionary components.

Heart of the system is the flat screen. More accurately, it's a folded cathode ray tube (CRT) and it's this that makes it possible to package the TV in a tiny box. In a conventional TV, an electron gun spurts electrons at the screen when the electrons are excited by the potential on the cathode. The beam is made to scan from left to right and up and down by varying the potential on a set of deflection plates. Modulation of the intensity of the beam creates the pattern we see on the screen.

With a folded tube however, it is neccessary to make the electron beam bend around a 90 degree corner. This causes all kinds of problems. For a start, the deflection of the beam resulting from a typical sawtooth wave applied to the deflection plates will be non-linear.

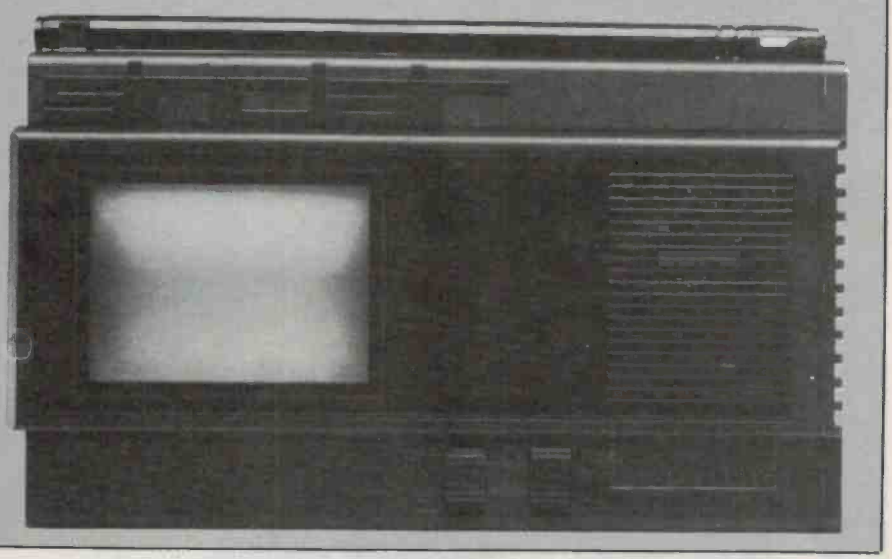
The problem was solved in co-operation with Ferranti, which developed a special integrated circuit to generate the complex waveforms necessary to scan the screen. This IC also uses digital techniques to monitor automatically the video and audio circuitry and to adjust the local broadcast standards.

According to Sinclair Research, the tube winds up with half the volume, relative to screen size, of a conventional tube. Just as importantly, it uses only one-third to one-tenth the power. However, the picture is up to three times brighter than normal. One reason for this super brightness is that one does not view the reverse of the screen, as is normally the case. In the folded CRT, the viewer sees the front of the screen, where the electrons actually strike the phosphors. This is done by fitting a clear window in the side of the tube, through which you look at the screen.

The tuner is also little short of miraculous. It measures just 31 x 23 x 11 mm. Sinclair used surface mount devices and hybrid components to achieve a power saving of 90 per cent over conventional circuits. It can configure itself for almost any standard except SECAM. So it can operate in a 525 or 625 line mode, and adjust for different audio carrier frequencies.

The biggest question, however, is: what is it good for? You obviously can't sit and watch it the way you would an ordinary TV. According to the Sinclair publicity, the way to do it is to treat it in much the same way as you would a book. It's ideal at the breakfast table, or in bed, or perhaps on the train. After using it for half an hour or so I can say that the biggest problem seems to be orienting the aerial for good reception. When the screen is as small as this one you need to get it right. Marginal ghosting makes it unwatchable.

In fact, for my money it's a bit too small, but maybe with a bit of practice one would get used to it. There are certainly advantages in being able to watch TV whenever and wherever you like. Rumour has it that Sinclair is developing a version with a similar sized package, but a screen twice as big. That should really be a winner.



QL, Sinclair's so called quantum leap in computing. All were, in some way or another, revolutionary products.

Not that he has always been successful. A low cost multimeter and a digital watch both turned out to be dead ends. The C5, his revolutionary new electric bike, looks set for the same expensive fate.

Unfortunately, the heady days are over. No computer company heavily engaged in personal computers is looking particularly rosy right now, and Sinclair is no exception. The down turn in demand for PCs has hit all manufacturers hard. It especially hit hard at a company that is also trying to recoup a multi-million dollar investment in an electric bike no one wants.

But they're an optimistic lot at Sinclair. And it would be hard not to be, doing exciting work based in some of the most picturesque countryside in Britain. Here, secreted away behind the hedgerows of rural Cambridgeshire, you can find Sinclair Research, and the so called think tank, "Metalab". And if you want to dig behind the headlines and get a feel for the strength of the company then this is the place to come.

Metalab was launched with a great deal of hullabaloo two years ago as a place where the best scientists in Britain could exploit ideas that might otherwise go abroad. The idea pushed by the publicity machine was that this would be a place for the best scientists to work with the best equipment and no financial constraints to produce whatever their hearts' desired.

In fact it was somewhat less than that. Clive Sinclair had a very precisely mapped out program for the future, and wanted brains to make it real. His plan: to develop some of the key technologies that will be needed to make Artificial Intelligence (AI) work.

Of the various projects, the closest to fruition is wafer scale technology. To understand what this involves, consider that integrated circuits are made by etching a pattern onto wafers of silicon. These wafers are typically four inches across (sometimes six inches). In conventional technology a single wafer will contain a host of individual circuits. At the end of the manufacturing process the wafer is cut up and the individual bits, each containing a single circuit, are encased in plastic to become the familiar IC we all know and love. ▶

THE C5

Sinclair claims the C5 is a completely new form of personal transport. It is certainly unique. Sometimes it's called a car, sometimes a bike; Sinclair Vehicles, the maker prefers to call it a personal electric transport.

Whatever it's called, it has one seat and three wheels, an electric motor and a set of peddles, a boot to put the shopping in, headlights, tail lights, a battery and a rather fancy looking body. The credentials are impressive. Lotus cars designed the chassis, British Aerospace designed the body. AB Automotive, which designs Jaguar dashboards, also did the instrumentation for the C5. Construction and servicing (in the UK) is by Hoover. The electromotive system is the result of over 10 years work by Sinclair.

The target market for the C5 is young people, as a safer alternative to motorized two wheelers, housewives as a shopping transport and urban commuters. The range is about 32 kilometres and running costs about equivalent to 1000 miles per gallon. Cost in the UK is about £399.

The motor is made by Polymotor, a Philips subsidiary that specializes in electric motors for the aerospace industry. It has been specially tailored for the C5 battery. The battery was developed by Oldham for the project, and is described as being a "supremely efficient" version of a lead acid battery. It only weighs 15 kg and delivers 35 Ah. It has been designed to withstand 'deep cycling' effects, ie, continual discharge followed by recharge. It takes eight hours to recharge.

The drive system is ultra simple, consisting of an epicyclic gearbox with reinforced nylon cogs. This drives one of the rear wheels. There is no regenerative breaking. When power is not supplied to the wheel the craft simply freewheels. This goes against the grain of most electric car designs, which use the breaking energy of the car to recharge the battery. However Sinclair Vehicles designers obviously thought the increase in complexity not worth the gains in battery life.

Whether the C5 is any good in a technical sense, the British public seems to be giving it the big thumbs down (it hasn't been offered for sale overseas yet). The press has been almost universally damning, describing it as unsafe and lacking in power and range. During the months since its launch Sinclair Vehicles has been steadily revising the size of this year's production run downwards. From predictions of a six figure market by 1985, it looks as though it will be lucky to reach four.

Whether there is any objective truth in the criticisms is hard to know. It's difficult to imagine it could be more unsafe than the motorbikes that massacre adolescents with such bloodstained regularity. And range: well in the city there must be a huge market of people whose daily movements do not total more than 32 km. As for speed, a little less of it might not be a bad thing. No doubt such thoughts have passed through Sir Clive's mind as well. Oh but the public is fickle.

Working on a wafer scale implies treating an entire wafer as single IC. The problem with this method in the past has always been the unreliability of the manufacturing process. For a variety of reasons manufacturing is not one hundred per cent reliable. Nothing like it. This is not a real problem in conventional technology, since all the circuits are tested on the wafer, and when it is cut up, only the good ones are used.

But it is a problem working at wafer scale. One error means the loss of the entire thing. Economics simply do not allow the creation of large areas of silicon like this. Sinclair Research has developed a mass storage device that consists of half a million identical memory cells. At power up, logic on the wafer forces a formatting routine. This routine systematically tests every location on the wafer for errors. When it finds one it steps around it. The logic circuits then ensure that no data is stored in these locations. Owing to the pattern formed during the formatting routine, the technique is called the Katz spiral. (Ivor Katz is one of the Metalab crew.)

The Katz spiral will result in a bulk storage add-on for the Sinclair QL with 500K capacity by the end of the year. Development plans call for the eventual use of 1.5 μm NMOS and finally micron size bipolar technology to produce a mass storage unit of around 7 or 8 Mbytes. According to Richard Cutting, who heads up Metalab, the device will probably sell for around £500 in the UK.

The significance of all this to AI is that Sinclair is developing techniques that will allow designers to store large numbers of circuits on a single wafer. One idea doing the rounds: it would allow them to develop a wafer consisting of perhaps 300 cells, each containing a processing unit and surrounded by some RAM. Such a design would appear to be ideal for parallel processing.

No one is quite sure yet how parallel processing would work, at least on this large a scale, but the idea is clear enough. The individual processors would each be assigned some particular task which they could do at the same time, instead of sequentially, as is required at the moment. One task identified at Sinclair for this type of technology is speech recognition.

According to Sinclair, the scenario is that one of the prime requirements for a fifth generation machine is the ability to interface naturally with the machine. Throw away keyboards and throw away rigorous logic as well. Speech recognition replaces the keyboard. To a limited extent this has already been done experimentally. Problem is that processing time is so slow it has little value. It takes so long because

the CPU has to compare each of the words in the memory with the received word and react accordingly.

Obviously, if the vocabularly is of any size this process is too slow for practical use. With parallel processing though, things could be speeded up immensely. Then you could supply each processor with only two or three words, perhaps only with one, and they could all carry out a test on their word at the same time. The result, almost instantaneous word recognition.

Metalab is also doing some work on graphics and pattern recognition that will probably use the same type of parallel processing technique. In any event, the feeling is that this is a core technology of the future, and the company is determined not to be left behind.

Another bit of the AI picture that is being put together at Metalab is something called "Natural Language". This is another problem, like speech recognition, that affects the way in which we interact with computers. The idea here is that, at present, we require a very formal, and unnatural, language to communicate with a computer. Even if computers could be taught to recognize speech, the computers of today would be incapable of understanding an input unless it was worded in very carefully constructed sentences. In fact it would be just like reading a program out aloud.

Sinclair would like to achieve a situation where the operator could instruct the computer in a far less formal manner. In fact a manner more akin to normal everyday speech. This is a natural language. It's difficult to know what this means in terms of nitty gritty programming techniques, except to say that the key concept seems to be that a program must be seen as a sequence of logical concepts. The task then is to teach the computer to recognize when one of these concepts is invoked, and how it is strung together with others.

Sinclair's strategy in the market place is to try and be pre-eminent in a few specialist areas of artificial intelligence. If past experience is any guide they will be the cheap areas, the areas where the common man first gets acquainted with the next generation of computers. How long to wait? According to Richard Cutting, by the end of the decade there will be significant breakthroughs. He predicts usable voice recognition by 1990 at least. How will it be packaged? What about a talking home doctor, as in "Hey, RSD2 I feel lousy, prescribe a pill". Another idea from Cutting: the home lawyer. He, or it, would be a walking compendium of advice on everything you wanted to know about your rights and obligations, but were too broke to pay for.

Whether or not ideas such as these are sufficient to pull Sinclair out of the sticky place into which he has fallen is hard to say. In spite of everything demand for the QL still grows apace, and a string of new devices seem to be assured at least for the next decade. But there have been an awful lot of lemons in the past. Maybe less in the future?

Stop Press:
London, 24 June — Clive Sinclair has left the board of Sinclair Research. The new chairman is Robert Maxwell. Maxwell, with heavy publishing interests, has bailed the company out in return for the chairman's seat. Sinclair retains rights to the C5 bike, although production has been halted. ●

Enhancing the image: an engineer on every board?

by Jim Rowe

AN INTERESTING LETTER appeared in the July issue of *Monitor*, a monthly newsletter published by the IREEA (Institution of Radio and Electronics Engineers Australia). Written by Mr Paul Wilson, a senior member of the Institution, the letter basically takes Australia's engineers to task for their apathy and conservatism.

Australia's electronics engineers only have themselves to blame, says Paul Wilson, for their relatively low status and recognition in our community. Unlike accountants and other professionals, they have not used their own organizations (like the IREEA) to market themselves to the community and explain their actual and potential contribution. In fact, he goes so far as to suggest that: "Barry Jones' jibe at the scientific community for being 'a bunch of wimps' could equally well be aimed at engineers, and well deserved it would be".

Mr Wilson suggests that professional bodies like the IREEA should be spending a major part of their annual budgets on a sustained, high level and professionally mounted public relations effort designed to make engineers clearly visible on television, in the newspapers and at public exhibitions. They should also be persuading corporate managers to reserve a seat on every board for a professional engineer.

He points out that many Australian manufacturing and industrial service companies employ trades or sales people to do jobs which are technically beyond them, and which really should be performed by engineers. Unless this is remedied, he suggests, there will continue to be a high level of industrial failures and accidents.

Paul Wilson ends with the suggestion that if engineers can achieve the visibility, status and financial rewards he believes they deserve, the profitability of Australian companies is also likely to improve. In other words, what's good for engineers will also turn out to be good for their employers, and by implication the rest of us (although perhaps not trades and sales people!).

Well, it's all pretty exciting and controversial stuff for the normally rather staid IREEA's *Monitor*, isn't it! Engineers are apathetic and conservative wimps, and well behind even bean counters when it comes to striving for decent status. But if only this hidden army of Clark Kents can get off their tails, find a 'phone box and change into their true Superselves, they'll be able to solve all the problems of Australia's industry in a single bound — and get all the adulation and riches they deserve. Bravo!

Seriously, though, I think Paul Wilson has raised some very valid points. By and large engineers have been extremely conservative lot, with their heads buried deeply in their work. They have not taken much interest in other aspects of either industry or the community, even in areas where engineering has legitimate and valuable contributions to make.

I'm sure he's also right that there *are* a lot of Australian companies where trades and sales people are trying to do jobs that are strictly beyond them technically.

But I'm not nearly so sure that today's engineers would automatically be a better choice to fill these positions. Nor do I believe that putting an engineer on every board would necessarily make companies more profitable.

Actually I'm not all that surprised that so many companies are employing trades and sales people. They may not have the technical expertise, to be sure, but a lot of the time they're much more down to earth than today's engineers. By that I mean they're aware of the need to produce a practical product, in a realistic time and for a price that will allow a profit.

Unfortunately so many of the engineers turned out in the last few years by universities and CAEs are heavily orientated towards theory and research. Ask them to juggle a Laplace transform or shuffle around a few Bessell functions, and you're talking their language — but when it comes to rolling up the old sleeves and producing a few real-world product designs, forget it! Particularly if it involves designing something to meet a price/profit target.

In fact a lot of these engineers are really quite proud of their ivory-tower training and attitude. Producing products for a profit? Why, those mundane, money grubbing activities are for lowly technicians and trades people, not We Professional Engineers!

Small wonder, then, that so many companies have selected not to employ engineers, but instead opted to employ cheaper and more practically orientated people. You can hardly blame them. And I doubt if they're likely to see much advantage in inviting engineers onto their boards at present, for the same reasons.

Clearly Paul Wilson is quite right in blaming all this on the engineers themselves and their professional organisations like the IREEA. But I don't think it's just a matter of doing a better PR job, to convince everybody that engineers are really the unrecognized saviours of society.

A much more effective way for engineers and their organizations to tackle the problem would be to exert pressure on the universities and CAEs, to get them to stop turning out academic boffins and start turning out the kind of practical engineers that industry really needs. Then the recognition, status and financial rewards for engineers would improve because they really *would be* more valuable to industry.

In other words, if the product is not selling at present, it could just be that the product needs improving. Let's spend a bit of effort on that, not just on better marketing.

Mind you, I have a strong feeling that getting professional bodies like the IREEA to exert this kind of pressure on the tertiary training institutions will not be easy. Most of the professional bodies seem to be dominated by academics — often the same people who determine the structure and content of engineering courses. So the professional bodies are part of the same highly conservative and inward-looking system as the unis and CAEs — a situation which has no doubt evolved because of the very same apathy referred to by Paul Wilson.

I have to congratulate Paul Wilson for raising this matter, and the IREEA for publishing his letter. But solving the problem won't be just a PR exercise. It's deeper than that. ●

Who are you?

THE HACK IS A CURIOUS BEING. In his function as arbiter over the fate of the various pieces of small paper that float over his desk every day he frequently wonders (a) who sends them, (b) why they bother and (c) what is it all FOR?

The answer to (b) and (c) elude him. Screw the paper up and throw it in the too hard basket. It's the one behind the filing cabinet where the mice nest in season. In pursuit of (a) read on kiddies, 'cause the readership survey is here.

Readership surveys come out at regular intervals when the gnome who produces them comes up for air. They tell US everything about YOU that we could possibly want to know but were too embarrased to ask. Now we know how the spooks feel in ASIO.

Consider if you will, the following. You are well-heeled and well housed, in fact six times more likely than normal to have bought a house during the last year. You are five times more likely than average to own a computer and twice as likely to own a typewriter. Given the near total illiteracy of most people with electronics training this is surprising. You are also heavily into speedboats, but not yachts, which get the big thumbs down.

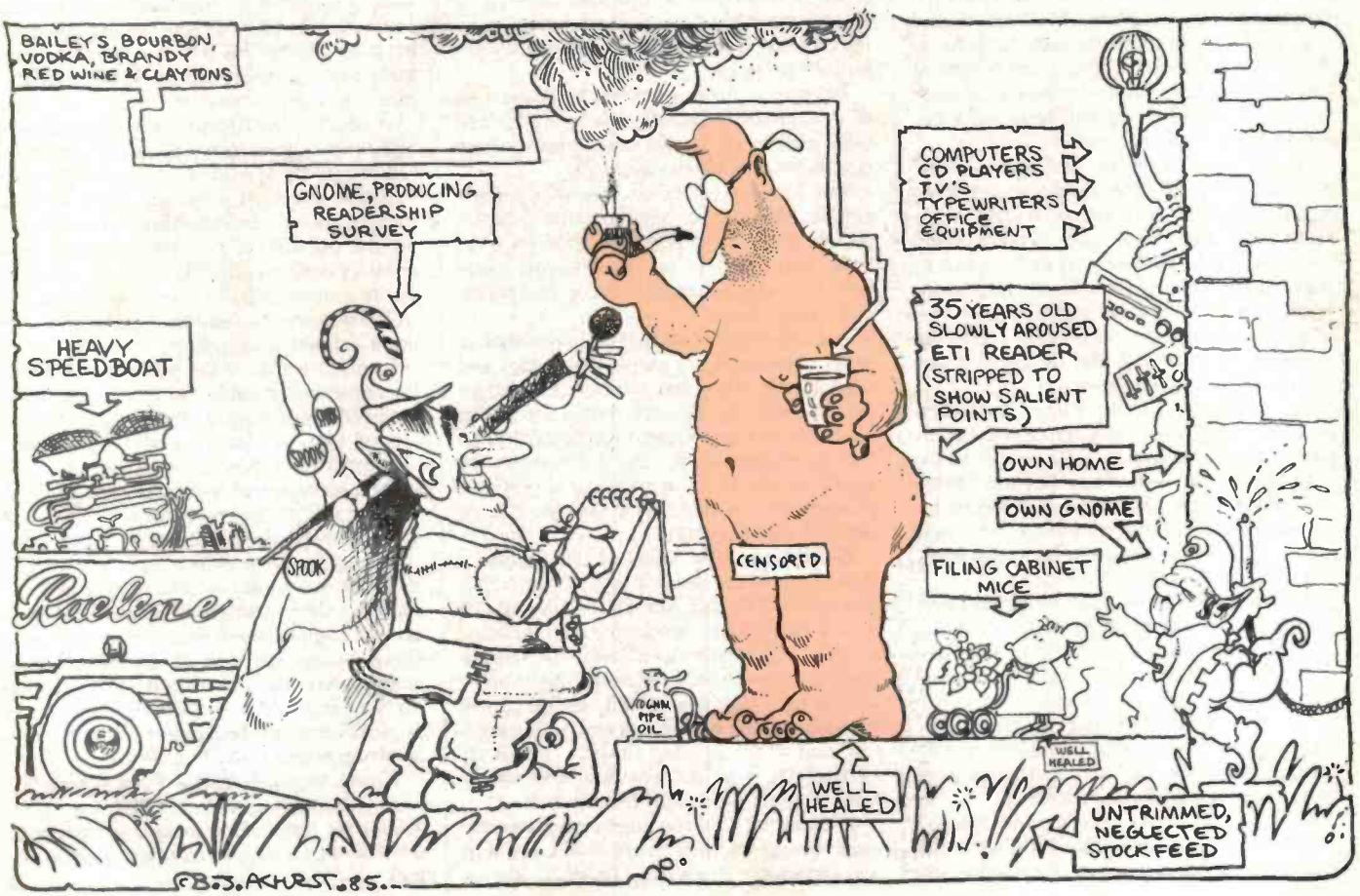
At work, you earn more than average, and are four or five times more likely to be consulted about purchases of computers and office equipment than the norm. The boss even asks your advice about banking. It's clear, however, that you know very little about stock feed as you are 60 per cent less likely than the norm to be consulted about it. The only consolation is that farmers avoid *Electronics Australia* readers like the plague; they're 80 per cent less likely to be asked for their views.

You are more likely than average to own an audio system, and obviously spend a lot of time thinking about it (boring sods) because you are six times more likely to want a CD player than the rest of the community. You have as many TVs and videos but watch commercial TV marginally less than the rest of them. That's because you spend more time watching videos (the survey doesn't say whether you also watch SBS and the ABC). You also spend more time making your own.

You smoke tailor-made cigarettes slightly less than the rest of the community, but roll your own more often. You are thus marginally more smelly than the readership of *Your Computer* magazine, but distinctly better than the *Penthouse* readers.

You're almost three times more likely than normal to be a pipe smoker. And you like to lubricate the process with a spot of cognac. You're almost six times more likely than the general population to have a taste for the stuff. You also like cream based liqueurs, especially a drop of the Baileys. There is also a penchant for bourbon, brandy and vodka, but only *Electronics Australia* readers would be seen dead with Australian whiskey. Red wine and 'Claytons' also get the nod but rosé is a definite no-no.

I'm afraid that when sex rears its lovely little head you're all a bit slow on the uptake. In fact, in the under 25 age group you're only one third as likely to be married as the norm. *Australian Penthouse* readers are twice as likely to be married at a similar age. But you're marginally more likely to be married later on. In fact by 35 you're more likely to be married than the *Penthouse* reader. All of which suggests a motto for the lovelorn *ETI* reader: "when you're on a good thing — stick to it".



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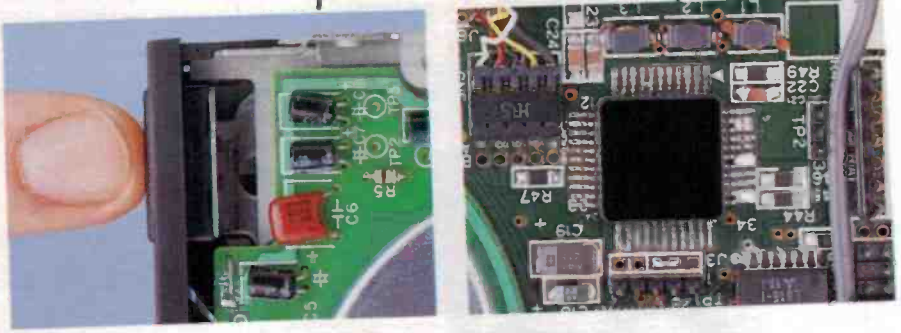

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