

AUSTRALIA'S DYNAMIC ELECTRONICS MONTHLY!

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# Electronics Today

INTERNATIONAL



JULY 1985

## SIZING UP SIGNAL GENERATORS



### REVIEWS:

PHILIPS HI-FI VCR

'EUROPEAN'  
SPEAKERS  
FROM JAPAN

VZ-300 COMPUTER  
AND DISK DRIVE

### PROJECTS:

TOP SPEC FOUR  
CHANNEL MIXER

INTELLIGENT  
DOOR LOCK

EXPERIMENTAL  
MICROBEE  
AUTODIALLER

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## 8010A 8012A (similar to 8050A)

- 8010A has 10A range and true RMS • 8012A has low ohms (0.001ohm resolution) • Both have conductance • Mains/Battery option

## 2 8020B

- 3½ digit • 0.1% basic accuracy • Eight functions including conductance
- Continuity beeper

## 3 8021B 8022B

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## 4 8024B

- 3½ digit • 0.1% basic accuracy
- 11 functions including temperature with K type thermocouples • Peak hold on voltage and current • Logic detection and continuity testing • Audible and visible indicators

## 5 8026B

- 3½ digit • 0.1% basic accuracy • True RMS to 10kHz • Conductance to 10,000Mohm
- Diode test and continuity beeper

## 6 8062A

- 4½ digit • 0.05% basic accuracy • Similar to 8060A without counter and dB • Relative reference • True RMS to 30kHz

## 7 8060A

- 4½ digit • 0.05% basic accuracy • True RMS to 100kHz • Frequency counter to 200kHz • dB and relative dB • Microprocessor self diagnostics • Relative reference for comparing values • Direct resistance to 300Mohm

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# Electronics Today

INTERNATIONAL

## FEATURES

<b>Sizing up signal generators</b>	12
The dimensions can be daunting	
<b>Two thousand kilowatts from under the sea</b>	125
Some history of Dutch radio engineering	
<b>Aussat nearly comes to Ravensthorpe</b>	126
Something of a sore point in the west	
<b>The story of Dulmont</b>	132
A lesson in Australian enterprise	

## PROJECTS

<b>ETI-1404: Four channel stereo mixer</b>	58
A quality mixer for the home recordist	
<b>ETI-1528: Intelligent door lock</b>	67
Press the secret code and <i>open sesame!</i>	
<b>ETI-698: Experimental 'Bee dialler</b>	78
To test the automatic dialling you could do ...	

## REVIEWS

<b>Loudspeakers shape up</b>	26
Sony APM22ES speakers use a square diaphragm	
<b>Philips' VR6940/75 VCR — a sound investment</b>	34
Unmatched stereo sound	
<b>The baby sure has grown</b>	102
The new VZ-300: more RAM and some other improvements	

## OFFERS

Reader information service	19
Energy Control offer	107
Hewlett Packard offer	119
ETI mail order books	24,120-122
Subscriptions offer	123

## DEPARTMENTS

News Digest	6	Idea of the Month	111
Sight & Sound News	40	Microbee Column	94
New Components	46	Commodore Column	98
New Equipment	52	Shoparound	129
Computing News	90	MiniMart	130
Communications News	114	Perspective	136
Letters	9	Dregs	138
Ideas for Experimenters	110		

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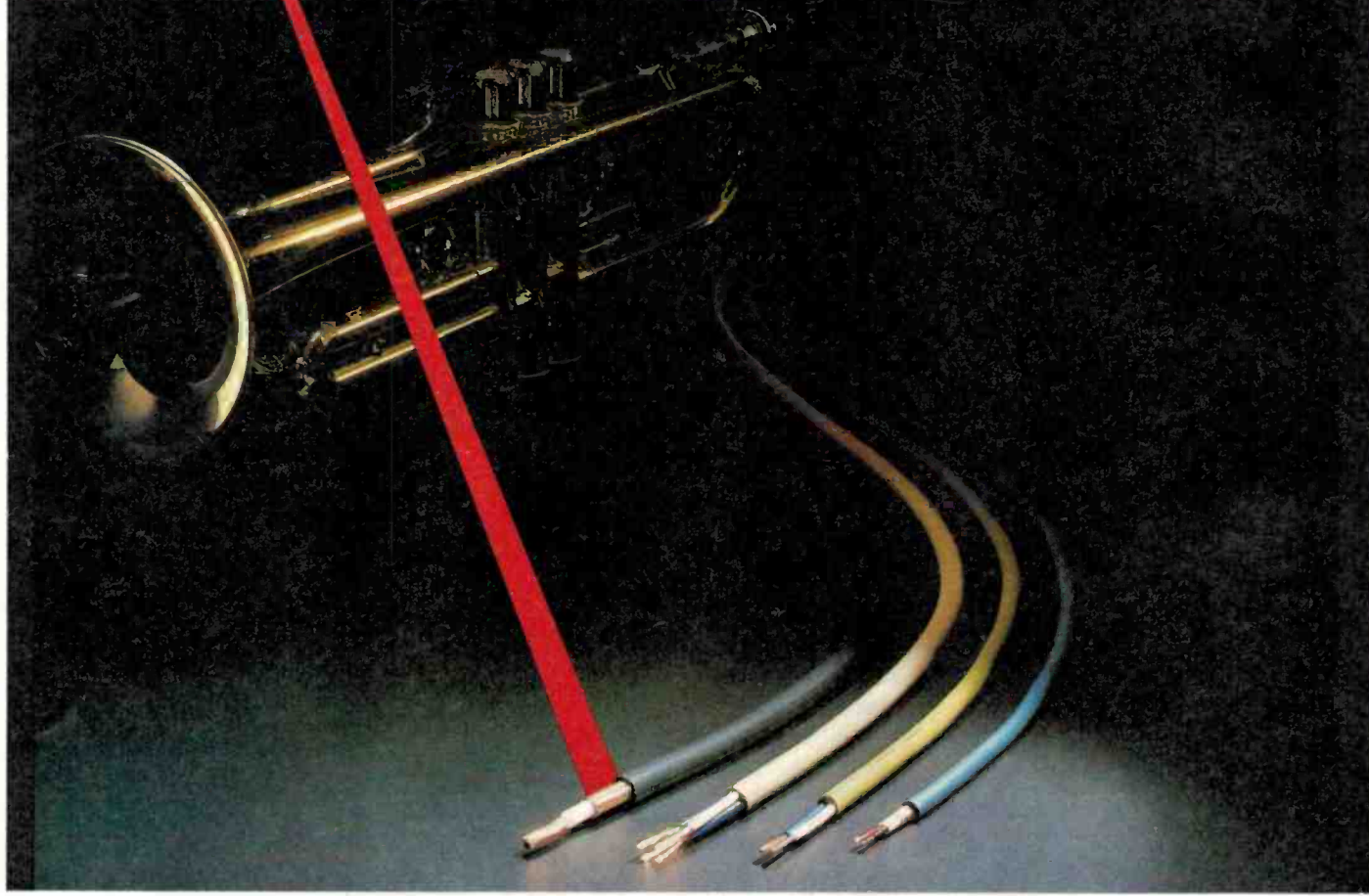
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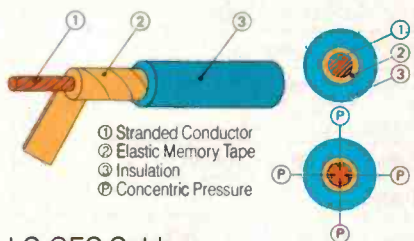


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**REMEMBER AM STEREO?** You know, that invention of the US AM broadcasters that was supposed to rescue them from the usurping FM?

There is no doubt that within a few years AM stereo will be highly popular among AM listeners. Yet the bungling over its introduction will do much to limit this success.

And it won't be helped by the abysmal performance of receivers. Makers still seem to be continuing the practice of putting narrow band AM and wide band FM in tuners.

AM stereo has had a long and tortured history. After some heavy lobbying in the early 1970s the FCC (like our DOC) eventually set up an AM stereo committee.

The committee was only set up after companies like Belar and people like Leonard Kahn promised to submit AM stereo designs so the committee would have something to consider. Eventually three other companies, Harris, Magnavox (a Philips subsidiary) and Motorola joined the fray.

Horror of all horrors, the FCC in 1980 chose the only company with a foreign parent, Magnavox.

It is rumoured that one of the other contenders filed an anti-trust suit in the US Supreme court. The court, in a monumentally stupid decision, said the FCC could no longer set such standards in the United States, where the decision would result in one owner of the design.

The FCC rescinded its approval of Magnavox and spent two suspense filled years scratching its head before making its final decision on AM stereo. Then it approved all five incompatible standards for use in the US.

Harris had not wasted time. It had done its marketing so well it soon had a hundred stations installing its system compared to ten for Magnavox and Motorola.

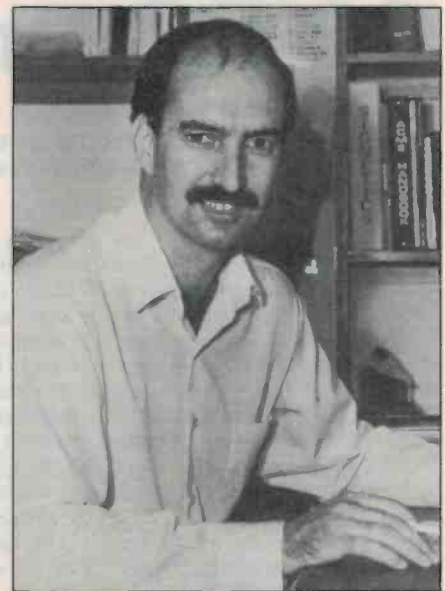
But all was not well for the Harris installations. The FCC said there was a discrepancy between the equipment being operated and that which it had approved. The FCC stopped the Harris stations from operating for a while and then banned further sales.

As it transpired, Motorola became the new leader, Harris decided to sell the Motorola system and Australia opted for one system, Motorola.

It's little wonder that it has been a long road to AM stereo!

The long term result may be even more devastating for the US. Because of the anti-trust decision the US may lose its ability to set broadcasting and other standards.

David Kelly  
Editor



**STARTING ELECTRONICS**

This feature continues with more on passive components to help the uninitiated (and the initiated?) get clear what a passive component is, how to read codes and what all those symbols mean — exactly.

**ELECTRONIC JUMPER LEADS**

This project should turn out to be the hottest car project for a while, if there are as many people out there as we suspect, who have had to stand over their greasy old batteries in pouring rain and dinner attire. The electronic jumper leads save all the discomfort by charging your battery via the cigarette lighter while you sit comfortably dry.

**NEXT MONTH**

**THE CHICAGO ELECTRONICS SHOW**

The world's biggest hi-fi release show will this year have to contend with our tenacious reporter Jon Fairall. So you can put your fare away, keep clear of the crowds and read Jon's account of what's new, what looks good and what looks likely.

**CASSETTE DECK REVIEWS**

Not a step into the past but two reviews of the new JVC KD V4000A and Teac R555 BL cassette decks. Magnetic recording isn't all video, and Louis Challis tests these new products to see how they shape up on the audio scene which seems only to talk CD.



# CSIRO under review

The Australian Science and Technology Council (ASTEC) has been commissioned by the federal government to conduct a \$200,000 review of government-funded research and development in Australia.

Under the direction of its chairman Professor Ralph Slatyer, ASTEC is presently looking into the CSIRO and will later extend its inquiries to other large Commonwealth research institutions such as the Defence Science and Technology Organization, the Australian Atomic Energy Commission, the Antarctic Division and the Bureau of Mineral Resources.

The review has been initiated due to growing disquiet in gov-

ernment circles over the direction of CSIRO research. With CSIRO chairman Dr Paul Wild having indicated that he intends to retire in September after completing his seven year term, there is also believed to be disagreement over changes in the top-level management structure of the CSIRO, to allow a non-scientist to be appointed as chief executive.

The last major review of the CSIRO was the Birch Inquiry

eight years ago. Whilst acknowledging that the CSIRO has an impressive international reputation and has made substantial contributions to industry and the community, the government believes that the present inquiry is necessary to ensure the most appropriate future direction for the organization. ASTEC's terms of reference include looking at the short and long term objectives of the various research institutes and their appropriateness to national economic, social and cultural goals.

Dr Wild has welcomed the review, saying that Australia's poor level of research and devel-

opment in the private sector has led to a lot of inaccurate statements being made about government-funded contributions. The present policy of the CSIRO is to encourage industry input of up to 30 per cent of total research funds. The inquiry together with the government's recently announced policy of allowing 150 per cent tax deduction for private research and development will hopefully encourage industry to become more involved in jointly-funded research with the CSIRO as well as to carry out more independent short-term research and development.

## Manufacturing boost for Vic

Exports of high technology equipment from Victoria will be boosted by up to \$30 million a year as a result of an agreement between Melbourne electronics company, Data Cable Pty Ltd, and the large US company, Genisco Technology Corporation.

Data Cable will manufacture a range of equipment under licence to Genisco for export to Pacific basin countries. This will entail a major expansion of Data Cable's Bayswater complex to handle the increased manufacturing that will initially be worth between \$20 million and \$30 million a year.

The transfer of technology will involve the manufacture of latest solid state memories for computers, tape drive systems

for computer peripheral memories, electromagnetic interference protection for computers, communications circuits and computer graphic equipment for computer-aided design and manufacture.

Transfer of technology will be extended to other state-of-the-art electronics as opportunities arise.

The Victorian Government representative in Los Angeles, Mr Richard Atkinson, was instrumental in setting up contact between the Victorian and US companies. The agreement will bring a large boost to Victoria's capabilities in high technology manufacture and particularly aid the state's ability to compete in export markets.

## Videotex exhibitions in Melbourne

A specialist videotex exhibition is to be held in Melbourne next month by Riddell Exhibitions. The show, intended for people with a commercial interest in videotex, is also supported by the Australian Videotex Industry Association, a body of video-

tex equipment suppliers.

The exhibition will be held at the Melbourne Regent Hotel on July 16. If you would like to attend contact Tony Pool, Riddell Exhibitions, 137 Burnley Street, Richmond Vic 3121.

## AWA totalizator screen

A huge 1/3 M watt electronic totalizator display screen, designed and manufactured in Australia by AWA has been delivered to the Royal Hong Kong Jockey Club (RHKJC).

AWA is the largest totalizator operator in Australia and is also a major supplier of electronic equipment to the wagering industry.

The screen measures more than 56 metres in length and six metres in height. It also contains 500 display characters each controlled by its own microprocessor taking 1.2 s to address all

8x6 characters; 20,000 integrated circuits; 400 metres of cabling; and 22,000 lamp bulbs rated at one triac per lamp.

The screen is powered by a low voltage of 24 volts thereby increasing safety and avoiding problems with regulatory authorities which could be encountered in overseas countries. For example, the size of the screen could classify it as a building in some countries, thereby subjecting it to the local wiring rules for buildings. Sensors on the board regulate the power output in accordance with load variation.

## The turnpike update

Hong Kong traffic authorities have come up with an electronic solution to traffic congestion problems, according to a recent British report.

The system, which is based on a 'user-pays' philosophy, involves implanting electronic loop detectors in certain busy roads which detect and record the number plates of cars passing over them. New electronic number plates are to be attached underneath the vehicle's body. The recorded number is transmitted to a central computer

which totes up monthly bills for the driver. Signs along the roadside will indicate the price of entering an approaching zone. The system allows prices of zones to vary according to peak hours or days.

According to the report, 18 of these electronic turnpikes have been installed and 2500 vehicles have been fitted with the electronic plates for a pilot test. And in case it sounds cheatable, any car passing without the attached number plate is automatically photographed for prosecution.



## Electronic fuel warmer

An electronic device, which prevents carburettors in cars from icing up, has won its designer the Texas Instruments Patent Incentive Award.

The device is the brain-child of Stephen Strobel, engineering manager of Texas Instruments' manufacturing plant at Elizabeth in South Australia. This is the first time the award has been presented to an employee in Australia.

The device takes the form of a 'gasket assembly', incorporating a 'PTC' ceramic heater, which

can be fitted between the inlet manifold of the engine and the carburettor. Linked to the motor vehicle's electrical system, the PTC ceramic is electrically self-heated to a pre-set temperature, thus maintaining carburettor temperature above the freezing point all year round.

Mr Strobel says it is one of several new devices being created as part of a program to further develop its electronic automotive control system.



## High-tech primary industry

New technology could greatly improve the competitive edge of Australia's primary industry, a report released by NSW state government claims.

Eric Bedford, state Technology Minister, said the report identified opportunities for the application of new technology in dairying, sheep, poultry and pig farming, and farm management, amongst other areas, and gave the examples of possibly developing ultrasonic protection against rodents for silos and the use of x-rays to sort potatoes from clods of earth.

## \$12m Telecom contract

Telecom Australia has ordered new generation equipment for its Digital Data Service (DDS), awarding GEC Marconi a \$12.2 million contract.

The contract is for time division cross connect (TDCC) equipment and management control systems (MACS) to be supplied by June 1987. The DDS network is currently handling around 10,000 terminations in all states, with a steady growth in the order of 10 percent each month.

## Funds link

Westpac and the Commonwealth Bank have linked their electronic funds transfer system at point of sale systems, to allow cardholders of both banks access to either bank's terminals. The move will link 1200 terminals, or 87 per cent of the EFTPOS system in Australia, with plans to have more than 2000 terminals operative in retail outlets. When the other major banks, the National and ANZ enter the system, this number of outlets should more than double.

## High frequency semis

MIT has applied for a patent on a type of semiconductor structure which should permit transistor operation at tetrahertz frequencies, radiation detectors at millimetre and submillimetre wavelengths, and which can be used in lasers. These devices will be structured so that a number of closely spaced quantum wells are coupled for tunnelling transfer of charge carriers from well to well.

## CAD/CAM data base

A new data base system launched by International System Database should be of interest to circuit designers. The system, Satcam, is a computer aided design/manufacture system which includes details of symbols and components, with software packages to produce circuit schematics. Towards the end of the year, ISD expects to have a further pc board layout package and simulation package.

For \$1500 ISD offers installation of this system, and quarterly updates for a subscription of around \$200 per month. That subscription price goes down with the number of user installations. Satcam is designed to assist the engineer from product

inception through to manufacture so that it can be accessed at one or many points in the design process. It can also link up with 'bureaux' for artwork design and board manufacture.

The hardware necessary for installation of the Satcam system to create the workstation, is an IBM or look alike which includes such features as a high-res graphics card, colour monitor, a graphics tablet and mouse. The Satcam software is updated by replacing disks, but customers or bureaux using the database constantly would require a modem.

Further information is available from ISD, 17-23 Merriwa St, Gordon, NSW 2072. (02)498-6522.



## Fairlight images

The Fairlight Computer Video Instrument has been mentioned in these pages before; it was described on its launch in last October's issue of ETI. But it's back in the news following a recent demonstration which marked the beginning of the Australian market assault.

The CVI is a video manipulator machine extraordinaire: it costs only \$6500. The machine distorts a video input signal in whatever fashion the user fancies, and includes a paint mode which allows mixing of textures, brush shapes, colours and includes an inbuilt stencil to overlay, underlay or isolate portions of video and painted images. The CVI allows multi-plane combinations, control of some visual aspect by an audio source, mosaic and pixelation effects as well as mirroring, freezing, and variable trailing, just to give you an idea. A sequencer and preset enables the user to preprogram up to 100 variations.

The huge cost of graphics machines lies in their memory requirements for broadcast standard resolution. Fairlight has chosen to keep the memory to 128K bytes RAM, 32K bytes ROM controlled by a 6809 processor at 2 MHz. It is a videographics machine originally conceived for the home enthusiast not the professional. But it is of quality and versatility to interest the large market of educational institutions and private companies which don't want to broadcast but require mass dissemination of information — not to mention all the music industry applications where its fore runner the CMI was adopted with such interest.

Fairlight is expecting to sell 10,000 in the first year, most in the US then Japan. And now that the designers have temporarily finished flogging it overseas, Australia can expect to hear a lot more about the CVI.

## COMPANY NEWS

Warburton Franki, ANI Perkins and O. H. O'Brien have amalgamated and now conduct business under the name Anitech.

The Brisbane office of TMPC Process Controls has a new phone number — (07)275-3366. Its toll free number for sales is (008)17-7364 and service is (008)22-4045.

Australian company N&K Technology Limited, has acquired all issued capital of EAI-Electronic Associates and plans to merge it with Ectron Pty Ltd, manufacturer of cables and electronic speech products.

EAI is the Australian agent for Facit Data Products (a division of L M Ericsson), Gould Inc Recording and ROLM Mil-Spec Computer.

Stewart Electronic Components has been appointed distributor in Victoria for Sprague Electric. Other Sprague distributors are VSI Electronics and Captron.

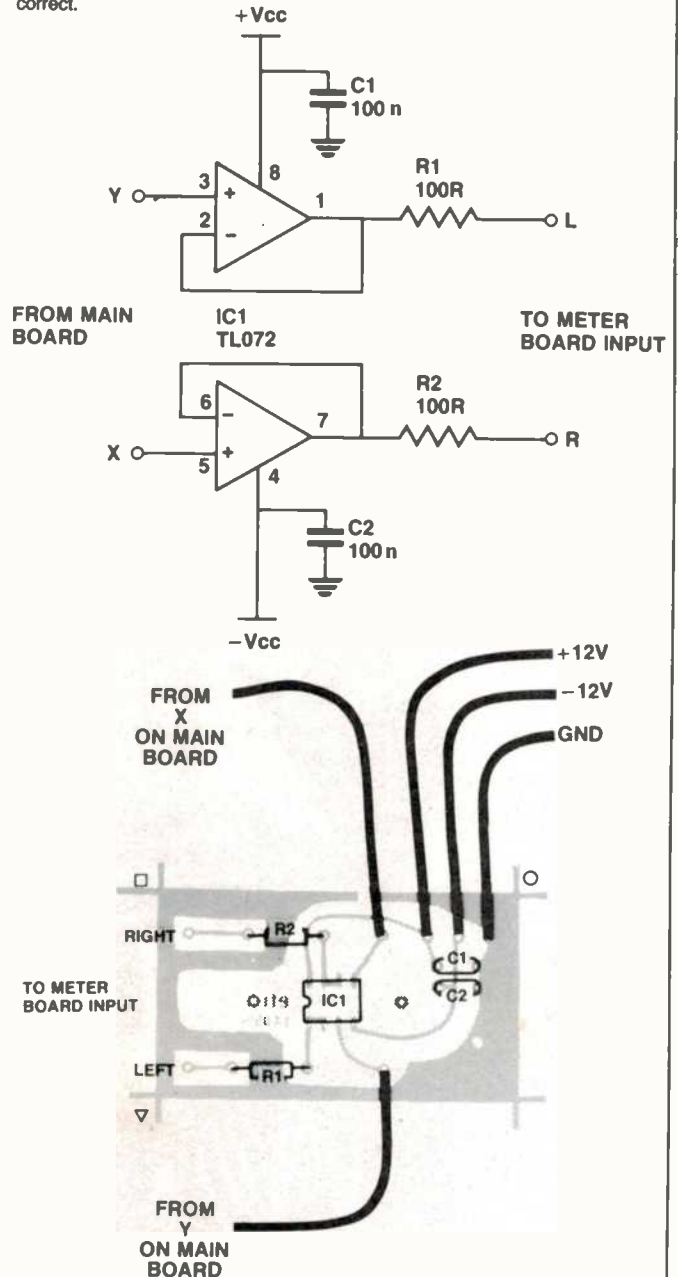
Metal Manufacturers Ltd, which plans to make optical cables here, has reorganized its subsidiaries Telcon Australia, Cablemakers (ACT) and Lakemba Electrical, and merged with AWM Electrical Wholesalers. This has resulted in a new company, TLE Electrical in NSW, WA and Darwin, while ex-Telcon branches in Vic and SA are now part of AWM Electrical.

Eracom Pty Ltd will concentrate on the development and marketing of information security products. This follows declining sales of general purpose computer systems to federal and state government departments and an increase of sales of security products to Australian banks and financial institutions.

## NOTES & ERRATA

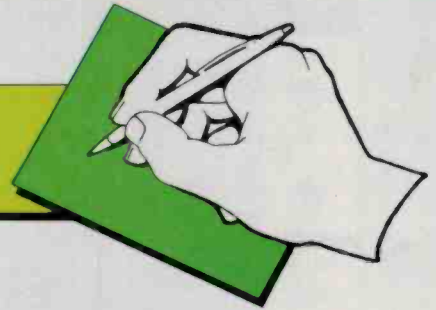
**Project 1405, Stereo Enhancer, March '85:** In the stereo enhancer circuit it is necessary to buffer the metering circuitry from the main signal path. It was originally intended to put the buffers on the meter board but due to layout requirements it was decided that the main board would be better. Unfortunately in the melée the buffers were deleted from the meter board but never re-instated on the main board. To fix this, an op-amp will have to be inserted between the main board and the meter board. The circuit and board are shown below. The small board mounts on two of the meter board mounting bolts on the right-hand side (looking from the front). The positive supply and earth to the buffer can be taken from the meter board supply pins. The negative supply can be taken from the junction of C4 and IC2. The values of the two caps on the reverse side of the meter board should be dropped from 220n to 22n.

Also, the pin numbers for IC5 and the component numbers for R4, R7 and C7, C10 were marked incorrectly on the circuit diagram. The overlay is correct.





# Letters to the Editor



## Flat response to cable

I cannot resist commenting on the increasing number of 'magic' speaker cables appearing in advertisements in yours and other magazines.

Their features are, at worst simplistic and misdirected, at best a nice mix of technical sounding ideas, none of which seems to relate at all to an audio frequency ac signal.

The advertisements read like humour, in fact I thought the one in an April magazine was an April fool's joke. The advertizers must think audio enthusiasts are a soft touch; I am sure they would not pay to advertise the stuff if people were not buying.

Why don't you cut through the graphite impregnated sheath surrounding the facts and commission Louis Challis to do some proper measurements on a range of these 'magic' cables.

**Bruce Rogers  
Glenorie, NSW**

## Advertiser replies

We have received a cryptic comment about our ad in the April edition of ETI from Mr Bruce Rogers. He suggests that our ad, which states that the sound improvement in QED INCON interconnecting cable is directional, is an April fool's day joke. This is not true but I understand that many of your readers with technical backgrounds might find it hard to accept.

As a technical magazine I am sure you are expecting a technical explanation about the qualities of INCON, however after 20 years in the hi-fi industry I have finally learnt when it comes to audio I must rely on my ears. Too often meaningless specifications cloud our judgment and when it comes to sound we too often rely on old concepts and specifications which are fast becoming outdated. We have argued the merits of

products such as INCON for some time now and ultimately Mr Rogers' technical background will have to come second to an open mind in this area.

QED has an excellent reputation for its speaker cables and accessories. INCON is a natural development for them. Rather than accepting the problem requirement as an acoustical one. The result, I can assure you, is truly amazing, however even QED has difficulty in explaining the directionality other than to say that it is due to a special extrusion technique which effectively aligns the 'grain' of the copper. QED is not the only company to produce an interconnecting cable which will actually noticeably improve the sound; others have done so and the cost of these cables are well above QED's (up to \$200 a pair).

The importance of INCON is relative to the quality of one's hi-fi system, it should be used on all reasonable cassette decks and tuners. It is essential for all pre-main amp connections and CD players. After listening to INCON in these areas one will find it hard to return to ordinary cables no matter how impressive they may look.

**Andrew Goldfinch  
Leisure Imports  
Artarmon, NSW**

## No snow jobs

RE DAVID KELLY's editorial of April 1985, hurrah for Barry Jones — he has found a bludger's job at last. He can conveniently forget about today and contemplate his toenails, meditating on the future to emerge from the innards of the great white elephant in Canberra, fit and able to inundate us poor slob with wise words of wisdom.

My dear editor, are you unaware this nation suffers from an unprecedented electronic chaos? Are you unaware that millions of tonnes of electronic consumer equipment is being dumped in this country built entirely from production overruns? Goods for which no spare parts are available. Are you unaware of the shocking inefficiency major companies torture service centres with?

It is impossible to imagine how a person like yourself who is 'where it is all at' can possibly applaud such a deplorable idea where the 'powers that be' can simply wash their hands of today, in the hope yesterday will disappear.

From the far North West, the rest of Aus-

tralia can appear as a foreign nation. It is faster to obtain parts from the UK than it is from Sydney or Perth. Did you know that when this area was serviced solely by sail, orders to Perth were processed faster and delivered in better condition than today? Are you aware many major companies are unable to process orders for spare parts under six weeks and that some very famous names cannot supply parts under six months?

To come back to your article, the public does not care a fig for the 'hi-tech' winners and losers as in the end there will be only one loser and that is John public. As it stands, the consumer is already the loser. But since most if not all politicians wouldn't know a transistor if they saw one it is not surprising they have played Pontius Pilate.

To ask if there is a conundrum is the ultimate in naivety. Editors of any publication have a responsibility to analyze, scrutinize and criticize, not do a 'snow job' for Barry Jones and his ilk.

**M. de Bortella  
'a lonely service man in the far NW'**

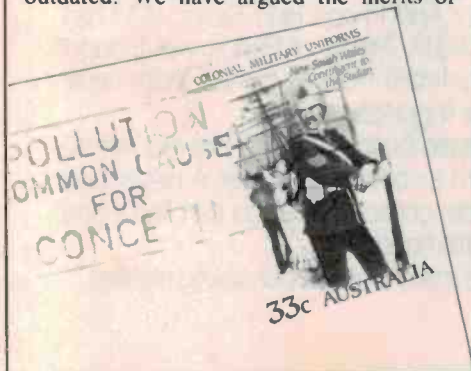
## Congratulations anyway

I WOULD LIKE to congratulate Ian Thomas for his articles on the improved CDI. Firstly, for setting out the design philosophy and the problems of achieving that, then the design in some detail and finally the practical solution. Connecting the primary tap seemed a bit dicey; I would have thought that another winding would have been easier and safer. Could he now be persuaded to return to a more humble project and produce a battery powered version of Project 1524, the Mouse Mangler?

I am also glad to read that you intend to start a readers forum; I have enjoyed the letters in *Wireless World* for many years and have long felt that there was a need for a similar forum here.

**W. Jolly  
Nambucca Heads, NSW**

Letters to the editor are welcomed, and should include the author's name, address and telephone number. They should be forwarded to:  
The Editor,  
140 Joynton Ave,  
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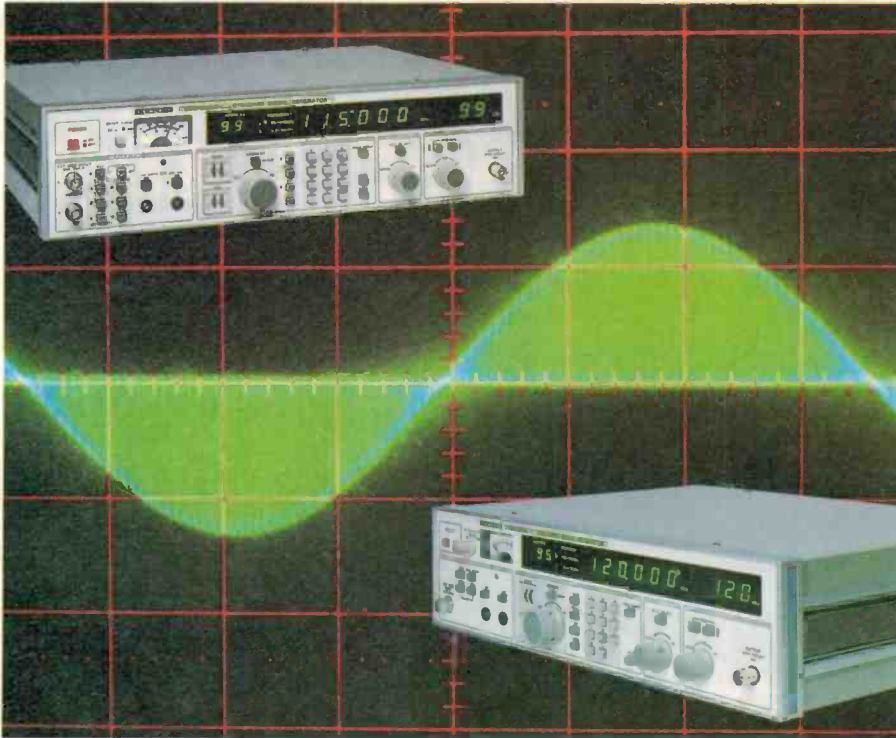
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## PHILIPS

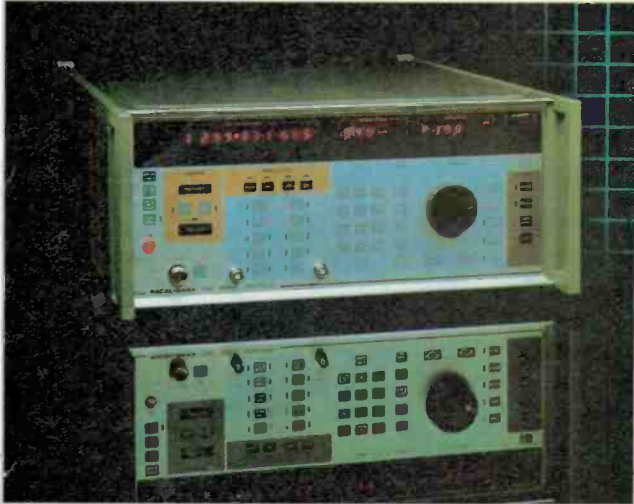
PMP V347/R



# SIZING UP SIGNAL GENERATORS



These pieces of equipment, basic to fault-finding, often look forbiddingly complicated. But it's worth your while to know how they work *for you*, and how to sort through the array of names and functions to find the one that suits.



**Upmarket**, for which you can generally expect GPIB interface and frequency ranges of MHz upwards.



Jon Fairall

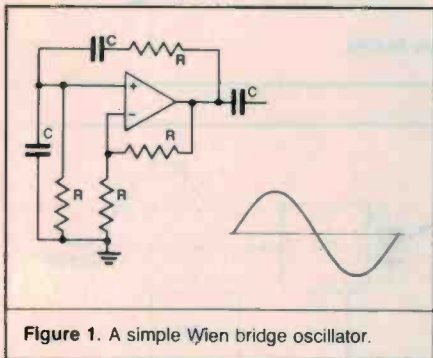


Figure 1. A simple Wien bridge oscillator.

YOU CAN TELL a great deal about a circuit from its quiescent conditions. Many classes of fault, probably the majority, show up as some anomaly in the way dc flows in the circuit. To detect such problems you only need a multimeter, and perhaps an oscilloscope on your bench.

But many types of more subtle fault are dynamic. Also, it is impossible to tell whether a circuit design is performing as well as it should by just looking at dc flows. If you want to know how the circuit actually responds when it's doing the job it was made for, then dynamic testing is essential. And for that, some precisely known input is essential.

The generic name for devices that give you a precisely known input is 'signal generator'. This term covers a multitude of special purpose devices. It can mean a low, medium or high frequency oscillator, or a function generator. There are specialist tools with various types of modulators or patterns for specialist applications.

Recent trends have, naturally enough, followed the digital revolution. Signal generators have been developed especially for testing digital circuits, and the design of generators has been influenced by digital techniques. Included in this process has been the advent of programmable test equipment.

So, how do they work, and just as importantly, how do you know when you have a good one? And perhaps most important of all, how do you use them to test a circuit?

### Oscillators

Oscillators can be divided up into low

### MAKING THE MEASUREMENT

There are a number of classic tests for which signal generators are essential. The obvious audio test is the frequency response of an amplifier. An equivalent test at rf is the determination of selectivity and sensitivity in receivers. This is by no means an exhaustive list, but it gives some idea of the subject.

To test an amplifier, a typical set-up would involve a signal at the frequency of interest being generated by the oscillator and fed to the amplifier, then inspected on the oscilloscope. To determine the frequency response of the system it is only necessary to alter the frequency of the oscillator and observe the amplitude on the CRO. It is also instructive to fiddle with the base and treble controls to observe the effect they have on the output.

Another way of changing the frequency in the oscillator is with a sweep generator. A sweep generator or sweeper is a signal generator with a special facility that allows the oscillator frequency to 'sweep' over a specific range. The frequency is changed in the oscillator by allowing the frequency to be controlled by a saw tooth generator. As this ramps up the output frequency increases. If this signal is also applied to the X axis of a CRO, while the output of the amplifier is applied to the Y axis then a display results that shows the output amplitude as a function of frequency — exactly what we want.

There are a few traps for young players worth knowing about. For instance many amplifier inputs, especially mic inputs, have very high voltage gain and require very small input signals. In fact the signal may well be smaller

than one can comfortably extract from a generator. In this case one will find a distorted signal, even if the amplifier is working correctly. The answer is to place an attenuator on the input. Standard attenuators are available with 20 dB and 40 dB loss across them and 600 ohm inputs and outputs.

The sensitivity of a receiver is one of its most important parameters. Briefly, the idea is to relate the rf input at the antennas to the audio frequency output. As a matter of definition the output is taken to be 50 mW, and the modulation depth to 30%. The sensitivity is then the input required to produce this. It is expressed in  $\mu\text{V}$ .

Another version of sensitivity is defined in terms of the input required to produce a signal-to-noise ratio of 12 dB. This figure was chosen as the minimum necessary to allow intelligible transmission. Once again the modulation depth is set to 30%. The rf level is then increased until the output resulting from the difference between the unmodulated signal and the modulated signal is 12 dB.

The selectivity of a receiver is a measure of its ability to reject unwanted frequencies and select a single wanted frequency. It is thus a measure of the quality of the IF strip. Once again the idea is to set up the signal generator so that it is producing a 30% modulation depth. The modulated and modulating frequencies may both be set to convenient frequencies. Level should then be set 6 dB above the sensitivity level defined above. The rf frequency is then altered both up and down until the signal-to-noise ratio once again decays to 10 dB.

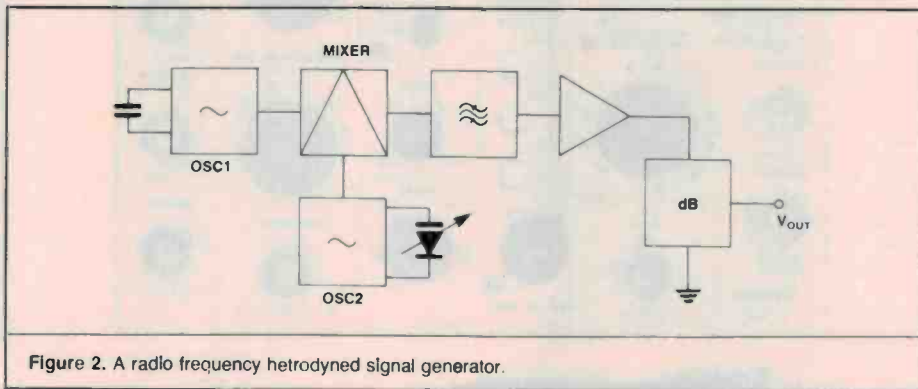


Figure 2. A radio frequency heterodyned signal generator.

(audio), medium (rf) and high (microwave) frequency applications. The simplest form is the low frequency oscillator, which may well be nothing more than the Wien bridge network of Figure 1. The frequency of operation is given by the equation:

$$f_0 = \frac{1}{(2\pi RC)}$$

so variable frequency can be achieved by making the resistance or capacitance or both user selectable. Since frequency depends solely on the value of R and C the oscillator will be as stable as its components. That can be very stable indeed.

The simple RC oscillator has the advantage of exceptional spectral purity, that is, its output contains the fundamental frequency and no others. Typical figures for distortion in this type of oscillator can be

as low as 0.02%

This type of device usually has an output range in the audio frequencies, say 50 Hz to 20 kHz. Exceptional products may run from dc up to megahertz. Beyond this range we are dealing with rf generators, used primarily in the testing of radio equipment. The distinction is not just one of definition. The two products actually use quite separate techniques for producing an output.

To make signal generators with outputs of tens or hundreds of megahertz there are many standard techniques. Perhaps the most common is heterodyning, in which two oscillators are mixed together and a sum produced (see Figure 2).

Another solution is to run an ordinary oscillator at low frequencies, and then put the resultant through frequency multiply-





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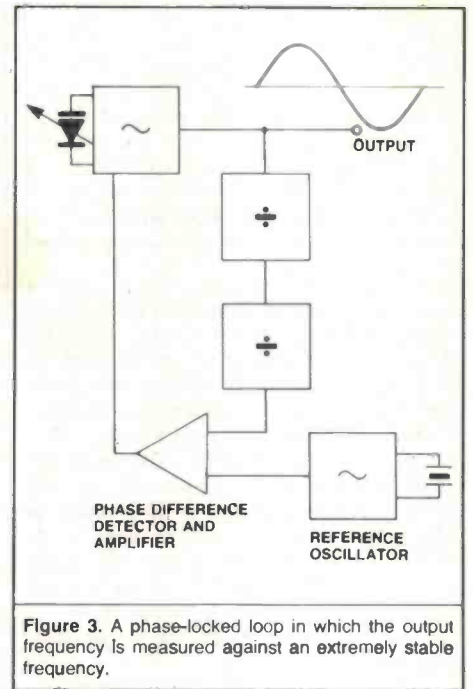
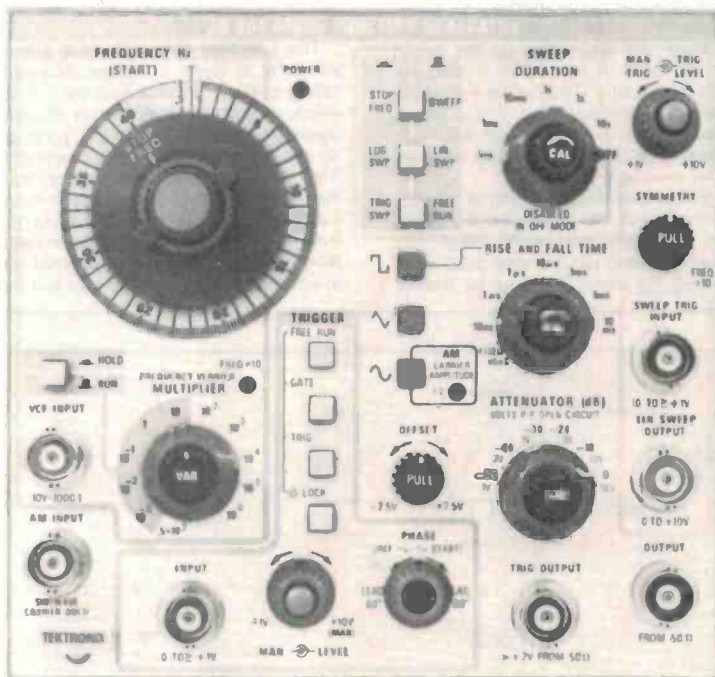


Figure 3. A phase-locked loop in which the output frequency is measured against an extremely stable frequency.



The Tek FG504 (above) provides more functions and variability than the Trio SG402 (left) which is close to the cheapest signal generator around.

ing circuits. The classic way of doing this is to put the output into a non-linear amplifier. The amplifier will then produce the fundamental plus a whole host of harmonics. One of these (usually the third or fifth) can then be picked off by a band pass filter and fed to another amplifier where the whole process can be repeated as often as desired.

Combinations of these methods are not uncommon. Typically, one will find the fundamental frequency being generated in a superhet configuration being fed to a series of multipliers, the exact configuration probably being dependent on the user-selected range switches on the front panel. Fine tuning will be done via the superhet oscillator.

At rf frequencies, crystals are commonly used, either to derive a fundamental frequency from which others can be built up, or as a reference for a voltage controlled

oscillator. A common method that can achieve very good frequency stability is the phase-locked loop. The usual pattern here is shown in Figure 3. The signal is generated from an oscillator. It is then divided down and compared with the frequency of a highly stable fixed frequency crystal oscillator. If there is an error in the phase of the two signals an error voltage is generated in the error amplifier and fed back to the VCO. In this way the inherent stability of a crystal oscillator can be applied to a less stable, variable high frequency oscillator.

**Function generator**

There are many applications where a sine wave is not the most appropriate form of input, but where a predictable, periodic wave is nevertheless required. This is the basic requirement of the function generator: a device that can output a number of different shaped waveforms. Typically these will include triangular, sawtooth and square waves, besides the sine wave of course.

A circuit for a simple triangular wave generator can be seen in Figure 4. This consists of an integrator plus a voltage sensitive inverter. From this, various other types of signal can be derived. A simple low pass filter, for instance, will yield the fundamental sine wave. Other common outputs include sawtooth waves with both positive and negative ramps and square waves.

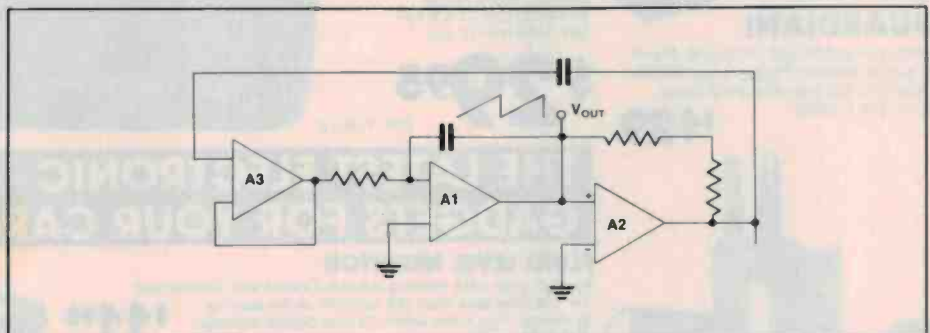
The advantage of the function generator is obviously its flexibility. You can derive a whole host of waveforms from the one box. Often you will find gating and triggering inputs to allow single shot operation or other special modes. Its disadvantage is that it's not as easy to get good frequency and amplitude stability from a function generator. Simple non-linearities in the filtering will cause some of these problems which are very hard to get rid of.

Whether this is important or not depends to a large extent on the application. For most trouble-shooting 1.5% distortion, a typical figure, will present no prob-

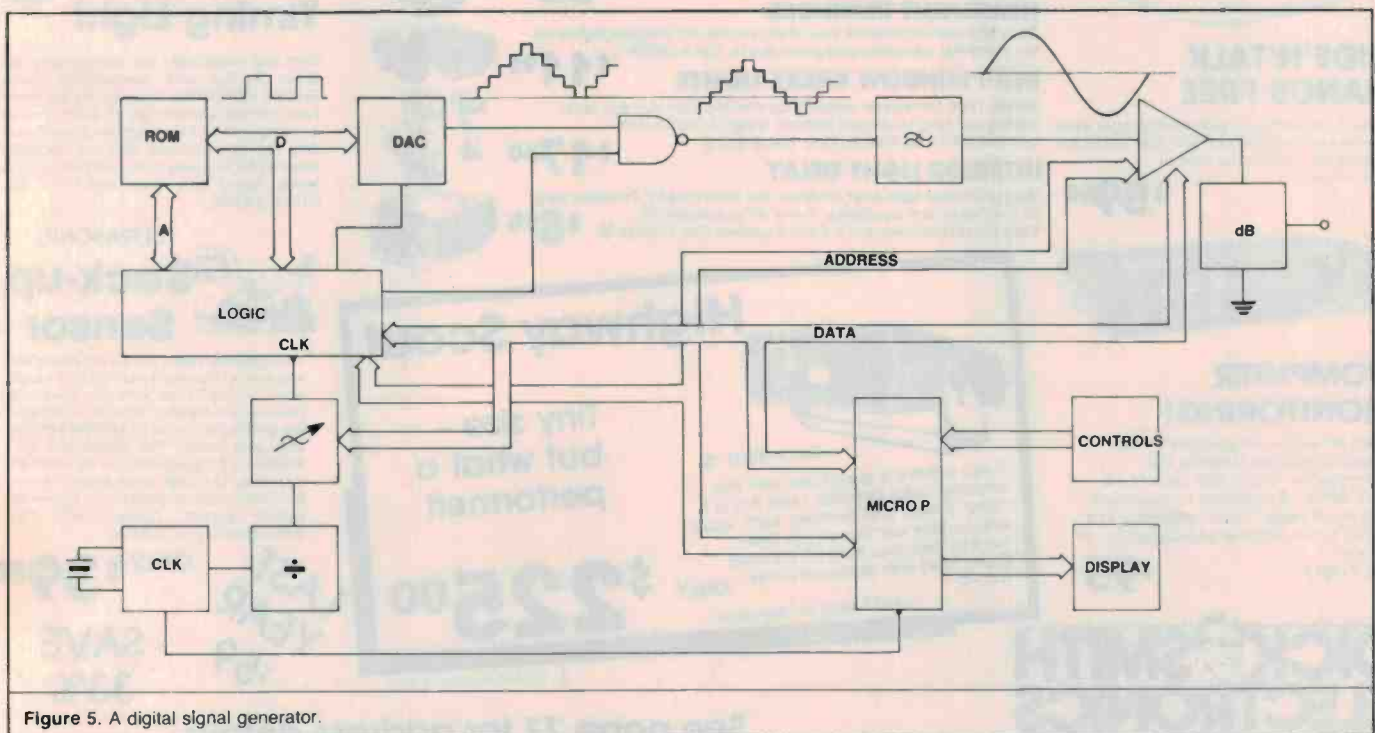
lems whatsoever. In a measuring laboratory, or R&D work, it might be quite intolerable.

**Digital techniques**

Lately there has been a lot of interest in applying digital techniques to signal generator design. Typical design philosophy is to store information about the desired waveshape in ROM, and then to read it out at a selected frequency. So, in an 8-bit system, one might divide the peak-to-peak voltage up into 255 equal sections. Conveniently, let the output be 255 mV p-p, then it's possible to define the output in terms of 1 mV steps. ▶



**Figure 4.** A sawtooth generator. A1 is an Integrator that produces a ramp output in response to a positive input. The slope of the ramp depends on the charge rate of the capacitor. When it reaches some predetermined level A2 switches states, causing A3 to change state as well. A1 is then subject to a negative voltage and it begins to ramp down. When it reaches some predetermined voltage set by A2 it toggles again and begins to ramp up. So the cycle repeats.



**Figure 5.** A digital signal generator.



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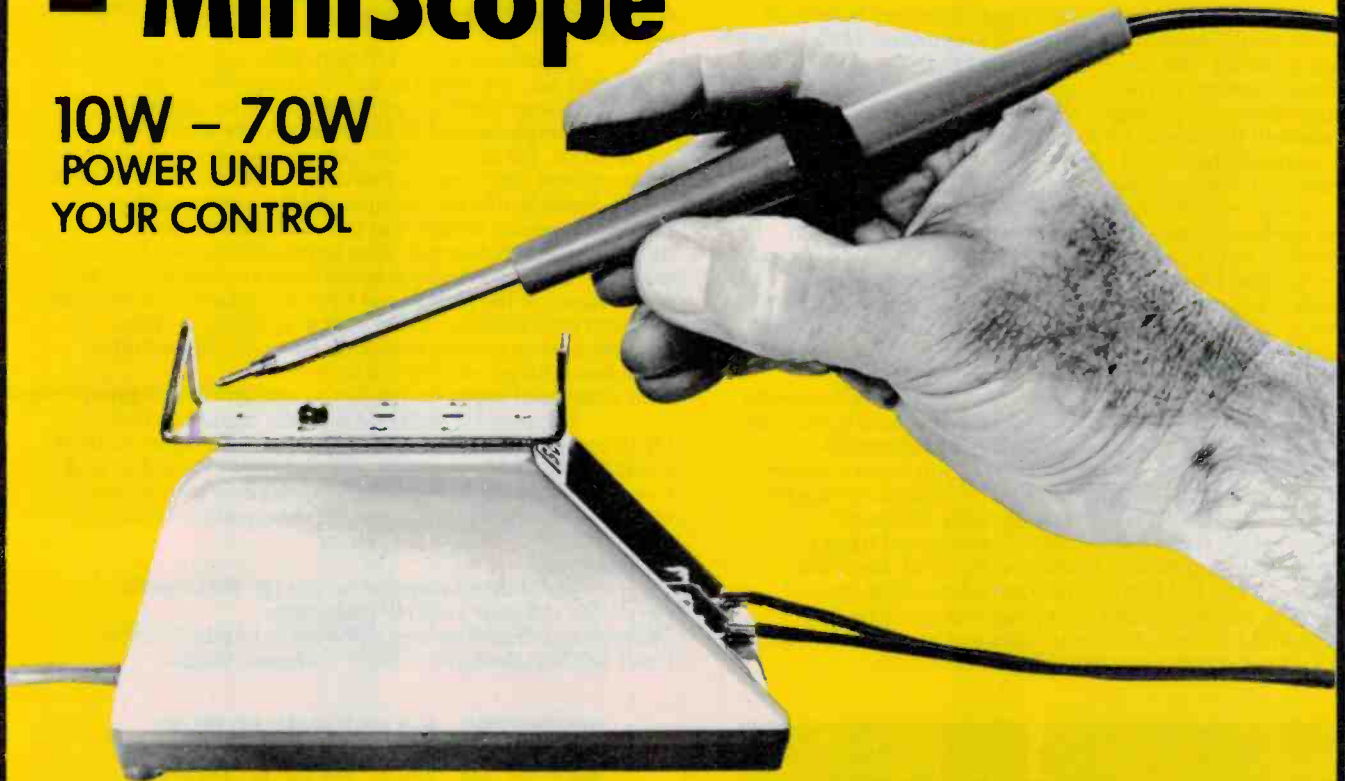
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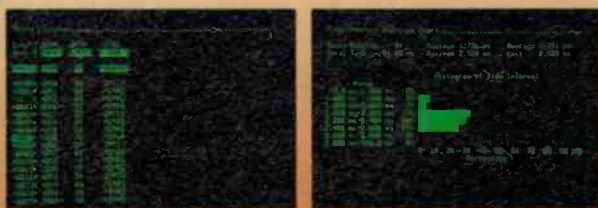
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## ADVERTISERS' INDEX

Advertiser	Code	Page Number
ACME .....	0701	30
Active Electronics .....	0702	83
All Electronic Components .....	0703	39
Altronics .....	0704	85,86,87,88,89
Applied Technology .....	0705	112
Arlac .....	0706	31
AWA Thorn .....	0707	137
Continental Venture .....	0708	128
Cooper Tool .....	0709	124
Daneva Australia .....	0710	25
Delsound .....	0711	129
Dick Smith Electronics .....	0712	16,44,45,54,55, 77,108,109
Disco World .....	0713	130
Dream Disk .....	0714	116
Dual Systems .....	0715	118
Elmeasco .....	0716	IFC
Energy Control .....	0717	92
Energy Control offer .....		107
Epson .....	0718	101
ETI books .....	0719	24,120,121,122
Ferguson Transformers .....	0720	128
Hewlett Packard .....	0721	18
Hewlett Packard offer .....		119
Icom Australia Pty Ltd .....	0722	130
Jaycar .....	0723	32,33,56, 57,96,97
Leisure Imports .....	0724	31
Microtrix .....	0725	129
Perth Consumer Electronics Show .....	0726	93
Philips .....	0727	10,11
Positronics .....	0728	128
Prepak .....	0729	100
Pulsar .....	0730	66,106
Rod Irving Electronics .....	0731	22,23,43,49, 50,51,70,71
Rose Music Pty Ltd .....	0732	OBC
Scan Audio Pty Ltd .....	0733	31
Scope .....	0734	17
Siemens Ltd .....	0735	131
SME Systems .....	0736	82
Sony Australia .....	0737	IBC
STC Cannon .....	0738	4
Subscriptions offer .....		123
Truscott .....	0739	92
Vicom .....	0740	113
Wireless Inst of Aust .....	0741	92



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		FL	FH		FM	AM					
Adret	2230A	10	1M	sine	yes	yes	no	France	—	Vicom	4,800
	740A	100k	1.1G	sine	yes	yes	yes	France	4.4mV	Vicom	13,500
AWA	G232	10	110k	sine	no	no	no	Australia	10V	AWA	2,662
B&K	3030	0.001	5M	F	yes	no	no	US	20V	Parameters	1,249
BWD	160A	0.02	2M	F	yes	no	no	Australia	10V	BWD	320
	603B	0.01	2M	F	yes	yes	no	Australia	10V	BWD	850
Fluke	6060A	100k	1G	sine	yes	yes	yes	US	4.5mV	Elmeasco	10,700
	6011A	10	11M	sine	yes	no	yes	US	2.2mV	Elmeasco	34,000
	6070A	200k	520M	sine	yes	yes	yes	US	8.9mV	Elmeasco	45,000
Giga	GU1320A	1G	2G	sine	yes	yes	yes	France	3.9mV	Vicom	14,000
	GU1301A	12G	18G	sine	yes	yes	yes	France	3.2mV	Vicom	14,000
Kikusui	418B	10	1M	sine	no	no	no	Japan	16V	Emona	319
	KSG4100	100k	110M	F	yes	yes	no	Japan	8.9mV	Emona	2,060
Krohn Hite	1200A	2	3M	F	yes	no	no	US	20V	Anitech †	1,392
	S400B	0.002	5M	F	yes	no	no	US	30V	Anitech †	2,518
Leader	LSG215A	100k	120M	sine	yes	yes	yes	Japan	1V	AWA	2,558
Marconi	6055	850M	18G	sine	yes	yes	yes	UK	—	GEC	4,500
	2022	10k	1G	sine	yes	yes	yes	UK	6mV	GEC	6,000
	6812	8G	12G	sine	yes	yes	yes	UK	2.8mV	GEC	48,000
Newtronics	Or-X190	0.004	4M	F	no	yes	no	—	20V	Kenelec	535
	200MSPC	0.002	7M	F	yes	yes	no	Israel	20V	Kenelec	1,501
Norma	FG3011	0.1	1M	F	no	no	no	Austria	20V	Paton	1,065
Phillips	PM5107	10	100k	pulse/ sine	no	no	no	Holland	6V	Phillips	819
	PM5131	0.1	2M	F	no	no	no	Holland	30V	Phillips	1,060
	PM5190	0.001	2.1M	F	no	no	yes	Holland	20V	Phillips	3,930
Racal	9084	10k	104M	sine	yes	yes	yes	UK	8.9mV	Racal	8,651
	9087	10k	1.3G	F	yes	yes	yes	UK	8.9mV	Racal	30,728
Sigmotek	PSG1	0.5	5M	pulse	—	—	no	US	10V	Emona	302
	ISG1	100k	110M	sine	yes	yes	yes	US	—	Emona	2,967
Sound Technology	1020A	88M	108M	sine	no	yes	no	US	30mV	Anitech †	7,587
Systron Donner	1626B	100M	26G	sine	no	no	yes	US	1.7mV	Scientific Devices	95,000
Tabor	8120	1m	12M	F	yes	yes	no	Israel	30V	Paton	2,100
Tek	FG501A	0.002	2M	F	no	yes	no	Japan	30V	Tektronix	1,829
	PG508	5	50M	pulse	—	—	no	Japan	20V	Tektronix	4,754
	FG504	0.001	40M	F	yes	yes	no	Japan	30V	Tektronix	5,637
Topward	TFG462	0.1	2M	F	no	no	no	Taiwan	20V	Parameters	238
	TFG4613	0.1	13M	F	yes	yes	no	Taiwan	20V	Elmeasco	1,265
Trio	SG402	100k	30M	sine	yes	no	no	Japan	0.1V	Parameters	135
Wavetek	952	1G	4G	sine	yes	yes	yes	US	3.1mV	Scientific Devices	11,000
	SSI-3000B	400k	1G	sine	yes	yes	yes	US	1.4mV	Scientific Devices	11,900

\* Price does not include 20% sales tax and is subject to exchange rate variation.

† Formerly Warburton Frankl.

To build up a sine wave using such techniques it's necessary to store information for one quadrant in the ROM. Values are pulled out and fed to the digital-to-analogue converter (DAC) where they are converted into a voltage level. To obtain the second quadrant it is only necessary to read out the values from ROM in the re-

verse direction. The third and fourth quadrants can be obtained by inverting the output of the DAC. To get rid of the 'staircase', or aliasing, it is only necessary to put the output into a low pass filter. Finally, we need an amplifier to allow the output level to be set. A typical layout is illustrated in Figure 5.

The logic is there primarily to allow the system to be clocked at the required frequency. This is derived from the system clock (crystal driven) and its dividers and adjusters. The processor controls the whole system and interprets instructions from the keyboard.

The advantages of such a system are

many. For a start, an infinite variety of waveforms may be generated by appropriate use of the ROM. Secondly, frequency can be made extremely accurate. The system clock is derived from a crystal and turned into a pulse train. It is no complex matter to apply some maths to this and derive some other frequency. Thirdly, because the aliasing is so much higher in frequency than the desired frequency, a simple low pass filter will get rid of it.

**Digital Control**

Another side to the digital revolution has been that control and measurement has been taken away from human operators and given to a computer. Generally the pattern is that a bus is created with numerous measuring instruments, display devices and control stations attached to it (see Figure 6). The whole system is controlled by a small computer.

Practical digital control systems became possible with the advent of the GPIB (General Purpose Interface Bus) standard, also known as IEEE 488. This defined the hardware necessary for any piece of equipment that was to be connected via the bus, and thus made possible the connection of equipment from many different manufacturers. Levels are TTL 5 V logic, and there is provision for read/write, handshake and interrupt lines.

Applications of this technology are numerous. It can entail no more than de-skilling testing procedure. A highly skilled technician can set up a test routine via a computer terminal, and then leave it to a factory hand to plug in items for test as required. All the test results can be logged and statistical information derived from the computer. Alternatively, it could be used for testing over long or inconvenient time scales, or even in some circumstances, for testing remote equipment.

**Error control**

In any measurement system there is error and uncertainty. As a matter of definition it is impossible to eliminate. However it is possible to know about the most common causes of error, and to make allowance for them.

Perhaps the most obvious source of error is a mismatch between the generator and its load. This can work in two ways. There can be a simple resistive loading of the circuit, such as would occur if a 600 ohm output was connected to a 50 ohm input. The consequences may be just that the generator output is not as high as expected. More seriously, this may lead to non-linearities in the output circuitry deforming the waveform, or to loading of the oscillator itself, causing frequency error.

Another common source of error is fre-

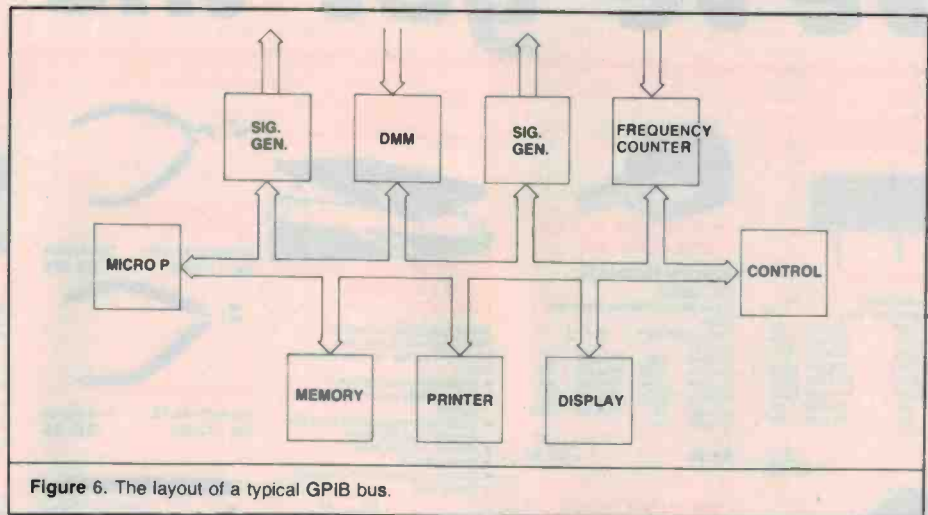


Figure 6. The layout of a typical GPIB bus.



A difference in price reflected in different features. The PM5131 has fewer waveforms but faster rise time, higher output voltage and sweep period.

quency dependent output. This can occur because the load has a frequency dependent output resistance, or because the generator itself has a frequency dependent output. In either case it is advisable to constantly test that the input is what you expect it to be. Trouble from this source will be minimized by correct matching.

Typical figures for amplitude stability are in the region of 0.5 dB from the bottom of the frequency range (say tens of hertz) up to at least 10 kHz. The amplifier should be capable of driving its output up to at least 30 volts. There should also be a TTL compatible output capable of driving TTL loads up to 5 volts.



# We've got the lot, at

## COMPONENTS!



### SPECTROL 43P

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 10+  
**\$1.10 \$1.00**



### 4SP TRIMPOTS

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



### NEW SWITCHES

1-9 10+  
SPDT Cat. \$11040 **\$1.50**  
DPDT Cat. \$11042 **\$1.60**



### SPECTROL MULTIDIALS

Model 15 **\$32.50**  
Model 16 **\$16.95**  
Model 21 **\$29.95**



### COUNTER

Cat. **\$12.95**



### ELECTRET MIC INSERTS

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



### VIDEO RF MODULATOR

At an unbelievable price!  
Our RF modulators are channel selectable either Channel 3 or Channel 1.  
1-9 10+  
at \$15040 **\$4.95** **\$3.95**

### PRIME SPEC RED LEDS

We bought 100,000 so you can reap the benefits!  
Cat. Z10150  
1-9 10-99 100+  
**\$0.10 \$0.09 \$0.08**



### 10 TURN WIRE WOUND POTENTIOMETER

**Spectrol Model 534**  
**1/4" shaft.**  
Equiv. (Bourns 3540S, Beckman 7256)  
Dials to suit 16-1-11, 18-1-11, 21-1-11  
R14050 50R R14100 5K  
R14055 100R R14110 10K  
R14060 200R R14120 20K  
R14070 500R R14130 50K  
R14080 1K R14140 100K  
R14090 2K  
1-9 10+  
**\$9.50 \$8.50**

## CONNECTORS!



### SOLDER CENTRONICS PLUGS

Unreal price for absolute top quality.  
Normally \$14.95 (Our opposition charge up to \$19.95).  
1-9 10+ 100+  
**\$6.50 \$5.95 \$4.95**



### 36 WAY CENTRONICS CRIMP PLUG

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



### IC SOCKETS (LOW PROFILE) How cheap can they go??

1+	10+	100+	1000+
8 Pin Cat.	15c	14c	12c
14 Pin Cat.	16c	15c	14c
16 Pin Cat.	17c	16c	15c
18 Pin Cat.	18c	17c	16c
20 Pin Cat.	29c	28c	27c
24 Pin Cat.	35c	34c	32c
40 Pin Cat.	45c	44c	35c



### UNPROTECTED HEADERS

Dual in Line 2.54mm	
1-9	10+
10 Way Cat. P12240	<b>\$1.95</b>
16 Way Cat. P12246	<b>\$2.95</b>
20 Way Cat. P12250	<b>\$3.25</b>
26 Way Cat. P12256	<b>\$3.75</b>
30 Way Cat. P12260	<b>\$3.95</b>
34 Way Cat. P12264	<b>\$4.95</b>
40 Way Cat. P12270	<b>\$5.25</b>
50 Way Cat. P12275	<b>\$5.95</b>

## CASES!



### PROFESSIONAL SERIES RACK MOUNTING CABINETS

These beautifully crafted rack cabinet boxes will give your equipment a real 1st class appearance:  
 • All aluminum construction.  
 • Removeable top and bottom panels.  
 • All dimensioning conforms to the International Standard.  
 • Natural or black finish.  
 • Ventilated lid.  
 • Deluxe brushed finish anodized front panel.



### 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)



### ECONOMY 19" RACK CASE

Tremendous Value! Dimensions W 480 x H 134 x D 250mm.  
 Cat. H10400 1-9 10+  
**\$34.95 \$29.50**

## TOOLS OF TRADE!



### WELLER WTCPN SOLDERING STATION

The WTCPN Features:  
 • Power Unit 240 V AC  
 • Temperature controlled iron, 24 V AC  
 • Flexible silicon lead for ease of use  
 • Can be left on without fear of damaged tips!  
 The best is always worth having.  
 Cat. T12500 **\$97.50**



### WE HAVE DONE IT AGAIN!

New multimeter at unbeatable value for under \$45! The new YU-FONG YFE-1030C features:  
 • Large 3 1/2" digit display. (1/2" inch high)  
 • Autopolarity, "..." display for Negative input.  
 • High over-load protection for all ranges.  
 • Over-load display highest figure "1" or "1-" alone glows.  
 • Power consumption 20mW approx.  
 Cat. **\$49.95**



### TRANSISTOR NIPPERS

Normally \$7.95! This Month **\$6.95**  
 Cat. T12070



### MICRO NIPPERS

Normally \$9.95 This Month **\$6.95**  
 Cat. T12050



### LOGIC PROBE 3800A

Features 20MHZ memory, TTL/CMOS operation. Normally \$29.50  
 Cat. Q11272 1-9 10+  
**\$23.50 \$19.50**



### 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 **\$69.50**

## IC'S GALORE!



### IC SPECIALS!

4116	1-9	10+
4164	\$1.80	\$1.70
2716	\$2.75	\$2.55
2716	\$5.50	\$5.50
2732	\$6.25	\$5.95
2764	\$8.25	\$7.95
27128	\$12.50	\$11.50
6116	\$5.50	\$5.15
41256	\$14.50	\$12.50

### WORLD MODEM CHIP

Cat. **\$49.95**

## BATTERIES!



### NICAID CHARGES

Cat. **\$24.95**



### NICAID BATTERIES

Save on carbon batteries with these Apollon Nickel cadmiums. Rechargeable up to 1000 times!  
 1-9 10+  
 Cat. S15020 AA500 MA **\$2.45**  
 Cat. S15021 C1.5 AH **\$2.25**  
**\$4.95** **\$3.95**  
 Cat. S15022 D4 AH **\$7.95** **\$6.95**

## HARDWARE!



### HIGH EFFICIENCY RADIAL FIN HEATSINK

Black anodised with a thick base plate, this radial fin heatsink can dissipate large amounts of heat for maximum efficiency.  
 105x65mm Cat. H10524 **\$2.80**  
 105x75mm Cat. H10525 **\$3.00**  
 105x150mm Cat. H10535 **\$5.50**  
 105x225mm Cat. H10546 **\$8.00**  
 105x300mm Cat. H10549 **\$12.00**



### BULK CABLE 100M ROLLS

Cat. W11222 3C2V75 OHM **\$22.00**  
 Cat. W11224 5C2V75 OHM **\$35.00**  
 Cat. W11219 4 Core Shielded **\$49.00**



### PANEL METER BARGAINS!!

250µa Sensitivity Panel cut out 36 x 16mm. Mounting hole centres at 49mm.  
 Cat. Q10400 normally \$1.50  
**NOW \$3.95**

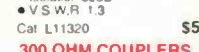


### TELEVISION ACCESSORIES!



### HYBRID SPLITTERS

2 Way  
 • Input/Output 75 Ohm  
 • Splitting loss 3.5dB  
 • Isolation 25dB  
 • V.S.W.R. 1.3  
 Cat. L11310 **\$3.95**



### 300 OHM COUPLERS

Suitable for UHF, VHF and FM.  
 2 Set  
 Cat. L11300 **\$2.85**  
 4 Set  
 Cat. L11302 **\$4.90**



### UHF/VHF OUTDOOR MATCHING TRANSFORMER

75-300 Ohm. Waterproof type  
 Cat. L11020 **\$3.75**



### UHF/VHF/FM ANTENNA

Frequency: VHF 48.216 MHz (Ch 1-12)  
 UHF 536-764 MHz (Ch 25-62)  
 Impedance: 75-300 (200) Ohm  
 Element: VHF 4, UHF 9  
 Gain (dB): VHF 4-6, UHF 4-8  
 Cat. L11014 **\$39.50**



### CONNECTOR CORDS

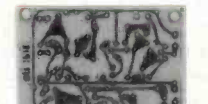
For TV/VTR (using cord 3C-2V) 2.5m long.  
 Male to Female **\$2.95**  
 Male to Female **\$2.95**



### MATCHING BALUN TRANSFORMER

Female>Type 75/300 Ohm  
 Cat. L11010 **\$2.95**

## CIRCUIT PRODUCTS!



### PC BOARDS

Make your own kits!

ET1478SA	1.85	ETH153	2.40
ET1478SB	1.65	84AU1	1.95
ET1478SC	1.65	ET1610	2.90
ET1478SD	1.65	ET1678	2.35
82A03B	2.80	80PG6	5.10
81FM10A	6.95	81DC2	1.65
81FM10B	3.20	82GA5	2.10
ET11405A	2.40	84U56	2.65
ET11405B	3.60	ET1147	2.85
ET1478MC	2.50	ET1458	3.25
ET1478MM	2.50	ET1071	1.60
ET1755A	5.55	ET1485	3.60
ET1755B	1.80	81MC8	7.55
ET1755C	1.80	ET1480	2.85
84MA11	2.30	82IV6	6.05
82TA10	1.90	ET1163	6.55
ET1755B	1.95	ET1159	2.65
84EC11	8.30	ET1466	6.55
ET1477	6.95	ET1280	2.70
ET1668	3.75	ET1675	3.35
ET1494	2.55	ET1671	2.55
ET1471	11.90	ET1461	3.25
ET11421	2.75	84TP2	2.75
ET1585T	1.45	ET1268	1.35
ET1585R	1.80	ET1712	1.60
82IV6	6.55	83GA6	6.05
84TP2	2.75	84MS10	2.65
ET1480	2.85	ET1256	1.80
84PA11	3.75		



### 1000 PROTOCARDS

SAVE \$20  
 Horizontal Buss Cat. H19125 **\$19.50**  
 Vertical Buss Cat. H19130 **\$19.50**  
 Pad Per Hole Cat. H19135 **\$19.50**



### FULL STRENGTH FERRIC CHLORIDE

250ml	1-9	10+
500ml	<b>\$1.95</b>	<b>\$1.75</b>
1 litre	<b>\$2.95</b>	<b>\$2.50</b>
	<b>\$4.95</b>	<b>4.50</b>



# Rod Irving Electronics!

"If not, then very nearly!"

## SECURITY EQUIPMENT!



### LOCAL BURGULAR ALARM CONTROL PANEL

The odds against you are climbing and prevention is better than cure!

- Adjustable exit/entry time delay and alarm time (avoids unnecessary noise pollution)
- 12V D.C. 1.5 Amp
- Provision for battery back-up.
- Tamper switch
- Optional outputs: Sirens, bells, floodlights, automatic diallers, tape recordings, closed circuit TV, etc.
- Accepts N.C. and N.O. detectors such as infrared, microwave, ultrasonic, wireless, vibration sensor, magnetic switch, door mat, smoke detector, glass breakage sensor, panic button etc.

Cat. S15051 **\$99.95**



### RITRON KEYLESS CAR ALARM

The first shipment sold out immediately to the trade. They didn't reach our own retail stores!

- Activated and disarmed by ignition key, so you never forget to turn it on.
- Multi-function, built in siren or external siren, car signal horn output.
- Easy to install, no door switch required.
- Automatic reset after 60 seconds (avoids noise pollution)
- Special sensor protects Stereo or CB.
- 12V DC

Cat. S15054 **\$39.95**



### ULTRASONIC BURGULAR ALARM

- Easy to install
- Connect with magnetic switch, infrared detector, etc.
- Equip with horn/speaker, lockswitch, flashlight, closed circuit TV, etc.
- Rechargeable battery circuit with recharge indicator L.E.D.
- N.O. and N.C. circuit breakdown indicator
- Low dry battery indicator

Cat. S15052 **\$89.95**

### MINI-TUNE BUZZER

- 5-15V White or black

Cat. A15062 1-9 **\$1.95** 10+ **\$1.75**



### HORN CRAZY!

- BW, aluminium or plastic. Normally \$9.50
- Aluminium Cat. C12015
- Plastic Cat. C12010

1-9 **\$6.50** 10+ **\$5.95**

## VIDEO ACCESSORIES!



### TDK VIDEO TAPES AT BARGAIN PRICES!

VHS:	E60	\$12.50
	E120	\$12.50
	E180	\$11.80
	E240	\$22.40
BETA:	L250	\$13.50
	L500	\$14.40
	L750	\$17.50



### VDR1 VIDEO DUBBING KIT

For European and Japanese machines.

**Contains:**  
 Audio/Video: 6 pin DIN plug to 6 pin DIN plug 1.5 metres.  
 Audio/Video: 6 pin DIN socket to (a) Video: RCA plug (b) Audio: 5 pin DIN plug. (Both 16cm in length)  
 Video: 1 each plug adaptor (PA21) RCA socket to PL259 plug (PA23) RCA socket to BNC plug  
 Audio: 5 pin DIN socket to 2 RCA plugs 16cm length 2 plug adaptors (PA60) RCA socket to 3.5mm phone plug

Cat. **\$16.95**

## AUDIO PRODUCTS!



### 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
AD80 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	5.95	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



### SUPER HORN

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

Cat. C12102 **\$12.95**



### ELECTRONIC CASSETTE DEMAGNETISER

Save \$2. Rec retail **\$19.95**  
 Cat. A11006 **NOW \$17.95**



### TDK LINE FILTERS

Cat. **\$12.50**



### P.A. SPEAKERS

Low dual cone, wide range, 200mm (8in.). Ideal for public address, background music, etc. Tremendous Value at these prices!

Cat. C12000 1-9 **\$5.95** 10+ **\$4.95**

## JOYSTICKS!



### CENTRE RETURN JOYSTICK

Features 2x150K pots, long shaft 40mm with 25mm control ball. Bonus adjustable offset feature on pots.

Cat. X15637 1-9 **\$9.95** 10+ **\$8.95**



### ARCADE FIRE BUTTONS

With micro switches.

Cat. **\$9.95**

## COMPUTER ACCESSORIES!



### REPLACEMENT KEYBOARDS

- For Apple
- 42 single key BASIC command
- One chip custom design encoder
- Made by ALPS, life time, 10 million operations
- Dimension: L340xW110xH42mm

Cat. KC2002 **\$79.50**



### IBM COMPATIBLE COMPUTER

**\$2,250**  
 Including Tax!

\*IBM is a registered trademark.



### RITRON (ZETA) DATASETTE

For data loading and saving, this Micron Datasette suits most home computers and features tape counter, monitor function for audio verification and slide volume control for output level.  
 Cat. C14900 **\$29.95**



### RITRON 2

Flush swivel base monitor, available in amber or green.  
 1-9 **\$215**  
 Green Cat. X14500 **\$205**  
 10+ **\$205**  
 Amber Cat. X14500 **\$205**

### NOW IN STOCK!



### 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 Baud 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

**\$379**



### RITRON INFO RUNNER

An exciting new printer from the experts "Ritron". This compact stylish printer performs like printers twice its price and size. 120 C.P.S., dot resolution graphics, tractor/friction feed, 10" paper.

**\$459**



### M4851

Streamline 5 1/4" disk drive. Double sided, double density 500K unformatted, 40 track/size. Steel band drive system.  
 Cat. C11901 **\$199**  
 Case & Power Supply to suit  
 Cat. X11011 **\$89**



### TELECOMMUNICATION PLUG TO 2 SOCKETS.

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



### READY MADE CABLES

Serial to Serial  
 Cat. P19011 **\$18.95**  
 Parallel centronics to centronics.  
 Cat. P19013 **\$23.95**



### COMPUTER PAPER

Top quality at a very affordable price! Blank 11 x 9 1/2", 2,000 sheet, quality 60 gsm bond paper.  
 Cat. C21001 **\$29.50**

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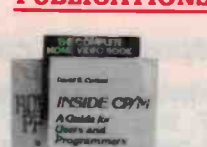
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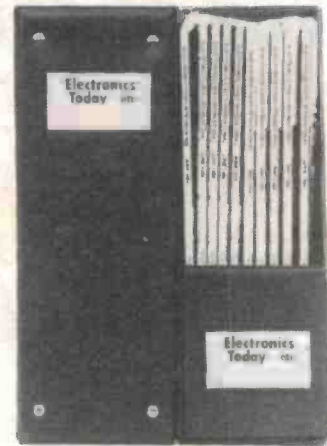
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# LOUDSPEAKERS SHAPE UP

## — Sony APM22ES

Louis Challis

Long research and development of square diaphragms has finally paid off for Sony with the emergence of a new, well-balanced "accurate piston motion" speaker system that uses aluminium honeycomb structures like those recently developed for the aerospace industry.

### SONY APM22ES LOUDSPEAKERS

Dimensions: 525 mm high x 290 mm wide x  
320 mm deep  
Weight: 14.3 kg  
Manufacturer: Sony Corporation, Tokyo,  
Japan  
RRP: \$749 per pair (excluding  
stand)

OVER THE LAST three years Japanese speaker manufacturers have been experimenting with various new forms and shapes of loudspeaker diaphragms. This has primarily been aimed at reducing the magnitude of the flexural vibration of the diaphragm from which all loudspeakers suffer to various degrees. It is this flexural vibration which you so often perceive as the second, third, and higher order harmonics, particularly under high drive conditions.

Obviously, the approaches being applied vary from manufacturer to manufacturer. Manufacturers are currently using esoteric materials, like carbon fibres, glass epoxy laminates, light-weight berilium domes, composite laminated structures and, last but not least, aluminium honeycomb structures of the type recently developed for the aerospace industry.

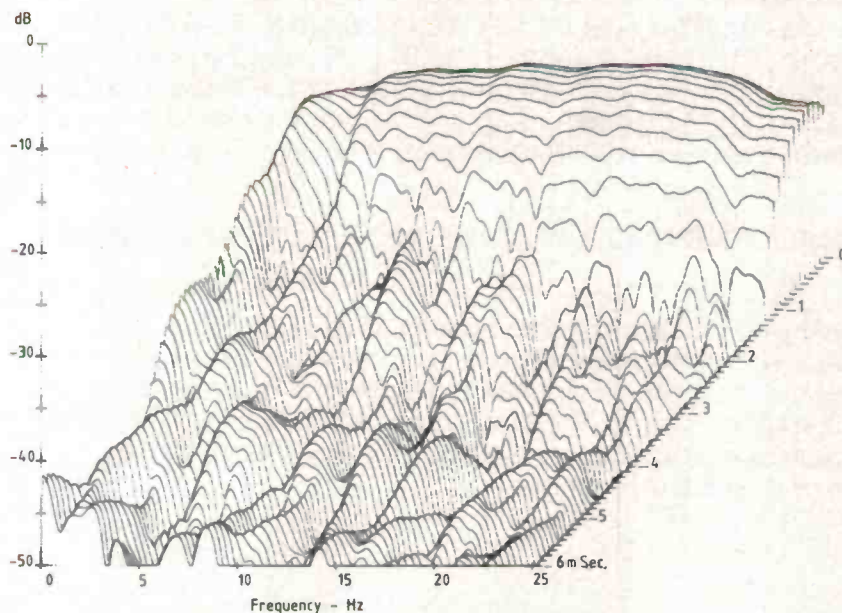
Sony has chosen aluminium honeycomb as the basic structure in the design of a new range of speakers. It has synthesized the basic concept of an ultra-rigid light-weight diaphragm and then modified it to use a square configuration, the appearance of which is radically different from anything I had previously seen.

This concept is not without its detractors as a square diaphragm is capable of producing many complex modal responses which are often more difficult to control than those produced by either a circular or oval diaphragm of similar dimensions.

When I visited Sony's electro-acoustics laboratory in Tokyo late last year, I found myself embroiled in a number of discussions with the design engineers who were involved in the development of this concept and who were strongly entrenched in the 'protagonist camp'. They believed that this speaker design is markedly superior to the other designs that they or their competitors have previously used. Whilst I accept that viewpoint, I was nonetheless critical of the likely modal analysis response of a diaphragm driven at only four points behind the aluminium honeycomb structure and which must vibrate in a clearly defined non-linear manner as a consequence.

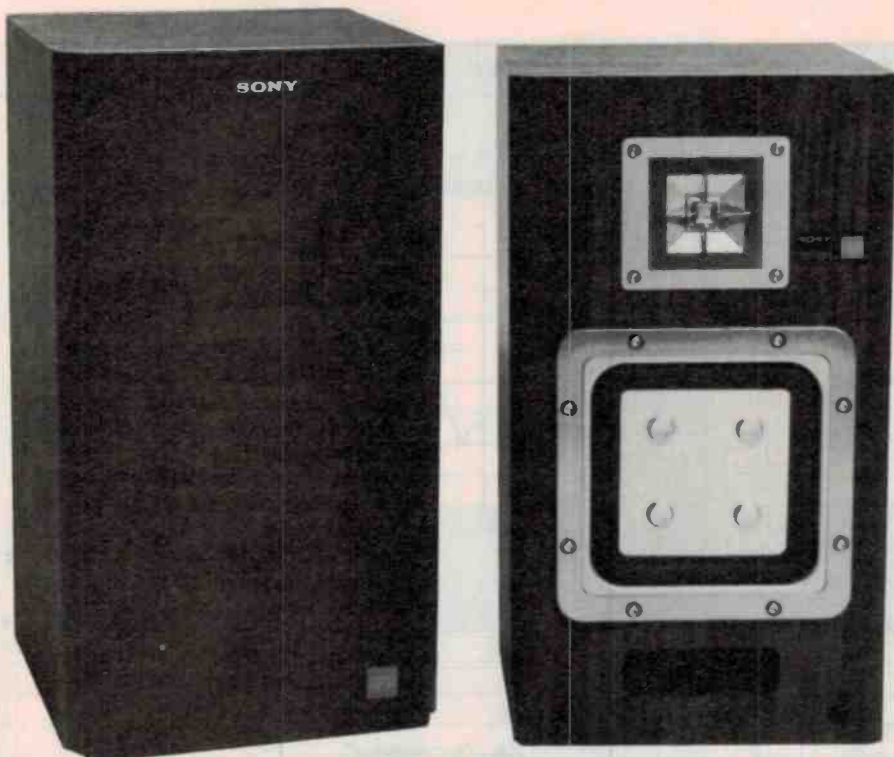
### Appearance

The "APM" emblazoned on the escutcheon of the speaker stands for "accurate piston motion" which are Sony's buzz-words to describe the acoustical feature that it has set out to achieve with this design. The speaker system uses an unusually well designed cabinet with curved and veneered front corners, and surprisingly curved back corners as well. These have a radius of 25 mm and are

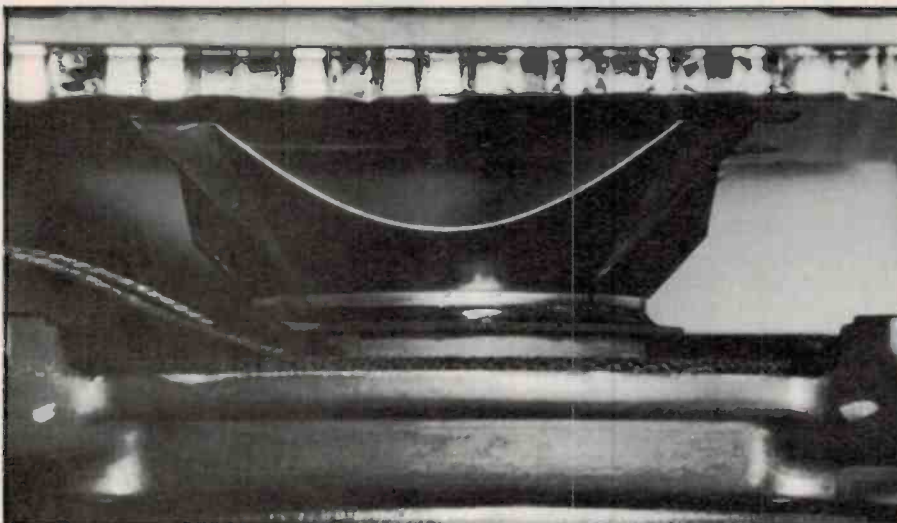


Delay response spectra.





The speaker diaphragm is supported on its rear face by the extended ends of the cruciform element.



intended to reduce diffraction effects. Surprisingly, the speaker external dress frame does not consistently follow this principle. By that I mean that the low frequency driver's speaker frame incorporates a step-out of 8 mm from the front of the cabinet which, because of its position with respect to the tweeter installation, must add unnecessary diffraction effects which could have been easily avoided.

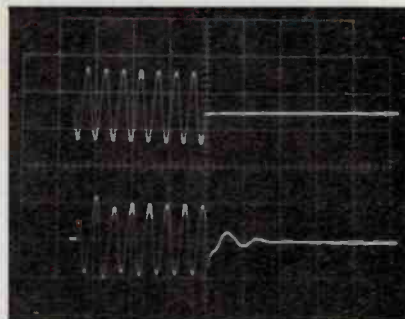
The cabinet is reasonably solid and uses a 20 mm thick piece of high density particle board. This is supplemented by internal absorptive linings with some internal bracing. The extended low frequency response is achieved by means of a usual rectangular loading port which is 75 mm deep. This has an area equivalent to that of a 75 mm diameter circular aperture but looks more 'high tech'. This loading port is located at the base of the cabinet where it angles down

towards the floor and this does improve its appearance. The cabinet is fully veneered with a plastic laminate which so closely simulates real wood, that I had difficulty in correctly identifying it for what it is.

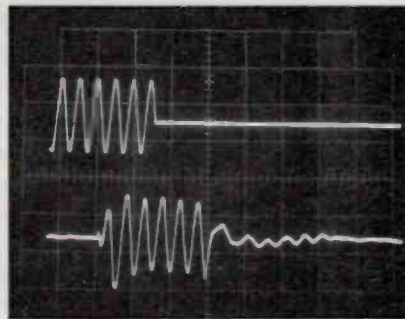
The woofer is unusual in that the square aluminium honeycomb diaphragm has a modest overall effective dimension of 135 mm<sup>2</sup>. This diaphragm is supported on its periphery by a very neatly executed flexible roll surround, which ensures that the woofer achieves an extremely long throw and also minimizes the risk of voice coil polling. The speaker diaphragm is supported at four points on its rear face by means of the extended ends of the folded and carefully shaped ends of a curved cruciform element. This is neatly fixed to the aluminium honeycomb structure (see photograph).

These termination points are carefully in-

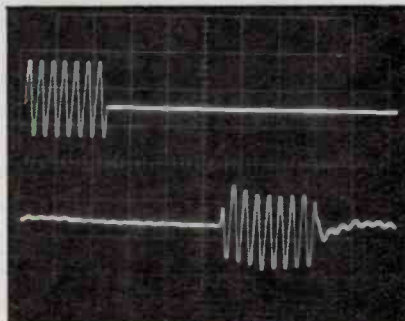
Tone burst response of Sony APM-22ES speaker, for 90 dB steady state SPL at 2 m on axis. Upper trace is electrical input, lower trace is loudspeaker output.



100 Hz (20 ms/div)



1 kHz (2 ms/div)



6.3 kHz (0.5 ms/div)

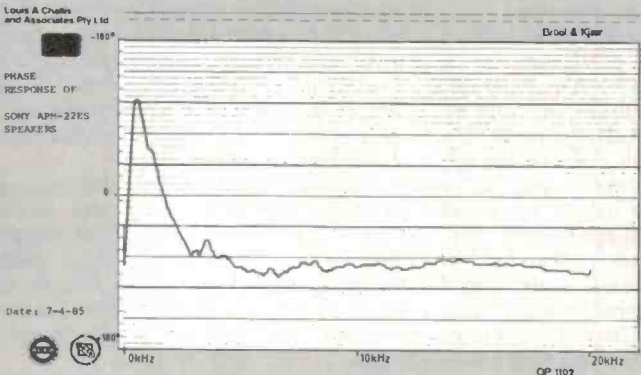
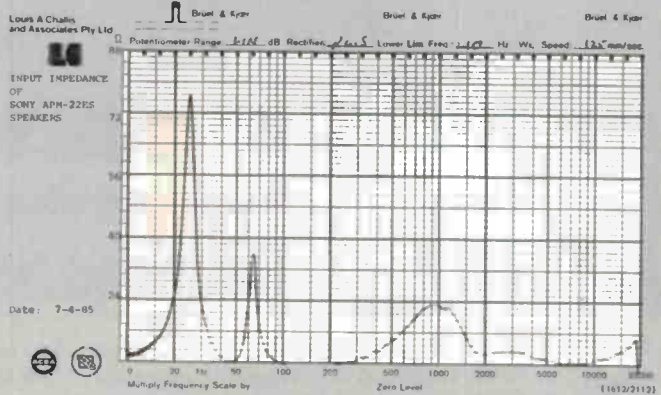
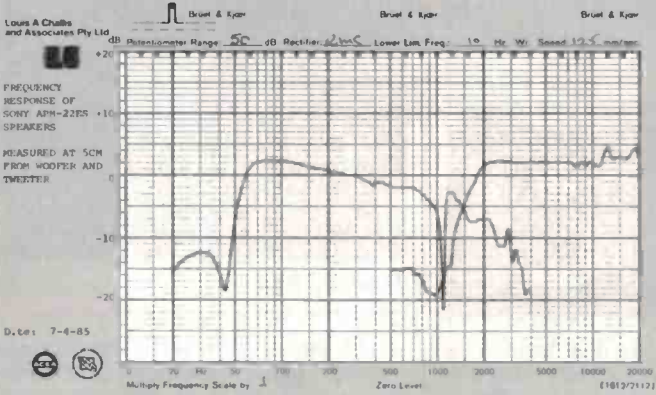
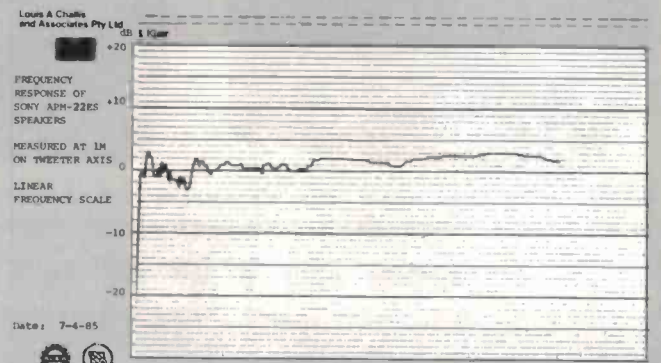
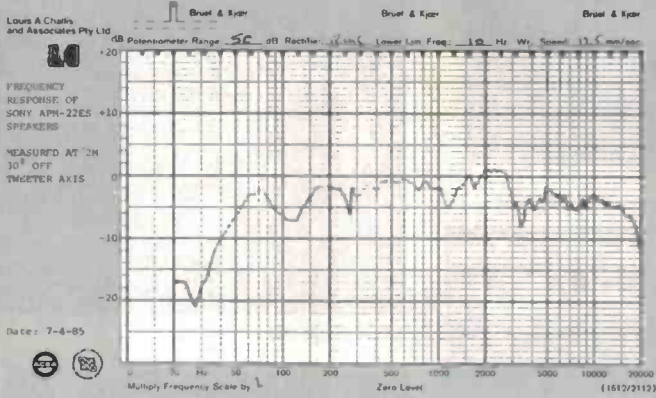
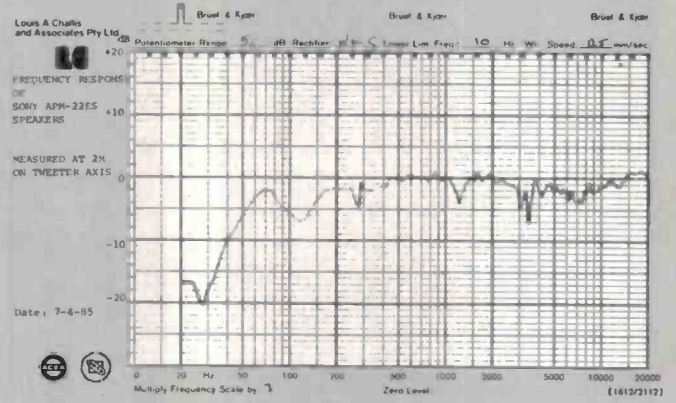
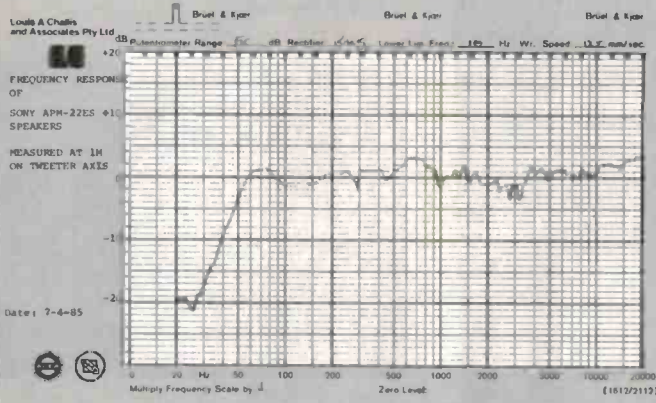
serted and glued to the aluminium panel and also reinforced on the point of penetration at the front of the panel by four aluminium cover plates. This bowl shaped cruciform driving element is directly terminated onto a 50 mm diameter semi-conventional circular voice coil. This sits in a heavy ferrite magnet structure supported by four diecast legs with an unusual shape and is moulded to the front of the speaker basket supporting assembly.

If anything, the tweeter is even more unusual in appearance than the woofer. Frankly, at first I would not have imagined anything less likely to provide a smooth high frequency response than a square diaphragm with a square flexible surround structure (oh well, one can't always be right).

The Sony engineers have cleverly compensated for the higher levels of 'on axis' di-



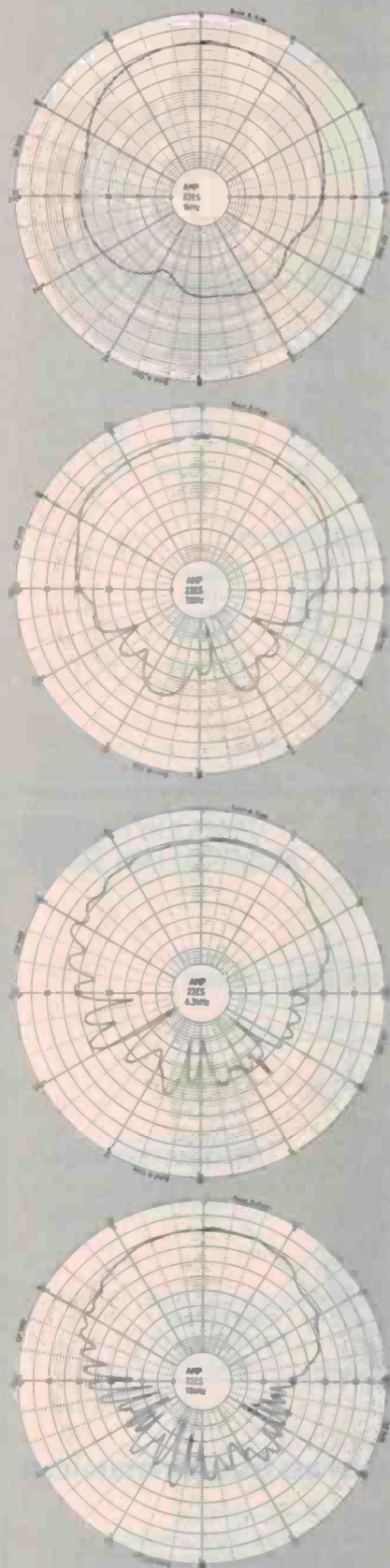
Characteristics as measured.



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Polar response plots.



rectivity effects of this diaphragm by placing a small carefully shaped square protection grid directly in front. This grid has four centrally radiating stiffening ribs 4 mm in front of that diaphragm. That grid structure simultaneously protects the grid and increases the lateral dispersion at the same time. Surprisingly, it also has a slight effect on the polar plot as the high frequency level recordings soon revealed.

The cabinet has a volume of 30 litres. The speaker grille is moulded from plastic and faced by a very fine open weave black cloth. Unlike other contemporary speaker cabinets, this grille sits proud of the cabinet, so that a diffraction cavity is provided behind the back of the plastic frame and the curved front of the speaker cabinet.

The rear of the cabinet incorporates a pair of spring loaded terminals which are designed to accept the bared wires of the leads. The speaker does not incorporate a protection circuit and accordingly labels are attached to the rear of the cabinet warning the user of the risks of overloading and also of the presence of stray magnetic leakage flux.

### Objective testing

The objective testing of the speaker revealed performance which is fully in keeping with most of the manufacturer's claims. The first and probably one of the most outstanding features is the flatness of the frequency response which extends from 50 Hz to beyond 20 kHz with a degree of uniformity that is remarkably good and rather atypical for most speakers selling at around this price.

The frequency response at 2 m does not change significantly and the response at 30° off axis exhibits less than a 5 dB change at 15 kHz and less than a 10 dB change at 20 kHz. The measurements of 50 mm from the low frequency driver's diaphragms exhibit a remarkable uniformity of response which is more typical of a textbook trace than what I would expect from a square diaphragm.

The impedance curve exhibits two distinct resonances, the lower one being at 25 Hz from the loading port and the higher one being at 65 Hz from the woofer resonance. The overall linearity of the impedance curve is remarkably good with the rated impedance being a genuine 8 ohms in accordance with the "IEC criteria". With these specific impedance characteristics you would be unlikely to experience any difficulties in paralleling two pairs of speakers of the same type or even two other nominal 8 ohm speakers with most amplifiers.

If I was pleased with the frequency response, I was even more pleased with the phase response which is maximally flat over the range 2 kHz to 20 kHz and markedly superior to any Sony speaker that I have ever previously tested. This phase response coupled with the good frequency response most certainly justifies the Sony applied accolade of "accurate piston motion". The polar plots revealed an excellent and wide

## SOUND REVIEW

dispersion angle substantially better than I had expected from a square diaphragm. At 10 kHz there is less than 1 dB droop at  $\pm 30^\circ$  to the main axis, whilst at  $\pm 60^\circ$  the droop is only a shade more than -6 dB. The tone burst testing revealed excellent performance at 100 Hz, reasonable performance at 1 kHz and some degree of carry-over at 6.3 kHz.

The most telling test is, of course, the decay response spectra, which exhibit only one really significant resonance from the whole system. That resonance occurs at a frequency of approximately 4 kHz and does not really intrude until the decay response levels are more than 10 dB below the peak level. That particular resonance is apparently a fundamental tweeter resonance and above that frequency there are no other significant resonance characteristics (so much for my theories about square diaphragms!).

Taken overall, the objective performance of the speaker is indicative of the results achieved by the long research and development programme which Sony has undertaken to produce this particular speaker system.

### Subjective testing

The subjective response was once again different from what I had expected by way of audible colouration or possible harshness at high frequencies (which I had previously observed in an earlier generation of this particular speaker design). The APM22ES is a well-balanced speaker offering superb stereo imaging, excellent low frequency response, markedly superior transient response and faithful reproduction of both the human voice and most musical instruments to which I listened.

I evaluated the speakers with inputs from a Sony CD-P101 CD player, and a Technics SL 120 direct drive turntable fitted with a Shure V15 IV cartridge.

The strong and overriding impression I gained was of unusual clarity with a trace of excessive brilliance at the highest frequencies particularly in the 10 to 16 kHz region. Here the speakers exhibit a rising frequency response which I could readily detect. In fact, I found it essential to introduce a small degree of high frequency cut on the pre-amplifier.

I tested the speakers with a wide range of programme content, including INXS on a new CD disc entitled *The Swing*, WEA 250 389-2. The low frequency response of the APM22ES speakers is remarkably good considering the volume, and their ability to deliver high powered signals with outputs over 105 dB with minimal audible distortion is excellent.

With a change of medium to the classical on Johann Pachelbel's "Canon and Gigue in D Major" on Deutsche Grammophon 413 309-2, I perceived that these speakers achieve a remarkably good transient re-



## SOUND REVIEW

sponse, excellent stereo imaging and generally smooth response throughout the full spectral range. I was, however, aware that there was some degree of colouration, particularly at the lower end of the mid-frequency spectrum where on voice I could detect some change of intonation compared with my reference monitors. This was particularly evident on a new Dinah Washington disc *Dinah Jams*, track 2 "Along Together", on EmArcy records 814 639-2. This particular disc also revealed traces of normal high frequency colouration during A-B testing although I did not consider that a strong condemnation.

The Sony APM22ES loudspeakers do provide a remarkably accurate piston motion and are substantially better in their detailed reproduction performance than the first generation of these speakers which I listened to a little more than 18 months ago. Whilst I have been somewhat critical of the design concept in which a square speaker diaphragm is used in such a system, I must nonetheless acknowledge that Sony has achieved a remarkable degree of fidelity in spite of my scepticism. I will be more than interested to assess the 'big brothers and sisters' in this series which should offer a superior performance.

### LOUDSPEAKER DATA SHEET

MEASURED PERFORMANCE OF: Sony AMP-22ES

FREQUENCY RESPONSE: 40 Hz to 20 kHz

CROSSOVER FREQUENCIES: 2 kHz

MAXIMUM POWER OUTPUT: 105 dB at 2m

SENSITIVITY:

(for 90 dB average at 2m) 8.4 V r.m.s. = 88 Watts (nominal into 8 Ohms)

HARMONIC DISTORTION:  
(for 96 dB at 1m)

	100Hz	1kHz	6.3kHz	
2nd	-23.8	-38.9	-57.6	dB
3rd	-33.1	-30.1	-46.5	dB
4th	-62.6	71.6	-65.7	dB
5th	-51.7	-70.9	-	dB
THD	6.8	3.3	0.49	%

INPUT IMPEDANCE  
ONE TEST:

100Hz/7kHz 4:1

100Hz	8.0	ohms
1kHz	22.7	ohms
6.3kHz	8.5	ohms
Min at 150 Hz	6.5	ohms

Date: 7th April 1985

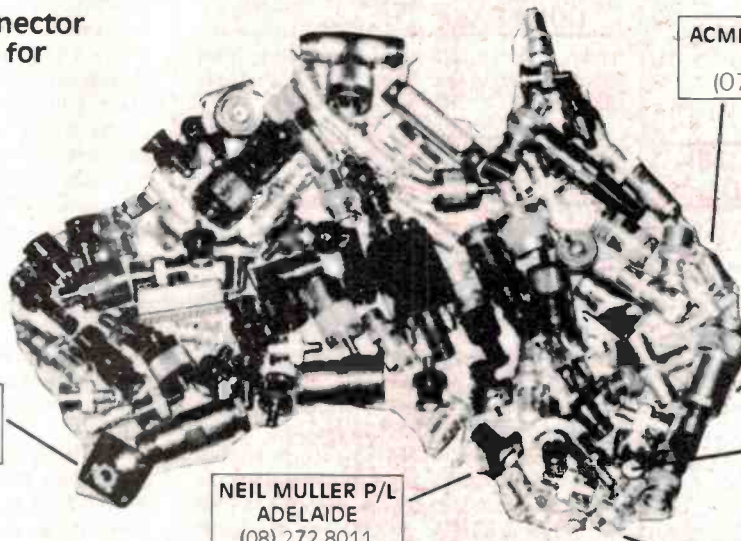


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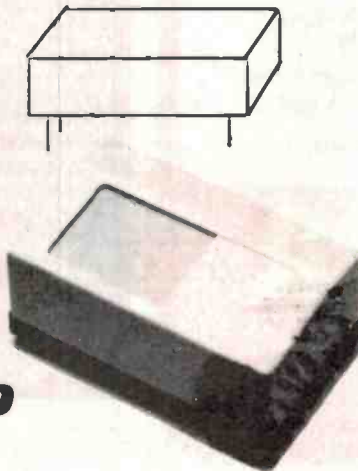
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# Philips' VR 6940/75 stereo VCR

## A SOUND INVESTMENT

The focus on stereo VCRs is usually on the stereo but there is obviously more to them than that. This review looks seriously at both video performance and audio performance, with good reports for the user.

Louis Challis

AS THIS REVIEW goes to press, the Australian distributors of stereo video recorders and the companies which market the software are preparing to release local industry standards for stereo video software. These standards are intended to define the minimum performance requirements for both VHS and Beta format stereo video tapes which will then qualify for the title "hi-fi stereo video".

Stereo VCR receivers are now an established part of the 'hi-fi' scene, and Philips Industries (Australia) has devoted considerable attention to making its presence felt in this new and burgeoning field. Philips, and its parent organization at Eindhoven in Holland, have been actively involved in producing VCRs for more than a decade. In that time span, they have developed two of their own systems which although technically excellent suffered from the problem of incompatibility with the other systems in the market place. Philips has now realized that 'when you go it alone' you run the risk of market-place rejection and has finally succumbed to those pressures. As a consequence, it has accepted VHS as the basic consumer VCR system. There tends to be a European preference for VHS type format and it is in Europe that Philips has its largest consumer market.

Whilst the other manufacturers of stereo VCRs have produced a wide range of technically innovative and generally outstanding machines, most of the marketing people (in those other firms) have tended to stress the differences in the ergonomic characteristics between stereo VCR machines and conventional audio stereo recorders.

By contrast, the engineers and marketing personnel at Philips have perceived the similarity in the operational characteristics of a VCR with those of a conventional audio cassette recorder. As a consequence,

they have once more gone against the tide and have endeavoured to unify the operational controls. This constitutes what most of us would perceive as an obvious ergonomic feature in the design of the unit and the new owner immediately feels at home with the controls, rapidly able to use both the audio and video controls. This particular feature is the most important design difference between this stereo VCR and the majority of others in the market place.

### Features

The front panel of the Philips VR 6940/75 VCR is black, which is a colour that Philips only recently adopted after two generations of using natural wood, followed by a generation of brushed satin aluminium (silver) front panels.

The front panel is divided into five separate sections with the top left hand section incorporating the front loading cassette well with Dolby noise reduction 'logo' emblazoned thereon.

To the left of the cassette well is an unusual CASSETTE EJECT button which only illuminates when there is a cassette inside the recorder (a nice touch). Immediately below this is a STANDBY switch which is similarly illuminated when the unit is in the standby mode.

Immediately below the cassette well is a large recessed display module which provides information on the time, the day of the week and an entirely separate digital clock on which the unattended recording times are programmed. The main time clock is backed up by an internal battery so that if the mains supply is cut off, or if you take the recorder to another room, you do not have to reprogramme the clock, timer or other critical information as I have found with my present home VCR. This is a 'big plus'.

On the right hand side of the display module is a four digit counter and a series of additional displays which provide data on the TV channel selected supplemented by a series of arrows and other coding. These include a red light to indicate the recording mode and a series of LEDs and numbers to indicate the length of tape. The display also provides information on the length of tape remaining, the counter memory data, the state of automatic programme search and information on the audio dubbing mode.

Most of these functions and the data inputs are controlled by the adjacent set of controls located behind the hinged supplementary control panel which is located on the right hand side of the cassette well. The display module provides additional information on the activation of the pause/still mode when the VCR is in the record mode. This display also indicates whether there is dew on the heads, whether the recorder is in the bi-lingual mode, whether the timer is activated and whether the Dolby noise reduction system is in operation. It also provides information in a well conceived approach on the preset programmes for daily recording, for the next seven days and for the period eight to fourteen days ahead. The controls for all of these functions are all located in a drop down panel located immediately to the right of the cassette well.

On the right hand side of the display are three push buttons, the first of which is for the instant time recording indicator, the second for counter reset and the third for activating the counter memory.

The right hand side of the front panel features an unusual flip-down cover which not only hides the less frequently used controls, but also incorporates a series of 'sensa-touch' switches. These sensa-touch controls are located on the internal horizontal surface of the panel and have four different





colour codes to indicate their functional relationships. The picture controls are coloured grey, the audio/video controls are blue, the timer controls are clearly identified by the use of red and the automatic programme controls by a turquoise colour.

The timer controls provide for extended programming of the 14 day timer, as well as for the automatic programme search facilities, and are located on the inner surface of the drop down lid. There is an equal number of other controls located on the vertical surface behind this cover, which control the picture adjustment, still tracking and left and right headphone adjustments.

These colour-coded controls are supplemented by a series of conventional switches for Dolby B noise reduction, the audio circuit for linear, mixed or hi-fi monitoring of the left and/or right audio tracks as well as the controls for manual or automatic audio recording. The last of these controls facilitates selection of audio alone or audio plus video or the source of the audio inputs from radio, auxiliary or tuner inputs.

The bottom row of controls operates in association with the timer controls on the drop down lid and provides the separate functions required for the timer mode switches associated with normal start and length of tape. Adjacent to this is the mono/auto bi-lingual switch and last but not least are the automatic search controls, all of which are neatly colour coded to clearly identify mono or auto and automatic search selection.

These are the controls that you would not want children, let alone friends to tamper with and consequently the provision of an effective cover is very sensible.

The main functional controls are provided on the front panel immediately below this drop down cover. They feature the sensible ergonomic design layout originally

developed for audio compact cassette recorders. These controls are both colour coded and feature the now standardized function symbols. The first of these is a RECORD switch with a central red slider control which has to be moved from left to right to initiate the recording process. Adjacent to this is the audio DUBBING switch, which facilitates adding a sound track to an existing video recording. Next is a STOP button featuring the now international 'blue square' symbol, a PAUSE still button which allows you to switch into the pause mode or examine individual frame stills. The PLAY button is flanked on either side by the FAST REWIND button which also provides video search capability, and FAST FORWARD buttons for video search. The last control in this group is a FRAME ADVANCE button which allows you to advance the individual frames one at a time in the pause/still mode.

At the right hand end of the front panel is a pair of vertical sliding audio signal attenuator controls. These flank a pair of calibrated LED level displays which cover the audible signal range from  $-20$  to  $+8$  VU. Whilst this marriage of control and display may initially seem to be a relatively unusual format, it is nonetheless well conceived.

At the extreme right hand side of the front panel are a pair of channel selector buttons which facilitate an upward or downward channel search mode. The channel selected is displayed at the right hand side of the display module. Below this is a headphone socket for a conventional 6.5 mm diameter tip ring and sleeve stereo headphone jack.

Immediately below the main controls is yet another flip down cover behind which the infrared remote control is neatly stored when not in use. Adjacent to this are the input sockets for the left and right channel

#### PHILIPS VHS STEREO VCR MODEL VR 6940/75

*Dimensions:* 430 mm (wide) x 390 mm (deep) x 93 mm (high)  
*Weight:* 12 kg  
*Manufactured:* In Japan by Philips  
*RRP:* \$1,300

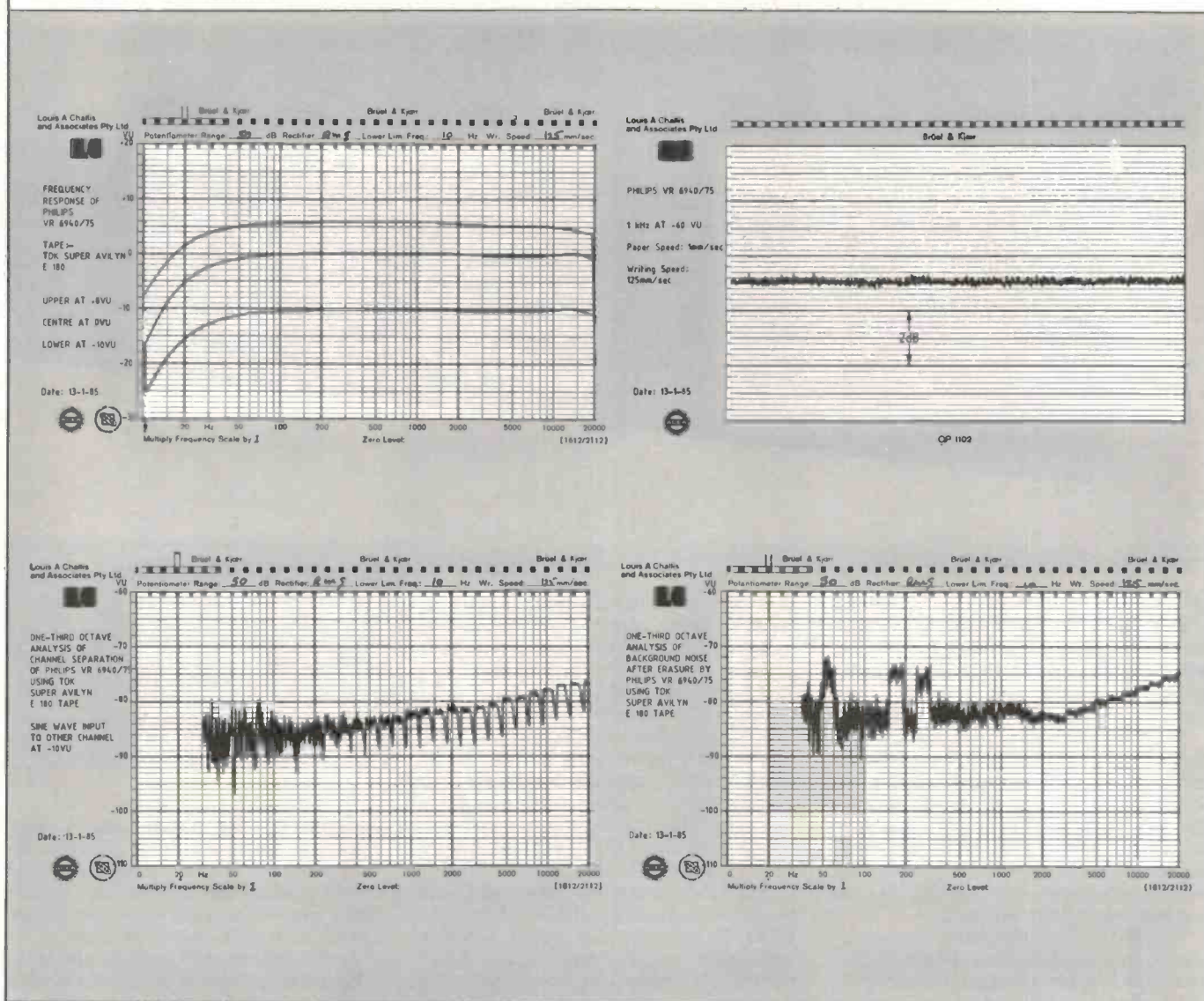
microphones. The remote control duplicates all of the main controls located on the front panel, together with pause/still, power on/off, single frame advance, ten channel direct selection, channel up/down selection, as well as an audio volume control.

At the right hand front of the top of the cabinet is yet another cover below which the 16-channel selector tuning controls are located. These provide individual channel tuning capabilities in the VHF low band (channels 0-5), the VHF high band (channels 5A-11) and the UHF band (channels 28-69). Fortunately, Philips has pretuned all of these controls to the Australian capital city television channels so that you are spared the 'agony' of having to adjust the VCR except in remote locations.

A small alignment tool is provided to facilitate the individual channel alignment in conjunction with the fine tuning thumb wheel controls. Three additional switches are provided for adjusting the automatic blank section (ABS) scan system which is used when playing back a tape on which only the audio track is recorded. A separate switch is provided for enhancing the colour when the VCR is used in either poor signal strength areas or is used with a poorly recorded video cassette. The last of these switches is the automatic fine tuning (AFT) switch which must be used when fine tuning the individual tuner controls. Adjacent to these is a small button which clears the ▶



## Characteristics as measured.



memory when the programmed information is faulty (as a result of extended power failure) or when you wish to delete all the recorded information.

On the rear of the VCR a recessed panel on the left hand side incorporates two pairs of RCA type coaxial input sockets for left and right audio channel inputs and outputs. These are supplemented by a standardized 5-pin DIN socket which conveniently provides a single lead for connecting up your audio amplifier for the same purpose. Immediately adjacent are two BNC video input/output sockets. Next is an antenna in and a separate rf out socket. Immediately adjacent is a switch for selecting either channel 3 or channel 4 when monitoring the output of the VCR on a conventional TV set. The last control on the panel is a switch which provides a test signal for your TV set. Next to this is a miniature tip and sleeve socket for controlling the camera pause function when the VCR is used in conjunction with an external video camera.

## Objective testing

The objective testing of the audio capabilities of the VCR provided some interesting results because for the first time it was decided that we should evaluate both the audio and video characteristics of a piece of video equipment.

In each case we evaluated the electrical parameters in terms of the electrical path through the video recorder without introducing the magnetic tape which we have designated as the 'EE' signal and again separately evaluated after being recorded and played back through the video recorder. This enabled us to separate out the video recorder magnetic playback path from the rest of the electronics in our objective analysis.

The first set of parameters we evaluated were the chroma linearities for the RGB pattern on a vectorscope. This revealed a considerable degree of phase 'twittering' and what I would describe as 'normal jitter' for a consumer VHS VCR. This same pat-

tern was evaluated in the colour-bar chroma wave form. Once again the jitter characteristics were clearly evident together with the impact of the field tilt which resulted in obvious blurring in all the photographs we took. This was particularly evident for each of the test signals evaluated following their passing through the record/replay heads of the recorder.

The multi-burst video frequency response using the VR 6940/75 analyzer revealed that the frequency response of the luminance circuitry extends to a frequency just over 2 MHz at which point it starts to fall rapidly to below the -6 dB point. The burst also shows the peaking response of the circuitry to the chrominance subcarrier at 4.43361875 MHz. The level of the peak at the chrominance subcarrier frequency is acceptable but not outstanding.

The record/playback staircase linearity response is excellent and although there is measurable jitter, this does not significantly impair the overall video linearity.



# SIGHT AND SOUND REVIEW

## MEASURED PERFORMANCE OF PHILIPS VR 6940/75 VIDEO RECORDER

Serial No. 6903

### VIDEO PERFORMANCE

Luminance bandwidth	2 MHz
Step Response linearity	better than 3%
Chrominance response	above average
Linearity at 50% luminance	above average.
Video gain	above average
Video field tilt	below average.
Still performance	line smudging evident.
Sensitivity	120 microvolts

### AUDIO PERFORMANCE

#### RECORD TO REPLAY RESPONSE (see graph)

Tape :-	TDK Super Avilyn E180		
Level	Lower -3 dB Point	Upper -3 dB Point	
+8 VU	25 Hz	20 kHz	
0 VU	27 Hz	20 kHz	
-10 VU	27 Hz	20 kHz	

#### SIGNAL TO NOISE RATIO (see graph)

Re +8 VU	67 dB(Lin)	77 dB(A)
----------	------------	----------

#### ERASURE RATIO

(For 1 kHz signal recorded at 0 VU)

Tape :-	TDC Super Avilyn E180	117 dB
---------	-----------------------	--------

#### MEASURED WOW & FLUTTER

0.004 %

#### LINEARITY

INPUT LEVEL dB	OUTPUT LEVEL dB
+8	+6.1
0	0
-10	-10
-20	-19.8
-30	-30.2
-40	-41.4
-50	-52.8
-60	-63.8
-70	-74.4
-80	-84.6
-90	-94.8

#### CROSS TALK

Better than 76 dB from 30 Hz to 20 kHz.

#### AUDIO TAPE DROP OUT

At -60 VU less than 0.3 peak over extended time sample.

#### HARMONIC DISTORTION

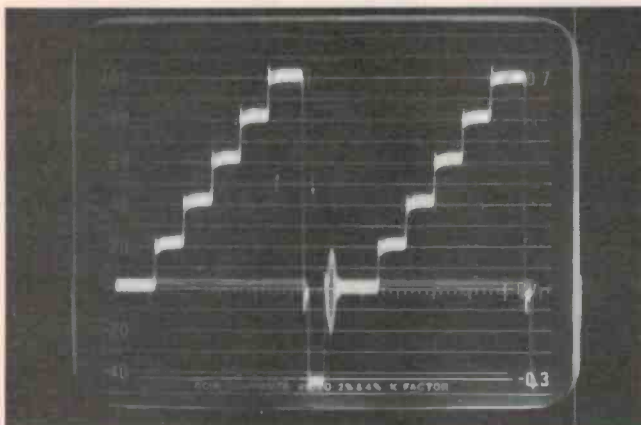
INPUT =	At 1kHz				
	+8 VU	0 VU	-6.0 VU	-20.0 VU	
2nd	-47.6	-50.9	-54.1	-55.7	dB
3rd	-50.0	-57.2	-66.7	-	dB
4th	-	-	-	-	dB
5th	-	-	-	-	dB
THD	0.52	0.32	0.20	0.16	%

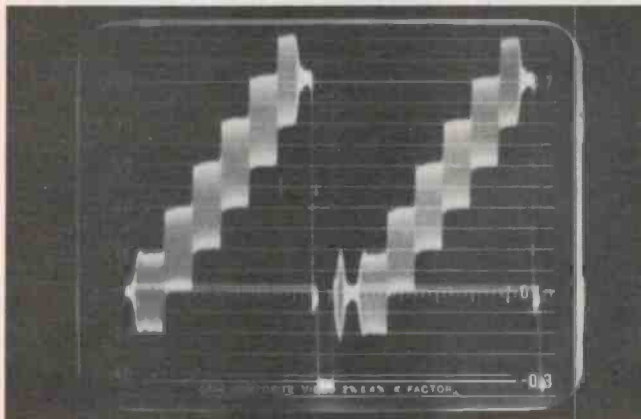
INPUT =	At 100Hz				
	+8 VU	0 VU	-6.0 VU	-20.0 VU	
2nd	-40.5	-46.0	-56.3	-45.1	dB
3rd	-42.9	-46.3	-45.9	-46.1	dB
4th	-69.6	-	-	-	dB
5th	-55.9	-56.6	-57.2	-60.5	dB
THD	1.20	0.71	0.55	0.75	%

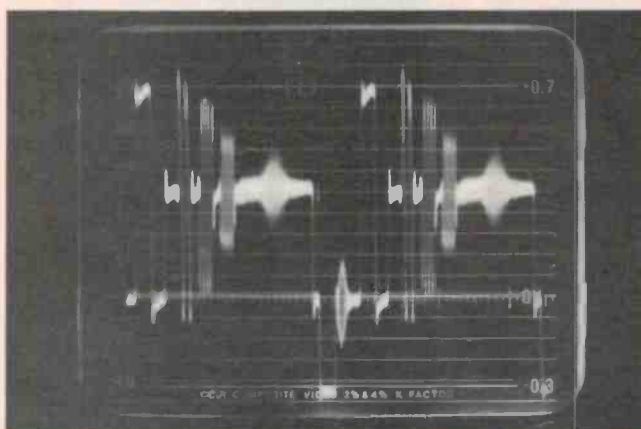
INPUT =	At 6.3 kHz				
	+8 VU	0 VU	-6.0 VU	-20.0 VU	
2nd	-42.3	-46.7	-51.2	Below Noise	dB
3rd	-35.8	-45.1	-56.2	Below Noise	dB
4th	-68.2	-	-	Below Noise	dB
5th	-	-	-	Below Noise	dB
THD	1.79	0.72	0.32	-	%



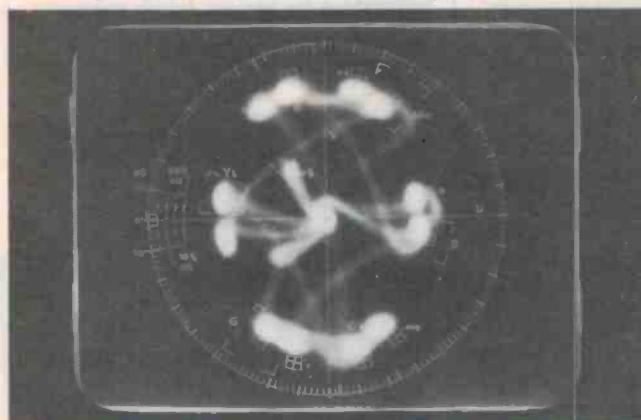
Staircase luminance linearity (record-playback).



Modulated staircase linearity (record-playback).



Video frequency response, multiburst (record-playback).



Vectorscope of colour bars (record-playback).



## SIGHT AND SOUND REVIEW

The objective assessment of the video electronics circuitry, in which the magnetic recording system was excluded, is remarkably smooth, flat with excellent linearity. The objective assessment of the magnetic circuitry reveals a performance which is slightly above average but by no means outstanding.

The assessment of the audio characteristics of the recorder was far more rewarding. The first and most obvious question is the record to replay frequency response of the VCR when operating in the stereo hi-fi mode. The test revealed that the frequency response was +0 -1 dB from 60 Hz to 20 kHz and +0 -3 dB from 30 Hz to well beyond 20 kHz. The linearity of this frequency response over the range 50 Hz to 20 kHz is extremely good and exhibits a degree of 'flatness' better than we would expect to find in most conventional audio compact cassette recorders.

The lower end of the frequency spectrum rolls over with the same basic characteristics as those exhibited by the Technics NV-850-A stereo VCR. If anything the response of this recorder is even flatter as the slight rise of the frequency response in the region 8 kHz to 16 kHz is much less pronounced (see "Stereo Hi-Fi VCRs" review, November 1984). It is my belief that the low frequency drooping response is a deliberate feature incorporated to improve the overall signal-to-noise characteristics of the VHS type stereo VCRs.

The Philips VR 6940/75 stereo VCR achieves an unweighted signal-to-noise ratio of 67 dB and an A-weighted signal-to-noise ratio of 77 dB(A) (re the +8 VU level). This performance whilst good and meeting the requirements of the new hi-fi stereo VCR standard, is not quite as good as that provided by either the Technics NV-850-A or Sony SL-HF 100AS VCRs or a number of other hi-fi stereo VCRs, which we have evaluated.

The erasure ratio for a 1 kHz signal recorded at 0 VU was quite outstanding and it achieved an erasure ratio of greater than 117 dB which is substantially better than that provided by either the Technics or Sony stereo VCRs.

The measured crosstalk between left and right channels was also markedly superior to the performance exhibited by other stereo VCRs achieving a separation of better than 76 dB at all frequencies between 30 Hz and 20 kHz.

The measured wow and flutter was extremely low and also better than that measured on other stereo VCRs. The flutter was a remarkably low 0.004%. The frequency linearity was particularly good in the region 0 VU to -30 VU but there was obvious and measurable non-linearity in the -40 to -90 VU range, as well as in the 0 to +8 VU range. This non-linearity is sympto-

matic of either encoding or decoding chip non-linearity and would manifest itself as a slight increase in measured distortion at very high levels and conversely at very low levels. A comparison of the measured distortion of this unit with those of the Technics NV-850-A reveals that the distortion characteristics are measurably higher in this unit, although I must acknowledge, still quite acceptable.

The assessment of audio tape drop out performed at -60 VU revealed a remarkably linear performance with total non-uniformity of less than 0.3 dB peak-to-peak over an extended time sample.

The overall objective performance of the audio section of the VCR revealed itself to be good, but not superlative.

### Subjective testing

The subjective evaluation of the Philips stereo VCR quickly revealed how delightfully simple this unit is in its practical usage and how functional its controls actually are, from an ergonomic standpoint. Both the picture controls and audio system controls proved to be a delightfully easy to use and generally superior to the other hi-fi stereo or conventional VCRs that I have previously reviewed.

I evaluated the VCR with a series of pre-recorded stereo VCR tapes in conjunction with a Sony Profeel monitor using the integral stereo amplifiers connected to a pair of Sony APM22ES speakers.

This revealed an audio quality which was outstanding and better than that provided by many so called 'hi-fi systems'.

After that I connected the VR 6940/75 to my conventional monitoring reference system and recorded a series of tapes using CD discs, conventional microgroove recordings and even recorded some stereo FM broadcasts for comparison purposes.

When replaying the recorder in synchronism with the original programme content on a CD disc, it proved to be an almost impossible task to detect the difference between the two formats, irrespective of whether the music was classical or popular.

After a protracted period and with careful listening, I was, however, able to detect

small differences but only under well controlled conditions and through cyclical AB comparisons. With conventional recordings (which have an inferior dynamic range) and with material recorded from the FM broadcasts, I was unable to pick any subjective difference between the two formats.

The Philips VR 6940/75 stereo VCR recorder provides excellent acoustic quality, which in most respects is superior to any reel-to-reel or audio compact cassette recorder currently available. With a recording time capability of more than three hours (depending on the tape) and the capacity to record a complete concert without needing to turn the tape over, it provides a facility which will prove to be as attractive as it is practical.

My only criticisms of this VCR relate firstly to the slow motion and still capabilities of the video section which did not prove to be as good as those provided by either the Technics NV-850-A or the Sony SL-HF 100AS. As this is a function that most people will rarely use, this does not really constitute a strong criticism. My second criticism relates to the speed of response of the video recorder which is noticeably slow. This may prove to be disconcerting for some users, particularly when attempting to use the recorder as a hi-fi audio recorder.

This Philips VR 6940/75 VCR provides reasonable video and excellent audio performance. With a recommended retail price of the order of \$1300, it offers many user desired features together with an audio performance which is quite outstanding. Its excellent ergonomic features and sensible 14-day programming will provide extremely easy usage. It does credit to its Australian designers. ●

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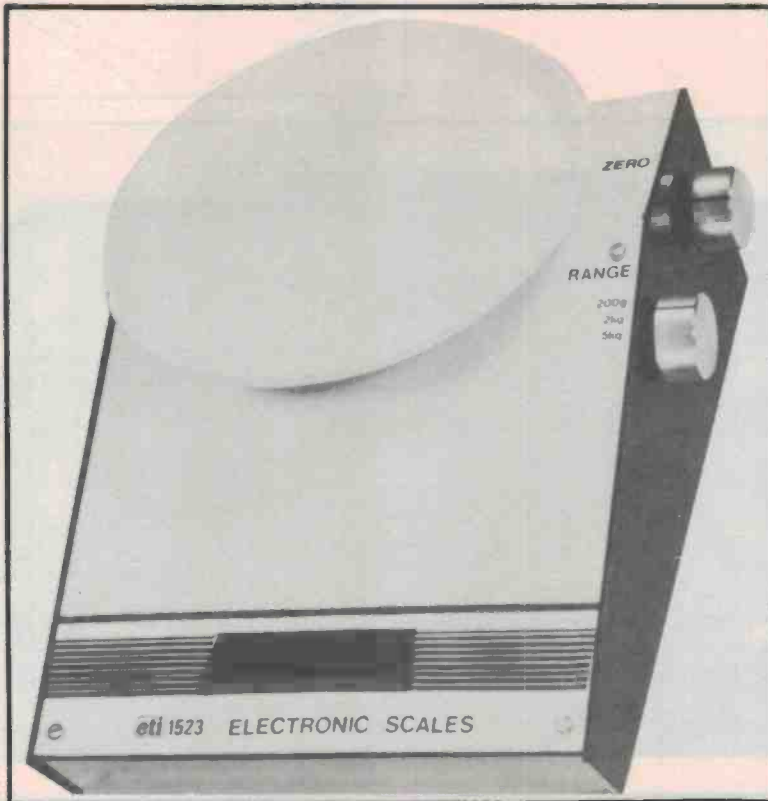




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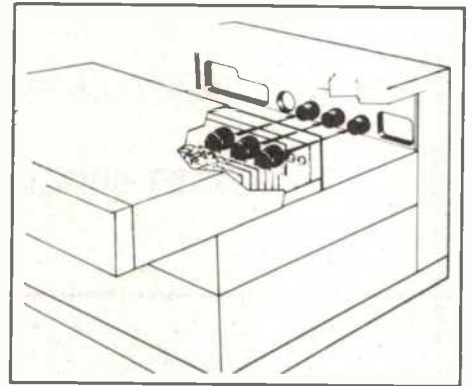
# High performance component system

AIWA's recently released V-900 is a compact audio system that enables high quality separate components to function together as an integral system.

This approach to audio design, uses a synchro performance audio network, known as SPAN.

The V-900 is easy to use and connection is simple enough, using an audio rack and thereby avoiding the confusion of connection cords.

Various component combinations are possible. The basic arrangement features the Lx-110 programmable linear tracking DD turntable, the MX-90 integrated amplifier with graphic equalizer and input terminals for a compact disc player, the TX-110 AM/FM stereo tuner with built-in timer, and the FX-90 auto-reverse cassette deck.



## Consumer electronics show

The first Australian International Consumer Electronics Exhibition will be staged at the Royal Exhibition Building in Melbourne from 21-27 September.

The organizers, Australian Exhibition Services, plan to make the exhibition an annual event alternating between Melbourne and Sydney, and say that it will be similar to the Chicago and Las Vegas shows in the USA, though on a smaller scale.

To be known as the "CE Show", this year's exhibition will be the largest display of domestic electronic equipment

ever assembled in Australia. It is primarily geared for those in the trade and retailers; the organizers plan to fly in leading buyers from all states. However, the public will also be admitted at special times.

As the show concludes the Friday before the VFL Grand Final, and also coincides with the Melbourne Agricultural Show week, good attendances are expected.

For further details about the CE Show contact Australian Exhibition Services Pty Ltd, 424 St Kilda Road, Melbourne, Vic 3004. (03)267-4500.

## Integrated amplifier

JVC has used new digital amp technology, the Gm Circuit, for its top-of-the-line A-X900B integrated amplifier.

The Gm Circuit is actually three different circuits: Gm volume, which provides 100 dB or more of signal-to-noise ratio (even at the nine o'clock position of the volume control); Gm selector, which reduces power amp gain by 6 dB or 12 dB so that noise is less apparent during low-level listening; and Gm driver, which reduces the effect of counter-electromotive force generated by the speakers.

The amplifier features a DAD input, monitoring and dubbing for up to three decks and gold-plated PHONO and DAD terminals.

Amp technologies include the Dynamic Super-A, a high-gain dc servo phono equalizer for MM and MC cartridges, and a low-impedance direct power supply. Total harmonic distortion is 0.0005% at 125 watt output, and signal-to-noise ratio is 85 dB phono (MM), 69 dB phono (MC) and 109 dB tuner, aux, DAD and tape ('66 IHF/DIN).



## BRIEFS

### Akai CD players

Trouble finding tracks easily on digital compact discs? Two new players from AKAI, the CD-A7 and CD-M88, have selection controls — [TO] [AND] [WITHOUT] — marked in plain English! Other features include 0.005% THD, 85 dB channel separation and 90 dB dynamic range.

### Kangaroos win

Congrats to Philips' central industrial design division which has taken out the honours in the national Industrial Designer Consumer Product category of the annual Design Institute of Australia Designer Awards. It was the Kangaroo range of VCRs that impressed the judges.

### JVC amp

The new Model A-X500VB amplifier from JVC promises high performance and versatility for sound buffs who also want a switcher for video inputs — it has switching capabilities for two video sources plus a video recorder. Audio characteristics include output power of 110 watts per channel, total harmonic distortion of 0.002% at 105 watt output, and frequency response of 3 Hz to 100 kHz +0 dB, -3 dB (8 ohms).



### New turntables

Also from JVC is a new quartz-locked, fully automatic turntable, the QL-F320, with wow and flutter of 0.025% (Wrms), 0.045% (DIN) and signal-to-noise ratio of 78 dB (DIN-B).

### Versatile enhancer

Bose's latest offering, the RoomMate stereo system, attracted considerable attention at this year's Chicago Consumer Electronics Show. Hardly surprising — it's a new concept which, by simply plugging into a personal stereo, TV or VCR, provides room-filling high-fidelity sound. For further information contact Bose Australia, 11 Muriel Ave, Rydalmere, NSW 2116. (02) 684-1255.

### Smaller and smaller

A complete VHS video recording and playback system in a single unit weighing just 1.9 kg, with a six to one power zoom lens and no annoying connection cables . . . sounds good? It's called VideoMovie GR-C1EA and to make it all possible JVC has come up with several innovations including a new head drum and loading system, and a single half-inch saticon picture tube. For further information contact JVC Hagemeyer, 5-7 Garema Ct, Kingsgrove, NSW 2208. (02)750-3777.

### High impedance cables

Five new pre-packaged leads have been added to QED's INCON range of interconnecting cables. Designed for high impedance applications, they're expected to be popular for use with turntables and moving coil step-up devices.

### Cassette decks

Teac has released two new cassette decks, the V-306C with Dolby B&C noise reduction and the V-330 with Dolby B. Both models feature LED peak level meters, frequency response (metal) of 30 Hz to 16 kHz, and wow and flutter of 0.06% (Wrms). For further information contact Teac, 115 Whiteman St, Sth Melbourne, Vic 3205. (03)699-6000.

### PAL compatibility

After impressing the TV and video industry with demonstrations of its NTSC PR-7000 VHS Hi-Fi Dub Recorder in Sydney and Melbourne earlier this year, JVC recently exhibited a PAL unit. All major functions are either on, or accessible from the front of the machine, including the test points — GROUND-DRUM, PULSE-VIDEO, RF OUT-HI-FI, AUDIO, RF OUT-NORMAL AUDIO. For further information contact JVC Hagemeyer, 5-7 Garema Ct, Kingsgrove, NSW 2008. (02)750-3777.

## Improved cordless remote control VCR

With competition running high in the video industry, improvements to VCRs pop up constantly. The latest pacesetter is the Philips VR 6541 model which includes features such as infrared remote control and electronic counter memory — previously available only with deluxe models.

The VR 6541 is a refinement of the Kangaroo range of VCRs which took out the national prize for consumer products in the recent Design Institute of Australia awards.

Its 11-function infrared remote control unit has the usual controls such as play, rewind, video search, pause, etc, and it can be used to change channels or to place the unit on standby

operation. The electronic counter memory allows easy access to pre-selected scenes by simply pressing the memory set button at the required point of a recording and when the cassette is subsequently rewound it will automatically stop at the set position.

The instant timer recording allows two events to be pre-programmed for unattended recording up to 14 days in advance or, alternatively, two events can be pre-programmed daily or weekly, and any one of seven different recording lengths can be selected in a single operation.

The channel select system has a digital readout showing which of 16 pre-set VHF/UHF chan-

nels has been selected; the video search controls on both the recorder and the remote unit are claimed to activate a forward and reverse search mode at least 10 times faster than normal speeds. The automatic front loading system has double cassette insert protection so that a

pre-recorded cassette without a protection tab will automatically begin playback and at the end of the recording will automatically rewind. Another handy feature, especially for professional users, is a single control freeze frame facility.





### Audio video selector

Akai's new SS-V5 audio selector acts as a control centre when using audio and video systems together. It has several advantages including a computer controlled signal flow display, as well as audio and video processor jacks and amplifier jacks.

All machines can remain connected, simply requiring the touch of a few buttons when you want to use a particular hook-up.

The SS-V5 enables three VTRs to be operated at the same time, simultaneously using

the EXT PROC function. Audio mode includes stereo bilingual capability and it is possible to record an audio source onto a video source. The selector also has microcomputer controlled input selector memory backup.

Total connection hook-up

consists of three VCRs, a video disc player, monitor or TV, cassette deck (audio amp), video tuner, audio processor or PCM, and video processor.

### CD player with remote control

Teac Australia has just released a new compact disc player with a 24 function infrared remote control. Called the PD-500, it is 440 mm wide and coloured black, so it will fit in with most standard sized hi fi systems.

The player has a high beam resolution, three beam laser diode pick-up system and allows random access of up to 12 tracks. It includes forward or reverse music search to find a particular part on a track, as well as forward or reverse music skip to select a particular track. There's a repeat function for any number of tracks or section of a track, and an index operation to enable the repeat of a particular tune on an indexed encoded disc.



### Professional sound at home



With its recently introduced TLX Series Linear Efficiency Loudspeakers, JBL claims to provide recording studio technology for the humble living room music buffs.

This improved sound is the result of several technical advances, notably titanium laminate tweeters and high polymer woofers.

Titanium is an exceptionally light, stiff material which gives the tweeter the structural integrity of a 'hard' dome and the dampening characteristics of a traditional soft dome. A clear phasing ellipse helps in flattening the high frequency response by shadowing the centre of the dome. Hence, the promise of lower distortion and extended smooth frequency response.

The woofers achieve optimum stiffness through the use of a

plasticized layer of high polymer composite added to a pulp base. This structure ensures that the cone behaves more like a true piston, with less rippling, less cone fatigue and less strain — in other words, distortion is reduced to inaudible levels.

Other features of the loudspeakers include linear efficiency response allowing room-filling levels with just 10 watts per channel, a multi-element dividing network providing seamless blending of the drivers and using 'bypass' capacitors in the crossover, solid enclosure construction with floating grilles, and in-line driver array. The speakers are rated at 8 ohms.

Four models are presently available in the TLX Series, ranging from the 165 mm TLX2 to the 250 mm TLX8.



# COMPUTER BOARDS

## THE NEW ZRT-80 KIT

### CRT TERMINAL BOARD!

A LOW COST Z-80 BASED SINGLE BOARD THAT ONLY NEEDS AN ASCII KEYBOARD, POWER SUPPLY AND VIDEO MONIOTR TO MAKE A COMPLETE CRT TERMINAL. USE AS A COMPUTER CONSOLE, OR WITH A MODEM OR USE WITH ANY OF THE PHONE-LINE COMPUTER SERVICES.

#### FEATURES:

- Uses a Z80A and 6845 CRT Controller for powerful video capabilities.
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- 24 x 80 standard format (60 Hz).
- Optional formats form 24 x 80 (50 Hz) to 64 lines x 96 characters (60 Hz).
- Higher density formats require up to 3 additional 2K x 8 6116 RAMS. Uses N.S. INS 8250 BAUD Rate Gen. and USART combo IC.
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- Any polarity of video or sync.
- Inverse Video Capability.
- Small Size: 6.5 x 9 inches.

BLANK PCB WITH 2716 CHAR. ROM, 2732 MON. ROM ..... \$179

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SOURCE DISKETTE - ADD \$20  
SET OF 2 CRYSTALS - ADD \$12

### LS100

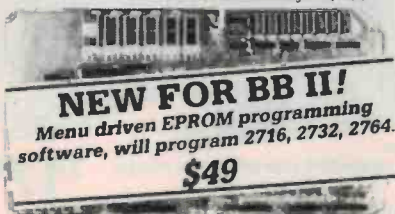
#### 256K S100 SOLID STATE DISK STATE DISK SIMULATOR

CALLED THE "LIGHT-SPEED 100" BECAUSE IT OFFERS AN OUTSTANDING INCREASE IN YOUR COMPUTER'S PERFORMANCE WHEN COMPARED TO A MECHANICAL FLOPPY DISK DRIVE.

#### FEATURES:

- 256K on board, using +5V 64K DRAMS.
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- The LS-100 provides an increase in speed of up to 7 to 10 times on Disk Intensive Software.

Full 256K Kit Including Tax \$799



## 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 (EPROM OR STATIC RAM): "Big Board II" has the three memory banks: the first memory bank has eight 4164 RAM's that provide 60K of user space and 4K of monitor space. The second memory bank has two 2K and 8 SRAM's for the memory-mapped CRT display and space for six 2732a or 2K x 8 static RAMS, or pin compatible (EPROMs). The third memory bank 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 a 450nS2732A EPROM containing the monitor.
- MULTIPLE DENSITY CONTROLLER FOR 8/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.
- VASTLY IMPROVED CRT DISPLAY: The "Big Board II" computer uses a 68455 CRT controller and 8002 Video Attributes controller to produce a display that will rival the display of quality terminals. Characters are formed by a 5 x 7 dot matrix on 16.75 KHz monitors and a 7 x 9 dot matrix on 15.75 KHz 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.
- A Z80 + S100 = TWO ASYNCHRONOUS SYNCHRONOUS SERIAL PORTS
- TWO Z80A CTCs = EIGHT PROGRAMMABLE COUNTERS/TIMERS: The "Big Board II" has two Z80-A CTCs. One is used to clock data into and out of the Z80-A S100, while the other is for systems and application use.
- PROM PROGRAMMING CIRCUITRY AND SOFTWARE: The "Big Board" computer has circuitry and drivers for programming 2716s, 2732A's, or pin-compatible (EPROMS).
- 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

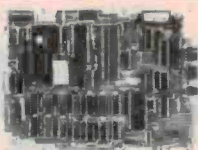
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Assembled and Tested \$849

(plus tax)



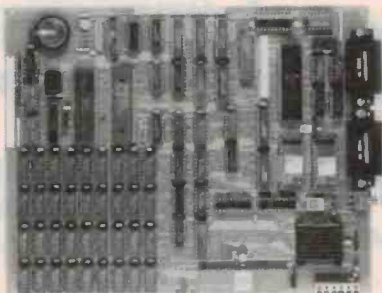
## THE LITTLE BIG BOARD

#### FEATURES:

- Z80A CPU (4 MHz)
- 65,536 bytes of RAM
- Two RS232C I/O ports.
- Battery back up realtime clock and calendar.
- Up to four, 8 inch or 5 1/2 inch double sided, double density or single density floppy disk drives.
- Full STD Bus
- Designed for CP/M, MP/M and CP/NET systems.

Cat.

(including tax) \$459



## PC 186 KIT

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.

#### FEATURES:

- 80816-3 (8MHz) or 80816-2 (10MHz) central processor
- Small size - only 203mm x 250mm
- Low power requirements
- 128k, 256k, 412, or 1 Mbyte of memory on board
- Parity checking on memory accesses
- Double density Floppy Disc Controller for 8" or 5 1/4" drives
- Digital data separator requiring no adjustments
- Can control Cipher Floppy tape
- SASI hard disk interface
- Two asynchronous serial channels
- Centronics parallel printer adapter
- CMOS battery backed calendar clock
- I/O Expansion bus
- 16 Kbytes of EPROM (2764's)
- Diagnostic and bootstrap in ROM

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.



## 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 unbelievable low price.

#### CHECK THE FEATURES!!!

- 64K RAM using 4116 RAMS
- 6809 Motorola CPU
- Double Density Floppy Disk Controller for either 5 1/4 or 8 inch drives. Uses WD1793.
- On board 90 x 24 video for a low cost console. Uses 2716 Chas. Gen. Programmable Formats. Uses 6845 CRT Controller.
- ASCII Keyboard parallel interface (6522).
- Serial I/O (6551) for RS232C or 20 MA loop.
- Centronics compatible parallel printer interface. (6523)
- Bus expansion interface with DMA Channel (6844).
- Dual timer for real clock application.
- 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 Files.
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- Includes the powerful 3rd generation Motorola 6809 Processor. Ideal for colleges, O.E.M.'s, industrial and scientific uses!

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5 1/4 OR 8 INCH SOURCE DISKETTE ADD ..... \$25 plus tax

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\$379

★ ★ ★ ★ ★ ★ ★ ★  
We stock a full range of computer connectors!  
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8156	4.95	4.00
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8237	2.50	2.00
8253	4.50	4.00
8255	3.50	2.95
8257	3.95	3.00
8259	3.95	3.00
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2 x 5 1/4" Standard Drive Case	
X11004 Bare Case	\$59
X11014 Case & Pwr Supply	\$129

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X11016 Case & Pwr Supply	\$395
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X11007 Bare Case	\$145
X11017 Case & Pwr Supply	\$395
1 x 8" Slimline Drive Case	
X11020 Bare Case	\$95
X11022 Case & Pwr Supply	\$159

Dual 8" Slimline Drive Case	
X11025 Bare Case	\$99
X11026 Case & Pwr Supply	\$245
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X11009 Bare Case	\$99
X11019 Case & Pwr Supply	\$159
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X11030 Bare Case	\$139
X11032 with Pwr Sup & Fan	\$475
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Room for BB2 etc. under drives	
X11005 Bare Case	\$149
X11015 Case & Pwr Supply	\$399

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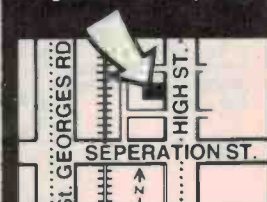
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This is for basic postage only, Comet Road freight, bulky and fragile items will be charged at different rates.

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# HUGE SAVINGS!

## Clear Acrylic Spray

A fine colourless spray that is ideal for the protection of front panels, etched screen print or Letraset lettering. Will moisture proof components, TV aerial terminations etc. 125 gram can. Cat N-1011

WAS \$3.95 **\$2.95**

**25% OFF**



## PUSH Button 'Phone' Pad

At this crazy price, it's worth keeping one in the junk box: just in case! This 12 key numeric pad with positive movements is great for computer projects, etc. Cat J-1001

WAS \$4.95 **\$2.99**



## BULK PACKS: the smart way to buy components.

When you want to save up to 50% and more...

## New additions to our semi range!

### Digital

74LS Series Type No.	Description	Cat No	Price Ea	Price 10 up
74LS11	Triple 3-Input AND gate	Z-4912	.70	.65
74LS21	Dual 4-Input positive AND gate	Z-4924	.95	.90
74LS123	Dual monostable multivibrator	Z-5310	\$1.30	\$1.15
74LS153	Dual 4-Input multiplexer	Z-5315	\$1.10	\$1.00
74LS157	Quad 2-Input multiplexer	Z-5287	\$1.15	\$1.05
74LS190	Up/down decade counter	Z-4999	\$1.60	\$1.50
74LS191	Up/down binary counter	Z-5000	\$1.50	\$1.40
74LS221	Dual monostable multivibrators (schmitt-trigger)	Z-5296	\$2.25	\$2.00
74LS240	Octal buffer/line driver	Z-5298	\$2.20	\$2.00
74LS241	Octal buffer/line driver	Z-5293	\$2.50	\$2.25
74LS244	Octal buffer/line driver	Z-5294	\$2.40	\$2.20
74LS245	Octal bus transceiver	Z-5299	\$2.20	\$2.00
74LS374	Octal D-type flip flop	Z-5297	\$2.00	\$1.90
<b>74C Series CMOS</b>				
74C74	Dual D-type edge triggered flip flop	Z-5372	\$1.30	\$1.20
74C157	Quad 2-Input multiplexer	Z-5374	\$4.50	\$4.05
74C173	4 Bit D-type register	Z-5376	\$2.95	\$2.70
74C221	Dual monostable multivibrators (schmitt-trigger)	Z-5378	\$4.10	\$3.80
74C922	16 Key encoder	Z-5380	\$9.50	\$9.00
<b>4000 Series CMOS</b>				
4044	Quad 3-state NAND RS latch	Z-4370	\$1.65	\$1.55
4528	Dual monostable	Z-4366	\$2.45	\$2.20
<b>Linear</b>				
LM319N	High speed comparator	Z-6049	\$3.70	\$3.50
LM335H	Precision temperature sensor (TO-46)	Z-6050	\$4.00	\$3.60
LM35Z	Precision temperature sensor (TO-92)	Z-6051	\$2.40	\$2.20
LM336AZ2-5	2.5V Reference source	Z-6036	\$4.95	\$4.70
LM336BZ5-0	2.5V Reference source	Z-6037	\$4.95	\$4.70
LM1871N	RC encoder	Z-6103	\$6.95	\$6.30
LM1872N	RC decoder	Z-6104	\$7.95	\$7.20
LM3046N	NPN Transistor array	Z-6107	\$1.85	\$1.75
LM10CLN	Op amp/voltage reference	Z-6084	\$6.95	\$6.30
LM13080N	Programmable power op amp	Z-6106	\$2.50	\$2.25
LM13600N	Dual transconductance amplifier	Z-6113	\$1.95	\$1.85
LM78L05CZ	3-Terminal 5V 100mA positive regulator	Z-6108	.60	.55
LM78L12ACZ	3-Terminal 12V 100mA positive regulator	Z-6110	.60	.55
LM78L15ACZ	3-Terminal 15V 100mA positive regulator	Z-6111	.60	.55

## Experimenter's Mobile

These great value CB's are not suitable for Australia but are brand new and factory surplus. They're ideal conversion to 6 or 10M bands. For parts value alone they're amazing value! (No Warranty applies) Cat J-1504

**\$39.95**



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**E-24 Metal Film Resistor Pack**  
300 Pieces in E-24 series for where fine tolerances are needed. Over \$21 worth! Cat R-7020 **\$17.95**

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300 more common values in our 1% types. Over \$18 worth! Cat R-7015 **\$13.95**

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60 greencaps in one of the handiest packs we sell! Values from .001 to 0.22uF (depending on packs!) with voltage ratings of at least 100V. Over \$14 worth. Cat R-7040 **\$9.95**

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55 top quality pcb mounting types (single ended) ranging from 2.2 to 470uF. Over \$19 worth at normal prices. Cat R-7030 **\$6.95**

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**Power Diode Pack**  
Another newey! 57 diodes, bridges and SCR's just right for the Junk box (you never know!!!) Power and g/p types included. Over \$25.00 worth Cat Z-3010 **\$11.95**

**Signal Diode Pack**  
100 pieces of the most used signal diodes around: germaniums & silicons, worth over \$22.00! Cat Z-3005 **\$11.95**


**Signal Transistor Pack**  
100 pieces of PNP & NPN small signal transistors - really handy types, too. Just right for that project. Over \$18 worth! Cat Z-3000 **\$11.95**

**Premium LED Pack**  
Not just your average LEDs: premium quality types with matched colours and brightness. 100 LEDs in 4 colours — over \$33 worth! Cat Z-3015 **\$17.95**



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## New Semi & IC Range



Type No	Description	Cat No	Price Ea	Price 10 up
4516	Synchronous up/down counter	Z-4362	\$2.30	\$2.00
ADC0802LCN	8-Bit A to D converter (error +.5% LSB)	Z-6833	\$14.95	\$13.50
DAC0800LCN	8-Bit D to A converter (non linearity + 0.19%FS)	Z-6834	\$4.80	\$4.40
LM1458N	Dual Bipolar Op Amp	Z-6028	.95	.85
SN76604N	Servo Amplifier (RC)	Z-6835	\$5.25	\$4.75
SC141D	400V/6A economy triac	Z-4510	\$1.60	\$1.50
BC327	100MHz 0.8W PNP Amplifier	Z-2240	.35	.30
MJE340	20W NPN High Voltage Amp	Z-2010	\$1.20	\$1.10
2N3904N	200MHz PNP Gen Purp Amp	Z-2070	.20	.18
2N3905A	200MHz NPN Gen Purp Amp	Z-2071	.20	.18
2N3460	N Channel J-FET	Z-2072	\$2.60	\$2.45
2N5486	N Channel J-FET	Z-2073	.70	.65
PN4360	P Channel J-FET	Z-2074	.85	.80
74HC00	Quad 2-Input NAND gate	Z-5800	.90	.80
74HC02	Quad 2-input NOR gate	Z-5802	.90	.80
74HC04	Hex Inverter	Z-5804	.90	.80
74HC08	Quad 2-input AND gate	Z-5808	\$1.10	\$1.00
74HC11N	Triple 3-input	Z-5811	\$1.10	\$1.00
74HC14	Hex Schmitt-Trigger	Z-5814	\$2.10	\$2.00
74HC27	Dual J-K flip flop	Z-5827	\$1.10	\$1.00
74HC30	8 input NAND gate	Z-5830	\$1.10	\$1.00
74HC32	Quad 2-input OR gate	Z-5832	\$1.10	\$1.00
74HC74	Dual D-type edge triggered flip flop	Z-5874	\$1.30	\$1.10
74HC76	Dual J-K master/slave flip flop	Z-5876	\$1.30	\$1.10
74HC85	4 Bit magnitude comparator	Z-5885	\$1.80	\$1.65
74HC86	Quad 2-Input EXCLUSIVE OR gate	Z-5886	\$1.30	\$1.10
74HC123	Dual re-triggerable monostable	Z-5910	\$1.80	\$1.65
74HC138	Expandable 3/8 decoder	Z-5915	\$1.80	\$1.65
74HC139	1 of 8 decoder/multiplexer	Z-5920	\$1.80	\$1.65
74HC157	Quad 2-input multiplexer	Z-5925	\$1.80	\$1.65
74HC165	Par load 8-bit shift register	Z-5930	\$3.50	\$3.25
74HC174	Hex D-type flip flop	Z-5935	\$1.80	\$1.65
74HC221	Dual monostable multivibrators (schmitt-trigger)	Z-5940	\$3.95	\$3.65
74HC240	Octal buffer/line driver	Z-5945	\$3.50	\$3.15
74HC244	Octal buffer/line driver	Z-5950	\$3.50	\$3.15
74HC245	Octal bus transceiver	Z-5955	\$4.95	\$4.50
74HC367	Hex bus driver & 3 state o/p	Z-5960	\$1.95	\$1.80
74HC373	Octal 3 state latch	Z-5965	\$4.10	\$3.80



**OOPS!  
WE LEFT  
THEM OUT.**

Alas: our new catalogue is out and we missed this new 500V ceramic capacitor range! Now in stock at your nearest DSE store. ... or DSXpress.

All one low, low price: just 11¢ each or 9¢ each in ten or more of same type.

Size	Cat No.	Size	Cat No.
0.8pF	R-2410	56pF	R-2453
2.7pF	R-2421	100pF	R-2485
3.3pF	R-2423	150pF	R-2489
5.6pF	R-2429	220pF	R-2493
15pF	R-2439	270pF	R-2495
18pF	R-2441	330pF	R-2496
27pF	R-2445	560pF	R-2501



## High Voltage Ceramics

Specially intended for use on mains suppression, etc. 'MN' series 240V AC continuous rated ceramics in three sizes:

0.1uF	(Cat R-2720)	\$1.30 ea	(\$1.20 ea 10 up)
0.047uF	(Cat R-2725)	50¢ ea	(45¢ ea 10 up)
0.01uF	(Cat R-2730)	80¢ ea	(75¢ ea 10 up)

And for really high voltages:

.001uF, (Cat R-2740) 1600V DC 80¢ ea (75¢ ea 10 up)

## Big Savings on Cable Connectors

Genuine 3M Scotchlok® brand connectors Type UG. They're the ones used by Telecom! Now at a BARGAIN price! Cat J-1020

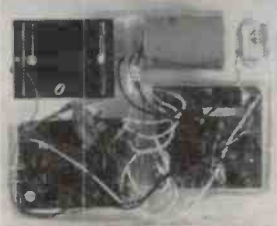
**PACK OF 10 ONLY \$1.99**



## Computer Flash Strobe

Manufacturer's oversight — they forgot to put it in a body! We've been assured that they work and at this price they're a real bargain. Everything's wired together, all you need including the light sensor. Great value for parts alone! Cat J-1002  
Circuit Included.

**\$14.95**



## Micro Switches

Quality microswitches with positive switching action! These are ideal wherever a limited switching movement is required. Don't miss this great deal! SPDT, 5A 12V or 3A 250V rating. Cat J-1004  
Genuine Omron brand.

**99¢**



## Famous Brand Swann Switches

Great value press fit mounting Swann switches! 240V, 4Amp. Ideal for that project where appearance is important. DPST Contacts. Cat J-1003

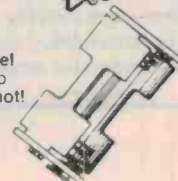
**\$1.20**



## Half Price Battery Holders!

Universal fitting battery holders at an amazing LOW price! Holds 4 'AA' batteries and accepts standard battery snap connector. Grab a few for the junkbox while the bargain's hot! Cat P-6124

**WAS 60¢ 30¢**



## Matte Black Spray Paint

**25% OFF**

A quick drying matte finish spray. Suitable for giving your project that professional finish. Ideal for spraying heatsinks to increase thermal efficiency. 175 grams. Cat N-1070

**WAS \$3.25 \$2.40**



## Do it with Diodes

BY X98300	Stud Diode, 300V 10 Amp Cat Z-3242	\$2.75
LT2462-52	Dual Colour LED, Red/Green Cat Z-4070	.60
TL32555	LED 5 x 2mm Rectangular, Yellow Cat Z-4097	.40
FND507	7 segment LED Display Cat Z-4152	\$1.65



# DICK SMITH ELECTRONICS

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See page 77 for address details



# Fast video RAM

A multiport video RAM released by Texas Instruments could reduce the costs of medium and high resolution bit-mapped graphic display systems.

The dynamic RAM (DRAM) will also enable the development of larger monochrome and colour screens by overcoming the system restrictions of standard DRAM devices. It will also mean users of spreadsheets and other graphics programs can display both text and graphics on the same screen.

David Cartwright of TI's Australian Semiconductor Division says the new device, the TMS4161, is the first MOS memory product to combine a 64K-bit DRAM with a 256-bit

shift register.

"Until now devices used for bit-mapped graphics have had only a single random-access port," he explained. "So there has always been a bottleneck restricting the data flow needed by the system. The processor needs to have access to the memory to update it, but at the same time the memory has to be outputting the data to meet the refresh requirements so the display doesn't fade.

"As a result the processor and the display refresh control-

ler have had to contend for a finite number of available memory cycles through the one port. The number of refresh cycles could not be reduced much below 70% of those available without making the screen flicker," he said.

By replacing the standard DRAMs with multiport video RAMs the system can operate more efficiently and with greater performance. The dual port feature of the TMS4161 allows the processor to access the memory nearly 100% of the time, compared with the previous 30%.

Simultaneously the shift gear (serial) port is shifting out the required data to the display refresh controller.

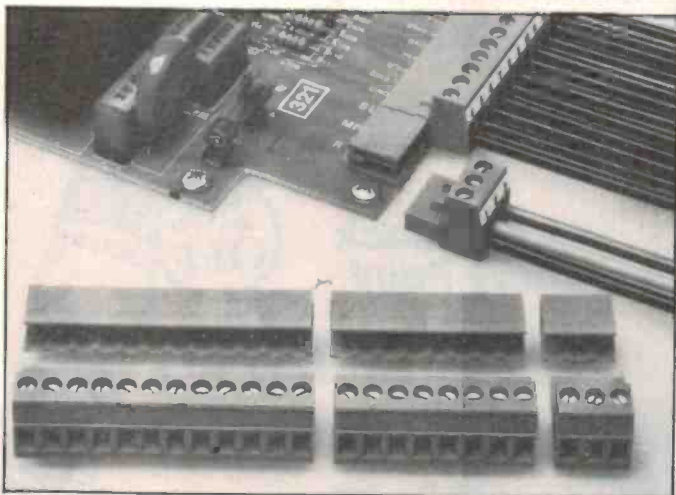
The integrated RAM and shift register eliminate the need for significant amounts of external hardware, thus simplifying system design.

A wide transfer path within the TMS4161 multiport video RAM allows 256 bits of data to be transferred from the DRAM memory array to the shift register (or vice versa) in a single memory cycle. Internally the shift register is then disconnected from the memory array.

The data can then be shifted out of the video RAM via the serial port at frequencies up to 25 MHz, while normal DRAM accesses take place.

The multiport architecture with the fast on-chip shift register allows the TMS4161 to be configured to support dot rates from 5 MHz to well beyond 150 MHz. It can support interlaced or non-interlaced displays as well as a variety of screen configurations.

For further information contact Semiconductor Division, 6 Talavera Road, North Ryde, NSW 2113. (02)887-1122.



## Plug-in terminal block

Australian distributor for Phoenix Contact, Anitech (formerly Warburton Franki), has recently released a two piece screw clamp pluggable connector for printed circuit boards; the MSTB 1.5 range.

These terminal blocks combine the reliability of the screw connection for wires up to 1.5 mm<sup>2</sup> with the ease of use of a plug-in terminal block. Two plug-in directions are available, parallel and vertical to the

printed circuit board; and the blocks offer from two to 24 poles.

Anitech carries all even number plus three and seven pole configurations in both the parallel and vertical styles.

Terminal blocks can be lined up without requiring changes in pin spacing. The handy plug part features dead front construction.

The complete assortment of marking cards is available for terminal block identification.

## Flexible printed circuits replace cables

Flexible printed circuits are increasingly replacing conventional wiring, cables, harnesses and wire wrapped circuits in the electronics, appliance and automotive industries. They interconnect rigid printed circuit boards and terminal strips with components on any other level in a sub-system. Their flexibility permits optimum adaptation of the available space.

Modern flexible printed circuit technology allows production of such passive components as resistors, capacitors, coils, fanfold coils, and shielding screens of differing types. The design variants permit standard line, fine line wiring, single-sided, double-sided and multi-layer flex circuits to be produced.

The use of flexible printed circuit boards can reportedly cut assembly costs up to 50 per cent. High repeatability of flex circuits assemblies virtually eliminates operator errors inherent in

point to point wiring, simplifying quality control operations and improving circuit reliability.

Flexible printed circuit laminates are really a composite of a metal conductor, an adhesive and a dielectric substrate. Metal foils most commonly used as conductors are copper, both rolled and electro-deposited aluminium, Inconel, stainless steel and beryllium copper. The adhesives used are mainly polyester, acrylic or epoxy. Dielectric substrates are polyester, polyimide, aramid, fluoro-plastics and reinforced composites.

Lead times are currently three to five weeks for samples and four to six weeks for production runs.

Lamron Pty Ltd has recently been appointed as the Australian agent for Omni Switch Inc.

For further information contact Lamron Pty Ltd, PO Box 438, Ryde, NSW 2112. (02)808-3666.



## BRIEFS

### UHF transistor

Siemens has released an epitaxial NPN silicon planar HF transistor, the BFR 96S, for applications in wideband antenna amplifiers up to the GHz range. The transistor has improved linearity over the previous BFR 96 model, and minimizes second and third order intermodulation products to meet stringent communications specifications. For further information contact Siemens Ltd, 544 Church St, Richmond, Vic 3121. (03)429-7111.

### High speed PALs

Four new, high-speed PAL programmable array logic devices are now available from Texas Instruments. Operating at twice the speed of existing PAL devices, they have maximum propagation delays of 15 nanoseconds and are fabricated in 2-micron impact. Consisting of a programmable-AND array which feeds a fixed-OR array, these devices also replace conventional logic glue. For further information contact TI, PO Box 106, Nth Ryde, NSW 2113. (02)887-1122.

### Tape and reel ICs

PC board assembly automation is helped by National Semiconductor's Tape-and-Reel System, known as STAR, which involves mounting integrated circuits sequentially in preformed cavities of a reel of conductive PVC material. The system is compatible with all NS surface mount package types. For further information contact National Semiconductor, 21/3 High St, Bayswater, Vic 3153. (03)729-6333.

### Piezo translators

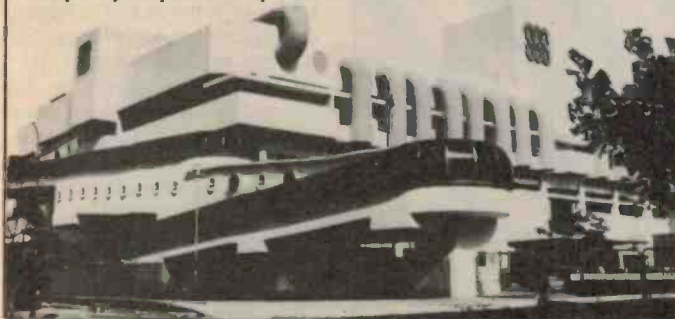
A piezoelectric macrotranslator with a range of travel adjustments up to 1000 microns has been released. Called the P.285, it uses a technology developed by Physik Instrumente of West Germany and has a load rating of 50 newtons. Advantages include high resolution and rapid displacement. For further information contact Warsash Pty Ltd, PO Box 217, Double Bay, NSW 2028. (02)30-6815.

### SIP resistor networks

Another new release is the M-Series conformal coated SIP resistor networks from Beckman Industrial. Available in isolated resistor and bussed resistor styles, these networks are of low/medium profile and come in  $\pm 2$ , 5 and 10 per cent tolerance values. For further information contact Anitech, 7 Birnie Ave, Lidcombe, NSW 2141.

### SGS opens \$50m IC plant

Singapore's electronics industry recently received a giant boost with the opening of a \$US50 million microchip production plant by the Italian multinational SGS Semiconductor. It's SGS's second production facility in Singapore, and has the capacity to produce up to half a billion ICs a year.



### Monolithic dc/dc converter

Parameters of Artarmon NSW has introduced a monolithic dc/dc converter, AD7560, which accepts a single +5V input and generates -5 V, -10 V, -15 V, +10 V and +15 V output voltages. All outputs are short-circuit protected and latch-up free. Contact Parameters at 41 Herbert St, Artarmon, NSW 2064. (02) 439-3288 for further information.

### High speed modem filters

New from Reticon . . . two high speed modem filters, the RM5636A designed for use in 2400 BPS modem applications and the RM5637A for 4800 BPS applications. Both models integrate four switched capacitor filters and feature  $\pm 5$  to  $\pm 10$  V power supply range as well as TTL/CMOS compatible digital inputs. For further information contact Total Electronics, 9 Harker St, Burwood, Vic 3125. (03)288-4044.

### 64K EPROM

The SGS M2764 from Ellistronics has 65,536-bit ultraviolet erasable and electrically programmable read-only memory (EPROM). Organized as 8,192 words by 8 bits, it's manufactured using SGS's N-channel Si-Gate MOS process. It has a single +5 V power supply with an access time of 200 ns, and also features a standby mode with maximum standby current of only 40 mA. For further information contact Ellistronics, 797 Springvale Rd, Mulgrave, Vic 3170. (03)561-5844.

### 16-bit microcomputer chip set

In 16-bit microcomputers . . . Siemens' chip set SAB 80286 and 82258 combines the central processing unit and memory management unit with memory protection on a 70 mm<sup>2</sup> chip. It displays several characteristics previously found only in office computers, such as data transmission rate of 16 Mbytes, addressable area of 16 Mbytes and four I/O channels. For further information contact Siemens, 544 Church St, Richmond, Vic 3121. (03)439-7111.

### Small D connectors

A new Superfast line of flat cable D-subminiature connectors is available for use with 9, 15, 25 or 37 contacts. The connectors have a special pin and socket design that enables mass termination of cable with 0.050 inch pitch. For further information contact Total Electronics, 9 Harker St, Burwood, Vic 3125. (03)288-4044.

### Firmware security

Intel has introduced a system security device, the 27926 KEPRON, which can also protect firmware. On-chip logic allows the device to compare a stored key with another KEPRON component, without revealing the key.

### Data comm controller chip

The Z8531 from the George Brown Group is an asynchronous, dual-channel data communications controller with facilities for modem controls in both channels. It's a serial-parallel, parallel-serial converter/controller that reduces the need for external logic and provides for data rates up to 1.5 M bit/second. The George Brown Group is at 174 Parramatta Rd, Camperdown, NSW 2050.

### High output IR LEDs

TRW's OP231 Series GaAlAs infrared light emitting diodes have 1.7 times the output of equivalent GaAs devices. Available from Total Electronics in hermetic TO-46 housings, they are suitable for a broad range of uses including signal/data transmission in scientific and industrial markets. Total Electronics is at 9 Harker St, Burwood, Vic, 3125. (03)288-4044.



### Solderless wrap block

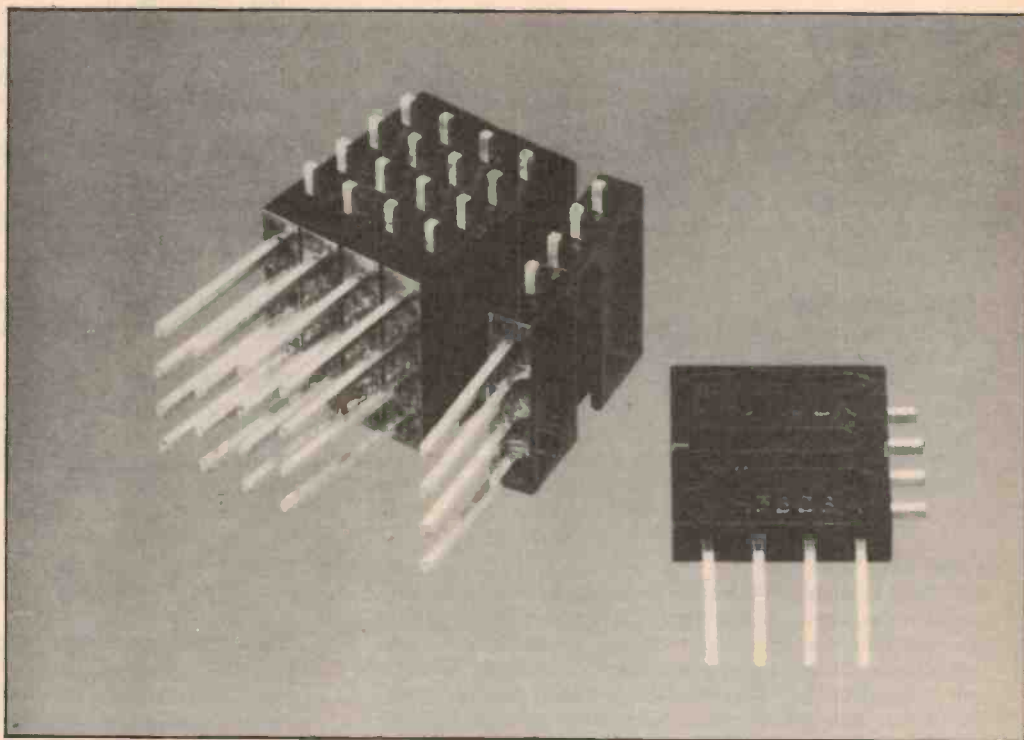
A new pcb-mounting solderless wrap block from Utilux Pty Ltd provides four right-angled circuits in a stackable glass filled polycarbonate housing.

Designed and manufactured by Utilux the blocks are fitted with brass 70/30 pins providing ratings of current/voltage 5 A max, 240 V 50 Hz at operating temperatures from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

The blocks are made up with an integral anti-slip locking system built into the housing, enabling side by side stacking on 5 mm centres.

Catalogue number is H3808A and they are supplied in boxes of thirty.

For further information contact Utilux, 74 Commercial Rd, Kingsgrove, NSW 2208. (02)50-0155.



### Fast PAL announced by National

National Semiconductor has put a new family of ultrafast PAL (programmable array logic) into production. With a 15 ns maximum access time, National claims the PAL family is the fastest in the semiconductor industry.

High speed logic for interface and control (around the 15 ns mark) is necessary because of

improved microprocessor performance. With this new high performance PAL family, logic designers can now replace advanced Schottky SSI/MSI devices with field programmable, semi-custom PAL devices. In most applications a single 20-pin National PAL device can replace from three to six SSI/MSI parts, and in some

special cases as many as 10 parts. With the 15 ns version, a user will have the performance of advanced Schottky in a lower cost replacement. This performance comparison arises because all logic can be accommodated in two or three logic levels (AND-OR or AND-OR-INVERT) and the PAL devices are specified worst-case over

temperature voltage.

National Semiconductor has achieved the 15 ns performance through advances in circuit design techniques and use of the company's proprietary OXISS fully-implanted, oxide-isolated bipolar process, with high reliability titanium-tungsten fuse links.

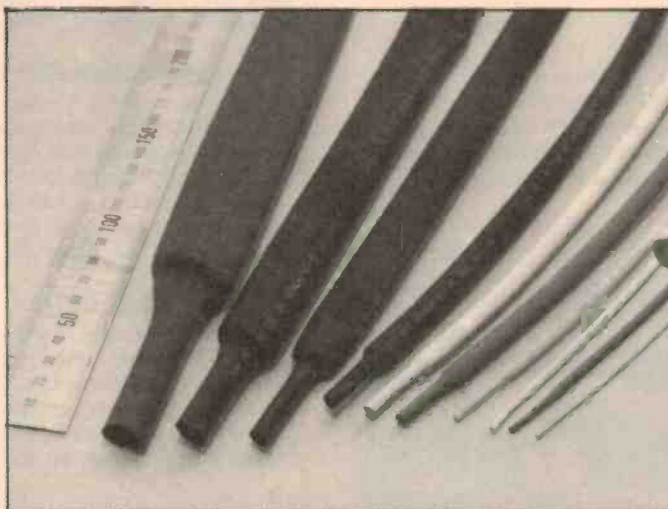
For further information contact National Semiconductor, High Street, Bayswater, Vic 3153. (03)729-6333.

### Heat shrink tubing

STC-Cannon Components Pty Ltd, Australian distributor of Hitachi cables, has available the new "Hishrink" tube, in the following ratings:  $90^{\circ}$ ,  $105^{\circ}$ ,  $135^{\circ}\text{C}$  temperature and 600 V.

The tubing is irradiated cross-linked polyolefin, and is useful for insulation, mechanical protection, binding and colour coding.

Colours available for the six ranges are detailed in the catalogue available from STC-Cannon, 248 Wickham Rd, Moorabbin, Vic 3189.



### LED bar graph driver

The Telefunken U1096B is housed in an 18-pin DIL pack but is capable of driving 30 LEDs in a moving spot display due to circuitry which drastically reduces driver line requirements and eliminates crossovers. The ICs can be cascaded to a maximum of 150 LEDs and each incorporates an A-D convertor, address logic and constant current source.

For further information contact Promark, Suite 208, 6-8 Clarke St, Crows Nest, NSW 2065. (02)439-6477.



ICL7106 19.50	74H106 2.50	74LS160 1.00	MM5874 19.50	SC152D 6.90	MRF455 37.00	VNR8AF 3.95	74148 2.00	FD1771 19.00	79L05 1.20
74H108 19.50	74H108 2.50	74LS161 8.00	MM5303 7.50	C103YV 9.00	MRF475 7.70	Z5C372 1.95	74150 1.50	FD1791 (887B)	79L12 1.20
ICL7117 21.50	74H113 1.10	74LS162 1.50	MM5309 14.50	C106B 9.00	MRF603 19.50	Z5C495 2.95	74151 1.20	FD1793 (887T)	79L18 1.20
ICL7611 6.95	74H114 1.10	74LS163 1.10	MM5369 4.95	C109 9.00	MRF541 49.00	Z5C710D 1.95	74154 1.75	FD1795 (887V)	79L24 1.20
ICL7612 8.95	74H183 7.50	74LS164 1.50	MM5420 9.50	C122E 2.95	MRF646 39.00	Z5C743 2.95	74155 1.50	FD1797 39.00	LM309K (7805K) 1.90
ICL7660 5.90	74C 74C	74LS165 1.00	LH0042CH 9.50	C260D 9.50	MRP131 1.00	Z5C945A 1.95	74157 1.00	FD1799 39.00	LM317T 4.50
ICL7864 4.90	74C00 7.50	74LS166 2.55	LH0071 9.50	C260E 9.50	MRP131A 7.00	Z5C1014 2.50	74158 1.00	WD1691 29.50	LM323HV 9.50
ICM7711 12.50	74C02 6.00	74LS169 2.45	LN1071 9.50	C260F 9.50	MRP131C 7.50	Z5C1017 4.95	74160 1.00	WD1931 22.50	LM323K 7.50
ICM7760 45.50	74C04 8.00	74LS174 9.00	LN2062 2.50	C260G 9.50	MRP131C 7.50	Z5C1018 1.95	74161 1.20	WD1933 34.50	LM330T 2.90
ICM7768 48.50	74C08 8.00	74LS175 8.00	LN2067 2.50	C260H 9.50	MRP131C 7.50	Z5C1019 2.95	74162 1.20	WD1934 14.75	LM330T 2.90
ICM7768 48.50	74C10 8.00	74LS181 1.20	LN2073 3.20	C260I 9.50	MRP131C 7.50	Z5C1020 2.95	74163 1.20	WD1935 29.00	LM330T 2.90
ICM7721A 18.50	74C20 8.00	74LS192 1.20	LN2074 4.90	C260J 9.50	MRP131C 7.50	Z5C1026 2.96	74165 1.20	WD2123 26.50	LM350K 8.50
ICM7721A 18.50	74C32 8.00	74LS193 1.20	LN2081 1.90	C260K 9.50	MRP131C 7.50	Z5C1027 2.96	74166 1.20	WD2520 16.50	LM359K 2.50
ICM7724A 21.50	74C34 1.30	74LS194 1.20	LN2082 2.90	C260L 9.50	MRP131C 7.50	Z5C1028 2.96	74167 2.20	TR1602 (S1883)	LM369K 19.50
ICM7726A 48.50	74C38 2.50	74LS195 9.00	LN2083 2.90	C260M 9.50	MRP131C 7.50	Z5C1029 1.95	74171 2.50	TR1602 (S1883)	78H05KC 9.00
ICM7726A 48.50	74C43 1.70	74LS196 9.00	LN2084 3.45	C260N 9.50	MRP131C 7.50	Z5C1030 1.95	74176 1.40	TR1863 8.90	78HGKC 9.00
ICM7727A 19.95	74C45 1.90	74LS197 1.75	LN2085 4.95	C260O 9.50	MRP131C 7.50	Z5C1031 2.95	74177 1.40	COM8116	78PS9KC 16.50
ICM7727A 19.95	74C83 2.30	74LS200 2.00	LN2086 4.95	C260P 9.50	MRP131C 7.50	Z5C1032 2.95	74178 2.15	BR1941 23.00	79HGKC 16.50
ICM7727A 19.95	74C85 2.30	74LS201 2.00	LN2087 4.95	C260Q 9.50	MRP131C 7.50	Z5C1033 2.95	74179 2.15	CR18002A	78S40 3.50
ICM7740 15.50	74C86 1.50	74LS202 2.00	LN2088 4.95	C260R 9.50	MRP131C 7.50	Z5C1034 2.95	74180 2.15	CR18002A	78S40 3.50
ICM7740 15.50	74C90 1.90	74LS204 1.50	LN2089 4.95	C260S 9.50	MRP131C 7.50	Z5C1035 2.95	74181 2.00	CR18002A	78S40 3.50
ICM7740 15.50	74C93 1.90	74LS205 1.50	LN2090 4.95	C260T 9.50	MRP131C 7.50	Z5C1036 2.95	74182 2.00	CR18002A	78S40 3.50
ICM7740 15.50	74C96 1.90	74LS206 1.50	LN2091 4.95	C260U 9.50	MRP131C 7.50	Z5C1037 2.95	74183 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C150 6.50	74LS209 1.50	LN2092 4.95	C260V 9.50	MRP131C 7.50	Z5C1038 2.95	74184 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C151 4.50	74LS210 1.50	LN2093 4.95	C260W 9.50	MRP131C 7.50	Z5C1039 2.95	74185 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C152 4.50	74LS211 1.50	LN2094 4.95	C260X 9.50	MRP131C 7.50	Z5C1040 2.95	74186 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C153 4.50	74LS212 1.50	LN2095 4.95	C260Y 9.50	MRP131C 7.50	Z5C1041 2.95	74187 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C154 4.50	74LS213 1.50	LN2096 4.95	C260Z 9.50	MRP131C 7.50	Z5C1042 2.95	74188 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C155 4.50	74LS214 1.50	LN2097 4.95	C260A 9.50	MRP131C 7.50	Z5C1043 2.95	74189 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C156 4.50	74LS215 1.50	LN2098 4.95	C260B 9.50	MRP131C 7.50	Z5C1044 2.95	74190 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C157 4.50	74LS216 1.50	LN2099 4.95	C260C 9.50	MRP131C 7.50	Z5C1045 2.95	74191 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C158 4.50	74LS217 1.50	LN2100 4.95	C260D 9.50	MRP131C 7.50	Z5C1046 2.95	74192 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C159 4.50	74LS218 1.50	LN2101 4.95	C260E 9.50	MRP131C 7.50	Z5C1047 2.95	74193 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C160 4.50	74LS219 1.50	LN2102 4.95	C260F 9.50	MRP131C 7.50	Z5C1048 2.95	74194 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C161 4.50	74LS220 1.50	LN2103 4.95	C260G 9.50	MRP131C 7.50	Z5C1049 2.95	74195 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C162 4.50	74LS221 1.50	LN2104 4.95	C260H 9.50	MRP131C 7.50	Z5C1050 2.95	74196 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C163 4.50	74LS222 1.50	LN2105 4.95	C260I 9.50	MRP131C 7.50	Z5C1051 2.95	74197 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C164 4.50	74LS223 1.50	LN2106 4.95	C260J 9.50	MRP131C 7.50	Z5C1052 2.95	74198 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C165 4.50	74LS224 1.50	LN2107 4.95	C260K 9.50	MRP131C 7.50	Z5C1053 2.95	74199 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C166 4.50	74LS225 1.50	LN2108 4.95	C260L 9.50	MRP131C 7.50	Z5C1054 2.95	74200 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C167 4.50	74LS226 1.50	LN2109 4.95	C260M 9.50	MRP131C 7.50	Z5C1055 2.95	74201 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C168 4.50	74LS227 1.50	LN2110 4.95	C260N 9.50	MRP131C 7.50	Z5C1056 2.95	74202 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C169 4.50	74LS228 1.50	LN2111 4.95	C260O 9.50	MRP131C 7.50	Z5C1057 2.95	74203 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C170 4.50	74LS229 1.50	LN2112 4.95	C260P 9.50	MRP131C 7.50	Z5C1058 2.95	74204 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C171 4.50	74LS230 1.50	LN2113 4.95	C260Q 9.50	MRP131C 7.50	Z5C1059 2.95	74205 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C172 4.50	74LS231 1.50	LN2114 4.95	C260R 9.50	MRP131C 7.50	Z5C1060 2.95	74206 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C173 4.50	74LS232 1.50	LN2115 4.95	C260S 9.50	MRP131C 7.50	Z5C1061 2.95	74207 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C174 4.50	74LS233 1.50	LN2116 4.95	C260T 9.50	MRP131C 7.50	Z5C1062 2.95	74208 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C175 4.50	74LS234 1.50	LN2117 4.95	C260U 9.50	MRP131C 7.50	Z5C1063 2.95	74209 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C176 4.50	74LS235 1.50	LN2118 4.95	C260V 9.50	MRP131C 7.50	Z5C1064 2.95	74210 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C177 4.50	74LS236 1.50	LN2119 4.95	C260W 9.50	MRP131C 7.50	Z5C1065 2.95	74211 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C178 4.50	74LS237 1.50	LN2120 4.95	C260X 9.50	MRP131C 7.50	Z5C1066 2.95	74212 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C179 4.50	74LS238 1.50	LN2121 4.95	C260Y 9.50	MRP131C 7.50	Z5C1067 2.95	74213 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C180 4.50	74LS239 1.50	LN2122 4.95	C260Z 9.50	MRP131C 7.50	Z5C1068 2.95	74214 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C181 4.50	74LS240 1.50	LN2123 4.95	C260A 9.50	MRP131C 7.50	Z5C1069 2.95	74215 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C182 4.50	74LS241 1.50	LN2124 4.95	C260B 9.50	MRP131C 7.50	Z5C1070 2.95	74216 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C183 4.50	74LS242 1.50	LN2125 4.95	C260C 9.50	MRP131C 7.50	Z5C1071 2.95	74217 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C184 4.50	74LS243 1.50	LN2126 4.95	C260D 9.50	MRP131C 7.50	Z5C1072 2.95	74218 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C185 4.50	74LS244 1.50	LN2127 4.95	C260E 9.50	MRP131C 7.50	Z5C1073 2.95	74219 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C186 4.50	74LS245 1.50	LN2128 4.95	C260F 9.50	MRP131C 7.50	Z5C1074 2.95	74220 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C187 4.50	74LS246 1.50	LN2129 4.95	C260G 9.50	MRP131C 7.50	Z5C1075 2.95	74221 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C188 4.50	74LS247 1.50	LN2130 4.95	C260H 9.50	MRP131C 7.50	Z5C1076 2.95	74222 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C189 4.50	74LS248 1.50	LN2131 4.95	C260I 9.50	MRP131C 7.50	Z5C1077 2.95	74223 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C190 4.50	74LS249 1.50	LN2132 4.95	C260J 9.50	MRP131C 7.50	Z5C1078 2.95	74224 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C191 4.50	74LS250 1.50	LN2133 4.95	C260K 9.50	MRP131C 7.50	Z5C1079 2.95	74225 2.00	CR18002A	78S40 3.50
ICM7755 2.75	74C192 4.50	74LS251 1.50	LN2134 4.95	C260L 9.50	MRP131C 7.50	Z5C1080 2.95	74226 2.00	CR18002A	78S40 3.50
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ICM7755 2.75	74C194 4.50	74LS253 1.50	LN2136 4.95	C260N 9.50	MRP131C 7.50	Z5C1082 2.95	74228 2.00	CR18002A	78S40 3.50
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ICM7755 2.75	74C198 4.50	74LS257 1.50	LN2140 4.95	C260R 9.50	MRP131C 7.50	Z5C1086 2.95	74232 2.00	CR18002A	78S40 3.50
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ICM7755									



# We've got kits galore at

## LATEST KITS!



### Sensational New Microbee Kit

**MICROBEE ENHANCER 1**  
This brand new, totally amazing kit for the Microbee is a must for all Microbee owners/users!

- Most expansion units up to this time offered at best only one or other features; and this made it impossible to run, say, complex sound effects mingled with speech. The Enhancer 1 will do all this and much more as well. It is quite amazing how much has been shoe-horned into this compact unit. The Enhancer 1's many powerful features include:
- Two ATARI/COM/MODRE/COLECO/SEARS type joystick inputs.
  - Two TRS COLOR COMPUTER type joystick inputs.
  - Allows the connection of Touch Pads, Paddles, Proportional Joysticks, Trackballs, Mice, temperature sensors, lights level sensors, transducers, etc, etc!
  - A 4 voice music/sound effects synthesizer.
  - A real time clock.
  - Unlimited vocabulary speech synthesizer (option).
  - Parallel printer interface (option).
  - A built-in speaker with volume control.
  - Listings of all necessary routines for use.
  - An impressive demonstration program package.
  - Compatible to all Microbees.
  - All units carry a 90 day warranty and servicing is also available.
  - Digital recording and playback of speech and sound.
  - An 8 channel analog to digital converter with variable voltage or variable resistance type analog inputs and also user selectable resolution from 1 to 9 bits.
  - A digital to analog converter with selectable resolution from 1-8 bits.
  - Allows automatic data acquisition and logging.
  - 5 digital input lines, 4 digital output lines.
  - A voice input channel.
  - A 40 pin experimenter socket with all 8 analog inputs, 5 digital inputs, 4 digital outputs, 3.58 MHz buffered clock, sound output (so that you can play the sound effects through your Hi Fi), 3 high resolution voltage comparators, OAC output etc.
- The amazing Microbee Enhancer is available exclusively from Rod Irving Electronics.

Cat. **\$149**



### 300 BAUD DIRECT CONNECT MODEM

- Modem? What do I want with a modem? Think of these advantages:
- Can't afford a floppy disc? Use your telephone to access one for the cost of a call.
  - Bored with your old programs? Download hundreds of free programs.
  - Want to get in touch with fellow computer enthusiasts? Use "electronic mail."
  - Ever used a CP/M system? CP-DOS/UNIX? Well a modem will make a your computer a remote terminal on some of the most exciting systems around. Save on ready built modems.

Cat. **\$99**



### MULTI SECTOR ALARM STATION

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

**Specifications:**

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

**Complete kit including deluxe prepunched metal work and electronics for only...**

Cat. **\$119**

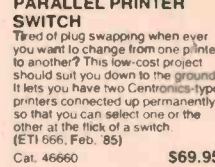


### LOW BATTERY VOLTAGE INDICATOR

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

(ETI 280, March '85)

Cat. **\$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 566, Feb. '85)

Cat. **\$69.95**



### 50 W AMPLIFIER MODULE

Cat. K44880  
(Heatsink optional extra) **\$27.50**

### 100 W AMPLIFIER MODULE

Cat. K44801  
(Heatsink optional extra) **\$29.95**



### CUDLIPP CRICKET

A fascinating Electronic Cricket with just two ICs. The Gudlipp can be used to bug your home, office etc! Great fun! (EA Feb. '82) 82¢ Cat. **\$12.00**



### BIPOLAR PROM PROGRAMMER

Every digital workshop should have one! Can be used to program the popular fusible-link PROMS like the 74S189/288, 82S23 & 82S123 etc (ETI June '83) ETI 688 **\$49.50**



### 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 8080/286 microcomputers and programs 2708's, 2716's, 2758's and 2732's. (EA July '80) 80P971 Cat. **\$79.50**



### 1W AUDIO AMPLIFIER

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



### ELECTRONIC WATT METER

This unit will measure the power consumption of any mains appliance with a rating up to 3 kilowatts. It makes use of a special op amp called an 'output transconductance amp' or OTA, for short. (EA Sept. '83) 83WMM Cat. **\$89.95**

## SERIES 5000 PRICES SLASHED!

By directly importing and a more technically orientated organisation, ROD IRVING ELECTRONICS can bring you these products at lower prices than their competitors. Enjoy the many other advantages of RIE Series 5000 kits such as "Super Finish" front panels at no extra cost, top quality components supplied throughout. Over 1,000 Sold.

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



### POWER AMPLIFIER

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

- ★ 1% Metal Film resistors are used where possible.
- ★ Aluminium case as per the original article.
- ★ All components are top quality.
- ★ 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 OUTPUT:** 100 W RMS into 8 ohms (±5% V SUPPLY)  
**FREQUENCY RESPONSE:** 8 Hz to 20 KHz, +0-0.4 dB 2.8 KHz to 65 KHz, +0-0.3 dB. NOTE: These figures are determined solely by passive filters.  
**INPUT SENSITIVITY:** 1 V RMS for 100 W output.  
**HUM:** 100 dB below full output (flat).  
**NOISE:** 116 dB below full output (flat, 20 KHz bandwidth).  
**2nd HARMONIC DISTORTION:** <0.001% at 1 KHz (0.0007% on Prototypes) at 100 W output using a ±56 V SUPPLY rated at 4A continues <0.003% at 10 KHz and 100 W.  
**3rd HARMONIC DISTORTION:** <0.0003% for all frequencies less than 10 KHz and all powers below clipping.  
**TOTAL HARMONIC DISTORTION:** Determined by 2nd Harmonic Distortion (see above).  
**INTERMODULATION DISTORTION:** 0.003% at 100 W, (50 Hz and 7 KHz mixed 4:1).  
**STABILITY:** Unconditional.

Cat. K44771. **Assembled and Tested \$499**



### PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER KIT ARE:

- ★ 1% Metal Film Resistors are supplied.
- ★ 14 Metres of Low Capacitance Shielded Cable are supplied (a bit extra in case of mistakes).
- ★ English "Lorin" switches are supplied (no substitutes here).
- ★ 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: 15 Hz-130 KHz, +0, -1 dB Low-Level Input - conforms to RIAA equalisation, ±0.2 dB  
**DISTORTION:** 1 KHz <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 300 mV input signal at full output (1.2V) >92 dB flat > 100 dB A-weighted. MM input, master full, with respect to full output (1.2V) at 5 mV input 50 ohms source resistance connected >86 dB flat; 92 dB A-weighted MC input, master full, with respect to full output (1.2V) and 200 uV input signal >71 dB flat >75 dB A-weighted.

Cat. K44791. **Assembled and Tested \$599**



### THIRD OCTAVE GRAPHIC EQUALIZER

**SPECIFICATIONS:**  
**BANDS:** 28 Bands from 31.5 Hz to 16 KHz.  
**NOISE:** <0.008 mV, sliders at 0, gain at 0 (-102 dB0).  
**20 KHz BANDWIDTH DISTORTION:** 0.007% at 300 mV signal, sliders at 0, gain at 0; maximum 0.01%, sliders at minimum.  
**FREQUENCY RESPONSE:** 12 Hz-105 KHz, +0, -1 dB, all controls flat.  
**BOOST AND CUT:** 14 dB. **1 Unit... \$199**  
**2 Units... \$379**

Cat. K44590



**POST & PACKING: \$10 per SERIES 5000 KIT.**



# Rod Irving Electronics!



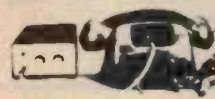
**HEADPHONE AMPLIFIER**  
PRACTICE WITHOUT ANNOYING THE FAMILY!  
If you play any type of electronic instrument, this headphone amplifier will surely interest you. It will let you practice for hours without upsetting the household, or you can use it to monitor your own instrument in the midst of a rowdy jam session. (EA Feb. '84) 83MA11  
Cat. K83011 \$28.00



**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 LIST or LPRINT command assumes a printer is connected to the RS232 port. Problem is, serial interface printers are more expensive than parallel Centronics interface printers. Save money by building this interface. (ETI Jan. '84) ETI 675  
Cat. K46750 \$59.00



**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 \$34.50



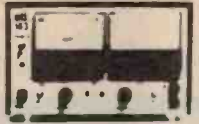
**PHONE MINDER**  
Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or it can perform either function separately. (EA Feb. '84) 84TP2  
Cat. K84021 \$24.00



**SOUND SIMULATOR FOR MODEL TRAINS**  
Fancy a diesel sound simulator for your model train layout? This circuit mounts inside the train for added realism and even varies its "speed" according to the throttle setting. (EA Nov. '84)  
Cat. K84110 \$18.00



**DIRECTIONAL DOOR MINDER**  
Most electronic door minders function by having a beam of light shining across doorway interrupted, but are incapable of detecting whether the light beam is broken by a person entering or leaving the room. This project overcomes that problem with the aid of digital logic. (ETI Nov. '84) ETI 278  
Cat. K42780 \$29.95



**LAB SUPPLY**  
Fully variable 0-40V current limited 0-5A supply with both voltage and current metering (two ranges: 0-0.5A/0-5A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by unique relay switching system switching between taps on the transformer secondary. (ETI May '83) ETI 163  
Cat. K41630 \$175.00



**CAR IGNITION KILLER**  
Most car burglar alarms are easily circumvented, but not this cunning "Ignition Killer". This sneaky anti-theft device uses a 555 timer to place an intermittent short circuit across the points. Until disabled by its hidden switch the circuit effectively makes the car undrivable — a sure deterrent to thieves! (EA Feb. '84) 84AU1  
Cat. K84010 \$16.95  
(Our kit includes the box!)



**ELECTRIC FENCE**  
Mains or battery powered, this electric fence controller is both inexpensive and versatile. Based on an automotive ignition coil, it should prove an adequate deterrent to all manner of livestock. Additionally, its operation conforms to the relevant clauses of Australian Sine 3129. (EA Sept. '82) 82EF9  
Cat. K82092 \$19.50



**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



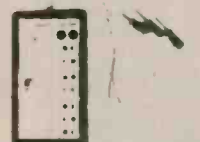
**RADIOTELETYPE CONVERTER FOR THE MICROBEE**  
Have your computer print the latest news from the international shortwave news service. Just hook up this project between your short wave receivers audio output and the MicroBee parallel port. A simple bit of software does the decoding. Can be hooked up to other computers too. (ETI Apr. '83)  
Cat. K41470 \$20.00



**ELECTRIC DUMMY LOAD**  
With this unit you can test power supplies at currents up to 15 Amps and voltage up to 60 Volts. It can "sink" up to 200 Watts on a static test and you can modulate the load to perform dynamic tests. (ETI Oct. '80) ETI 147  
Cat. K41470 \$109



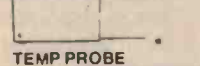
**VIDEO AMPLIFIER**  
Bothered by smeary colours, signal beats and RF interference on your computer display? Throw away that cheap and nasty RF modulator and use a direct video connection instead, it's much better! The Video Amplifier features adjustable gain and provides both normal and inverted outputs. Power is derived from a 12V DC plugpack supply. (EA Aug. '83) 83VA8  
Cat. K83081 \$15.00



**TRANSISTOR TESTER**  
1000's SOLD  
Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester, such as the EA Handy Tester. (EA Sept. '83) 83TT8  
Cat. K83080 \$15.00



**FUNCTION GENERATOR**  
This Function Generator with digital readout produces Sine, Triangle and Square waves over a frequency range from below 20Hz to above 150kHz 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 \$87.50  
Cat. K82041



**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 \$24.50



**150W BASS AMP**  
This guitar amp for impeccable bass players features many facilities found on expensive commercial ones. It delivers 150 watts into 4 ohms, has a t-band graphic limiter, line out and bi-amp facilities. (ETI Aug. '84) ETI 1410  
Cat. K54100 \$299



**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 \$49.50



**ZENER TESTER**  
A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes. (ETI May '83) ETI 164  
Cat. K41640 \$9.50



**COMPUTER DRIVEN RADIO-TELETYPE TRANSCIVER**  
Here's what you've been asking for, a full transmit-receive system for computer driven radio teletype station. The software provides all the latest "whizz-bangs" like split-screen operation, automatically repeating test message, printer output and more. The hardware uses tried and proven techniques. While designed to team with the popular Microbee, tips are available on interfacing the unit to other computers. (ETI Nov. '84) ETI 755  
Cat. K47550 \$139.00



**MOTORCYCLE INTERCOM**  
OVER 300 SOLD!  
Motorcycling is fun, but the conversation between rider and passenger is usually just not possible. But build this intercom and you can converse with your passenger at any time while you are on the move. There are no "push-to-talk" buttons, adjustable volume and it's easy to build! (EA Feb. '84) 84MC2  
Cat. K84020 \$45.00



**EPROM PROGRAMMER EP1**  
No need for a Micro with EA's great Eprom Programmer suitable for 2716/2758 Eproms. (EA Jan. '82) 82EP1  
Cat. K82013 \$47.50  
With Textool Sockets \$59.95



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



**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 \$24.95



**MUSICOLOR IV**  
Add excitement to parties, card nights and discos with EAs Musicolor IV light show. This is the latest in the famous line of musicolors and it offers features such as four channel "color organ" plus four channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety. (EA Aug. '81) 81MCC  
Cat. K81080 \$89.00



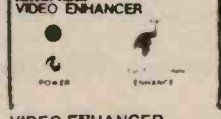
**ELECTRONIC MOUSETRAP**  
This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again! (ETI Aug. '84) ETI 1524  
Cat. K55240 \$29.95



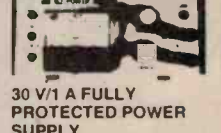
**PH METER KIT**  
Build this pH meter for the swimming pool season is here again! From swimming pools to fish tanks to gardening, this pH meter has many applications around the home. This unit features a large 3 1/2 digit liquid crystal display and resolution to 0.1 pH units, making it suitable for use in the laboratory as well. (EA Dec. '82) 82PH12  
Cat. K82123 \$139



**DUAL TRACKING POWER SUPPLY**  
Built around positive and negative 3-Terminal Regulators, this versatile dual tracking Power Supply can provide voltages up to 2A. In addition the Supply features a fixed +5V 0.9A output and is completely protected against short circuits, overloads and thermal runaway. (EA March '82) 82PS2  
Cat. K82030 \$87.50



**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



**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



**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



**HUMIDITY METER**  
This project can be built to give a readout of relative humidity either on a LED dot-mode display or a conventional meter. In addition it can be used with another project as a controller to turn on and off a water mist spray in a hothouse, for example. (ETI May '81) ETI-256 (includes humidity sensor \$19.50)  
Cat. K52460 \$29.50



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



**ROD IRVING ELECTRONICS**  
425 High Street,  
NORTHCOTE, 3070  
VICTORIA, AUSTRALIA  
Phone (03) 489 8866  
TELEX: AA 38897  
48-50 A Beckett Street,  
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\$1-\$9.99	\$2.00
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\$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.



Errors and omissions excepted



# GPIB for IBM PC

A new Tektronix GPIB tool kit has been specifically designed to aid the integration of an IBM PC into a GPIB instrument system.

The new GPIB package, known as GURU, consists of a GPIB interface board with self-test/diagnostics, a high-quality shielded GPIB cable, tutorial manual, and extensive support software including a test procedure generator and subroutines library.

For users needing fast results or lacking programming experience, GURU provides a software tool allowing the user to generate a program that executes a prescribed test sequence without writing any code. By knowing the details of the task to be performed, a user need only follow the instructions and answer menu questions, and the routine will be generated.

The BASIC library of 16 subroutines provides the user with the more frequently used subroutines thus allowing him to focus on his problem rather than controlling the bus.

Any of these subroutines may be called interactively. They include instrument selection and setup, range and tolerance tests, waveform acquisition and storage, and waveform graphs and statistics.

A GURU Application Pro-



gram Library will be established for GURU users. It will provide a valuable central pool of available instrument utility programs,

a focal point for GPIB reference, and an important user resource for instrument application programs.

For further information contact Tektronix, 80 Waterloo Road, North Ryde, NSW 2113. (02)888-7066.



## Modular EPROM programmer

The new PKW-1000 intelligent EPROM programmer from Aval Corp uses adaptors that are easily clipped in and out of its front panel for flexibility. The system firmware PROM is mounted in a ZIF socket under the programming module, allowing it to be updated without opening the case when new releases are issued.

The standard FX-1 module that comes included with the programmer supports all devices from 2716 up to 27256 and also covers the

CMOS and 'A' versions. All intelligent programming algorithms currently in use are included. Other modules now available cover single chip micros or turn the unit into a gang programmer. The PX module allows the machine to be a ROM emulator up to 256K bit capacity. The FX module is a complete hardware test adaptor. It checks that all programming and bus voltages are correctly calibrated.

For further information contact Alfatron on (03)758-9000.



## BRIEFS

### Versatile EPROM emulator

The XM512 emulator recently launched by GP Industrial Electronics is capable of emulating all EPROMs in common use, up to the 27512. Designed for use with the XP640 or P9030 EPROM programmers, it will be of particular interest to microsystem design and development engineers. For further details contact Elmeasco Instruments Pty Ltd, 15 McDonald St, Mortlake, NSW 2137. (02)736-2888.

### Performance-oriented system DMM

Keithley Instruments has released a Model 193 high performance 6½-digit system DMM which provides the measurement speed, IEEE bus flexibility, intelligence and measurement sensitivity required for automated test applications. Scientific Devices, 2 Jacks Road, South Oakleigh, Vic 3167, has details.



### High speed logic analyzer

Gould's K-205 logic analyzer offers 48 channels at 100 MHz, making it suitable for high speed bit-slice microprocessors, ECL devices, gate arrays and discreet logic designs. According to Gould, it is a "no compromise" analyzer providing high-speed performance across all channels. For more information contact Elmeasco Instruments Pty Ltd, 15 McDonald St, Mortlake, NSW 2137. (02)736-2888.

### Board-test support network

A worldwide network for board test application services has been announced by Hewlett-Packard. Called the HP SupportNet, it links a factory-based application centre in the US with 14 regional support centres, including one in Australia. Services provided by the network include custom programming, fixturing, library development, training and consulting.



### Step-down transformers for hard wiring

Ferguson has introduced nine ratings housed in enclosures designed for wall or floor mounting and suitable for hard wiring. Output range is 12 volts, 24 volts and 32 volts with ratings from 125 VA to 1000 VA. More information is available from Ferguson Transformers Pty Ltd, 331 High St, Chatswood, NSW 2067. (02)407-0261.

### 68000 multibus computer board

Based on the Motorola 68000 (8 MHz) CPU, MACE's new DENSAN DSB-68K/10 single board computer can directly address up to 16M bytes of memory space. Improved speed has been achieved by designing the local RAM with "no wait" access.

### Selection of electronic counters

Hewlett-Packard has produced a 14-page, full colour brochure describing the company's range of electronic counters. It lists 21 products and includes a feature comparison chart to help the reader select the counter best suited to solving a particular measurement problem. For a copy of the "Counter Brochure", contact Hewlett-Packard, 31-41 Joseph St, Blackburn, Vic 3130. (03)895-2895.

### The right transducer

The Measurement & Control Division of EEL has just released its Data Instruments Short Form Catalogue, listing details of DI's pressure transducers, load cells, digital pressure indicators and transducer instrumentation products. To obtain a copy contact EEL's state branches of the Measurement & Control Division, 8 Lyon Park Road, North Ryde, NSW 2113. (02)888-9000.

### Debug RAM unit

The SE-49402 Debug Ram Unit replaces and emulates EPROMs and ROMs up to 256K bit capacity, and can emulate two devices simultaneously for 16 bit applications. An add-on unit for PROM programmers is also available. For more information contact Alfatron Pty Ltd, 1761 Ferntree Gully Rd, Ferntree Gully, Vic 3156. (03)758-9000.

### World sales for logger

Melbourne-based Data Electronics has begun exporting its low cost data logger, the Datataker, to the USA and Canada. Retailing for less than \$2000, the Datataker provides fully programmable analogue and digital data acquisition and logging. For further information about this logger contact Data Electronics, 42 Rutland Road, Box Hill, Vic 3128. (03)890-2422.



### Fibre optic splice kits

Total Electronics has Optasplce Series Kits for making permanent or temporary optical fibre splices at low cost and with low dB losses. Each kit contains a splice assembly tool, microscope, crimp tool, tweezers and uv optical adhesive. If you want to know more, contact Total Electronics, 9 Harker St, Burwood, Vic 3125. (03)288-4044.



**THINK OF ALL THE MONEY I'VE SAVED!**

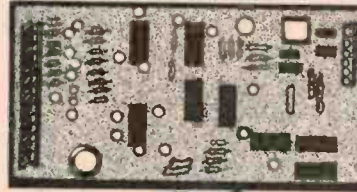
- Actually you make a double saving: You save because our kits represent a saving over the individual component price (many kit components are not easily obtained!)



AND you save by building it yourself: compare equivalent commercial devices. You save \$\$\$ and enjoy yourself immensely - because you supply the labour.

# KITS: THE DO-IT-

## More Features — Better Car Security!



In December 1983, the 'Open Road' magazine (NRMA) gave ten features a car alarm should have. The best commercial system available had only eight. This alarm system from Electronics Australia, has nine (and if used in conjunction with the Ignition killer below, has ten!) Your car needs protection. Good door locks and an Ignition lock aren't enough. Build this incredibly effective alarm system and your car has the best chance it will ever have of being where you left it when you return.  
Cat K-3252

As described in EA **SAVE \$2.55 \$64<sup>95</sup>**



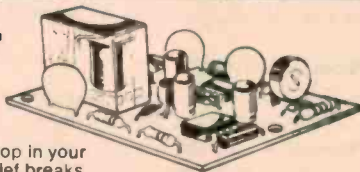
## Supra-Ultrasonic Movement Detector!

Cat K-3251  
As described in EA

The perfect add-on kit for the Deluxe Car Alarm! The problem with 99% of car alarms is that they cannot prevent the thief who breaks a window and reaches in for the goodies. While this kit won't prevent the window being broken, it will protect your property inside the car. Silent ultrasonic rays detect any movement and trigger the main alarm system.

**\$23<sup>95</sup>**

## Bargain Car Protection



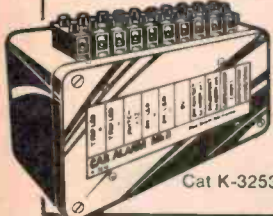
This alarm senses the voltage drop in your car's electrical system when a thief breaks into it. There's a visual warning for thieves so that chances are they will not even attempt a break-in. Easy to install — save a lot of trouble.  
Cat K-3250

As described in ETI

SAVE \$1.55

**\$11<sup>95</sup>**

## No False-Alarm Car Alarm!



Cat K-3253

One of the most sophisticated, yet simple alarms around. It uses a triggering technique which makes it less prone to false alarms — a common problem with many car alarms, yet it will sense a voltage drop anywhere in the electrical system. For example, when a door is opened, or a jumper lead is applied to the starter, etc.

As described in ETI

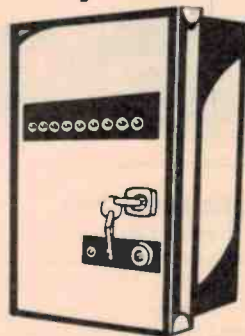
**\$29<sup>95</sup>**

## Professional Quality Home Security

What a superb kit! EA have thought of just about everything in the development of this design. It offers features which you'd normally find on \$200 and more commercial units (even ours!)

- It offers:
- Security key operation
  - 2 instant and six delay sectors
  - Inbuilt mains power supply with battery backup
  - Siren (up to two speakers) PLUS bell (relay) output and also capable of driving telephone diallers, strobes, etc etc.
  - Inbuilt local test facilities, including buzzer.

And we've made the EA design even better: a heavier steel case, for example. And our kit includes our specially prepared instructions — so you won't have any problems! \*BATTERIES NOT INCLUDED



**\$120**

Cat K-3424

As described in EA

## Ignition Killer

Ingenious but simple circuit based on a 555 timer that literally kills your car ignition and then re-sets itself, making the thief think something is wrong with the engine. The theory is he'll then go and pinch someone else's car instead.

Cat K-3255

**\$16<sup>95</sup>**

As described in EA



## VCR Theft Alarm ~~\$54<sup>95</sup>~~ \$29<sup>95</sup>

Don't let your VCR become the most talked about item behind the pub! Build this neat little kit and it will scream its head off with your pride and joy!

Cat K-3423

As described in EA



## Save on 2m Transceivers!

The perfect mate for the UHF kit. The DSE Commander VHF transceiver has been developed in response to the huge number of requests from our customers: those who had the 'Explorer' under their belts and had been bitten by the old 'home brew' bug! (In fact, a number of customers said they didn't really need another 2m transceiver: they'd built it for the sheer fun of making something again!)

SAVE \$10 **\$189**

Cat K-6308



# YOURSELF SAVINGS ACCOUNT!

## Stereo Simulator

Wish those old video movies had modern stereo sound? This low-cost gadget turns almost any mono signal into amazingly good synthetic stereo!  
Cat K-3421

**\$23<sup>95</sup>**



## Stereo Enhancer

Here's a great kit for those on a space budget! If your listening area is not exactly stereo quality, the stereo enhancer will 'widen' the sound to make it sound like it's almost designed that way!

Cat K-3419

As described in EA

**\$79<sup>95</sup>**

## Servicemans Dream — TV Pattern Generator

With just seven IC's you get three patterns: dot, crosshatch and blank raster. Not bad value, huh? An indispensable aid for the serviceman or hobbyist — and this one's small enough to carry around anywhere. Includes deluxe front panel and VHF modulator.

Operates from plug-pack adaptor (9V DC).  
Cat K-3472

**\$33<sup>95</sup>**



## 4 Sector Protector

Once upon a time, we had a kit for a simple alarm. Then everyone started asking for an all bells and whistles kit. So we brought out the EA 8 sector alarm kit. Now it seems everyone wants a simpler kit again!!! Here it is: designed by Dick Smith Electronics Research and Development division to suit the requirements of the majority of users.

• Features instant or delayed inputs • Wire-out-proof system-suitable for all types of sensors • LED sector and control state indication • Adjustable entry, exit and alarm periods

Short form kit - suits 'building in' to whatever you like!  
Easy to build - and could save your property!

Cat K-3254

**\$23<sup>95</sup>**

## UHF Transceiver

SAVE \$10

Now almost 1000 DSE UHF Explorer transceivers have been built and, from the reports we've received, very few problems have been found: most constructors are delighted with the ease it's definitely not a kit for the beginner (after all, you need an amateur licence to use it!) and we strongly advise both UHF and digital trouble-shooting experience, as well as professional standard of construction (UHF is not kind to sloppy constructors!) The result: you'll end up with a transceiver at least the equal of most commercial units, at a fraction of the cost (now that the dollar's gone through the floor!)  
Cat K-6300

UHF/VHF TRANSCEIVER UPGRADE

Add-on kit to give your Explorer full repeater operating capability, plus S-meter, an additional crystal filter and a new front panel to take S-meter and repeater switching.  
Cat K-6302

**\$189**

**\$24<sup>50</sup>**



## Turns TV To Stereo!

SAVE \$50



Build this stereo TV decoder and get full hi-hi quality stereo television sound for just a fraction of the cost of replacing the telly!

You have a choice of building the decoder with its own power amplifiers — or you can simply feed the output into your hi fi stereo system to cut costs even further.

The result: stereo TV sound you'll be proud of! And even more: included is a TV tuner which picks up UHF — so if your telly can't quite manage UHF you're even further in front!  
Cat K-6325

~~\$249~~ **\$199**

## Teletext Decoder

Cat K-6315

Teletext — that mine of information given out free by a lot of TV stations - hasn't really taken off in Oz: mainly because of the cost of Teletext Televisions (most are around or over the big \$1000 mark!) We've kept the price way, way down by designing this Teletext converter to be used in conjunction with a VCR. Check with your local TV station(s) to ensure Teletext or captions are being transmitted before commencing construction!

**\$229**

## ADD REMOTE CONTROL TO YOUR TELETEXT!

Yes! Now your Teletext Decoder (Cat K-6315) can be converted to full infra-red remote control with this nifty kit. Complete with transmitter and receiver, transfers all controls currently on wired handpiece to infra-red unit. Pro quality transmitter case with push-button operation (just like on TVs and videos!) and full instructions are included to construct and link into Teletext kit.  
Cat K-3425

Now you can have control from your armchair!

**\$49<sup>95</sup>**



**\$52<sup>95</sup>**

## VCR Sound Processor

Unless you're lucky enough to have one of the new hi fi videos, the sound from your VCR is probably pretty pedestrian! Now you can give it a lift with this VCR Sound Processor!

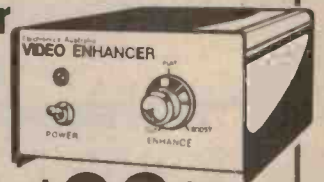
Cat K-3422

## Video Enhancer

If the sound on your VCR is crook, what about the video! Especially when you're making copies of tapes (yes, the ones you shot yourself of course). Make sure you don't lose detail when dubbing: use the EA video enhancer.

Very simple to use: all control is via one knob. And unlike most enhancers, you can cut as well as boost (ideal for softening harsh pictures).

Cat K-3463



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SAVE \$3

## UHF Linear Power Amp

Now a power amplifier to UHF AMATEUR AND CB radio. A very healthy 25 watts output from virtually any UHF input (from around 300mW or so.) And that could make the difference between being heard or not. The amplifier kit is complete to the last nut and bolt - including the same deluxe case used in our UHF amateur transceiver, and its matching power supply. So now you can build a matching amplifier too!  
Cat K-6314



**\$129** LIMITED STOCK

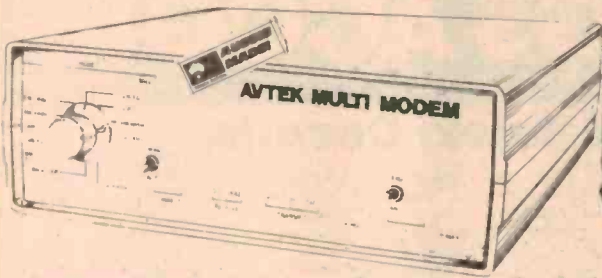
# DICK SMITH ELECTRONICS

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See page 77 for address details



# JAYCAR - UNIQUE PRODUCTS



## AVTEK MULTIMODEMS

State-of-the-art multimodem - has the following data standards CCITT V.21 & V.23, BELL 103 & 202 - Data rates 300, 600 & 1200 BPS - Backward channel 75 BPS in conjunction with 1200 BPS - Computer interface CCITT V.24 (RS232C) - Power requirements 240V AC 3 watts. Talk to the world with this fine Multimodem.

Cat. XC-4820 **\$349.00 INCLUDES PHONE**

**AUTO ANSWER VERSION \$399.00**

Cat. XC-4822

### MiniModem

★ 300 Baud full duplex ★ Answer/originate ★ Plugs straight in (hardware phone) ★ Superior V.51 chip performance (identical to Multimodem) ★ Telecom approval C84/37/1173. Cat. XC-4825

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INCLUDES PHONE

**Blue Strobe Flasher 12V** This unit has a magnetic base and is fitted with 4 metres of cable terminating in a cigarette lighter plug. Ideal for car alarms or fitted to a siren cover to bring visual attention to a theft.

Cat. LA-5105

**ONLY \$32.50**

**Electricity Authority Approved Fuseholder!** At Last! A 3AG 240V 10A fuseholder that is approved but at a reasonable price! (Approval No. CS2929). Ideal for manufacturers.

Cat. S2-2025 **ONLY \$3.95**

## MICRON PROFESSIONAL 20W IRON

240V AC SOLDERING IRON

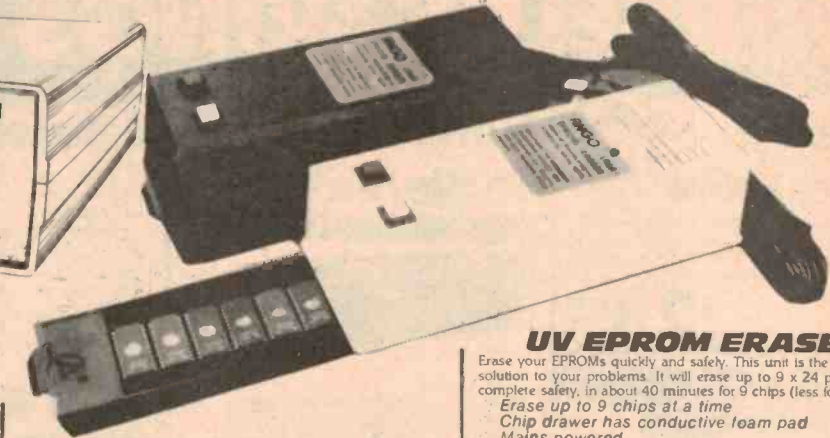
This great iron has all the features of those costing a lot more.  
● 370°C fixed temperature ● High efficiency patented heating element ● Iron clad, chrome plated, long life interchangeable tips  
Cat. TS-1550

**ONLY \$22.50**  
IRON CLAD TIPS

This soldering iron uses high grade iron clad, chrome plated and pre-tinned tips. Tip life expectancy is many times that of conventional plated tips.

Cat. TS-1552 MICRO CHISEL - 1mm  
Cat. TS-1553 MINI CHISEL - 1.5mm  
Cat. TS-1554 STANDARD CHISEL - 3mm

**ALL TIPS \$3.50 EACH**



## 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 for 9 chips (less for less chips).

Erase up to 9 chips at a time  
Chip drawer has conductive foam pad  
Mains powered  
High UV intensity at chip surface ensures thorough erase  
Engineered to prevent UV exposure  
Long life UV tube  
Dimensions 217 x 80 x 68mm  
Weight 670 grams  
Cat. XE-4950

**ONLY \$89.50**

**At Last! A car 12V cigarette lighter SOCKET!** A panel mount source of 12V for cars, boats, planes. You even can plug a cigarette lighter into it!

Cat. PS-2002 **ONLY \$4.50**



## NEW! Gel-cell Battery Charger

Specifically for charging Gel-cells with ¼" quick connect tabs on them. 240V AC to 12V DC @ 300mA ensures fast charge!

Cat. MB-3506 **ONLY \$10.95**



**MAIL ORDER HOTLINE**  
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**SCOOP PURCHASE!**  
GENUINE  
**SIEMENS**

**Universal voltage tester with LED indicator**  
The Siemens "UNISPANN" voltage probe has been around for some time now. You can determine the presence of AC or DC voltages safely anywhere with this quality probe. It will even tell you which AC mains conductor is active and works from 6-500V AC or DC. It also shows DC polarity. Normally these units are very expensive but a Jaycar SCOOP PURCHASE brings them to you at a great price!  
WHILE STOCKS LAST - AN INCREDIBLE BARGAIN  
Cat. QT-2220

**ONLY \$12.95**



## LOW COST MICRON 25 WATT IRON

Ideal for the hobbyist and handyman. 240V operated with spare tips available. Lightweight! Tip temperature variation is well within limits suitable for electronic work. Comes complete with tip.

Cat. TS-1440

**ONLY \$17.50**  
SPARE TIPS TO SUIT

Cat. TS-1441  
Cat. TS-1442  
Cat. TS-1443

MICRO CHISEL  
MINI CHISEL  
STANDARD CHISEL

**ALL PRICED AT \$2.95 EACH**

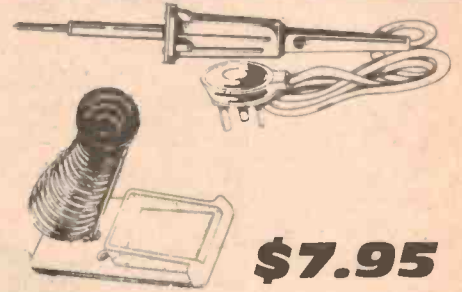
## Soldering Iron Stand

Holds virtually any iron for convenient use. Includes tip wiping sponge.

Cat. TS-1500

SPARE SONGES  
Cat. TS-1400

**ONLY \$1.50 ea**



**\$7.95**

## AT LAST! An Economical RACK CABINET MOUNTING SYSTEM!

This fully Australian-made product we believe will become one of our hottest selling items!

It has taken an Aussie manufacturer to come up with the world's first low cost rack mounting system especially for the budget-conscious home constructor!

The rack mounting system basically consists of specially designed aluminium-extruded frames. Moulded plastic corner and feet pieces connect the extrusions together to form a rigid frame. No spanners, screwdrivers are needed but the use of a rubber or wooden mallet is advised to securely fit together the self-aligning pieces. When assembled the frame can be further strengthened with pop rivets. The system is supplied in knocked-down (kit) form to keep costs and freight down. Assembly takes around 20 minutes and instructions are supplied. In keeping with the low-cost philosophy, side and top panels are not included. Any reasonably competent reader should be able to fashion wooden or metal panels to suit. (Edge finish is not necessary as the panels recess into the frame.) Jaycar will have special side panel sets available shortly however. Please watch our ads for further details.

## THE RACK IS AVAILABLE IN 3 SIZES 6, 12 and 18 rack unit

(One rack unit is 44.5mm or 1 3/4")

Each kit comprises: ★ 12 frame pieces, including 2 pieces with pre-punched holes for front panel mounting. Natural anodised finish. (You can use the rack back-to-front to mount non-standard racks). ★ 4 top corners (black) ★ 4 bottom corners (black) ★ 4 x clip-in M-6 nuts (for mounting your equipment) ★ 4 x M-6 Phillips head mounting screws ★ easy to follow instructions. But the best part about this exciting concept is **THE PRICE!**

**ONLY**

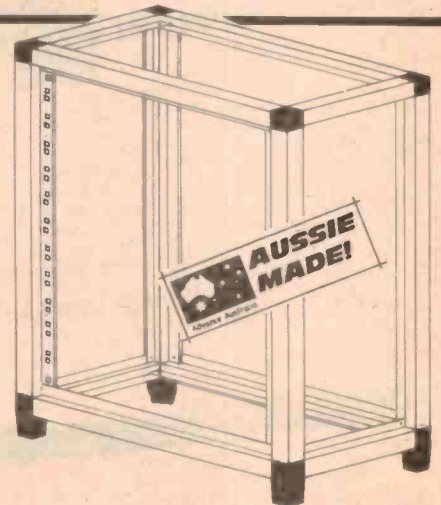
Cat. HR-5310 **6 RACK FRAME \$ 99**  
Cat. HR-5320 **12 RACK FRAME \$119**  
Cat. HR-5330 **18 RACK FRAME \$139**

Extra M-6 captive nuts (Pack of 12)

Cat. HP-0640 **\$4.95**

Extra M-6 x 16mm plated Phillips head mounting screws (pack of 12)

Cat. HP-0645 **\$2.95**





# AT LOW, LOW PRICES FOR YOU

## ULTRASONIC PEST REPELLER

Which of these do you need to get rid of? Mice, blowflies, birds, spiders, bats, rats, cockroaches, flies, moths or fleas? The Verminex ultrasonic insect/pest repeller creates a sonic environment which is totally hostile to the creatures mentioned.

### HOW DOES IT WORK?

The environment is relatively devoid of ultrasonic sounds. Evolution has not had a compelling reason to protect non acoustic sensory mechanisms from ultrasonic stimulation. By subjecting an insect or rodent to a high level ultrasonic soundwave of a particular pattern the creature begins to behave in a typical fashion. The pest becomes disoriented, lethargic and bewildered. The natural reaction is to escape from the sound affected area. The sonic pattern is the secret and this pattern is a combination of scores of frequencies mixed together. The pattern was developed by Professor J.L. Stewart - the man who invented the Bionic ear. It works!

Like us, you would be skeptical at first that this would work. Our first reaction was, "If they are so good why haven't we heard about them before?" or "Surely a product like this - if it was any good - would have been around years ago". There have been ultrasonic repellers around but none of them have the patented soundwave pattern of the Verminex. We have on our file, many letters of testimony to the fact that the Verminex is effective. The letters are from Australian Universities, Animal Husbandry research institutions, commercial Piggeries, restaurants etc. Many of them had several pest problems! Your pest problems may not be as bad but it may still be a nuisance, which is why the domestic Verminex was developed. We are so confident of the Verminex units' effectiveness, we make the following offer.

Buy the Verminex from us and use it for up to 14 days (21 days for mail order customers). If you are not happy with the product after using it as directed, return it to us in a clean, original condition and we will refund your money in full! (Less post/packing). What have you got to lose? The Verminex covers an area of 2000 sq.ft (uninterrupted) and is not cheap. But if the idea of dangerous chemicals, sprays, baits etc worries you it's a great solution. It is supplied with a 240V plug pack but can be battery powered.

Cat. VS-5500  
**WHAT HAVE YOU GOT TO LOSE EXCEPT THE BUGS! \$79.00**

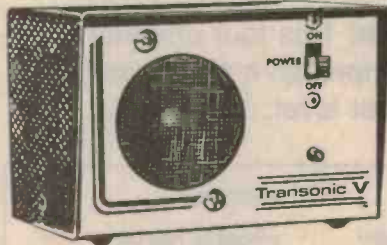


## NEW! BY POPULAR DEMAND! Verminex Transonic V Commercial Ultrasonic Pest Repeller

Everything that we have said about the Verminex domestic unit except that it is for commercial applications!

- ★ Sturdy metal cabinet
  - ★ 3 selectable pitch and loudness settings to optimise for particular problems
  - ★ Low power consumption
  - ★ 14 day satisfaction guarantee
  - ★ Includes AC mains adaptor
- Cat. VS-5510

**ONLY \$159.00**



## REGENCY BRAND RF-ONE X & K BAND RADAR DETECTOR

Quality Regency (U.S./Japanese made radar detector at an unbelievable price!

- ★ Receives both X & K band radar.
- ★ Adjustable sensitivity for city/country driving
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- ★ LED pilot lamp.
- ★ 3 mounting positions.
- ★ Installs in seconds with 12V lighter plug

Cat. XR-0500  
**ONLY \$129.00**



## FERGUSON TRANSFORMERS PC MOUNT 5VA

- |              |                            |
|--------------|----------------------------|
| Cat. MF-1000 | PL9/5VA 2 x 4 1/2V @ 1.11A |
| Cat. MF-1002 | PL12/5VA 2 x 6V @ 830mA    |
| Cat. MF-1004 | PL15/5VA 2 x 7.5V @ 670mA  |
| Cat. MF-1006 | PL18/5VA 2 x 9V @ 560mA    |
| Cat. MF-1009 | PL24/5VA 2 x 12V @ 420mA   |
| Cat. MF-1012 | PL30/5VA 2 x 15V @ 330mA   |
| Cat. MF-1015 | PL40/5VA 2 x 20V @ 250mA   |

**ALL AT \$10.95 each**

### 2.5VA PC MOUNT

- |              |                            |
|--------------|----------------------------|
| Cat. MF-0950 | PL18/2.5VA 2 x 9V @ 280mA  |
| Cat. MF-0952 | PL24/2.5VA 2 x 12V @ 210mA |
| Cat. MF-0954 | PL30/2.5VA 2 x 15V @ 170mA |

**PRICED AT \$9.95 each**

### PL20VA FLAT PACK

- |              |                            |
|--------------|----------------------------|
| Cat. MF-1030 | PL12/20VA 2 x 6V @ 1.67A   |
| Cat. MF-1033 | PL15/20VA 2 x 7.5V @ 1.33A |
| Cat. MF-1036 | PL18/20VA 2 x 9V @ 1.11A   |
| Cat. MF-1039 | PL24/20VA 2 x 12V @ 830mA  |
| Cat. MF-1042 | PL30/20VA 2 x 15V @ 670mA  |
| Cat. MF-1045 | PL40/20VA 2 x 20V @ 500mA  |

**PRICED AT \$17.50 each**

### PL40VA FLAT PACK

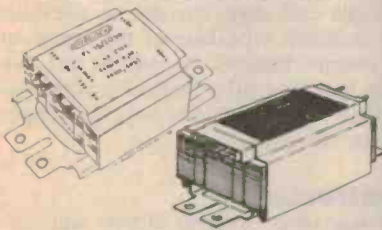
- |              |                            |
|--------------|----------------------------|
| Cat. MF-1051 | PL15/40VA 2 x 7.5V @ 2.67A |
| Cat. MF-1054 | PL18/40VA 2 x 9V @ 2.22A   |
| Cat. MF-1057 | PL24/40VA 2 x 12V @ 1.67A  |
| Cat. MF-1060 | PL30/40VA 2 x 15V @ 1.33A  |

**PRICED AT \$20.95 each**

### PL60VA

- |              |                                     |
|--------------|-------------------------------------|
| Cat. MF-1072 | PL15/60VA 15V @ 4A one winding only |
| Cat. MF-1075 | PL18/60VA 2 x 9V @ 3.33A            |
| Cat. MF-1078 | PL24/60VA 2 x 12V @ 2.5A            |
| Cat. MF-1081 | PL30/60VA 2 x 15V @ 2A              |
| Cat. MF-1082 | PL40/60VA 2 x 20V @ 1.5A            |

**PRICED AT \$26.50 each**



## SQUEAKY CLEAN MAINS FILTERS

Two fantastic low cost models. MS-4010 will supply up to 4 appliances. Each 240V socket is isolated from the other, i.e. interference from disc drives is de-coupled from the CPU power supply etc. It will supply up to 4 outlets with a total load of 6 amps (unswitched).  
Cat. MS-4010

**ONLY \$125.00**



Single 10 amp line socket type filter (unswitched).  
Cat. MS-4012

**ONLY \$34.95**

## 2 1/2" DIAMETER SPEAKER 32 OHM VOICE COIL

We have a small quantity of these handy little speakers. The high voice coil impedance enables you to drive them directly with, say, a BC 548 (without an output transformer).

Cat. AF-3002

**ONLY \$3.00 each**

## DESK MOUNTED LAMP MAGNIFIER

This unit magnifies any object under a clear cool fluorescent light. The magnification is the maximum obtainable (lens 127mm diameter bi convex 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. (We doubt whether 20 years continuous use would wear out the German made flexible arms for example). Spare fluoro tubes are available either from us or electrical outlets.

If you have trouble with fine PCB work or component identification but still want both hands free, this is for you. We thoroughly recommend this quality Australian made product.

### Technical Information

Illumination: 22W Fluorescent

Weight: 8.16kg

Lateral Extension: 254mm

Vertical Extension: 254mm

Fixing: Heavy table base (grey) with two chrome plated flexible arms.

Lens (see text)

Cat. SL-2700

**ONLY \$169**

# Jaycar ELECTRONICS

Incorporating ELECTRONIC AGENCIES

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COMET ROAD FREIGHT ANYWHERE IN AUSTRALIA ONLY \$12



**MAIL ORDER VIA  
YOUR PHONE**



# FOUR CHANNEL MIXER

Home recording ain't what it used to be! This four channel mixer gives professional quality with impressive specs, which might really threaten the sound of street level.

Robert Irwin

Parameter	Value	Comments
max input sensitivity	-50 dBm (2.5 mV)	
signal-to-noise ratio	-78 dB relative to +4 dBm	settings for max gain
distortion	0.03% @ +4 dBm, 2 kHz	settings for max gain
input impedance	3k ohm nominal	depends on $h_{ie}$ of transistors
output impedance	100 ohms	
frequency response	10 Hz to 30 kHz ( $\pm 1$ dB)	

## ETI-1404 SPECIFICATIONS

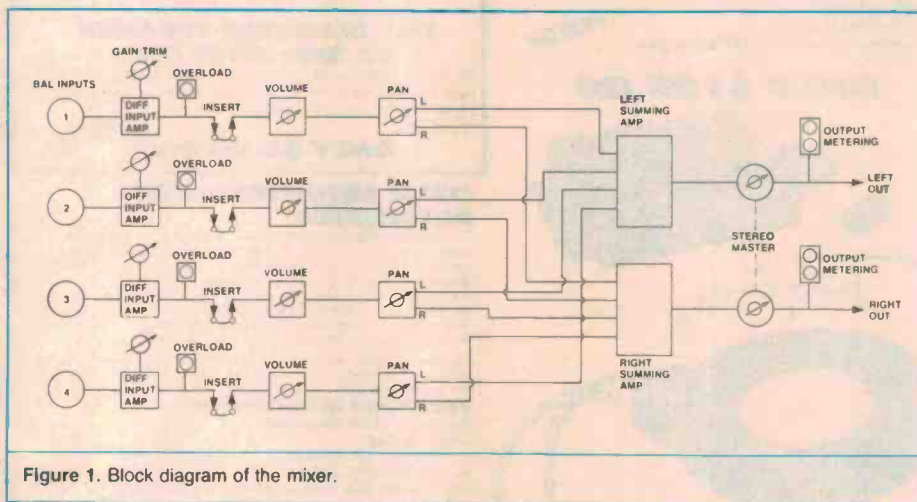


Figure 1. Block diagram of the mixer.

### Introduction

THIS MIXER PROVIDES four balanced inputs and stereo output. It was designed to be an easy to use mixer with noise and distortion figures good enough for recording or broadcast use. The mixer has a facility to insert external devices such as tone controls or effects into the signal path on each channel thus making it suitable for a wide variety of applications. To keep costs down and simplify the construction, all the components, including the mains transformer, mount on two pc boards. This means there is a minimum of interwiring needed.

I originally intended the mixer as a simple monitor mixer for a four track home recording studio but with the balance inputs and

insert facility I have since found quite a few other uses for it, from on-stage use as a keyboard mixer to uses in the audio visual area.

### Design details

Figure 1 shows a block diagram of the mixer. The first stage consists of a high gain differential amplifier. This gives a balanced input and provides the full gain for the system. The reason for putting all the gain on the input stage is to raise the signal level immediately and therefore preserve a high signal-to-noise ratio throughout the rest of the circuitry. To cope with different input levels this first stage is provided with a GAIN TRIM control which allows the first stage gain to be set at an appropriate level to

drive the rest of the mixer. To ensure that the mixer is not overdriven an overload LED is provided on each channel. This is set to indicate a level of +15 dBm and indicates that the channel is approaching clipping levels. The GAIN TRIM can then be used to lower the input gain slightly.

Just prior to the volume control on each channel is an insert point. This allows access to the signal line via a stereo jack on the back of the mixer. At this point an external effect such as echo or reverb can be added in. Equalization or tone controls could also be inserted at this point. The insert point has another use in that it is possible to use it as the input if you wish to drive one channel from a high level single-ended source such as the output from a pre-amp. When nothing is plugged into the insert jack the terminals are shorted so that the signal goes straight through.

A pan control is provided on each channel to split the signal into left and right portions for a stereo output mix. The left and right channels are then mixed separately in a virtual earth summing circuit. A stereo master volume control is used to control the overall output signal level.

As with each input channel, an overload LED indicates a peaking of the signal on both output channels. As well as this, the output has a +4 dBm indication which allows the output signal to be kept at a proper level for recording.

### Construction

Because of the number of pots and connectors needed, the metalwork is probably the hardest part of construction so it is best to get it over and done with. I mounted the prototype in a slope front metal cabinet which I bought from Tandy. This was an ideal case for the mixer and all the circuitry fits in relatively neatly. The box comes apart in two sections. The lid is bent to form the back panel and the base is bent up to form the sides. Start by taking the box apart (don't lose the screws!) and attacking the lid. The front panel should be marked





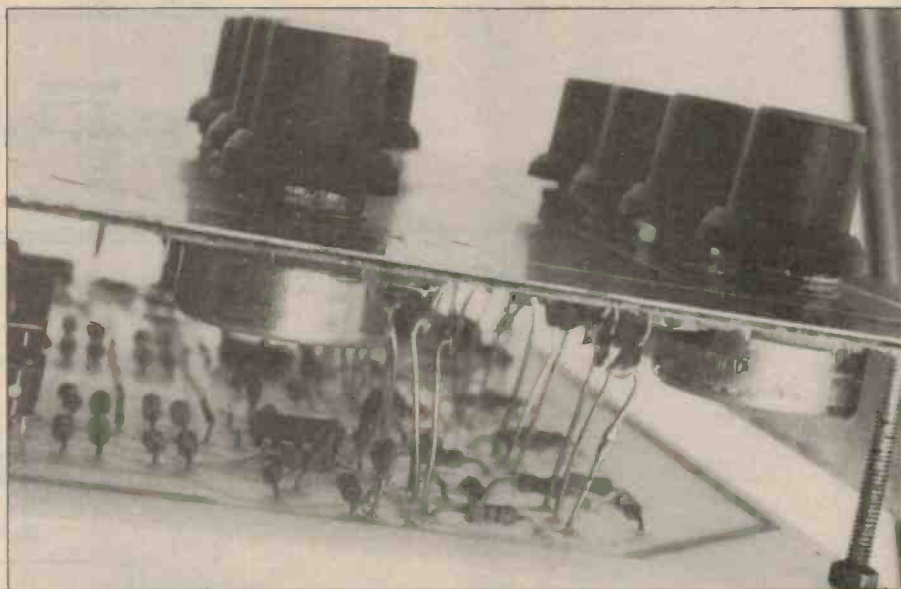
out either by using the Scotchcal as a template or by using the drilling diagram. Either way make sure you are accurate as the pc board and pots mount straight through on the back of the panel and if you do not mark the hole centres accurately you may have trouble getting the pots to fit properly. Once the lid has been marked out, centre punch and drill out the holes to the correct size. The four holes for the pc board mounting bolts should be countersunk. Remove any burrs around the holes with a large drill or round file.

The centres for the holes on the back panel should now be marked out. Once again you can use the Scotchcal as a template to locate the centres. On the prototype I used 3-pin cannon XLR sockets for the inputs. These require a rather large one inch hole for the body of the socket to go through. This is best done using a hole punch set. If you don't have a set then try borrowing one as you will probably have trouble drilling a hole this size. The alternative is to drill a smaller hole and file it out (nasty!). Also drill the small holes for the XLR connector mounting bolts.

If you are intending to use the INSERT facility then holes for insulated, switched stereo sockets should be drilled between the XLR connectors. For the prototype output I used a two-way panel mount RCA connector. This was to allow the mixer to be connected straight to the inputs of a tape deck. If you wish you can use 6.5 mm jacks for the output. Either way, the appropriate holes should be drilled.

You can now turn your attention to the bottom of the box. The power supply board mounts on the floor of the case on the right hand side (looking from the front). Position the pc board about 1 cm in from the side and midway between the front and back. Make sure the board will not foul on the screws for the rubber feet. Mark the position of the mounting holes. Drill these to fit 6BA bolts.

The mains cord, switch and fuse holder all



This picture shows the mounting of the pc board and pots. The legs of the pots must not short against each other or any component on the board.

mount on the right-hand side wall. The hole for the mains cord grommet should be cut in the bottom back corner and the 2AG fuse holder mounts directly above. Mark and cut these holes. The prototype used a miniature, 240 V rocker switch as the main power switch. To mount this a small square hole had to be cut to accommodate the rocker and two small holes for the mounting bolts drilled. This was done at the top of the side panel. If you are not using this type of switch then cut an appropriate hole for the switch you are using.

Once all the holes have been drilled and cut smooth of any burrs and rough edges, you can hang up your drill and warm up the soldering iron for the construction of the pc boards.

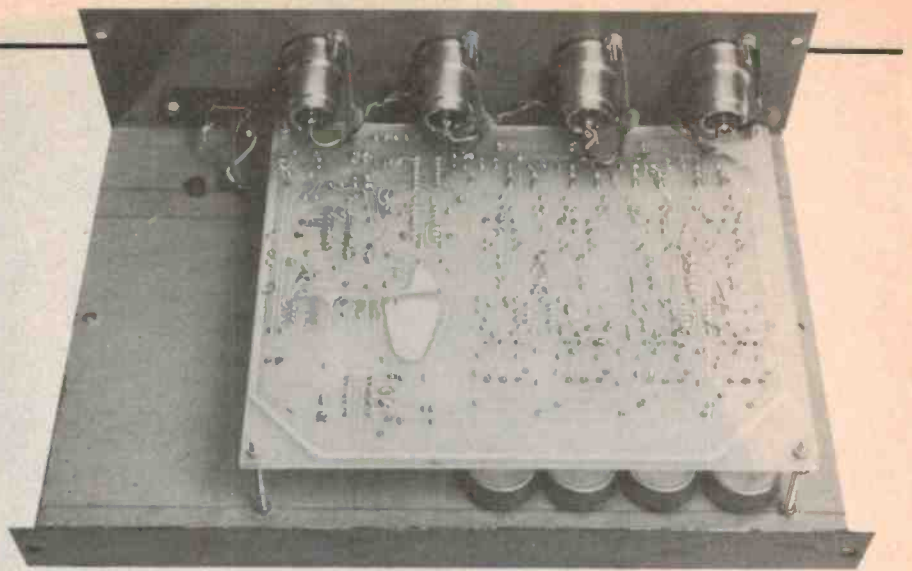
Start with the power supply board. The Ferguson PL30/5VA transformer is a pc board mounting type. This should be soldered in first. Make sure the solder joints on this are secure and that the transformer is flush against the board. Next solder in all the capacitors and the resistor. Make sure you put the caps in the correct way round. The four diodes and two regulator ICs can go in next. Once again these must be put in the correct way round. To finish off, solder 120 mm lengths of hookup wire to the LED output. The LED should then be soldered on to flying leads making sure that you get it the correct way round. The legs of the LED should be cut reasonably short and insulated with spaghetti to ensure that they will not contact anything or short out. Also, sol- ▶



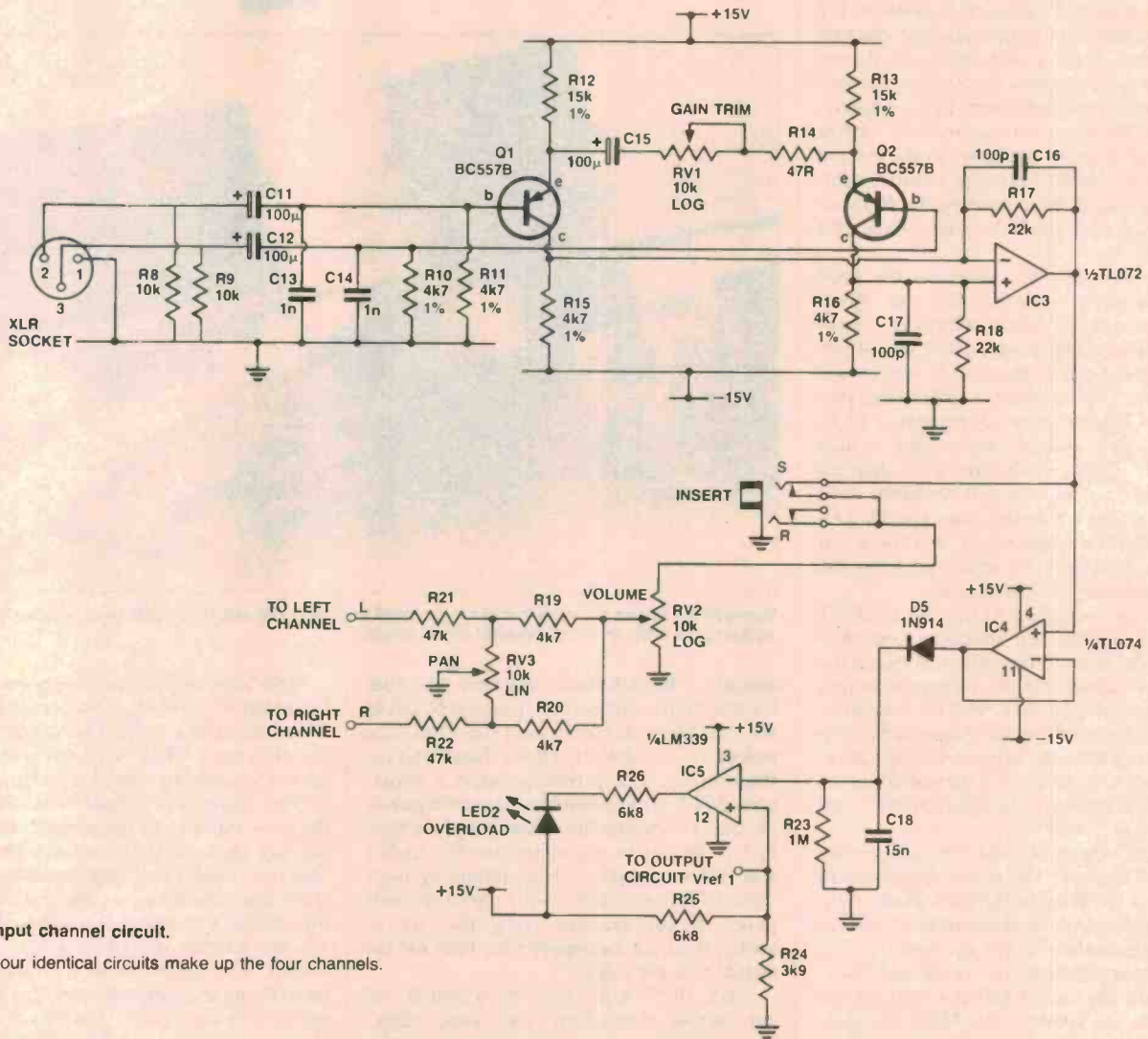
# Project 1404

der 100 mm lengths of heavy duty, insulated mains wire to the 240 Vac input points. To be extra safe it is a good idea to insulate the exposed solder joints and copper tracks on the mains side of the transformer with silicon compound (Silastic). This will prevent any loose bits of solder or metal from contacting the mains.

Now to the main board. Before soldering anything give the copper side of the board a thorough check to make sure there are no shorted or broken tracks. If everything is OK then locate and solder in all the wire links. The four long links in the centre of the board carry the supply rails and should be insulated. The other links can be made from tinned copper wire. Next solder in all the resistors and capacitors making sure



The completed IId, showing the position of the board and input and output sockets. The insert sockets should be mounted in the spaces between the XLR connectors. Note the 100n ceramic capacitors connected between the earth pin (pin 1) and the chassis on each side of the XLR connectors.

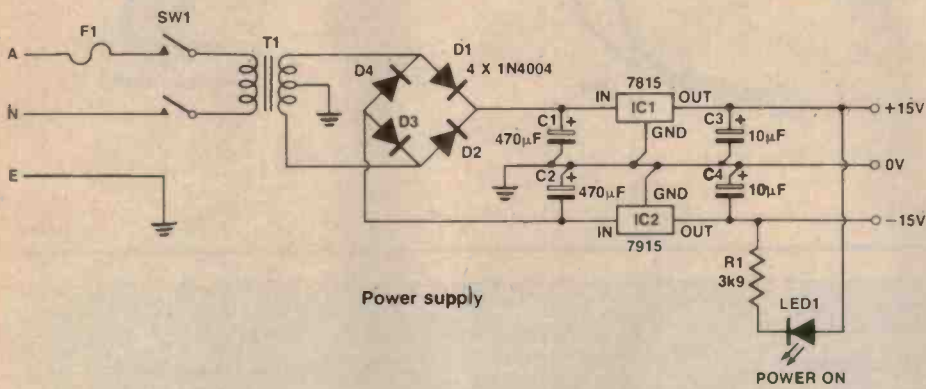
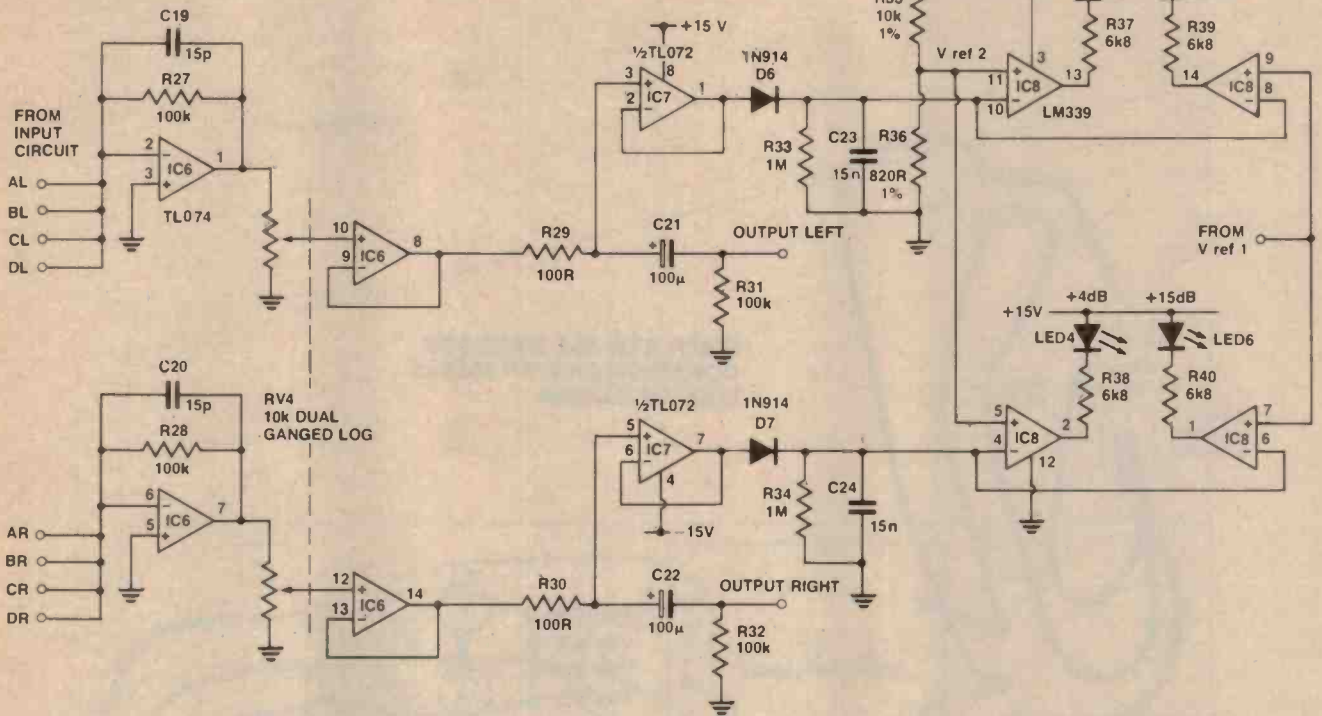


Input channel circuit.

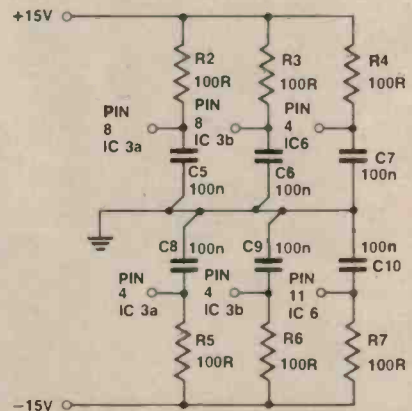
Four identical circuits make up the four channels.



Mixing and output circuitry.

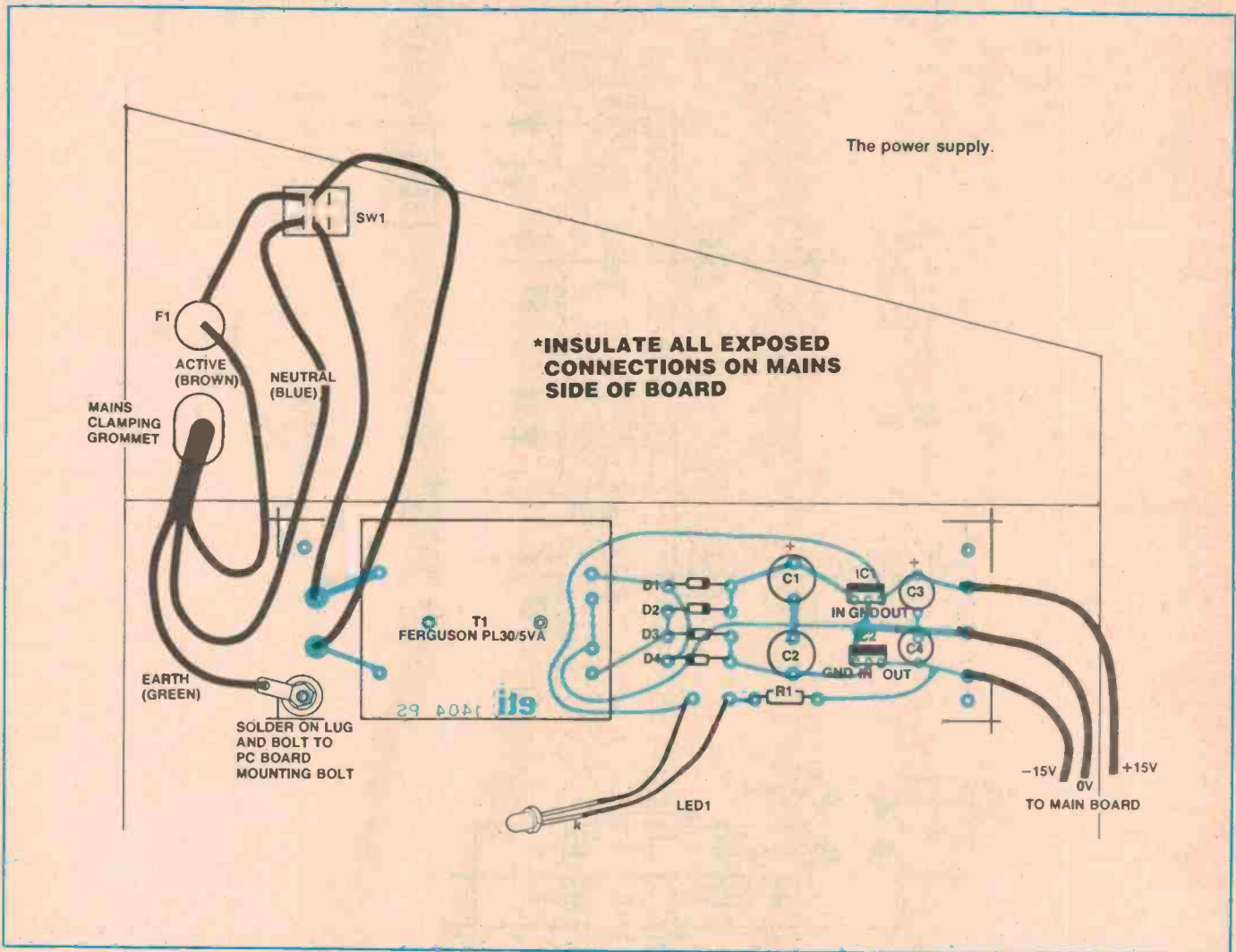


Power supply



Noise decoupling for the ICs in the signal line.





## PARTS LIST — ETI-1404

Resistors ..... all 1/4 W, 5% unless noted

R1, 24	.....3k9	
R2, 3, 4, 5, 6, 7,	29, 30	.....100R
R25	.....6k8	
R27, 28, R31, 32	.....100k	
R33, 34	.....1M	
R35	.....10k 1%	
R36	.....820R 1%	
R37, 38, 39, 40	.....6k8	
RV4	.....10k dual ganged log pot	

For a complete mixer, four of each of the resistors listed below are needed:

R8, 9	.....10k
R10, 11, 15, 16	.....4k7 1%
R12, 13	.....15k 1%
R14	.....47R
R17, 18	.....22k
R19, 20	.....4k7
R21, 22	.....47k
R23	.....1M
R26	.....6k8
RV1, 2	.....10k log
RV3	.....10k lin

### Capacitors

C1, 2	.....470µ, 50 V RB electro
C3, 4	.....10µ, 35 V tantalum
C5, 6, 7, 8, 9, 10	.....100n ceramic bypass
C19, 20	.....15p ceramic
C21, 22	.....100µ 25 V RB electro
C23, 24	.....15n greencap

For a complete mixer, four of each of the capacitors listed below is needed:

C11, 12, 15	.....100µ, 25 V RB electro
C13, 14	.....1n ceramic
C16, 17	.....100p ceramic
C18	.....15n greencap

### Semiconductors

IC1	.....7815 regulator
IC2	.....7915 regulator
IC3A, 3B, 7	.....TL072
IC4, 6	.....TL074
IC5, 8	.....LM339
D1, 2, 3, 4	.....IN4004 or similar
D6, 7	.....IN914 or similar
LED1, 5, 6	.....5 mm red LED
LED3, 4	.....5 mm yellow LED

For a complete mixer, four of each of the

semiconductors listed below is needed:

D5	.....IN914
LED2	.....5 mm red LED

### Miscellaneous

T1 ..... Ferguson PL30/5VA  
 SW1 ..... miniature 240 V, 3 A rocker  
 4 x 3 pin XLR panel mount female sockets; 4 x 6 mm switched insulated stereo sockets; two-way RCA panel mount socket; 2AG panel mount fuse holder; 100 mA 2AG fuse; 8 x 5 mm LED mounting grommets; 13 plastic push-on knobs and inserts; mains clamping grommet; mains flex and plug; 4 x 5 mm long 6BA countersunk bolts; 4 x 25 mm long 6BA bolts; 20 x 6BA bolts and washers; 4 x 6 mm stand off spacers; 3 m of 24 gauge tinned copper wire; assorted hookup wire (three colours); ETI-1404 and ETI-1404PS pc boards; Scotchcal front and back panels; slope-front metal case (W 265 mm, L 200 mm, FH 32 mm, RH 82 mm) such as Tandy type 270-266.

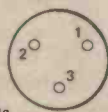
Price estimate: \$140



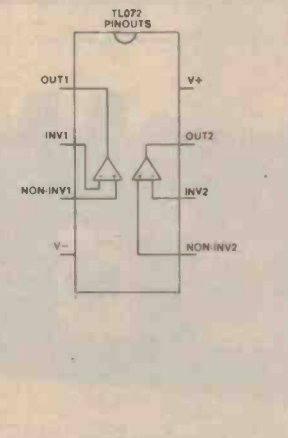
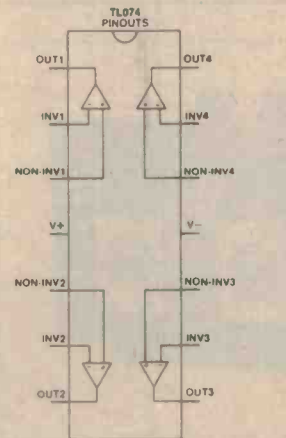
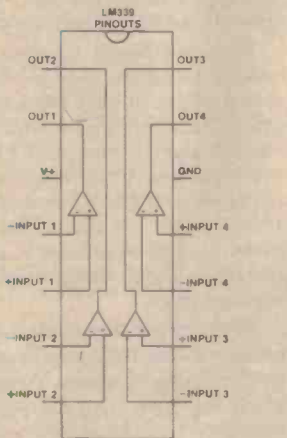
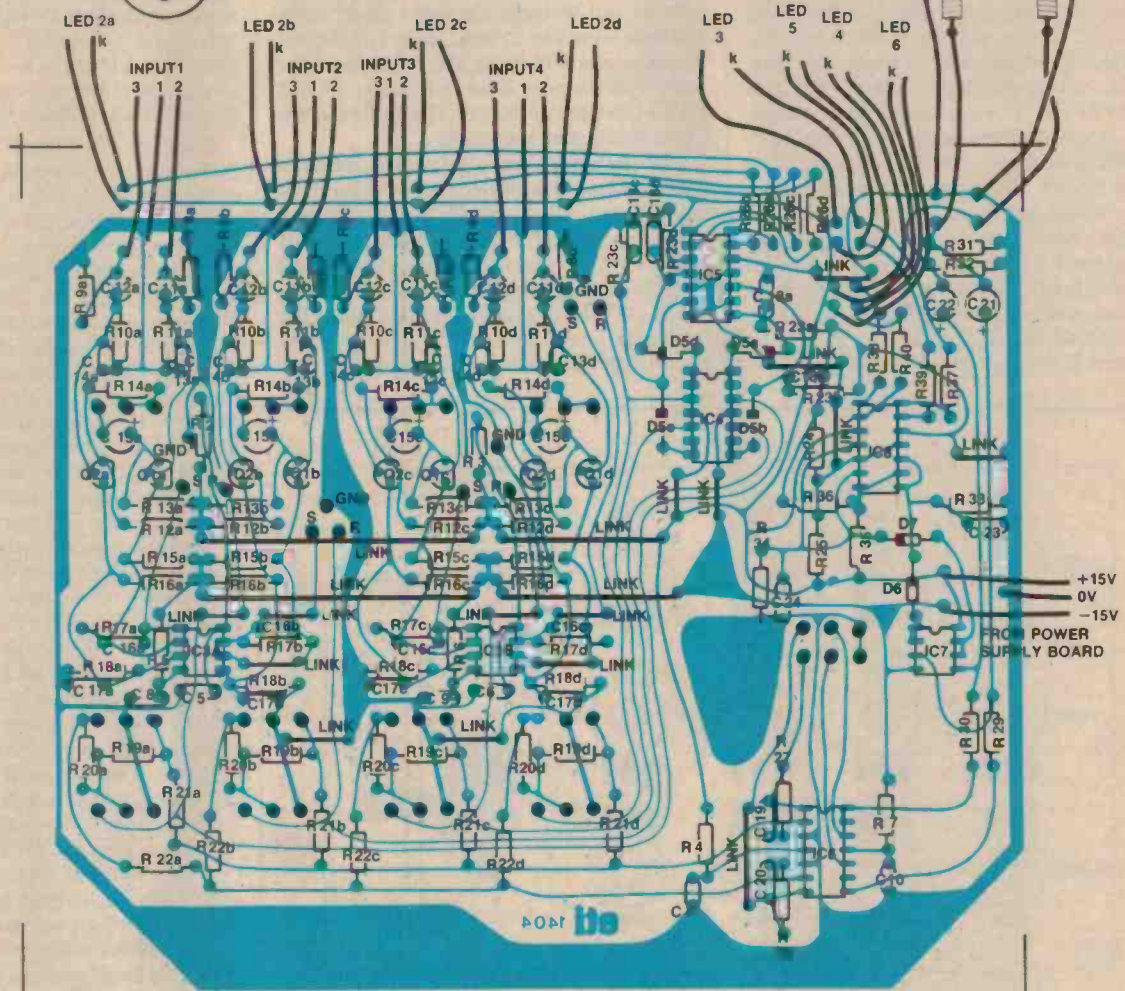
INSERT SOCKET (BACK VIEW)



INPUT SOCKET



LEFT OUTPUT RIGHT OUTPUT





that the electrolytic capacitors are put in the right way round. The transistors, diodes and ICs can then be soldered in taking very special care to get these the correct way round. For the next step you will need some long lengths of hookup wire. Three different colours will enable you to colour-code the flying leads and save a lot of headaches tracing the wiring later on. Solder 100 mm lengths of wire to each of the input points. Each group of three input lines (positive, negative and earth) should be braided together. Solder 150 mm lengths of wire to the power supply input points and braid these together. Attach 60 mm lengths of wire to each of the LED lines. Attach the LEDs to the flying leads. Make sure you put them on the correct way round. If inserts are being used then solder 120 mm lengths of wire to the insert points and braid each group. This

completes the pc board construction for now. The pots will be attached later when the board is mounted.

The pc board is mounted on four 45 mm long, 6BA, countersunk bolts. These should now be put through the front panel holes and nuts attached to hold them in position. Another nut should be put on each of the bolts and screwed down till it sits 30 mm above the back of the lid. The pc board will sit on these nuts eventually.

The prototype case had a grey coloured lid. I sprayed it with matt black paint to fit in with the black Scotchcal front panel. After the paint dries thoroughly, put on the Scotchcal front panel carefully. This is best done by drilling pilot holes in the Scotchcal, peeling off the backing paper and laying the Scotchcal face down (sticky side up) on a flat surface. The lid can then be positioned

carefully above the Scotchcal and the holes in the lid lined up with the pilot holes. When the lid is lined up carefully lower it onto the Scotchcal and press down firmly. The Scotchcal should stick to the lid. The same can be done for the back panel Scotchcal if you are using it. The holes in the Scotchcal can be cut out with a sharp scalpel or a reamer. Be very careful not to tear the Scotchcal when doing this.

Now the fun begins! To mount the pots and board you will need a little preparation, some dexterity, and a good pair of long-nose pliers. First, cut a length of 24 gauge tinned copper wire into 70 mm lengths (42 in all) and solder them to the pot lugs. These will form the mounting legs of the pots. You can then insert these pot legs into the appropriate holes in the pc board (get them the right way round) but do not solder them yet. Splay the legs on the reverse side of the board so that the pots won't fall out when you turn the board upside down. Get the lid of the box and rest it face down on a couple of blocks of wood (or whatever) in such a way that you can get at both sides of it, and the holes for the pots are clear to allow the pots to poke through. Turn the pc board upside down and position it above the mounting bolts. Use the long-nosed pliers to get all the pots into the holes, and as you do, reach under the lid and loosely screw on the washers and nuts to keep the pots from coming out again. Once all the pots are in, start lowering the pc board onto the mounting bolts. You will need to pull the pot legs through as you lower the board to prevent the legs bending between the board and the lid. When you get the board down to the stop nuts secure it there with the remaining nuts. Turn the lid over and begin tightening the pot nuts. You will have to try to hold the back of the pot while you are tightening it to prevent it from turning. Make sure that the legs are straight and not shorting against anything between the board and the lid. When all the pots are tight, flip the lid over and solder all the pot legs to the board and trim off the excess lead length.

With the board in place you can now mount the LEDs. You will need your long-nosed pliers to grip the LED and push it into the mounting grommet. Be sure to get the left and right output LEDs in their correct positions. Don't forget to slip the locking rings over the LEDs before you mount them. After all the LEDs are mounted make a quick visual check that the legs of the LEDs aren't shorted together or touching anything.

Next, mount the input, output and insert sockets on the back panel and wire them according to the diagram. You should have already soldered flying leads onto the pc board so it should just be a matter of hooking them up. A 100n ceramic capacitor should be soldered to the earth pin of each

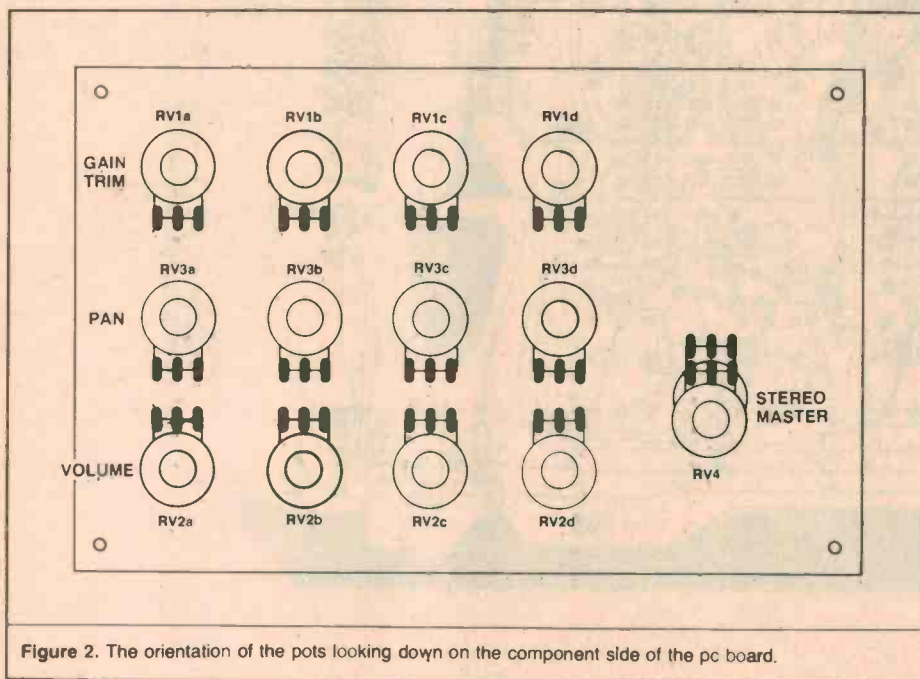
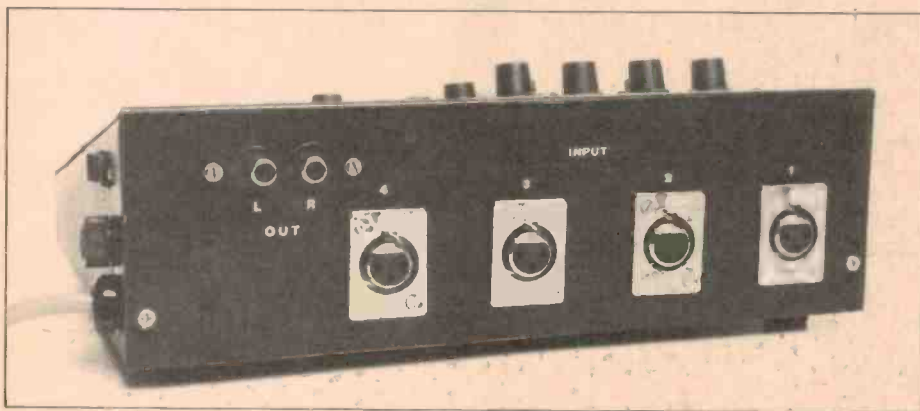


Figure 2. The orientation of the pots looking down on the component side of the pc board.



What's behind the mixer? This picture shows the general back panel layout. Note the position of the mains cord, fuse and switch.



## dBm

In the article several references are made to a thing called dBm. As some of you may already know this is a measurement of relative power quite commonly used in the audio field. It is calculated in the same way as a normal dB power ratio except that the reference used is 1 mW of power into a 600 ohm load resistance. Thus 0 dBm is 1 mW of power into a 600 ohm or 0.77 Vrms across a 600 ohm load since:

$$P = \frac{V^2}{R} \text{ therefore } V = \sqrt{PR} = 0.77 \text{ V}$$

The indicators on the mixer are set at +4 and +15 dBm respectively. As a voltage this becomes:

$$+15 \text{ dBm} = 10 \log_{10} \left\{ \frac{V^2}{600} \right\} \frac{1 \text{ mW}}{1 \text{ mW}}$$

Therefore  $V = 4.36 \text{ Vrms} = 6.1 \text{ V}_{\text{peak}}$ ; similarly  
 $+4 \text{ dBm} = 1.23 \text{ Vrms} = 1.74 \text{ V}_{\text{peak}}$

input jack (pin 1 on the XLRs) and then connected to the chassis. This should be the only connection between signal earth and mains earth loop when the mixer is connected to another piece of equipment.

The mains wiring is next. Strip the outside of the end of the mains flex for about 100 mm. Insert this end through the hole in the side of the box and clamp it with a clamping grommet. The fuse holder and switch can then be mounted. Wire up the fuse holder and switch according to the wiring diagram. All exposed connections should be insulated with spaghetti. The mounting bolts for the power supply board should be put through the bottom of the box and secured with bolts. A solder lug is attached to the earth wire of the mains flex and should be secured by one of the nuts. Make sure there is a bit of slack on the earth wire so that if the mains cord is pulled out the earth strap will be the last to break. By putting the lid next to the bottom, there should be enough flying lead from the power input to the main board to connect to the power supply board and allow the board to be bolted down to the floor of the box. Use 6 mm stand off spacers to mount the power supply board. Be careful to get the connections for the positive, negative and ground rails correct. Also, complete the mains wiring by attaching the flying leads for the active and neutral on the board to the switch. The POWER ON LED should be mounted into the lid of the box. Once you have checked all your wiring (double check the mains wiring) the unit can be tested.

With the lid still off (it should be sitting face down next to the bottom panel) put a 100 mA fuse in the fuse holder. Make sure that the gain trim is set to LINE and the STEREO MASTER is down. The mixer can then be plugged in. Briefly turn on the power switch and check that the POWER ON LED is lit. If there are no strange happenings (explosions, arcs, sparks and the

## HOW IT WORKS

Looking at the input circuit diagram, Q1 and Q2 form a differential amplifier. When RV1 is set to zero resistance, the emitters of Q1 and Q2 are effectively coupled together for ac small signals. The differential gain will be approximately 100 determined by the collector load resistors, R15 and R16. The dc bias current through each transistor is about 1 mA. When RV1 is increased the emitters are progressively decoupled and the gain falls. C13, C14 and R10, R11 provide input filtering of high frequencies.

The transistor stage is followed by a differential op-amp stage formed by half of IC3. The gain is given by R17/R16 (4.7). C16 and C17 provide high frequency stability.

RV2 is the channel volume control and acts as a simple attenuator. The output from this is fed to the pan circuitry. The signal is split and fed to an attenuation network formed by R19, R20 and RV3. The wiper of RV3 is grounded so that when the pot is at one of its travel limits one of the fixed resistors is grounded. This means that no signal travels through on this grounded side but the signal on the other side passes through unattenuated. If the pot travel is reversed, the side that passes the signal will be reversed. By varying the position of RV3 the amount of signal going to the left and right channels can be varied.

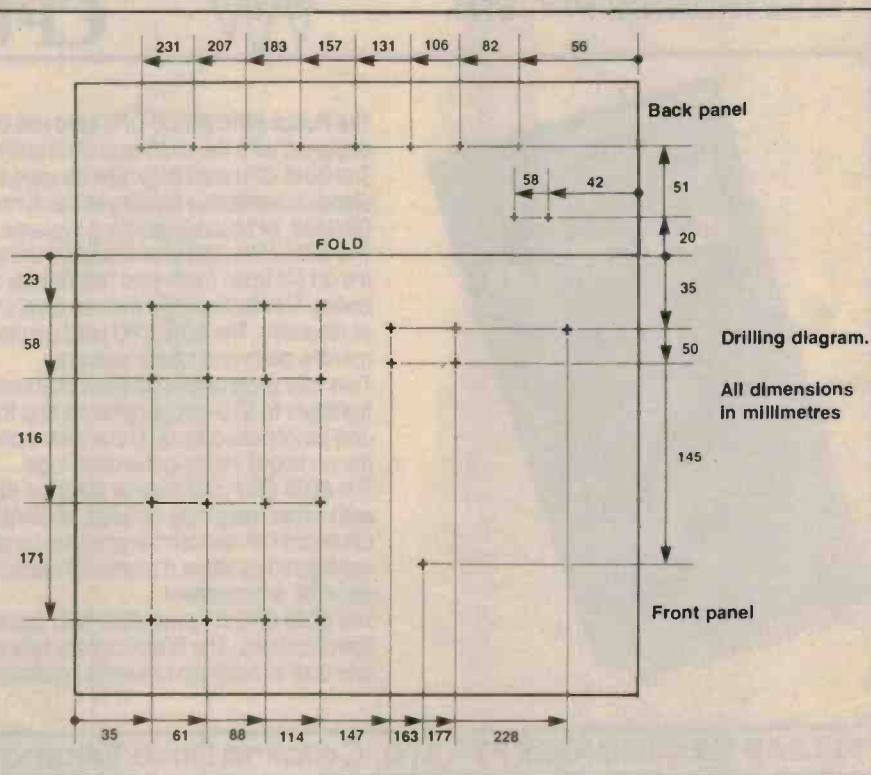
Just prior to RV2, the signal is monitored by an overload indicator formed by 1/4 of IC5 (a quad comparator). IC5 is configured as a comparator with a reference voltage on the non-inverting input. The reference is derived by dividing down the positive supply rail with R24 and R25 to about 5.5 V. The non-inverting input is driven by the signal in the channel. When the signal exceeds 6.1 volts (the reference voltage plus the diode drop of D5) the comparator output swings low turning on the LED. The output of the

LM339 is open collector and can sink about 5 mA. R26 limits the current to about 2 mA. D5, R23 and C18 act as a peak detector to drive the comparator and IC4 buffers the indicator circuitry from the signal line.

If we now look at the output circuitry, the left and right signals from each channel are fed via 47k resistors to the summing nodes of the left and right summing amps formed by two of the amps in a TL074 quad op-amp (IC6). The input from each input channel is summed equally with a gain of 2.1 set by the feedback resistors, R27 and R28. The summed outputs are fed to the stereo master volume control formed by the dual ganged pot, RV4, which acts as a simple attenuator. The remaining two op-amps in IC6 are configured as buffers to buffer the pot from the output. R29 and R30 decouple the op-amps from any capacitive loading on the output and the output is ac coupled by C21, C22, R31 and R32.

The remaining circuitry forms a two stage level indicator for the left and right inputs. This works in an identical manner to the overload indication on each channel except that an extra comparator and associated circuitry has been added to both sides to give a +4 dBm indication as well as the +15 dBm overload indication.

The power supply is a standard split rail supply using two, three terminal regulators, IC1 and IC2. Diodes D1, 2, 3, 4 full-wave rectify the output from the transformer and this is then filtered by C1 and C2 to give the unregulated input to IC1 and IC2. Capacitors C3 and C4 ensure stability of the regulators. LED1 indicates that the power is on and R1 limits the current in the LED to about 8 mA. Noise decoupling of the power supply to the op-amps in the signal line is provided by R2, 3, 4, 5, 6, 7 and C5, 6, 7, 8, 9, 10.



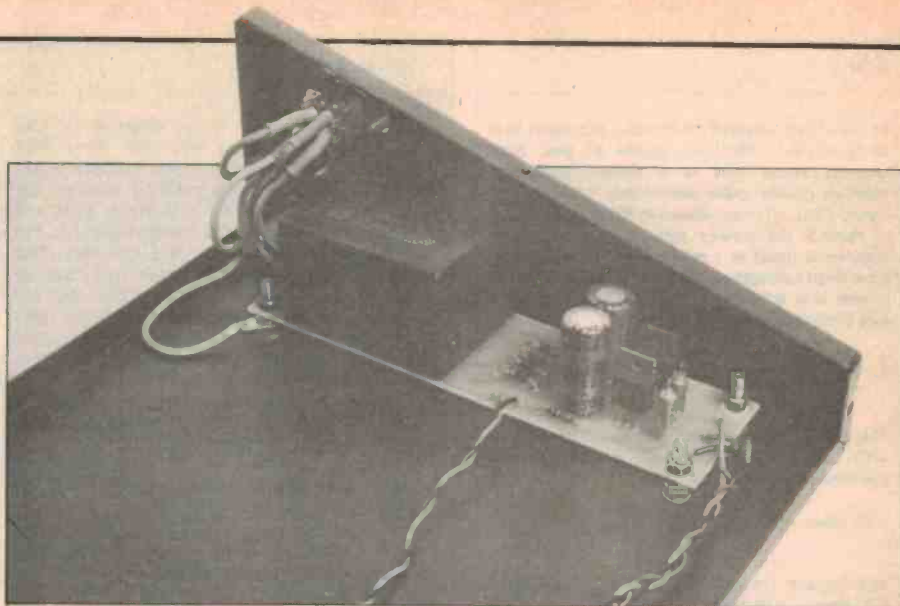


## Project 1404

like) then switch off and re-assemble the lid to the bottom panel. Switch on again and check that none of the OVERLOAD LEDs is lit. Turn the GAIN TRIM controls to MIC. If any of the overload LEDs light then the input may be oscillating or going dc. Turn off and check the power supply to all the ICs and make sure you have not made a mistake in wiring or board construction. If all is well then plug a microphone into an input and yell! With the GAIN TRIM set to MIC you should be able to overload the input and see the overload LED come on. If you have a signal generator and CRO then you can easily verify the operation of the circuit.

### Using it

The mixer is very simple to use. Plug some microphones or other signal sources in to the input and plug the output into a tape deck or amp. The inputs can accept signals up to about a volt in magnitude so keyboards or the outputs from tape decks can be put in directly. To set the mixer levels up you should initially set the volume and stereo master controls to about "7". ("7", "8" and "9" are reversed out on the front panel to make them easy to find.) The GAIN TRIM can then be used to set the



The power supply. The earth wire of the mains is secured by the mounting bolt of the pc board. Don't forget to insulate the fuse holder and switch connections.

input sensitivity at a point where it will drive the output to +4 dBm without overloading the input. The channel volume controls can then be adjusted to get the desired channel mix. When using the GAIN TRIM controls it should be remembered that the maximum system gain occurs when the control is in the MIC position.

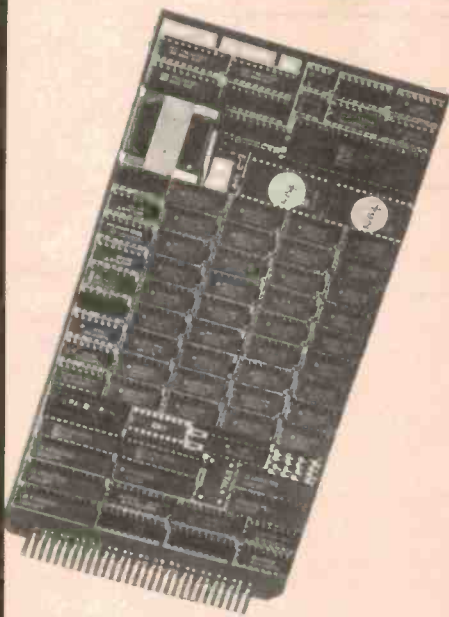
Remember that the input is designed to

accept balanced signals so if you are using a single ended input then the negative input of the channel must be connected to ground. This is usually done in the plug that goes into the input and not in the mixer itself. Also, if you are not using an input channel then turn the volume on this channel down. This will stop any noise on the channel getting through. ●

# PULSAR

ELECTRONICS PTY. LTD.

## 80186 8MHz CPU CARD-6016



The Pulsar 6016 80186 CPU card has been designed with the multi-user environment in mind. The 6016 CPU card may also be used as a stand-alone device running either Turbodos V1.4, CP/M86, or MSdos operating systems. The 6016 CPU card was designed using state of the art Mil Spec multi-wire technology circuit board. This technology ensures a very high degree of reliability. The 6016 CPU card carries a full 12 months parts and labour warranty. Two fully programmable DMA channels handle transfers to STD bus peripherals and the parallel and serial networks. STD bus Interrupts can use the on board vector generation logic. The 6016 CPU card may be supplied ex factory with either megabyte or 256k of DRAM on board. On board DIP switches enable the card to be configured as either a master or slave in the network environment. The 6016 CPU card meets all STD bus electrical specifications. The 80186 card is fully designed and built in Australia to exacting tolerances.

#### BUS INTERFACE:

—STD bus

#### EXTERNAL CONNECTIONS:

—2 x RS232 ports  
—1 x RS485 LAN port

#### DIMENSIONS:

—114.3 mm (4.5in) width by  
—221 mm (8.75in) length

#### POWER REQUIREMENT:

—3 amp at 5 volts  
—100 mA  $\pm$  12 volts

#### OPERATING ENVIRONMENT:

—0°–70°

#### BUS DATA TRANSFER RATE:

—12 Mb/second

#### DMA:

—2 fully programmable  
—3 counter timers

#### RAM AVAILABLE:

—256k minimum  
—1 Megabyte max

#### CLOCK RATE:

—8 MHz

#### SERIAL PORTS SPEED:

—50 baud min  
—34.4k baud max supporting A-sync,  
B-sync, SDLC, HDLC and other bit  
protocols

#### prom available:

—4k min  
—8k max

#### LAN TRANSFER RATE:

—1.5 Mb/second  
—max drive distance 4000 metres

#### INTERRUPTS:

—completely programmable

PULSAR ELECTRONICS PTY. LTD. Catalina Drive Tullamarine. 3043. (03) 330 2555



# INTELLIGENT DOOR CONTROLLER

S. K. Hui

Always forgetting your keys? If the answer's 'yes', this project will open doors for you. It's a pushbutton door locking device that operates on an interactive code system just like your bank Handycard or Cashcard. There's a catch, though — you'll have to remember the 4-digit code!

IT'S ALWAYS INCONVENIENT to be locked out. And it's happened to most of us at one time or another. We've probably all had the experience of coming home on a

freezing cold, rainy night to find we've forgotten our keys. Or perhaps we've remembered the keys but had to stand there fumbling to find the right key, using the



Cables and wires are brought out at the rear of the box.

A 4 X 4 matrix membrane keypad with the LED display mounted next to the door.

wrong one, and all the time the rain keeps pouring down. Or perhaps, like me, you just don't like carrying around a lot of heavy jingling keys.

But whatever gripes we have about keys, we can't really live peacefully without the security of the key/lock system. Few of us can have peace of mind after leaving the house if we haven't locked it with a key. Things like keyfinders, keyrings, buckles, etc have been made to ease the problems with keys but they are only half measures. You still have to carry the keys (plus the finders!) around with you, and remember them too! The solution to the key problem, of course, lies in the ETI-1528 Intelligent Door Controller.

This intelligent door controller integrates the doorbell, locking action, interactive codes and alarm protection into one system. And the door locking and memory of the code are power-fail safe.

By now you may be thinking that this is just another combination lock project. But read on! As the name implies, this controller has great versatility which makes it very different from anything else. In fact, it works so well that we have installed one ourselves.

The unit can be used either as a stand alone door lock with self-protecting ability or hooked up to your existing house alarm. In the latter case, the unit becomes a detector in the sensing loop of your house alarm system. You are then spared the cost of an extra backup battery and a siren horn.

The design of this controller could have been approached by using a CPU and a ROM. This approach would require EPROM programming and software debugging. To a lot of hobbyists, this is a problem. The design of this circuit is therefore based on simple logic gates and flipflops only. No software is needed, the circuit is under 100% hardware control and can be constructed quite easily at home with simple tools.

Curious readers may wonder what the chances are of an intruder getting the code right. Since there are 13 possible keys to choose from (0-9, ●▼■), the chance of getting the entry code right the first time is 1 out of 13x13x13x13. Furthermore, getting the code right before the alarm triggers is less than 4 in 28561. And there's not a ▶



chance of changing the codes without a complete knowledge of the old ones!

## Principle of the circuit

The ETI-1528 interfaces several external devices through its output relays. Their relationships are best illustrated in a diagram (see Figure 1). The keypad is a 4 x 4 matrix membrane type which is weather-proof. It is usually mounted on the wall next to the door or on the door. Any key pressed will be scanned by the circuit. If the input combination is correctly entered, a 12 V supply will be connected to the strike and a disabling signal sent to stop the siren horn (in case it had been triggered). The energized strike would allow the door to be pushed open without the use of a key. There are other types of electric strikes which operate in an opposite way. (See the Electric Strike box for further explanations and photographic illustrations.)

What if someone tries to fiddle with the keypad until the door opens? Well, as I mentioned before, the controller is self protecting. Every key pressed will be counted (except the door bell key). An accumulation of 16 counts will trigger the siren or your house alarm system. The count can always be cleared if the entry code is entered correctly.

As well, there is a time delay of about two seconds between each key pressed. Pressing key 'C' will inhibit this timing delay. As soon as any other key is pressed, the timing will start. Pressing the correct digit will reset the timing for another two seconds. Pressing the wrong digit will not reset the timing. After two seconds the system gets reset automatically. In such a case I am afraid you have to restart everything from the beginning by pressing 'C' again and then pressing the four entry code digits to open the door.

A doorbell facility is also incorporated in the keypad of the controller, eliminating the need for any other pushbutton on the door which could look messy. This facility is simply a special key.

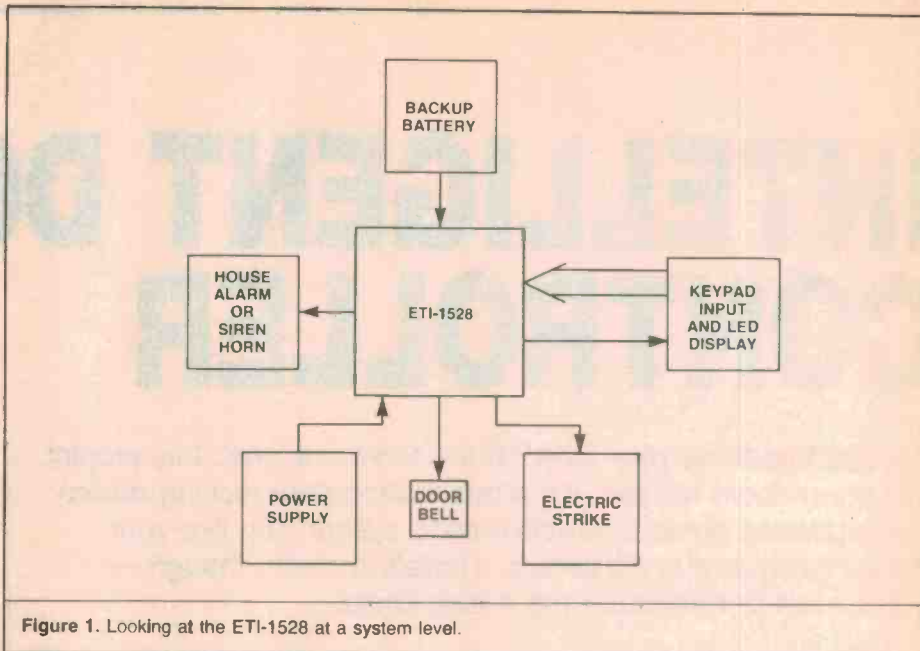


Figure 1. Looking at the ETI-1528 at a system level.

Together with the keypad, a small LED is mounted on the door. This LED will flash in different ways to indicate different conditions of the controller.

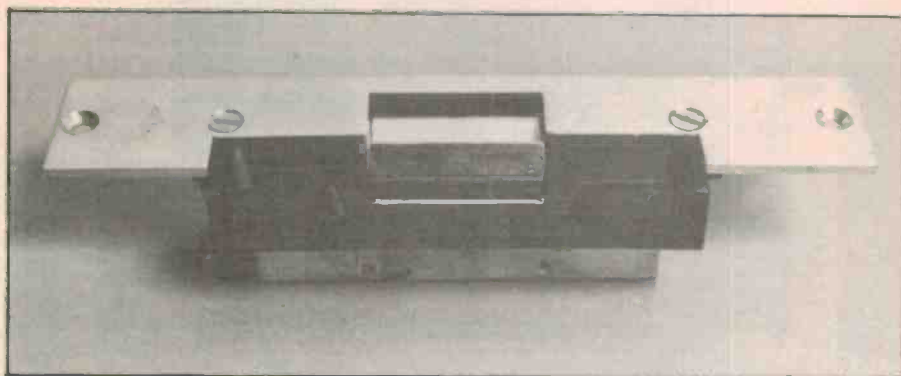
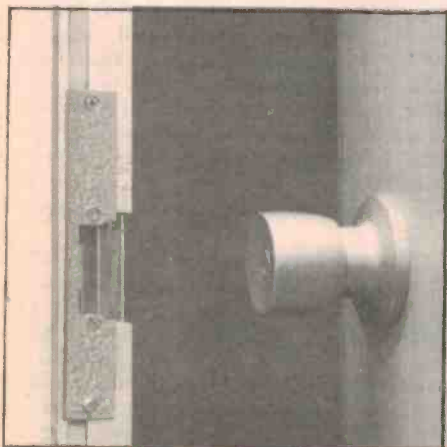
All in all, the operation of the ETI-1528 can be summarized briefly as follows:

1. A four-digit entry code is required. The right code will energize the strike and the LED is turned off for a few seconds to indicate that the door is unlocked. In addition, the input key counter is cleared and the alarm section is paralyzed.
2. If you want to change the codes, seven digits have to be keyed in correctly. The first three digits form the control code and the other four digits the entry code. You are then able to change the code, which is signalled by the controller through flashing of the LED. This arrangement prevents someone who knows how to get in the house changing the codes.
3. In case of power failure, the backup battery will be switched on automatically to keep the codes stored in the memory and the rest of the circuit running. Enough for the system level, now it's time

for us to get down to the nitty gritty. As you can see in Figure 2, the input command key selector (ICKS) will pick up the command key pressed. There are three reserved command keys on the keypad. They are 'C', 'S', and 'A' as shown in the photograph. As the letters imply, pressing key 'C' will cause the ICKS to set the clear line, key 'S' is for setting the set line and the 'A' key is for the bell line. A strobe pulse is also generated whenever a key is pressed (no matter what key it is). These four signals control the vital behaviour of the circuit.

The input key counter (IKC) is preset to 16 whenever the codes have been entered correctly. The clock for this counter is derived from the strobing pulse. Each time a key is pressed, the strobing pulse will cause the counter to decrement by 1. When the doorbell key is pressed, however, the active bell line generated from the ICKS will stop the counter from decrementing. So pressing the 'A' on the keypad will have no effect on the IKC. When the IKC reaches zero count, a pulse is generated to trigger the alarm section.

The alarm section is very simple, yet flex-



One of the many high security electric strikes available.

◁ The relationship between the doorlock and the electric strike.



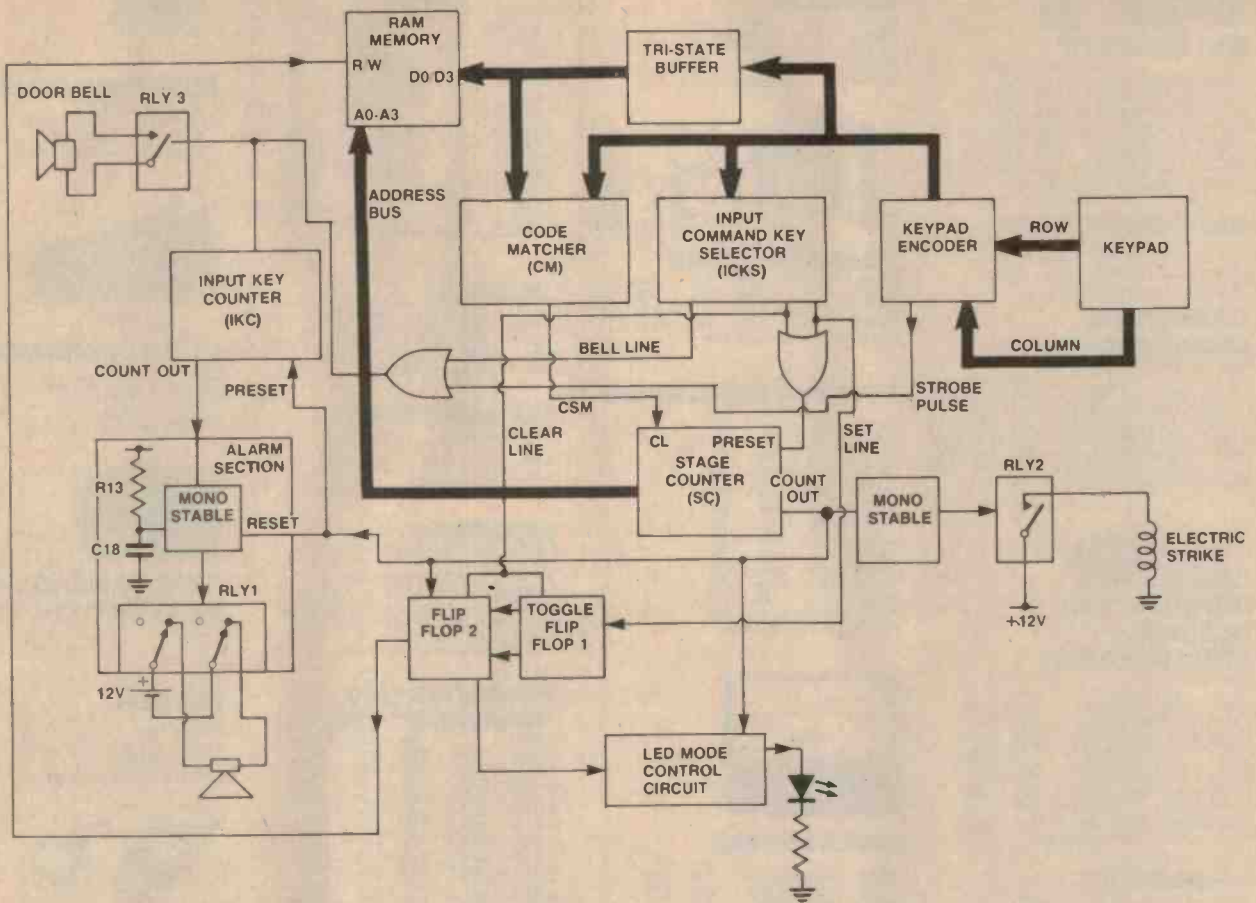


Figure 2. Block diagram.

ible. It consists of a monostable and a DPDT relay. The pulse generated by IKC triggers the monostable. The monostable sends out a timing pulse about two minutes long (the exact period depends on the values of C17 and R13). During the period the alarm relay (RL1) is ON, it is up to you to connect anything you like to it. One option would be to connect the backup battery and the siren horn to the relay, so that when the relay is ON the battery is connected to the horn. However, for anyone who already has a house alarm system installed a more economical way is possible, the wiring of which is shown in Figure 3. At the end of the two minutes, the timing pulse stops and the monostable resets itself, turning the relay to OFF.

The timing pulse can also be terminated earlier if the entry code is entered. If the relay (RL1) is hooked up to your house alarm as a detecting element in the sensing loop, turning off the relay (RL1) will not stop your house alarm from going off. You will have to use your alarm key to switch it off. One very ambitious option is to connect the relay to an auto-dialler and get a warning message sent across the phone system!

There are two sets of inputs to the code

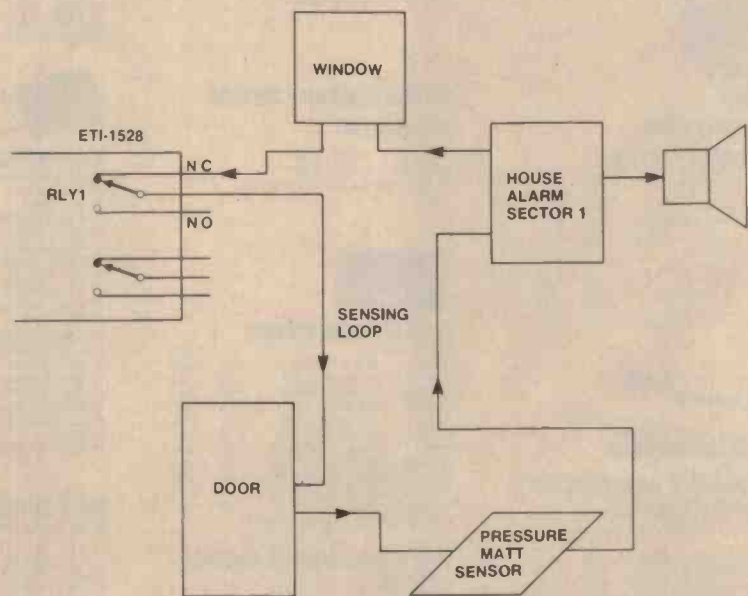


Figure 3. Wiring of the door controller to house alarm system.





### IDC SOCKETS

	1-9	10+	100+
P12100 10 Pin Socket	1.95	1.75	1.25
P12101 16 Pin Socket	2.25	2.05	1.65
P12102 20 Pin Socket	2.45	2.25	1.90
P12104 26 Pin Socket	2.65	2.45	2.00
P12106 34 Pin Socket	2.75	2.55	2.15
P12108 40 Pin Socket	2.95	2.75	2.25
P12110 50 Pin Socket	3.50	2.95	2.50

Plus 20% Sales Tax where applicable

### IDC CONNECTORS

	1-99	100+
P12114 14 Pin Dip Plug	0.60	0.50
P12115 16 Pin Dip Plug	0.65	0.55

Plus 20% tax where applicable

### CARD EDGE CONNECTORS

Edge Connectors to Disk Drives Etc.

	10-24	25-99	100+
P12060 10 Way Card Edge Con	2.95	2.50	2.10
P12062 20 Way Card Edge Con	3.25	2.75	1.95
P12064 26 Way Card Edge Con	3.55	2.95	2.30
P12066 34 Way Card Edge Con	3.95	3.50	2.30
P12068 40 Way Card Edge Con	4.50	3.90	3.50
P12070 50 Way Card Edge Con	5.50	4.50	3.90

Plus 20% Sales Tax where applicable



### UNPROTECTED HEADERS STRIP HEADERS

Dual in Line 2.54mm

	1-9	10+
P12240 10 Way Unprot Header	1.25	1.10
P12245 15 Way Unprot Header	1.35	1.20
P12250 20 Way Unprot Header	1.45	1.25
P12256 26 Way Unprot Header	1.50	1.40
P12260 30 Way Unprot Header	1.75	1.65
P12264 34 Way Unprot Header	1.95	1.75
P12270 40 Way Unprot Header	2.25	1.95
P12275 50 Way Unprot Header	2.75	2.50
P12280 60 Way Unprot Header	2.95	2.75

Plus 20% Sales Tax where applicable

### R.A HEADERS

	1-9	10+
P12241 R.A. 10Way Unprot Head	1.45	1.30
P12247 R.A. 16Way Unprot Head	1.55	1.40
P12251 R.A. 20Way Unprot Head	1.65	1.45
P12257 R.A. 26Way Unprot Head	1.70	1.50
P12261 R.A. 30Way Unprot Head	1.95	1.85
P12265 R.A. 34Way Unprot Head	2.15	1.95
P12271 R.A. 40Way Unprot Head	2.45	2.15
P12276 R.A. 50Way Unprot Head	2.95	2.70
P12281 R.A. 60Way Unprot Head	3.15	2.95

Plus 20% Sales Tax where applicable



### COMPUTER CONNECTORS

Cat No.	Description	1-99	100+	1000+
P10900	DB25 Plug	1.30	1.20	1.00
P10901	DB25 Socket	1.40	1.30	1.20
P12210	Centronics Solder	3.50	3.15	3.00
P12200	Centronics Crimp	6.00	5.50	5.00
P10880	DB9 Plug	1.30	1.20	0.90
P10881	DB9 Socket	1.40	1.30	1.00
P10890	DB15 Plug	1.30	1.20	0.90
P10891	DB15 Socket	1.40	1.30	1.00
P10902	DB25 Cover	.80	.75	.70

Plus 20% tax where applicable

### CANNON TYPE AUDIO CONNECTORS

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	1-9	10+
3 Pin Line male Cat. P10960	1.60	1.50
3 Pin Chas male Cat. P10962	1.70	1.50
3 Pin Line female Cat. P10964	2.10	1.80
3 Pin Chas F.Male Cat. P10966	2.50	1.90

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### RCA CHASSIS MOUNT METAL

Cat No.	1-99	100+
P10231	0.16	0.13

Plus 32 1/2% tax where applicable

### RCA INSULATING SOCKETS

Cat No.	Desc.	1-99	100+
P10232	2 Way	0.25	0.21
P10234	4 Way	0.45	0.40
P10236	6 Way	0.75	0.60

Plus 32 1/2% tax where applicable



### TRANSFORMERS

Cat No.	1-99	100+	1000+
M12851	2851	2.50	1.90
M12155	2155	4.80	3.70
M16672	6672	6.35	5.95

Plus 20% tax where applicable

### VOLTAGE REGULATORS

	10+	100+	1000+
7805UC	.45	.44	.43
7805KC	1.50	1.40	1.20
7812UC	.45	.44	.43
7815KC	1.50	1.40	1.20
7818UC	.50	.49	.48
7818KC	1.50	1.40	1.20
7905UC	.70	.60	.55
7912UC	.70	.60	.55
uA323KC	4.50	3.90	3.75
78H12	7.00	6.00	5.90
78HGKC	7.50	6.50	6.00
79HGKC	16.50	16.00	14.00
78P05	11.50	11.00	10.50
78P12	14.00	13.50	13.00

Plus 20% tax where applicable



### PANEL METERS

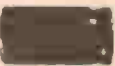
	1-9	10+
Q10500	MU45 0-1mA	5.95 5.75
Q10502	MU45 50-0.50uA	5.95 5.75
Q10504	MU45 0-100uA	5.95 5.75
Q10505	MU45 0-50uA	5.95 5.75
Q10510	MU45 0-5A	5.95 5.75
Q10518	MU45 0-1A	5.95 5.75
Q10520	MU45 0-20V	5.95 5.75
Q10535	MU45 VU	6.95 6.75
Q10530	MU52 0-1mA	7.95 7.35
Q10533	MU52 0-5mA	7.95 7.35
Q10538	MU65 0-50mA	9.35 8.95
Q10540	MU65 0-1mA	9.35 8.95
Q10550	MU65 0-100mA	9.35 8.95
Q10560	MU65 0-20V	9.35 8.95

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### SOLDERING IRON STANDS

Cat No.	1-99	100+
T113023	3.75	3.50

Plus 7 1/2% tax where applicable



### ELECTROLYTICS

Cat No.	Desc.	10+	100+
R1415	1uF 63V PCB RB	0.05 0.04	
R15461	10uF 16V PCB RB	0.05 0.04	
R15462	10uF 25V PCB RB	0.05 0.04	
R15482	22uF 25V PCB RB	0.06 0.05	
R15521	47uF 16V PCB RB	0.07 0.06	
R15522	47uF 25V PCB RB	0.08 0.07	
R15581	1000uF 16V PCB RB	0.21 0.20	
R15582	1000uF 25V PCB RB	0.28 0.25	
R15591	2200uF 16V PCB RB	0.39 0.33	
R15592	2200uF 25V PCB RB	0.55 0.50	
R15904	2200uF 50V AXIAL	1.50 1.00	

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### RG CAN TYPE WITH LUGS

	1-99	100+
R164585	8000uF 75V	6.00 5.80
R16587	10,000uF	7.00 6.50
	10+	100+
R15593	2200uF 35V RB	.70 .65
R15531	100uF 16V RB	.07 .06
R15465	10uF 63V RB	.07 .06
R15535	100uF 63V RB	.18 .17
R15532	100uF 25V RB	.08 .07

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### TRANSISTOR

	10-99	100+	10-99	100+
2SK149	3.90	3.70	2SK134	3.90 3.70
PN2222A	10 .08	PN2907A	10 .08	
PN3463	15 .13	PN3565	12 .11	
PN3566	15 .13	PN3567	10 .08	
PN3569	18 .16	PN3623	18 .16	
PN3640	18 .16	PN3641	10 .08	
PN3642	10 .08	PN3643	10 .08	
PN3644	15 .13	PN3645	15 .13	
PN4250A	15 .13	PN4355	16 .14	
PN4356	16 .14	MPSA42	23 .20	
MPSA43	23 .20	MPSA55	15 .14	
MPSA56	15 .14	MPSA92	22 .20	
MPSA93	22 .20			
BU126	1.50 1.25	BUX80	2.50 2.20	
BU208	2.50 2.20	2SD350	2.50 2.20	

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### BRIDGES

	10+	100+	1000+	10K+
6A 400V	1.00	0.80	0.75	0.69
W02	0.24	0.23	0.20	0.18
W04	0.25	0.24	0.21	0.19

Plus 20% tax where applicable

### SIP RESISTORS

	1-9	10+
Standard values.		
6 Pin	0.50	0.40
8 Pin	0.60	0.50
10 Pin	0.65	0.60

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PACKED \$5.25/1000	
TAPED AND BOXED \$5.25/1000	
\$5.00/1000 10K LOTS	
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\$12.00/1000 \$11.00/1000/10K LOT	
SUPPLY E24 VALUE	
Plus 32 1/2% tax where applicable	

### POLYESTER 100V "GREENCAP" TYPE

Cat No.	1-99	100+	1000+
R15137	.001uF	0.06	0.04 .036
R15137	.0012uF	0.06	0.04 .036
R15138	.0015uF	0.06	0.04 .036
R15140	.0022uF	0.06	0.04 .036
R15142	.0033uF	0.06	0.04 .036
R15143	.0039uF	0.06	0.04 .036
R15145	.0047uF	0.06	0.04 .036
R15146	.0056uF	0.06	0.04 .036
R15147	.0082uF	0.06	0.04 .036
R15148	01uF	0.07	0.05 .045
R15150	015uF	0.07	0.05 .045
R15152	022uF	0.07	0.05 .045
R15154	033uF	0.07	0.05 .045
R15155	039uF	0.07	0.05 .045
R15156	.047uF	0.08	0.06 .055
R15157	.056uF	0.08	0.06 .055
R15158	.068uF	0.08	0.06 .055
R15159	.082uF	0.08	0.07 .055
R15160	1uF	0.09	0.08 .07
R15162	15uF	0.11	0.10 .09
R15164	.22uF	0.15	0.14 .13
R15165	.27uF	0.16	0.15 .14
R15172	1uF	0.70	0.55 0.50
R15176	2.2uF	1.20	1.10
R15178	3.3uF	1.50	1.20

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### CRYSTALS

Cat No.	Frequency	Can	10+	100+	500+	1000+
Y11000	1MHz	HC33	5.50	4.75	4.50	4.00
Y11005	2MHz	HC33	2.25	1.95	1.85	1.70
Y11008	2.4575MHz	HC33	2.25	1.95	1.85	1.70
Y11015	3.57954MHz	HC18	1.20	90 .65 .60		
Y11020	4.000MHz	HC18	1.30	90 .75 .60		
Y11022	4.194304MHz	HC18	1.40	90 .75 .60		
Y11025	4.75MHz	HC18	1.40	90 .75 .60		
Y11026	4.9152MHz	HC18	1.40	90 .75 .60		
Y11042	6.144MHz	HC18	1.40	90 .75 .60		
Y11050	8.000MHz	HC18	1.40	90 .75 .60		
Y11055	8.867238MHz	HC18	1.40	90 .75 .60		
Y11070	12.000MHz	HC18	1.40	90 .75 .60		
Y11072	14.318MHz	HC18	1.40	90 .75 .60		
Y11080	16.000MHz	HC18	1.40	90 .75 .60		
Y11085	18.432MHz	HC18	1.40	90 .75 .60		
Y11090	20.000MHz	HC18	1.40	90 .75 .60		

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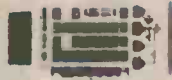
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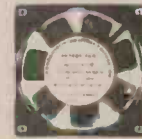
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W12625 25 Way 2.50 32.50 29.00 28.50 25.00  
W12626 26 Way 2.60 34.00 32.00 29.00 26.00  
W12634 34 Way 2.80 44.00 42.00 39.00 34.00  
W12636 36 Way 3.00 48.00 47.00 42.50 36.00  
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8226 1.90 1.70 1.50 1.00  
8253 3.90 3.70 3.50 3.00  
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7405 2K	74LS10 1K	74LS273 3K	7406 12K	74LS14 2K	74LS393 2K
7407 4K	74LS40 1K	UA774 4K	7416 2K	74LS74 12K	UA339 6K
7445 3K	74LS86 2K	1488 7K	7446 2K	74LS123 2K	1489 5K
7447 2K	74LS138 3K	7812UC 4K	7473 1.5K	74LS139 2K	7805UC 5K
7474 1.2K	74LS155 1K	UA555 4K			

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20 Pin .13 .12 11 10  
22 Pin .14 .13 .12 11  
24 Pin .15 .14 .13 .12  
28 Pin .19 .17 .15 .14  
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74F08	0.64	0.60	0.56	
74F10	0.64	0.60	0.56	
74F109	0.88	0.83	0.77	
74F11	0.64	0.60	0.56	
74F112	1.30	1.22	1.13	
74F113	1.30	1.22	1.13	
74F114	1.30	1.22	1.13	
74F138	1.50	1.41	1.32	
74F139	1.50	1.41	1.32	
74F148	1.39	1.31	1.22	
74F151	1.50	1.41	1.32	
74F153	1.50	1.41	1.32	
74F157	1.50	1.41	1.32	
74F158	1.50	1.41	1.32	
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74F240	2.98	2.79	2.60	0.56
74F241	2.43	2.28	2.13	
74F243	3.70	3.47	3.23	
74F244	2.98	2.79	2.60	
74F245	7.00	5.56	6.12	
74F251	1.64	1.54	1.43	
74F253	1.44	1.35	1.26	
74F257	1.60	1.50	1.40	
74F258	1.63	1.53	1.43	
74F280	1.34	1.26	1.18	
74F283	1.81	1.75	1.59	
74F299	6.94	6.51	6.08	
74F32	0.64	0.60	0.56	
74F322	5.80	5.43	5.07	
74F323	7.66	7.19	6.70	
74F350	3.00	2.81	2.62	
74F352	1.63	1.53	1.43	
74F353	1.63	1.53	1.43	
74F373	3.36	3.15	2.94	
74F374	3.36	3.15	2.94	
74F378	2.04	1.92	1.79	
74F379	2.14	2.01	1.87	
74F381	5.00	4.69	4.37	
74F382	5.20	4.82	4.55	
74F384	11.23	10.53	9.83	
74F385	9.82	9.21	8.60	
74F398	3.82	3.62	3.45	
74F399	2.33	2.19	2.04	
74F521	3.56	3.34	3.12	
74F524	10.69	10.02	9.35	
74F533	3.36	3.20	2.90	
74F534	3.36	3.20	2.90	
74F537	5.02	4.70	4.39	
74F538	5.02	4.70	4.39	
74F539	5.02	4.70	4.39	
74F543	7.06	6.62	6.17	
74F544	6.94	6.51	6.08	
74F545	5.39	5.05	4.72	
74F547	5.17	4.84	4.52	
74F548	4.47	4.19	3.91	
74F568	3.94	3.70	3.45	
74F569	3.94	3.70	3.45	
74F582	9.87	9.25	8.64	
74F583	7.33	6.87	6.42	
74F588	5.69	5.34	4.98	
74F64	0.80	0.57	0.53	
74F675	1.22	1.14	1.06	
74F74	0.64	0.60	0.56	
74F86	0.88	0.81	0.76	

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## HOW IT WORKS

IC1 is a 16 keypad encoder that continuously scans the keypad to see if any key has been pressed. The scanning frequency is determined by capacitor C1. The chip incorporates debouncing facility, with debouncing period determined by C2. With the chosen values for C1 and C2, the scanning rate is about 1 kHz and the debouncing time is 100 ms.

The key you press is encoded into a 4-bit binary word. The word appears at pins 17, 16, 15 and 14. They were coded as A, B, C and D respectively in the circuit diagram, with A being the least significant bit. When the logic levels at A, B, C and D become valid, an active high strobe pulse is sent out at pin 12. For convenience I'll call these A, B, C, D lines together a 'Data Bus'.

The data bus goes to a code matcher which is simply four exclusive-NOR gates and the ICKS section. The ICKS is formed by a few AND gates in order to pick up the command key from the data bus. The output of the ICKS has three lines called 'clear', 'set' and 'bell'. They are at logic zero normally, until the right key is pressed.

For example, if the 'C' key on the keypad is pressed, the clear line is activated. It stays at logic 1 but will return to 0 as soon as you release the key. The binary logic in the data bus required to activate the clear, set and bell lines are 1101, 1110 and 1111 respectively. As can be seen in the circuit diagram, either 'clear' or 'set' active will give rise to an active high pulse to pin 1 of IC6. IC6 is a presettable counter. The pulse appearing at pin 1 causes the counter to force its outputs Q0, Q1, Q2, Q3 to a specific pattern. If 'clear' were 'active' the output pattern of the counter would be 0100, or 0111 if set were active. The above patterns correspond to decimals 4 and 7 respectively.

Data in the data bus is latched by IC1 even after you release the key. The RAM is disabled when the key is released and its data output pins become high impedance. Pull up/down resistors R1, R2, R3 and R20 then define a logic pattern to the code matcher, which is the same as the data word in the data bus if 'C' is pressed. As a result of pressing 'C', the CSM line is active even after the key is released, since the logic pattern produced by R1, R2, R3, R20 matches with the 'C' in the data bus. The timing circuit formed by R9, C8 and Q3 is disabled. As soon as you press another key, the RAM is enabled and stays that way while your finger is down on the key. Data is read out from the RAM and matched with the data bus. CSM will be activated if they are the same. The timing circuit is disabled. As soon as you release the key, RAM is deselected and CSM line goes low. Q3 in the timing circuit is turned off. The current will slowly charge up C8 through R9. Pressing another correct key will turn on Q3 and discharge C8 instantly. If the wrong key is pressed or if the two second time delay expires, the voltage across C8 is high enough to turn pin 10 of IC14 high and preset the SC to 4 or 7. The entire number sequence would have to be entered again to open the door.

The output of the counter defines the ad-

dress of the stored data in the RAM. Normally, the strobe pulse from the IC1 should enable the RAM. Due to the gating action of IC14a, IC14b and IC10a, the strobe pulse will not enable the RAM if the key pressed is a command key ('C', 'S', 'B').

If the key pressed corresponds to a normal digit, the RAM is enabled during the period when the strobe pulse is high. The code matcher immediately responds by comparing the data bus with the RAM output data. If they are the same, pin 4 of IC8 will be high, allowing pin 3 of IC8 to return back to high when the strobe pulse in pin 1 goes high. It is easy enough to see that a positive going transition is generated at pin 3 of IC8. Since this pin is connected to the clock input of the counter (IC6), the counter gets decremented by one. Had the codes not matched, there wouldn't be any clocking to the counter.

The decremented counter will have its output pointed to the next address in the RAM. If another key is entered correctly again, when you release your finger from the key, the counter decrements once more. Eventually when the counter reaches zero, pin 7 of IC6 goes low. This signal goes to pin 2 of IC10, pin 14 of IC5 and pin 4 of IC15. It causes several things to happen at the same time.

Firstly, it causes the pin 3 of IC10 to go low as well. This negative transition triggers the '555 timer (IC12). The timer generates a pulse about four to five seconds long. This pulse energizes the relay RLY2 and turns off the LED. The energized RLY2 connects the 12 V supply to the strike and the door gets unlocked.

Secondly, the '555 timer (IC15) will be reset and logic at pin 3 is pulled back to 0 V. Since the alarm relay RLY2 is driven by pin 3, RLY2 is turned off and any siren horn connected to the 12 V supply through the relay turns silent.

Thirdly, pin 15 of IC5 goes high and clocks the flipflop (IC11b). Now, the outputs of the flipflop Q and  $\bar{Q}$  may or may not change. It depends on whether it was 'C' or 'S' that was pressed in the first place. If it was 'C', the controller thinks you only want the door to open so the outputs of the flipflop would not change state (Q stays at high and  $\bar{Q}$  stays at low). Had 'S' been pressed before the code numbers were keyed in, the outputs of the flipflop would change state. As a result, pin 10 of IC12 goes low, stopping the door from opening, pin 1 of IC9 goes low to enable the tri-state buffers, and pin 10 of the RAM (IC7) goes low to turn it into write mode, ready to accept new data. Also, pin 1 of IC13 is connected in parallel with pin 3 of the flipflop (IC11). IC13 is a presettable counter and the clocking of the flipflop will preset the counter back to the original 16. You will then have a fresh 16 mistakes allowance, before the '555 timer is triggered and RL1 turns the siren on.

As a result it is necessary to press 'C' each time the entry code is entered. Otherwise, the reset pin of the '555 will always be grounded and the siren horn can never be triggered. On the other hand, pin 4 of IC12 goes high and allows pin 5 of IC12 to gener-

ate a continuous pulse train. This has the effect of flashing the LED, signifying that you can key in new codes.

Finally, there's the battery backup part of the controller. Normally a fully charged 12 V battery will have 13.2 V to about 14.4 V across its terminals. Make sure the transformer you use is a 9 V to 10 V (rms) one. It will give you about 12.7 V to 13.8 V after being smoothed by the reservoir capacitors C20 and C21. If you turn on the power now, this voltage will be responsible for supplying the total current required by the controller and the charging of the battery.

If the battery you connected is not fully charged, D5 and D7 will turn on. The power supply will be responsible for all the current required by the controller and for the charging of the battery. The voltage across the battery will rise until D5 turns off, stopping any more charging current. This situation is maintained so long as the voltage across the battery stays the same. If the voltage drops, the power supply will top it up again. This is a balanced situation. Had the battery you connected in the first place been fully charged, D5 would be turned off and D7 turned on, allowing both the supply and the battery to supply current to the controller. Gradually the voltage across the battery drops, but the voltage in the power supply remains the same, so that D7 turns off and D5 turns on to charge up the battery. Again the balanced situation is reached. If the power supply is cut off, D7 turns on but D5 turns off, allowing the battery to supply current to circuit.

## ELECTRIC STRIKE

A lot of people think of an electric strike as an electrically operated lock. In fact, your door lock does not have to be changed when you install this controller. A normal door lock comes with two pieces. The lock itself is mounted on the door, and a metal plate (strike) on the door frame.

An electric strike is simply that — a metal plate you mount on the door frame, see our picture. It normally works like a metal plate. But when a current is applied to it, the strike falls open allowing the door to be pushed open, even though the door is still locked.

There are several different types of electric strike readily available. The voltage required to operate them is normally 12 V, 24 V or 36 V. The current drawn varies also, depending on the size of the solenoid. Typically it is several hundreds of milliamperes to 1.5 A. There is another type of strike which works in the opposite way. It draws continuous current when the door is locked. The door can only be opened if the power is removed.

No matter what type of strike you use, the door can still be opened with the key if the strike fails to operate. This feature certainly adds more flexibility to the controller. The strike you should buy for this project is a 12 V, power on for opening type. This allows tremendous power saving because the strike is locked most of the time. The price also varies considerably depending on the type and manufacturer. The usual range is from \$60 to \$350.



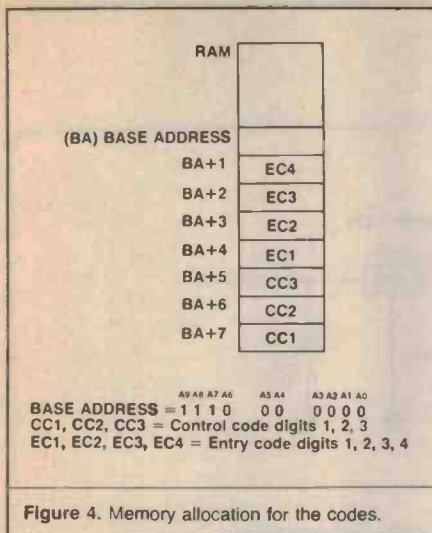


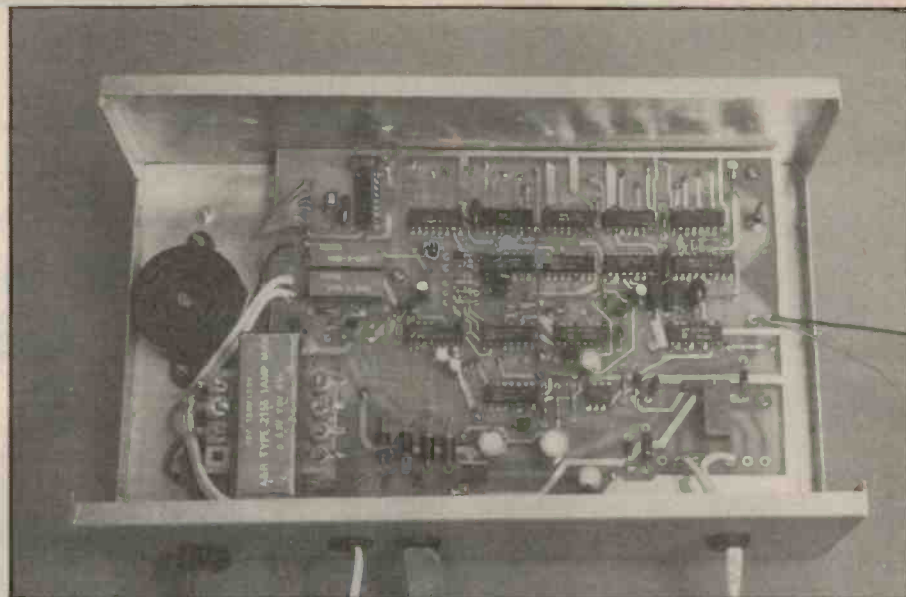
Figure 4. Memory allocation for the codes.

matcher. As shown in Figure 2, one comes from the RAM memory; the other comes from the keypad encoder — this is the code representing the key you pressed. If the digit you pressed matches the one in the memory, the CSM line becomes active and the stage counter (SC) will be decremented by one.

The output of the SC is a 4-bit binary word which defines the address of the next data word to be read out from the RAM memory. If the digits are keyed in correctly, the SC will eventually reach zero. The count out line of SC sends out a pulse to trigger a monostable which will turn on the electric strike for about four to five seconds. This pulse also disables the alarm section of the controller and turns off the LED. The LED will come on again at the end of the timing period. The controller will not reset itself unless key 'C' is pressed. This means that every time you want to get in the house you merely have to press 'CWXYZC' (where WXYZ is the four-digit entry code).

The command keys 'C' (clear) and 'S' (set) also have other functions. Pressing key 'C' will preset the stage counter (SC) to 4. The output of the counter is connected to the address pins of the RAM memory. Therefore, this 4 becomes the address of the first digit of the entry code. If the digit you press now is the same as the one stored in address 4 of the RAM, the code matcher will give a valid CSM signal. The CSM clocks the stage counter, and its output becomes 3 (which is the address where the second digit of entry code is stored). If the number you pressed is not matched to the number stored in address 3, the SC will not be decremented but every key entered will be counted by the IKC.

Pressing key 'S' will toggle the state of the flipflop 1. It also sets the output of the SC to 7. You should press 'C' and then 'S'. Key 'C' sets the output state of flipflop 1 to a predetermined state and 'S' then toggles it. Any key you press now will cause the number stored in address 7 of the RAM to be read out. The same mechanism operates as before. If the numbers match, the SC gets



Internal arrangement for the circuit board and the transformer. A piezo electric buzzer is used as a doorbell here.

decremented to 6 and so on. Note that the digit stored in the address 7 is the first digit of the control code.

The memory allocation of the codes is illustrated in Figure 4. On entering your seventh digit correctly, the SC sends out a signal to trigger flipflop 2 and enable the LED to flash quickly. The triggered flipflop 2 will transfer the state of flipflop 1 to the output. The output of flipflop 2 controls the read/write of the RAM and now turns it into write mode. In addition the tri-state buffer is enabled to divert the input number from the keypad to the RAM. At this point, you are ready to put your new codes into the memory.

Whenever the LED is flashing by itself, you can input new codes. But before you do that, you have to press the 'S' once to set the SC back to 7. The next digit you key in will get stored in address 7. Because of the enabled tri-state buffer, the input number from the keypad is matched to itself and the CSM signal from the code matcher is always active.

So no matter what key you press now, the SC gets decremented and the numbers are stored consecutively in the RAM. At the end, when entering the seventh digit, the SC reaches the zero count again. It sends out a signal to change the flashing LED back to the normal ON situation. Two sets of new codes have just been created. Again, do not forget to press 'C' to reset the system.

Now, let us change the old entry and control codes to new ones. First, enter the old codes as 'CSPQRWXYZ' and the LED should flash. Then press your new codes as 'SHIJKLMN' and the LED should go back to ON. Now press 'C' to reset the system. The old control code PQR is replaced by the new one HIJ. Similarly, the old entry code WXYZ becomes KLMN.

When the controller is powered up after you have installed it, a slightly different

input procedure would have to be followed. Refer to the setting up and testing section.

## Construction

There is not as much work involved in constructing the controller as there is in installing the system. Nor is construction particularly difficult — any average handyman should be able to manage easily.

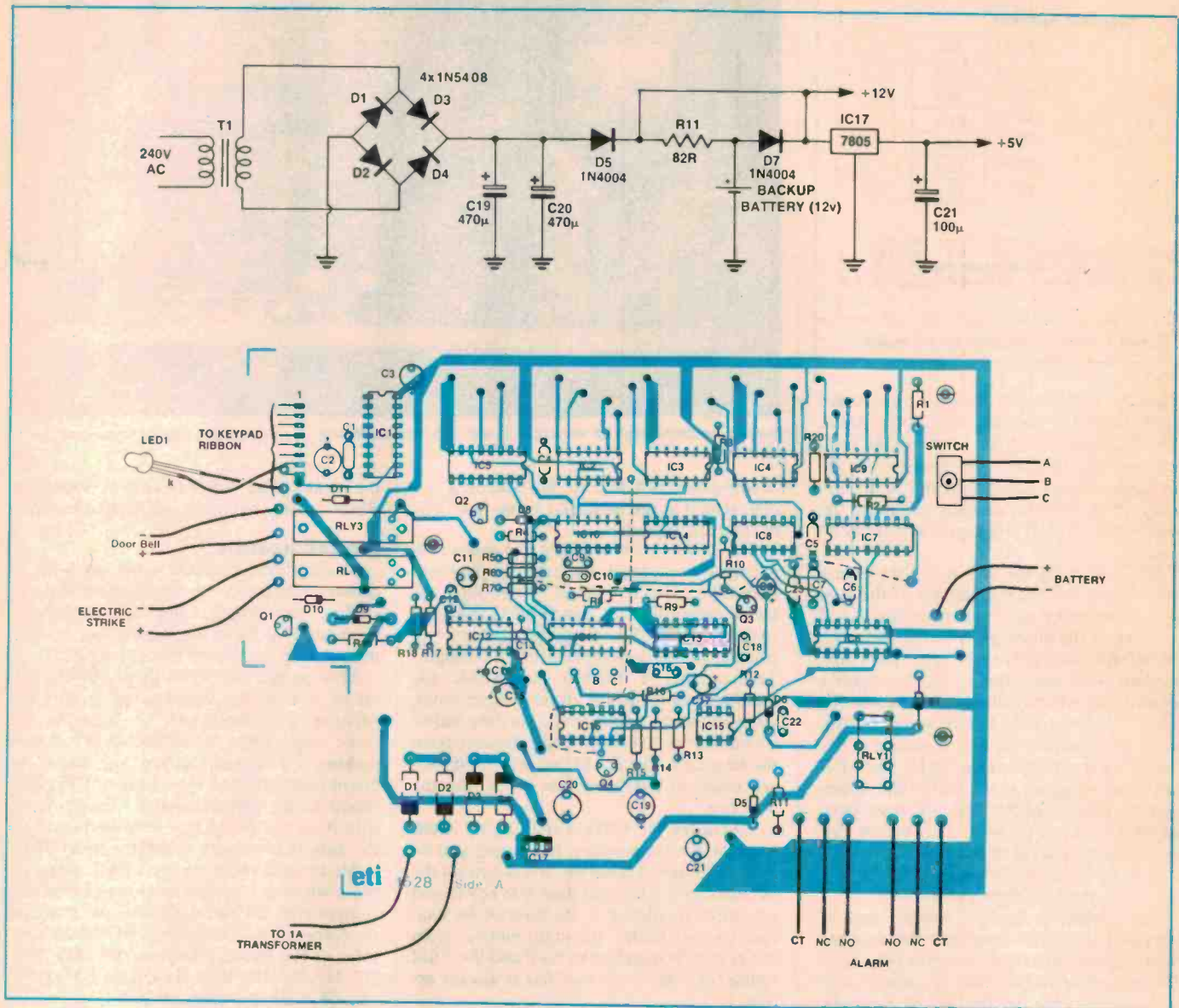
Most people will probably simply buy the kit or at least the board direct from a kit supplier. For those who are keen to get some experience of double-sided board making, I'd suggest you read the article on board making in the June issue of ETI. The board is not plated through. Tracks from side A of the board can only be joined to the side B ones with feedthrough wire. In order to save room on the board, some of these wires are derived from the pins of the components. So be careful because some of the components need to be soldered on both sides of the board. They are D4, D5, D6, D7, D9, R1, R9, R10, R14, R16, R17, R19, C3, C8, C24 and all the ICs.

Installation of the system includes mounting the controller behind or somewhere near the door as well as mounting the keypad on the door and the horn on the roof. If you are using the membrane type of keypad, you need only to stick it on the door. The plastic strip that comes out of the keypad should be bent and passed through a slot on the door. This makes the keypad look good when the keypad frame is mounted, as no wires leaving the keypad can be seen.

As shown in Figure 5, there are eight carbon tracks printed on the plastic strip. The first carbon track should be connected to '1' as in the overlay diagram, the second carbon track to '2' and so on. The three command keys, 'C', 'S' and 'J', must be in the position shown in Figure 5. It's up to you what you put on the blank keys — anything you like!



# Project 1528



## PARTS LIST — ETI-1528

Resistors.....all 1/4W, 5% unless noted

R1, 2, 3, 20, 16 .....100k  
 R4, 10, 15, 19 .....8k2  
 R6, 8, 12, 17 .....10k  
 R5 .....470k  
 R7, 13 .....1M2  
 R9 .....560k  
 R11 .....82R 1W, 5%  
 R14 .....180R  
 R18 .....33k

### Capacitors

C1, 4, 5, 7 .....47n green  
 C2, 3 .....10µ 16 V electro  
 C6 .....82n green  
 C8, 15 .....3µ3 15 V electro  
 C9 .....56n green  
 C10, 12, 16, 18, 22 .....15n green

C11, 14 .....4µ7 16 V electro  
 C13 .....100p ceramic  
 C17, 21 .....100µ 16 V electro  
 C19, 20 .....470µ 25 V electro  
 C23 .....150n green

### Semiconductors

IC1 .....74C922  
 IC2, 3, 8, 10 .....4081B  
 IC4 .....4077B  
 IC5 .....4049  
 IC6, 13 .....4029B  
 IC7 .....2114p  
 IC9 .....4503  
 IC11 .....4027B  
 IC12 .....556  
 IC14, 16 .....4071B  
 IC15 .....555  
 IC17 .....7805

Q1, 2, 3 .....BC549C

Q4 .....BC559

D1, 2, 3, 4 .....1N5408

D5, 6, 7, 8, 9,

10, 11 .....1N4004

LED1 .....3 mm red LED

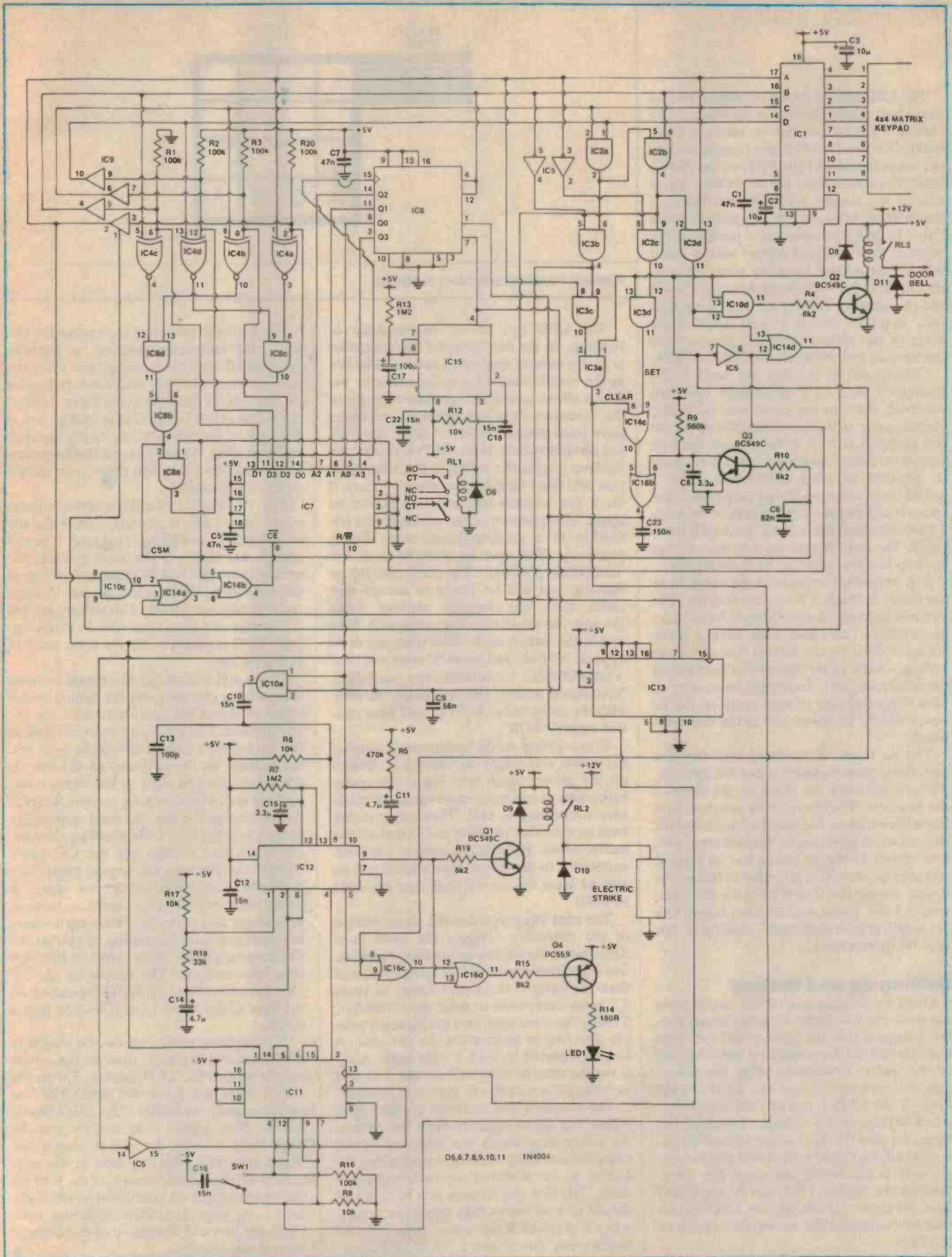
### Miscellaneous

T1 .....1A, 9-10 Vrms  
 RL1 .....5 V coil, double-pole  
 RL2, 3 .....5 V coil, 1 A contact rating reed switch

A double-sided board; a section of 10-way ribbon cable and hook up wire; 4 x 4 membrane keypad with mounting frame and front layer plastic; metal box with a front panel; SPDT, toggle switch. Half metre of 25G insulated copper wire, optional electric strike and the backup battery.

**Price estimate: \$82**







The LED should be the smallest type and glued into a hole drilled on the frame. The pins of the LED should be cut to a minimum. Use two 25G (0.2 mm) insulated copper wires to connect the LED to the ribbon cable that comes from the controller. A section of the copper wire will inevitably be sandwiched between the keypad and the door. In order to have a low profile of the keypad, thin insulated copper wire is much better than normal hook up wire. The ribbon cable is the 10-way flexible type. Don't use the rainbow ribbon cable as the single core structure makes it very stiff. Eight wires of the ribbon cable are reserved for the keypad and the other two for the LED.

Coming out of the box are wires to be connected to a 12 V electrically operated doorbell, wires to the siren horn (or house alarm), cable to the mains and the ribbon to the keypad/LED. You can mount the box somewhere near the keypad, where it's easy to dispense all those cables and wires. I would not recommend using long ribbon because it affects the scanning rate of the keys. I have mounted the 1.2 Ahr backup battery inside the box. If you want to use a huge backup battery, you can fix it externally.

It is important to connect the earth from the mains to the box for safety reasons. The live and the neutral wires should be as short as possible. The cable must have a cable clamp to fix it on the box so that any force pulling on the cable cannot put tension on the soldering joint. To reduce the chance of false triggering, the ground track on the pc board should be connected to the box electrically.

The pc board is mounted into the box with three plastic spacers about 5-6 mm tall. You should mark the holes on the floor of the box first. They have to be matched with the three holes on the pc board reserved for the screws to go through. The left hand bottom corner of the pc board has an unused rectangular area. It is intended to be cut out if you mount the transformer to the same spot as I did. If you want to use a bigger box or a different transformer, cutting it out may be unnecessary.

## Setting up and testing

Don't be disillusioned if the circuit does not work the first time. To make things easier, I suggest that the battery and the siren horn should not be connected until the rest of the circuit is working. Plug the power plug into the mains and the LED should flash. If the LED is not on, use a meter to check if there is any voltage difference between its pins. If there is no voltage difference at all, bad luck! I am afraid you have to go back to the board and trace the signal through the circuit. (This will be explained later.) If there is a voltage, the LED will either be connected the wrong way round or be faulty.

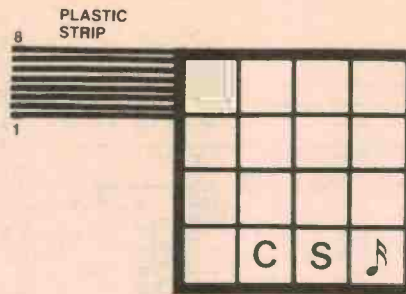


Figure 5. Keypad carbon tracks numbering.

The LED can be on continuously or flashing. In the former case, the controller is in the normal mode and you need to key in the control and entry codes correctly before it allows you to change the codes. Since the system is only just installed, no codes have been stored. Problem! Well, the trick lies on that switch. If the LED is on but not flashing, toggle the switch to the other position and then turn off the power. Leave it for a few seconds and turn the power on again. This position of the switch forces the flipflop to a predetermined state during power up. This may be referred to as the 'initializing position'. The LED should be flashing and will be ready to accept new codes from the keypad without going through the usual matching sequence. Now toggle the switch back. This time, no need to press 'C' first, just press 'S' once and then 'PQRWXYZC' to initialize the controller. You should now be able to unlock the door with the entry code 'WXYZ' and your control code is 'PQR'.

If everything works as expected, unplug the power and solder the battery in. Switch on the power again and repeat the same procedure as you have done earlier to make sure everything is OK. Throw the switch back to the other position and switch off the mains power. Because the battery has been connected to the circuit, you should still be able to open the door and change the code as usual.

The next thing to test is the alarm section of the controller. Trigger the siren horn deliberately by keying in random numbers. See if you can turn it off by keying in 'C' and then the entry code. Don't forget to press 'C' again every time to reset the controller. Testing the siren may be a problem for people who live in quiet areas. In this case, it can be replaced by a 12 V light bulb. Also, leave the siren or light bulb on and it should be able to turn itself off after two minutes.

The standard way to check a circuit is to follow the signal right through the circuit. As a first step, check the soldering of the components. Make sure all components required to be soldered on both sides are there. The first chip to look at is IC1. Pin 12 should give an active high signal every time a key is pressed. If this signal appears to be healthy you should check pin 15 of IC6.

Turn off the power to the controller and select the initializing position, so that the LED will flash when powered up. Press the number keys and note the pulses generated on this pin. If the pulses are there, look at the signal at pin 7 of IC6. It should go low at the end of the seventh key being input to the controller. As soon as this has happened probe pin 10 of the '556 timer; you should detect a high signal.

Pin 15 of IC13 should receive a pulse every time a key is pressed, except for the doorbell key (when this is pressed, it would always stay high). If you keep pressing the wrong keys, pin 7 of IC13 should go low at the sixteenth pulse applied to pin 15 since the chip was last preset. This will trigger the '555 timer and its output (pin 3) should go high. IC13 is preset to 16 whenever pin 7 of IC6 goes low.

If you still cannot get the circuit to work after all this checking, try the timing circuit which works on the delay between each key you pressed. Press 'C' once and then look at the voltage of CSM. It should be high and the voltage on the collector of Q3 low. If you press the first digit of the entry code, nothing is changed so long as your finger is down pressing the key. As soon as your finger releases the key, CSM should go low immediately and voltage on the C8 slowly charges up. Pressing the second entry code digit would send this voltage low again. It would start to charge up again as soon as your finger leaves the key. Pressing a wrong key does not reset the timing. If you let the C8 charge up freely, it sets pin 1 of IC6 high after two seconds. The output of the SC then presets to 0111 or 0100, depending on the logic at pin 4 and 12 of IC6 when preset occurs.

If everything works, throw the switch to the initializing position, turn on the power supply so that the LED flashes. Throw the switch back and press 'SPQRWXYZC' to initialize your controller. The LED should be on. Now solder your battery and the siren horn in with the power supply on. Make sure the soldering iron is *not* connected to the mains when you do that, or the power supply on board will be short-circuited by your grounded soldering iron. Close the box and setting up of the controller is done.



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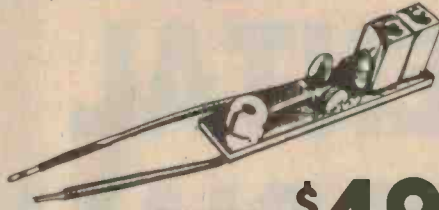
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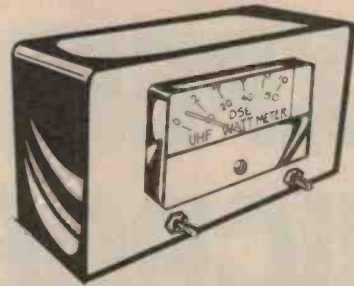
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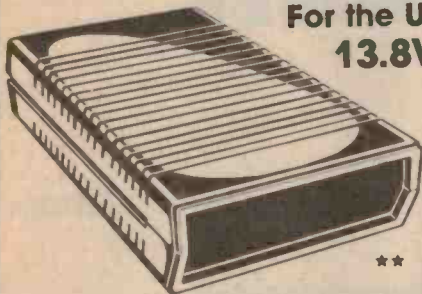
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# EXPERIMENTAL MICROBEE DIALLER

This is an experimental project which uses the Microbee as part of an automatic dialling system. It is designed to fit with the ETI-699 modem, but can be used with any modem and any Microbee with Telcom.

Geoff Nicholls

THIS PROJECT IMPLEMENTS the automatic dialling features of the Telcom II program on the Microbee to demonstrate the decadic dialling system. The design does not meet all Telecom requirements, however, and should be regarded as a purely experimental device, not to be attached to the switched telephone network.

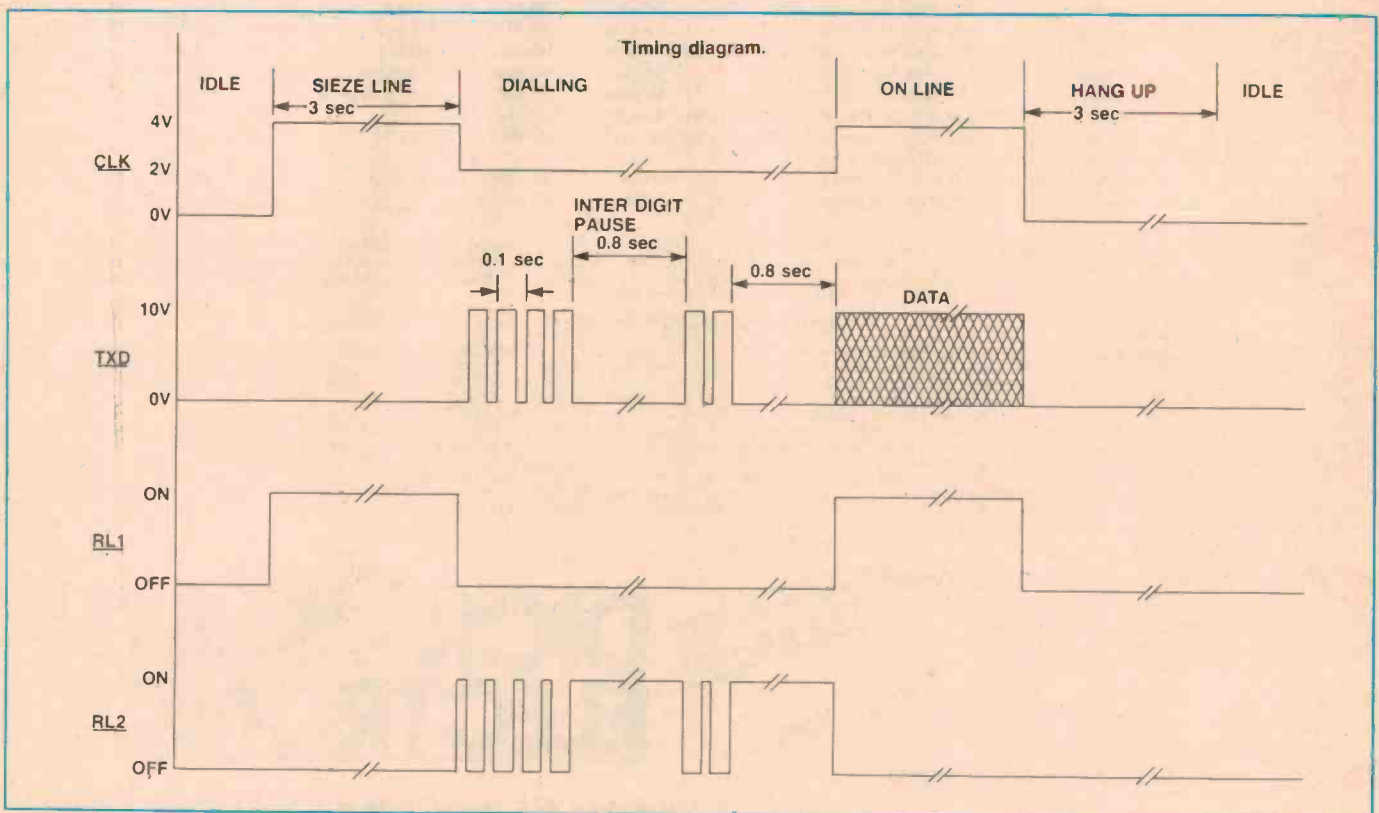
## Dialling systems

There are two general types of signalling employed in telephone systems to allow automatic subscriber dialling. The newer

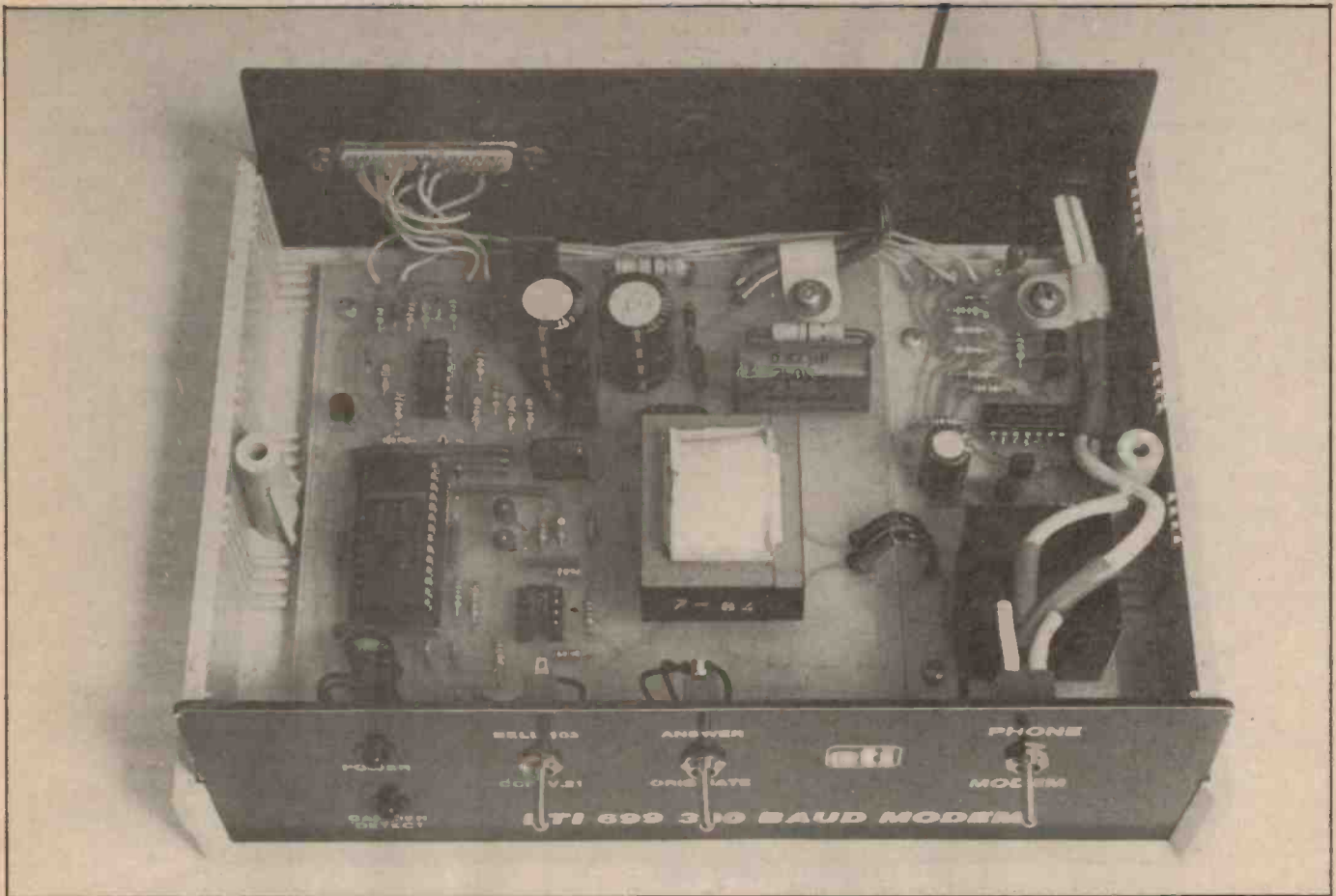
system is called VF tone signalling (Voice Frequency), Touch Tone or DTMF (Dual Tone Multiple Frequency) and is not available at all exchanges. This system sends tone pairs down the line to represent the digits in the number being dialled. Tone signalling has two main advantages over the decadic system, firstly the number can be dialled much faster and secondly the dialling signals fall within the voice frequency range and don't require a dc path to the exchange. There are few exchanges using VF signalling at the present time, however.

## Decadic dialling

The older system is called decadic signalling and consists of pulses caused by opening and closing the line circuit. Each digit of a called number is made up of a train of pulses corresponding to the digit, eg a "4" consists of four pulses. The pulses have a 2:1 break to make ratio and a nominal repetition rate of 10 pulses per second, so the make period is about 33 ms and the break period about 66 ms. There is a pause between successive digit trains of 0.8 to 4.0







Above. Overhead view of dialler installed in ETI-699. Note spaghetti sleeves over switch lugs and position of phone cable clamp. Below. Installed dialler showing RS232 wire routing.

seconds. Some PABX systems also require a three second access pause after dialling the exchange digit to seize an exchange line. Most systems use "0" for the exchange digit.

### Calling example

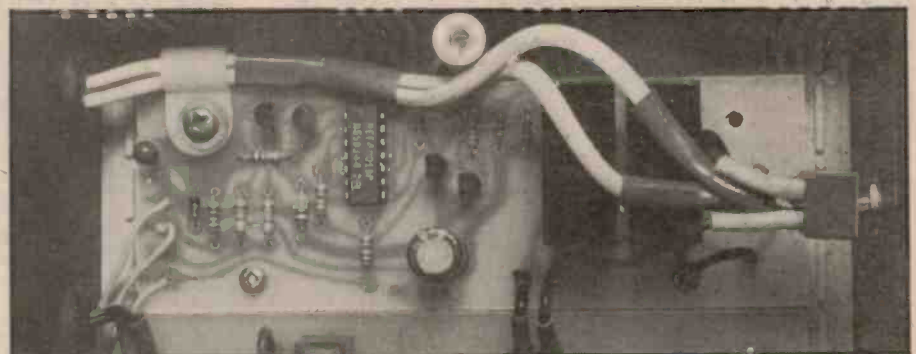
A simplified description of what happens during an outgoing call follows.

The exchange line is open circuit at the subscriber's end when the appliance (phone or modem) is ONHOOK. Other terms employed in reference to the open line are "free" and "unlooped". To make a call the line is "looped" by switching a low impedance load across it. The exchange senses the current being drawn and finds a "free register" which returns dial tone to the subscriber. A "calling path" has been found through the exchange. When a person makes the call she listens for the dial tone before commencing to dial, however a "deaf" modem must wait three seconds to ensure that a calling path has been "seized". Dialling can then take place as described before.

### Telcom II

The ETI-698 was designed exclusively for use with the Telcom communications program, written by Gerard Hill (popular surname around Applied Technology!). It will *not work* with any other known computers and/or software so *don't ask me!*

Telcom supports automatic dialling with



a built-in telephone directory, so you may simply type DIAL FRED to get the 'Bee to look up Fred's number and then dial it for you. It can also send any character sequence required to log-on to a system. Very clever!!

I have noticed a few things about the operation of Telcom II on our 128K Microbees that you should be aware of. Firstly, the 'Bee will 'hang' if RXD is clamped to a high voltage. This will only happen with a faulty modem.

Secondly, Telcom seems to power up in the ONLINE state, so you have to type HANGUP to free the line. The automatic redial feature (invoked by DIAL#) will continuously dial the number, wait 20 seconds for a CARRIER DETECT (on pin 5,

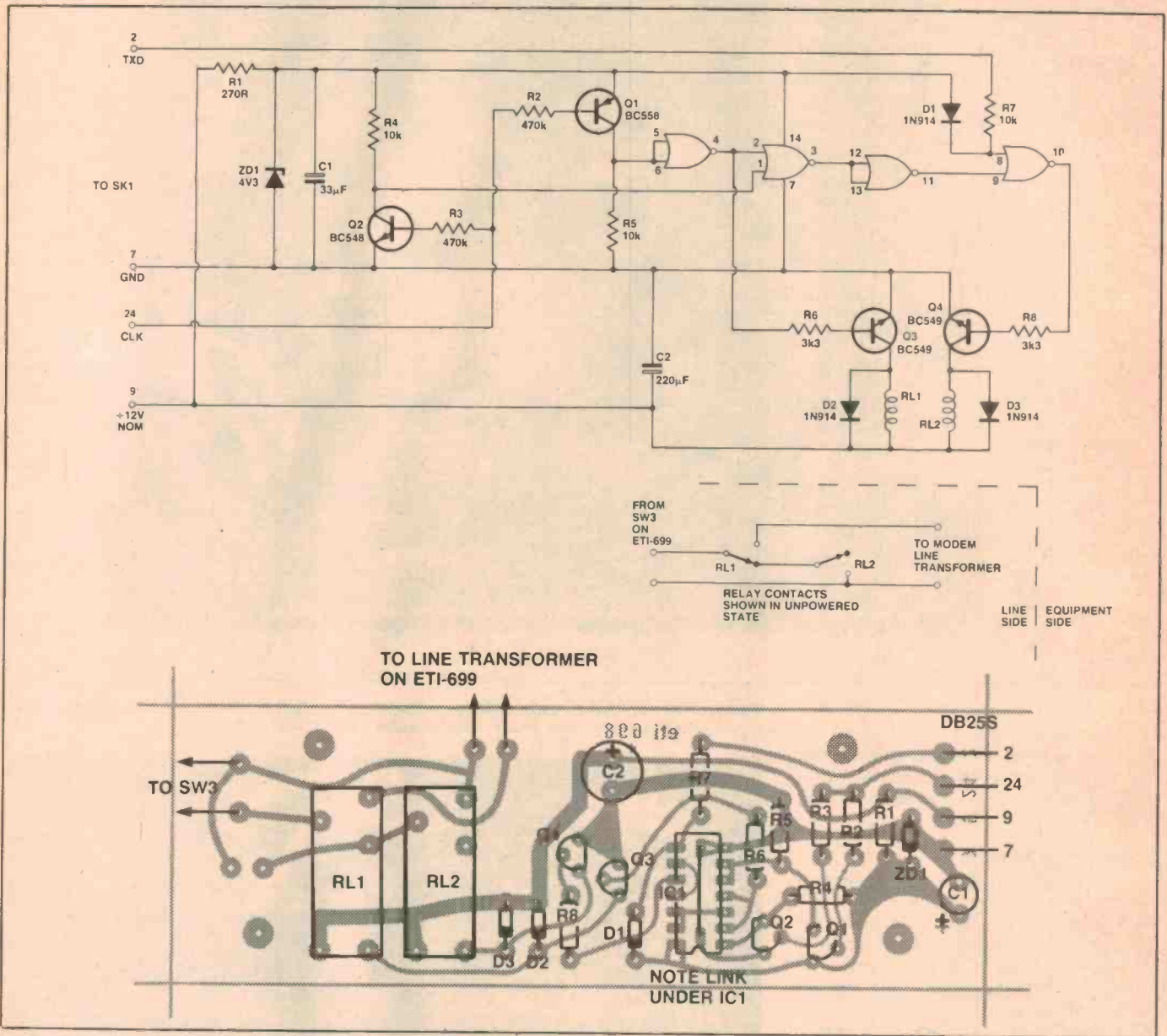
not pin 8) and then hang up and repeat, ad infinitum, if there is no modem at the other end! This could lead to prosecution for causing a public nuisance, apart from any Telecommunications Act offences.

One further quirk, while experimenting with the '698 I got Telcom to DIAL some very long numbers so I could take CRO photographs. (Not on the telephone system, of course!) As the dialling cursor moved off the right hand edge of the screen it began to change the border line that runs around the Telcom help screen. A quick RESET command fixed it up.

I would like to thank Gerard Hill for explaining the operation of Telcom's dialling software.



# Project 698



RL2 switching delay. Upper trace: pin 10, IC1 2 V/cm. Lower trace: line current 15 mA/cm.

Photo 1. 20 ms/cm.

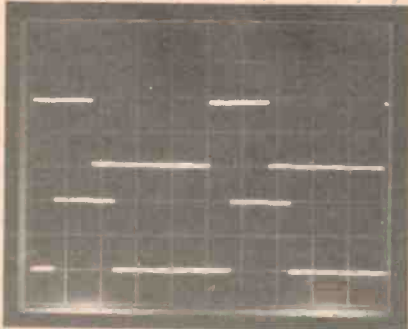
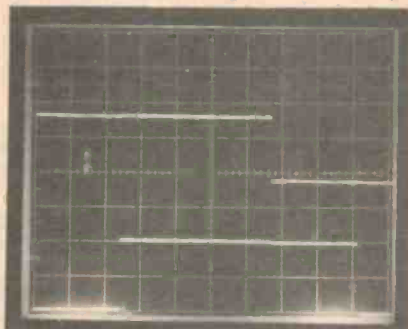
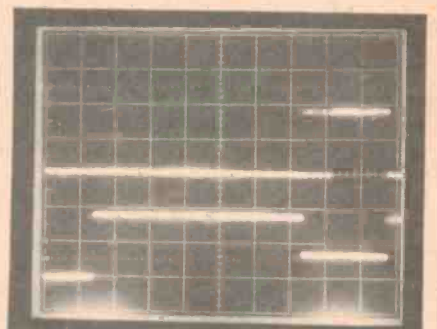


Photo 2. 5 ms/cm.



Sieze line and dial "4". Upper trace: pin 10, IC1 2 V/cm. Lower trace: CLK signal, 2 V/cm. Note the three states of CLK.





## PARTS LIST — ETI-698

<b>Resistors</b> .....	all 1/4W, 5% unless noted
R1.....	270R
R2, 3.....	470k
R4, 5, 7.....	10k
R6, 8.....	3k3
<b>Capacitors</b>	
C1.....	.33 μF 16 VV tag tantalum
C2.....	220 μF 25 VV RB electrolytic
<b>Semiconductors</b>	
IC1.....	4001B
Q1.....	BC558 pnp
Q2.....	BC548 npn
Q3, 4.....	BC549 npn
ZD1.....	4V3 zener 1N4731 etc
D1, 2, 3.....	1N914, 1N4148 etc
<b>Miscellaneous</b>	
ETI-698 pc board; RL1, RL2 SPDT relay Takamisawa VS12STAN; 250 Vac rated hookup wire; 4PK screws to mount board; spaghetti.	

Price estimate: \$22

### A note on relays

The '698 uses two VS 12STAN Takamisawa relays, one to switch the modem in and the other to generate dial pulses. There is a potential problem with this setup because of the response time of the dialling relay. The shortest pulse required during dialling is 33 ms and the relays used have an attack and release time of about 12 ms with a 10 V supply. The prototype relay had nearly identical attack and release times which meant that the dialling pulses were not distorted. Other pin compatible relays may not work in this application. I checked one of the types that comes in a see-through plastic case and found it would not even close the contacts! The problem is caused by the low operating voltage — the nominal 12 V from the 'Bee is actually just under 10 V. If you are having any problem in this area you may want to connect a separate power supply to get a full 12 Vdc to the relays. The supply positive connects to pin 9 and the negative to pin 7.

The prototype relay switching times are shown in CRO Photographs 1 and 2. The '698 was powered from a 128K Microbee for these waveforms.

Ideally, a reed relay should be used for RL2, but there does not seem to be any pin compatible types to the pc board pattern. A last minute attempt to relay the pc board for a reed failed to achieve the required 5 mm clearance between line and equipment tracks on the pc board.

### Construction

All components mount on the ETI-698 printed circuit board, which is designed to fit next to the ETI-699 300 baud modem pc board.

Check over the board before commencing

## HOW IT WORKS

The circuit decodes the TXD and CLK signals from pins 2 and 24 respectively of the Microbee DB-25S connector to control two relays. The Microbee buffers the TXD output with a pnp pull up transistor, so it cannot be set to a HI-Z (high impedance) state. The CLK line is unbuffered however, and can be

set to HI-Z. Since the CLK line can be in three states while the TXD line can be in two, there are six possible combinations of which only four are used for controlling the dialler. The required states of the two signals are as follows:

STATE	CLK	TXD	RL1	RL2
ONLINE	HIGH	DON'T CARE	ON	OFF
HANGUP	LOW	DON'T CARE	OFF	OFF
DIALLING	HI-Z	LOW	OFF	ON
DIALLING	HI-Z	HIGH	OFF	OFF

The Timing diagram shows the sequence involved in making a call from an initial on-hook or unlooped state. If the initial state was online then Telcom would have performed a three second hangup routine to drop the previous call before slezing the new line.

Relay RL1 switches the line input between the modem port and the other relay, RL2. RL2 'makes and breaks' the line to do the actual dialling.

Power is obtained from pin 9 of the Microbee's serial port. This is the filtered but unregulated supply from the Microbee motherboard. The nominal +12 V (typically +10 V) is filtered by C2 and powers the two relays and the logic power regulator comprising R1, ZD1 and C1. ZD1 is operated at current of 20 mA to ensure its breakdown voltage is close to 4.3 volts.

Transistors Q1 and Q2 are used to detect the three states of the CLK signal. When CLK is LOW, Q2 will be cut off and Q1 will be saturated.

When CLK is HIGH, Q2 will saturate while Q1 will be cut off. The actual voltage level on the CLK line in the HIGH state is about 3.8 volts. To ensure that Q1 will be cut off at this voltage the logic power supply is

made 4.3 volts. When CLK is in the HI-Z or high impedance state, current will flow out of the base of Q1 and into the base of Q2, thus saturating both transistors.

A quad NOR gate (IC1) decodes the relay control signals from the levels on the collectors of Q1 and Q2. If these voltages are represented by the logical variables Q1 and Q2, then the positive logic expressions implemented are:

$$RL1 = \overline{Q1}$$

$$RL2 = TXD + \overline{Q1} + Q2$$

$$RL2 = TXD \cdot Q1 \cdot \overline{Q2}$$

Pin 9 of IC1 will only go low and allow TXD to control RL2 when CLK is in the HI-Z state, at other times RL2 is not energized.

Relay RL1 is energized when Q1 is cut off which only happens when CLK is HIGH.

Diode D1 clamps the TXD voltage to the logic supply to protect the input of IC1. R7 limits the current through D1 to less than one milliamp.

Diodes D2 and D3 are flywheel diodes to control the emf generated when the relay coils are de-energized.

ing construction, look for bridged tracks, broken tracks and undrilled holes.

Solder in the wire link under IC1 first, then the resistors. The two capacitors are polarized so check them before soldering. The four transistors can go in next; note that Q1 is a pnp type while the others are npn. The IC is CMOS so take care to avoid touching the pins while soldering it in. The two signal diodes can go in now, together with the zener diode. The last components to go in are the two relays, push them right down against the pc board before soldering.

The board should be connected with 250 Vac hookup wire for all line side conductors. To install the unit in my modem case I desoldered the wires going from the '699 pc board to SW3 and shortened them before soldering them to the '698. You will see that the pads on both boards line up to make the installation look neat. Two new lengths of 250 Vac wire run from the end of the '698 pc board up to the lugs on SW3. Use insulating spaghetti on these to completely cover the line conductors — it should not be possible to touch any metal connected to the line.

The cable clamp on the wires to the phone should be moved to the back right-

hand corner of the pc board, as in the photographs. The pc board mounts with four PK screws, one goes through the cable clamp as well as the pc board so it needs to be a little longer than the other three. Try to route the line wires as far away from the pc board as possible, it would be a good idea to slip a piece of spaghetti over the whole length to add an extra insulation layer. I also recommend covering the line side pc board tracks with Silastic to insulate them.

The four wires at the back of the pc board go to the DB-25S socket from the Microbee. The pin numbers are marked on the pc board as well as on the overlay so you should have no trouble sorting them out. Note that Telcom requires CARRIER DETECT to be connected to pin 5 (CTS) not pin 8.

You should now be ready to connect the Microbee up, boot Telcom and try the DIAL command. Connect a 470 ohm resistor in series with a 15 Vdc supply to simulate the exchange line. Put a CRO probe across the resistor to display the current in the line for the different states. You can then experiment with Telcom's dialling commands and observe the effects on the CRO.



# THE MASTER-CARD SYSTEM SOLUTION

## 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.

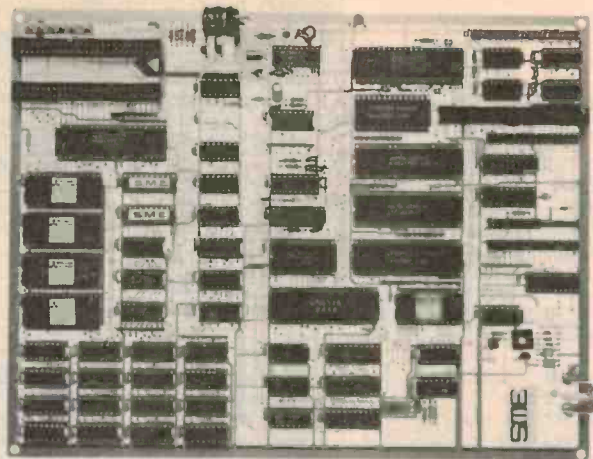
Other features of **THE MASTER-CARD** include a battery backed real time clock, three spare 28 pin eprom sockets, 16 parallel TTL I/O lines and two expansion slots with Z80 signals.

## 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-2026

The **KNIGHT-2026** is an expanded **KNIGHT-2002** with a half height 26 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-2026 Specifications

* The <b>KNIGHT-2002</b> plus the following.		
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EXPANSION	.....	1 Free slot
* All disk sizes unformatted		

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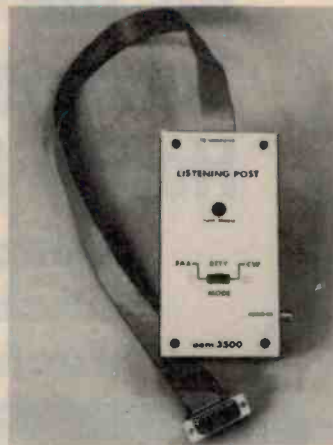
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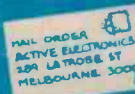
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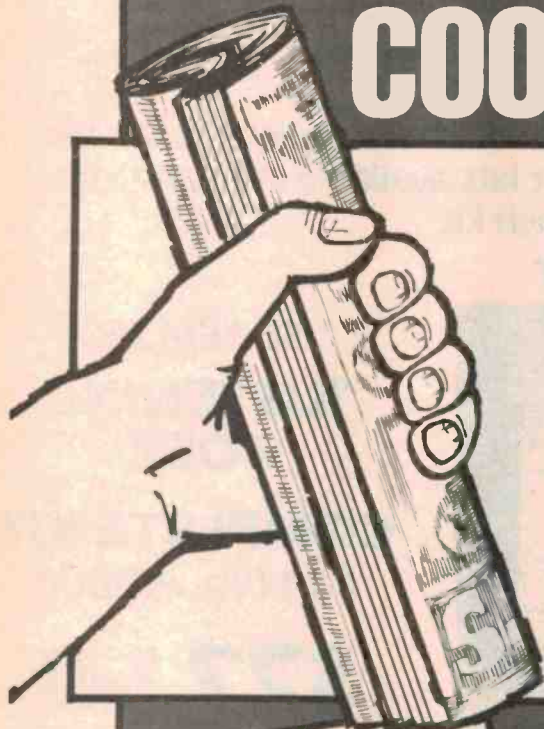
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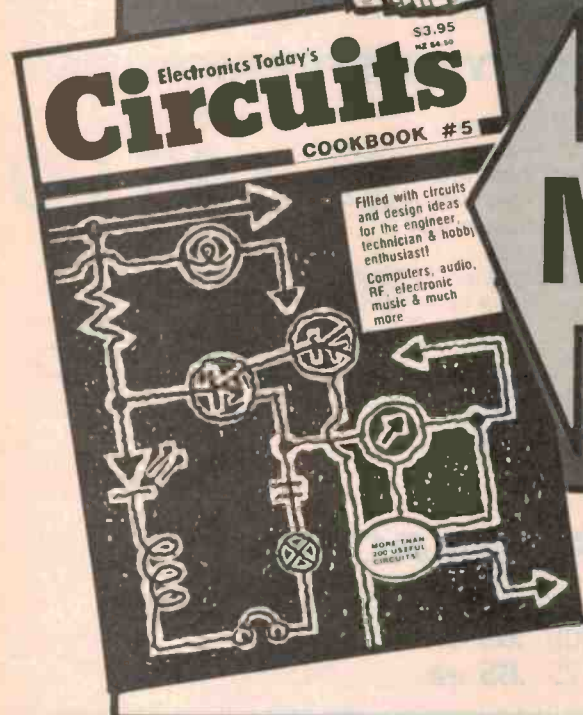
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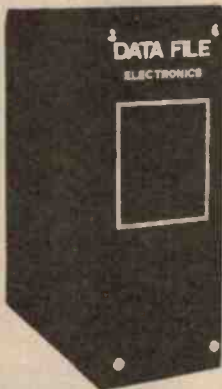
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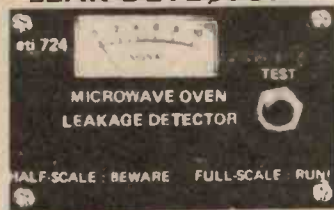
R 3505 **\$5.95**

**Other Pack Bargains**  
All computer selected values mix  
All \$5.95 Per Pack

- R 3501 Carbon film resistors .25W PK 300
- R 3510 Greencap Capacitors PK 50 pcs
- R 3515 Ceramic Capacitors PK-100 pcs
- R 3520 PC Mount Electrolytics PK 40 pcs

### MICROWAVE OVEN LEAK DETECTOR

ETI PROJECT



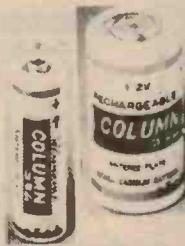
Completely passive project receives microwaves via an antenna which develops a voltage across a detector diode driving the meter. Monitor your microwave oven with this easy to build kit. All components mount on single PCB including the meter.

K1724 ..... (still only) **\$14.50**

**These Prices will rise by up to 30% with next shipment**  
(prices quoted are definitely for current stock only - phone now to reserve your order)

### NICAD RECHARGEABLE BATTERIES

Premium Grade—good for up to 1000 recharges.  
AA Size charge at 45-50MA  
C Size charge at 160-180MA  
AA Size 500 MAH  
C Size 1.8 AH



S 5020	AA	1-9	10-99	100+
S 5022	C	2.45	2.00	1.80
		5.95	5.40	4.98

### SEALED LEAD ACID

As used in security systems, battery backup for computers etc. Premium grade long life (typically in excess of 5 years). Easy to charge.



S 5065	12V	1.2AH	ea.	5 Up
S 5067	12V	2.7AH	19.95	16.98
S 5069	12V	4.5AH	24.95	19.98
			34.95	26.95

### 16 WAY PARTS DRAWER SET

See through acrylic parts drawer. Slide-in Ident. card fronted drawers. Ident. cards supplied. Value Plus!



H 0440

**\$19.50**

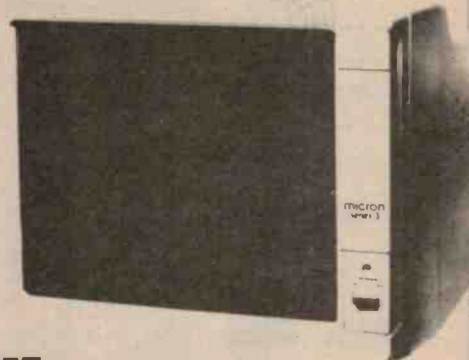
4up

**\$17.95**

### High Definition Computer Monitor

There are a number of low cost 'Hobbyist' monitors around these days at prices unheard of a year or so ago. However, they all suffer from poor to medium definition or resolution—hence eye strain becomes a real headache. The situation has all changed with the 1985 release of the superb Micron Series 3. Non glare, naturally, and screen character resolution well worthy of mating up with top end personal or professional computers.

### NEW Micron Series 3

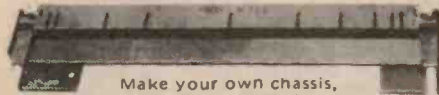


D 1115 Green Non Glare  
**\$179**

• 1050 lines resolution at centre screen • 22MHz bandwidth • Video input impedance switch allows networking use • Incredible repeat—Incredible—Resolution.  
**SPECIFICATION:**  
Screen—Green phosphor Front Controls—Power on off character brightness-intensity display centering Rear controls—Background intensity, vertical and horizontal adjustment etc Input Impedance—Switch 75 10K  
Bandwidth—10Hz-22MHz Resolution—1050 lines minimum at centre screen

### PANBRAKE SHEET METAL BENDER

Our Panbrake Sheetmetal bender continues to be one of our most popular tools. Just the shot for making up heatsinks, brackets, chassis etc.



Make your own chassis, boxes brackets etc.  
Unique slotted upper clamping bar allows complex corner bends etc.

Handles up to 16 gauge metal and up to 445mm wide.

T 2400 *Direct import price!* **\$89.95**

### IMPORT SCOOP

### Quality Commonwealth Computer Fan 80MM - 240V

• Super quiet • Sealed sleeve bearings for long life • Sturdy die cast frame • Operating range -10 deg C to +70 C

### SUPERB QUALITY SLIMLINE GRAPHIC EQUALISER / AMPLIFIER

WAS \$89.50



Incredibly compact 22H x 145W x 132D. 7 Key 30W/30W Led Level meters/Qual Japan Marf. Freq. Response 20HZ-30KHZ. C 9132

**ONLY \$55**

CAT F 1020

**\$12**  
4  
or More  
**\$11**

Amazing Value



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# SEMICONDUCTOR DATA BOOKS

## MOTOROLA SEMICONDUCTOR

### MOTOROLA CMOS DATA

A comprehensive reference covering 40XX 45XX CMOS family's along with specialty devices such as LCO drivers, telephone and general communication functions and industrial control. **322 pages illustrated in 16 chapters of electronics.**

B 3105... \$12.95

### SCHOTTKY TTL DATA

Essential reference for the enthusiast and engineer alike. Designing and servicing digital circuitry is an absorbing and exciting task. The LS, ALS and FAST families along with design considerations and circuit characteristics are logically presented in this manual making it quick and easy to use.

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### MOTOROLA MEMORY DATA

An absolute must for the microprocessor buff. This is the latest reprint of Motorola's famous memory data manual and includes the latest specifications and design application data on TTL RAM, TTL PROM, MOS, MEMORY, MECL RAM, MECL PROM, MOS DYNAMIC RAM, MOS, STATIC RAM, MOS EPROM, MOS EEPROM AND MOS ROM. Worth many dollars more.

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### LINEAR & INTERFACE DATA

Popular data manual. At last readily available. Includes data design procedures and equivalent listings for 1000's of devices under headings of AMPS, VOLTS, REGS AND SPECIAL PURPOSE CIRCUITS. Gives data, design procedures and equivalent listings for MEMORY MICROPROCESSOR SUPPORT LINE DRIVERS RECEIVERS TELEPHONE COMP. AIDS VOLTAGE REFERENCE AND DATA CONVERSION DEVICES. Includes comprehensive selector guide.

B 1114... \$22.95

### MOTOROLA MECL DATA

Emitter Collector Logic (ECL) is today's fastest form of digital logic providing the most direct way of improving system performance. This previously hard to get manual provides data on the 10K, 10K and 10K series MECL memory and PLD CHIPS.

B 1100... \$11.95

### MOTOROLA POWER DATA

Motorola are the undisputed world leader in power transistors. Renowned for their low cost and reliability. Book includes a 5 page selection guide, application notes and data sheets for over 700 devices. 389 pages.

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### MOTOROLA MASTER SELECTION GUIDE

The most useful book ever printed. Covers MOS IC's listed by function. LINEAR IC's listed by function. INTERFACE IC's listed by function. LSI memory, TTL logic power products. SCR's diodes transistors listed by application and ratings. RF small signal and opto devices listed by application and ratings. Essential data given for all devices. Terrific value.

B 1104... \$7.95

### MOTOROLA OPTO DATA

Handy reference provides data and application notes on photo couplers, infrared LEDs, photo transistors and a complete chapter on fibre optics & communications system which is fast gaining usage world wide. Very Educational.

B 1118... \$11.95

### MOTOROLA 8-BIT MICROPROCESSORS AND PERIPHERALS

This manual covers all aspects of Motorola's microprocessor microcomputer and peripheral components. A clearly written manual providing all the data necessary to design and build a working computer system from scratch. 100's of circuit examples, flow charts, truth tables and programme routines.

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### NATIONAL SEMICONDUCTOR INTERFACE

This data book provides complete specifications for a variety of transmission line drivers, receivers, peripheral power drivers and level translators/buffers. Product selection guides list applications information and operating features. Memory dynamic memory microprocessor data communication and disc support products are also covered in the data book. The interface appendix section contains cross reference guides, the programmable logic section describes the technology design and gives application support.

Pages: 1520 Year: 1983

B 1005... \$13.50

5 Up... \$12.00

### DATA CONVERSION ACQUISITION DATA BOOK

The 1981 edition of the Data Conversion Acquisition Data Book is one of the most comprehensive in the industry. It contains specifications for high technology conversion products in the analog signal path, both preceding and following the conversion process. Combining high volume production capability with leading edge technology such as thin film resistors, laser trimming and advanced micro CMOS and bipolar processing has helped develop products best suited to your design needs.

Pages: 1232 Year: 1984

B 1007... \$13.50

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### LINEAR DATABASE

The 1982 edition of the National Semiconductor Linear Database is the most comprehensive available. It presents approximately 2000 pages of specifications for our highest level product lines. Applications, descriptions, features and diagrams in this database include detailed sections for Voltage Regulators, Op Amps, Voltage Comparators, A to D, D to A Converters, Industrial Blocks and Audio and TV Circuits. The database also features advanced telecommunication devices and speech synthesis (DIGITAL), plus other non-linear-of-the-art linear products offering performance, economy, quality and reliability.

Pages: 1952 Year: 1982

B 1010... \$15.00

5 Up... \$14.00

### LINEAR SUPPLEMENT

The 1982 Linear Supplement provides the most recent information on National's new linear products. This supplement also provides a comprehensive index published in the Monthly Catalog. New products designed by indicated by an Asterisk and in bold type. Revised data sheets are listed in bold type. National's supplement database system allows you to make product selections of your latest product offerings.

Pages: 566 Year: 1984

B 1011... \$7.50

5 Up... \$6.50

### LOGIC DATABASE

National's new Logic Database covers five of their logic families: TTL, 104, 104 Schottky, 104S, 74S, 10A, 10A Schottky, 74S, 74S, high speed (64M, 74M) and low power (34L, 74L). The Logic Database is especially organized for quick and easy referencing offers fast complete functional indices. Fast complete functional indices for MSI devices. In addition, includes over 100 connection diagrams and test waveforms to help speed the design cycle. All in all it's probably the most comprehensive collection of practical information ever assembled on such a broad line of practical components.

Pages: 550 Year: 1981

B 1015... \$11.00

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### MOS MEMORY DATABASE

The 1982 MOS Memory Database is a comprehensive collection of information advanced high density memory products covering the spectrum of this mainstream semiconductor component category. National Semiconductor has an array of advanced technology processes to apply to memory design and development. These range from high-density tripropyl process used in the most advanced RAMs, the smart geometry silicon gate and oxide-isolated micro-CMOS technology which is now being applied to high-performance memory devices for the first time.

Page: 336 Year: 1982

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### HYBRID PRODUCTS DATABASE

The Hybrid Products Database is the only National Semiconductor publication that contains complete information on all our hybrid semiconductor products. Included are precision thin film and thick film products which provide the user with standard functions from operational amplifiers to converters with capabilities beyond those of current monolithic technology. Product selection guides and application section are also included.

Pages: 792 Year: 1982

B 1045... \$9.95

5 Up... \$9.25

### TRANSISTOR DATABASE

National Semiconductor has added many new transistors and product families since publication of the last database. Many have already been widely acclaimed by users in addition to small-signal power bipolar and field effect transistors that have been the mainstay of our catalog. A new section for multiple-emitter-effect transistors. More part numbers will be added as demand expands. To keep current on all new National transistors please contact your National sales representative or franchised distributor and ask to be placed on the customer mailing list.

Pages: 558 Year: 1982

B 1050... \$9.95

5 Up... \$9.25

### CMOS DATABASE-1984

The CMOS Database contains the industry's most comprehensive collection of high performance CMOS products available. Our early commitment to micro CMOS technology has made possible the development of a broad spectrum of advanced devices that will simplify your design and ensure the reliability of your systems. Micro CMOS technology describes National's array of microgeometry, silicon-gate, oxide-isolated processes used to build the products in this book. Using N or P well substrates and multiple-layer metal on polysilicon interconnect structures, micro CMOS processes feature sizes of 0.70 or 1.0-microns, with junction feature sizes in development.

Pages: 1520 Year: 1984

B 1030... \$13.50

5 Up... \$12.00

### VOLTAGE REGULATOR HANDBOOK

With the variety of fixed and variable regulator technology currently available, the 336 page Voltage Regulator Handbook becomes a must for the selection of these terminal and dual tracking components that meet the system requirements while utilizing the most cost effective approach. Beginning with product selection procedure and a data sheet summary, the text continues with easy accessible information about booster circuitry, power transformers and filter specifications, test methods, manufacturers cross references and extended use applications for National's regulators.

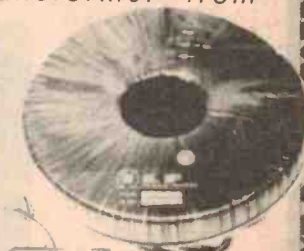
Page: 336 Year: 1982

B 1055... \$9.95

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# STATE OF THE ART TOROID POWER TRANSFORMERS

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



4 MODELS TO CHOOSE FROM ALL WITH 240V PRIMARY



NEW FOR 85'

### 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	PARL. SEC	SER. SEC	EA	10UP
M 3050	12V + 12V	160	13.2A	6.6A	45.00	43.50
M 3060	25V + 25V	160	6.4A	3.2A	45.00	43.50
M 3070	35V + 35V	160	4.6A	2.3A	45.00	43.50
M 3100	40V + 40V	300	7.5A	3.75A	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 toroids 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.

## MOTOROLA BONUS OFFER SET OF 9 TITLES SAVE \$30 \$99.00

## NATIONAL SEMI BONUS OFFER SET OF 10 TITLES SAVE \$22 \$89.00

## Home Telephone Extension Cords and Adaptors

PRICES RISE 25% NEXT MONTH



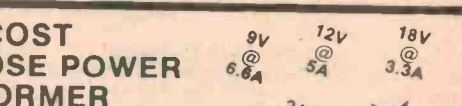
Now you can have your Telephone in the backyard or just on the other side of the lounge room with these nifty telephone leads. Double Adaptor allow two phones into the one line ideal for cordless phones etc

- P 0990 5 Metre extn lead \$14.95
- P 0992 10 Metre extn lead \$17.50
- P 0995 Phone Dble Adpt \$12.50

## NEW ALTRONICS PRODUCT LOW COST MULTIPURPOSE POWER TRANSFORMER

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. Made right here in Australia. Use of high grade Silicon steel has enabled surprisingly compact dimensions (70mm x 70mm x 58mm 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 new is the Low Price — Just \$22.50 Cat. M 2165

An exclusive Altronics Design Why didn't we think of it years ago!!

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## ALCOHOL BREATH INDICATOR

Save your license! Save your life!  
Save the lives of others! Save your job!



The Blotron Breath Indicator is designed to help you make an informed decision before getting behind the wheel of a vehicle. It is pocket size lightweight, portable and laboratory calibrated. An exclusive bi-valve breath-sampling chamber measures the alcohol in your blood. The Meter indicates your alcohol content level. The meter pointer and Leds indicate three stages of alcohol consumption—safe—questionable—legally drunk.

Two Models

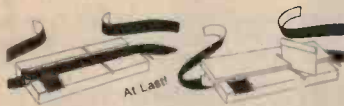
A 0905 Calibrated to .05 BAC  
A 0908 Calibrated to .08 BAC

**BOTH \$79.50 ea**

Requires 4 "AAA" Batteries Cat.S 5004

HIGHLY RECOMMENDED \* MADE IN U.S.A.

## New Video Repair Kit VHS/BETA



**Now \$7.95**

A VHS/BETA Video Tape Repair Kit. No need to throw out your damaged tapes—this nifty splicing kit can save you a fortune (if you've got small children this kit will save you several fortunes!) All accessories included for joining tape and refixing leader ends etc. CAT A 9315  
**Fantastic Value**

## EA'S LABORATORY POWER SUPPLY

**3—50 Volt at up to 5 Amps**

Single Printed Circuit Board construction - dead easy to build.

EXCLUSIVE TO ALTRONICS:

- \* Deluxe instrument case.
- \* Attractive silk screened front panel.
- \* Fully drilled and punched chassis - no holes to drill.
- \* Front panel supplied to accommodate K 3325 option if required.
- \* Heatsink tubing supplied for critical component termination.



**K 3300 | \$139.50**

SPECIFICATIONS:

- \* Output Voltage = 3-50 volts
- \* Output current up to 5 amps (max. 175W)
- \* Floating outputs isolated from ground.
- \* Ripple less than 90mV p.p at Max.

Auxiliary + /-12V Option

**K 3302 ..... \$12.50**

## DAINICHI HIGH FIDELITY SPEAKERS

Custom made for Altronic by Dainichi, one of the most respected loudspeaker makers in Japan (they manufacture speakers for Pioneer) All very conservatively rated—superb for building up a low cost speaker system. Naturally they also serve as rather excellent replacement speakers.

### CONE TWEETER 50 WATT

5 Watt Max.Power 8 Ohm Z

Amazing performance budget price. Frequency response 2 KHZ-18 KHZ. 110mm Diam. Hole centres 79mm. Australia's best value at this price.



**C 3020 \$8.95 4up \$8.00**

### MIDRANGE 50 WATT

Midrange clarity that has to be heard to be appreciated!

Absolutely 1st class reproduction of midrange—piano, vocal, guitar, violin etc. Huge 50 watts max. Input. 8 Ohm. Frequency response 700-5 KHZ. Value Plus!



**C 3030 \$22.50 4up \$20.00**

### DOME TWEETER 60 WATT

60 Watt Max.Power

Silky smooth frequency response. 1.5 KHZ to 20 KHZ. Wide Angle dispersion. Massive power handling capacity. Diam. 94mm. High spectrum. Purity. Incredible low price!



**C 3010 \$19.50 4up \$18.00**

### WOOFER

307mm (12 in.) 40 watts max. power 8 Ohm.

Roll edge one suspension. Resonant of 30 HZ. Frequency range 30-2 KHZ. Smooth faithful bass speaker. Ideal HI-FI replacement. 48mm voice coil.



**C 3040 \$42.50 4up \$39.95**

## Superb Entertainers Microphone Cardlod Moving Coil

Our C 0380 Cardlod Microphone has been acclaimed by professional entertainers all over Australia. Next month there's a veritable truck load of new stock arriving—so out they go at an unbelievable price—Just \$50 be quick!



Over 1000 Sold

C 0380  
Now **\$50**

Simply superb entertainers microphone Silky smooth response (useable to 18KHz). Extremely low feedback incidence. Inbuilt wind filter eliminates "Pops". Balanced line circuit enables long mic cable runs.

Impedance — 200 Ohms  
Output Level — 75db/1000Hz  
Frequency Response (Useable) — 30Hz — 18KHz  
Sturdy Carry Case Included

## Last chance to equip your Lab with Hitachi's famous Dual Beam V212 20 meg. Cro at Just \$699



Prices will Rise \$100 shortly

**\$699**

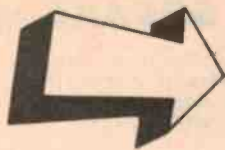
We are proud to include Hitachi's superb Oscilloscope in our range of test equipment. It features: • Thin, light and compact design (310W x 130W x 370Dmm, 6kg) • Large 6 inch rectangular internal graticule CRT • Vertical mode triggering selection to provide stable triggering of each channel • High accuracy + 3% • High sensitivity 1mV/div • Stable, low drift design • TV sync separation circuit built-in • Convenient X-Y mode for phase difference measurements • Tilting ball supplied CAT Q 0152

## 10 to 1 Attenuator Probe Kit

1 to 1 or 10 to 1 Attenuation

**Q 0153 \$42.50**





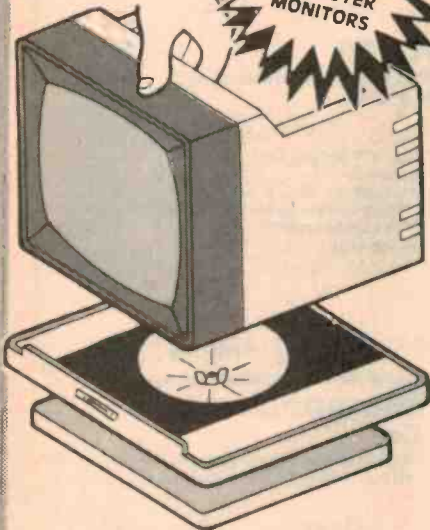
**UNIVERSAL  
MONITOR STAND  
WITH PAN & TILT ADJUSTMENT**

This brilliant monitor stand enables you to swivel left/right and tilt up/down to position monitor to any desired position. Hence viewing position is enhanced and screen glare eliminated.

Altronics direct import price is now under \$30.

D 1100

**\$29.95**



**Printer Interfaces  
Printer Interfaces  
Bargain of 1985**

Convert your 80 Col parallel printer to Serial with one of these Interface Cards.

**Were Selling for \$145**

**Now An Amazing \$49**

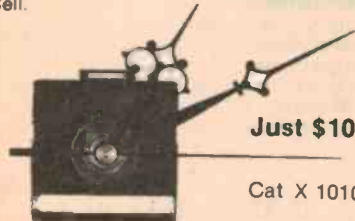
**Two Models**

D 1178 Suits CP 80 **\$49**

D 1179 Suits DP 80 **\$49**  
or Fax 80

**Clock Movement**

Fit your own custom Clock Face. Great for novel applications such as fitting to pictures etc. Very accurate, runs for approx 1 year on one AA Cell.



**Just \$10**

Cat X 1010

**Microbee Owners**

As we no longer sell the Microbee Computer range, we now have these surplus products which we want to quit 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!

**MICROBEE LIGHT PEN  
(ETI AUG '83)**



**Just \$10**

**PROVIDES DIRECT PERSONAL  
CONTACT WITH YOUR BEE!**

This pen works in the low-resolution graphics mode and connects directly to the I/O port • Fully documented with software example. CAT 9649

**MULTIPROM INTERFACE  
FOR THE MICROBEE**



~~\$99.50~~ **Now \$40**

(ETI NOV '83)

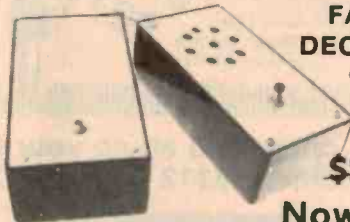
44K OF PROGRAM STORAGE • FULLY SOFTWARE SELECTABLE • SUITS BOTH IC AND PLUS MACHINES • 8 OUTPUTS FOR CONTROL APPLICATIONS.

A sensational kit for the MICROBEE requires no modification to the computer except for the fitting of a 50 pin expansion socket. This project is easy to build and will allow you to store and software select up to 44K of eeprom storage — acts like a mini disk drive system with the speed of RAM. Extra units may be added to further increase storage.

The ALTRONICS Kit comes complete in every way.

- Full set of IC sockets
- Double sided, plated through board
- Assembled connection lead to Microbee
- fully documented
- Cassette monitor included (plus sourcefile)

CAT K 9673



**FAX  
DECODER**

(ETI SEPT '83)

~~\$24.50~~

**Now \$15**

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

**RADIOTELETYPE DECODER  
(ETI APRIL '83)**



**Now  
\$20**

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

**Ex Display Monitors  
Unbelievable \$99**

What are we raving about? No there is nothing peculiar about the display of these fine high resolution Micron Series 2 and Series 3 Monitors — "Ex" refers to the fact that they have been used by us for Display and Demonstration purposes and are therefore, strictly speaking, not brand new. Not that in most cases you could notice any difference between these and the identical new stock item (there's possibly the odd superficial scratch but, after 2 weeks use at home, this would be normal anyway).

All Perfect Working Order — All Guaranteed.



**All \$99 each**

We will endeavour to supply the model you request - however, we reserve the right to substitute if necessary.

- Cat D 1114 Series 2 Green Screen HI Res
- Cat D 1115 Series 2 Green Screen N/Glare
- Cat D 1115 Series 3 Green Screen N/Glare

**But at \$99 there must be a catch??**

There is! We have only a very, very limited quantity — so ring your order soon.

**Superb true Analogue  
Joystick Kits for the  
Microbee Computers**

**Both 1/2 Price**

The ideal Joystick for games where delicate proportional control is required to accurately position your craft on the screen. For the more serious user it can substitute for a 'mouse' in graphic business or other programmes. Available in two forms.

Standard  
K 9674 ..... \$24.50

**Now \$12**

Deluxe with self centring control lever  
K 9675 ..... \$35.00

**Now \$17**



**Joystick for  
Microbee Computer**  
Fitted with interface lead and plug for Microbee

Were \$29.50 Now **\$10**

D 1420

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FOR NEXT DAY JETSERVICE DELIVERY

**BUILD THESE FABULOUS KITS**

**OSCILLOSCOPE SENSATION!**

(See EA Oct '84)



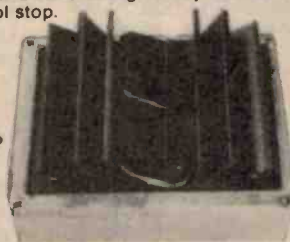
K 2000  
**Only \$249**

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 type 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.

**TRANSISTOR ASSISTED IGNITION WITH DWELL EXTENSION**

KEEP YOUR ENGINE IN TOP TUNE

Yes, it's bad enough paying \$2.00 a gallon for petrol without wasting a fortune on an out of tune engine. Fit this transistor assisted ignition kit in minutes and start saving money from the very next petrol stop.



K 4010  
**\$35.00**

Value Plus

This unique electronic ignition system will easily double the interval between tune ups. Plugs and Points stay in top condition for much, much longer. Greatly reduced plug breakdown at high rev's. Dead easy to build and (even better) there are only 3 electrical connectors required to the car wiring system.

(See EA Mag. Jan '85)

Protect your Home or Business from intruders with this "State of the Art" Burglar Alarm.

**MULTI SECTOR BURGLAR ALARM STATION**



**FEATURES:**

- Alarm has 8 separate input circuits—8 sectors can be monitored independently.
- Each input circuit is provided with an indicator LED and a sector On/Off switch
- Individual sector isolation allows the user to have some areas of the premises habited while others remain protected e.g. Inside Off/Outside On.
- inputs accept both normally closed and normally open sensors
- Two inputs provided with an entry delay (between 10 - 75 seconds)
- Internal trip warning buzzer—alerts owner/occupant of pending alarm operation—great for the "forgetful" amongst us. This buzzer is pre-settable between 5 and 55 seconds prior to Alarm.
- Unique circuit detects automatically when any N/O or N/C loops are either open circuit or dead short. e.g. someone trying to bridge reed switches etc.
- Switched output can be used to send a silent alarm through an auto-dialler circuit or similar.
- Full battery back up provided via. 12V—1.2Ah battery
- Supplied in an attractive functional security case.

K 1900 A Mere **\$139.00**

**STATE OF THE ART**

**The Avtek MultiModem**

a breakthrough in low cost modem design Using state-of-the-art VLSI integrated circuitry, the Avtek MultiModem provides the highest standards of reliability for data communications on public phone lines. Digital signal processing is used to achieve functions normally requiring analogue filters.



MULTIMODEM NEVER REQUIRES ADJUSTMENT

MULTIMODEM WORKS RELIABLY ON LINES WHERE OTHER MODEMS CAN'T FUNCTION Its digital filters are much sharper than on conventional modems. Line interference is screened out. You get error free data transfer, even on very noisy lines.

**MULTISTANDARD OPERATION**  
CCITT and Bell Duplex and Half Duplex.  
**AUTO ANSWER OPTION (MODEL D 1205)**  
Autoanswer is the ability of your computer/modem to receive when the phone rings. Some computer/software combinations do this. MultiModem offers the alternative for computers without this facility—hardware autoanswer. Leave your computer waiting for information.

**TEST FUNCTIONS**  
DIG: This function enables the user to test the modem's operation over a line, testing both modem and line.  
ANL: Provides testing of computer, software, cabling and modem.

**SPECIFICATIONS**  
Data Standards: CCITT V.21 & V.23 Bell 103 & 22  
Data Rates: 300, 600 & 1200 BPS  
Backward Channel: 75 BPS in conjunction with 1200 BPS

Computer Interface: CCITT V.24 (RS232C)  
Power Requirements: 240 VAC Power drain—3 watts  
TWO MODELS  
D 1200 (Standard) **\$349.00**  
D 1205 with auto answer **\$389.00**

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<b>OSBURN</b> CARLINGFORD Jaycar ..... 872 4444	<b>SUBURBAN</b> FORTITUDE VALLEY McGrath Electronics ..... 832 3944	All Electronic Components ..... 662 3509 McGrath Electronics ..... 347 1122
<b>CONCORD</b> Jaycar ..... 745 3077	St Lucia Electronics ..... 523547	<b>SUBURBAN</b> BENTLEIGH Absolute Electronics ..... 557 3971
<b>GORE HILL</b> Jaycar ..... 439 4799	<b>PADDINGTON</b> Jacobs Electronics ..... 369 8594	<b>BOX HILL SOUTH</b> Eastern Communications 288 3107
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# Voice data input

According to Lockheed-Georgia, talking to computers is more productive — especially for people who don't like keyboards. So it's investing money to apply voice input technology to the company's computer based generative process planning system.

The reasoning goes that when planners are at a terminal, they often have their hands full with engineering drawings, manuals, and other documents. Putting drawings down or turning away from the manuals to enter data takes time and breaks their concentration. That break in con-

centration costs time and can lead to errors, including simple typos.

Six process planners have been trained to use the voice data entry system, which is based on an IBM PC XT. The system consists of a terminal emulation package called

IRMA, a voice recognition board from Tecmar, and software developed by Lockheed.

Lockheed's system is a "user dependent, discrete word" system. That means the computer can recognize only single words (or phrases not more than 1.5 seconds long), and that it can recognize only the voice patterns of users who have "trained" it.

There are certain inherent limitations in this type of system, however, says one com-

pany spokesman. "Voice systems may have trouble recognizing words because of a cold, a dry throat, or a moment of laziness in pronunciation."

But he said that planned improvements in Voice GENPLAN include adding continuous word recognition hardware, improving vocabulary handling software, and implementing user suggested changes.

## A future for educational software

According to a market research group, International Resource Development Inc, the home market for educational software will really only begin to take off two to three years from now.

A key technological contributor to this takeoff will be the emergence of powerful, full-function, and readily affordable portable micros — because students need to use computers both at home and at school.

The interactive videodisk will be another valuable addition.

Demographic tendencies should also encourage market takeoff a few years down the road. The home is increasingly becoming the centre for the learning experience. Adult education is on the rise. According to Maureen Fleming, a senior IRD researcher, this will increase the demand for educational materials, including software.

With a few significant exceptions, educational software currently is widely viewed as bad.

The shortcomings are generally of two types. First, many programs are simply scholastically unsound. But also, offerings tend to be of the relatively "dumb" drill and practice variety, rather than conceptually more advanced.

The suggestion from one American study is that by 1987-1988 much headway will have been made towards overcoming these problems. Educators will know more about the ins and outs of software design; technical experts will be more sophisticated regarding effective academic practices. The role of D&P programs will diminish, to be filled by tutorials, simulations and model-building offerings.

## More Microbee

With special features such as Telecom approval, the new "Beemodem" from Applied Tech gives you legal opportunity to connect your Microbee to other computers via the telephone line. Simple installation consists of plugging in two cables, to the telephone socket and to the RS232 port. Operation modes are CCITT V.21 ORIG and ANS 300 bps full duplex, from a 12 V at 140 mA from the host computer through the RS232 port. It also has a 1200/75 baud option.

The modem consists of two

parts — the Beemodem unit and a handset. All for \$189.50.

And if that ain't enough to keep you busy, Microbee now offers a hardware/software modification option for use of Viatel. (Viatel, Telecom's teletext links you to banking, news, weather etc information). The Microbee Viatel option works with the 1200/75 baud rate on the Beemodem.

For further information contact Applied Technology, 1 Pattison Ave, Waitara, NSW 2077. (02)487-2711 or capital city offices.

### CLUB CALL

The Melbourne Microbee club you knew as **Microbug Australia** is now incorporated. The new name is **Mbug Australia Inc**, at PO Box 157, Nunawading, Vic 3131.

The club now meets at the Mount Waverley Community Centre, Cnr. Miller Crescent and Stephenson's Road, Mount Waverley, on the second Wednesday of each month, from 7.30 pm. The club now has bulletin board access. Membership for RCPM access is only \$10, and may be test driven on (03)873-5734.





## Positronic's micro

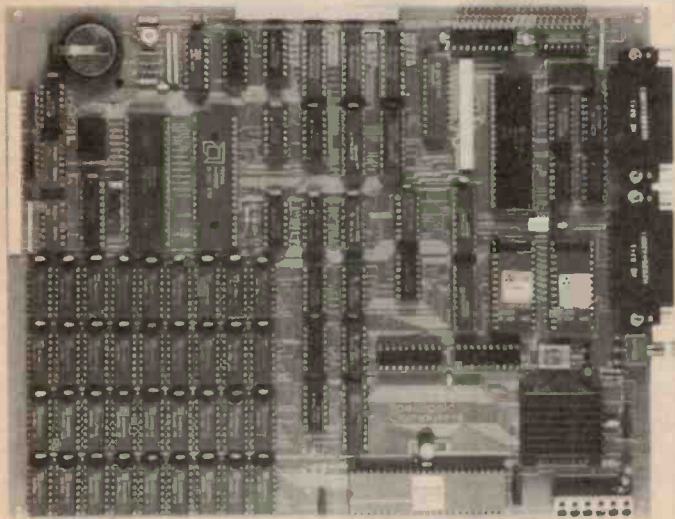
Positronic Computers has released an Australian designed single board 80186 microcomputer that is specifically designed to support the latest 10 MHz 80186 from AMD. It is said to provide up to 25% more processing performance than any other 80186 based system and up to three times the performance of the standard 8086 CPU, and includes all peripheral functions required for a single-user computer system.

The card was laid-out using a PC layout system written by Positronic Computers, and will shortly be enhanced by the addition of a high resolution graphics adapter and networking interface.

The PC186 is specifically designed to support the TurboDOS operating system and is available with complete implementation. Included with TurboDOS 1.4 are system utilities

for file maintenance and archiving, a Z80 emulator package allowing all current Z80 programmes to be run on the PC186. TPC and READPC are two utilities for executing MSDOS programmes and reading MSDOS diskettes respectively. TurboDOS also uses a sophisticated disk catching system that makes most disk systems run as fast as a RAM-disk. Print spooling is also included as are utilities for print queue maintenance. TurboDOS supports most CP/M, Concurrent CP/M, and MP/M-86 programmes including Digital Research's GSX-86 package. A range of application programs including dBase II, Wordstar and Turbo Pascal are available for immediate use. The price is \$1250.

For further information contact Positronics, 1 Strathaird Close, Diamond Ck, Vic 3089. (03)438-2713.



## More modems

Another modem system, the 2123B, has been released by Consolidated Electronic Industries. The CEI data 2123B handles sync or asynch data formats in full or half duplex modes. Options include a baud rate converter from 75/150/300 to 1200 baud for terminals not supporting split baud operation, and a sync clock generator (SCT,

SCR) for 1200 baud half duplex synchronous operation.

A maximum of 16 modems can be fitted into a configuration for rack mounting with the rack available as a further option.

For further information contact CEI, 15a Anderson Rd, Thornbury, Vic 3071. (03)484-0791.

### A bit of savvy

The Savvy PC combines artificial intelligence capabilities, an operating system with virtual memory management, an adaptive pattern recognition processor and a relational database manager. It contains about 250 functions for arithmetic, expandable vocabulary and program structure. Further information is available from Aladdin Computer Services, 11 Ormond Rd, Elwood, Vic 3184. (03)531-4173.

### Buffers and switches

Melco printer buffers and switches, distributed by Alfatron, include 32K byte units suitable for some PCs, with standard units as well as machine specific ones available. Buffer sizes are up to 128K bytes. For further information contact Alfatron, 1761 Ferntree Gully Rd, Ferntree Gully, Vic 3156. (03)758-9000.

### Two way converter

The new Transdata 192 allows communications between an RS232 serial interface and parallel Centronics in either direction. The compact unit uses CMOS technology, and permits data rates up to 19.2 kbaud. Handshaking in ASCII is by X-on/X-off and EIA control signals; Hex is via EIA only. Designed and manufactured in Australia, more info on it is available from Lamron, PO Box 438, Ryde, NSW 2112. (03)808-3666.

### Surge absorber unit

This unit absorbs induced surges between lines or from ground for the protection of electronic equipment including computers. It's available from Autotronics, 1/3 Marshall Rd, Kirrawee, NSW 2232. (02)521-3711.

### Microsoft C compiler

The new Microsoft C compiler is designed to increase execution speed and compactness of C programs. C language is popular for systems programming because of flexibility and portability. This compiler allows calls to other Microsoft languages such as Fortran, Pascal and Assembler.

### Fruits of education

Apple is offering school purchase buys on the IIe and Macintosh. The Apple IIc Introductory System of Apple IIc (128K), disk drive, 80 column card and ports comes free with the purchase of nine IIe Starter Systems. The Macintosh with software and peripherals is going for \$2767.

### New Spellbinder

A new Spellbinder Scientific version provides mathematical and chemical symbols for the technical user. A symbol editor is provided for manipulation of on-screen symbols. It can output on the HP Laserjet printer and the Epson MX and FX series among others. For further information contact Software Source, PO Box 311, Bondi Junction, NSW 2022. (02)389-6388.

### IBM compatible portable computers

Vicom has introduced the Gridcase line of IBM compatible portable computers. The computers offer local and remote area networking, have a built-in 3½-inch floppy (720K), weigh 6 kg and offer a choice in flat panel displays memory options and battery power configurations. For further information contact Vicom, PO Box 366, Sth Melbourne, Vic 3205. (03)62-6931.





# Rockwell

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12 MHz available soon		
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R6503P	CPU, 28 pin	\$7.24
R6504P	CPU, 28 pin	\$7.24
R6507P	CPU, 28 pin	\$7.24
R6511Q	Single chip microcomputer, 64 pin CPU, RAM ACIA I/O, Timers, 64K Address	\$20.93
R6520P	PIA 40 pin	\$5.13
R6522P	VIA 40 pin, 20 I/O, 2 x Timer/Ctr S. Reg.	\$7.37
R6532P	COMBO 40 pin, 128 byte RAM, 20 I/O, Timer	\$9.21
R6541Q	Slave Processor, 64 x 8 RAM, 23 I/O, host slave I/F, timers, 4 K, external address	\$15.01
R6545-1P	Video controller	\$12.51
R6551P	ACIA integral Baud rate gener.	\$8.82
R6592P	Single chip printer controller for Epson Low cost printer	\$15.14

## CMOS

R65C02P1	CPU, 50 pin plastic, enhanced instruction set	\$10.00
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R65C51P1	ACIA 28 pin	\$10.00
R2424	MODEM CHIP SETS	\$495.43

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Centronics	Serial	Ex Tax \$281.68 Incl Tax \$321.23
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TATUNG TVT600A TERMINAL		Ex Tax \$803.22

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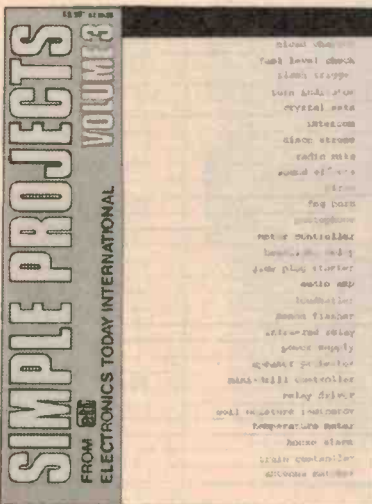
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## CONFERENCES AND SEMINARS

But the value of the Perth Electronics Show goes far beyond the public exhibits, it's a total industry forum and is THE most important event of the year. You'll have the opportunity to participate in seminars and workshops devoted to product trends, marketing, merchandising and promotions.

Separate public seminars will be held this year on our rapidly changing industry as an attraction to the Perth Electronics Show.

## PREVIEW NEW PRODUCTS TO PLAN CHRISTMAS BUYING

August is an ideal time for buyers and retailers to plan orders with manufacturers for the Christmas period. The Perth Electronics Show has also proven popular with the publishers of our industry journals featuring many new releases, direct from Chicago. The Perth show gives ample time to make the important deadlines for the October/November issues.

## NEW AIRFARE/ACCOMMODATION OFFER

In conjunction with Ansett Airlines and Jepsens Travel, the Perth Electronics Show have organised some very attractive three and seven day airfare and accommodation packages.

7 Night Accommodation/Airfare Package  
Per person costs

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Melbourne	738	965	809	1108	664	817	681	852
Adelaide	668	895	739	1038	594	747	611	782
Brisbane	834	1061	905	1204	760	913	777	948
Hobart	804	1031	875	1174	730	883	747	918
Launceston	790	1017	1160	861	716	869	733	904
Canberra	790	1017	861	1160	716	869	733	904
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Telex 70284 JEBRED. Telephone (02) 922 4300

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Melbourne	715	841	718	850	561	736	670	736
Adelaide	635	761	638	770	581	656	590	656
Brisbane	877	1003	880	1012	823	898	832	898
Hobart	792	918	795	927	738	813	747	813
Launceston	774	900	777	909	720	795	729	795
Canberra	775	901	778	910	721	796	730	796
Add night:	43	85	44	88	25	50	28	50

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- \* 3 nights accommodation at hotel of your choice.
- \* Economy class return fare to Perth from your homeport.
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For further information on the Perth Electronic Show contact The Manager, Chris Gulland.  
Perth Electronic Show  
PO Box 745  
West Perth 6005  
Telex 92952. Telephone (09) 382 3122



# MICROBEE COLUMN

## Boggle

D. Betts, Belmont Vic 3216

This is a remake of the famous game of the same name. It is a lot harder to make some decent words with this one. The highest score I ever achieved was 10! But despite its difficulty the game has good educational value. The boxes for the letters are drawn in LORES. The scores for the players are displayed on the screen and there is an optional printer output so your friends can take home the score sheet.

```
00100 REM // BOGGLE - a word game program for the microbee //
00110 REM // Written by Dean Betts, Geelong //
00120 GOSUB 1340:REM ** LORES TITLE DISPLAY **
00130 GOSUB 1050:REM ** INSTRUCTIONS **
00140 CLS:INPUT "Enter number of players "X
00150 DIM A(1)(X),B(X),G(16)
00160 FOR X=1 TO X:PRINT "Enter player "X"s name ";INPUT " " A(X)
00170 NEXT X
00180 GOSUB 770
00190 CURS 29:PRINT "Ready.."
00200 A2$=KEY:IF A2$="" THEN 200
00210 CURS 29:PRINT " "
00220 REM ** RANDOM LETTER **
00230 FOR I=1 TO 16:LET B(I)=INT(RND*26)+65
00240 NEXT I
00250 GOSUB 850
00260 REM ** 3 MINUTE TIMER **
00270 D=731:E1=.05
00280 FOR I1=E1 TO .01 STEP -.01
00290 FOR H=0 TO D:NEXT H
00300 CURS 26:PRINT (FB.2 11)
00310 NEXT I1:FOR H=0 TO D:NEXT H
00320 CURS 1:PRINT "BEGIN!";PLAY 23
00330 CURS 30:PRINT " " :CURS 30:PRINT "3.00"
00340 FOR H=0 TO D:NEXT H
00350 E1=2.59:CURS 30:PRINT " " :CURS 1:PRINT " "
00360 FOR I1=E1 TO 2 STEP -.01
00370 CURS 26:PRINT (FB.2 11)
00380 FOR H=0 TO D:NEXT H
00390 NEXT I1
```

```
00400 E1=1.59
00410 CURS 30:PRINT " "
00420 FOR I1=E1 TO 1 STEP -.01
00430 CURS 26:PRINT (FB.2 11)
00440 FOR H=0 TO D:NEXT H
00450 NEXT I1
00460 E1=.59
00470 CURS 30:PRINT " "
00480 FOR I1=E1 TO 0 STEP -.01
00490 CURS 26:PRINT (FB.2 11)
00500 FOR H=0 TO D:NEXT H
00510 NEXT I1
00520 CLS:PLAY 1,10
00530 CURS 27,8:UNDERLINE:PRINT "CORRECTION":CURS 21,16:NORMAL:PRINT "Press any
key to begin!"
00540 A2$=KEY:IF A2$="" THEN 540
00550 CLS:GOSUB 770:GOSUB CURS 18,1:PRINT "Press any key when finished."
00560 A2$=KEY:IF A2$="" THEN 560
00570 FOR H=1 TO X:CLS
00580 CURS 21:PRINT "Player "H"s Report Card":PRINT "Name = ";A(X)
00590 INPUT "Input score = ";IN:PRINT
00600 LET S(H)=N+S(H)
00610 PRINT "Total score = ";S(H)
00620 PLAY 0,16:NEXT H
00630 GOSUB 950
00640 PRINT:PRINT "Do you want to quit? [Y/N] ";
00650 A2$=KEY:IF A2$="" THEN 650
00660 IF A2$="Y" THEN 680
00670 GOTO 180
00680 PRINT "Do you want a printout of scores? [Y/N] ";
00690 A2$=KEY:IF A2$="" THEN 690
00700 IF A2$="Y" THEN 730
00710 GOSUB 950
00720 POKE 220,111:END
00730 OUT#5 ON
00740 GOSUB 950
00750 OUT#5 OFF
00760 GOTO 720
00770 CLS:LORES:REM ** PLOT LINES BETWEEN LETTERS **
00780 A=39:C=3
00790 PLOT 32,A TO 32,C:PLOT 63,A TO 63,C:PLOT 92,A TO 92,C
00800 A=4:C=122
00810 PLOT A,12 TO C,12:PLOT A,21 TO C,21:PLOT A,30 TO C,30
00820 A=318:124:C=39
00830 PLOT A,A TO B,A TO B,C TO A,C TO A,A
00840 RETURN
00850 REM ** PRINT LETTER IN APPROPRIATE SQUARE **
00860 K=9
00870 FOR I=1 TO 4:CURS K,5:PRINT CHR$(G(I)):LET K=K+15:NEXT I
00880 K=9
00890 FOR I=5 TO 8:CURS K,8:PRINT CHR$(G(I)):LET K=K+15:NEXT I
00900 K=9
00910 FOR I=9 TO 12:CURS K,11:PRINT CHR$(G(I)):LET K=K+15:NEXT I
00920 K=9
00930 FOR I=13 TO 16:CURS K,14:PRINT CHR$(G(I)):LET K=K+15:NEXT I
00940 RETURN
00950 REM ** REPORT **
00960 CLS:CURS 30:UNDERLINE:PRINT "REPORT":NORMAL:PRINT \
00970 FOR H=1 TO X
00980 PRINT A(H):TAB 16;S(H)
00990 NEXT H
01000 RETURN
01010 REM ** PRINT LETTER IN APPROPRIATE SQUARE **
01020 PRINT A(X):TAB 32;S(H)
01030 NEXT H
01040 RETURN
01050 REM ** INSTRUCTIONS **
01060 CLS:PRINT " Welcome to BOGGLE ! This program is a computerised version
01070 PRINT "of the game with the same name. I (the computer) will randomly"
01080 PRINT "choose 16 letters and print them in a box on the screen. The"
01090 PRINT "player(s) have a certain amount of time to write as many words"
01100 PRINT "as possible using the letters in the box. Note that consecutive"
01110 PRINT "letters in the word must be adjacent to each other in the box."
01120 CURS 29,8:UNDERLINE:PRINT "SCORING":NORMAL
01130 PRINT " "
01140 PRINT "At the end of the 3 minutes, each player swaps their list"
01150 PRINT "with another person to prevent cheating. That person then"
01160 PRINT "counts up the number of words in the list in front of them and"
01170 PRINT "enters the score into the computer when the person's name is"
01180 PRINT "printed. I will then give you a progressive score and ask you if"
01190 PRINT "you wish to quit."
01200 PRINT "There is an optional printer output at the end of the game."
01210 A2$=KEY:IF A2$="" THEN 1200
01220 CLS:PRINT " "
01230 PRINT "Each player will need a pen (or pencil) and a piece of"
01240 PRINT "paper. This is to write down the words. Any amount of people"
01250 PRINT "can play."
01260 PRINT " "
01270 PRINT "The amount of time given can't be changed from within the"
01280 PRINT "program as you cannot change the amount of sand in the hourglass"
01290 PRINT "in the real version which you can buy in the shops."
01300 PRINT " "
01310 PRINT "At the end of the time allotment, the letters will be"
01320 PRINT "cleared off the screen and a buzzer sounded. You shall swap"
01330 PRINT "papers, then the letters are printed on the screen again to"
01340 PRINT "verify any queries or doubts."
01350 PRINT "PRESS ANY KEY TO START..":
01360 A2$=KEY:IF A2$="" THEN 1320
01370 RETURN
01380 REM ** LORES TITLE DISPLAY **
01390 M=0
01400 CLS:LORES
01410 PLOT 35,24 TO 89,24 TO 89,35 TO 35,35 TO 35,24
01420 FOR F=21 TO 43
01430 READ D:CURS F,M:PRINT CHR$(D):NEXT F
01440 IF M=6 THEN LET M=7:GOTO 1390 ELSE 1440
01450 DATA 183,179,153,192,170,131,131,149,192,150,131,131,192,150,131,131,192,1
49,192,192,183,179,147
01460 DATA 181,176,154,192,170,176,176,149,192,181,176,155,192,181,176,155,192,1
81,176,192,181,176,176,176
01470 CURS 19,10:PRINT ">>> A FAMILY WORD GAME <<<"
01480 CURS 13,15:PRINT "Written by Dean Betts, September 1984."
01490 PLAY 0,16
01470 PLAY 18;0;16;0;18;0;13;0;10;0;13;0;0;0,3
01480 PLAY 18;0;16;0;18;0;13;0;10;0;13;0;0;0,3
01490 PLAY 18;0;20;0;21;0;20;0;21;0;18;0;20;0;19;0;20;0;17;0
01500 PLAY 18;0;13;0;19;0;13;0;18;0,3
01510 PLAY 18;0;16;0;18;0;13;0;10;0;13;0;0;0,3
01520 PLAY 18;0;16;0;18;0;13;0;10;0;13;0;0;0,3
01530 PLAY 18;0;20;0;21;0;20;0;21;0;18;0;20;0;19;0;20;0;17;0
01540 PLAY 18;0;13;0;19;0;13;0;18;0,3
01550 RETURN
```

## 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."  
 \* Breach of copyright is now a criminal offence.

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# JAYCAR - KIT SUPPORT FOR ALL

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Ref. EA February 1985

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☆ **Battery or mains operation** ☆  
**Full control - bass, treble and volume** ☆  
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**Gel battery automatically recharged when mains used.**

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 A FURTHER SAVING

## 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**



## 12/230V · 300

**WATT INVERTER** · This unit provides up to 300VA of power at 235V from an ordinary car battery. It is ideal as a standby AC power supply. The output voltage is regulated and gives a precise 50Hz. The kit also has current limiting with ultimate thermal shutdown.

The Jaycar kit features quality conservatively rated components and is complete down to the case and front panel.

Ref. EA June 1982

Cat. KA-1574

**\$220.00**

## MAIN FEATURES OF THE NEW PLAYMASTER

- ★ 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

## MAIL ORDER HOTLINE

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**(02) 646 1300**

## AUSTRALIAN ELECTRONICS WELCOME!

We would like to say "Welcome!" to the brand-new electronics hobby magazine 'Australian Electronics Monthly'. The editor Roger Harrison is known to us all and David Tillbrook chief project engineer, is very highly regarded. David, you may recall designed the incredibly successful ETI 5000 series amplifiers. Jaycar is very excited about the new magazine, the planned projects and what AEM has planned for the electronic enthusiast. Shown below are the Jaycar kits for the JULY '85 ISSUE of AEM. Don't forget to buy a copy!

## AEM 3500 'The Listening Post'

Ref. July 1985 AEM. This device attaches between the audio output of a short wave receiver and the input port of a computer. It allows decoding and printing of Morse Code, Radioteletype (RTTY), AND radio facsimile (FAX) pictures! You can, for example watch weather maps from the Met and dump them on to your printer!

Specific software for the Microbee is in the first article. Programs for other popular computers will be printed in later issues of Australian Electronics Monthly.

Complete set of specified components (inc. IDC plug).

Cat. KM-3015

**ONLY \$29.50** **NEW**

## 8 CHANNEL MIXER Model 8002

Jaycar engineers have produced a real winner with the 8002 stereo mixer. The front panel measures 19" wide x 14" high (8 rack units). This enables the 8002 to be mounted into PA racks if necessary. It has many features including: ● Balanced (600 ohm) mic inputs/line inputs ● Input attenuators ● Bass, mid and treble equalisation on each input ● "Effects" capability ● Foldback on all 8 inputs ● Stereo pan on all 8 inputs ● 5534A OP amps for low noise and very low distortion PLUS many other features and specs to be found in our 1985 catalogue on page 4/5.

Ref. EA April/May 1983 Cat. KJ-6504

**ONLY \$535.00**



## Meet Roger Harrison & Dave Tillbrook!

Come and have a talk to Roger and Dave at our GORE HILL STORE on SATURDAY JULY 13th and 20th from 10.30 a.m. - NOON.

Now you can ask them all those questions that you have always wanted, or suggest to them what you think would make a good project. You never know, maybe you will see YOUR Idea in print!

## 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 now - has been that built and tested units were no dearer than kits, if you 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 pre-punched and every component including nuts and bolts are provided, along with instructions.

Cat. KJ-7050

**ONLY \$269**

## DELUXE CAR BURGLAR ALARM

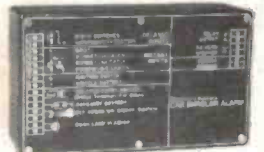
Ref. EA May 1984

This unit provides a very comprehensive array of facilities viz:

- ★ Two delayed inputs, six instant
- ★ 10 second delay exit, 10 second delay entry
- ★ Provision for auxiliary battery
- ★ Alarm trips for 2 minutes with automatic rearming
- ★ No separate siren driver required
- ★ 13mA current consumption; 500mA when alarm is triggered
- ★ Flashing dash panel lamp, key operated on/off, provision for 2 way protection

The Jaycar kit includes all PCB components, specified case and Scotchcal front panel. Cat. KA-1550

**ONLY \$69.50** **AUSSIE MADE!**



## MOTORCYCLE INTERCOM

Ref. EA February 1984

What a great kit! This full duplex unit enables you to talk to your pillion passenger whilst driving 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**



## MUSICOLOR IV

Ref. EA August 1981

The ultimate lighting controller. Combines a four channel sound-to-light effect with a four channel chaser.

- Front panel LED display
- 4 different chaser patterns
- Auto and manual reverse chase
- Sound triggered chaser
- Inbuilt electret microphone
- Safe, opto-isolated circuitry

Cat. KA-1010

**ONLY \$99.90**

## PLAYMASTER SERIES II MOSFET AMP KIT

Ref. EA Jan/Feb/March 1985

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



**NOW IN STOCK**



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# THREE PROJECT MAGAZINES

## MONTHLY **NEW**

### AEM 6500 - 60/120 Watt Utility Mosfet Amp Modules

Ref. July 1985 AEM  
This is a low cost high performance design using proven MOSFET technology. A single pair of (25J49/25K134) Mosfets will deliver up to 60 watts output. Another pair may be added for 120 watt performance. The module has been designed to fit into a large variety of commonly stocked instrument cases and rack boxes. It features VERY LOW distortion and impeccable transient performance. It is unconditionally stable and virtually blow-up proof. It can be powered from common transformer/rectifier/capacitor combinations. A Winner!  
As usual, the Jaycar kit reflects a quality approach. All specified components for each version are included.

**60 WATT MODULE** Cat. KM-3010 **\$49.50**  
**120 WATT MODULE** Cat. KM-3012 **\$65.00**

### AEM 9500 Beat Triggered Strobe

Ref. AEM July 1985  
This project provides a very bright stroboscopic effect for parties, discos, etc., but with an ADDITIONAL FEATURE! This strobe will actually flash in synchronisation with the music!  
The Jaycar kit includes case, photographic reflector flash tube etc.  
Cat. KM-3018

**ONLY \$59.00 **NEW****



### VIDEO AMP/BUFFER

Ref. EA August 1983  
The answer to a maddening prayer? This device can be made to fit inside a TV set (or in a separate box if necessary). It basically enables you to connect straight into the video drive of your TV turning it into a colour monitor. This means that the video signal from your computer, VCR, TV game etc. does not need to be converted to RF and go through the TV IF strip. You will be amazed by the clearer, sharper signal that has less interference! Notes on how to fit to various TV sets included.  
Cat. KA-1527

**ONLY \$14.95**



## ELECTRONICS TODAY INTERNATIONAL

### NEW 4 Input Mixer ETI 1404

Ref. ETI June 1985 This unit enables you to mix 4 separate signal sources. The mixer can be configured to take line, phono, or microphone level inputs. In other words, you can tailor the mixer to your individual requirements! The Jaycar kit includes all parts EXCEPT the front panel & the case, which comes from TANDY!  
Cat. KE-4700



**ONLY \$99.00**

### NEW OP-Amp Tester

Ref. ETI April 1985 Test OP-Amps with 741-type pinouts (e.g. TL071, TL074, 5534 etc.) with this nifty tester. Checks single, dual and quad packages!  
Cat. KE-4693



**ONLY \$29.95**

### NEW Microbee Dialler

Ref. ETI July 1985. Complete set of parts.  
Cat. KE-4696

**ONLY \$19.95 **NEW****

### GREAT NEW KITS FROM ETI Modem Kit

Ref. ETI May 1985  
This brilliant new design is a price breakthrough. Never has a modem with such SOPHISTICATED FEATURES been offered at such an incredibly low price. Now you can have no excuse to gain the tremendous benefits that a modem will offer viz:

- ★ Access to huge data banks
- ★ Networking
- ★ Telecommunications
- ★ Electronic shopping
- ★ Software exchange
- ★ And much more

This ETI kit is a full modem with facilities similar to units costing hundreds of dollars more. It even includes a Telecom approved push button telephone! Now is your chance to use your electronic skills in your new hobby and save a fortune over ready built.

You can obtain this modern kit (which includes a telephone for us humans) for the incredibly low introductory price of only \$149. That's right! \$149, inc. case, down to the last nut and bolt. But hurry! Stocks of the critical modem chip are very low and will severely limit kit supply.



**ONLY \$139**

### NEW ETI ECONOMY HOUSE/CAR ALARM MODULE

Ref. ETI May 1985  
This low cost full feature module can form the basis of a sophisticated anti theft system!

**ETI 1527** Cat. KE-4698 **\$24.95**

### ETI 675 Centronics to RS-232 Adaptor

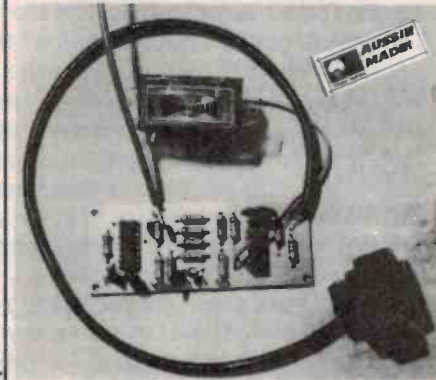
Ref. ETI January 1984  
This small project enables you to interface a printer to the RS-232 serial port of your computer. The kit consists of PCB and parts (including a special right angle Cannon DB25 plug) but not the Centronics plug or DIP switches, which are optional anyway.  
Cat. KE-4666

**ONLY \$34.00**

### ETI 733 RTTY Decoder

Ref. ETI April 1983  
This simple project allows you to hook up your Microbee to a communications receiver (or a similar good quality receiver) and print radio teletype messages on your VDU screen. A simple bit of software does the decoding. The kit can be adapted for use on other Z80 based systems. The Jaycar kit includes box, centre-zero meter, DB15 plug and software listing as well as other kit instructions.  
Cat. KE-4654

**ONLY \$19.95**



### 1/3 OCTAVE (28 BAND) GRAPHIC EQUALISER

This kit enables you to control 28 narrow bands of frequencies between 31.5Hz and 16kHz. By being able to do this you will be able to very effectively compensate for acoustic deficiencies in any indoor environment.

The 1/3 (i.e. 3 controls per octave) equaliser has been chosen for the 5000 system as most professional equalisation is done by 1/3 octave units. It gives total control over listening environment. The Jaycar kit includes fully prepunched and plated chassis, prepunched heavy gauge front panel, anodised and silkscreened to match the other 5000 components. It is original to the ETI design (Jaycar supplied the prototypes) but includes refinements such as quality IC sockets, UMBRAKO front panel fitting screws and matching brushed finish black anodised level control.

Each unit is mono, two will be required for stereo operation.  
Cat. KE-4204

**1 of \$199**  
**stereo pair \$389**  
**(SAVE \$10)**

#### SPECIFICATIONS

Signal to Noise	-102dB with respect to 1V
Frequency Response	12Hz - 105kHz to -1dB
Boost/Cut	14dB (28dB total)
Distortion	100Hz (0.007%)
	1kHz (0.007%)
	10kHz (0.008%)

(essentially irrespective of cut or boost)  
Current Consumption (DC) Approx 100mA @ ±15V (requires 30V AC CT)



# Jaycar ELECTRONICS

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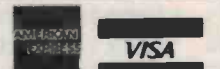
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## BILLS BRACKETS

W.F. Kreykes, St Albans, Vic 3021

This is a utility program that will be of use to all those with a printer and who submit programs for publication. When control characters are reproduced some of them can be very hard to read. This program changes all that.

It is essential for '64 owners who are not using a Commodore printer. I came across a similar program recently but found that it was not all it claimed to be as it didn't take into account all the controls. This pro-

gram converts all 39 control characters into readable abbreviations in brackets equal in length, which makes programs easy to read and enter.

I have shown all the codes at the end of my program which features: high speed, all codes a standard three digits, all 39 control characters provided for, works on standard Commodore, or with extended basics, such as Simons' and hexadecimal loader for ease when programming by hand.

```

10 REM  BILLS' BRACKETS, A SPECIAL LISTINGS FEATURE FOR THE COMMODORE '64.
12 REM  DESIGNED BY W.F.KREYKES. 5-10-84. ONLY ENTER LINES 13 TO 46.
13 PRINT"[CLR][3*DN][4*RHT][BLK][RVS]BILLS' BRACKETS, WITH HEX LOADER[OFF]
14 PRINT"[DN][GRN][4*RHT]PLEASE WAIT WHILE I POKE MYSELF!":L=52949
15 FORM=28TO46:READA$:FORJ=1TOLEN(A$)-1STEP2:GOSUB24:H=V*16
16 J=J+1:GOSUB24:POKEL,V+H:L=L+1:C=C+V+H:NEXT:NEXT
17 IFL-C<>21661THENPRINT"[DN][2*RHT][LGR]DATA ERROR":GOTO27
18 PRINTSPC(53)"[PUR]ALL IS NOW DONE
19 PRINT"[DN][BLK]SYS52988 TURNS [RVS]BILLS' BRACKETS[OFF] ON OR OFF
20 PRINT"[DN] THIS WORKS WITH NORMAL OR NON-";
21 PRINT"STANDARD [DN]ADDRESSES AT $0306, ";
22 PRINT"IE SIMONS' BASIC.":SYS52988
23 PRINT"[6*RHT][DN][RVS][PUR]BILLS' BRACKETS NOW IN FORCE[OFF][BLK]":NEW
24 V=ASC(MID$(A$,J,1)):IFV>47ANDV<58THENV=V-48:RETURN
25 IFV>64ANDV<71THENV=V-55:RETURN
26 PRINT"[2*DN][LBU]      NON HEX VALUE IN DATA LINE # "M
27 PRINTTAB(47)"[BLK]CORRECT ERROR AND RE-RUN.":END
28 DATA 8D 09 08 8E 0E 14 94 8C 8B 8A 89 88 87 86 85 9B
29 DATA 9A 99 98 97 96 95 81 9E 1F 1E 9C 9F 1C 05 90 92
30 DATA 12 13 93 9D 91 11 1D A0 00 AD 07 03 C9 CF F0 0B
31 DATA A0 02 8D 25 CF AD 06 03 8D 24 CF B9 25 CF 8D 07
32 DATA 03 B9 24 CF 8D 06 03 60 08 24 0F 30 06 28 4C 6D
33 DATA 82 1D CF A2 28 CA F0 F5 DD D4 CE D0 F8 48 86 FF
34 DATA 8A 65 FF 65 FF 85 FF A2 FF 68 E8 C8 D1 5F F0 FA
35 DATA 88 98 48 A9 5B 20 D2 FF 8A F0 1D 69 02 A2 FF E8
36 DATA E9 0A 10 FB A8 8A F0 05 69 30 20 D2 FF 98 69 3A
37 DATA 20 D2 FF A9 2A 20 D2 FF A6 FF A0 03 E8 8D 81 CF
38 DATA 20 D2 FF 88 D0 F6 A9 5D 20 D2 FF 68 A8 28 4C 00
39 DATA A7 52 45 54 45 4E 41 44 49 53 55 50 52 4C 57 52
40 DATA 44 45 4C 49 4E 53 46 4B 38 46 4B 36 46 4B 34 46
41 DATA 4B 32 46 4B 37 46 4B 35 46 4B 33 46 4B 31 47 59
42 DATA 33 4C 42 55 4C 47 52 47 59 32 47 59 31 4C 52 45
43 DATA 42 52 4F 4F 52 41 59 45 4C 42 4C 55 47 52 4E 50
44 DATA 55 52 43 59 4E 52 45 44 57 48 49 42 4C 4B 4F 46
45 DATA 46 52 56 53 48 4D 45 43 4C 52 4C 46 54 55 50 5E
46 DATA 44 57 4E 52 48 54
47 "[DN] = CRSR DOWN [UP↑] = CRSR UP [RHT] = CRSR RIGHT [LFT] = CRSR LEFT
48 "[CLR] = CLR SCREEN [HME] = HOME CRSR [RVS] = RVS ON [OFF] = RVS OFF
49 "[BLK] = BLACK [WHI] = WHITE [RED] = RED [CYN] = CYAN
50 "[PUR] = PURPLE [GRN] = GREEN [BLU] = BLUE [YEL] = YELLOW
51 "[ORA] = ORANGE [BRO] = BROWN [LRE] = LIGHT RED [GY1] = GREY 1
52 "[GY2] = GREY 2 [LGR] = LT. GREEN [LBU] = LIGHT BLUE [GY3] = GREY 3
53 "[LWR] = LOWER CASE [UPR] = UPPER CASE [DIS] = DISABLE CASE SWITCHING KEYS
54 "[INS] = INSERT [DEL] = DELETE [RET] = SHIFT RETURN.
55 "[ENA] ENABLE CASE SWITCHING KEYS [FK1] - [FK8] SPECIAL FUNCTION KEYS 1 - 8
56 "[13*DN] = PRESS CRSR DOWN KEY 13 TIMES

```



## SAVE IT

C. Groenhout, Watson, ACT 2602

This hybrid BASIC/Machine Language program allows the user of any VIC-20 system to transfer any amount of memory from the computer to the Commodore Datasette or 1540/1541 disk drive. The uses of such a programme include saving programmable character sets, machine language programmes and text files directly from memory time after time without using up any usable memory or corrupting the files to be copied. First you enter the file name to be used. After that you are asked to enter the start and end addresses in decimal. It's always a good idea to add a byte or two on to the end address just in case ... Finally you are asked if you wish to use a tape or disk drive. This can be changed by POKEing either 1 (tape) or 8(disk) into 676. To SAVE memory type SYS673 <RETURN> and to LOAD it type LOAD"FILENAME",D,1 with D being the device number referred to above.

```
10 I=673
20 READA:IFA=256THEN40
30 POKEI,A:I=I+1:GOTO20
40 PRINT"PLEASE ENTER FILENAME"
50 INPUTFL#
60 L=LEN(FL#):IFL>16THENFL#=LEFT$(FL#,16)
70 FORA=0TOL-1:POKE752+A,ASC(MID$(FL#,A+1,1)):NEXT
80 POKE683,L
90 PRINT"PLEASE ENTER START ADDRESS"
100 INPUTSA:HB=INT(SA/256):LB=SA-HB*256
110 POKE251,LB:POKE252,HB
120 PRINT"PLEASE ENTER END ADDRESS"
130 INPUTEA:HB=INT(EA/256):LB=EA-HB*256
140 POKE694,LB:POKE696,HB
150 PRINT"TAPE OR DISK (T/D)"
160 INPUTI#:IFLEFT$(I#,1)="T"THENPOKE676,1
170 PRINT"TYPE SYS673 TO SAVE MEMORY"
180 NEW
673 DATA 169,1,162,8,160,1,32,136
681 DATA 255,169,16,162,240,160,2,32
683 DATA 189,255,169,251,162,255,160,95
697 DATA 32,216,255,96,256
```

## ENVELOPE GENERATOR

C. Groenhout, Watson, ACT

Here is a short BASIC loader for a versatile machine code programme designed to give VIC users one of the 64's musical features. Rather than the usual ON/OFF sound you get from your VIC, this programme allows you to select your attack (the time it takes the computer to reach maximum volume), the decay (the time it takes the computer's volume to drop to the sustain level), the sustain level (the level at which the computer stays after the decay of volume), the sustain time (the time at which it stays at this level) and finally the release time (the time it takes for the volume to die away completely). It is from these parameters the term ADSR is derived. As noted the values for all five parameters are POKEd into addresses from 752 to 756 with values between 0 and 255. Try to avoid 0 except for the sustain level as you sometimes get some pretty weird results! After POKEing in the values you simply turn on the voice or voices you wish to use and SYS7176 to trigger the envelope. Happy SYSing!

```
10 POKE56,28:POKE52,28:I=7168
20 READA:IFA=256THEN8000
30 POKEI,A:I=I+1:GOTO20
7168 DATA 160,0,200,192,255,208,251,96
7176 DATA 162,0,32,27,28,142,14,144
7184 DATA 232,224,16,208,245,169,0,201
7192 DATA 1,208,22,173,240,2,141,245
7200 DATA 2,32,0,28,172,245,2,136
7208 DATA 152,141,245,2,192,0,208,241
7216 DATA 96,32,67,28,202,142,14,144
7224 DATA 236,242,2,208,244,169,0,201
7232 DATA 1,208,22,173,241,2,141,245
7240 DATA 2,32,0,28,172,245,2,136
7248 DATA 152,141,245,2,192,0,208,241
7256 DATA 96,173,243,2,141,245,2,32
7264 DATA 0,28,32,0,28,32,0,28
7272 DATA 92,0,28,172,245,2,136,152
7280 DATA 141,245,2,192,0,208,232,32
7288 DATA 131,28,202,142,14,144,224,0
7296 DATA 208,245,96,173,244,2,141,245
7304 DATA 2,32,0,28,172,245,2,136
7312 DATA 152,141,245,2,192,0,208,241
7320 DATA 96,256
8000 POKE36876,200
8010 POKE752,5:REM ATTACK TIME
8020 POKE753,20:REM DECAY TIME
8030 POKE754,5:REM SUSTAIN LEVEL
8040 POKE755,30:REM SUSTAIN TIME
8050 POKE756,10:REM RELEASE TIME
8060 SYS7176
```



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# Dick Smith's new VZ-300: THE BABY SURE HAS GROWN!

Jim Rowe

Following its very successful VZ-200 'baby' personal computer, Dick Smith Electronics has just released an improved version called the VZ-300. It has also announced a new low-priced floppy disk system, to go with either model. So for a really penetrating review of these new products, we passed them over to someone who was pretty deeply involved in the development of the original VZ-200 . . .

I HAVE TO ADMIT that I was really quite keen to check out the new VZ-300 personal computer. During my years at Dick Smith Electronics, one of the projects I spent quite some time on was the development and support of the little VZ-200. I believed then, and I still believe now, that the VZ-200 turned out to be an excellent 'first computer' for beginners — cheap, yet surprisingly powerful. Obviously quite a few other people thought so too, because DSE has apparently sold over 30,000 of them.

Perhaps my enthusiasm for the VZ-200 might seem to make me biased, but I don't think so. While on the whole I believe the VZ-200 turned out well, it certainly wasn't perfect. Like every other model on the market it had its shortcomings, and as someone who worked on the project right from the beginning I've probably had more insight into these than most.

Right at the outset, I should say that overall I'm very impressed with the new VZ-300. It is very much better than the VZ-200 in a number of ways, and certainly a worthy successor to it. Considering that DSE is selling it for the same price as the initial price of the VZ-200 — \$199 — that makes it even better value for money.

That said, there are a few disappointments. Earlier shortcomings which still haven't been fixed, the odd irritating new one, and areas of incompatibility with the earlier model (some of which were probably unavoidable). Luckily most of these are relatively minor. But let's look at the positive side first.

## Improvements

The most obvious improvement over the old VZ-200 is the keyboard. In place of the original array of rather rubbery tablets (the Yanks call them "Chiclets" after the US brand of chewing gum), the VZ-300 sports a much more professional full-size moving key array in the standard typewriter configuration. There's now a normal space bar at the front centre, and two shift keys in the normal positions. These are very big improvements, making the new model much more suitable for word processing. Great!

The case of the VZ-300 is a little bigger than that of its predecessor: 305 x 183 x 56 mm compared with 290 x 163 x 51 mm. It is also made from slightly darker plastic — much the same colour as the IBM-PC. It not only looks better, but is also provided with better ventilation so that it runs cooler.

The other main improvement isn't obvious until you start using it. The new VZ-300 has considerably more inbuilt random access memory to store user programs and their data. This is distinct from the 'video RAM', used to store the information displayed on the video monitor or TV screen; both the new and old models have 2K of video RAM.

Instead of the 6K bytes of user RAM provided in the original VZ-200, the new model sports a full 16K — nearly three times as much. This is a very worthwhile increase, and means that many users won't need to worry about extra RAM.

Of course there is extra RAM available, in the form of plug-in cartridges as there

was for the VZ-200. In fact there are now two RAM cartridges, one to provide a further 16K bytes and the other described as providing 64K.

Another improvement, albeit relatively minor, is that the VZ-300 is fitted with a small switch underneath to disable the colour part of the video signal. This means that if you are using the computer with a monochrome video monitor or TV set which is incapable of displaying colour, you can switch it off to clean up the display.

The VZ-200 was fairly irritating in this respect, with a constantly moving Moire interference pattern on the screen. The main cause of the pattern was a beat between the 3.58 MHz clock signal used for the computer itself, and the 4.43 MHz signal used for the video colour subcarrier. Early VZ-200s were particularly effected, but later machines used a reverse video format (ie, dark lettering on a bright screen) and improved internal shielding, which made quite a difference.

The new VZ-300 still has the reverse video format, and also has a completely reworked main circuit board inside — so the shielding may be further improved. The DSE catalogue blurb suggests that the main system clock frequency has been shifted from 3.58 MHz to 3.54 MHz, although I haven't had a chance to check this. If this is so, it was presumably done to reduce the Moire problem.

One way or another there does seem to be less pattern evident on the screen, although it is still there and mildly irritating even with the colour switched off.

By the way, the DSE catalogue suggests that the VZ-300 has additional colour display capabilities compared with the earlier model. This doesn't seem to be evident from the user manual, and some quick tests certainly didn't show up any extra display modes. So if there are any, they're well hidden.

Like the later versions of the VZ-200, you can swing between the 'green characters on black' and 'black characters on



## TABLE 1. BASIC VZ-300 SPECIFICATION

Processor/speed .....	Z 80/3.5 MHz
Internal User RAM .....	16K
Internal ROM .....	16K
Keyboard .....	46 keys, typewriter format
Video format, text .....	32 x 16
Graphics .....	64 x 32, 128 x 64
Colours .....	8/9
Inbuilt I/O .....	video, VHF, cassette
Cassette data rate .....	600 baud
Power supply .....	12 V/1 A (adaptor supplied)

### Expansion capabilities:

- 16K RAM expansion cartridge
- 64K RAM expansion cartridge (see text)
- Twin joysticks with interface
- Centronics-type printer interface
- Data cassette recorder
- Floppy disk drive with power adaptor
- Disk controller cartridge
- Four-colour printer plotter



green' modes for text and lo-res graphics if you wish, by using POKE statements (POKE 30744,0 and POKE 30744,1). Doing this in a program in conjunction with the COLOR statement effectively gives you another pair of background colours, and one more character colour: black.

### Could be more

Now for the disappointments. I suppose the first of these is the one already noted, that the Moire problem is still evident. But I recall that this problem was a particularly difficult one to solve, so perhaps we should be tolerant here.

Frankly I was more disappointed to find that the internal BASIC in ROM is unchanged from that in the later VZ-200s. It is still a partly nobbled version of Microsoft Level II, with useful things like ON GOTO, ON GOSUB, DEL, STRINGS, TRON, TROFF, AUTO, VARPTR, DEFINT, DEFDBL, DEFSNG, DEFSTR, and double precision maths still all disabled. Since the BASIC is fully licensed from Microsoft, I know of no reason why these functions could not have been activated for the VZ-300. It would have made it much more powerful, even more powerful than the original TRS-80 and System 80 for only one quarter the price. What a pity this wasn't done.

Other disappointments come to light when we look at the VZ-300's RAM expansion cartridges. And it's here that things start to get a little complicated.

First there's the matter of compatibility with the VZ-200. In its latest catalogue, DSE says that both modules will also work with the VZ-200. While it's true that they'll both plug into the VZ-200, this is really quite misleading — particularly for the 16K cartridge.

With the original VZ-200, the internal 6K of user RAM extends to address 8FFF hexadecimal, or 36863 decimal. The VZ-200's 16K expansion cartridge provides as you'd

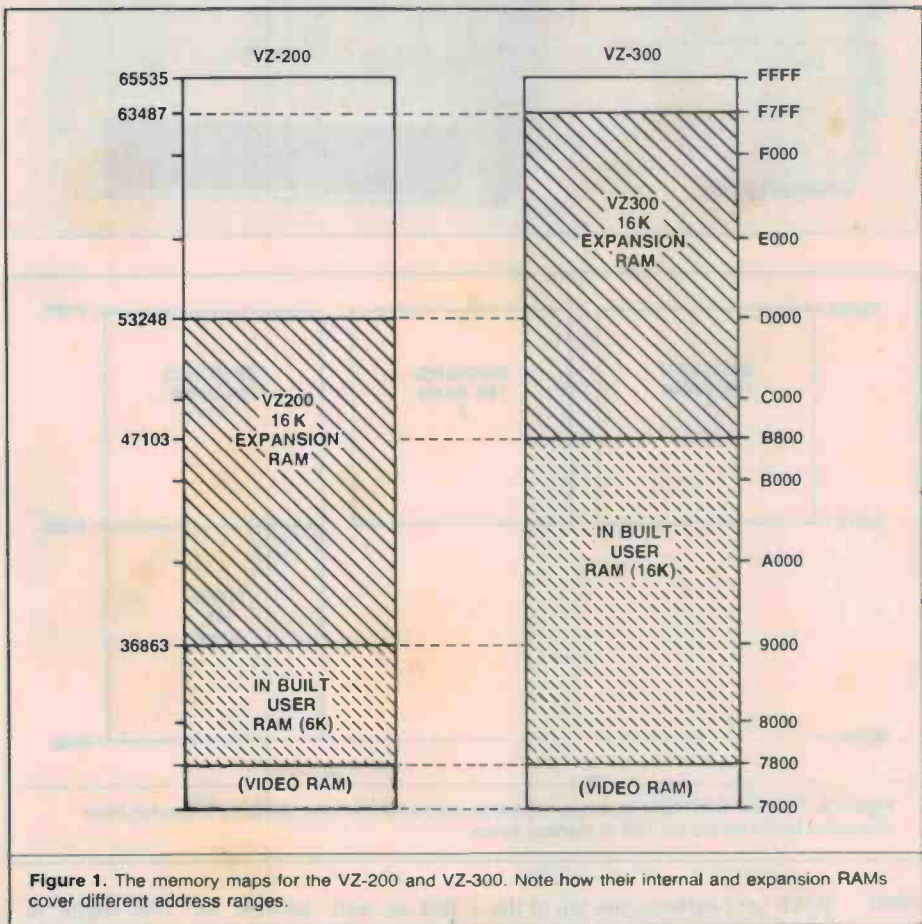


Figure 1. The memory maps for the VZ-200 and VZ-300. Note how their internal and expansion RAMs cover different address ranges.

expect 16K of extra RAM, starting at 9000 hex or 36864 decimal and extending to CFFF hex or 53247 decimal.

However because the new VZ-300 has 16K of internal user RAM, the internal memory already extends up to B7FF hex, or 47103 decimal. So naturally the VZ-300's 16K expansion cartridge starts at B800 hex or 47104, and extends up to F7FF hex or 63487 decimal — only 2K short of the top of

memory space. This means that the two 16K memory expansion cartridges cover different address ranges, making them at least partially incompatible (see Figure 1).

If you plug the VZ-300 cartridge into the older model it will function electrically, but the BASIC interpreter won't be able to use it. In fact it won't even know the extra memory is present, because there will be a 10K 'hole' of unoccupied memory addresses ▶



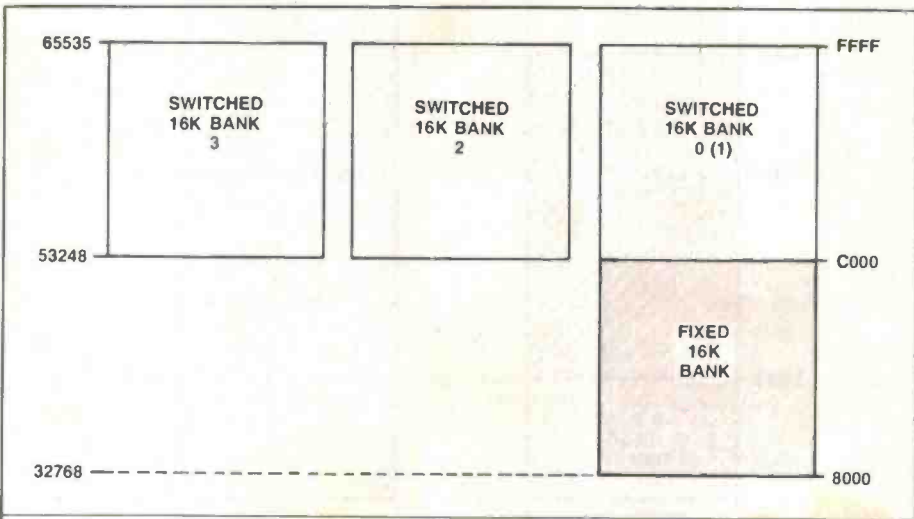


Figure 2. The new '64K' RAM expansion cartridge uses software bank switching to provide three alternative banks for the top 16K of memory space.

(9000 — B7FF hex) between the top of the internal RAM and the start of the expansion RAM.

When the VZ-200 powers up, its operating system checks how much RAM memory is fitted by running up the addresses with a quick write/read test. As soon as the test fails, it calls the address of the last successful test the 'top of RAM'; in other words, it tests for the top of *contiguous* RAM.

So if you try this out, as I did, you find that the VZ-200 completely ignores the extra RAM and makes no use of it. Which is

just as well, because the 10K chasm in memory space could cause all sorts of crashes and weird software problems!

The VZ-200's 16K expansion cartridge won't work properly with the VZ-300 either, although in this case it does give *some* extra RAM — not 16K, but a measly 6K. Again Figure 1 shows why: the only additional addresses it provides are from B800 to CFFF hex, or 47104 to 53247 decimal.

In a way this is a bit of a pity, because people with the original VZ-200 won't

really be able to make full use of their old 16K cartridge if they 'trade up' to a new VZ-300. If they use it, they'll still only get a total of 22K of user RAM — exactly the same as they had before (ie, 24K overall counting the 2K video RAM).

Of course this really arises from the fact that the VZ-300 already has an extra 10K of internal RAM, occupying the extra memory addresses. I guess it's one of the prices you pay for having an improved model with much more RAM in it already!

It would have been nice if the original 16K cartridge had been fitted with a switch, for changing its memory addresses to suit either model. Why didn't we all think of that at the time? (Alright, nobody's perfect!)

But to summarize, the old and new 16K RAM expansion cartridges are NOT interchangeable. Each is really only suitable for use with its own model — although you *may* be able to use the old one with the new computer if you don't mind getting only 6K of extra RAM.

When it comes to the '64K' cartridge, there isn't so much a compatibility problem as one of functionality.

Because of the way the VZ-200/VZ-300 memory space is allocated, with user RAM starting at address 7800 hex or 30720 decimal, both models can only have a total of 34K bytes of user RAM effectively functional at any instant. So the designers of the computer had a problem when it came to providing a '64K' expansion cartridge.

They solved it by using a technique known as "bank switching". The 64K of available RAM is divided into four 16K chunks or banks, one of which is arranged to permanently occupy addresses 8000 to BFFF hex (32768 — 49151 decimal); this largely overlaps the existing internal RAM. The other three banks are all arranged to occupy the remaining 16K of addresses, from C000 to FFFF hex (49152 - 65535 decimal); see Figure 2.

Of course there isn't much point in having all three banks simply working in parallel, so a pair of flip-flops at a special address (7F hex) in I/O (input-output) space is used to switch only one of the three banks on at any particular time, under software control. By writing a code number to this I/O address, a program can switch from one bank to another. The code numbers for the three banks are 0 (or 1), 2 and 3 respectively.

So although the whole 64K can't be written to or read from at any particular instant, programs can turn the banks on and off. Or to be more exact, *machine language* programs can do this. BASIC programs can't, because the VZ-200/VZ-300 BASIC interpreter keeps its stack and string variable buffer at the top of available RAM. So if a BASIC program tried to switch memory banks, vital information would be whisked



away from the interpreter, and the system would 'crash'.

In other words, only machine language programs can take advantage of the extra 32K of RAM available in the 64K cartridge. With BASIC programs, the cartridge can effectively only be used as a 32K cartridge. This applies to both the VZ-200 and the new VZ-300.

There is a difference, though, because of the way the 64K cartridge's RAM starts at 8000 hex and overlaps the internal RAMs. With the VZ-200, you get an additional 28K bytes over the basic machine. Whereas with the VZ-300 you only get an additional 18K, a mere 2K more than you get with the new 16K cartridge.

So for BASIC programmers (probably the vast majority) the 64K cartridge is really only worthwhile for the VZ-200. With the new VZ-300 it only gives you 2K more than the 16K cartridge. Worth remembering, when you consider that it's nearly double the price!

The only other mildly disappointing thing about the VZ-300 is the user manual. Instead of the three separate original manuals, all user material has now been jammed into a single overstuffed comb binding. No doubt this saves a few cents, but it also makes the manual very much harder to open flat for use. It's one of those silly little things that could easily have been avoided.

Despite all of these little disappointments and irritations, the new VZ-300 is still a very good little computer. Hence my comment earlier that I believe it's even better value for money than the VZ-200. In fact it must surely be the cheapest possible way to get a complete colour computer, suitable not only for learning the fundamentals, but then for being expanded and put to practical use.

By the way, the other VZ expansion items all seem to work just as happily with the new VZ-300 as they did with the earlier model. This includes the Centronics printer interface, 4-colour printer/plotter, joysticks and data cassette recorder. As far as I can see there are no compatibility problems with these at all.

### Disk drive and controller

Talking of expansion, this leads me to the other new release from DSE, the VZ disk drive and controller. Here again the news is good not only for buyers of the new VZ-300, but for owners of the VZ-200 as well; because the new disk system does indeed seem to work equally well with both models. And it brings a whole new order of operating convenience and efficiency to both.

The basic disk system consists of three items of hardware: the controller cartridge, the disk drive itself, and a power supply

adaptor for the disk drive.

The controller cartridge plugs into the rear of the computer, into the same connector normally used by the expansion RAM cartridges. However, so that you can still use a RAM expansion cartridge with the disk controller fitted, it has a further connector on the top to receive the RAM cartridge. It's quite a neat arrangement.

On the back of the disk controller cartridge are two 20-way sockets, each of which can receive the ribbon cable from a disk drive. In other words, the controller is designed to handle not just one, but two drives if you wish. The sockets are marked "D1" and "D2", and naturally enough if you have only one drive, its cable plugs into the D1 socket.

The disk drive is a compact half-height 5/4-inch unit, in a moulded plastic case which matches the VZ-300 and the controller cartridge cases. The ribbon cable leading to the controller cartridge is permanently attached to the drive case. The only other connection is a 5-pin DIN socket which takes the power for the drive, from an in-line type power adaptor. Each drive needs its own adaptor, while the power for the controller cartridge comes from the computer supply.

So much for the hardware for the disk system, which is quite neat and straightforward. Now for the interesting part: how it works. The manual and brochures are very sketchy about this, but after a bit of detective work and checking it out with a few test routines, I think I've worked out the basics.

As far as I can discover, the disk drives and controller use a simplified storage encoding system something like that used in the Apple II computer family. There doesn't seem to be a dedicated disk controller chip in the controller cartridge, just an 8K byte ROM and a few housekeeping chips. And the disk drive electronics is simpler than for the usual SA-400 type, with only a few basic signals conveyed each way along the cable to the controller. For example the drive has no opto-detector for the disk index holes, so there is no index signal.

So far so good, of course. The simple disk system used in the Apple II family has proved a particularly reliable one over the years, and if the VZ system is similar then it too could well turn out to be just as reliable. And the lack of a detector for the disk index holes means that like the Apple disk system, the VZ system can use either soft or hard sectored disks equally well. I tried this out in fact, and both types of disk worked beautifully. Great!

### DOS

By now, the more experienced readers are no doubt starting to ask "OK, OK, but what about the DOS?" (For the not-so-ex-

perienced, a DOS is a disk operating system, or the program needed to look after all of the housekeeping jobs involved in storing information on the disk, and then retrieving it again.)

Glad you asked. Inside the controller's 8K ROM, along with the machine language routines used to control the disk drive itself, there looks to be quite a tidy little DOS — or more accurately, a little disk BASIC. In other words, a set of routines which patch themselves into the existing VZ ROM BASIC, to provide it with the extra BASIC commands to cope with basic disk operations. You get these disk BASIC commands as soon as you turn on the computer with the disk controller plugged in; they don't have to be loaded into RAM from a system disk.

The controller's 8K ROM doesn't gobble up valuable memory addresses normally used by RAM, either. It occupies a range of otherwise vacant addresses down below the RAM area, between the top of the BASIC ROMs at 4000 hex (16384 decimal), and the VZ's keyboard array at 6800 hex (26624 decimal). So when the disk system is installed, you still have as much RAM as before. It's very neat and efficient.

Now if you're an experienced old pro or hacker looking for a really fancy bells-and-whistles DOS, forget it. VZ disk BASIC has a pretty modest set of commands. But on the other hand if you're a newcomer who's never used a disk system before, it has all the disk commands you're likely to need for a long, long time. And they're nice and simple to use, as they should be.

The commands are listed in Table 2. As you can see, they provide all of the basic things needed for preparing disks, loading and saving both BASIC and machine language programs, maintaining disks, checking disk status and doing simple sequential data storage from BASIC programs.

How does the VZ disk system check out? Not bad at all; in fact considering what it is designed to do, it does it particularly well.

First of all, I tried formatting a few blank disks using the INIT command. It took about 75 seconds per disk, which compares quite well with most other disk systems. Then I tried loading in a few decent-sized BASIC programs from cassette tape, saving them on disk and re-loading them, to compare these disk operations with doing the same things via tape. That's the ultimate test.

The results were fine. Take for example a program of a little over 6K, which took about 82 seconds to save to tape and another 82 seconds — after the start of the program had been found — to verify or load again. With the disk system this program took only about 12 seconds to SAVE (including an automatic verify), and only 7.5 seconds to LOAD again. So the disk system ▶



## COMPUTER REVIEW

is about 14 times faster than tape for saving, and about 11 times faster for loading. And very much more convenient, of course.

By the way, the VZ disk system uses a fairly standard single density storage format

with 40 tracks each of sixteen 128-byte sectors. This gives 624 sectors, or 78K bytes of formatted storage per disk. Not enormous, but quite practical.

I tried out just about all of the disk com-

mands and functions, which all seemed to operate very reliably. In fact it all worked without a hitch of any kind, not only with the new VZ-300 but with my son's original model VZ-200 as well.

Of course the more experienced user will tend to be a little disappointed at the lack of some of the fancier DOS functions like those for random access (PUT, GET, FIELD, MKDS/IS/\$\$ and CVD/IS etc). But that's not really relevant here. This system was designed for the typical user, who mainly wants to load and save programs quickly and easily. It does that, and it does it well.

All in all, I'm quite impressed with the VZ disk system. Of course compared with the basic VZ-300 it's not cheap; the disk drive and its power adaptor alone will cost you \$249, more than the computer itself. And you still need the controller cartridge, at \$79 more. But it's still very modest compared with the cost of other disk systems.

So there you have it. A new and improved VZ-300 computer, and a beautiful little disk drive system for both models. Despite a few minor disappointments, they're both really good products.

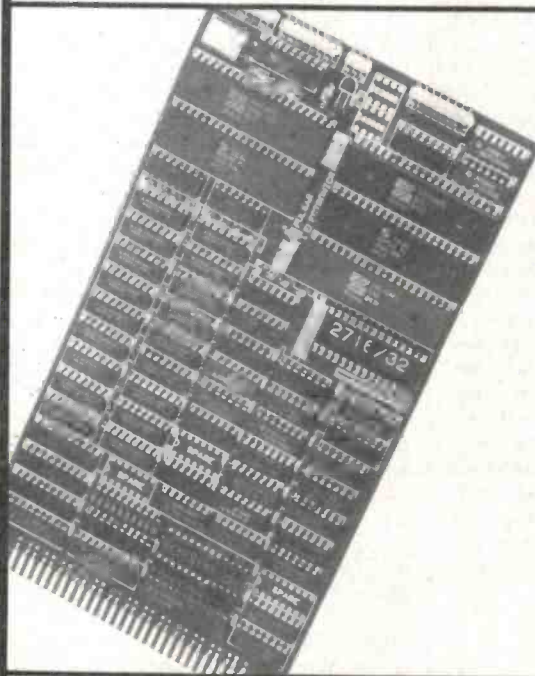
TABLE 2. VZ DISK SYSTEM — COMMANDS

INIT .....	Formats a blank diskette for use (either soft or hard sector)
DIR .....	Lists the files on a disk
STATUS .....	Gives available storage space on disk (in both sectors and bytes)
SAYE"filename" .....	Saves BASIC program to disk with filename given (8 chars maximum)
LOAD"filename" .....	Loads named program into memory without executing
RUN"filename" .....	Loads named program and starts execution
REN"oldname", "newname" .....	Rename disk file
ERA"filename" .....	Erase disk file
DRIVE n .....	Change currently used disk drive (n = 1 or 2)
BSAVE"filename", s,e .....	Save binary file (eg, machine language program), with filename given, starting at address s and ending at address e (both in hex)
BLOAD"filename" .....	Load named binary file into memory
BRUN"filename" .....	Load named machine language program into memory and begin execution
DCOPY"filename" .....	Copy named disk file from one disk to another
OPEN"filename" .....	Open a data file for write or read
PR#"filename" .....	Write data to opened disk file
IN#"filename" .....	Read data from opened disk file
CLOSE"filename" .....	Close disk file

# PULSAR

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The 6080 CPU card has been designed and built in Australia to exacting tolerances.

\*Enclosed systems use the 7Mb/sec bus.

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- STD bus
- with vectored interrupts

### EXTERNAL CONNECTIONS:

- 2 x serial ports RS232
- 1 x LAN RS485
- 1 x parallel port 10 line

### DIMENSIONS:

- 114.3 mm (4.5in) width by
- 221 mm (8.75in) length

### POWER REQUIREMENTS:

- 0.5 amp 12 volts
- 2 amp 5 volts
- 100 mA  $\pm$  12 volts (RS232)

### OPERATING ENVIRONMENT:

- 0°-70°

### BUS TRANSFER RATE:

- 7 Mb/second

### DMA CHANNEL:

- Two fully implemented on the STD Bus

### RAM AVAILABLE:

- 128k standard
- on board error detection

### CLOCK RATE:

- 8 mHz

### SERIAL PORTS:

- 50 baud min
- 38.4k baud max supporting A-sync, Bi-sync, SDLC, HDLC and other bit protocols

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### CIO:

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- programmable parallel I/O

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The RSC Forth Development System has been designed for the computer hacker who wants to get into Forth without giving up too much time and money. Standard features of the system firmware include: Disk interface, Centronics printer port and EPROM capability.

**STARTER KIT**

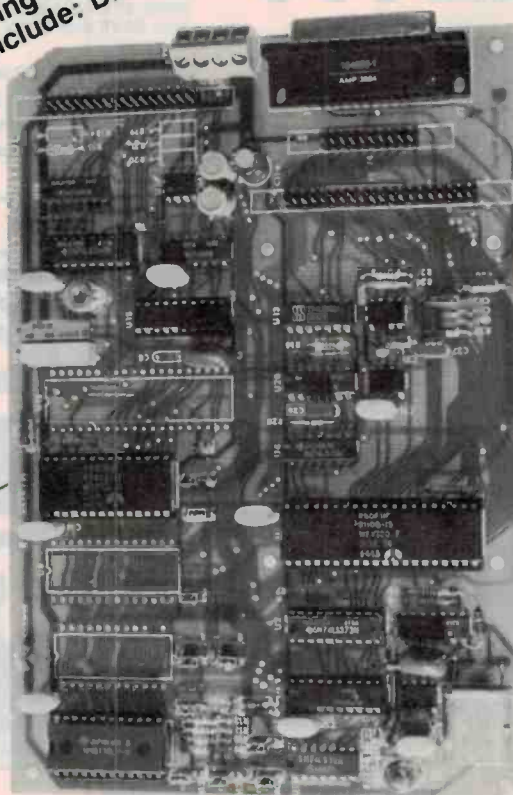
- (i) Low cost development system mains DS board, plated through holes and silkscreen as seen on page 72 of ETI May, 1985.
- (ii) The complete RSC Forth manual.
- (iii) R65F11 Forth Kernel and Microcomputer.
- (iv) R65FR1 Development ROM.
- (v) Programmed Bipolar PROM.

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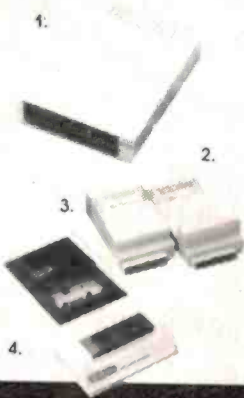
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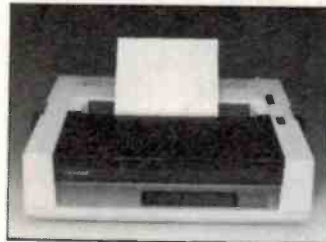


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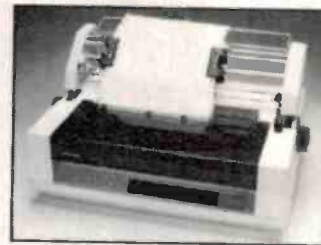
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Famous Uchida DWX-305 daisywheel printer, fitted with Serial (RS-232C) port for all those people with serial ports on their computers! Fantastic letter quality, 3 pitches and 18cps print speed, with a paper width up to 330mm. Optional tractor feed also available. (Cat X-3273 at \$119) **\$599**  
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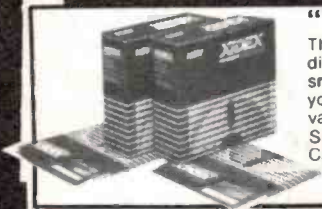


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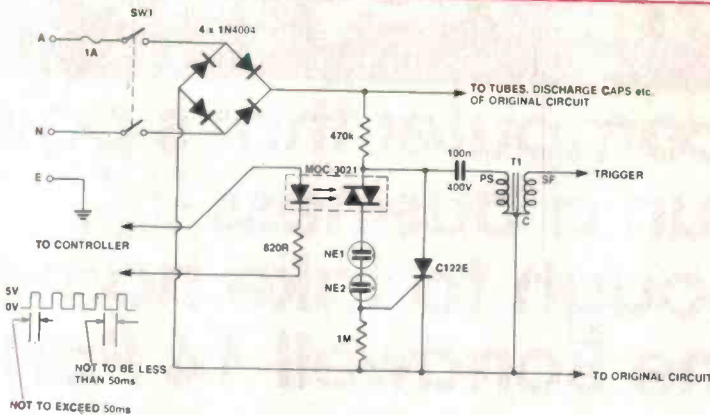
Dick Smith Electronics Pty Ltd

# COMPUTERSTOP





## IDEAS FOR EXPERIMENTERS



### ETI-574 modification

Recently, Stephen McBride of Townsville, Qld was asked to build two high power strobes with a remote flash rate controller.

I decided to build two ETI-574 strobes using two xenon tubes. Both strobes worked well and the two units together put out quite a bit of light.

However, getting the two synchronised was a bit of a problem.

I could have slaved one unit from the other one's trigger pulse but that would mean running four kilovolts around the place. I wasn't too keen on that!

Secondly, I wasn't wrapped in the idea of having 350 V, unisolated, from the mains floating

around the console on a pot, and it wouldn't have surprised me if the unit had become sensitive to transients as well.

So, I had to look for a method of triggering both units together using a low, safe, isolated voltage. It had to be fast, inexpensive and capable of withstanding large voltages.

It was when I was reading the

article on opto-couplers featured in the June 1983 edition of ETI that it clicked.

A MOC3021 triac driver! It could do all the things I needed plus handle a fair amount of load current. I modified the strobe as shown in the circuit diagram, and placed a wire link across the pads used by RV1.

It should be noted that if the trigger pulses are longer than 50 ms in duration it will result in multiple flashes due to the cycling action of the circuit. The maximum flash fare is around 20 ms.

I noticed one problem. The C106D is prone to false triggering, so I replaced both SCRs with GE C122Es, which have a higher gate current. I found they offered very satisfactory operation free from false triggers. Rx may be changed to suit the trigger voltage but it must allow a current of 5 mA for the LED.

A simple 555 timer circuit is being used to control the strobes. Both units work very well indeed.

## '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.

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

\* Breach of copyright is now a criminal offence.

Title of Idea .....

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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.

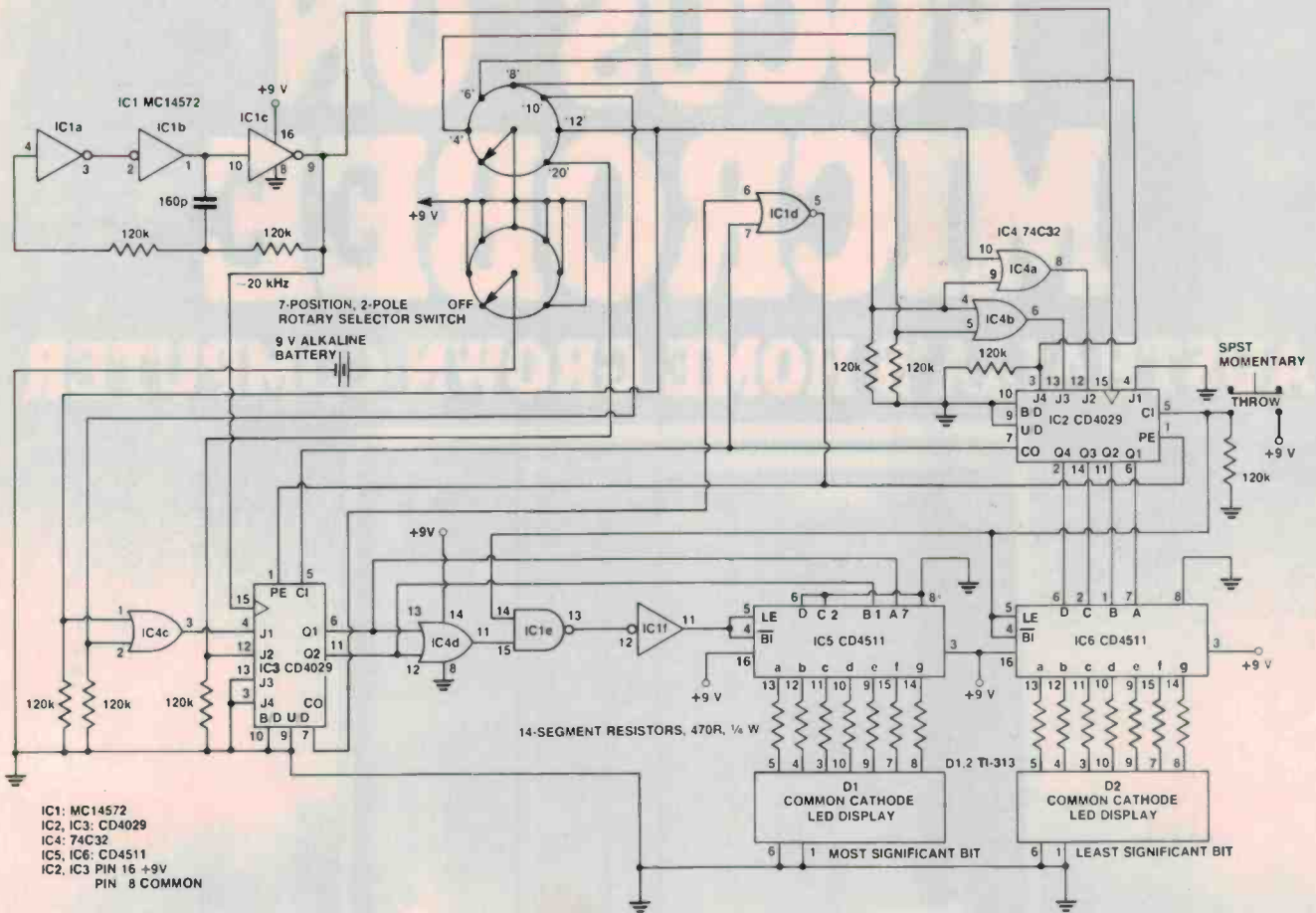
The winning entry will be judged by the editor of ETI Magazine, whose decision will be final. No correspondence can be entered into regarding the decision.

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.





## Multi-sided gaming die

D. N. Ellis, Alice Springs, NT

Popular role-playing adventure gaming requires repeated throws of dice with 4, 6, 8, 10, 12 and 20 sides. This idea uses a battery operated CMOS circuit that simulates the range of each dice using a total of only six ICs.

The rotary switch turns the circuit on when the desired dice is selected. The player then pushes the THROW button to display the value of the die.

IC1 is a 'potpourri' chip consisting of four inverters, a NAND gate and a NOR gate. Three of the inverters form an oscillator of approximately 20 kHz. IC2 and IC3 are 4029s, wired as decade-down counters.

The selector switch, with OR gates from IC4, determines

counter values that correspond to the chosen die. At the instant IC2 and IC3 reach a count of 00, a section of IC1 forces the counter to return to the chosen preset die value. IC2 and IC3 then count down, and the process repeats until the THROW button is pushed.

This momentary SPST switch stops the counters and unblanks the display for viewing as long as it is held active. Releasing the THROW button blanks the display and allows IC2 and IC3 to decrement.

Since the counter is cycling at a rate ranging from 1 kHz (20-sided die) to 5 kHz (4-sided die), a high degree of randomness is assured. A section of IC4

blanks the most significant digit for numbers less than ten to conserve battery power.

IC5 and IC6 are 4511 BCD to seven-segment decoder drivers. D1 and D2 are common cathode LED displays, current limited by the 470 ohm segment resistors.

A 9 V alkaline transistor battery gives many hours of operation because of the CMOS circuitry, and because the current drain of the LED displays occurs only for the duration of the THROW button activity.

The circuit layout is not critical and the packaging can be as desired for operator preference.



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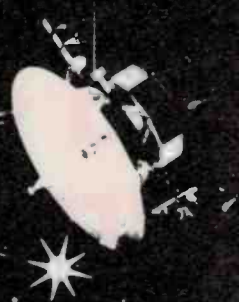


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# UNINTERRUPTED FREQUENCY COVERAGE 100 KHz ~ 1.4 GHz with RF CONVERTERS for

# SX-400 SERIES SCANNING MONITOR RECEIVER



- FIRE
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- MARINE
- AIR
- SPACE INFORMATION
- BUG DETECTOR



### RF-8014 DOWN CONVERTER

**800 MHz ~ 1.4 GHz RF converter for SX-400**  
 ● Bands: MAIN (to cover 26 ~ 520 MHz with SX-400) • 800 MHz ~ 1.0 GHz • 1.0 GHz ~ 1.2 GHz • 1.2 GHz ~ 1.4 GHz • AUTO (Automatic control of RF-8014 with an external computer, etc.) ● Frequencies shown in SX-400 display: 500 MHz lower between 800 MHz ~ 1.0 GHz, 700 MHz lower between 1 ~ 1.2 GHz, 900 MHz lower between 1.2 ~ 1.4 GHz ● Individual Band Switches and LED Indicators ● Current Drain: 250 mA (approx.) ● Accessories: 1 BNC/M-adaptor, 1 Cable with BNC terminals ● Dimensions: W 148 x H 51 x D 225 (mm)



### RF-5080 DOWN CONVERTER

**500 ~ 800 MHz RF converter for SX-400**  
 ● Bands: MAIN (to cover 26 ~ 520 MHz with SX-400) • 500 ~ 600 MHz • 600 ~ 700 MHz • 700 ~ 800 MHz • AUTO (Automatic control of RF-5080 with an external computer, etc.) ● Frequencies shown in SX-400 display: 300 MHz lower between 500 ~ 600 MHz, 400 MHz lower between 600 ~ 700 MHz, 500 MHz lower between 700 ~ 800 MHz ● Individual Band Switches and LED Indicators ● Current Drain: 250 mA (approx.) ● Accessories: 1 BNC/M-adaptor, 1 Cable with BNC terminals ● Dimensions: W 148 x H 51 x D 225 (mm)



### RF-1030 UP CONVERTER

**100 KHz ~ 30 MHz RF converter for SX-400**  
 ● Bands: (1) 100 KHz ~ 1 MHz, (2) 1 ~ 2 MHz, (3) 2 ~ 4 MHz, (4) 4 ~ 8 MHz, (5) 8 ~ 17 MHz, (6) 17 ~ 30 MHz • AUTO (Automatic control of 6 bands of RF-1030 with an external computer, etc.) ● Frequencies shown in SX-400 display: 50 MHz higher on all bands than the frequencies received. ● Individual Mode Switches and LED Indicators: AM, USB, LSB, CW, AUTO • CW filter (optional) required for CW reception • AUTO—Automatic Control of modes of RF-1030 with an external computer, etc. ● Band Switch and LED Band Indicators, Squelch Control, RF Att., AF Gain Control, Delta Tuning, IF ON/OFF Switch, NB (Noise Blanker) Switch ● Current Drain: 1 A (approx.)

\* Power Supply Unit P-1A (optional) required for RF-1030 ● Accessories: 1 BNC/M-adaptor, 2 Cable with BNC terminals ● Dimensions: W 300 x H 90 x D 233 (mm)



### ACB-300 ANTENNA CONTROL BOX

**Manual and Automatic antenna control system for SX-400 series RF converters**  
 ● Individual Band Switches and LED Indicators: 1030, 5080, 8014, 1.4 GHz UP (for reception of 1.4 GHz above) AUTO (Automatic control of antennas for RF-1030, RF-5080, RF-8014 and for MAIN scanner) ● Current Drain: 50 mA (approx.) ● Accessories: 1 Cable with BNC terminals ● Dimensions: W 148 x H 51 x D 225 (mm)



### SX-400

**26 ~ 520 MHz General Coverage Scanner**  
 ● Wider Coverage (100 KHz ~ 1.4 GHz or above) with RF converters (optional) ● Computer controlled memory channel expansion (unlimited), High-Speed reprogramming, Record of Frequencies and Time, and all functions remote controllable with RC-4000 Interface (optional) ● 20 memory channels, Momentary recall of any memory channel ● Continuous normal and limit search without interruptions by birds ● Stop Mode Switch for scan or search of modulated signals ● Quick search of the most important frequency with Priority ● Selective FM Narrow/Wide Switch for FM/TV listening ● Variable Delay Control (0 ~ 4 Sec.) ● Current Drain: 1 A (approx.) ● Dimensions: W 300 x H 90 x D 233 (mm)

**RC-4000 DATA INTERFACE Control of SX-400 series Scanner and RF Converters through Computer.**  
 ● Direct system for NEC 8801A computer ● High-Speed Reprogramming of 20 channels ● Scan of unlimited channels stored in computer ● Record of Frequencies and Time of signals received ● Automatic Control of Bands and Modes of RF converters and ACB-300.



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If you want to know the correct time, the present propagation conditions, the weather in the South Pacific and a point on which to calibrate your receiver accurately, there are over 50 stations broadcasting this type of information.

Over the years surveyors, navigators and others in remote areas have had the problem of ascertaining the correct time. A shortwave service provides this information for a multitude of uses, through special time stations.

Australian listeners are well aware of VNG, Lyndhurst Vic, which broadcasts on 4500, 7500 and 12000 kHz. The station can be recognized by its time pips every second. Every 15 minutes, on the quarter hour, it announces the following:

"This is VNG Lyndhurst, Victoria, Australia, on 4.5, 7.5 or 12 MHz. VNG is a standard frequency and time signal service of the Australian Telecommunications Commission."

The most famous time stations are WWV at Fort Collins, Colorado, and WWVH in Hawaii. These stations operate 24 hours a day on 2500, 5000, 10000 and 15000 kHz. WWVH has a female announcer who gives the time every minute, ahead of the male announcer whose voice originates from WWV. As well, WWVH identifies the station with complete details at 29 and 59 minutes past each hour, as follows:

"National Bureau of Standards, WWVH Kekaha, Kauai. The station broadcasts on the internationally allocated standard carrier frequencies of 2.5, 5, 10 and 15 MHz providing time of day, standard time interval and other related information. Enquiries regarding these transmissions may be directed to the National Bureau of Standards, Time and Frequency Services Section, Boulder, Colorado 80302."

In the case of WWV the time announcements are made from

recordings. The voice comes from two drums, one containing the hours and minutes and the other the seconds. The cost of WWV is about \$180,000 to the US taxpayer and WWVH costs almost twice as much.

WWV commenced operating in 1923 with its transmitters at Beltsville, Maryland, and moved to Fort Collins, Colorado, in 1969, at which time I visited the newly established facility.

Another time station heard well in the Australasian area is JYJ which broadcasts from Japan and is often heard on 5000 kHz. Announcements are on the hour and the time given is Japanese Standard Time. The time station in Turin, Italy, can be picked up too. Its announcement is in Italian and English, just after the hour, identifying as IBS, standard frequency and time signal from the National Elettrotecnico Institute, Turin. A further signal from Europe, often heard on 5000 kHz, is MSF which is operated by the National Physical Laboratory in Teddington, England.

Listeners throughout the world are aware of Greenwich and Greenwich Mean Time. In 1974 international time stations decided to change this time reference to UTC (Universal Co-ordinated Time) and this new term is now used by most time stations.

Time signals are also carried by most broadcasters, using UTC time. However, the BBC still uses the 'Greenwich Time Signal' in many of its broadcasts, though these actually originate from Hailsham in Sussex and Greenwich has been retained only as an interesting museum.

(Greenwich has had more free publicity than any other place on Earth, but the fact that it is part of London has meant that the

observatory has had to be moved.)

## Odd frequencies

Though most time and frequency stations are operating on 5 or 10 MHz, there are a few exceptions.

The Canadian time station CHU, located near Ottawa, announces in English and French. It doesn't use GMT or UTC as is common with most international time stations, but instead gives Canadian Eastern Standard Time. CHU operates on 3330, 7335 and 14670 kHz. These frequencies have been in use for 60 years and were chosen to be close to the 20, 40 and 80 metre amateur bands. CHU is used mainly as a time reference rather than a frequency reference station due to the fact that WWV on 10000 kHz can be used to calibrate the dial of your radio.

Other unusual frequencies are used by Moscow on 14996 with 8 kW and 9996 with 5 kW. China uses 15000 kHz and the power is 10 kW. Colombo uses 8473 kHz with 5 kW.

Though all these stations use 10 kW or less, they are widely received throughout the world. Only one such station uses a recognized international frequency band — station YVTO in Caracas, Venezuela, which operates on 6100 kHz with 1 kW

and can be heard around 0900 UTC.

## Accurate time

The old Greenwich Mean Time was not accurate as it was based on the rotation of the Earth and its axis as related to the sun. Nowadays, signals are based on atomic time.

The centre of UTC time measurements is in Paris and a world network of atomic clocks is used to measure the number of vibrations of atoms per second, enabling almost precise calculation of time. However, due to the variation in the rotation of the Earth, at various times some adjustment is necessary, and to make this adjustment a leap second is added; the last one was added on 30 June 1983 and the next is predicted for 30 June 1985.

Readers can write to any of the time stations for verification, and reports are appreciated as they give the stations their main indication of coverage.

Some background information to this article was researched by Jonathan Marks of Media Network, Radio Netherlands. The *World Radio & Television Handbook* has a complete list of all the world's time stations along with frequencies and addresses.

— Arthur Cushen

## 1985 amateur courses

The Victorian Division of the Wireless Institute of Australia is holding a series of classes for the enthusiast, interested in upgrading.

Instruction covering the official DOC theory syllabus and required Morse code sending/receiving proficiency is given one evening a week for six months ending in time for the DOC examinations.

Novice theory and Morse

classes begin Tuesday, 27 August 1985. AOCV theory class starts Monday, 26 August. AOCV/Morse commences Tuesday, 27 August. Revision weekends are held on 3 and 4 August, 1985 (Novice) and 10 and 11 August, 1985 (AOCV).

For further information contact The Educational Officer, Wireless Institute, 412 Brunswick Street, Fitzroy, 3065 Victoria. (03)417-3535.



## VOA helps listeners

The Voice of America has realized that a special programme for shortwave listeners is long overdue and recently the "Magazine Show" on Thursdays has included ten to fifteen minutes of news for radio listeners. The broadcast is heard at 1330 UTC on 6110 and 15425 kHz and again at 1730 on 6040, 9760, 11760 and 15205 kHz. The broadcasts have been notable for interesting interviews with personalities such as Michael Murray, secretary general of the European DX Council. Bill Whitacre, at present on a year's leave has sent back interviews with the writer and other shortwave personalities he has met in the South Pacific. The compere of the programme is Gene Rich, and the shortwave segment is heard at the start of the show.

This regular attention to technical information is a response

to requests from shortwave listeners, explained Gordon Gaippe, deputy chief of VOA's English Programmes Division. The first part of the weekly segment answers listeners' questions either informally or in a more developed feature style or interview. (A book is awarded to those listeners whose questions are answered on the air.) Then follows an engineering expert giving tips on how to receive a better signal, providing listeners with information on such matters as sun spots and propagation reports, new receiving equipment on the market, and technological improvements at VOA. The final section consists of an interview with some authoritative person such as an engineer from a major electronics firm or the president of a DXers association.

— A. Cushen

## Intelligent radio data modem

GFS Electronic Imports is selling a new microprocessor-controlled radio data modem. Known as the CPU-100 it is designed to provide both Baudot and ASCII data communications over a narrow band HF/VHF/UHF/FM or SSB radio path. Being intelligent it relies on internal firmware for control of its operating facilities which may easily be 'reconfigured' to suit a user's requirements.

A number of versions of the CPU-100 currently exist. All are designed to connect directly to a dumb terminal or TTY KSR printer (ASCII) via the RS232 port. Baud rate to this I/O port is selectable from 50 to 19200 baud via an internal dip switch.

The commercial version of the CPU-100 provides a fully transparent interface between the

user's remote terminal, narrow band radio bearer and main frame computer. It can do this either as a full duplex system (using a duplex radio link), a half duplex system or simplex depending on the user's requirements.

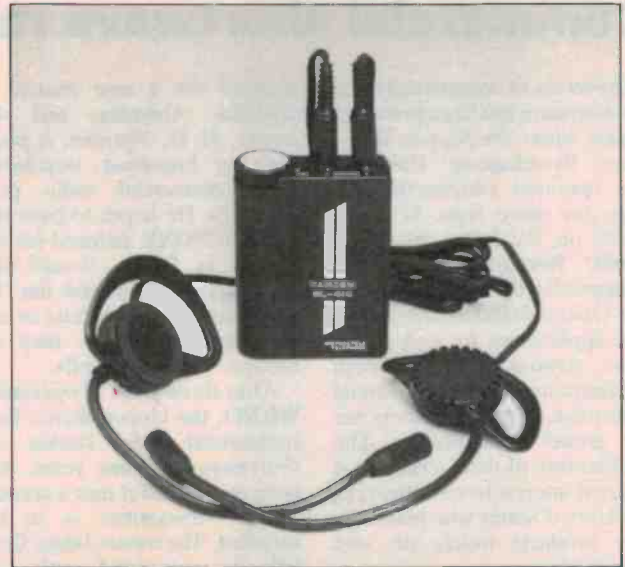
Error detection and/or full error correction can be provided. Data speeds used over the bearer may be up to 2400 baud depending on the radio link's quality. Other facilities may be also built in to the CPU-100.

An amateur radio version of the CPU-100 is also available.

For further information contact GFS Electronic Imports, 17 McKeon Road, PO Box 97, Mitcham, Vic 3132. (03)873-3777.



## BRIEFS



### Vox motorcycle intercom

A new motorcycle intercom available from Dick Smith consists of a master unit and two earpiece/microphones. The master unit fits into the pocket or attaches to the bike frame and uses two AA batteries to power it.

### Adaptor product catalogue

A 32-page catalogue from TRW Connector describes a range of adaptors including the Super Mod series, Patchmaster cross-connect systems, line switches, RS232 adaptors, Optalign fibre optic connectors and Optasplice optical fibre splice kits. Contact Total Electronics, 9 Harker St, Burwood, Vic 3125, (03)288-4044 for further information.

### New TVW7 antenna

Perth's TVW7 has installed a new 24 panel broadband array, replacing the original 1959 imported antenna. It was designed by Antenna Engineering Australia and will radiate 100 kW from a 10 kW transmitter.

### Microcomm scanner

The new Micromm SX-155 programmable pocket scanner replaces the old SX-150. Touted features are double battery life, reduced spurious response and improved antenna performance on UHF. For further information contact GFS Electronic Imports, 17 McKeon Rd, Mitcham, Vic 3132. (03)873-3777.

### Boot mobile antenna

Appealing to us who like as little trouble as possible, the new Hoxin HS25 mobile antenna secures under the boot lip without drilling holes. It can take any of the Scalar type antenna bases commonly used in commercial two-way, CB and amateur radio. Further information is available from GFS Electronic Imports, 17 McKeon Rd, Mitcham, Vic 3132. (03)873-3777.

### Coaxial switch

The CH20A single pole, two output position coaxial switch is claimed to have negligible insertion loss and super wide frequency range. It's available from Dick Smith stores.



## Commercial shortwave radio

The success of commercial radio on shortwave has been proved in Japan, where the Nippon Shortwave Broadcasting Company has operated commercial stations for more than 30 years, solely on the lower frequency bands. Recently the Federal Communications Commission in the United States received several applications for new shortwave stations. Two of these applications are for commercial enterprise, while the others are for gospel broadcasting. The profitability of these ventures is of great interest to advertizers in the United States who manufacture products which are sold worldwide.

Four 500 kW transmitters are

planned for a new station at Opelika, Alabama, and the owner, H. D. Norman, is planning to broadcast worldwide with commercial radio programmes. He hopes to have the call sign NDXE assigned for his slogan 'in Dixie', though the FCC has not allocated the 'N' prefix to any commercial or international station — they all use the 'W' or 'K' prefix.

After three years of operation WRNO, the United States' first commercial radio station on shortwave for some years, has been so successful that a second 100 kW transmitter is to be installed. The owner James Costello is concerned with the placing of the two 100 kW trans-

mitters in close proximity and with the inter-coupling between the two antennas. The station is restricted to 5 acres of ground and is using a log periodic for its major transmissions and a new dipole for beaming transmissions westwards. WRNO operates 24 hours a day and now has separate programming from its key station on FM in New Orleans.

Recently in a five-hour talk-back programme, the "Ray Briem Show", originating from KABC, Los Angeles, shortwave listening was the focal point and the programme was carried on nearly 50 ABC stations from Honolulu to New York. Ray Briem spoke to H. D. Norman

of NDXE and James Costello of WRNO about the plans for their stations. He also spoke to Tom Meyer of Radio Nederland, Ian McFarland of Radio Canada, and Larry Miller of Miller Publishing. As well, the writer Stuart McKenzie of Los Angeles and Richard Wood of Honolulu acted as anchormen, discussing radio listening problems with people who phoned in. This programme was the biggest promotion of the hobby in the United States on mediumwave, and interest was such that a further coast-to-coast broadcast is planned.

— Arthur Cushen

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### UTC AND LOCAL TIMES

The recent radio regulations, in force from 1 January 1982, state that UTC (Universal Time Coordinated) shall be applied whenever a specified time is used in international radiocommunications activities (replacing GMT), and it shall be presented as a four digit group (0000-2359). For most practical purposes, UTC is equivalent to mean solar time at the time meridian (0 degrees longitude), formerly expressed in GMT.

When it is midnight (0000 UTC), other standard times are as follows:

- 0100 Stockholm, Oslo, Copenhagen, Paris, Bonn, Berlin, Warsaw, Berne, Vienna, Prague, Budapest, Madrid, Rome, Tunis, Lagos, Kinshasa, Luanda
- 0200 Helsinki, Bucharest, Athens, Ankara, Beirut, Damascus, Tel Aviv, Amman, Cairo, Lusaka, Maputo, Johannesburg
- 0300 Moscow, Baghdad, Kuwait, Riyadh, Addis Ababa, Nairobi, Dar es Salaam
- 0300 Teheran
- 0400 Abu Dhabi, Dubai
- 0430 Kabul
- 0500 Karachi
- 0530 New Delhi, Colombo
- 0600 Tashkent, Dakar
- 0630 Rangoon
- 0700 Novosibirsk, Hanoi, Bangkok, Jakarta
- 0800 Singapore, Beijing, Hong Kong, Taipei, Manila, Perth
- 0900 Vladivostok, Tokyo
- 0930 Adelaide
- 1000 Sydney
- 1200 Wellington
- 1400 Honolulu
- 1500 Anchorage
- 1600 Vancouver, Los Angeles
- 1700 Edmonton, Denver
- 1800 Winnipeg, Chicago, Mexico City
- 1900 Ottawa, New York, Havana, Bogota, Lima
- 2000 Halifax, La Paz, Santiago
- 2100 Brasilia, Buenos Aires
- 2400 Reykjavik, London, Algiers, Casablanca, Las Palmas, Accra

The international date line occurs at 1200 hours, so that New Zealand and Australia are observing a different day from places east of New Zealand; when it is 1000 hours in Sydney it is the previous day in Hawaii.

— Arthur Cushen



## CLUB CALL

General Meetings of the Western Suburbs Radio Club are held on the first Friday of each month at 8 pm, at the Ern Rose Memorial Pavilion, Seaver Grove, Reservoir (Edwardes Park Lake) Melway Map 18 D4.

The club postal address is PO Box 336, Reservoir Vic, 3073.

Club nets are held each Tuesday evening on 145.450 MHz FM at 7.30 pm and also on 28.470 MHz at 8.30 pm local time.

## KILOHERTZ COMMENT

**FRENCH GUYANA:** Radio France International has now officially opened the new relay station at Montsinery in French Guyana. Although it was built to enable Radio France International to be heard in all Latin American countries and the Caribbean, it will soon also be used for programmes to Africa. An eleventh antenna under construction is directed towards West Africa where it would reinforce the RFI broadcasts from France and the Moyabi relay station in Gabon. The Guyana relay station was linked to France via satellite and is currently equipped with three 500 kW Thomson transmitters, according to a BBC report.

**GUAM:** The Adventist World Radio is using transmitters in several countries to carry its gospel programme, including Trans Europe in Portugal, Africa Number One and the Sri Lanka Broadcasting Corporation. Adventist World Radio has announced that the FCC has granted a licence to construct a 100 kW transmitter on Guam. Doctor

N. C. Wilson, the world president of the Adventist church in a recent interview said that the station would give AWR the capability of reaching one half of the world's population. The station plans to broadcast gospel programming but also cover areas such as medicine and family life. AWR plans to set up production units in the countries to which the broadcasts are directed. Production units would send their programmes to the transmitter at Guam for broadcasting. It is expected that transmissions will commence in early 1986. Staff have already been appointed, including the station manager.

The station will be known as AWR Asia and the studios at Poona, India producing programmes for Adventist World Radio to be broadcast from Sri Lanka, are now known as AWR South Asia.

**HONG KONG:** Construction has begun on the BBC's long-discussed relay station at Tsang Tsul in the eastern New Territories. Building work and

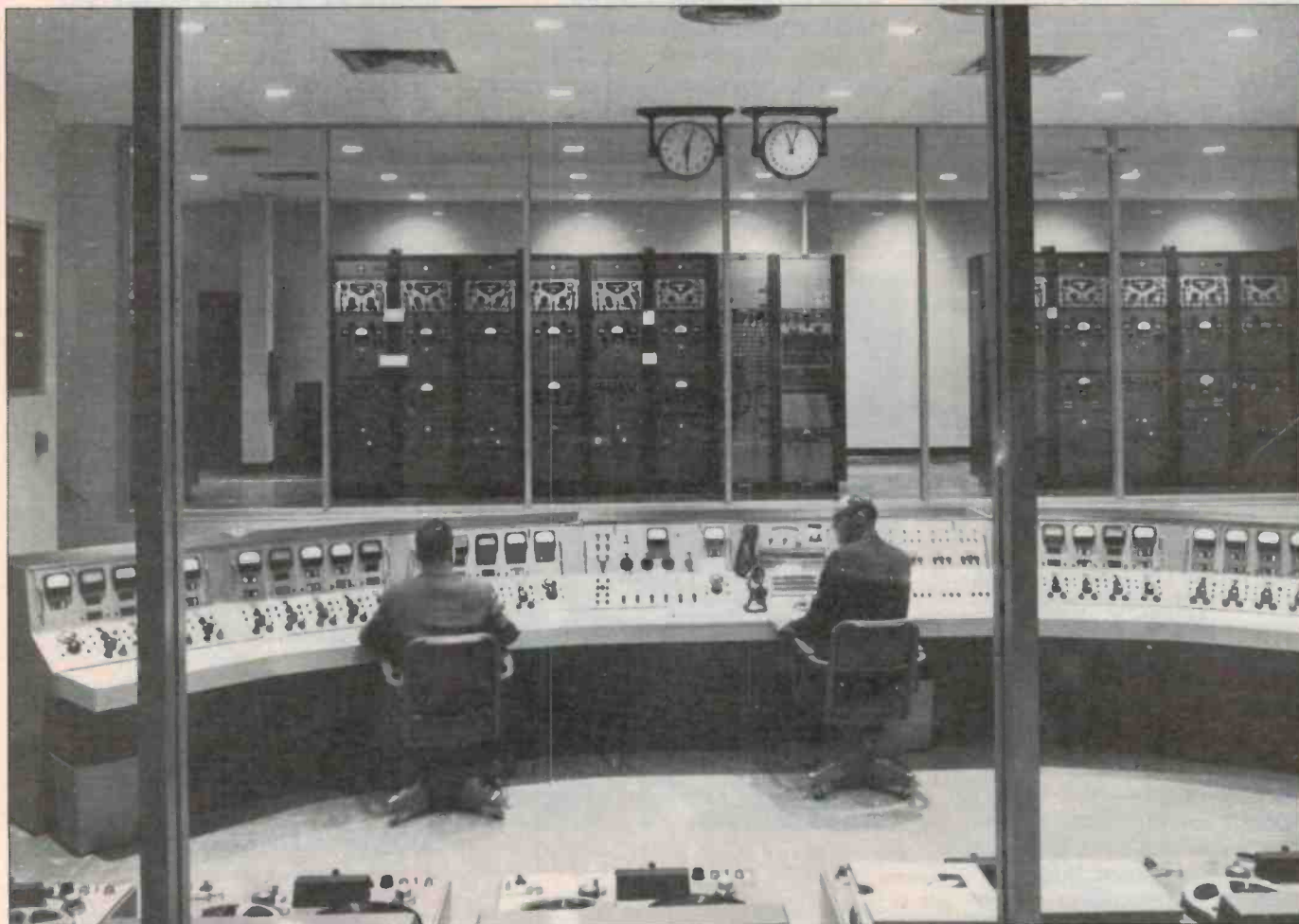
test transmissions should be completed by the end of 1986, so that the relay station can begin regular service early in 1987. Two 300 kW transmitters and five vertical antennas are being built at a cost of approximately \$11 million, according to the Asian Broadcasting Union.

**ICELAND:** Not a new transmitter but a new transmission has been observed from Icelandic Radio at Reykjavik, according to Sweden's Calling DXers. The transmissions are for Icelandic fishermen and are on 13797 kHz, 1215-1245 UTC omnidirectional, 1245-1315 UTC towards western Europe, and 1315-1345 UTC to eastern North America. A further frequency 9859 kHz is used 1855-1935 UTC omnidirectional, 1935-2010 UTC to eastern North America.

**KENYA:** Two new 250 kW transmitters have been registered for broadcast on the following schedule: 1230-1530 and 1930-2130 UTC on 6050 and 7225 kHz and 1530-1930 UTC on

9655 and 11745 kHz, according to Radio Nederland's "Media Network". **UNITED STATES:** The Marconi Company has announced a contract to supply a 500 kW transmitter to be installed at the Voice of America transmitting site at Greenville, North Carolina, USA. At a cost of \$2m US, this is the first transmitter to be installed, marking the start of the re-equipment phase of the Voice of America's multi-million dollar modernization programme. The transmitter, B6127, will be built by Marconi in Chelmsford, and is similar to one supplied to the BBC.

This item was contributed by Arthur Cushen, 212 Eam 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).



Master control console area of the Voice of America, Greenville, North Carolina transmitting site which was opened February 8, 1963 and is now being upgraded with new equipment.



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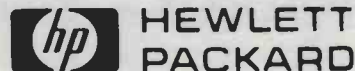
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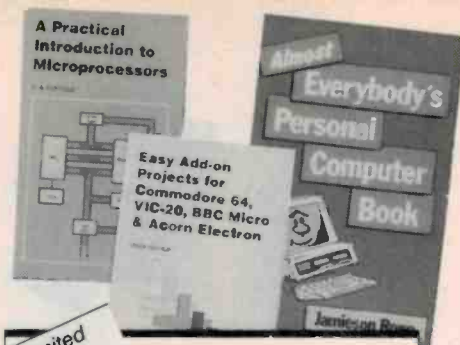
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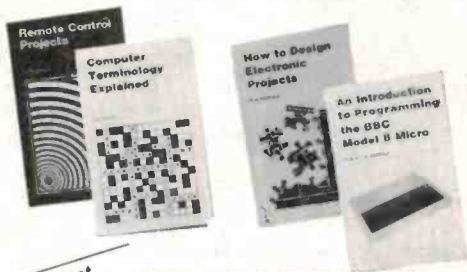
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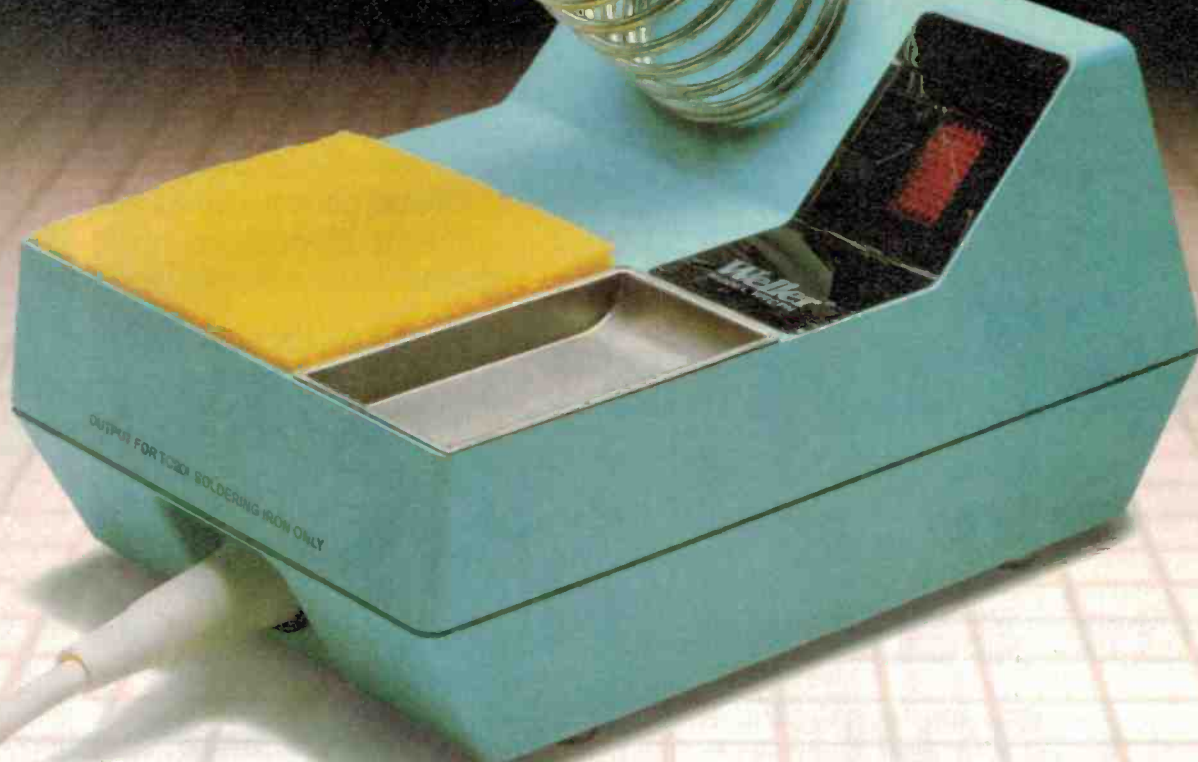
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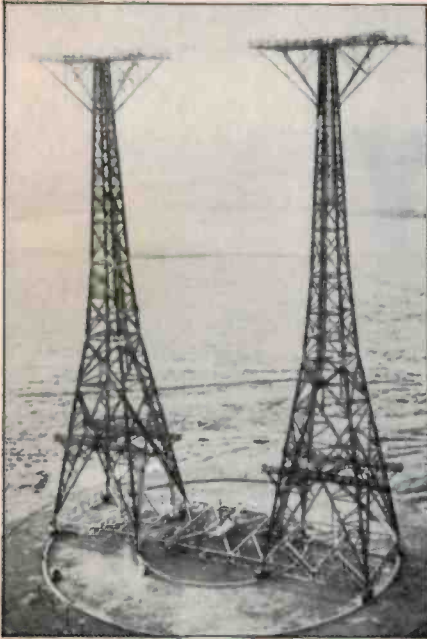


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# Two thousand kilowatts from under the sea

Arthur Cushen

What do you think of besides windmills and dykes when someone says Dutch engineering? Try broadcasting . . .

THE RECENT TESTING of four 500 kW transmitters by Radio Nederland at its Flevoland site, an area reclaimed from the sea, and four metres below sea level, is the climax of some 58 years of shortwave broadcasting from Holland.

It was in 1927 that the Netherlands became one of the first countries to recognize the power of the shortwave broadcasting medium. Early experiments via station PCJ in Eindhoven were convincing enough to make a solid investment in the future.

In 1937 the Dutch made broadcasting history when they constructed a wooden rotatable directional shortwave antenna. It was at Huizen, a few miles north-east from the studios in Hilversum, and this writer has verifications which show the rotatable aerial in operation. Today the site is an apartment block of flats and the position of the actual aerial is commemorated with an inscription where the antenna once stood.

In the 1950s, shortwave broadcasting from the Netherlands moved to the centre of the country, to the village of Lopik. There was room for future expansion in those days, but not now. As the Lopik facilities began to show their age, the search

started for a new place to put the shortwave transmitters.

Since Flevo is four metres below sea level, the water table is quite high and the ground is also rather soft. New techniques have had to be found to anchor the antenna masts securely, since the totally flat polder means everything is exposed to the full force of wintry weather. While computer programmes exist to calculate how a chosen antenna design should perform in theory, a lot of natural or man-made factors also have to be considered in practice. After the antennas were hung between supporting towers, the Dutch PTT hired a helicopter equipped with special measuring apparatus, and switched the transmitter on with reduced power. By flying in a circle with a radius of two kilometres from the antennas, it was then possible to plot the radiation patterns of each antenna.

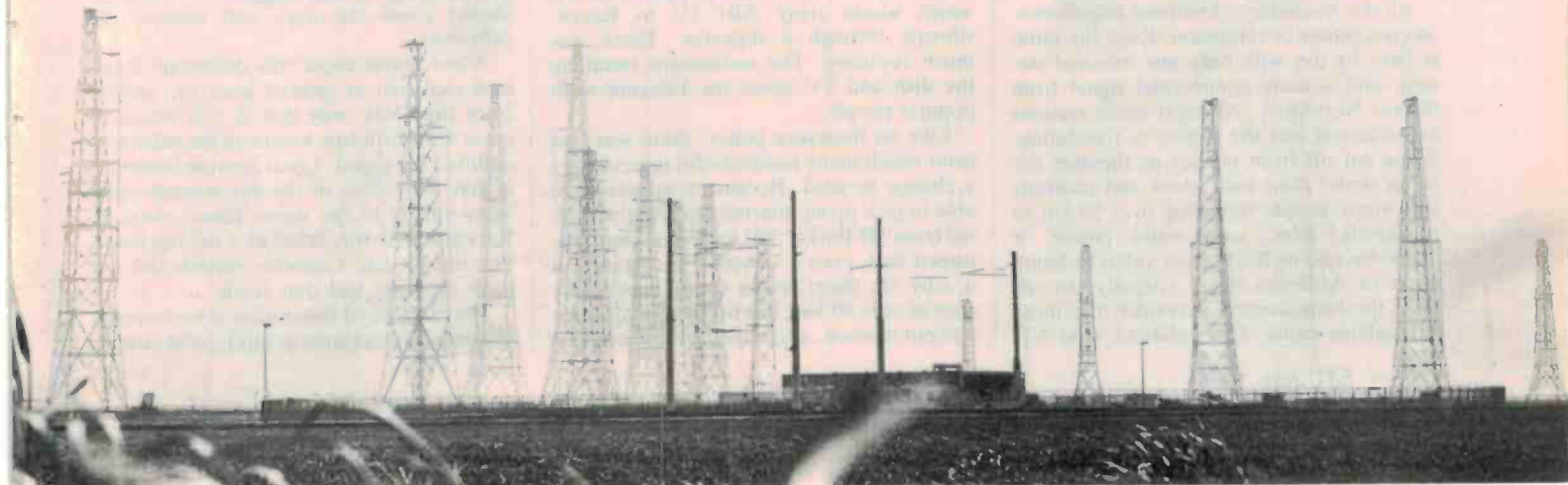
Computer technology is also used to the maximum. Changing frequencies at the old Lopik transmitter facilities was quite an ordeal. When moving from one metre band to another, this often entailed physically moving and tuning quite a number of parts of the transmitter. It is a credit to the transmit-

ter crews that they managed to do this with the required precision in the short time available between programmes. Modern multi-band transmitters have eliminated the need for this type of manual labour; engineering skill is now focused instead on maintaining a highly complex computer controlled switching system. New programme and frequency schedules are entered into a computer terminal at Radio Nederland where it is possible to monitor what is happening some 16 kilometres away.

The testing phase of the transmitter complex is now nearing completion. A new programme and frequency schedule will take advantage of the ability to serve new areas of the world with a stronger signal.

As well as the new Flevoland transmitter site, Radio Nederland operates relay bases at Bonaire in the Caribbean and on Madagascar. Two English transmissions are beamed to Australia, 0730-0825 UTC on 9630 and 9715 kHz, and 1030-1125 UTC on 9650 kHz.

View of Radio Nederlands' new Flevo transmitter site.





# AUSSAT NEARLY COMES TO RAVENSTHORPE

Outback areas have never really reaped the benefits from hi-tech electronics communications. Aussat is supposed to fix that. But some places out there in the communications wilderness don't see much salvation through the DOC.

Malcolm Goldfinch

THERE IS A SMALL number of people we call Australians who are the victims of an 'electronic apartheid'. Because they are a tiny minority, politicians and the media are inclined to pretend they are not there. But like most other Australians, they have to pay their taxes; they pay a lot and there is not much room for dodging, when in most cases, their income is from a Government sponsored body or a public company.

Ravensthorpe/Jerdacuttup is an area situated in a highly mineralized area of mallee country with salt lakes and rivers some 600 km south-east of Perth. It lies between Albany and Esperance running down to the coast at Hopetoun, where copper concentrate was shipped from the Ravensthorpe mine prior to World War I.

The shire population is now only 1410. When the mine died in 1979 there was an exodus of miners, and the district now relies on some determined farmers who in the late 60s learnt how to turn the 'useless' mallee scrub into pastureland and wheatfields.

All this was achieved without telephones, electric power or television. Even the radio is faint by day with only one national station, and a weak commercial signal from distant Norseman. At night more stations are received but the fading is frustrating. Being cut off from movies or theatres the locals make their own plays and musicals with some people travelling over 50 km to rehearsals. Now, with mains power, it would be one of the highest video-in-home areas in Australia being virtually cut off from the broadcasting networks that most Australians enjoy. City relatives send VC

recordings of "Jewel in the Crown", "Breakout" or shows like "Minder". They are like recipes or receipts in the old days, being left in mail boxes at the road for swaps.

The people of the Ravensthorpe district have taken this land and made it into a great earner of foreign dollars but they have been forced, even today, to live in an 'electronic apartheid' land with little of the electronic communications we all pay for in taxes since the Whitlam government abolished radio/TV licences.

Five years ago these people complained about the years of taxes paid for TV/FM and radio services they never received. Local members were put on the line and action resulted, but it seemed to some the technical action that followed was straight out of Alice In Wonderland.

With a great flourish in 1979, it was announced that Ravensthorpe would soon have one of the marvels of modern science, a dish to point at the Intelsat bird in the sky which would relay ABC-TV to Ravensthorpe through a repeater. There was much rejoicing. The technicians installing the dish and TV tower for Telecom were popular people.

Like an insurance policy, there was fine print which many residents did not even get a chance to read. Because residents were able to pick up an intermittent marginal signal from Mt Barker 400 km away, they presumed that, even a 10 watt TV repeater on nearby Mr Short would surely cover their area of only 80 km. But oddly, the repeater was put in town, at ground level, not on the

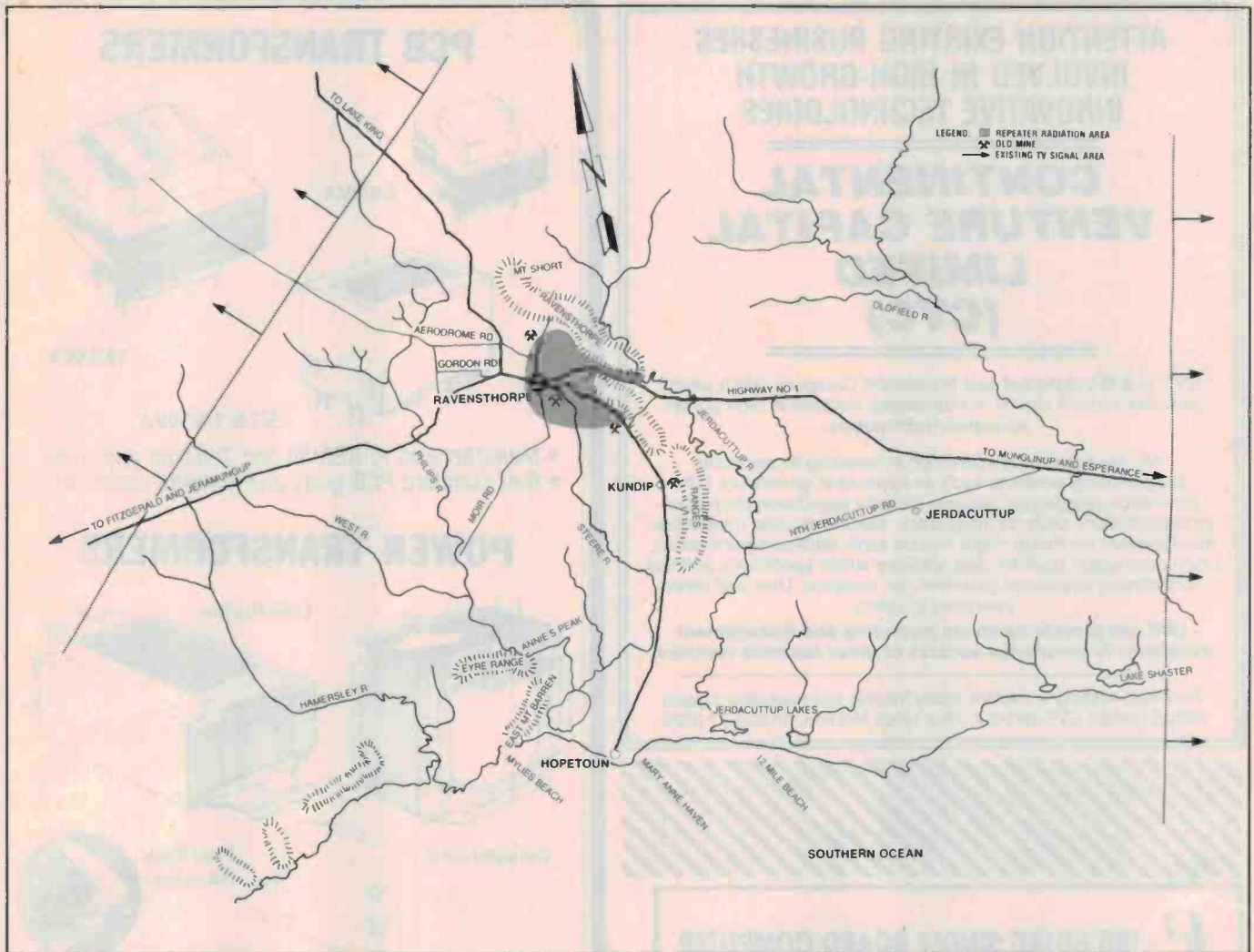
top of a mountain or the ranges. It was down past the hospital in town where gum trees had to be chopped down so as not to interfere with the dish and aerial radiation paths. The tower was hardly higher than the gum trees and the twin dipole radiators were fitted with reflector grids at the back so the total radiation was some 90 degrees facing toward the town with the Ravensthorpe ranges behind. The 300 odd people living in the township were promised rabbits-ear aerial reception.

In practice the reception is excellent to incredibly poor. The motel at the bottom of the hill had a marginal signal. The ranges absorb much of what is left but an escaping signal through a gap gives acceptable TV to a few along the path out toward Lake King for some 40 km to the north where there is other TV reception. For the people in the Jerdacuttup district or the town of Hopetoun on the coast it does nothing. One irate farmer only one kilometre behind the mast gets nothing. It was suggested to him he should climb the mast and remove the reflectors.

When asked about this deliberate localized radiation at ground level the answer from the DOC was that it was asked to cover Ravensthorpe town and the reflectors doubled the signal. Local opinion however, is that the pollies of the day wanted votes from miners in the upper house election. Ravensthorpe was listed as a mining town. The out of date Canberra records did not show the mine had shut down.

The purpose of this outline is to show the dilemmas of residents in this typical outback





area; there are probably many like it across Australia. The story tells these communities that the media has not deserted them entirely. Now the polities are crowing that Aussat is the answer for these 'electronic apartheid' communities. But it only brings a host of other problems. For example in Ravensthorpe, does the community continue to use its repeater which only covers a quarter of the population, or does each household solve the problem at considerable cost with its own Aussat dish, down converter and decoder?

Politicians have promised that the cost of linking with Aussat would be affordable. Advertisements in Perth are appearing for Aussat links at \$2500. Jim Lawrence, Ravensthorpe Shire President, recalls figures of \$800 to \$1000 with emphasis on the \$800. He is adamant that a cost of over \$2000 would be totally out of the question for most residents. And this does not include the cost of a decoder for the proposed encoding to protect city television stations from country competition. He expects this to be another \$500.

We discussed the technical aspects of the problem of remote reception generally. The

introduction of mains power by SEC has resulted in interference bars on the occasional TV picture received, and even in some of the repeater areas when the evening dew comes down and there is arcing on 33 kV insulators.

The problem facing the shire is what to do for its ratepayers. Should it adopt a 'self help' service of one channel costing up to \$150,000+ to cover the whole shire, or leave the Ravensthorpe repeater as it is, and allow the 300 odd lucky ones in the repeater beam to have the added luxury of the possibility of broadcast transmitters for a number of ABC sound programmes, added to the Ravensthorpe installations. To the other 1110: "You may have paid taxes for electronic links with the world but the government has put you in an electronic apartheid area. If you cannot afford a dish link, stiff cheddar mate!"

Without the billions in foreign exchange earned by our remote farming and mining communities, many of us would be short of videos, just to pick one all-import line. Surely we city dwellers could insist on a better deal for these neglected citizens.





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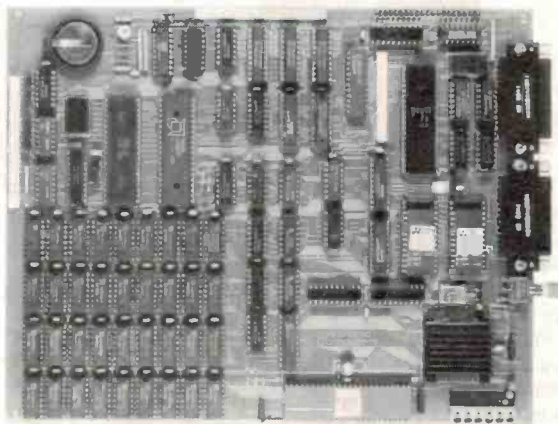
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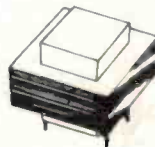
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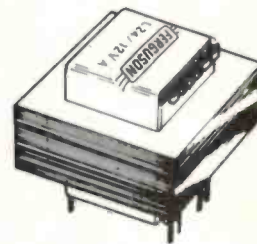
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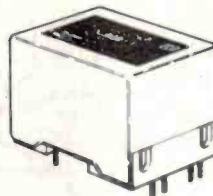
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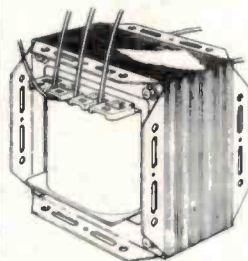
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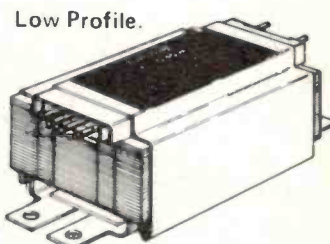
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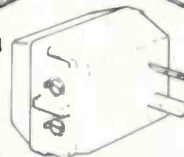
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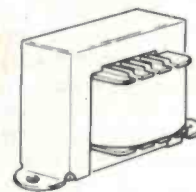
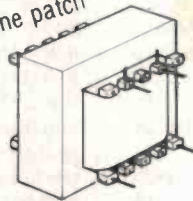
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## SHOP AROUND

Components for this month's projects are pretty well available at all the favourite points of sale.

### ETI-698 Experimental 'Bee dialler

This project to theoretically work out what might happen if you linked your Microbee and modem with a dash of Telcom uses a few common resistors, capacitors and semis. The only exotic ingredients possibly difficult to procure are the relays SPDT Takamisawa VS12STAN, which Geoff obtained from Radio Despatch, 869 George St, Broadway, NSW 2007, (02)211-0744. At this point, Jaycar has indicated it will make up a kit for this project. By the way the

instrument case was supplied by Altronics in Perth, (09) 328 1599.

### ETI-1404 4-channel mixer

A little something for the home recordist. It's got lots of parts none of which should be hard to find. Try Tandy for the case if you really can't find anything at the local components supermarket. Jaycar will be doing this project in kit form without case or XLR connectors.

### ETI-1528 Intelligent door lock

Swap your front door keys for a bunch of components — and pretty common ones at that!

None of these parts is particularly obscure. The reed relays and membrane keypad (just in case) are available from RS Components, 28-30 Northwood St, Leederville, WA 6007 and 50 Rosebery Ave, Rosebery, NSW 2018, (02)662-1233.

### 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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When ordering, make sure you specify positives or negatives, according to the process you use. Your cheque or money order should be made payable to 'ETI Artwork Sales'. Prices for the artwork for this month's projects are as follows:

ETI-698 (pcb) .....	\$3.75
ETI-1404 (front panel) ...	\$8.00
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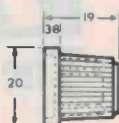
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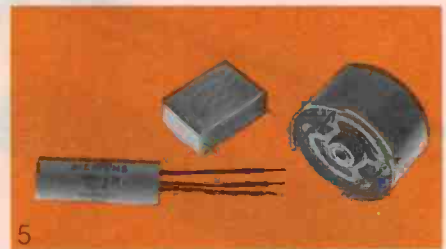
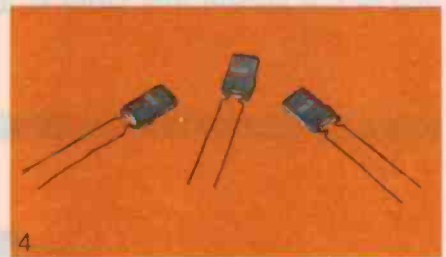
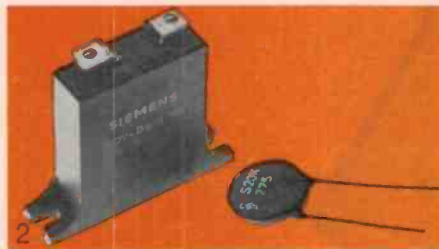
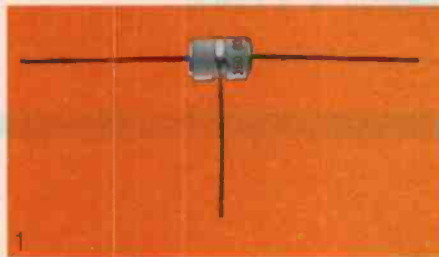
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# THE STORY OF DULMONT

An exciting new idea, keen forward-looking engineers, even an enthusiastic backing company isn't enough to translate "inspired project" into "going concern". Just concern. We're not sure if this story is a tragedy or a moral.

Jon Fairall



The original Dulmont Magnum, with black casing.

DULMONT ELECTRIC SYSTEMS was formed to construct and market the Dulmont Magnum computer, a small, highly advanced lap-top portable. The company lasted just three short years.

The story of the Dulmont company is instructive. It reveals a lot about how Australians in high places view technology, a lot about how easy, or how hard it is to make and sell high technology in this country today. It reveals a lot about the reality behind some of the myths.

## Dulmison

Dulmison is a Wyong based manufacturer of electric switchgear. The managing director is Clive Mackness. In 1971 Mackness had an idea that a market existed for a small computer to be used instead of business cards. The idea was that instead of engaging in the ritual of exchanging cards, as businessmen do now, one would be able to put all one's contacts into a little data base. The device would be no bigger than a businessman's inside breast pocket.

At the same time David Irwin was working for Dulmison as a freelance engineer. Mackness approached Irwin with his idea and they agreed that Irwin would do a feasibility study. Was it possible? Could Dulmison do it?

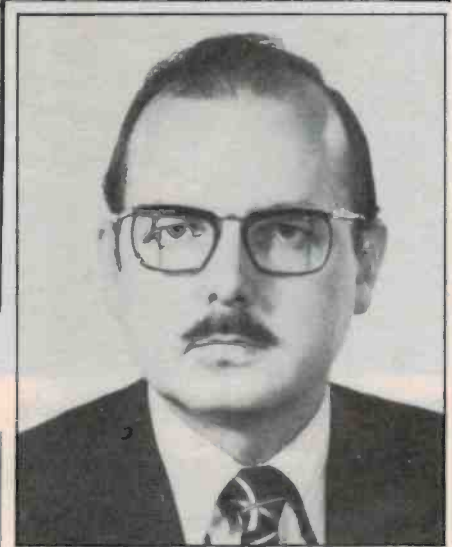
Possible it was. Gathering a small team of like-minded engineers and enthusiasts around him, Irwin got right into the job of designing something to take on the world.

And it didn't take long to get something





Above. Engineer David Irwin, designer of the Dulmont Magnum. Right. Dr Rolf Godesar, manager of Tramont.



up and running. Neither did it take long for Irwin and his friends to realize that the specifications could be much greater and new plans transformed the prototype. It grew like topsy. First it was a full sized 'Qwerty' keyboard. Then it was a bigger display. Most revolutionary of all, was a 16-bit processor.

But money was easy. Mackness approached Barry Cohen, the local federal member for Gosford. The federal government was starting to make noises about the wasteland that is Australian Manufacturing. Here was a product that had a bright future. Could the fed help? Indeed it could. \$800,000 later Mackness was smiling and Irwin breathed easier.

The machine took shape. It was the 80186 processor churning over at eight megs. There was 256K of RAM sitting in rows on the board. The screen, nestling under the flip top lid, was an eight-line LCD developed by Hitachi. But everyone involved in the project was at the bottom of a steep learning curve. None of them had ever been involved in developing something as complex as this before. There were plenty of traps for young players. The specifications of the machine changed nightly. The desire to create the ultimate portable machine meant that every development from the component manufacturers had to be analyzed, and if possible included in the product.

Every change took time. But the product was now chewing up development funds

like crazy and Mackness realized that without substantial inputs of capital, things looked bleak indeed. He began a round of all the big firms. The household names of Australian business and commerce. The movers and the explorers. The biggest and the best. Always the results were the same. It was, says Mackness, one of the worst times of the lot. At the mention of "micro-computer" the eyes in the board room glazed over, and the smiling faces all said "No". Politely, of course. But No.

### Tramont

In the early twenties, the Belgian firm of Tractionel developed a booming business out of designing and building the electric engines for trams that shuttled the good burgers of Brussels around the city. Since then Tractionel has become the biggest firm in Belgium, with investments on every continent and scores of locally run subsidiaries.

In Australia the local subsidiary is called Tramont. The manager is Dr Rolf Godesar. Godesar had been looking for some interesting investments in Australia for his principals in Brussels. When a merchant bank approached him with news that a revolutionary new microcomputer was looking for a partner he jumped at the opportunity. He met Mackness. Together they looked at the mass of circuit boards and wires that made up the prototype and did some calculations. He was hooked.

Talking about it today, Godesar's eyes still glow with enthusiasm at the potential

he saw for the machine. How many Avon ladies are there in the world? How many travelling salesmen? Thousands, hundreds of thousands. And each represents a potential sale.

Godesar sat down with the Dulmison people and worked out the development program. Funds were going to be a problem, but there was optimism in the air. The job was to keep the company afloat, let the engineers get on with it, and try to sell. They joined the company names together and called themselves Dulmont. And the product? In a moment of boyish enthusiasm they named it after a six gun from the old wild west. Small with a powerful punch. "The Magnum".

### Dulmont

Now clearly, time was money. The pressure was on Irwin. Talking to the people today one gets the impression that there was a change in attitude on the part of all involved. They were no longer a bunch of hackers sitting in someone's back room fooling around for the hell of it. The kiddy stuff was over. They had a timetable and they stuck to it. Sometimes it must have seemed that the fates were conspiring against them. There was trouble with the ▶





The new Kookaburra from Time, with white casing.

screen. It was so new that for a while there was serious doubt that Hitachi could deliver. There were shortages of RAM chips at critical times during the development. In fact, Dulmont was reduced to going onto the black market in search of some, so development could go ahead.

And go ahead it did. Irwin remembers that for months at a time people were working the most incredible hours. It was real 24 hour a day stuff. And it paid off. Software was written. The MS-DOS operating system was tailored to the machine, the software packages were customized. Word processor and Spreadsheet all worked. The case was built. Ten months later, pre-production machines were rolling out of the factory and Irwin began the hunt for bugs. And bugs there were in plenty. Sort out one and another appeared. It was, perhaps, inevitable. It took time to sort out, and time was what they didn't have.

Meanwhile the hunt for money went on. Tramont had put about \$1.5m into Dulmont. Dulmison contributed the dregs of the government grant plus the product and all the development to date. They both took equal shares in the new company. They reckoned on sufficient capital to take the product through to the end of development. The problem then would be to find the funds for marketing. It was a matter of some speculation, but they assumed they would need as much money as for the development phase.

With two partners, there were twice as many heads around the table, and twice as many options. Tractionel, with its worldwide contacts, was well positioned to get more money internationally. In addition, the big Belgian company was not exactly short of a quid itself.

Dulmison was another proposition altogether. While not exactly a garage operator, it was a very little company operating in a very big league. Money had always been tight. It didn't get any better.

A decision was taken to ease the cash flow problems by putting the product on the market. It was too early. All over the country, enthusiastic computer writers, distributors and a cast of thousands had been primed to expect something miraculous from the Dulmont company. At last it was here. And the bloody thing didn't work. They weren't delivered when promised. Software didn't do what it was supposed to. All kinds of key combinations would send it crazy. David Irwin today, shakes his head: "We needed an extra six months".

#### AIDC

So they tried the old government handout routine again. This time they contacted the Australian Industries Development Corporation (AIDC). AIDC's charter is to provide development funds for high technology development. According to Godesar, the AIDC gets about 10 enquiries a day. They have twelve people to assess them all. The

result is that assessment is done on the run, or not at all. Not that the assessment is particularly imaginative, even when it is done.

In fact, the AIDC shares the conservatism of industry generally. According to AIDC spokesman Barry Hilson, supporting Australian microprocessor design is too risky. There is a clause in the regulations that demands that AIDC have regard to the commercial realities of the marketplace. It's too much of a risk attacking overseas markets head on. Not that AIDC has a blanket prohibition on investing in electronic products. In the past they have invested in modems and the like. But they must be suitably low key.

The facts of life are that you need the minister's ear, or you can forget it. Mackness, using the good offices of Barry Cohen, got to see Science Minister Barry Jones, the most knowledgeable, and most excitable of Hawke's men. They had the advantage of having a Magnum in their briefcase when they walked into the office. By all accounts he was impressed. He even, according to Godesar, took it into the cabinet room.

The cabinet response was very positive, but not sufficiently to cut through the mass of officialdom that surrounds grant giving. To be fair, people who know how Canberra works say that it's an unwise minister who tries to cross his public servants. So the bureaucrats fiddled while the Magnum burned.

Another problem dogged their attempts to get hold of government money. It seems that money is quite readily available for development work, (witness the original contribution to Dulmison). But money to take it beyond development is very difficult to find. Setting up a distribution network, paying for the newspaper ads, that you do by yourself. It's a curious set of priorities.

The company lurched along for a couple of months. Sales were slow. Reviews in the press went from glowing to polite to downright bad. Another blow fell. The US distributors, the key to all the company's hopes, started to hear worrying stories about Dulmont's financial health. The message came across the Pacific: "Thanks, but no thanks. Call us when you have got your act together".

#### FIRB

Easy option two was for Tractionel to put more money into the Magnum. Godesar was more and more impressed with what he saw coming out of the workshop. The reports back to Belgium glowed with optimism. The money was forthcoming. But the Foreign Investment Review Board had a view on the matter too.

Whenever money is transferred into Australia the FIRB must first approve the deal. They took a long, long look at the proposed Tractionel transaction. The fed had an in-



vestment to protect here. Having invested \$800,000 in the company, it didn't want to see control of the company fly out of the window to Belgium. So, the order went out. No funds for Dulmont until you can prove there is no source of Australian funds to do the job.

According to Godesar, things rapidly became impossible. They tried. A merchant bank was hired to put a business proposal together, and they touted it around all the likely sources of funds. The reaction was the now familiar blank look.

The FIRB, according to a spokesman, is not in the business of putting companies out of business. In the final analysis, says the FIRB, it's better to have a foreign company than no company. The logic is impeccable, but there is a gap between logic and performance that indicates that the FIRB hasn't quite got it right yet. Dulmont was bleeding to death. There were no funds, just a growing mountain of bills.

**The end**

On 15 August, Tractionel and Dulmison decided that the end had come. Losing the US distribution and inability to get FIRB approval for an increase of foreign capital had made their liquidity problems worse; it began to seem like flogging a dead horse.

The facts were painfully obvious to everyone. They had a great product on their hands, but they didn't have the money to tell anyone about it. There was a brand identity problem, says Mackness: "Who the hell is Dulmont?"

Both parties decided to apply for a Scheme of Arrangement to gain some time to reschedule debts and find fresh funds. A Scheme of Arrangement is an agreement between debtor and creditors to set affairs in order before resorting to bankruptcy procedures.

**Time**

At this stage the New South Wales state government had got wind of Dulmont's problems and looked into the feasibility of mounting a rescue operation. The message was that the money might be available, but not while substantial equity was held by a foreign company, and only if manufacturing remained in New South Wales.

At the same time Michael Roberts, owner of Time Office Computers came onto the scene. Time computers has been around in one form or the other since the early seventies. The company has been successfully manufacturing local area networks and terminal emulators for over a decade. It is not the most visible company in the world, at least as far as the general public is concerned, but it does have a name where it counts. Over the last few years Roberts has sold thousands of his products to big government and business organizations. Turn-over is in the vicinity of \$15m a year, staff

about 175. Proudly it tells you that 25% of its budget goes into research.

Roberts also sells a small stand-alone computer, the Time 4500, for the office environment. It's a bit long in the tooth now though, and he was in the market for something new. The demise of Dulmont happened just at the right time. It was a nice package. Time got the Magnum for a song. Both Dulmison and Tramont are a little coy about saying exactly how much they lost. Godesar says that a figure around \$1.5m would not be too far amiss. The NSW government got behind the company with a million dollars — half as a grant, and half as a loan guarantee.

So, finally the Magnum came home. Irwin found himself ensconced in a fashionable office amidst the creative directors and executive vice-presidents in North Sydney's advertizing belt. The company has a small development staff working on the new 25 line screen and (possibly) an internal modem by the end of '85.

Mackness went back to Wyong, enriched, no doubt, by the experience, but not better off. Exactly how much he lost he won't say. He is still infatuated with the product

though. When I met him for lunch to talk about the history of the Magnum, I recognized him as the man sitting behind the wheel of his Jag typing furiously on a Magnum. He said he was using the Spreadsheet. Something about a business proposal in China, and he was just playing with a few of the variables. Such is the life of a businessman.

Old habits die hard for Rolf Godesar as well. He still uses the Magnum regularly, and his secretary was busy typing on one, complete with disk drives, expensive daisy-wheel printer and video display when I met him. He remembers his time on the Magnum with a certain amount of bitterness. It was a great idea, but no one would listen.

In spite of the problems the future looks bright for the Magnum. Time, with inextinguishable bad taste, has named it the "Kookaburra". Time is a business supplier and intends to market the Kookaburra to the people it knows and understands. Don't expect to see it in Dick Smith's. Dealerships are being expanded internationally. French software has been written and over 1000 have already sold there. The elusive US market still beckons. ●

**COMPARISONS**

When the Dulmont Magnum was launched it was one of the world's most advanced small computers. It still is a world class performer as comparison with similar products in the Australian market shows. The main competition is probably from the Hewlett Packard Portable, the Data General One, the Sharp PC 5000 and the Epson PX 8. This table is revealing.

	HP Portable	Sharp PC 5000	Data General One	Epson PX 8	Kookaburra (Dulmont Magnum)
Data width (bits)	16	16	16	8	16
CPU	8086	8088	80C88	Z80	80186
Speed (MHz)	5.33	4	3.9	2.45	6
Standard memory (K)	272	128	128	64	96
Screen (lines)	16	8	25	8	16
Weight (kg)	3.85	4.42	4.07	2.27	4
Standard software	MS-DOS	MS-DOS	MS-DOS	CP/M	MS-DOS
	Word processing			Word processing	Word processing
	Spreadsheet			Spreadsheet	Spreadsheet
		BASIC		BASIC	BASIC
					database
	clock diary			diary	clock diary
	communications			communications	communications
	graphics				
Input/output	1 x RS-232	1 x RS-232	2 x RS-232	1 x RS-232	2 x RS-232, Centronics
					video
PRICE*	\$4800	\$2700	\$4000	\$1495	\$1905

\* Price of basic unit, disk drive, expansion packs.

Note: Many of these are advertised with modems Inbuilt. These are usually Bell standard modems and unsuitable for Australia. In all cases an external modem may be connected for Australia. Standard function programs are available for all of these but you have to pay (lots and lots) when they are not included in the basic price.



# IBM: high-tech, huge and successful, but still human!

by Jim Rowe



SOME TIME AGO, along with a bunch of other media people, I was invited to look over the new IBM Australia headquarters in "Cumberland Forest", West Pennant Hills. For those of you who aren't familiar with the sprawling Sydney area, that's about 24 kilometres north-west of the city centre — and a very attractive semi-rural suburb.

Sometimes this kind of visit can be pretty boring, with a seemingly tireless company guide dragging you all around endless departments and proudly spouting statistics: how many tonnes of concrete, how many miles of wiring and so on. But not this one; in fact it was really quite fascinating, even for a group of normally pretty cynical media hacks.

Not that IBM didn't throw around the odd statistic. When a company like IBM builds a new national headquarters complex, there's bound to be some impressive statistics — if not for the building itself, then for its computer systems at least. After all, if IBM can't put together an impressive high-tech building and computer system, who can?

I guess none of us was very surprised to find computer terminals on just about every desk, or a forest of *deja-vu* CPUs and multi-megabyte disk drives down in the basement — with suitably mind-boggling statistics to match. I think it was 120 Mips and 80 gigabytes, but it might have been the other way around. It doesn't really matter.

What was much more interesting was the way IBM and its architects have used computers and other pieces of modern technology to attack some very down-to-earth problems, the kind that you find in just about every company. Like reducing the electricity bill, by using an array of huge insulated water tanks in the basement to store 'cold', allowing the airconditioning chillers to be run at night when they can take advantage of the off-peak power rates.

Needless to say the chillers are turned on and off by a computer, which is also used to control a system of motorized venetian blinds outside the windows. The blinds are arranged to minimize solar energy loading while maintaining the best possible outlook.

The computer also controls all of the lighting in the buildings, and after 6.30 pm it automatically turns off the lights in all areas except those where the occupants have signalled their presence using a little IR remote control 'zapper' unit.

Using these techniques, IBM has been able to chop its peak power loading by about 30%, with a very significant cost saving. Most impressive!

There was something even more impressive for those of us who spend a lot of our time making and receiving 'phone calls — or more accurately, leaving messages and then waiting until the person we wanted to talk to returns to their desk and 'phones us back. This was the computerized telephone message-taking system that IBM has installed, the first of its kind in Australia.

It's very fancy. If a called extension doesn't answer after a set number of rings, the system automatically answers and offers to take a message. The message is stored digitally, and a flashing light appears on the called extension rather like the scheme used in many hotels. Then when the person you were calling returns, the system will play back the message to them. They don't even have to go back to that extension to listen for any messages. In fact, they can call in from home after work, check any messages and leave appropriate replies to be delivered next day. How's that eh?

This system is in addition to IBM's full-scale electronic mail system, which works via the now-ubiquitous desktop terminal. Each IBM staffer has a unique identification code number (a VM or 'virtual machine' number), and you can send memos or other files to anyone care of their number, once you've logged on. This system is a complete worldwide network, so you can leave messages for anyone in the vast IBM octopus.

All in all even a few hours touring through the new IBM complex was enough to show how modern technology can be used to make big improvements in the efficiency of running a business. It was very impressive.

But I must confess what impressed me

even more was the atmosphere of the place — the surprisingly warm humanity. I guess like many people on the outside of 'Big Blue', I've tended to have a mental picture of it as a huge impersonal monolith inhabited by drilled regiments of humourless EDP boffins and zoot suited, super-aggressive sales people. And I get the funny feeling that at least some of those within IBM half expect everyone outside to think of them in that way.

Some of the things we saw and heard on the tour would even support that picture — like an incredibly thorough security system (computerized, of course), and that business of giving everyone a virtual machine identification number. Superficially it sounds almost as if the humans have become only peripheral attachments to some giant hidden computer, which forms the 'real' heart of corporate IBM.

Yet when you go through and actually talk to the IBM people, you find that it isn't like that at all. It came as quite a surprise to find that everyone seems very happy. The morale seems high, and people seem to be getting a great deal of job satisfaction. More than that, there's a surprising degree of pride in the company and its achievements — the sort of thing you normally only seem to get in very small companies, not mega corporations like IBM.

In their very popular book *In Search of Excellence*, Tom Peters and Bob Waterman point out that big human organizations are generally incredibly dumb. They almost always lose sight of basic commonsense values, like treating your people right and not letting formal rules obscure or obstruct the company's fundamental goals.

You only have to visit IBM for a couple of hours to see how very successful this company has been in solving these problems. It really is an extremely professional and people-orientated organization. I guess that figures. If it wasn't, it could never have grown so huge while still remaining so phenomenally successful.



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## DREGS

THE DREGS HACK spends a great deal of his time tethered to his desk reading press releases sent from people who want to be noticed. Most of the releases are boring, some are interesting. A few are ridiculous. Some make one sit up and think. Therewith a crosssection.

### CAD/CAM

Remember *Starwars*? What about *Starwars 2* or *Starwars 3*? Special effects were generated by a company specially set up for the exercise, called Lucasfilm. Lucasfilm broke a lot of new ground in terms of special effects. Much of it was done by computer manipulation of models, with photographic techniques, and with computer generated images. Most of the hardware to accomplish these functions had to be made in house, with the result that Lucasfilm is now one of the leading suppliers of animation machines. Their baby is called the Pixar.

Basic specifications of the Pixar are pretty impressive. It has four processors to control Red, Green, Blue and Text. Each processor can shift pixels from RAM to screen at 10 MHz. It sells for around \$US100,000. (To find out what that is in real money, contact your stockbroker.)

Anyway, the point of the story is that

Lucasfilm is getting bored with making movies, (been there, done that) so now they're moving into other areas. According to the magazine *High Technology*, Lucasfilm is trying to flog the Pixar to mining companies, and developing software appropriate to fossicking around for gold in them thar hills. Now, you know what C3PO was complaining about when he was wandering around in the desert.

### Robotics

Oh to be in England now that spring is here! We've just heard that the British Home Office is trying to develop a robot nose to detect persons trafficking in certain noxious substances. To help in the inquiries (as it were), the researchers grew large quantities of cannabis in a greenhouse. Unfortunately the plants proved too vigorous to be contained and burst out of the top of the enclosure.

From there they proceeded to spread their seeds all over the neighbourhood. The Herefordshire police assured the media that they were not about to launch any prosecutions over the incident.

### Ancient history

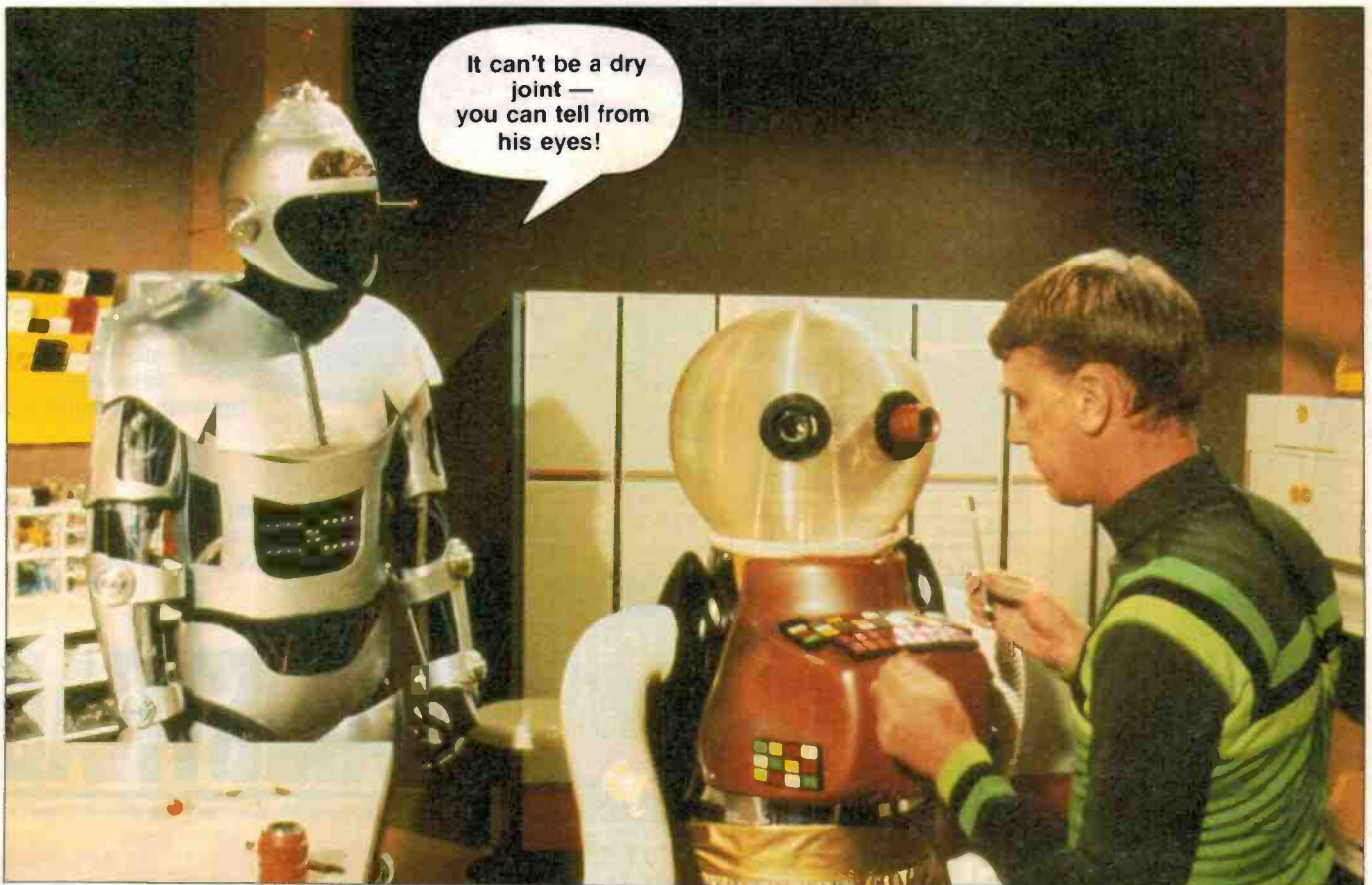
ANU researchers have just released some pictures of ancient bacteria. It is believed

that the sample is some 3.4m years old. It appears that the bacteria have many things in common with modern bacteria, although they are rather primitive compared to our modern specimens. The really interesting thing about these bacteria is that it appears that at the time of their demise they were in the act of replicating themselves. There is a lot one could say about this, but the Hack's innate sense of decency prevents him.

### Good ideas

An American policeman and his dentist have got together to develop a way of tracing missing kids. Their idea is a tiny disc, containing the child's name, address, telephone number and blood type, that can be glued to the child's upper molar.

So far about 2000 children in Illinois, a middle American state, have had the disc strapped to a tooth. Apparently it can be read quite easily with the aid of a magnifying glass, providing you first snap it off the tooth, but one has to look pretty closely to find the tooth. Next time you get into a scrape, if the ambulance man pulls back your lips to inspect a molar or two don't worry, he only wants your name.





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